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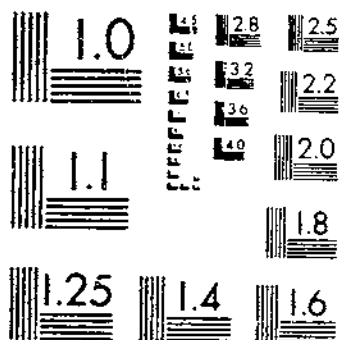
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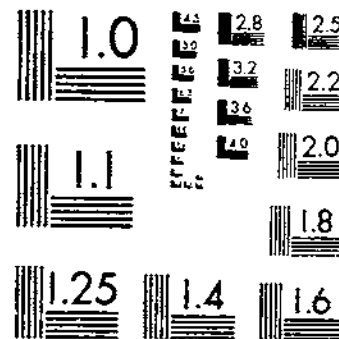
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**UNITED STATES  
DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C.**

# Measurement of Evaporation From Land and Water Surfaces<sup>1</sup>

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## INTRODUCTION

Among the various climatic factors of hydrologic and agricultural significance the return of moisture to the atmosphere from natural land surfaces has resisted measurement most strongly and is consequently least well known. As precipitation and run-off, water is in the liquid state and can be measured by means of straightforward sampling techniques, but upon evaporating, water becomes an invisible gas which mixes with the other gases of the atmosphere and is disseminated through it.

For the farmer the soil is a reservoir into which water is contributed by precipitation and from which it is withdrawn by evaporation and transpiration from the growing crops. During a prolonged period without rain the soil moisture may be drawn upon until a deficiency that approaches the wilting point is produced and plant development is retarded and crop yields reduced. At the time of a storm, precipi-

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tation can partly or wholly replace the moisture that has been lost, but during the period following the storm, evaporation and transpiration will again deplete the moisture supply. In determining drought hazard, measurement of the varying rates of evaporation and transpiration is as essential as information concerning the amount and distribution of rainfall, because they determine the rate at which the water supply is consumed (3).<sup>2</sup>

Whereas agriculturists are concerned chiefly with the portion of the precipitation that enters the ground and is available to plants, hydrologists are concerned primarily with the portion that runs off. Run-off varies greatly from place to place, even in small watersheds, because of differences in field moisture caused by evaporation and transpiration between rains. When the soil is dry, little run-off will occur, except in very intense or prolonged rains, because the greater part of the rainfall will be used to replenish soil moisture. As a rule, only after the soil becomes saturated will water flow from the land as run-off. Thus, to predict from observations of rainfall the amount of moisture available for run-off, an accurate measure of the rate at which the soil dries out is highly desirable.

Scientists have long recognized the serious need for a method of measuring water losses by evaporation from land surfaces as well as from free-water surfaces. Over bodies of free water, a continuous supply of moisture is available for evaporation and the actual losses are dependent directly upon climatic and meteorologic factors. For this reason it has been possible to develop empirical formulas which permit the computation, with reasonable accuracy, of the anticipated water losses from lakes or reservoirs in terms of meteorologic data alone (4, pp. 223-265; 8; 9; 96; 118).

The rate of emission of water vapor from a natural land surface cannot be determined by such methods. When the surface soil is moist, evaporation may be more rapid than from a free water surface because the soil with its minute irregularities will present a larger evaporating surface. As the surface soil becomes dry evaporation losses diminish greatly even though the subsoil remains moist. Replacement of surface water from below by capillary action is extremely slow, and the soil moisture can escape to the outer air only as vapor by diffusion through the soil air. Furthermore, as the growing season advances, foliage shields the ground surface, causing a progressive diminution in the direct evaporation from the soil even though water losses by transpiration increase.

The physical process of transpiration is not yet completely understood (25, 86, 171), but it is recognized that the amount of water lost by transpiration from an area depends on the density and character of the vegetation as well as on atmospheric conditions. Transpiration in-

<sup>2</sup> Italic numbers in parentheses refer to Bibliography, pp. 60-75.

creases with plant development until maturity is reached, largely because of increase in the area of the transpiring surface and in the number of stomatal openings. Plant activity subsides with maturity and transpiration rapidly diminishes. The amount of water removed from a field by transpiration depends on the water requirements of the plants growing in it and on their growth, which in turn may be limited by the amount of water available. Thus, water losses from land surfaces, resulting from evaporation and transpiration, bear no direct relation to evaporation losses from free-water surfaces. Therefore, no empirical formula employing ordinary meteorological data could be expected to give reliable values of evaporation and transpiration from land surfaces. Similarly, evaporation from pans or atmometers cannot supply even a relative measure of water loss from natural surfaces (5).

Some information has been obtained on the amount of transpiration from various species of plants growing in pots, tanks, and lysimeters that can be weighed continuously or at periodic intervals (14, 15). Because of the necessarily limited surface area of such containers and because their walls confine the plant roots and restrict the normal movement of water in the soil, this method creates highly artificial conditions and can yield results only roughly indicative of the magnitude of evaporation and transpiration from natural surfaces (110, 158, p. 28).

The lack of a direct measure of losses by evaporation from natural surfaces has led to the development of many empirical formulas for expressing the effectiveness of precipitation. Transeau (167), one of the earliest to be concerned with the problem, used the quotient of total measured rainfall divided by computed free-water evaporation as a moisture index and prepared a map of the eastern part of the United States to show the distribution of this quantity. Livingston and Shreve (87, p. 325), following Transeau, made a map of the distribution of the ratio of precipitation to evaporation over the entire United States (fig. 1, A). Lang's (78) "rain factor," de Martonne's (92) "index of aridity," Meyer's (95) "N-S quotient"<sup>3</sup> and the "hygrometric quotient" of Szymkiewicz (147) represent other attempts to determine effective precipitation. The climatic classifications of Köppen (71, 72, 73, 74, 75) and Thornthwaite (155, 156) both employ means for determining effective precipitation (fig. 1, B). However, no evaporation index derived indirectly by computation can take the place of actual measurements of evaporation.

If accurate measurements of precipitation and run-off are available, integrated values of the losses by transpiration and evaporation can be obtained by simple subtraction. Such values provide general

<sup>3</sup> Meyer's N-S (Niederschlag-Sättigungsdefizit) quotient is obtained by dividing depth of precipitation in millimeters by saturation deficit expressed in millimeters of mercury.

information on the average effectiveness of precipitation over long periods; they also serve for comparing water losses in regions of

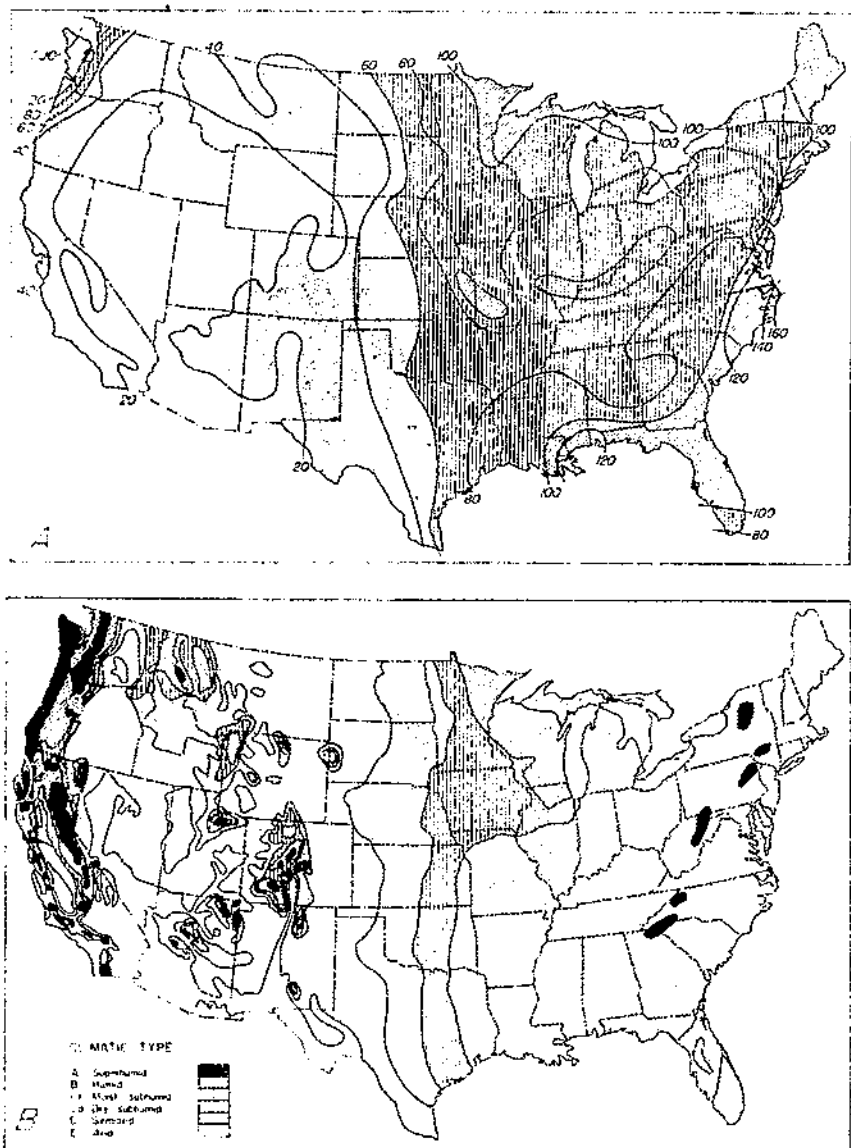


FIGURE 1.—A, Precipitation-evaporation ratios in the United States for the average frostless season, after Livingston and Shreve (87, p. 325), 1921; B, precipitation-effectiveness ( $P/E$ ) indices, after Thornthwaite (155, 156), 1931.

different vegetal cover. Kittredge (69) has recently made use of available average annual rainfall and run-off data and has prepared a map showing the distribution of the average annual water losses

to the atmosphere in the United States (fig. 2). Working independently, but using the same method, Baulig (9) prepared a similar map for the central and eastern part of the United States. Accurate determination of evaporation losses for periods of a year or less is not possible by this method because of lag in both run-off and evaporation.

Fortunately, the rapid development of aviation during the last two decades has led to detailed investigation of the nature of the lower layers of the atmosphere and has resulted in notable advances in our understanding of the mechanics of moisture and heat transfer

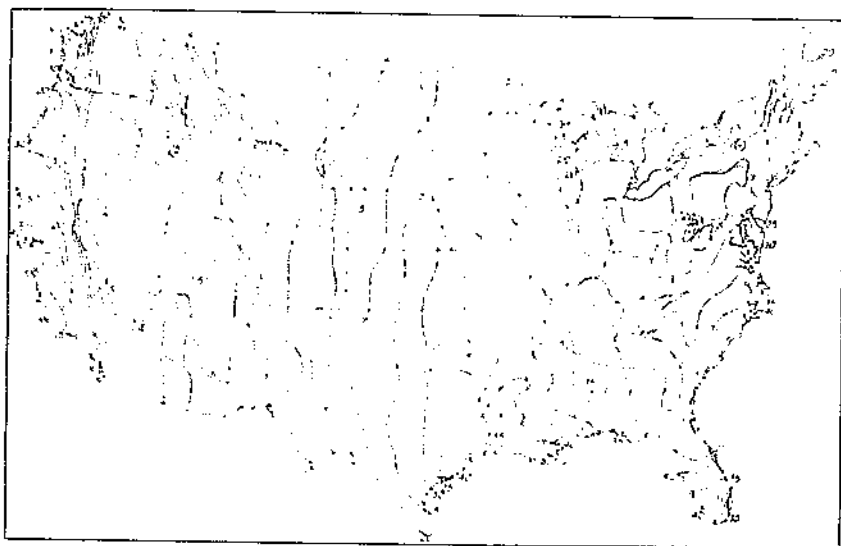


FIGURE 2.—Average annual water losses in inches due to transpiration and evaporation, after Kittredge (69), 1938.

through these layers. This knowledge has made possible the development of a technique for the direct measurement of evaporation and transpiration from natural surfaces (160).

When water vapor enters the atmosphere from the ground or from plants it is transmitted upward into the air to some indefinite distance from the ground. The transfer of moisture from the ground is accomplished through the irregular or turbulent mixing of the lower air, by which bodies of the moister air from near the ground are carried upward and replaced by drier bodies brought down from above in the process of turbulent mixing.

The movement of smoke demonstrates plainly the mixing of the air that takes place in the turbulent layer. Where a visible gas, having approximately the same density as the air, is released, as in figure 3, the effect of turbulent mixing is apparent. The water vapor

in the air is invisible, but its concentration can be measured by means of a number of familiar instruments.

When water vapor is emitted from an evaporating surface and is transported upward in the turbulent eddies the total moisture concentration of the air will be greatest at the surface and will diminish with height. Since the rate of flow of moisture upward from an evaporating surface and the intensity of the turbulent mixing determine the gradient of moisture concentration in the overlying atmosphere, it follows that the rate of evaporation can be determined by

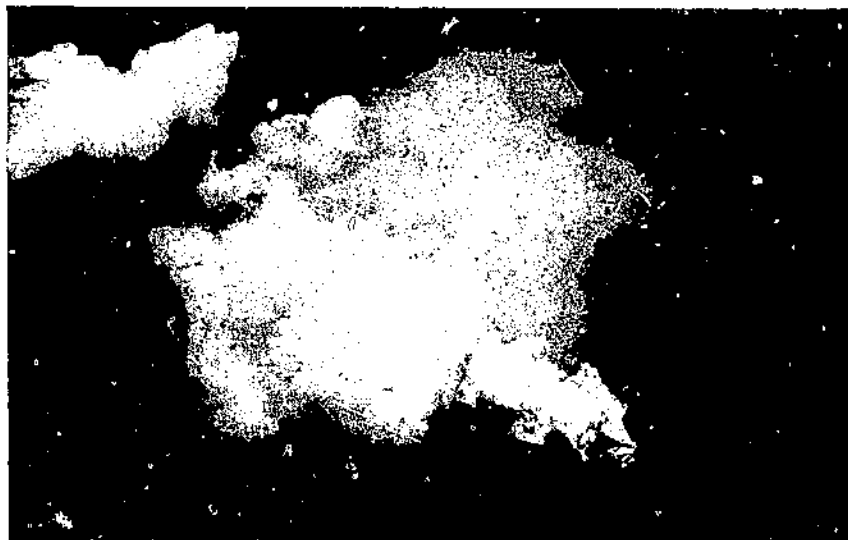


FIGURE 3.—The movement of smoke demonstrates plainly the mixing of the air that takes place in the turbulent layer. (Courtesy of Chemical Warfare Service, United States War Department.)

measuring the moisture gradient and the turbulence (fig. 4). This bulletin discusses the nature of evaporation, the theory of turbulence as it relates to the measurement of evaporation, and the problems involved in making the necessary physical measurements of atmospheric moisture and wind velocity.

### THE NATURE OF EVAPORATION

Water covers more than four-fifths of the surface of the earth, and water vapor is present in varying concentration everywhere in the lower atmosphere. The molecules that make up the water on the earth's surface and the water vapor in the atmosphere are in ceaseless motion. Some of the molecules of the liquid acquire sufficient momentum to break through the surface and escape into the free air. At the same time some of the molecules of water vapor in the air

strike the water surface and are unable to leave it. Strictly speaking, the movement of molecules from water to air is evaporation and the reverse movement is condensation. Popularly, evaporation is considered as a net loss of mass from a liquid and condensation as a net gain to a liquid as a result of this exchange.

The rate at which molecules leave a water surface depends solely on the characteristics of the water. An increase in the kinetic energy of the molecules means that an increasing number are able to leave the liquid. Since an increase in its molecular energy signifies a rise

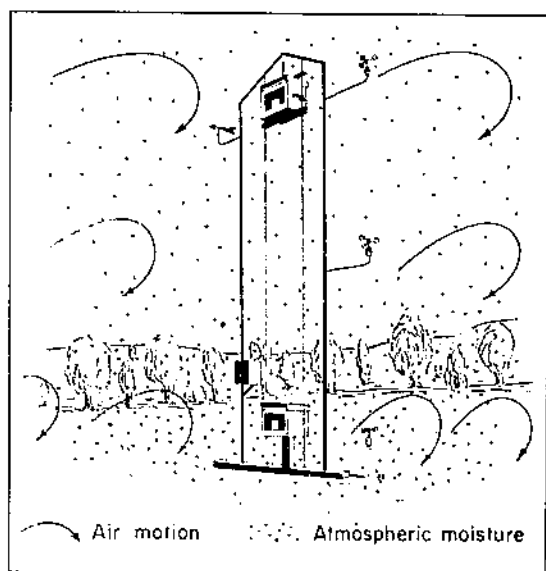


FIGURE 4.—To determine the rate of transfer of moisture from the ground to the atmosphere it is necessary only to measure the humidity of the air at two levels and the rate of mixing of the air between them.

in the temperature of the water, the rate at which molecules break away from the water surface depends on its temperature.

The rate at which water molecules reenter the liquid depends solely on the concentration and temperature of the water vapor in the air.

It is a matter of common experience that water exposed to the open air will ordinarily disappear rapidly. If, however, a body of water is exposed in an enclosed vessel the net loss of water is small, regardless of the water temperature, even though the space above the water was originally completely dry. Although the molecules of water vapor entering the space above the water surface are confined by the walls of the vessel, at first there are so few that the number that return to the liquid is small. Hence the number of molecules in the enclosed space increases rapidly. With an increase in the concentration of water vapor, there is an increase in the rate of return of the molecules

to the liquid. Eventually, the vapor concentration becomes such that just as many molecules return to the water as leave it. At this time equilibrium between the liquid and its vapor is attained, and, strictly speaking, the rate of evaporation is then equal to the rate of condensation.

The molecules of the vapor exert a pressure against the confining walls of the vessel, and when equilibrium is established this pressure is equal to the force with which the molecules leave the surface of the liquid. The pressure of the vapor, like the total pressure of the atmosphere, is ordinarily measured in terms of the height of the column of mercury it will balance. This equilibrium pressure is called the maximum or saturation vapor pressure. It depends on the temperature of the liquid (2, pp. 124-128).

As the temperature of a liquid is raised the saturation vapor pressure is increased according to a well-known law (49, p. 107). However, if water is heated under constant pressure, as for example, in the open atmosphere, a temperature is soon reached at which bubbles of vapor form throughout the liquid. This temperature is called the boiling point. It has been found experimentally that the saturation vapor pressure at the boiling point is equal to the external pressure. This fact provides a convenient and easy method for determining the saturation vapor pressure corresponding to different temperatures of a liquid by ascertaining its boiling point under various external pressures.

If air fills the space above the liquid, evaporation will proceed almost as if the space were empty. The presence of an indifferent gas does reduce very slightly the saturation vapor pressure, but for all practical purposes this reduction is negligible.

The saturation vapor pressure over a liquid having a surface with convex curvature is greater than that over one having a plane surface.<sup>4</sup> The increase in vapor pressure resulting from curvature of the surface is very small, and except in studies of incipient condensation on minute nuclei is generally negligible. Bennett (10) has computed that two drops of water of temperature 10° C., one of radius 10<sup>-5</sup> cm. and the other of radius 10<sup>-6</sup> cm., would have vapor pressures 1.2 percent and 12.7 percent, respectively, above the saturation value over a flat surface.

Of greater importance is the depression of vapor pressure at the surfaces of aqueous solutions. Evaporation from a pan of water will be reduced, for instance, if salt is dissolved in the water, in a degree

<sup>4</sup> In 1870, Kelvin (62) pointed out that convex curvature tends to increase the vapor pressure according to the law

$$\log \frac{e'}{e} = \frac{2s}{r\rho RT},$$

where  $e'$  is the vapor pressure over a surface with radius of curvature  $r$ ,  $e$  the vapor pressure over a plane surface,  $s$  the surface tension of the liquid,  $\rho$  the density of the liquid,  $R$  the gas constant for the vapor, and  $T$  the absolute temperature.

proportional to the salt concentration. In part, this effect results from the fact that as salt enters into the solution some of the sodium and chlorine ions are at the surface and interfere with the escape of water molecules from the liquid. The suppression of evaporation may also be due to an attraction which may exist between the molecules of the solute and the water molecules. Water molecules can enter the liquid from the air about as freely as ever, but fewer can escape across the surface to the air than from pure water.

The effect of ordinary sodium chloride is such that in a saturated solution at ordinary air temperatures the vapor pressure of the liquid is reduced to three-fourths of its normal value. If the saturated solution and the overlying air have the same temperature, equilibrium is established, and as many water molecules return to the liquid as leave it when the air is 75 percent saturated. Only if the relative humidity of the air is less than 75 percent is there a net loss of water molecules from the liquid.

Various substances dissolved in water will lower its vapor pressure by different amounts. A saturated solution of lithium chloride, for instance, is in equilibrium with the air at only 16 percent of saturation. On the other hand, a saturated aqueous solution of potassium nitrate is in equilibrium with the air when it is 95 percent saturated. The interference of lithium chloride is so great that the rate of escape of water molecules from the surface of the solution into the air is only 0.16 of the rate of escape from pure water.

The depression of vapor pressure over five common solutions at various temperatures is shown in table 1.

TABLE 1: *Relative humidities maintained at specified temperatures by various saturated saline solutions*

Temperature (° F.)	Relative humidity obtained using saturated solution of--				
	KNO <sub>3</sub>	NaCl	Mg(NO <sub>3</sub> ) <sub>2</sub> ·6H <sub>2</sub> O	MgCl <sub>2</sub> ·6H <sub>2</sub> O	LiCl
	Percent	Percent	Percent	Percent	Percent
104.....	90	75	51	33	16
95.....	92	75	51	33	16
86.....	91	75	52	33	16
77.....	95	75	52	32	16
68.....	95	75	53	32	16
59.....	95	76	53	31	16
50.....	95	76	53	31	16
41.....	96	76	54	30	16
32.....	96	76	54	30	16

Evaporation in the popular sense means the loss of mass of a fluid by vaporization. Since a liquid tends to lose molecules at a rate dependent only on the physical condition of the liquid, any influence, such as the application of heat, absorption of radiation, or introduction of solutes will produce some change in the rate of evaporation. For any given fixed condition of the liquid, the rate of loss of mass



depends inversely upon the rate at which molecules return to the liquid, which depends solely upon the condition of the vapor (158). If the molecules that leave the liquid are carried away from the vicinity of its surface there will be fewer to return, and a loss of mass will result. This point should be emphasized. Unless there is some mechanism for decreasing the number of molecules that would ordinarily return to the liquid, there can be no appreciable loss of mass. Almost the entire loss from the liquid would be the small number of molecules necessary to raise the vapor pressure in the air immediately above the liquid to its saturation value.

Molecules move away from the vicinity of an evaporating surface by the ordinary phenomenon of diffusion. But diffusion is so slow that there would always be nearly as many molecules flying back into the liquid as are flying away from it, and evaporation would be an extremely unimportant process if the molecules were not removed from the vicinity of the surface of the liquid in some other way.

Actually, the phenomenon of turbulent transfer in the atmosphere is by far the most effective factor in carrying water molecules away from an evaporating surface. Transfer by turbulent mixing is usually at least 25,000 times as effective as molecular diffusion, and it may be considered almost wholly responsible for any loss of moisture from an evaporating surface freely exposed to the air.

### REVIEW OF PREVIOUS METHODS OF DETERMINING EVAPORATION<sup>5</sup>

Since the rate of emission of water vapor from a land, water, or plant surface cannot be measured directly, as can the rate of water accretion to the surface, and since the measured rate of loss of water from a pan or atmometer cannot give this rate of emission, the measurement of evaporation must be approached in an indirect manner.

Observations of evaporation from lakes, reservoirs, and pans have been used in the development of many empirical formulas in which evaporation is expressed as a function of meteorological data such as temperature, relative humidity, barometric pressure, wind velocity, and solar radiation. Dalton (26) was the first to point out that evaporation is proportional to the difference between vapor pressure of the air at the water surface and that of the overlying air, although apparently he never expressed this relationship in mathematical terms.

Rohwer (118) has presented and discussed a number of evaporation formulas. Most of these formulas contain the expression  $(e_s - e_a)$ ,  $e_s$  being the vapor pressure at the surface of the liquid and  $e_a$  the vapor pressure of the air, and a factor  $W$ , which expresses the influence of wind velocity. Rohwer's empirical formula is:

$$E = (0.44 + 0.118W)(e_s - e_a),$$

<sup>5</sup> Summarized from Thornthwaite and Holzman (100).

in which  $E$  is evaporation in inches in 24 hours,  $W$  is mean velocity of surface wind in miles per hour, and  $e_s$  and  $e_a$  are mean vapor pressures in inches of mercury at the water surface and in the air, respectively. Rohwer mentions the similarity of this formula to Dalton's original formula:

$$E = C(e_s - e_a).$$

A different approach to the problem of determining evaporation from lakes and other bodies of water has been suggested by Ångström (1). He indicated that there must be a balance of energy between the insolation absorbed by a body of water and the energy exchanges due to radiation, convection, conduction, and the latent heat of evaporation, and that evaporation might be determined by measuring the necessary components of this equilibrium. Richardson (111, 112) and Cummings (20) have used this principle in determining evaporation losses, but the difficulty of obtaining various essential measurements, such as temperature gradients within the body of water and heat exchanges due to convection, prevents the determination of accurate short-time measures of evaporation and prohibits the determination of moisture losses from land areas. Yamamoto (180) has made similar use of the principle of conservation of energy in his studies of condensation of dew.

Studies of the structure of the lower atmosphere made in recent years have yielded much essential information on turbulence and the intensity of turbulent mixing in the air. In the turbulent layer the mixing process depends on the shearing stresses associated with the roughness of the ground and with wind velocity, and increases as the values of these factors increase. The mixing process also depends upon the stability or density structure of the air, the intensity of mixing diminishing, under otherwise constant conditions, as stability increases. Beneath the turbulent layer there is a shallow layer, the thickness of which is usually measured in millimeters, called the laminar layer, in which air flow is laminar and vertical transfer of momentum and admixtures proceeds solely by diffusion. The vertical motion of the air in the turbulent layer tends to establish an adiabatic distribution of temperature and a uniform admixture of water vapor, and thus to eliminate differences in moisture concentration. If moisture is neither added to nor withdrawn from the turbulent layer its moisture content quickly becomes uniform throughout.

On the other hand, water vapor emitted from an evaporating surface is transported upward and scattered throughout the turbulent layer. Thus, as long as a stream of water vapor flows upward into the turbulent layer the moisture concentration will be highest at its base and diminishes upward, and a moisture gradient directed upward will be established. Such a gradient can be maintained only so long as moisture continues to be added below. Soon after evaporation

ceases, the moisture is distributed uniformly throughout the layer, and the moisture gradient is thereby destroyed. Similarly, if water vapor is abstracted from the base of the layer by condensation in the form of dew or frost, the moisture concentration there will be reduced; and so long as removal of moisture continues, a moisture gradient directed downward will be maintained. The greater the intensity of turbulent mixing, the greater is the tendency toward the establishment of uniformity of moisture concentration and the greater the evaporation or condensation required to maintain a constant gradient upward or downward. Similarly, the steeper the moisture gradient which persists in an air column with a given rate of turbulent mixing, the greater is the rate of evaporation required to produce it.

From these facts it is evident that evaporation from any surface may be determined by taking into consideration the vertical distribution of moisture in the air and the intensity of turbulent mixing. The general form of an equation for rate of evaporation based on these considerations is

$$E = -A \frac{dq}{dz},$$

in which  $A$  is the coefficient of turbulent mixing, or the "Austausch coefficient" of Wilhelm Schmidt (129), and  $dq/dz$  is the rate of change of moisture concentration with respect to height above the evaporating surface. Observations required to measure evaporation are the moisture concentration at two levels within the turbulent layer, the heights of the two observations, so that the moisture gradient may be obtained, and measurements of wind velocity at two or more levels from which the intensity of turbulent mixing may be computed.

Jeffreys (57) and Giblett (40) were among the earliest investigators to study the problem of evaporation in terms of atmospheric turbulence. However, because of various nonrigorous assumptions regarding the nature of the Austausch coefficient, the value of their results is limited, and they can be applied only to the evaporation from bodies of water (17, pp. 270-275). Sutton (137), making use of Taylor's (151) researches, has extended Jeffreys' analysis by assuming that the Austausch coefficient varies with height. His theoretical work is in very good agreement with the experimental measurement of evaporation for variously shaped areas. Schmidt (130) has made use of a formula devised by Ertel (31) for calculating the Austausch coefficient and claims to have measured the actual evaporation from a meadow.

During the last two decades great progress in the theoretical treatment of the mechanism of turbulent interchange has been made by various aerodynamicists, including Taylor (149, 150, 151, 152, 153, 154), Prandtl (103, 104, 105, 106), von Kármán (59, 60, 61, 62), and others (11, 113, 114, 115). In 1935, von Kármán

(61) published an excellent summary of the problems associated with the various theories of turbulence. Rossby (123, 124, 125) has made use of von Kármán's postulate of dynamic similarity and the concept of mixing length in his important researches on atmospheric turbulence. Sverdrup (141), extending Rossby's researches, has added much to our knowledge of the variation of the coefficient of eddy viscosity under changing conditions of thermal stability.

Although the theoretical treatment of problems of turbulence is still in the initial stage, enough has been accomplished to provide an understanding of the mechanism of evaporation and to permit the development of a formula by means of which evaporation from land and water surfaces alike may be determined.

A difficulty in the use of the theory of turbulence in the determination of evaporation is the fact that the laws of moisture transfer are different in the laminar and turbulent layers, being linear in the former and nonlinear in the latter. Leighly (82) avoided the turbulent layer entirely and confined his study to the laminar or boundary layer, where the specific humidity gradient is linear and where the coefficient of diffusion can be used. Since the boundary layer is very thin if the air is in motion, Leighly's method would be useful only for determining evaporation from small areas. (He thinks that the limit is a diameter not much greater than 4 feet.) In fact, the making of moisture determinations at two levels in a layer as thin as the boundary layer would require a type of instrumentation not now available. With existing instruments it is quite impossible to recognize vapor pressure differences within a distance of a few millimeters. Thus, the use of Leighly's method must await the development of new instruments.

The problem of the difference of the moisture gradient and the process of moisture transfer in the boundary and turbulent layers confronted Sverdrup (142, 144) in his study of evaporation over the oceans. With the meager data at his disposal, consisting only of wind velocity and moisture concentration at one level in the turbulent layer and the temperature and salinity of the ocean water, he was forced to consider the gradients in both the laminar and turbulent layers. Although this was accomplished with great ingenuity, the final computations can be considered only as rough indications of oceanic evaporation. Millar (96), in his study of evaporation from the Great Lakes, approached the problem in much the same manner as Sverdrup, and his results are subject to the same limitations. Montgomery (97) in 1940 published a series of observations of the vertical distribution of temperature and moisture made during July and August 1935 over the surface of the North Atlantic. He made no measurements of wind velocity gradient, and the formula he developed for evaporation from the sea surface is of the same general form as those of Sverdrup and Millar.

At this point it is possible to consider the physical limitations of the various empirical formulas based on Dalton's law, which have been presented in an earlier paragraph. These formulas are developed for determining evaporation from free water surfaces and make use of observations of the temperature of the water surface (from which the vapor pressure of the air in direct contact with the water is determined) and the vapor pressure and wind velocity at some level in the turbulent layer. Because of the previously mentioned difference in the moisture gradients and the processes of moisture transfer in the boundary and turbulent layers, it is impossible to derive simple empirical constants, to be used in connection with the difference between the vapor pressure of the water surface and the overlying air ( $e_w - e_a$ ) and a wind factor, that will give more than a statistical approximation of the evaporation from free water surfaces. If Sverdrup's method of integrating through the boundary layer is used, more satisfactory results, at least for large water bodies, can be expected. Under no circumstances can such observations be used for determining evaporation from land or transpiration from vegetation. Those formulas employing the so-called vapor-pressure deficit ( $\delta$ ), the difference between the saturation vapor pressure and the actual vapor pressure at some level in the air ( $E_a - e_a$ ) are unrelated to the physical principles of evaporation and cannot be expected to yield satisfactory results.

### THE MEASUREMENT OF TURBULENCE

Air flowing along the surface of the ground encounters a frictional resistance and is slowed down. The effect of this resistance is felt for hundreds of feet aloft. Within this zone of frictional influence each successively higher layer of air moves faster than the one immediately beneath so that shearing stresses are set up between them, which result in the upward and downward displacement of small masses of air, each tending to preserve the horizontal velocity that it had previously. If a mass moves upward to a faster moving layer, in the process of mixing it will tend to retard the air in the higher layer. Similarly, a mass of air moving downward will tend to speed up the air in the lower layer. Thus, the difference in velocity between two adjacent levels tends to be equalized as horizontal momentum is transferred downward and ultimately dissipated at the ground. The tendency toward equalization of velocity depends on the rate of vertical mass interchange, or the intensity of turbulent mixing (fig. 5).

The greater the differences in velocity between adjacent layers, or the stronger the shear, the greater is the tendency for turbulence to develop and to reduce the shear. If there were no external influences helping to maintain the differences in wind velocity at different levels, turbulent mixing would eventually equalize the velocities in all levels and the air would move as a solid. However, since the supply of

momentum in the upper air is practically inexhaustible, and since momentum is constantly being converted into heat and lost at the ground surface, wind velocities in different levels are never completely equalized. Thus, although turbulence tends to destroy shear, nevertheless the strongest mixing at a fixed level near the ground is associated with the strongest shear.

The dependence of vertical differences in velocity on the intensity of turbulent mixing is important in the measurement of evaporation

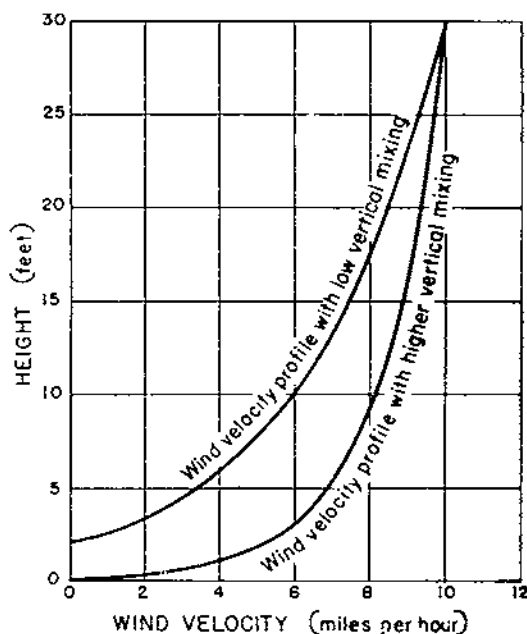


FIGURE 5. When vertical mixing is slight because of weak turbulence, wind velocity diminishes rapidly near the ground and reaches zero some distance above it. As turbulence becomes stronger, vertical mixing increases and wind velocity diminishes less rapidly until very close to the ground and reaches zero nearer the ground surface.

because it enables us to determine the rate of mixing in the atmosphere by measuring the vertical gradient of wind velocity.

The vertical transfer of horizontal momentum (the shearing stress) is represented by the quantity  $\tau_{xz}$ , where it is assumed that the chief flow is in the  $x$  direction. The actual horizontal momentum in any level in the atmosphere is the product of the velocity,  $u$ , and the mass of the air,  $m$ , at that level. If, in figure 6,  $xy$  represents a given horizontal cross section through the atmosphere, and if  $a, b, c, \dots n$  and  $a', b', c', \dots n'$  are bodies of air at levels above and below it,

respectively, then in time,  $t$ , the total momentum transferred upward and downward through this cross section will be:

$$\uparrow \sum_{i'=a'}^{n'} m_{i'} u_{i'}, \quad (1)$$

$$\downarrow \sum_{i=a}^n m_i u_i. \quad (2)$$

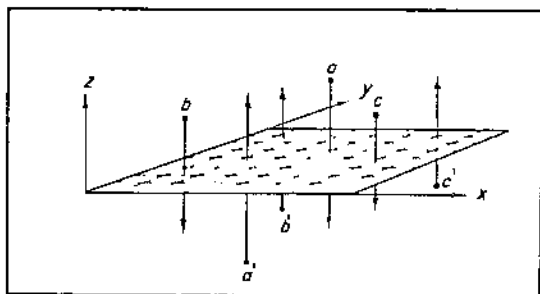


FIGURE 6.—Masses of air,  $a, b, c, \dots, n$ , are transferred downward and masses  $a', b', c', \dots, n'$  are transferred upward across horizontal plane  $xy$ .

The net transport of momentum downward will be the difference between (2) and (1):

$$T_u \downarrow = \sum_{i=a}^n m_i u_i - \sum_{i'=a'}^{n'} m_{i'} u_{i'}, \quad (3)$$

but the velocity at any given level may be expressed as a departure from the velocity at  $xy$ . Thus,  $u_i$  and  $u_{i'}$  may be written as follows:

$$u_i = u_o + \lambda_i \frac{du}{dz}, \quad (4)$$

$$u_{i'} = u_o - \lambda_{i'} \frac{du}{dz}, \quad (5)$$

where  $u_o$  is the velocity in the  $x$ -direction in plane  $xy$ ,  $\lambda_i$  and  $\lambda_{i'}$  are the perpendicular distances of  $i$  and  $i'$  from  $xy$ , and  $du/dz$  is the rate of change of wind velocity with respect to height.

Substituting for  $u_i$  and  $u_{i'}$  in (3):

$$T_u \downarrow = \sum_{i=a}^n m_i \left( u_o + \lambda_i \frac{du}{dz} \right) - \sum_{i'=a'}^{n'} m_{i'} \left( u_o - \lambda_{i'} \frac{du}{dz} \right), \quad (6)$$

$$T_u \downarrow = \sum_{i=a}^n m_i u_o + \sum_{i=a}^n m_i \lambda_i \frac{du}{dz} - \sum_{i'=a'}^{n'} m_{i'} u_o + \sum_{i'=a'}^{n'} m_{i'} \lambda_{i'} \frac{du}{dz}. \quad (7)$$

The terms  $\sum_{i'=a'}^{n'} m_{i'}$  and  $\sum_{i=a}^n m_i$  designate the total mass of air transported upward and downward, respectively. Thus:

$$\sum_{i'=a'}^{n'} m_{i'} u_o = \sum_{i'=a'}^{n'} m_{i'} u_o, \quad (8)$$

and

$$T_u \downarrow = \frac{du}{dz} \left( \sum_{i=a}^n m_i \lambda_i + \sum_{i'=a'}^{n'} m_{i'} \lambda_{i'} \right), \quad (9)$$

in which  $\sum_{i=a}^n m_i \lambda_i + \sum_{i'=a'}^{n'} m_{i'} \lambda_{i'}$  represents the combined sum of all the masses of air transported both upward and downward through their respective distances,  $\lambda$ , across section  $xy$  having area  $f$  in time  $t$ .

For unit area and unit time this expression would be

$$\sum_{i=a}^n \frac{m_i \lambda_i}{ft} + \sum_{i'=a'}^{n'} \frac{m_{i'} \lambda_{i'}}{ft}, \text{ or simply } \sum \frac{m \lambda}{ft}.$$

This expression is an index or coefficient of turbulent interchange of momentum, or the Austausch coefficient,  $A$ . It is also called the coefficient of eddy viscosity.

$$A = \sum \frac{m \lambda}{ft}. \quad (10)$$

The net downward transport of momentum,  $T_u \downarrow$ , is the shearing stress, which is represented by the symbol,  $\tau$ . Thus, the general equation for shearing stress is

$$\tau = A \frac{du}{dz}. \quad (11)$$

By considering the problem from a slightly different viewpoint, a second equation for the shearing stress may be obtained, and the value of  $A$  in equation (11) can be determined. If the mean values of the velocity component of the air in the three directions,  $x$ ,  $y$ , and  $z$  are indicated by  $u$ ,  $v$ ,  $\bar{w}$ , and the instantaneous deviations from these mean values by  $u'$ ,  $v'$ , and  $w'$ , the actual velocities,  $u$ ,  $v$ , and  $w$ , would be

$$\left. \begin{aligned} u &= \bar{u} + u', \\ v &= \bar{v} + v', \\ w &= \bar{w} + w'. \end{aligned} \right\} \quad (12)$$

Since the principal flow is assumed to be velocity  $u$  in the  $x$ -direction, velocities to the right and left counterbalance each other, as do upward and downward velocities. Consequently, the average velocities to the right and left ( $\bar{v}$ ), and up and down ( $\bar{w}$ ), are zero. Thus,  $v = v'$  and  $w = w'$ .

The mass of air passing up or down through a unit area of the horizontal plane in an element of time will be  $\rho w dt$ . The momentum of this mass, having velocity  $u$  in the  $x$ -direction, will be  $\rho u w dt$ , and this is transferred vertically upward through the horizontal plane. Therefore:

$$T_u \uparrow = \rho u w dt. \quad (13)$$



Substituting the values of  $u$  and  $w$ :

$$T_u \uparrow = \rho(\bar{u} + u')(\bar{w} + w')dt, \quad (14)$$

$$T_u \uparrow = \rho(\bar{u}\bar{w} + \bar{u}w' + u'\bar{w} + u'w')dt. \quad (15)$$

Since the main flow is  $\bar{u}$  in the  $x$ -direction, the actual velocities upward will be equal to those downward, and the mean value of these vertical velocity components  $w$  will be equal to zero. Then:

$$T_u \uparrow = \rho(\bar{u}w' + u'w')dt. \quad (16)$$

This equation gives the transfer of momentum during time interval  $dt$ . Over a longer period of time,  $T$ , the average momentum transfer will be:

$$T_u \uparrow = \frac{1}{T} \int_0^T \rho(\bar{u}w' + u'w')dt, \quad (17)$$

or from (13):

$$T_u \uparrow = \frac{1}{T} \int_0^T \rho u w dt. \quad (18)$$

But the expression  $(1/T) \int_0^T \rho u w dt$  merely represents the average momentum transfer in unit time, or simply  $\rho \bar{u} \bar{w}$  (mean value of  $\rho u w$ ).

$$T_u \uparrow = \rho \bar{u} \bar{w}. \quad (19)$$

Similarly, from the relations expressed in (17):

$$T_u \uparrow = \rho \bar{u} \bar{w}' + \rho \bar{u}' \bar{w}'. \quad (20)$$

Although  $\bar{w}'$ , the mean value of  $w'$ , is zero, it does not follow that the mean value of the product  $u'w'$  is likewise zero. That  $\bar{u'w'}$  does not equal zero is due to the fact that there is a negative correlation between  $u'$  and  $w'$ . However, the term  $\bar{u} \bar{w}'$  equals zero because  $\bar{u}$  for any given situation is a constant. Therefore:

$$T_u \uparrow = \rho \bar{u'w'}. \quad (21)$$

Since

$$T_u \downarrow = -T_u \uparrow,$$

and  $T_u \downarrow$  is the force which the upper air exerts on the lower, or  $\tau_{xz}$ , it follows that

$$\tau_{xz} = -\rho \bar{u'w'}. \quad (22)$$

Because of the normally negative correlation between  $u'$  and  $w'$ ,  $\tau_{xz}$  is actually normally positive, as should be expected from the fact that the faster air drags the slower with it.

The negative correlation between  $u'$  and  $w'$  results from the fact that the horizontal component of wind velocity increases with height. When a mass of air rises to a higher level its vertical velocity,  $w$ , is positive, and because the average value of the vertical velocity,  $\bar{w}$ , is zero,  $w'$  is also positive. As it rises, it tends to retain its initial hori-

zonal velocity,  $u$ , and since this is less than the average horizontal velocity,  $\bar{u}$ , at the new level,  $u'$  is negative. Similarly, when air moves to a lower level, and  $w'$  is negative, its velocity,  $u$ , is greater than the average velocity,  $\bar{u}$ , in the new environment, and  $u$  is positive. Thus, the instantaneous deviations of the velocity  $u'$  and  $w'$  are of necessity opposite in sign; when one is positive, the other is negative, and the product  $u'w'$  is negative.

The shearing stress,  $-\rho\overline{u'w'}$ , or the average transfer of momentum, represents a tangential force per unit area that is entirely due to the turbulent motion in the fluid. Actually, the total shearing force must also take account of a force that is due to the viscosity of the fluid. Thus:

$$\tau_{xz} = \mu \frac{du}{dz} - \rho\overline{u'w'}, \quad (23)$$

where  $\mu$  is the coefficient of molecular viscosity and  $d\bar{u}/dz$  is the gradient of the mean velocity.

In the immediate vicinity of a solid boundary surface, the turbulent stress becomes zero because the eddy velocity components become vanishingly small. The layer or zone directly in contact with the surface is known as the laminar layer; only here is the term  $\mu (d\bar{u}/dz)$  of any importance. In the turbulent layer proper, the shear term due to molecular viscosity is so small in comparison with  $-\rho\overline{u'w'}$  that it may be entirely neglected.

The wind velocity terms in equation (22) are the instantaneous deviations of horizontal velocity  $u'$  in the  $x$ -direction and the instantaneous deviations of vertical velocity  $w'$  in the  $z$ -direction. These values can be measured only with very specialized equipment. Since only the mean value of the velocity in the  $x$ -direction,  $\bar{u}$ , is readily and regularly measured, further development of equation (22) is necessary in order that the shearing stress may be expressed in easily measurable quantities. This is accomplished through the use of Prandtl's theory of momentum transfer (32).

If a parcel of air having mean velocity  $\bar{u}$  is transferred upward through distance  $\lambda$  where the mean velocity is  $\bar{u} + \lambda(d\bar{u}/dz)$ , and its initial mean velocity is preserved in the new environment, it follows that

$$u' = \bar{u} - \left( \bar{u} + \lambda \frac{d\bar{u}}{dz} \right) = -\lambda \frac{d\bar{u}}{dz}.$$

Measurements have shown that on the average in the turbulent atmosphere there are equal amounts of kinetic energy associated with all three wind velocity components,  $u'$ ,  $v'$ , and  $w'$ . Hence,  $w'$  must, on the average, be proportional to the distance  $\lambda$ , through which the turbulent eddies travel and to  $d\bar{u}/dz$ , so that  $w'$  is of the form  $\lambda(d\bar{u}/dz)$

although not necessarily equal to it. Remembering that  $u'$  and  $w'$  are opposite in sign and substituting in (22) we obtain:

$$\tau = \rho l^2 \left( \frac{d\bar{u}}{dz} \right)^2, \quad (24)$$

in which  $\lambda$  is replaced by  $l$ , which is a mean length known as the mixing length.

The mixing length is considered as the vertical distance traveled by the eddies from the level where they originated to the level where they lose their individuality and mix with the turbulent fluid surrounding them. This "path of mixing" is related to the size of the eddies; the larger the diameter of an eddy, the greater the distance it may travel before it disintegrates. Apparently, too, the size of an eddy is directly proportional to the distance from the boundary surface at which it forms. Thus, the mixing length is proportional to the height (32, pp. 250-265; 59; 60; 105; 106, pp. 123-135). This relationship is shown by the expression

$$l = k_0 z, \quad (25)$$

in which  $k_0$  is a constant of proportionality, known as the "universal turbulence constant," or von Kármán's constant.

At times of very light winds and strong radiational cooling next to the ground—that is, with high atmospheric stability—the mixing length may not be proportional to height. However, there is a layer within 16 feet of the ground where the relation  $l = k_0 z$  is very close even under conditions of extreme stability (138, 141, 143, 145, 146).

Substituting for  $l$  in (24) we have

$$\tau = \rho (k_0 z)^2 \left( \frac{d\bar{u}}{dz} \right)^2. \quad (26)$$

By combining the two equations for shearing stress, (11) and (26), an expression for the Austausch coefficient is obtained.

$$A = \rho (k_0 z)^2 \left( \frac{d\bar{u}}{dz} \right). \quad (27)$$

Solving for  $d\bar{u}/dz$  in (26) we obtain:

$$\frac{d\bar{u}}{dz} = \frac{1}{k_0 z} \sqrt{\frac{\tau}{\rho}}. \quad (28)$$

The shearing stress,  $\tau$ , can be considered as constant within 20 or 30 feet of the ground, according to Prandtl (105), and the vertical differences in density are so small within this distance that they can be neglected. Thus, equation (28) can easily be integrated. Integrating between the limits  $\bar{u}_1$  and  $\bar{u}_2$  for the velocity, and  $z_1$  and  $z_2$  for the height, we have

$$\bar{u}_2 - \bar{u}_1 = \frac{1}{k_0} \sqrt{\frac{\tau}{\rho}} \log_e \frac{z_2}{z_1}. \quad (29)$$

Solving for  $\sqrt{\tau/\rho}$ :

$$\sqrt{\frac{\tau}{\rho}} = k_0 \frac{(\bar{u}_2 - \bar{u}_1)}{\log_e \frac{z_2}{z_1}} \quad (30)$$

Combining (27), (28), and (30) we have a simplified expression for the Austausch coefficient:

$$A = \frac{\rho k_0^2 z (\bar{u}_2 - \bar{u}_1)}{\log_e \frac{z_2}{z_1}} \quad (31)$$

Equation (31) shows that  $A$  is proportional to  $z$ , or in other words, the Austausch varies directly with height, because in any given situation all the other terms are constant.

### THE EQUATION FOR EVAPORATION

Moisture is transferred upward through the atmosphere by the same turbulent motion that causes a downward transfer of momentum, and by an analytical treatment similar to that employed in the development of equation (11) it can be shown that

$$E = -A \frac{dq}{dz} \quad (32)$$

in which  $E$  is evaporation,  $dq/dz$  is the gradient of moisture concentration, and  $A$  is again the Austausch coefficient, or, in this case, the coefficient of eddy conductivity. Since it is reasonably assumed that the Austausch for momentum and matter are the same, the value of  $A$  in (31) can be substituted in (32):

$$E = -\frac{\rho k_0^2 z (\bar{u}_2 - \bar{u}_1) dq}{\log_e \frac{z_2}{z_1} dz} \quad (33)$$

and

$$\frac{dq}{dz} = -\frac{E \log_e \frac{z_2}{z_1}}{\rho k_0^2 z (\bar{u}_2 - \bar{u}_1)} \quad (34)$$

This equation can easily be integrated between two different levels in the atmosphere:

$$q_1 - q_2 = \frac{E \log_e \frac{z_2}{z_1}}{\rho k_0^2 (\bar{u}_2 - \bar{u}_1)} \log_e \frac{z_2}{z_1} \quad (35)$$

$$E = \frac{\rho k_0^2 (q_1 - q_2) (\bar{u}_2 - \bar{u}_1)}{\left( \log_e \frac{z_2}{z_1} \right)^2} \quad (36)$$

In case the measurements of moisture and wind are not made at the same levels a more general form of the equation is required:

$$E = \frac{\rho k_0^2 (q_1 - q_2) (\bar{u}_2 - \bar{u}_1)}{\log_e \frac{z_{e2}}{z_{e1}} \log_e \frac{z_{u2}}{z_{u1}}}, \quad (37)$$

where  $z_{e2}$  and  $z_{e1}$  are levels where moisture measurements are made and  $z_{u2}$  and  $z_{u1}$  are the levels corresponding to the wind measurements. The much greater convenience of equation (36) indicates that wherever possible the measurement of moisture and wind should be made at the same levels. All values are in CGS units.

The formula giving evaporation in inches depth per hour is

$$E = \frac{1.34 k_0^2 P (q_1 - q_2) (u_2 - u_1)}{(T + 459.4) \left( \log_e \frac{z_2}{z_1} \right)^2}, \quad (38)$$

where  $k_0$  is the universal turbulence constant,  $P$  the pressure in inches of mercury,  $q_1$  and  $q_2$  the specific humidity in grams of moisture per kilogram of air,  $u_2$  and  $u_1$  the mean wind velocities in miles per hour at heights  $z_2$  and  $z_1$ , and  $T$  the temperature in degrees Fahrenheit.

Frequently the water vapor concentration at the two levels is most conveniently expressed as vapor pressure,  $e$ , or as absolute humidity,  $\rho_w$ . These values are related to specific humidity,  $q$ , as follows:

$$q = 0.622 \frac{e}{P}, \quad (39)$$

where  $P$  is total pressure of the air, or

$$q = \frac{\rho_w}{\rho_a}, \quad (40)$$

where  $\rho_a$  is density of the air.

Thus, equation (38) may be written as

$$E = \frac{833 k_0^2 (e_1 - e_2) (u_2 - u_1)}{(T + 459.4) \left( \log_e \frac{z_2}{z_1} \right)^2}, \quad (41)$$

where  $e_1$  and  $e_2$  are in millimeters of mercury at  $z_1$  and  $z_2$ . Since the density differences in the air within a few feet of the ground can be neglected,

$$E = \frac{0.063 k_0^2 (\rho_{w1} - \rho_{w2}) (u_2 - u_1)}{\left( \log_e \frac{z_2}{z_1} \right)^2}, \quad (42)$$

where  $E$  is the total evaporation in the time interval,  $\rho_{w1}$  and  $\rho_{w2}$  are the average absolute humidities at  $z_1$  and  $z_2$ , expressed in grams of moisture per cubic meter of air, and  $u_1$  and  $u_2$  are total miles of wind in the time interval.

Four terms appear in the evaporation equation; the universal turbulence constant,  $k_s$ ; the ratio of the heights of the two points of observation,  $z_2/z_1$ ; the moisture gradient,  $q_1 - q_2$ ; and the wind gradient,  $u_2 - u_1$ . The accuracy with which evaporation is determined depends on the accuracy of measurement of each of these terms. The problems of measurement will be discussed in the following sections.

#### THE DETERMINATION OF THE QUANTITY $z_2/z_1$

From equations (29) and (35) it could be predicted that the vertical distribution of both wind velocity and moisture concentration would follow a logarithmic law within the part of the turbulent layer where shearing stress,  $\tau$ , and density,  $\rho$ , may be considered constant; and actual observations have repeatedly demonstrated this to be true. Of course the logarithmic law applies only above the level where active turbulent transfer begins.

Over a smooth surface there is a laminar layer, only a few millimeters thick, beneath the turbulent layer, in which turbulence does not operate but momentum is transferred by intermolecular friction and moisture by molecular diffusion. If the logarithmic law held down to the top of the laminar layer, wind velocities would reach zero at a small distance above the physical bounding surface,  $z_0$ , within the turbulent layer. Actually, there are small finite velocities in the laminar layer and in the turbulent sublayer immediately above it. In the turbulent sublayer the shearing stress is no longer constant but diminishes rapidly as the laminar layer is approached. Consequently the logarithmic law does not apply in the lowest part of the turbulent layer itself.

A most important influence on the operation of the logarithmic law is the presence of a cover of vegetation over the ground surface. In a field of grain much of the momentum of the lower levels of the atmosphere is transferred downward to the ground along the plant stems and very little by turbulence. Thus within the plant mass the shearing stress,  $\tau$ , is greatly reduced, and the logarithmic law consequently does not apply.

Lettau (85, p. 78) has reached the conclusion that molecular conduction and diffusion are the principal means of transfer in the atmosphere within or below a thick plant canopy and cites as evidence the work of Geiger (39) on heat transfer. It is probable that only in the densest vegetation is turbulent transfer entirely suppressed. A thick layer of sphagnum moss would provide such a cover. Mass transfer of momentum and moisture takes place within the plant mass in a grain field or in a woodland or forest but at a greatly reduced rate, which is much less than that in the air above the tops of the plants.

Since the logarithmic law applies only above the level where active

turbulence begins, this level rather than the ground level is the base of reference for the wind-velocity profile and may be designated the source surface for turbulent transfer. Through the season, as plants grow to maturity, the source surface gradually moves away from the ground and the layer in which the logarithmic law does not operate becomes thicker. As wheat or corn develops, the source surface rises, and its average position remains near the tops of the plants. When the crop is harvested the source surface drops to a position close to the ground near the top of the stubble. In a forested area the logarithmic law of wind distribution would be expected to apply only above the tops of the trees, and the source surface is at such a height that only the tallest trees extend above it. Thus, in a mature forest the source surface might easily be 100 feet above the ground, with most of the momentum of the atmosphere reaching the ground along the tree trunks. Wind movement within the forest demonstrates the failure of the logarithmic law.

The lack of coincidence of the source surface with the ground surface is apparent in winter after a fall of snow. As snow accumulates on the ground the level of the source surface, in this case also the evaporating surface, rises. As the snow melts away, the source surface gradually returns to the ground level.

It is necessary to distinguish between the ground surface and the source surface because the measurements of wind velocity and moisture concentration are made at fixed heights above the ground surface, whereas the logarithmic law applies with the source surface as a base of reference. Thus, as the source surface rises with the accumulation of snow on the ground or the growth of vegetation there is a reduction in the effective height at which the observations of wind velocity and moisture concentration are made. Thus,

$$z = h - h_0,$$

in which  $h$  is the height above the ground of the instruments used in the observations and  $z$  is their height above the source surface.

The terms  $z_2$  and  $z_1$  in the evaporation equation, therefore, do not represent heights above the ground but rather heights above the source surface for active turbulent transfer. Since they may differ greatly from the measured heights above the ground,  $h_2$  and  $h_1$ , it is necessary to determine the height of the source surface  $h_0$ .

The wind velocity profile over three types of surfaces is shown in figure 7. The surface in figure 7, A is smooth, and the source surface and the natural surface coincide. Hence,  $z_3$ ,  $z_2$ , and  $z_1$  are the same as  $h_3$ ,  $h_2$ , and  $h_1$ . As the logarithmic distribution is extrapolated downward wind velocity would become zero at height  $z_0$ . Actually the logarithmic law fails a short distance above  $z_0$ , and small finite velocities are to be found down through the laminar layer (included

in  $z_0$ ) to the actual physical surface. The surface in figure 7, *B* is covered with dense vegetation. Here the source surface is a distance,  $h_0$ , above the ground surface and  $z_3$ ,  $z_2$ , and  $z_1$  are less than  $h_3$ ,  $h_2$ , and  $h_1$  by that distance. By extrapolation of the logarithmic distribution downward  $z_0$  is seen to be a short distance above  $h_0$ . Actually wind velocity does not disappear at  $z_0$  but continues down through the vegetation to the ground. In figure 7, *C* the surface is represented as being covered with a mantle of snow. The situation here is similar to that of the smooth surface (figure 7, *A*) except that the heights  $z_3$ ,  $z_2$ , and  $z_1$  are less than  $h_3$ ,  $h_2$ , and  $h_1$  by an amount,  $h_0$ , equal to the thickness of the snow mantle.

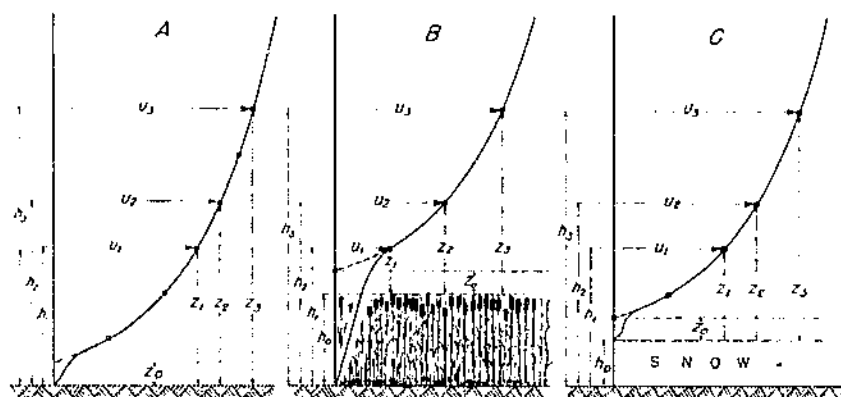


FIGURE 7.- Schematic representation of the wind velocity profile near the ground: (*A*) Over a smooth surface; (*B*) over a vegetation-covered surface; (*C*) over a snow-covered surface.

Sometimes the source surface,  $h_0$ , can be measured directly, and sometimes, as over a water surface or over a bare smooth field, it is so small that it can be ignored. It can readily be determined from measurements of wind velocity at three levels within the zone where the logarithmic law holds. If the heights of the points at which wind velocities  $u_3$ ,  $u_2$ , and  $u_1$  are observed are  $h_3$ ,  $h_2$ , and  $h_1$ , then, as in figure 7, *B*,

$$\begin{aligned} h_3 - h_0 &= z_3, \\ h_2 - h_0 &= z_2, \\ h_1 - h_0 &= z_1. \end{aligned} \quad (43)$$

Because of its logarithmic vertical distribution, wind velocity can be related to height by the equation

$$h - h_0 = z_0 b^u, \quad (44)$$

in which wind velocity becomes zero at some finite distance,  $z_0$ , above the evaporating surface. This may be rewritten in the form

$$\log_e (h - h_0) = \log_e z_0 + u \log_e b. \quad (45)$$



Substituting the values for three given points  $(u_1, h_1)$ ,  $(u_2, h_2)$ , and  $(u_3, h_3)$ , we have:

$$\log_e (h_3 - h_o) = \log_e z_o + u_3 \log_e b, \quad (46)$$

$$\log_e (h_2 - h_o) = \log_e z_o + u_2 \log_e b, \quad (47)$$

$$\log_e (h_1 - h_o) = \log_e z_o + u_1 \log_e b. \quad (48)$$

Subtracting:

$$\log_e (h_3 - h_o) - \log_e (h_1 - h_o) = (u_3 - u_1) \log_e b, \quad (49)$$

$$\log_e (h_2 - h_o) - \log_e (h_1 - h_o) = (u_2 - u_1) \log_e b. \quad (50)$$

From (49) and (50) we obtain:

$$\frac{u_3 - u_1}{u_2 - u_1} = \frac{\log_e \frac{h_3 - h_o}{h_1 - h_o}}{\log_e \frac{h_2 - h_o}{h_1 - h_o}}. \quad (51)$$

It is not easy to solve this equation for  $h_o$ , but the determination of the values of  $(u_3 - u_1)/(u_2 - u_1)$  which correspond to given values of  $h_o$  can be made without difficulty. In table 2 the values of  $h_o$  corresponding to given values of  $(u_3 - u_1)/(u_2 - u_1)$  are given for an installation where wind velocity measurements are made 4, 8, and 16 feet above the ground.

TABLE 2.—Values of  $h_o$  for corresponding values of  $(u_3 - u_1)/(u_2 - u_1)$  where  $h_3 = 16$  feet,  $h_2 = 8$  feet, and  $h_1 = 4$  feet

$\frac{u_3 - u_1}{u_2 - u_1}$	$h_o$	$\frac{u_3 - u_1}{u_2 - u_1}$	$h_o$	$\frac{u_3 - u_1}{u_2 - u_1}$	$h_o$	$\frac{u_3 - u_1}{u_2 - u_1}$	$h_o$
	<i>Feet</i>		<i>Feet</i>		<i>Feet</i>		<i>Feet</i>
1.21	3.975	1.41	3.691	1.61	2.925	1.81	1.726
1.22	3.989	1.42	3.634	1.62	2.880	1.82	1.652
1.23	3.992	1.43	3.606	1.63	2.831	1.83	1.577
1.24	3.954	1.44	3.577	1.64	2.781	1.84	1.500
1.25	3.915	1.45	3.547	1.65	2.729	1.85	1.421
1.26	3.935	1.46	3.516	1.66	2.676	1.86	1.340
1.27	3.924	1.47	3.484	1.67	2.622	1.87	1.258
1.28	3.912	1.48	3.451	1.68	2.567	1.88	1.174
1.29	3.899	1.49	3.417	1.69	2.510	1.89	1.088
1.30	3.885	1.50	3.382	1.70	2.452	1.90	1.000
1.31	3.870	1.51	3.346	1.71	2.393	1.91	.910
1.32	3.854	1.52	3.308	1.72	2.332	1.92	.818
1.33	3.837	1.53	3.271	1.73	2.270	1.93	.723
1.34	3.819	1.54	3.232	1.74	2.207	1.94	.626
1.35	3.800	1.55	3.192	1.75	2.145	1.95	.527
1.36	3.780	1.56	3.151	1.76	2.077	1.96	.426
1.37	3.759	1.57	3.109	1.77	2.010	1.97	.323
1.38	3.736	1.58	3.066	1.78	1.944	1.98	.218
1.39	3.712	1.59	3.021	1.79	1.874	1.99	.110
1.40	3.687	1.60	2.975	1.80	1.799	2.00	.000

The height of the source surface above the natural surface will depend on surface roughness, which results from irregularities in the surface itself and in the distribution of vegetation and other objects upon it. Over a smooth ice surface the source surface will be near the physical surface. Where there are surface irregularities the two

surfaces will not coincide, but the effective source surface will be above the natural surface. The height of the source surface also depends upon the strength of the wind and rises with increase in wind velocity.

Another important influence on the height of the source surface,  $h_0$ , is the vertical temperature structure of the atmosphere. When the lower levels of the atmosphere become increasingly stable, as when the air adjacent to the ground is cooled more rapidly than that above, there is an increasing tendency for the various layers to remain in their original position. Thus, the intensity of turbulent mixing, measured by the Austausch coefficient, is reduced and there is a smaller downward transfer of momentum. There is, therefore, less tendency for the equalization of wind velocity in the source levels, and the wind velocity gradient tends to increase. As a result, the position of the source surface is raised and the layer within which the logarithmic law does not operate becomes thicker (fig. 6). This change has nothing to do with the character of the roughness of the surface but is related solely to the stability of the atmosphere.<sup>6</sup>

Extrapolation of the logarithmic distribution of wind velocity downward to the source surface yields a mean velocity of zero at a small distance above it. This distance is the height,  $z_0$ . It has been known as the roughness coefficient and has been considered to be a physical constant for each type of surface; it is quite small, averaging only about 0.4 centimeters (97, 125, 141, 143, 145, 146). In the layer between the source surface and the height  $z_0$ , turbulence would still exist and there would be a small mixing length in which the relation

$$l = k_0 z,$$

would apply just as in the higher levels.

Actually there is no physical justification for extrapolating the logarithmic distribution of wind velocity downward to the source surface, since within the transitional layer near the source surface the shearing stress,  $\tau$ , is reduced and the logarithmic law does not apply. Wind velocity measurements near the surface are regularly higher than would be expected on the basis of a logarithmic distribution. Probably neither  $h_0$  nor  $z_0$  has any physical reality, but they are both useful statistical concepts. Even though the logarithmic law does not apply within the layer itself, the height  $h_0$  supplies a base of reference for determining the ratio  $z_2/z_1$  for the levels where it does apply.

The height  $z_0$  cannot be measured directly, but since it is the level at which wind velocity becomes zero by downward extrapolation it can be determined from measurement of wind velocities at two levels,

<sup>6</sup> The influence of stability was discussed in a series of papers by Pauschke (100), Sutton (138), and Sverdrup (141, 143, 145, 146).

$h_2$  and  $h_1$ , provided the value of  $h_0$  is known. From equation (44) we obtain:

$$h_2 - h_0 = z_0 b^{u_2}, \quad (52)$$

$$h_1 - h_0 = z_0 b^{u_1}. \quad (53)$$

Hence:

$$(h_1 - h_0)^{u_2} = z_0^{u_2} b^{u_1 + u_2}, \quad (54)$$

$$(h_2 - h_0)^{u_1} = z_0^{u_1} b^{u_2 + u_1}. \quad (55)$$

Dividing:

$$\frac{(h_1 - h_0)^{u_2}}{(h_2 - h_0)^{u_1}} = z_0^{u_2 - u_1}, \quad (56)$$

$$z_0 = \left[ \frac{(h_1 - h_0)^{u_2}}{(h_2 - h_0)^{u_1}} \right]^{\frac{1}{u_2 - u_1}}. \quad (57)$$

Table 3 gives the average hourly values of the term  $z_0$  for 7 months at the evaporation station at Arlington, Va. There is a definite diurnal variation in every month, with  $z_0$  reaching its maximum height in the hours near midnight and its minimum about noon, in direct relation to the diurnal march of stability of the lower layers of the atmosphere and in inverse relation to the diurnal march of wind velocity.<sup>7</sup> The gradual increase from January to May may be due to increased roughness of the surface associated with the growth of the vegetation, and the decreases in June and July may have resulted from repeated mowing of the field.

TABLE 3.—Diurnal variation of  $z_0$  by months at Arlington, Va., 1939

Average $z_0$ for hour ending at—												
Month	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.
January.....	<i>0.220</i>	<i>0.135</i>	<i>0.205</i>	<i>0.210</i>	<i>0.230</i>	<i>0.435</i>	<i>0.270</i>	<i>0.329</i>	<i>0.099</i>	<i>0.049</i>	<i>0.018</i>	<i>0.017</i>
March.....	<i>0.344</i>	<i>0.366</i>	<i>0.457</i>	<i>0.402</i>	<i>0.390</i>	<i>0.488</i>	<i>0.421</i>	<i>0.125</i>	<i>0.067</i>	<i>0.073</i>	<i>0.040</i>	<i>0.027</i>
April.....	<i>1.143</i>	<i>1.676</i>	<i>1.445</i>	<i>0.853</i>	<i>1.210</i>	<i>1.774</i>	<i>1.082</i>	<i>0.954</i>	<i>0.860</i>	<i>0.268</i>	<i>0.274</i>	<i>0.350</i>
May.....	<i>1.570</i>	<i>2.134</i>	<i>1.600</i>	<i>0.664</i>	<i>0.567</i>	<i>0.533</i>	<i>0.762</i>	<i>0.610</i>	<i>0.396</i>	<i>0.225</i>	<i>0.244</i>	<i>0.414</i>
June.....	<i>1.814</i>	<i>1.783</i>	<i>1.530</i>	<i>1.896</i>	<i>1.372</i>	<i>1.420</i>	<i>0.914</i>	<i>0.853</i>	<i>0.320</i>	<i>0.183</i>	<i>0.238</i>	<i>0.134</i>
July.....	<i>1.048</i>	<i>1.100</i>	<i>0.975</i>	<i>0.914</i>	<i>1.052</i>	<i>0.914</i>	<i>0.820</i>	<i>0.497</i>	<i>0.555</i>	<i>0.984</i>	<i>0.902</i>	<i>0.616</i>
August.....	<i>1.219</i>	<i>0.457</i>	<i>0.914</i>	<i>0.524</i>	<i>0.564</i>	<i>0.110</i>	<i>0.110</i>	<i>0.116</i>	<i>0.034</i>	<i>0.116</i>	<i>0.067</i>	<i>0.073</i>
Average.....	<i>1.037</i>	<i>1.066</i>	<i>1.018</i>	<i>0.772</i>	<i>0.769</i>	<i>0.810</i>	<i>0.628</i>	<i>0.502</i>	<i>0.333</i>	<i>0.271</i>	<i>0.255</i>	<i>0.233</i>

Average $z_0$ for hour ending at—													Average
Month	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
January.....	<i>0.007</i>	<i>0.053</i>	<i>0.014</i>	<i>0.930</i>	<i>0.127</i>	<i>0.127</i>	<i>0.380</i>	<i>0.420</i>	<i>0.355</i>	<i>0.320</i>	<i>0.159</i>	<i>0.441</i>	<i>0.194</i>
March.....	<i>0.040</i>	<i>0.027</i>	<i>0.001</i>	<i>0.046</i>	<i>0.110</i>	<i>0.213</i>	<i>0.350</i>	<i>0.306</i>	<i>0.518</i>	<i>1.570</i>	<i>0.519</i>	<i>0.570</i>	<i>0.273</i>
April.....	<i>0.364</i>	<i>0.564</i>	<i>0.390</i>	<i>0.445</i>	<i>0.323</i>	<i>0.866</i>	<i>1.402</i>	<i>2.073</i>	<i>2.104</i>	<i>1.539</i>	<i>1.524</i>	<i>1.329</i>	<i>1.038</i>
May.....	<i>0.209</i>	<i>0.149</i>	<i>0.335</i>	<i>0.836</i>	<i>0.780</i>	<i>1.311</i>	<i>3.048</i>	<i>3.749</i>	<i>3.092</i>	<i>4.359</i>	<i>3.658</i>	<i>2.134</i>	<i>1.431</i>
June.....	<i>0.183</i>	<i>0.350</i>	<i>0.402</i>	<i>0.350</i>	<i>0.573</i>	<i>0.594</i>	<i>0.744</i>	<i>1.024</i>	<i>0.878</i>	<i>0.930</i>	<i>1.404</i>	<i>1.768</i>	<i>0.906</i>
July.....	<i>0.670</i>	<i>0.661</i>	<i>0.628</i>	<i>0.538</i>	<i>0.905</i>	<i>0.933</i>	<i>1.265</i>	<i>1.856</i>	<i>2.042</i>	<i>1.658</i>	<i>1.082</i>	<i>0.994</i>	<i>0.937</i>
August.....	<i>0.076</i>	<i>0.067</i>	<i>0.164</i>	<i>0.004</i>	<i>0.177</i>	<i>0.335</i>	<i>0.670</i>	<i>0.357</i>	<i>0.488</i>	<i>0.306</i>	<i>0.472</i>	<i>0.570</i>	<i>0.330</i>
Average.....	<i>0.234</i>	<i>0.285</i>	<i>0.285</i>	<i>0.381</i>	<i>0.429</i>	<i>0.626</i>	<i>1.120</i>	<i>1.412</i>	<i>1.487</i>	<i>1.397</i>	<i>1.277</i>	<i>1.118</i>	<i>0.740</i>

<sup>7</sup> Observations made at Beltsville during 1941 have shown that  $z_0$  is 0.4 cm. only when the wind approximates 3½ miles per hour at the 4-foot level. With wind velocities of 1 mile per hour  $z_0$  is greater than 0.60 cm., but at 9 m. p. h. it is only 0.06 cm.

The influence of stability on  $h_o$  is not significant in determining evaporation, and in installations where there is no other reason for the evaporation surface to be other than the natural surface no appreciable error will result from considering  $z_2$  and  $z_1$  to be equal to  $h_2$  and  $h_1$ . Where this can be done with safety, the quantity  $z_2/z_1$  becomes a constant which can be combined with the other constant in the evaporation equation, and wind velocity measurements at only two levels will be required. For evaporation installations over most land surfaces,  $h_o$  must be taken into consideration and either obtained by direct measurement or computed from measurements of wind velocity.

### THE UNIVERSAL TURBULENCE CONSTANT

The constant of proportionality,  $k_o$ , relates the mixing length,  $l$ , to height,  $z$ , and has become known as the universal turbulence constant. The value of  $k_o$  has been determined mainly from measurements of velocity distributions of water in smooth and rough pipes and from wind tunnel measurements and has variously been found to be 0.36, 0.38 (123, p. 6), and 0.40 (60, p. 11). A recent study of flow of water in open channels has indicated that  $k_o$  may have values between 0.22 and 0.43, depending on the geometry of the channel (148, p. 648), but there appears to be considerable uncertainty about the correct determination of the shearing stress.

The determination of a  $k_o$  that is appropriate for conditions in wind tunnels and pipes is straightforward because independent measurements of the shearing stress may be made in terms of the pressure distribution as well as the velocity distribution. No such straightforward procedure can be used in the free air. Consequently, the value of  $k_o$  has never been determined for the atmosphere. In the computation of the evaporation data which are presented in a later section (pp. 47-62), the value 0.38, following Rossby's usage (124, p. 6), has been employed. Montgomery (97) suggests that a value somewhat higher than 0.38 may be more appropriate for the atmosphere.

Ertel (81) has developed a formula by means of which the Austausch coefficient may be determined from observations of short time fluctuations of any physical property of the atmosphere, such as momentum, temperature, specific humidity, or dust. Lettau (84) and Müller (98) have made use of Ertel's Austausch formula for wind and temperature, respectively, and Fritzsche and Stange (86) have applied it to a study of the vertical temperature distribution over a metropolitan area. Schmidt has also used Ertel's formula for determining the Austausch from very detailed wind observations. In addition, Schmidt extended his Austausch measurements to the vapor transport problem and claims to have measured the evaporation from an open grassland (130, pp. 365-367).

Ertel's Austausch equation does not contain the proportionality factor,  $k_0$ . Thus, if it is equated to the expression for the Austausch, given in equation (31), it is possible to determine the value of  $k_0$  from measurements of the short-time fluctuations of wind velocity.

Ertel's formula for determining the Austausch for momentum is

$$A = \frac{\rho \sigma u \cdot \sigma \left( \frac{du}{dt} \right)}{\left( \frac{d\bar{u}}{dz} \right)^2}, \quad (58)$$

where  $\rho$  is the density of the air,  $u$  is the actual wind velocity at level  $z$ ,  $du/dt$  is the change of wind velocity with time,  $d\bar{u}/dz$  is the change of average wind velocity with height,  $\sigma u$  is the standard deviation of  $u$ , and  $\sigma(du/dt)$  is the standard deviation of  $du/dt$ .

Combining the two equations for  $A$ , (31) and (58), we get the following expression for  $k_0^2$ :

$$k_0^2 = \frac{\sigma u \cdot \sigma \left( \frac{du}{dt} \right) \log_e \frac{z_2}{z_1}}{z \left( \frac{d\bar{u}}{dz} \right)^2 (\bar{u}_2 - \bar{u}_1)}, \quad (59)$$

but from (28) and (30):

$$\frac{d\bar{u}}{dz} = \frac{\bar{u}_2 - \bar{u}_1}{z \log_e \frac{z_2}{z_1}}, \quad (60)$$

Substituting in equation (59):

$$k_0^2 = \frac{\sigma u \cdot \sigma \left( \frac{du}{dt} \right) z \left( \log_e \frac{z_2}{z_1} \right)^3}{(\bar{u}_2 - \bar{u}_1)^3}. \quad (61)$$

The terms  $\sigma u$  and  $\sigma du/dt$  can be determined with the aid of the following formulas, where the element  $u$  is observed at equal short time intervals and has a series of values  $u_i$  ( $i=1, 2, 3 \dots n$ ):

$$u'_i = u_i - \bar{u}, \quad (62)$$

$$\sigma u = \sqrt{\frac{\sum_{i=1}^n (u'_i)^2}{n}}. \quad (63)$$

If the time interval between successive observations of  $u$  is  $\Delta t$ , then  $\sigma du/dt$  may be calculated with the aid of the formula:

$$\sigma \left( \frac{du}{dt} \right) = \frac{1}{\Delta t} \sqrt{\frac{\sum_{i=1}^{n-1} \{u_{(i+1)} - u_i\}^2}{n-1}}. \quad (64)$$

## THE MEASUREMENT OF ATMOSPHERIC MOISTURE

In the evaporation equation the moisture term appears as a difference between the humidity at two levels in the atmosphere, a difference which is usually very small. Proportionately small errors in observation can result in large percentage errors in the difference and consequently in the final computation of the evaporation. Thus accurate measurements of atmospheric moisture are indispensable to the successful application of the method.

Although for many years there have been a number of ways whereby the amount of water vapor in the atmosphere could be measured, none of them is ideally adapted to the problem of measuring the transfer of moisture between the ground surface and the atmosphere. The four methods of determining atmospheric moisture in most common use are (1) the chemical-absorption method; (2) the temperature of condensation, or dew-point method; (3) the psychrometric method; and (4) the hygroscopic expansion method. All are well known and need be described only briefly (2, pp. 135-160; 34; 56, pp. 12-16; 101).

In the chemical method a measured volume of air is passed through tubes containing a desiccating material, such as phosphorus pentoxide, and the water absorbed from the air is measured, usually as a gain in weight of the apparatus during a designated period of time. Under favorable conditions the average absolute humidity as an integrated value for the period of a day can be determined to within 0.1 percent of its true value. Where a sample of air can be quickly withdrawn from the atmosphere its moisture concentration at a given moment can be determined with equal accuracy. The chemical absorption method has been generally regarded as being principally a laboratory technique and of limited value for making field measurements.

In the condensation method the essential apparatus consists of a polished metal mirror which can be cooled several degrees below air temperature and whose temperature can be observed or recorded. In operation, the mirror is cooled until moisture condenses on its surface, at which time its temperature is observed. The mirror is then allowed to warm up until the moisture disappears, and the temperature is again observed. The mean of the two observations is considered to be the dew point. The condensation method is not ordinarily employed in making meteorological observations.

The wet- and dry-bulb psychrometer is perhaps the most familiar instrument for making determinations of atmospheric humidity. It consists of two matched thermometers, the bulb of one being wrapped with a muslin wick, which is wet when observations are to be taken. Air is circulated past the bulbs, either by means of a fan or by whirling the thermometers. The dry-bulb thermometer gives a reading of air temperature; the temperature of the wet bulb is depressed by an amount dependent on the rate of evaporation of the water from the

wick, which in turn depends upon the dryness of the air. Relative humidity is determined by reference to psychrometric tables. The method is a favorite one because of its simplicity, but it is subject to instrumental and observational errors and often fails in weather when the water freezes in the wick of the wet bulb, and in extremely dry weather ridiculous results are sometimes obtained (101).

Instruments utilizing the principle of the wet- and dry-bulb psychrometer that give a continuous record have been built, but in them the errors inherent in the method are subject to further exaggeration.

Fibers of hygroscopic material increase in length when exposed to air of high relative humidity and shrink in dry air. In the hygrometer some hygroscopic substance is attached to an indicator needle so that the needle is deflected with changes in relative humidity of the air (77). In the hygrograph a pen that makes a continuous record of the relative humidity is activated through a system of levers by a hygroscopic substance.

Many hygroscopic materials both natural and synthetic have been used experimentally in humidity-indicating and humidity-recording instruments but none has yet been found that is more satisfactory than human hair. The hair hygrometer is extremely sensitive to changes in atmospheric humidity, but it possesses the incurable defect of drifting out of calibration. Furthermore, each instrument must be calibrated individually in terms of standard known humidities. No hair hygrograph can be expected to give a reliable record unless it is checked and recalibrated at frequent intervals (54, 132).

To be of practical use in the determination of atmospheric humidity, instruments should be reasonably inexpensive and so simple in operation that observations can be made according to a prescribed routine by inexperienced observers. For that reason meteorological practice in the measurement of humidity in the United States is limited to the wet- and dry-bulb psychrometer and the hair hygrometer, despite the recognized defects of both instruments (101, p. r).

The hair hygrograph is the only instrument in common use that will make a continuous record of atmospheric humidity. It was this fact that led to the selection of the hygrothermograph for use in the original evaporation measurements.

#### USE OF HYGROTHERMOGRAPHS IN EVAPORATION MEASUREMENTS

The hair hygrometer is recognized as being deficient in many respects, and unless great care is used, satisfactory results cannot be expected. The chief deficiencies are the uncertainty of registration of very high and very low values and the tendency for each instrument to develop individual peculiarities as a result of the particular changes to which it has been subjected.

The fact that pairs of instruments continue for some time to behave similarly after they have been carefully calibrated and matched, provided they are kept together and have the same history, makes it possible to use hygrothermographs successfully in evaporation measurements. Detailed instructions for the calibration of hygrothermographs and instructions for their use in evaporation measurements have been presented elsewhere.<sup>5</sup> It should be borne in mind that no manufacturer can exercise the necessary care in calibration; thus, new instruments must be calibrated before they can be used.

In order to be certain of the results obtained by the use of hygrothermographs in evaporation stations, six instruments should be used on each installation. All six instruments must first be carefully calibrated; then they may be grouped in pairs and used in succession on the tower. Before two instruments are used they should be given a background run side by side out of doors in an instrument shelter. After use they must be given another background run and then a calibration run in the moisture chamber.

At the original evaporation station in Arlington, hygrothermographs were used to determine the moisture concentration at two levels in the atmosphere. A tower was erected so that an instrument shelter large enough to house a hygrothermograph could be raised to a height of 28 feet and lowered for servicing. Another shelter accommodated a second hygrothermograph 2 feet from the ground (fig. 8). All the data presented and discussed in later sections were obtained from this or a similar installation.

Satisfactory records may be obtained in this manner, but the high initial cost of instruments and the enormous labor involved in making the observations prohibit the use of hygrothermographs in any practical program for measuring evaporation.

The primary objective of the evaporation study is to develop a new type of climatic data, namely, evaporation from the natural land surface, and to obtain these data for many different types of areas in the various parts of the country. With the goal of establishing perhaps hundreds of evaporation stations it became evident that the cost of installation and operation would have to be reduced to a minimum. Thus, it was realized that the use of hygrothermographs, involving a high initial cost and requiring constant surveillance and frequent recalibrations, would not permit the establishment of the number of stations desired. Consequently, other possible methods of measuring atmospheric humidity have been examined.

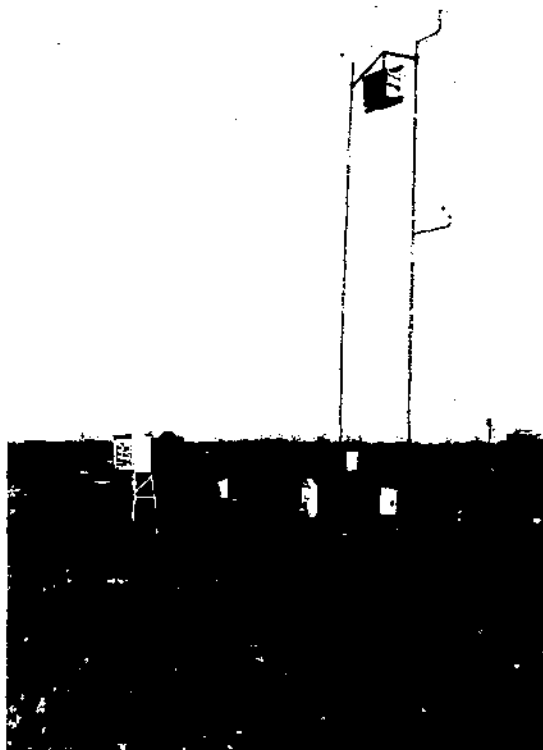
<sup>5</sup> THORNTON, C. W. HANDBOOK FOR CLIMATOLOGISTS. V. INSTRUCTIONS FOR THE MEASUREMENT OF EVAPORATION FROM NATURAL SURFACES. 22 pp., illus. 1930. [Micrographed.]

CORWIN, LEONARD B. INSTRUCTIONS FOR THE INSTALLATION OF EVAPORATION STATIONS. In *Handbook for Climatologists*, pt. 5, App. A., 21 pp., illus. 1930. [Micrographed.]



## THE WET- AND DRY-BULB PSYCHROMETER

Wet- and dry-bulb psychrometers have been used by Sverdrup (141), Montgomery (97), Spillhaus (183), and Church<sup>9</sup> for measurement of moisture gradients in the atmosphere over the ocean. The customary procedure is to obtain simultaneous readings from Assman psychrometers at two or more levels at 15-minute intervals. Since the



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FIGURE 8.—The original evaporation installation at Arlington, Va. The humidity of the air was determined at two levels with hygrothermographs. Wind velocity was determined at three levels with whirling cup anemometers.

constant attention of at least one observer is required at each observation station, it is obvious that the method could never be used on any widespread scale to secure observations for any long period.

Recording wet- and dry-bulb psychrometers are made, but to secure measurements of sufficient accuracy with them would be no easier than with hair hygrometers. The principle of wet- and dry-bulb psychrometry (55) has also been extended to thermo-electrical techniques (18, 67, 81, 102, 178) to aid in measuring moisture, but all these

<sup>9</sup> Unpublished manuscript.

techniques have their limitations and are not conveniently suitable for field work. In addition, the fact that they fail almost completely in winter makes them of little value for evaporation studies.

### THE DEW-POINT RECORDER

The simplest and one of the earliest methods of measuring the concentration of moisture in the atmosphere is to determine the dew point. Air is cooled until its moisture reaches the point of saturation; the temperature is then observed, and the vapor pressure is obtained by referring to appropriate hygrometric tables. This method depends on the fact that the pressure of water vapor does not change as the air is cooled but remains the same until saturation is reached. The temperature at which the air becomes saturated is called the dew point.

All types of apparatus for determining the dew point possess a surface—usually a polished metal mirror exposed to the air so that condensed moisture can be detected—which can be cooled several degrees below air temperature and whose temperature can be observed. The exposed surface is cooled slowly until condensation appears, at which time its temperature is observed. This temperature is the dew point.

The most familiar dew-point hygrometer is a modification by Alluard of an apparatus designed nearly a century ago by Regnault. It consists of a small rectangular metal box whose surface is silver plated and polished. The box contains ether, which is vaporized and cooled as air is forced through it. The surface of the box is similarly cooled, and the temperature at which dew is observed to appear and disappear upon it is determined by means of a sensitive thermometer suspended in the ether.

The principle of the dew-point hygrometer has been used in the design of an instrument, illustrated in figure 9, which will give a continuous record of the dew point of the atmosphere.<sup>10</sup>

The essential element of the instrument is a polished metal mirror whose temperature can be controlled at the dew point and recorded. A thin, polished, chrome-plated, copper disk (10) approximately the diameter of a dime is affixed to the end of a copper rod (11) inserted through a stopper (12) of low heat conductivity into a conventional thermos bottle (14) containing a cooling medium such as water-ice with salt or solid carbon dioxide with or without alcohol. Heat is conducted downward along the copper rod, and the mirror is cooled. Embedded in the end of the rod directly beneath the mirror is a small electrical heating element (16) which counteracts the flow of heat

<sup>10</sup> For references on instruments for use in determining the moisture concentration of flue gases and the dew point of distillates or for use in controlling air-conditioning equipment see Thornthwaite and Owen (1924, footnote 6, p. 515).

from the mirror when the circuit is closed. Light from an incandescent bulb (17) is reflected from the surface of the mirror to a photoelectric cell (18). The electric current generated by the photoelectric cell operates a sensitive relay, which in turn energizes a power relay (19) which opens a switch (20) against the action of a spring (21), and the operation of the heating element (16) beneath the mirror is prevented.

Heat from the mirror is conducted along the rod until moisture from the surrounding atmosphere condenses on its reflecting surface. This

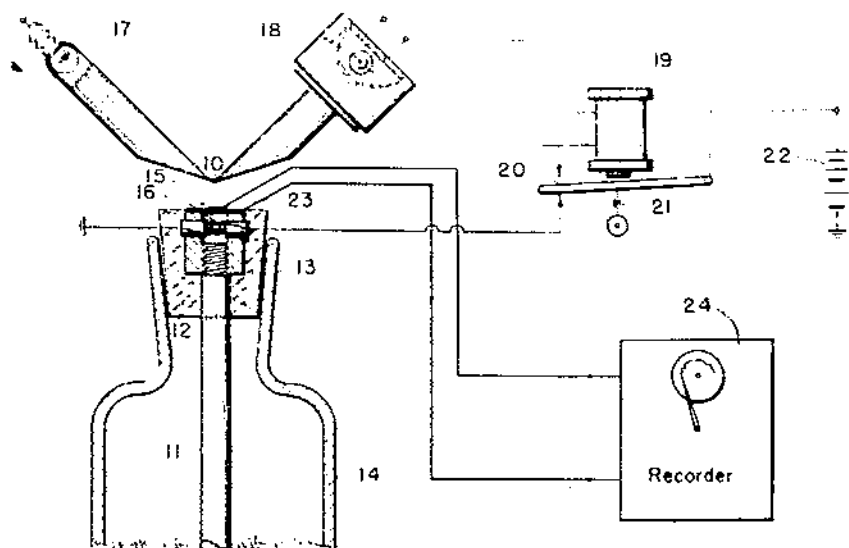


FIGURE 9. Schematic representation of dew-point recorder.

condensation lowers the reflecting efficiency of the mirror, the light reaching the photoelectric cell is reduced, and the current generated is no longer sufficient to energize the relay (19). Consequently, the switch (20) is closed by the spring (21), and the heating element warms the mirror to a point where the condensation formed on its surface is evaporated. The reflecting efficiency of the mirror is thereby restored, the photoelectric cell is again excited, and the switch is opened by the power relay. The heating element then stops functioning, permitting heat from the mirror to flow along the rod, and the entire cycle of operations is repeated.

A mere film of moisture on the mirror, invisible to the eye, is sufficient to reduce the output of the photoelectric cell by 10 microamperes, which is the range within which a sensitive relay will operate. Consequently, the temperature of the mirror remains very close to the dew point, varying only slightly above and below as the mirror is alternately heated and cooled. The temperature is de-

terminated by means of a thermocouple, the cold junction of which is a part of the mirror. The warm junction of the thermocouple is maintained at a standard temperature. Any standard electrical recorder may be used to obtain a record of the dew point.

For use in the dew-point instrument a photographic recorder has certain points of superiority over one which operates electrically. The thermocouple is connected through a galvanometer. A light beam, reflected by the galvanometer mirror, is directed through a slot onto sensitized photographic paper which revolves on a drum or cylinder. A switch in the light circuit is attached to the power relay (19) so that the light flashes momentarily just as the incipient condensation appears on the mirror. Thus, the record is a series of points all at the dew point rather than a continuous, wavy line ranging above and below the dew point. Since a complete cycle requires only about 50 seconds the series of points approximate a continuous line.

In figure 10, the record of depression of the dew point below atmospheric temperature for a period of 14 hours on June 19-20, 1940, is compared with a record of relative humidity for the same period produced by a hair hygograph. The general pattern of both curves is the same, but the much greater sensitivity and greater degree of refinement of the dew-point record is apparent.

Considerable improvement in the dew-point recorder was achieved by redesigning the instrument and substituting radio amplifying tubes and non-self-generating type photoelectric tubes for the mechanical relays and the self-generating photoelectric cells used in the original design (fig. 11). As before, the mirror is cooled by dry ice and heated by an electrical heating element, but in the new instrument the amount of heating is made to vary with the amount of moisture condensed on the mirror. The thermos bottle is placed in an inverted position so that the dry ice always touches the stopper, and a long copper rod extending to the bottom of the bottle is unnecessary.

A polished metal mirror (10) is affixed to a stopper (11) of low heat conductivity and connected by means of a copper wire or rod to a metal plate (12), all of which is inserted into the mouth of an inverted thermos bottle (9) which contains a cooling medium such as solid carbon dioxide. Heat is conducted from the mirror to the solid carbon dioxide, and the mirror is cooled. In close proximity to the mirror is a small electrical heating element (13) which counteracts the flow of heat from the mirror.

The mirror forms a part of the inner surface of the top of a small lighttight box (14) with high reflecting inner walls. Light from a source (15) is passed through tube (16) and is reflected from the surface of the mirror (10) and passed down tube (17), where it is absorbed.

A photoelectric cell (18) mounted in the box (14) is connected through suitable amplifying tubes (19) to the electrical heating element (13).

Heat from the mirror is conducted to the solid carbon dioxide until moisture from the air in the box begins to condense on its reflecting surface. This incipient condensation tends to lower the reflecting efficiency of the mirror, and the light no longer passes en-

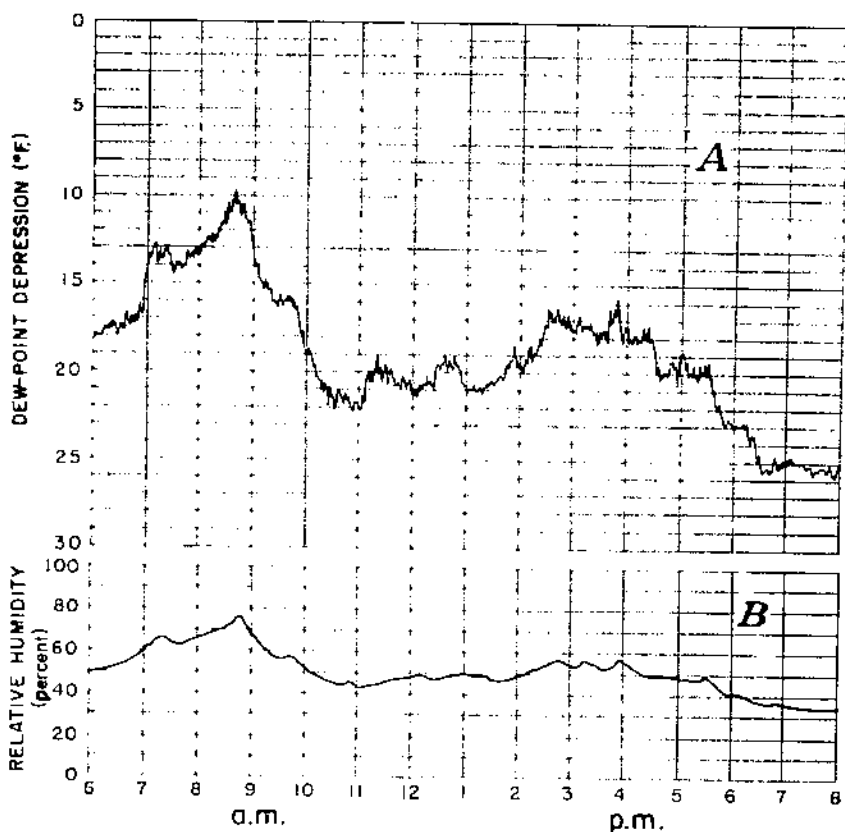


FIGURE 10.--Record of dew-point depression in °F. (A) and relative humidity in percent (B) for the period 6 p. m., June 19, to 8 a. m., June 20, 1940, at Arlington, Va.

tirely out of the box through tube (17) but is in part scattered within the box and energizes the photoelectric cell (18). The increased electrical output of the photoelectric cell, after being greatly amplified, goes to the electrical heating element and warms the mirror, and the condensed moisture tends to be reevaporated. The device can be adjusted so that there is a great variation in heating of the mirror with very slight variation in its reflecting efficiency. Thus the temperature of the mirror can be maintained almost precisely at the dew point.

Much developmental work remains to be done before the dew-point recorder can be considered to be a practical field instrument. However, since it contains no element that has not been used many times in other applications, there is no reason to doubt that it will eventually be perfected.

The dew-point recorder will probably never be an instrument for untrained observers. For that reason it may never be manufactured in large numbers, and the price will be relatively high. Although the dew-point recorder should occupy an important place

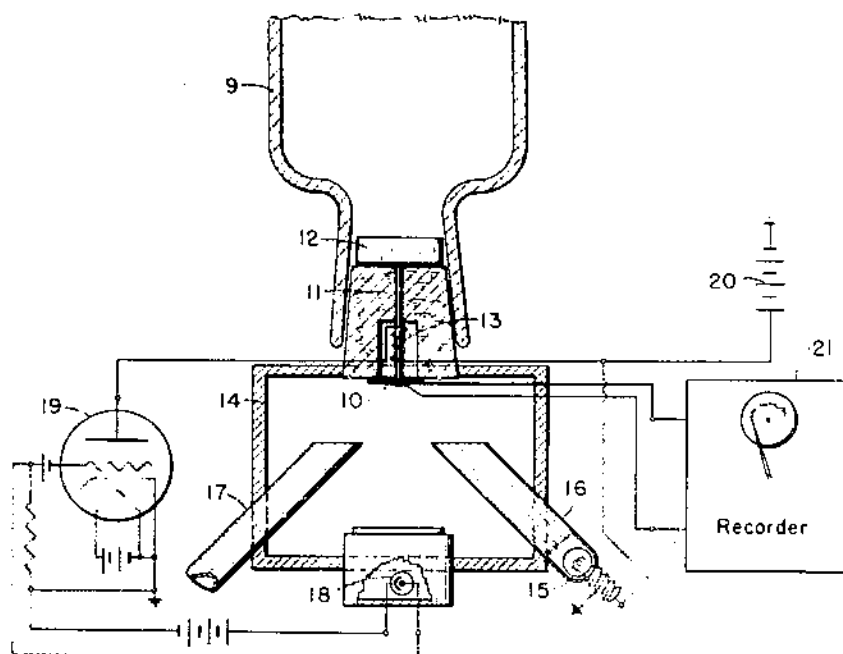


FIGURE 11. -Dew-point recorder using radio tubes in place of mechanical relays.

in evaporation studies, it is not likely that an evaporation survey of the whole country, such as is contemplated in the extension of the work at present under way, could be undertaken with this instrument.

### THE PAN HYGROMETER

A new method, differing from those in regular use, but combining features of the chemical absorption and the psychrometric methods and giving an integrated value of vapor pressure over any given time interval, was developed in the hope that it might be of value in the evaporation study. Although the method proved to be impractical for field use it is theoretically sound and may find some use in hygrometry.

The fundamental equation for evaporation from a free water surface is:

$$V = \frac{m(e_w - e_a)}{h}, \quad (65)$$

in which

$V$  is the rate of evaporation,

$m$  is the coefficient for vapor transport within the laminar or boundary layer,

$h$  is the thickness of the layer, which in turn depends upon the physical characteristics of the pan, of exposure, and of wind movement, and

$e_w$  and  $e_a$  are vapor pressures of the water surface and the air at the top of the boundary layer, respectively.

Transforming the equation, we find:

$$e_a = e_w - \frac{Vh}{m}. \quad (66)$$

If two pans having the same physical characteristics and containing solutions of different vapor pressures at their surfaces were exposed together so that the quantities  $m$  and  $h$  are the same in both cases, we would have two equations for  $e_a$ :

$$e_a = e_{w1} - \frac{V_1 h}{m}, \quad (67)$$

$$e_a = e_{w2} - \frac{V_2 h}{m}. \quad (68)$$

By a simple algebraic manipulation we get an equation for  $e_a$  in terms of the evaporation from the two pans and the vapor pressure of the two water surfaces, in which  $m$  and  $h$  do not appear:

$$e_a = \frac{V_1 e_{w2} - V_2 e_{w1}}{V_1 - V_2}. \quad (69)$$

From this equation we can obtain the average atmospheric vapor pressure for any period by measuring the change in mass of the two liquids and the temperatures of the water surfaces during the period.

It should be pointed out that equation (66) is of the same form as the general psychrometric equation:

$$e_a = e_w - AB(t_w - t_a), \quad (70)$$

in which  $B$  is barometric pressure and  $A$  a factor which varies slightly with vapor pressure of the air and temperature of the wet bulb and which is empirically determined. Since  $e_w$  is obtained as the saturation vapor pressure at the temperature of the wet bulb the errors in the determination of atmospheric vapor pressure by means of a psychrom-

eter are due not only to possible errors of the empirical constants, but more largely to errors in the determination of wet-bulb temperature itself.

Since equation (69) contains no empirical constants and includes only factors which can be measured easily and accurately, it is believed that it supplies a method which is more reliable than the psychrometric method for the determination of atmospheric humidity. The instrument lacks the flexibility and simplicity of design of the wet- and dry-bulb psychrometer, however, and for that reason it can never be expected to replace the latter.

One way to obtain different vapor pressures over water surfaces in the two pans would be to maintain the water temperatures at constant but different predetermined values. Equipment for water temperature control is standard and readily obtainable but expensive. However, with water temperature controlled, the terms for vapor pressure of the water surface become constants, and the determination of  $e_a$  is further simplified.

A more practical way to obtain different vapor pressures at the surfaces of the two liquids is through the use of saturated aqueous solutions. Those listed in table 1 have proved to be satisfactory. Actually, pure water may be used in one pan. Most desirable for the other is a solution such as magnesium chloride, in which the vapor pressure is considerably depressed.

Successful application of this method requires identity of exposure of the two pans, and this is not easy to achieve. However, after a number of failures, a cylindrical shelter made up of a series of horizontal cells and covered with rabbit wire proved to give satisfactory results (fig. 12). In the final model the pans were mounted on scales so that a continuous record of their weight was obtained. Bimetallic strips supplied a continuous record of the temperatures of the liquids (fig. 13).

In an attempt to get a practicable field instrument, pans only 9 inches in diameter and 2 inches high were used. The result was that in high wind a part of the liquid spilled out of the pans, a very serious difficulty. This difficulty could be overcome by using deeper pans or by redesigning the shelter so as to cut down the air flow. However, to the present, no further work has been done on the pan hygrometer.

#### THE CHEMICAL-ABSORPTION HYGROMETER (159)

For determining the concentration of moisture in the atmosphere no method could be more direct than that of removing all the water vapor from a measured volume of air and weighing it. The customary laboratory procedure of measuring a volume of air by allowing it to displace a given volume of water or some other liquid as it flows from



a closed container is not adapted to field use. On the other hand, pumps that will deliver air at the rate of only 5 to 10 litres per hour with the necessary accuracy were not available.

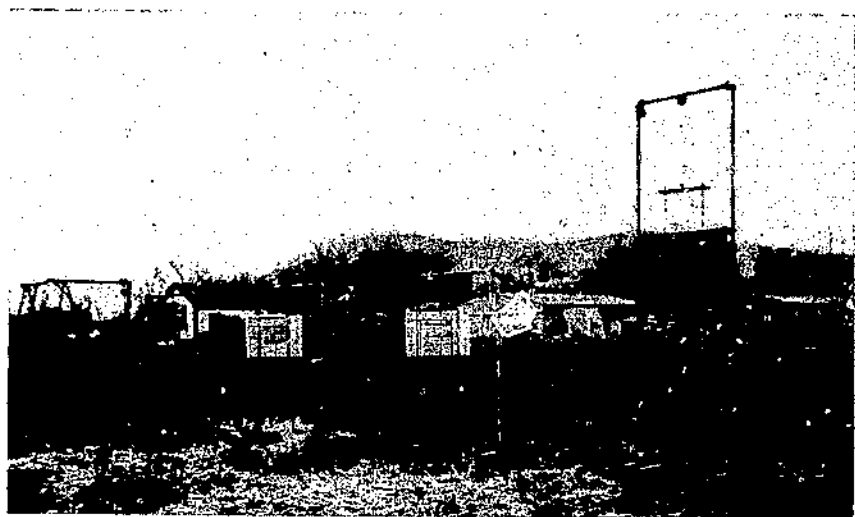
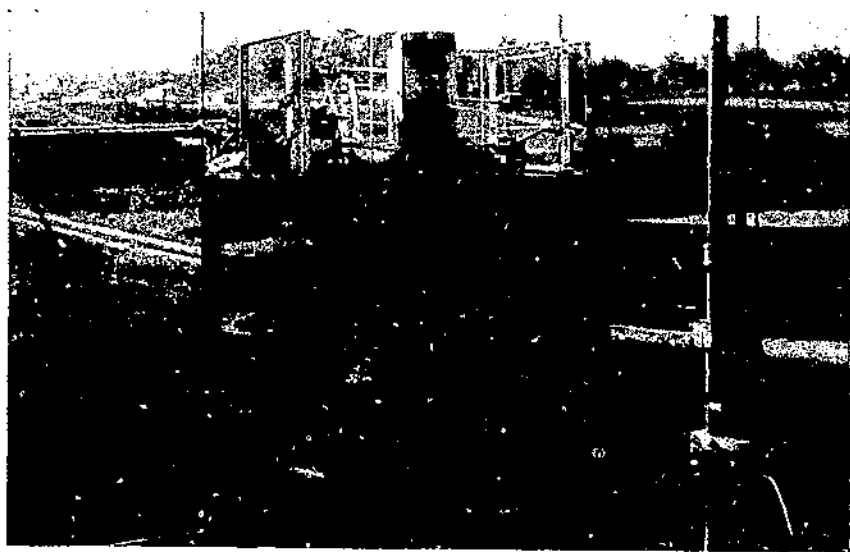


FIGURE 12.—Various types of shelters designed in the attempt to secure identity of exposure of two pans.



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FIGURE 13.—Pan hygrometer unit to record weight and temperature of the liquids in the two pans.

However, a dual mercury pump having the needed capacity was designed and built. The essential element of the pump is a horseshoe-shaped glass tube, open at both ends and partly filled with mercury.

A rocking motion of the tube causes the mercury to move back and forth from one end to the other, alternately forcing the air out and drawing it in. Since the total volume of the tube is constant, the amount of air entering one end exactly equals that being forced out the other. Equipped with suitable valves, both ends of the tube become individual pumps identical in capacity.

The pump was at first driven by a small 110-volt A.-C. motor. Later it was found that a D.-C. motor designed for the Coast Guard to operate for an entire year from a single 6-volt dry battery has ample power to drive the mercury pump.

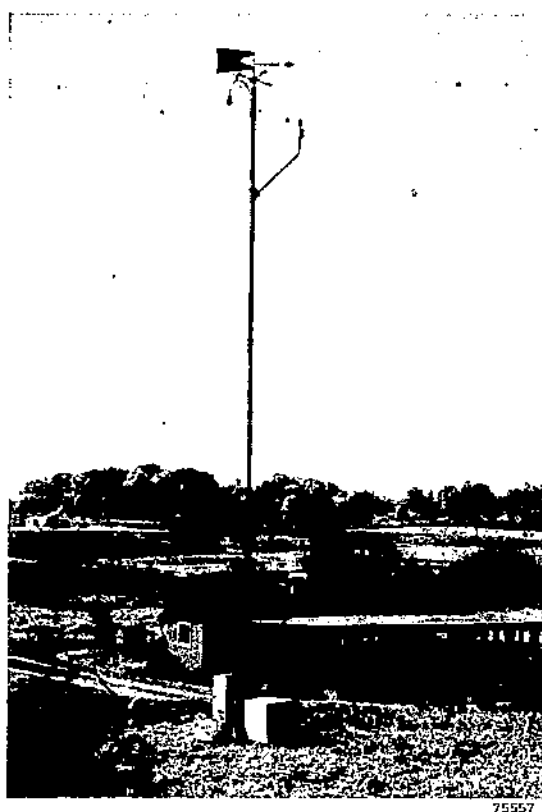
A chemical-absorption apparatus using this pump was installed in the field at Arlington on November 1, 1940, and was operated successfully until the middle of December, during which time reasonable daily values of evaporation and condensation were obtained. It was mounted at the base of a standard wind tower, and air was drawn from the 4-foot and 16-foot levels through  $\frac{1}{4}$ -inch copper tubing, the samples being taken exactly in the horizontal planes where wind velocities are determined (fig. 14). In order to exclude dust, rain, and insects, the ends of the tubes were bent downward and were fitted with copper wool filters. The indicators for wind mileage at the two levels were mounted above (fig. 15). Although evaporation measurements were not made after the middle of December, the pump continued to run without interruption until April 1, when it was dismantled.

An improved device, using two glass hypodermic syringes as pump cylinders and pistons and having diaphragm valves, driven as before by the constant-speed, battery-operated motor, was received in February 1941. For summer and winter operation, this pump unit will draw accurately 4.5 or 9.0 l. of air per hour through the absorptive apparatus from each of the two levels. Although the instrument has not yet been adequately tested, it promises to provide an accurate means of measuring atmospheric moisture and will permit the establishment of simple and inexpensive evaporation stations (fig. 16).

The chemical-absorption hygrometer requires a suitable drying agent. Such an agent should remove all the water vapor from the air and should have a large water-holding capacity. It should be granular to allow an unimpeded flow of air through it. It should be capable of reactivation, so that it can be used repeatedly, and should be safe to handle in the field as well as in the laboratory. The last two requirements eliminated the otherwise efficient phosphorus pentoxide ( $P_2O_5$ ) and sulfuric acid ( $H_2SO_4$ ).

Table 4 gives the results of tests of a number of drying agents made by Bower (18) at the Bureau of Standards and shows the amount of residual water vapor that each agent was unable to remove. Although alumina ( $Al_2O_3$ ) is not the most efficient drying agent it is

well within the limits of accuracy required, and it was selected because it is convenient to use, is relatively inexpensive, and can be easily reactivated.



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FIGURE 14.—Chemical-absorption apparatus in the field at Arlington, Va., November 1940.

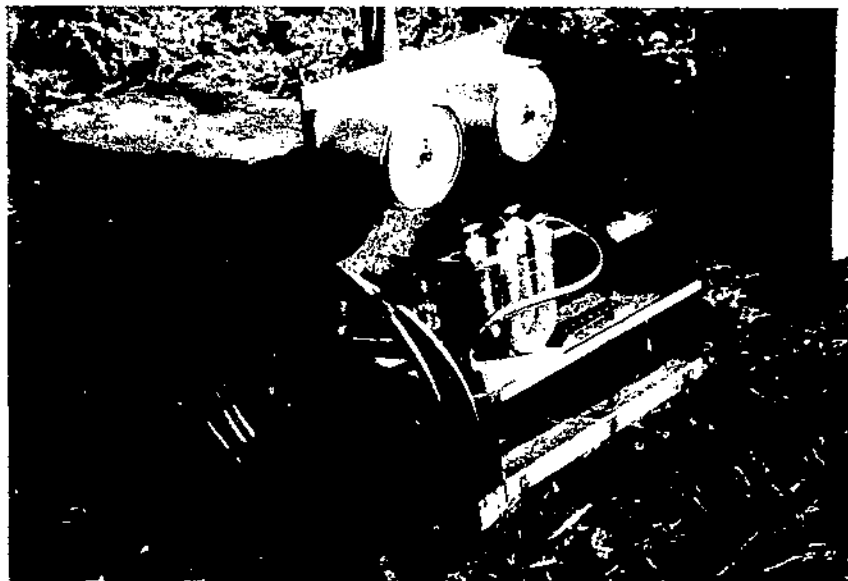
TABLE 4. Milligrams of residual water per liter of air dried<sup>1</sup>

Material	Volume of air per hour per ml desiccant umb	Total volume of air per ml of desiccant (c)	Residual water per liter of air (mg)
CuSO <sub>4</sub> (anh.)	36 to 60	0.45 to 0.7	2.8 (2.7 to 2.9)
CaCl <sub>2</sub> (gran.)	60 to 165	6.1 to 24.2	1.5 (1.4 to 1.6)
CaCl <sub>2</sub> (tech. anh.)	115 to 150	4.0 to 5.8	1.25 (1.23 to 1.27)
ZnCl <sub>2</sub> (sticks)	120 to 335	.8 to 2.1	.98 (.94 to 1.02)
Ba (ClO <sub>3</sub> ) <sub>2</sub> (anh.)	20 to 36	2.3 to 3.7	.82 (.76 to .88)
NaOH (sticks)	75 to 170	2.3 to 8.9	.80 (.78 to .83)
CuCl <sub>2</sub> (anh.)	75 to 240	1.2 to 7.8	.36 (.33 to .39)
Mg (ClO <sub>3</sub> ) <sub>2</sub> ·3H <sub>2</sub> O	65 to 160	4.0 to 7.2	.631 (.628 to .633)
Silica gel	65 to 135	6.5 to 7.7	.63 (.62 to .64)
KOH (sticks)	55 to 65	3.2 to 7.2	.614 (.610 to .617)
Al <sub>2</sub> O <sub>3</sub>	65 to 135	6.5 to 7.7	.605 (.604 to .606)
CaSO <sub>4</sub> (anh.)	75 to 150	1.2 to 18.5	.605 (.601 to .609)
CaO	60 to 90	7.6 to 10.1	.603 (.603 to .604)
Mg (ClO <sub>3</sub> ) <sub>2</sub> (anh.)	95 to 130	6.4 to 13.2	.602 (.602 to .603)
BaO	64 to 66	10.6 to 25	.60095 (.6006 to .6005)

<sup>1</sup> Adapted from Bower (13, table 1, p. 276).

Alumina will hold nearly 20 percent of its weight of water and picks up all but  $5 \times 10^{-3}$  mg. of water vapor per liter of air, which amounts to only about 0.1 percent at 32° F. At higher temperatures and higher moisture concentrations the percentage of moisture not removed from the air is much less.

Alumina depends for its efficiency not only on absorption but on adsorption as well. Absorption is a chemical process and results in the chemical combination of water molecules with the  $\text{Al}_2\text{O}_3$  molecules. Adsorption is merely a physical process in which molecules



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FIGURE 15.— Detailed view of chemical-absorption hygrometer containing mercury pump.

of water adhere to the surface of the drying agent. To increase the adsorptive efficiency of the alumina it is specially prepared as a colloidal gel, by which means its surface area is enormously increased.

Alumina will adsorb carbon dioxide from the air in small amounts. However, it quickly reaches equilibrium with the concentration of carbon dioxide in the air, so it can be saturated with carbon dioxide without reducing its capacity for water by passing a few liters of dry air through the tubes before they are used.

Standard U-shaped glass drying tubes were used to hold the drying agent. The tubes each have two glass sidearms to facilitate making connections to the pumps and the sampling tubes. They also have ground glass stoppers for sealing when samples are not being taken. Even when the tubes were closed the alumina picked up about 1 mg. of

water per day. All leakage was prevented by coating the stoppers with a thin film of pet-cock grease.

To achieve the desired accuracy great care must be exercised in weighing the drying tubes. An analytic balance sensitive to  $5 \times 10^{-5}$  gm. in 100 gm. is needed, and standard laboratory procedures should be employed.

Since the drying tubes contain some air, the fact that the weight of air changes with change in temperature and pressure must be

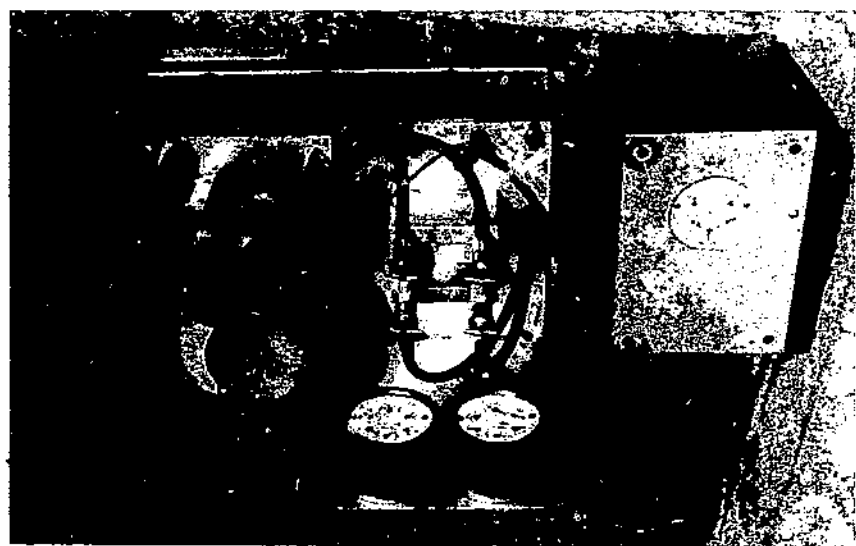


FIGURE 16.—Detailed view of chemical absorption hygrometer containing piston pump.

taken into consideration. A closed empty tube of 35 cc. capacity will increase by  $9 \times 10^{-5}$  gm. in weight with a rise in temperature of  $1^{\circ}$  F. at  $32^{\circ}$ , or nearly 2 mg. with a temperature rise of  $30^{\circ}$ . The buoyancy can be minimized by keeping the balance room at a nearly constant temperature and opening the tubes momentarily to allow them to come to pressure equilibrium with the air in the room before weighing. The use of a tare, consisting of a tube filled with alumina in the regular manner but not exposed to the air, is recommended.

As long as both pumps draw exactly the same amount of air from both levels in a given time interval most of these possible errors are neutralized when absolute humidity gradients are determined. The mean value of the absolute humidity gradient for a given length of time is obtained by dividing the difference in mass of water vapor collected from the two levels by the volume of air drawn through each tube.

## THE MEASUREMENT OF WIND VELOCITY

Wind velocity is less difficult to measure than atmospheric moisture. A number of different whirling-cup anemometers are available that either register total miles of wind passed in a given time interval or give continuous records of wind velocity. These instruments measure only the average values of the horizontal component of the wind. To measure the instantaneous velocities in the major direction, as well as those to the right and left and up and down, is much more difficult and requires specialized equipment. Pressure-plate anemometers, hot-wire anemometers, or pressure-tube anemographs are generally used for this purpose, and the scale and frequency of the fluctuations measured depends upon the inertia of the instrument used.

The wind measurements required in the evaporation equation can be obtained with standard instruments. Wind velocity is measured at two levels with a pair of contacting cup-type anemometers. Wind direction is measured at the upper level only.

The type of wind record required depends on the kind of humidity instruments being used. If continuous records of atmospheric moisture are being obtained, as from dew-point recorders or hygrothermographs, continuous records of wind velocity will be required in order to determine the rate of evaporation for short time intervals. If, however, only integrated values of atmospheric moisture are being obtained, as from chemical absorption hygrometers, continuous records of wind velocity are unnecessary, but only an indication of the total miles of wind passed during the time interval for which the moisture measurements apply.

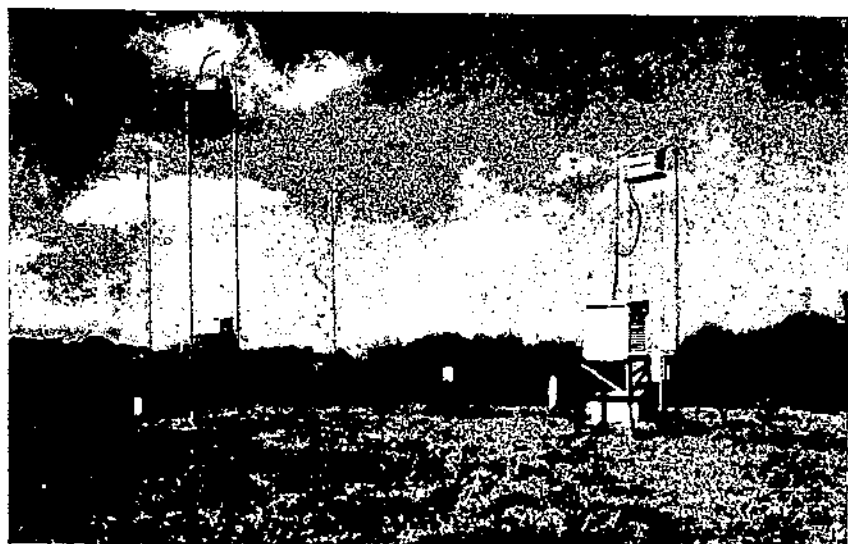
The fact that the required wind value in the evaporation equation is the difference in velocity at the two levels makes it unnecessary to apply a correction factor to the readings of either instrument. Wind velocity enters the formula also in the determination of  $z_2/z_1$ , and here actual velocities are required. However, failure to apply the small correction factors to get true wind speeds at the two levels will result in errors so small they can be neglected.

A YEAR OF EVAPORATION AT ARLINGTON, VA.<sup>11</sup>

An experimental evaporation station was established at the United States Department of Agriculture Experimental Farm in Arlington, Va., in the autumn of 1938. During 1939, effort was concentrated on the objective of securing a complete record of evaporation and condensation for a year. Instrument failure and other difficulties prevented the full accomplishment of this objective, but the gaps in the records do not diminish their value greatly. Hygrothermographs were used for the determination of humidity.

<sup>11</sup> Part of the material in this section has appeared previously (160, 162, 163).

During 1940 attention was focused on the problem of securing improved instruments, and a number for measuring and recording moisture and wind were designed and tested. The more important of these have already been described. Figure 17 shows the various instrumental installations that were being tested in November 1940. The tower at the extreme left is a complete station, from which observations of both wind velocity and humidity at two levels are obtained. The chemical-absorption hygrometer is used for the moisture determinations. The next tower to the right is the pan-hygrometer instal-



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FIGURE 17. The evaporation station at Arlington, Va., November 1940.

lation for moisture determinations only. From the next tower measurements of wind velocity at four levels and of wind direction are obtained. At the extreme right behind a standard Weather Bureau shelter is the dew-point recorder. Here the dew-point transmitters are at the appropriate levels, whereas in the improved instrument, not shown in this view, air is drawn from the proper levels to the instrument, which is on the ground. The instruments were located in a hay field on the relatively flat top of a gentle ridge.

The first usable records of moisture concentration were obtained on October 15, 1938. Wind-velocity measurements began November 23, 1938, and the first computations of evaporation were made for December 10, 1938. The station continued in operation throughout the calendar year 1939, but because of instrumental difficulties and the necessity for experimenting with various types of equipment there are a number of unavoidable gaps in the records. Most of the usable hourly values of temperature, specific humidity, and wind velocity

for the various levels obtained during the year are presented in the appendix tables 10 to 12, pp. 76-118.

To give an indication of the diurnal changes in moisture and the changes in gradient for various air masses, the observations for a number of days are discussed in some detail. Figure 18 shows the march of moisture concentration at the two levels for 2 days in early autumn, during which time a modified Polar Continental air

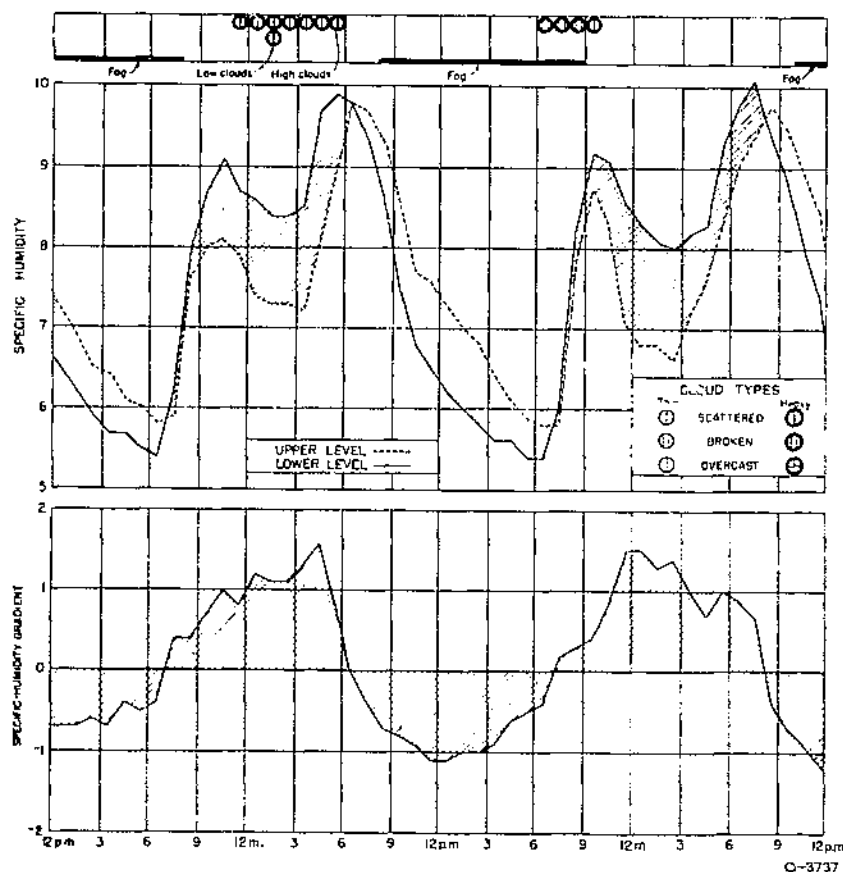


FIGURE 18. -Moisture concentration at two levels and moisture gradient, October 15 and 16, 1938, at Arlington, Va.

mass remained over the area. The sky was clear, and moderate temperatures prevailed. The air mass was relatively stagnant, and winds were light and variable. Significant radiational cooling occurred throughout the night, and a moderate ground fog condition limiting visibilities to 1 to 2 miles was observed at the airport, less than a mile from the evaporation station.

During the first night the moisture concentration of the air dropped



to a minimum of 5.4 and 5.8 gm. in the lower and upper levels because moisture was abstracted by condensation at the ground. As soon as the ground began to warm up after sunrise and evaporation commenced, moisture concentration rose rapidly, beginning at the lower level and producing a reversal in the gradient. Shortly before noon, thermal convection had developed to a point where the moisture was carried to the upper air faster than it was received from the ground, and the concentration at both levels diminished about 0.8 gm. In late afternoon, with a diminution of convection, the evaporation again exceeded the rate of transport aloft and the moisture concentration rose to the high point of the day. Between 6 and 7 p. m. the cooling of the ground surface began, and soon the concentration at both levels was the same. With continued cooling, condensation began, and as moisture was abstracted from the lower level the gradient was reversed, and the concentration at both levels diminished throughout the night. In the morning there was a heavy dew deposit.

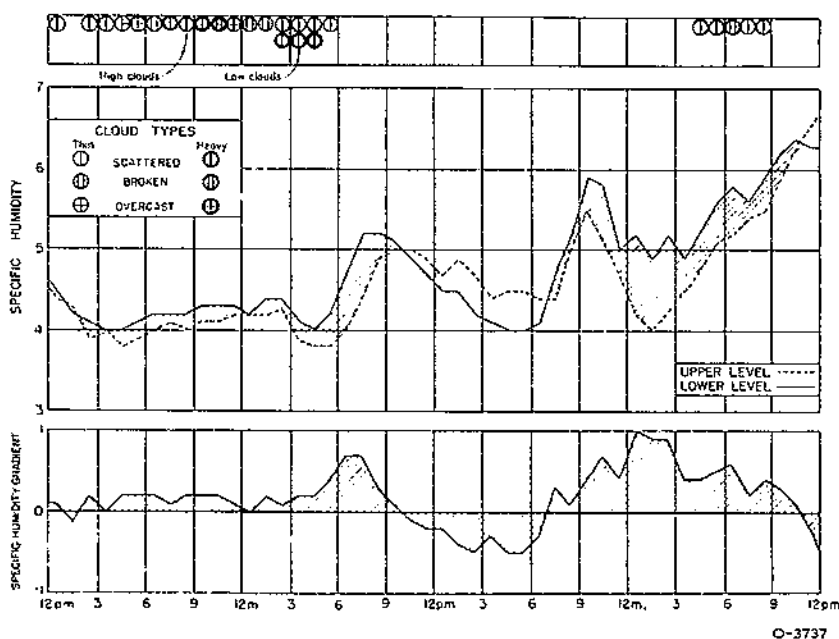
The same sequence of conditions was repeated the next day; first, an upward shift of gradient followed by a rapid increase of moisture concentration as evaporation proceeded; then, a diminution of concentration with a continued upward-directed gradient as thermal convection carried the moisture to the drier levels aloft; then, as convection subsided, a rapid increase in concentration; and finally, with the onset of ground radiation at the end of the day, condensation, a gradient directed downward, and a rapid diminution of moisture.

A few days later, with the passage of a well-marked front, the transitional Polar Continental air mass was displaced by a fresh polar air mass. The moisture concentration dropped within the course of a few hours from about 10.5 to about 4.0 gm. The moisture gradient pattern for the 2 days following is shown in figure 19. Except for scattered cirrus and a few scattered cumulus clouds during the afternoon the sky was clear throughout the 2-day period. For nearly the entire first day the wind direction was predominantly from the west and west-northwest, and velocities ranged from 5 to 15 miles per hour. The moisture gradient, although small, was directed upward for approximately 28 hours after the invasion of the polar air mass. The moisture concentration remained almost stationary at about 4 gm. until approximately 3 p. m., when a moderate amount of convection forced a small decline. It is of interest to note that scattered cumulus clouds were observed between 3 and 5 p. m., which coincided with the observed decline in moisture concentration. During the evening, evaporation continued and the concentration rose more than a gram. Not until after 10 p. m. did the gradient turn downward and condensation commence.

Throughout the remainder of the night surface wind velocities were generally less than 2 to 3 miles per hour, and with moisture

abstraction going on at the ground, the moisture concentration slowly declined. The gradient pattern of the second day resembled those of the two earlier days shown in figure 18, although the rate of evaporation was considerably reduced. The important difference in pattern is that the moisture gradient was directed upward until 11 p. m., the moisture concentration continuing to rise until that time.

Figures 20 and 21 show the moisture gradient pattern and the hourly rates of evaporation for December 11 to 14, during which time



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FIGURE 19. Moisture concentration at two levels and moisture gradient, October 21 and 22, 1938, at Arlington, Va.

a Polar Continental air mass displaced a southerly current of well-modified polar air. On December 11, the synoptic weather chart indicated the presence of a well-modified returning flow of polar air over the eastern part of the United States. The sky conditions as observed at the Washington airport, which adjoins the Arlington Farm, varied greatly from hour to hour. The thin, broken to overcast, altostratus clouds which predominated during the early morning and forenoon, thickened during the afternoon and evening to a nearly continuous overcast with a base at 6,000 to 7,000 feet. During this time the specific-humidity gradient was directed upward. Between 5 and 7 p. m., the clouds became scattered and broken, and radiational cooling of the ground hastened the usual reversal of the specific-humidity gradient. As the overcast thickened again, the gradient shifted upwards temporarily for an hour. Thereafter the gradient was directed

downward except for a period between midnight and 3 a. m. of December 12. The upward gradient at this time was probably due to a slight increase in surface temperature caused by the downward transport of heat by turbulence induced by the increased wind velocities which prevailed during this period.

During the early morning of December 12, the clouds were, in general, high and scattered, and calm or extremely light winds pre-

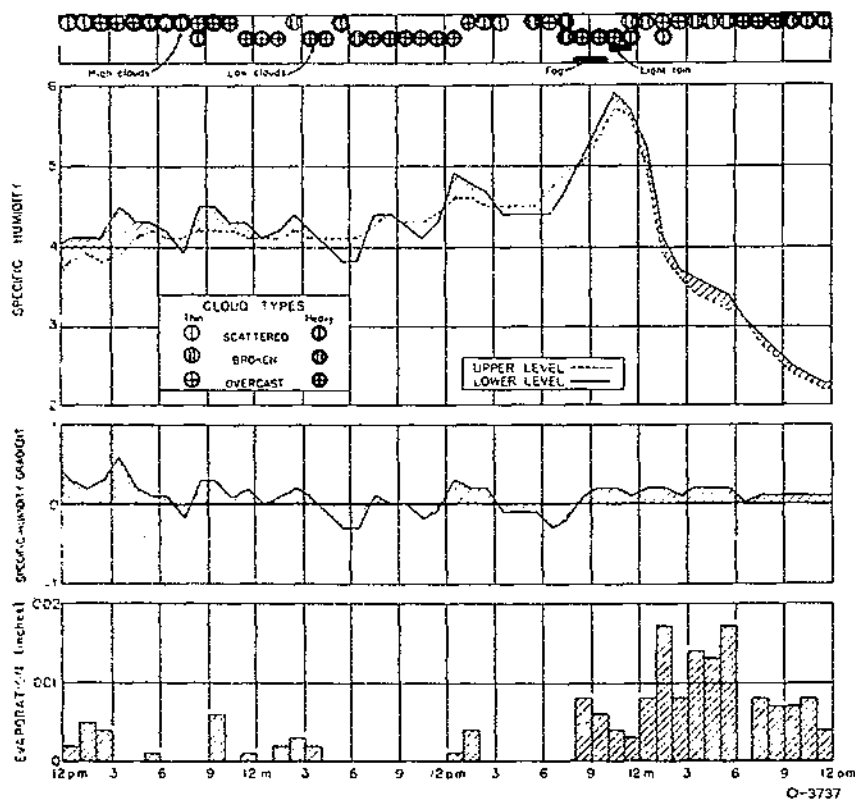


FIGURE 20. Moisture concentration at two levels, moisture gradient, and hourly evaporation, December 11 and 12, 1938, at Arlington, Va.

vailed. The moisture gradient continued downward, and a light dew formation resulted. At 9 a. m., the sky became overcast with upper altostratus and lower stratocumulus decks, heralding the approach of a cold front. Occasional sprinkles were noted during the hour ending at 9 a. m., and light rain was observed between 10:10 and 11:25 a. m. The amount of rainfall, however, was less than 0.01 inch. The front, which marked the boundary of Polar Continental air, passed the station at approximately 11 a. m. and was associated with a wind shift to the northwest and a dissipation of the stratocumulus deck. During the ensuing 30 hours, the wind remained in the northwest,

with velocities generally between 8 and 15 miles per hour. The specific-humidity gradient was directed upward for the two hours preceding the frontal passage and continued to be directed upward until the morning of the 14th. The gradient shifted downward at this time, and a heavy frost ensued.

It is to be noted that on the 13th there was no drop in specific humidity resulting from large-scale thermal or convective turbulence

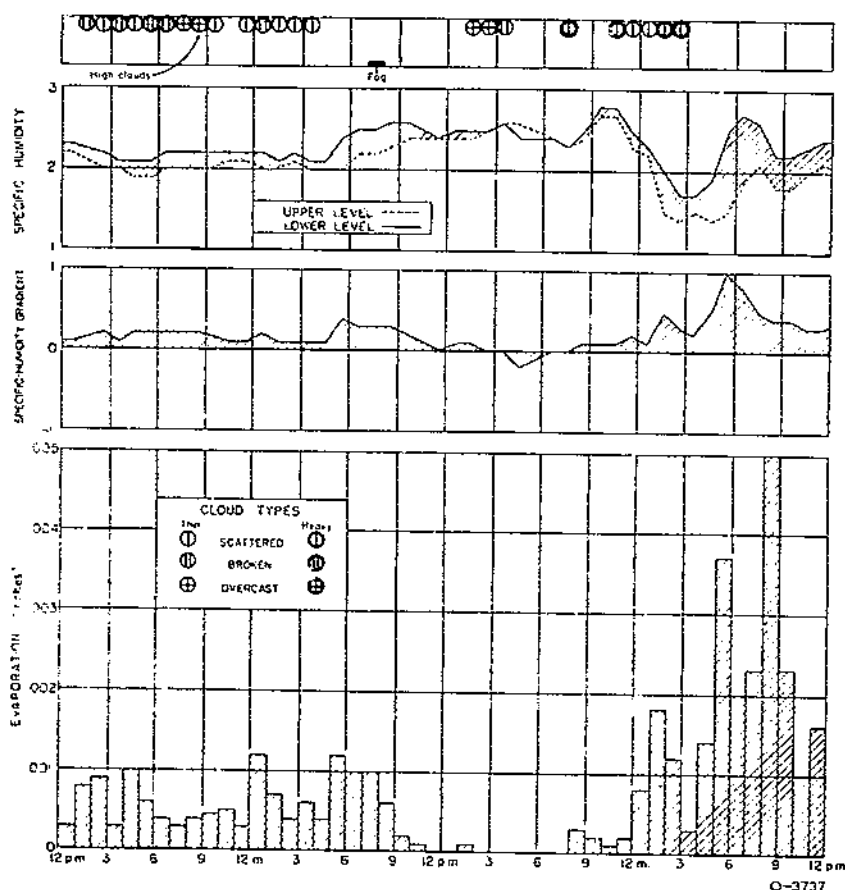


FIGURE 21.—Moisture concentration at two levels, moisture gradient, and hourly evaporation, December 13 and 14, 1938, at Arlington, Va.

such as was illustrated in figure 18. This is explained by the fact that convective turbulence was limited to the thick layer of polar air, within which mixing by mechanical turbulence had already established complete uniformity of moisture concentration. Thus there was no possibility of replacement of the air at the level of the observations by drier air from aloft.

On December 14, however, the wind velocities in the polar air were light and variable and the thickness of the mechanically turbulent

layer was much less than that on the 13th. From 11 a. m. to 3 p. m. the characteristic convective turbulence was manifested by a steady drop in the specific humidities in spite of the fact that evaporation was continuously adding moisture to the atmosphere. A secondary decrease in the specific humidities beginning at 8 p. m. was also due to mixing with drier air aloft. The wind velocities increased at this time, shifting from south at 3 miles per hour to west-northwest at 15 miles per hour, causing a rise in surface temperature from 38° to 42°.

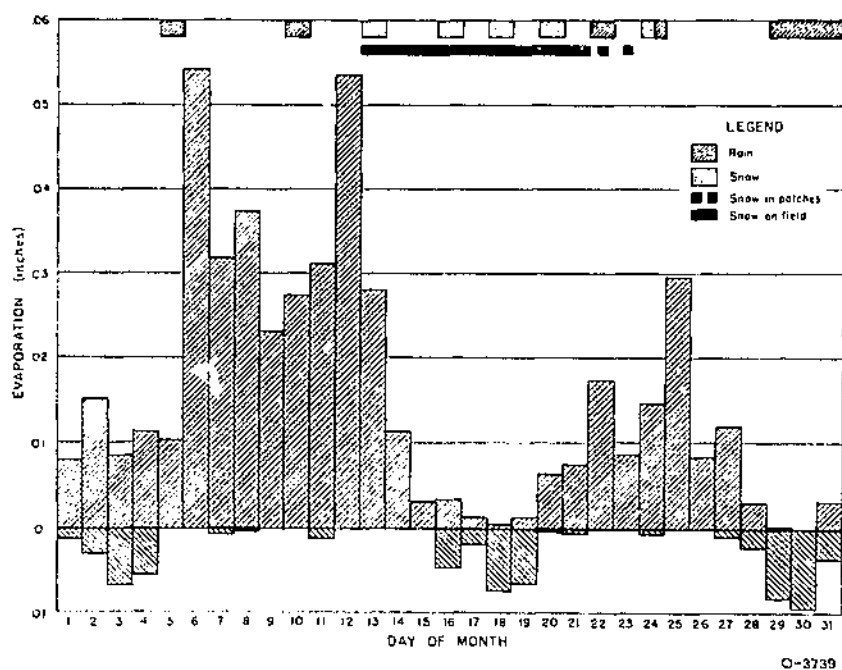


FIGURE 22. Daily totals of evaporation and condensation for the month of January 1939, at Arlington, Va.

The water loss from the land surface at Arlington Farm, combining evaporation from the soil, evaporation of dew and frost, and transpiration, for the 4 days December 11, 12, 13, and 14 was 0.0026, 0.0137, 0.0132, and 0.0239 inch, respectively.

Figure 22 shows the daily evaporation and condensation for the month of January. In table 5 the type of information obtained and the hourly evaporation values for January 27, 1939, are presented merely for illustrative purposes.

During the first 4 days in January, the ground surface was dry and the moisture was apparently removed chiefly by transpiration (169). Variable high scattered clouds and light variable winds prevailed during this period, and appreciable amounts of dew condensed during the early morning hours. On January 5, a low stratus overcast prevailed

TABLE 5.—Data for the computation of evaporation and the evaporation at Arlington, Va., for the 24-hour period Jan. 27, 1939

Observations and computed evaporation	Hour ending at—											
	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.
Upper observations:												
Relative humidity.....percent	66.2	70.8	75.2	80.1	81.5	75.1	52.0	45.4	43.5	45.2	41.0	39.4
Temperature.....degrees F.	20.3	20.3	20.1	18.9	18.7	19.3	22.8	23.3	24.0	25.1	26.5	28.5
Vapor pressure.....inches of mercury	.071	.074	.075	.079	.079	.075	.061	.055	.054	.059	.057	.061
Wind.....miles per hour	5.0	3.8	4.0	1.3	1.5	3.5	9.0	5.8	12.5	12.8	19.2	12.5
Lower observations:												
Relative humidity.....percent	71.6	76.7	80.9	84.9	87.9	81.2	58.8	52.5	51.4	50.0	45.5	42.0
Temperature.....degrees F.	19.4	18.5	17.5	16.5	16.0	16.5	20.5	21.0	22.4	21.9	26.9	29.4
Vapor pressure.....inches of mercury	.075	.074	.074	.074	.075	.073	.062	.057	.060	.065	.065	.067
Wind.....miles per hour	3.2	2.0	1.8	1.0	.2	1.5	5.5	3.5	7.5	8.2	12.8	8.5
Difference:												
Vapor pressure.....inch	.004	.000	-.004	-.005	-.004	-.002	.001	.002	.006	.006	.008	.006
Wind.....miles per hour	1.8	1.8	2.2	.8	1.3	2.0	3.2	2.3	6.0	4.6	6.4	1.0
Evaporation <sup>1</sup> .....inch	.0003	.0000	-.0003	-.0001	-.0002	-.0001	.0001	.0002	.0013	.0010	.0018	.0008
	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.
Upper observations:												
Relative humidity.....percent	36.5	34.2	31.0	32.0	34.1	35.3	35.5	35.5	37.6	41.0	43.0	47.5
Temperature.....degrees F.	30.5	32.5	34.0	34.0	34.0	33.0	32.3	31.7	31.0	30.0	28.3	26.5
Vapor pressure.....inches of mercury	.061	.063	.061	.062	.067	.066	.065	.063	.065	.068	.065	.067
Wind.....miles per hour	13.5	15.2	11.8	12.2	14.5	11.2	8.0	7.2	5.0	3.5	2.8	4.2
Lower observations:												
Relative humidity.....percent	38.0	34.2	32.0	34.5	36.9	39.3	41.5	41.1	43.1	50.0	61.0	71.4
Temperature.....degrees F.	31.9	33.9	34.9	33.6	32.9	31.4	30.4	29.4	29.4	26.3	22.9	21.4
Vapor pressure.....inches of mercury	.068	.067	.065	.066	.069	.069	.070	.066	.069	.071	.076	.070
Wind.....miles per hour	9.2	10.5	9.8	9.8	9.0	8.0	5.0	4.2	2.8	1.8	.0	1.2
Difference:												
Vapor pressure.....inch	.007	.004	.001	.004	.002	.003	.005	.003	.004	.003	.011	.012
Wind.....miles per hour	4.3	4.7	5.0	2.4	5.5	3.2	3.0	3.0	2.2	1.7	2.8	3.0
Evaporation <sup>1</sup> .....inch	.0011	.0007	.0007	.0003	.0004	.0003	.0005	.0003	.0003	.0002	.0010	.0013

<sup>1</sup>Negative evaporation is condensation. Totals for the period: Evaporation, 0.0126 inch; condensation, 0.0007 inch.

throughout the greater part of the day. Intermittent sprinkles and occasional light rain totaling 0.07 inch occurred during the 24-hour period. In spite of the cloudy conditions and the precipitation a measurable moisture gradient directed upward was detected, and 0.0103 inch of evaporation occurred. The following day, January 6, the sky was relatively clear, moderate wind velocities were observed, and the evaporation was greatly increased, amounting to 0.0544 inch. On the 7th, 8th, and 9th, variable high clouds to clear skies prevailed, but the daily evaporation totals were, as was to be expected, less than that of the 6th, when the ground surface was moistened by the previous day's rainfall. On the 8th, the evaporation was slightly greater than on the 7th or 9th and may be explained by the moderate wind velocities, occasionally reaching 22 miles per hour. Light rain amounting to 0.07 inch fell between 7 a. m. and 9:30 a. m. on January 10. In spite of the moisture on the ground and a moderate south-southwest wind which varied between 8 and 12 miles per hour, the evaporation amounted to only 0.0276 inch. The suppression of evaporation on this day may be explained by the diminution of the moisture gradient by the invasion of more moist air from the south, which caused an increase in specific humidity from 3.5 to approximately 7 gm. On the following day, there was only slightly more evaporation. However, by the morning of the 12th, fresh polar air had invaded the area, and the specific humidity dropped to 2.2 gm. The wind blew prevailingly from the northwest, with a velocity ranging between 5 and 15 miles per hour, and in spite of a high overcast the evaporation attained a value of 0.0535 inch. The increased evaporation into polar air masses, which has been found consistently in our observations, was anticipated on the basis of the cycle of air masses (51, 157).

The high altostratus overcast that was present throughout the 12th steadily lowered and thickened, heralding the approach of a warm-front storm. On the 13th, a mixed precipitation of freezing rain, sleet, and snow fell throughout the greater part of the day. On the 16th, a light snow fell between 6 a. m. and 11 a. m. On the 18th, snow began falling shortly after midnight and continued throughout the day until 10 p. m. A light snow, associated with an upper cold front, occurred on the 20th between 5 p. m. and 9 p. m. Thus from the 13th through the 20th the site of the evaporation station was covered with snow ranging in depth from 1 to 6 inches.

During this period the blanket of snow was fundamentally responsible for the suppression of evaporation. A snow cover may suppress evaporation in a number of different ways, although the moisture losses by evaporation from a snow field may be large when suitable atmospheric conditions prevail. Because of the difference in the physical characteristics of a snow cover and a grass cover there must obviously be a difference in the roughness factor characterizing the

type of surface and a consequent difference in the intensity of turbulent mixing.

Table 6 gives the average hourly values of  $z_0$  for the period in January during which the field was snow covered and for the remainder of the month. The average for the days with snow was 0.11 cm. and for those without snow, 0.28 cm. With the cover of snow the ratio  $z_2/z_1$  dropped from 25.23 to 25.09, and the evaporation should have been increased 0.6 percent as a result of this change. This extremely small increase is more than offset by other influences.

TABLE 6.—*Diurnal variation of  $z_0$  for the days with and without snow cover in January 1939*

Condition of ground	Days	Average $z_0$ for hour ending at—											
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.
	Num- ber	1	2	3	4	5	6	7	8	9	10	11	12
Snow covered	9	0.1828	0.3658	0.3353	0.4877	0.2743	0.2377	0.2134	0.1768	0.1311	0.0823	0.0244	0.0518
Free from snow	22	.2682	.1128	.1534	.1737	.2438	.3962	.1826	.2131	.1128	.0701	.0246	.0171
		1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.
Snow covered	9	0.0011	0.0010	0.0003	0.0005	0.0030	0.0214	0.0046	0.0143	0.0221	0.0107	0.0213	0.0300
Free from snow	22	.0271	.0259	.0518	.0914	.2621	.3810	.7010	1.0393	.7620	.4572	.2501	.7925

Average: Snow covered, 0.1127; free from snow, 0.2841.

An important factor governing the rate of evaporation from the snow is the temperature of the snow surface (7). It is well known that a snow surface radiates energy as does a black body (174), and on a clear calm night excessive inversions of temperature may be established in the air next to the snow. During the daylight hours much of the incident radiation is reflected and the snow surface temperatures may remain well below the dew-point temperatures of the air. In any event, the temperature of the snow surface must remain at the freezing temperature until all the snow is melted. A grass-covered field also radiates energy as does a black body, but during the daylight hours most of the incident energy is absorbed and the surface temperatures may be greatly increased, so that transpiration of the plants increases. Transpiration may be regarded as the most effective mechanism whereby moisture is returned to the atmosphere from land areas (169). A snow cover obviously precludes the operation of the process of transpiration. Thus, it will be evident that unless the air dew-point temperatures are lower than the snow-surface temperatures (vapor pressure gradient directed upwards) there can be no evaporation. If, as may frequently be the case, the air dew-point temperature exceeds that of the snow cover (vapor pressure gradient



directed downwards), a frost condensation must be occurring on the snow surface. This explains what took place between the 16th and 20th, when an appreciable amount of frost was condensed on the snow surface.

On the 22d and 23d, only patches of snow remained on the field, and by the morning of the 24th it had entirely disappeared. The increase of evaporation during the period between the 22d and 27th over that of the period between the 14th and 21st is to be attributed directly to the disappearance of the snow cover. However, even with the disappearance of the snow it is to be noticed that the average daily evaporation rates for the period from the 21st to the 27th were lower than those for the period preceding the first snowfall. This is accounted for by the greatly decreased temperature of the ground during the last half of the month.

Cold and dry Polar Continental air occupied the area on the 27th but was displaced by a southwesterly current of transitional tropical air on the 28th. The dew-point temperatures of the polar air averaged approximately  $12^{\circ}$  F. but increased to about  $26^{\circ}$  in the modified air. The ground temperatures were still low, and with the invasion of the modified air with increased specific humidity the moisture gradient was directed downward for a good part of the day, and appreciable condensation of frost occurred. The 29th was overcast, and light rain began at 11 a. m. and continued until after midnight. The cloud base, which remained below 1,000 feet, lowered to the ground in the evening, resulting in foggy conditions. On the 30th, a low stratus overcast with ceilings varying between 200 and 600 feet and light rain or mist and fog persisted during the entire day. The rain ceased in the early morning of the 31st, when a polar air mass again invaded the eastern part of the United States. Practically no evaporation occurred on the 29th or the 30th. On both of these days, however, significant amounts of condensation occurred. The small evaporation of the 31st was associated with the invasion of the polar air mass. The total amount of evaporation at the Arlington Farm for the month of January 1939 amounted to 0.4905 inch. The total amount of condensation as computed was 0.0753 inch.

Daily values of evaporation, condensation, and precipitation for the entire year, except for the months of February and September, are given in table 7. Records for these two months are missing because of the interruption of the observations by instrumental failure and the installation of new equipment. The records of a few days during the 10 months are also missing or incomplete.<sup>12</sup>

<sup>12</sup> Interruptions in the record occurred when birds attempted to nest in the hygrothermographs, using the hair elements for building material, and when on several occasions spiders in large numbers caused trouble not only in the hygrothermographs but in the anemometers and wind recorders as well.

TABLE 7.—Exchange of moisture between the ground and the atmosphere,  
Arlington, Va., 1939<sup>1</sup>

Date	Rain fall	Con- densation	Evap- oration	Net evap- oration	Date	Rain fall	Con- densation	Evap- oration	Net evap- oration
Inches	Inches	Inches	Inches		April—Continued.	Inches	Inches	Inches	Inches
January:					6	0.59	0.0271	0.0033	-0.0238
1	0.0011	0.0080	0.0069		7		0.0066	0.0350	0.0283
2	0.0030	0.0152	0.0122		8		0.0066	0.0281	0.0215
3	0.0067	0.0085	0.0018		9	0.02	0	0.0277	0.0277
4	0.0054	0.0112	0.0058		10	0.03	0.0113	0.0110	0.0003
5	0.0001	0.0103	0.0102		11	0.18	0.0063	0.0525	0.0462
6	0	0.0544	0.0544		12		0	0.0698	0.0698
7	0.0006	0.0319	0.0313		13		0.0011	0.0569	0.0558
8	0.0002	0.0374	0.0372		14		0	0.0818	0.0818
9	0	0.0232	0.0232		15		0.0178	0.0375	0.0197
10	0.07	0	0.0276	0.0276	16	0.54	0.0010	0.0290	0.0280
11		0.0011	0.0312	0.0301	17		0	0.1204	0.1204
12		0	0.0535	0.0535	18		0.03	0.0440	0.0410
13	0.71	0	0.0281	0.0281	19		0.0122	0.0710	0.0588
14	0	0	0.0113	0.0113	20		0.0058	0.0233	0.0175
15	0	0.0033	0.0033	0.0033	21	0.03	0.0127	0.0577	0.0450
16	0.02	0.0047	0.0037	0.0010	22	0.01	0.0042	0.0450	0.0408
17		0.0018	0.0013	0.0005	23		0.0298	0.0331	0.0033
18	0.51	0.0072	0.0000	0.0072	24		0.0402	0.0212	0.0190
19		0.0004	0.0014	0.0010	25		0	0.0430	0.0430
20	0.02	0.0001	0.0004	0.0003	26	0.65	0.0070	0.0266	0.0196
21		0.0003	0.0077	0.0074	27		0.0036	0.0385	0.0349
22	0.01	0	0.0177	0.0177	28		0.0101	0.0180	0.0079
23		0	0.0088	0.0088	29	0.18	0.0217	0.0036	0.0181
24	0.03	0.0006	0.0149	0.0143	30		0.0080	0.0236	0.0156
25		0	0.0290	0.0290					
26		0	0.0085	0.0085	Total	2.03	0.0070	1.0723	0.7653
27		0.0007	0.0120	0.0113	May:				
28		0.0023	0.0029	0.0006	1		0.0170	0.0143	0.0027
29	0.90	0.0081	0.0001	0.0077	2		0.0020	0.0388	0.0368
30	0.97				3		0.0013	0.0037	0.0024
31	0.01	0.0004	0.0031	0.0027	4		0	0.0028	0.0028
Total	3.41	0.0565	0.0747	0.1282	5		0	0.0041	0.0041
Adjusted total <sup>2</sup>		0.0753	0.0005	0.1522	6		0	0.0040	0.0040
March:					7		0	0.0060	0.0060
1	0	0	0.0725	0.0725	8		0.0055	0.0080	0.0025
2	0	0	0.0460	0.0460	9				
3	0	0	0.0568	0.0568	10		0	0.1154	0.1154
4	0.16	0.0006	0.0068	0.0062	11		0	0.0460	0.0460
5	0.18	0	0.0274	0.0274	12		0.0013	0.0390	0.0377
6		0.0027	0.0203	0.0176	13				
7		0.0005	0.0201	0.0196	14				
8	0	0	0.0165	0.0165	15				
9	0	0	0.0317	0.0317	16		0	0.0401	0.0401
10	0	0	0.0225	0.0225	17		0.0010	0.0524	0.0514
11	0.28	0.0001	0.0407	0.0406	18		0.0005	0.0275	0.0270
12	0.34	0.0006	0.0053	0.0047	19		0.0023	0.0435	0.0412
13		0.0007	0.0172	0.0165	20		0	0.0503	0.0503
14		0.0002	0.0065	0.0063	21		0	0.0410	0.0410
15	0.51	0.0030	0.0051	0.0021	22	0.20			
16	0.08	0.0004	0.0105	0.0101	23				
17	0	0	0.0181	0.0181	24		0	0.0583	0.0583
18	0	0	0.0177	0.0177	25				
19	0	0	0.0196	0.0196	26		0.0011	0.0152	0.0141
20	0	0	0.0290	0.0290	27		0.0044	0.0537	0.0493
21	0	0	0.0109	0.0109	28		0.0089	0.0330	0.0241
22	0	0	0.0221	0.0221	29		0.0080	0.0083	0.0003
23		0.0004	0.0153	0.0149	30		0.0061	0.0212	0.0151
24		0.0021	0.0153	0.0132	31		0.0016	0.0161	0.0145
25	0	0	0.0004	0.0004	Total	2.0	0.0552	1.2802	1.1950
26		0.0030	0.0245	0.0215	Adjusted total <sup>2</sup>		1.104	1.6331	1.5429
27	0.03	0	0.0167	0.0167	June:				
28	0	0	0.0709	0.0709	1	0.14	0.0245	0.0065	0.0180
29	0.03	0	0.0570	0.0570	2	0.16	0.0324	0.0205	0.0119
30	0.60	0.0135	0.0078	0.0057	3		0	0.0030	0.0030
31	0	0	0.0380	0.0380	4		0	0.0145	0.0145
Total	2.81	0.0280	0.2449	0.2169	5		0	0.0195	0.0195
April:					6		0	0.0195	0.0195
1	0.0060	0.0213	0.0123		7		0	0.0392	0.0392
2	0.0013	0.0178	0.0166		8	1.17	0.0004	0.0118	0.0114
3	0.0118	0.0160	0.0051		9	0.01	0.0109	0.0780	0.0671
4	0.0077	0.0079	0.0002		10		0	0.0791	0.0791
5	0.0052	0.0020	0.0032		11		0.0032	0.1169	0.1137

See footnotes at end of table.

TABLE 7.—*Exchange of moisture between the ground and the atmosphere, Arlington, Va., 1939*—Continued.

Date	Rain fall	Con- densation	Evap- oration	Net evap- oration	Date	Rain fall	Con- densation	Evap- oration	Net evap- oration
June—Continued.	Inches	Inches	Inches	Inches	August	Con.	Inches	Inches	Inches
12		0.0007	0.0004	0.0037	15		0.0025	0.0210	0.0215
13	1.88	0.0160	0.0292	0.0123	16		0.0054	0.0150	0.0096
14		0.0133	0.1521	0.1388	17		0.0018	0.0216	0.0168
15	0		0.1185	0.1185	18		.82	0.0254	0.0054
16		0.0038	0.003	0.025	19		1.73	0.0350	0.0242
17		0.0020	0.0006	0.0086	20		.38	0.0005	0.0279
18	.16	0	0.0511	0.0511	21			0.0005	0.0313
19		0.0030	0.241	0.234	22		0	0.0085	0.0085
20		0.0085	0.0211	0.0610	23			0.0001	0.0708
21		0.0016	0.0582	0.0566	24			0.0200	0.0223
22					25			0.0221	0.0235
23	.31				26			0.0032	0.0306
24					27				
25					28		0	.1160	.1160
26					29				
27		0.0233	0.0180	0.0217	30				
28	.18	0.0066	0.0678	0.0012	31			0.0003	.1217
29	.55	0.0043	0.0710	0.0367					.1214
30	1.36	0.0033	0.0587	0.0554	Total		2.98	.1411	1.3183
Total	5.87	.2157	2.1102	1.8945	Adjusted total			.1561	1.4506
Adjusted total 1		.2587	2.5322	2.2735	October				
July					1		.72		
1		0.0054	0.0508	0.0454	2		.22		
2		0.0044	0.0171	0.0137	3				
3		0.0221	0.0066	0.0158	4			0.0030	0.0202
4	0.08	0.0059	0.0085	0.0274	5			0.0038	0.0216
5	.25				6			0.0102	0.0131
6					7			0.0045	0.0190
7	.09	0.0021	0.0066	0.0045	8			0.0031	0.0133
8		0.0026	0.0877	0.0852	9			0.0083	0.0083
9		0.0354	0.1510	0.1156	10			0.0115	0.0088
10		0.0482	0.0006	0.0476	11			0.0082	0.0002
11		0.0202	0.0153	0.0251	12			0.0101	0.0085
12		0.0215	0.0557	0.0312	13			0.0117	0.0337
13		0	0.1210	0.1210	14			0.0325	0.0071
14		0.0003	0.0583	0.0580	15			0.0055	0.0107
15		0.0081	0.1173	0.1092	16			0.0010	0.0165
16	0		0.0411	0.0411	17			0.0010	0.0191
17	.21	0	0.0273	0.0273	18			0	0.0318
18		0.0063	0.0044	0.0111	19			0.0053	0.0216
19	.02	0.0063	0.0376	0.0313	20			0.0150	0.0038
20	.26	0.0163	0.0506	0.0343	21		.02	0.0009	0.0039
21	.11	0.0028	0.0166	0.0138	22				
22		0.0001	0.0001	0.0001	23			0.0014	0.0145
23		0	0.0357	0.0357	24			0.0051	0.0034
24		0.0150	0.0782	0.0632	25		.09	0.0121	0.0113
25		0	0.0701	0.0701	26			0.0061	0.0191
26	.00	0	0.0071	0.0071	27			.03	0.0088
27					28		.02	0.0057	0.0090
28		0.0015	0.0198	0.0183	29				
29		0.0015	0.0102	0.0087	30		.21		
30	.08	0.0118	0.0136	0.0018	31		1.01	0.0207	0.0053
31	.10	0.0026	0.0189	0.0163	Total		2.38	.2021	.6321
Total	2.16	.2604	1.8083	1.5482	Adjusted total			.2501	.7830
Adjusted total 2		.2815	1.9341	1.6526	November				
August					1			0.0036	0.0083
1		0	0.0068	0.0068	2			0.0030	0.0090
2			0.0085	0.0085	3		.22	0.0049	0.0078
3	.05	0.0006	0.0114	0.0108	4		1.00		
4		0.0110	0.0512	0.0402	5				
5		0	0.0337	0.0337	6			0.0091	0.0159
6		0.0007	0.0338	0.0331	7			0	0.0302
7		0.0111	0.0158	0.0147	8			0.0218	0.0356
8		0.0075	0.0129	0.0054	9			0	0.0215
9		0.0220	0.0177	0.0057	10			0	0.0597
10		0.0003	0.0718	0.0715	11			0.0132	0.0504
11		0	0.0608	0.0608	12			0.0005	0.0215
12		0.0017	0.0115	0.0098	13			0	0.0346
13		0.0025	0.0020	0.0005	14			0	0.0198
14		0.0009	0.0150	0.0141	15			0.0019	0.0000
					16			0.0010	0.0389

See footnotes at end of table.

TABLE 7.—*Exchange of moisture between the ground and the atmosphere, Arlington, Va., 1939*—Continued.

Date	Rain fall	Con- den- sation	Evap- ora- tion	Net evap- ora- tion	Date	Rain fall	Con- den- sation	Evap- ora- tion	Net evap- ora- tion
	Inches	Inches	Inches	Inches		Inches	Inches	Inches	Inches
November	Con.				December	Con.			
17		0.0001	0.0002	0.0001	8				
18		0.0013	0.0012	0.0001	10	0.00			
19	0.05	0.0350	0	0.0350	11				
20	0.02	0.0168	0	0.0168	12				
21		0.0120	0	0.0120	13	0.43	0.0127	0.0000	-0.0118
22	0.10	0.0090	0	0.0090	14		0.0140	0.0111	-0.0126
23		0.0216	0	0.0216	15		0.0014	0.0092	-0.0078
24		0.0127	0.0122	0.0005	16		0.0122	0.0044	-0.0078
25	0.04	0.0002	0.0120	0.0127	17		0.0030	0.0078	-0.0048
26		0	0.0216	0.0216	18		0.0067	0.0012	-0.0055
27		0.0008	0.0021	0.0013	19		0.0017	0.0057	-0.0040
28		0.0031	0.0011	0.0010	20	7.5	0	0.0095	0.0135
29		0	0.0168	0.0168	21		0	0.0187	0.0187
30		0	0.0096	0.0096	22		0	0.0244	0.0244
Total	1.40	0.2035	0.5308	0.3503	23		0.0050	0.0143	0.0093
Adjusted total		0.2181	0.5034	0.3753	24		0	0.0156	0.0156
December					25		0	0.0312	0.0312
1	0.06				26		0	0.0201	0.0204
2	0.45				27	0.30	0	0.0260	0.0260
3		0.0035	0.0109	0.0074	28	0.01	0	0.0108	0.0108
4		0.0035	0.0085	0.0050	29	0.09	0.0035	0.0061	0.0026
5	0.01	0	0.0336	0.0336	30	0.03			
6	0.01	0	0.0157	0.0157	31				
7		0.0084	0.0117	0.0281	Total	2.20	0.0800	0.0885	0.3285
8		0.0035	0.0205	0.0170	Adjusted total		0.0880	0.5509	0.4429

<sup>1</sup> No data for February and September because of the interruption of the observations by instrumental failure and the installation of new equipment.

<sup>2</sup> Includes estimated values for the days on which the data are unsatisfactory or incomplete because of instrumental failure.

<sup>3</sup> Rainfall data for November and December taken from Weather Bureau records for Washington, D. C.

The observations of precipitation, evaporation, and condensation are summarized by months in table 8. During the 10 months the total contribution of moisture to the ground by precipitation was 26.34 inches and by condensation, 1.81 inches. The total loss by evaporation and transpiration was 11.97 inches. By subtraction, a value of 16.18 inches is obtained for run-off and increase in ground storage.

TABLE 8.—*Exchange of moisture between the ground and the atmosphere, Arlington, Va., for the year 1939*

Month	Precipitation	Conden- sation	Evapora- tion	Month	Precipitation	Conden- sation	Evapora- tion
	Inches	Inches	Inches		Inches	Inches	Inches
January	3.41	0.08	0.49	August	2.98	0.10	1.46
February <sup>1</sup>				September <sup>1</sup>			
March	2.81	0.03	0.92	October	2.38	0.25	0.78
April	2.93	0.31	1.07	November	1.40	0.22	0.59
May	2.20	0.11	1.65	December	2.20	0.11	0.55
June	5.87	0.20	2.53	Total	26.34	1.81	11.97
July	2.16	0.28	1.93				

<sup>1</sup> Incomplete record.

The losses to the atmosphere were at a minimum in winter, when evaporation was suppressed by low ground temperatures and transpiration was almost completely inactive. Losses by transpiration

were greatest in June, when the vegetation had nearly reached maturity and growth was still active. Transpiration losses were reduced in July and August by mowing.

Precipitation was very scanty in May, and the soil moisture was reduced nearly an inch and a half by evaporation and transpiration. However, much of this soil-moisture loss was restored by a rain of 1.17 inches on June 8 and a rain of 1.88 inches, on June 13, of which 1.51 inches fell in a single hour.

Evaporation losses to the atmosphere in June were five times as great as in January. Precipitation in winter, however, is nearly as great as in summer and, in addition, may be stored on the ground in the form of snow. Thus, the chance that general floods will occur in the colder seasons is greatly enhanced. Actually, the flood hazard is greatest in early spring, when evaporation losses are still small and warm rains, together with the melting of accumulated winter snow, are most likely to overtax drainage channels.

In the central and eastern parts of the United States nearly all major flood-producing storms are terminated by invasions of relatively dry air masses of polar continental origin characterized by a thick turbulent layer and low concentrations of water vapor. These air masses provide conditions most favorable to evaporation and are able to absorb enormous quantities of moisture from the rain-drenched land. Since floods on large watersheds are most frequently due to general storms which must first restore to the soil reservoir water lost by previous evaporation and transpiration, it is evident that land use practices favoring evaporation will accordingly lessen the burden imposed on stream channels by excessive rains, both by retarding immediate run-off and by creating a water-storage capacity in the soil.

The losses of moisture from a field in Arlington into continental and maritime air masses during June and July 1939 are shown in table 9. Although the maritime air was considerably warmer than the continental air, its daily rate of intake of moisture from the ground was only 58 percent as great. That evaporation into continental masses is greater than into polar masses has been verified by observation of the change in water content of these masses as they traverse the country (51).

TABLE 9.—*Exchanges of water vapor between the ground and continental and maritime air masses during June and July 1939 at the Arlington experiment station*

Month and air mass type	Days	Average temperature	Total evaporation	Total condensation	Total loss from ground	Average daily loss from ground
	Number	<sup>o</sup> F.	Inch	Inch	Inch	Inch
June:						
Continental	10	74.0	0.8887	0.0075	0.8812	0.0881
Maritime	11	76.4	.7182	.1507	.5675	.0516
July:						
Continental	12	72.7	.9740	.0005	.9045	.0754
Maritime	14	78.2	.7878	.1070	.6208	.0443

## EVAPORATION MEASUREMENTS IN AGRICULTURAL RESEARCH

In the development of the science of climatology there has gradually emerged the concept of climate as the integration of temperature, wind, sunshine, moisture, and other factors within a region which give it personality and individuality. Ingenious and accurate instruments have been developed for measuring and recording some of the elements of weather and climate. There are, however, no instruments for measuring the climatic complex. Furthermore, there are not a few elements of the climate that either are not measured adequately or are not measured at all. Finally, there is little doubt that there are significant factors of climate, the very existence of which are today unknown.

In 1864, Marsh (90, p. 24) wrote as follows:

There is one branch of research which is of the utmost importance \* \* \* but which, from the great difficulty of direct observation upon it, has been less successfully studied than almost any other problem of physical science. I refer to the proportions between precipitation, superficial drainage, absorption, and evaporation. Precise actual measurement of these quantities upon even a single acre of ground is impossible \* \* \*

In the intervening years much progress has been made in the measurement of precipitation and run-off, and recently much attention has been given to the problems involved in the measurement of infiltration into different soils and under different forms of soil management. But the measurement of evaporation has continued to be impossible, despite the fact that it has become increasingly necessary as measurements of rainfall, run-off, and infiltration have been improved.

Not until the last decade had the development of the theoretical study of atmospheric turbulence produced results which suggested a means of making this important but previously impossible measurement. The theoretical foundation of the method is sound; it remains to improve and simplify the instruments for making the necessary measurements of atmospheric humidity and wind velocity and to obtain a more reliable value for the universal turbulence constant. The final step will be to test the method by determining the evaporation from the surface of the water in a reservoir, where the loss can also be determined independently by direct measurement.

Until recently, no satisfactory technique for the measurement of actual moisture losses from natural surfaces such as fields or watersheds has been developed. Consequently, the analysis and solution of many climatic and hydrologic problems have been delayed because of the lack of the necessary evaporation and transpiration data. The future promises that measurements of the transfer of moisture to the atmosphere from all types of geographic surfaces will become

available and that they will provide information on the moisture requirements of various crops and types of natural vegetation and on the effectiveness of various moisture-conserving practices. With the accumulation of this information the interrelations of climate, hydrology, and agriculture will be more clearly understood.

Intimately associated with the problem of retarding and reducing run-off for flood control is a knowledge of the manner in which and the rate at which the soil loses moisture to the atmosphere. During rainless periods, soil moisture is diminished at rates fundamentally dependent upon the ecologic complex. This is true because transpiration is the chief mechanism whereby water is lost from the soil (169). Generally speaking, when rain falls on the land, only the part in excess of that needed to restore the soil moisture to its full storage capacity will run off. Obviously, then, in those regions where flood-producing rains are common, a plant cover having high transpiration values should be favored so that appreciable soil-moisture deficiencies may be built up between rains; and to minimize crop failure in areas of high drought incidence, plants with small transpiration values should be favored. When measurements of evaporation, condensation, and transpiration from natural surfaces under different types of plant cover are available for a large number of locations throughout the country, refinements in meteorology, hydrology, and agricultural climatology not now possible can be made.

### SUMMARY

This study is an attempt to satisfy a long-felt need for a method of determining water losses to the atmosphere from land surfaces possessing various types of vegetal cover as well as from free water surfaces. Since the water entering the atmosphere becomes a gas and is invisible, direct methods such as those in use for measuring precipitation or run-off in streams cannot be employed.

Recent studies of turbulence in the lower levels of the atmosphere have supplied essential information that makes possible the determination of the rate of transfer of moisture from a natural surface into the atmosphere. An equation is here developed that gives this rate of moisture transfer in terms of measurements of wind velocity and humidity at two levels directly above the surface.

The measurements of both wind velocity and humidity must be made with a high order of accuracy. Thus careful study of various types of hygrometers and anemometers was made and some new instruments were designed and tested. A salt hygrometer, a chemical-absorption hygrometer, and a dew-point recorder are described.

An evaporation station was established over a meadow at the Experimental Farm in Arlington, Va., in late autumn, 1938. The station was operated through 1939, and a nearly complete hourly

record of evaporation and condensation from the field was obtained. Tables presented in the bulletin include hourly values of temperature and of specific humidity at two levels and hourly values of wind movement at four levels. They also include daily totals of condensation and evaporation; the first record of its kind ever made. There are a few unavoidable gaps in the record.



## BIBLIOGRAPHY

- (1) ÅNGSTRÖM, ANDERS.  
1920. APPLICATIONS OF HEAT RADIATION MEASUREMENTS TO THE PROBLEMS OF THE EVAPORATION FROM LAKES AND THE HEAT CONNECTION AT THEIR SURFACES. *Geog. Ann.* 2: [237] 252.
- (2) ALBRIGHT, JOHN G.  
1939. *PHYSICAL METEOROLOGY*. 392 pp., illus. New York.
- (3) ALTY, F.  
1939. EVAPORATION IN AGRICULTURAL METEOROLOGY. *Canad. Jour. Res., Sect. C, Bot. Sci.* 17: [1] 3, illus.
- (4) AMERICAN SOCIETY OF CIVIL ENGINEERS.  
1933 34. EVAPORATION FROM WATER SURFACES: A SYMPOSIUM. *Amer. Soc. Civ. Engrs. Proc.* 59: [221] 268, illus., [901] 905, [1036] 1045, [1441] 1443, [1633] 1636, 1933; 60: [369] 380, 1934.
- (5) ———.  
1939. HYDROLOGY OF THE GREAT LAKES: A SYMPOSIUM. *Amer. Soc. Civ. Engrs. Proc.* 65: [583] 606, [1105] 1108, [1305] 1313, [1435] 1441, illus.
- (6) ANDERSON, DONALD B.  
1936. RELATIVE HUMIDITY OR VAPOR PRESSURE DEFICIT. *Ecology* 17: 277-282, illus.
- (7) BAKER, F. S.  
1917. SOME FIELD EXPERIMENTS ON EVAPORATION FROM SNOW SURFACES. *U. S. Monthly Weather Rev.* 15: 363-366, illus.
- (8) BANERJI, S. K., and WADIA, H. M.  
1932. ON EVAPORATION AND ITS MEASUREMENT. *Indian Met. Dept. Mem.* 25: 291-325, illus.
- (9) BAULIG, H.  
1939. UNE CARTE DU DÉFICIT D'ÉVAPORATION DANS L'EST ET LE CENTRE DES ÉTATS-UNIS. *Ann. de Géog.* 48: 491-503, illus.
- (10) BENNETT, M. G.  
1934. THE CONDENSATION OF WATER IN THE ATMOSPHERE. *Roy. Met. Soc. [London], Quart. Jour.* 50: 3-14.
- (11) BEST, H. C.  
1935. TRANSFER OF HEAT AND MOMENTUM IN THE LOWEST LAYERS OF THE ATMOSPHERE. [*U. S.*] *Met. Off., Geophys. Memo.* 65, 66 pp., illus.
- (12) BOWEN, I. S.  
1926. THE RATIO OF HEAT LOSSES BY CONDUCTION AND BY EVAPORATION FROM ANY WATER SURFACE. *Phys. Rev. (Ser. 2)* 27: 779-787, illus.
- (13) BOWER, J. H.  
1934. COMPARATIVE EFFICIENCIES OF VARIOUS DEHYDRATING AGENTS USED FOR DRYING GASES (A SURVEY OF COMMERCIAL DRYING AGENTS). [*U. S.*] *Natl. Bur. Standards Jour. Res.* 12: 241-248, illus.
- (14) BRIGGS, LYMAN J., and SHANTZ, H. L.  
1911. RELATIVE WATER REQUIREMENTS OF PLANTS. *Jour. Agr. Res.* 3: 1-64, illus.
- (15) ———, and SHANTZ, H. L.  
1917. THE WATER REQUIREMENTS OF PLANTS AS INFLUENCED BY ENVIRONMENT. 2d Pan Amer. Sci. Cong. Proc. (1915-16) 3: 95-107, illus.
- (16) BROOKS, C. E. P.  
1939. THE DEWPOINT "MYTH". *Met. Mag. [London]* 74: 181-182.
- (17) BRUNT, DAVID.  
1939. *PHYSICAL & DYNAMICAL METEOROLOGY*. Ed. 2, 428 pp., illus. Cambridge, [Eng.]

- (18) CAMMERER, J. S.  
1937. DIE MESSUNG DER LUFTFEUCHTIGKEIT DURCH THERMOELEMENTE IN RUHENDER LUFT. *Messtechnik* 13: 21-23, illus.
- (19) CHURCH, J. E.  
1934. EVAPORATION AT HIGH ALTITUDES AND LATITUDES. *Amer. Geophys. Union Trans.* 15: 326-351, illus. [Appendix: Measurements of Evaporation and Temperature from Soil and Water in Southern Greenland, pp. 343-351.]
- (20) CUMMINGS, N. W.  
1929. RELATION BETWEEN EVAPORATION AND HUMIDITY AS DEDUCED QUANTITATIVELY FROM RATIONAL EQUATIONS BASED ON THERMODYNAMICS AND MOLECULAR THEORY. *Natl. Res. Council Bul.* 68: 47-56.
- (21) ————  
1930. CERTAIN LIMITATIONS ON THE POSSIBLE VALUES OF THE RATIO OF HEAT LOSSES BY CONVECTION AND BY EVAPORATION AT A WATER SURFACE. *U. S. Monthly Weather Rev.* 58: 144-146, illus.
- (22) ————  
1936. EVAPORATION FROM WATER-SURFACE: STATUS OF PRESENT KNOWLEDGE AND NEED FOR FURTHER INVESTIGATIONS. *Amer. Geophys. Union Trans.* 17: 507-509.
- (23) ————  
1940. THE EVAPORATION-ENERGY EQUATIONS AND THEIR PRACTICAL APPLICATION. *Amer. Geophys. Union Trans.* 21: 512-522, illus.
- (24) ———— and RICHARDSON, BERT.  
1927. EVAPORATION FROM LAKES. *Phys. Rev. (Ser. 2)* 30: 527-534, illus.
- (25) CURTIS, OTIS F.  
1938. WALLACE AND CLUM, "LEAF TEMPERATURES": A CRITICAL ANALYSIS WITH ADDITIONAL DATA. *Amer. Jour. Bot.* 25: 761-771, illus.
- (26) DALTON, JOHN.  
1802. EXPERIMENTAL ESSAYS ON THE CONSTITUTION OF MIXED GASES; ON THE FORCE OF STEAM OR VAPOUR FROM WATER AND OTHER LIQUIDS IN DIFFERENT TEMPERATURES, BOTH IN A TORRICELLIAN VACUUM AND IN AIR; ON EVAPORATION; AND ON THE EXPANSION OF GASES BY HEAT. *Manchester Lit. and Phil. Soc. Mem.* 5: 535-602, illus.
- (27) DOCKING, A. R., HEYMANN, E., KERLEY, LUCY F., and MORTENSEN, K. N.  
1940. EVAPORATION OF WATER THROUGH MULTIMOLECULAR FILMS. *Nature [London]* 146: 265.
- (28) DORSEY, N. ERNEST.  
1910. PROPERTIES OF ORDINARY WATER-SUBSTANCE IN ALL ITS PHASES: WATER-VAPOUR, WATER, AND ALL THE ICES. 673 pp., illus. New York.
- (29) ÉLIESS, FRANZ.  
1929 30. DIE WÄRMEÜBERTRAGUNG EINER GEREIZTEN PLATTE AN STRÖMENDE LUFT. *Ztschr. f. Angew. Math. u. Mech.* 9: 434-453, illus., 1929; 10: 1-14, illus., 1930.
- (30) ————  
1930. DIE BERÜCKSICHTIGUNG DER THERMISCHEN TRÄGHEIT DES MESSDRAHTES BEI MESSUNGEN MITTELS HITZDRAHTMETRODE UND DIE ERMITTLUNG DER WÄRMEÜBERGANGZAHN BEI NICHT STATIONÄREM TEMPERATURZUSTAND. *Ztschr. f. Angew. Math. u. Mech.* 10: 241-247, illus.
- (31) ERTEL, HANS.  
1930. EINE METHODE ZUR BERECHNUNG DES AUSTAUSCHKOEFFIZIENTEN AUS DEN FEINREGISTRIERUNGEN DER TURBULENTEN SCHWANKUNGEN. *Gerlands Beih. z. Geophys.* 25: 279-289.
- (32) EWALD, P. P., PÖSCHL, TH., and PRANDTL, L.  
1936. THE PHYSICS OF SOLIDS AND FLUIDS, WITH RECENT DEVELOPMENTS. Authorized trans. by J. Dougall and W. M. Deans. Ed. 2, 396 pp., illus.
- (33) FEDOROV, V. P.  
1938. [THE METHODOLOGY OF ESTIMATING OF CALCULATION ABOUT WATER SURFACE EVAPORATION.] *Met. i Hydrol.* 1938 (5): 136-138, illus.

- (34) FERGUSON, S. P.  
1925. METHODS FOR MEASURING HUMIDITY. *Optical Soc. Amer. Jour.*  
and *Rev. Sci. Instruments* 10: 119-121.
- (35) FRIEDRICH, WILHELM.  
1938. ZUR METHODE DER VERDUNSTUNGSMESSUNGEN. 6th Aufl. *Hydrol.*  
*Konf.*, Berlin and L'ebek, 1938, Ber. 16 C, 22 pp., illus.
- (36) FRITZSCHE, GERHARD, and STANGE, RUDOLF.  
1936. VERTIKALER TEMPERATURVERLAUF ÜBER EINEN GROSSSTADT.  
*Beitr. z. Phys. der Freien Atmos.* 23: 93-110, illus.
- (37) GATES, FRANK C.  
1929. THE GARGOYLE AS A SCIENTIFIC INSTRUMENT. *Science* 70: 148-  
149.
- (38) ——— and BLACK, ROBERT L.  
1931. THE DRAGOYLE AS AN ECOLOGICAL INSTRUMENT. *Ecology* 12:  
448-452, illus.
- (39) GEIGER, RUDOLF.  
1936 37. MIKROKLIMATOLOGISCHE BESCHREIBUNG DER WÄRMESCHICHT-  
TUNG AM BODEN. *Met. Ztschr.* [Braunschweig] 53: [357]-  
360, illus., 1936; 54: 133-138, 278-281, illus., 1937.
- (40) GIRLETT, M. A.  
1921. SOME PROBLEMS CONNECTED WITH EVAPORATION FROM LARGE  
EXPANSES OF WATER. *Roy. Soc. London, Proc., Ser. A*, 99:  
472-490, illus.
- (41) GIRARD, JOHN.  
1939. WATER SUPPLY ON UPPER SALT RIVER, ARIZONA. *Amer. Soc. Civ.*  
*Engin. Proc.* 65: [1675]-1686, illus.
- (42) GLAZERBROOK, RICHARD, ed.  
1923. METEOROLOGY, METROLOGY, AND MEASURING APPARATUS. *In A*  
*Dictionary of Applied Physics*, v. 3, illus. London.
- (43) GOLDSTEIN, S.  
1931. ON THE STABILITY OF SUPERPOSED STREAMS OF FLUIDS OF DIFFER-  
ENT DENSITIES. *Roy. Soc. London, Proc., Ser. A*, 132: 524-  
548, illus.
- (44) HARDY, ERLE L., OVERPECK, J. C., and WILSON, C. P.  
1939. PRECIPITATION AND EVAPORATION IN NEW MEXICO. *N. Mex.*  
*Agr. Expt. Sta. Bul.* 269, 68 pp., illus.
- (45) HARKNESS, H. W.  
1939. A STUDY OF THE RIDEAL ABSORPTION HYGROMETER. *Rev. Sci.*  
*Instruments* 10: 237-241, illus.
- (46) HARRIS, F. S., and ROBINSON, J. S.  
1916. FACTORS AFFECTING THE EVAPORATION OF MOISTURE FROM THE  
SOIL. *Jour. Agr. Res.* 7: 439-461, illus.
- (47) HEDESTRAND, GUNNAR.  
1924. ON THE INFLUENCE OF THIN SURFACE FILMS ON THE EVAPORATION  
OF WATER. *Jour. Phys. Chem.* 28: [1245]-1252, illus.
- (48) HEYWOOD, G. S. P.  
1931. WIND STRUCTURE NEAR THE GROUND AND ITS RELATION TO TEMPER-  
ATURE GRADIENT. *Roy. Met. Soc. [London], Quart. Jour.*  
57: 433-455, illus. [Discussion, pp. 452-455.]
- (49) HOARE, F. E.  
1938. A TEXTBOOK OF THERMODYNAMICS. Ed. 2, 307 pp., illus. London.
- (50) HODGMAN, CHARLES D., ed.  
1940. HANDBOOK OF CHEMISTRY AND PHYSICS; A READY-REFERENCE  
BOOK OF CHEMICAL AND PHYSICAL DATA. Ed. 24, 2564 pp.,  
illus. Cleveland, Ohio.
- (51) HOLZMAN, BENJAMIN.  
1937. SOURCES OF MOISTURE FOR PRECIPITATION IN THE UNITED STATES.  
*U. S. Dept. Agr. Tech. Bul.* 589, 42 pp., illus.
- (52) HORTON, ROBERT E.  
1917. A NEW EVAPORATION FORMULA DEVELOPED. *Engin. News-Rec.*  
78: 196-199, illus.
- (53) ———  
1934. WATER-LOSSES IN HIGH LATITUDES AND AT HIGH ELEVATIONS.  
*Amer. Geophys. Union Trans.* 15: 351-379, illus.
- (54) HOTTE, GEORGE H.  
1935. MICRO-ANALYSIS OF HUMAN HEAD-HAIR. *Mass. Inst. Technol.*,  
*Met. Course, Prof. Notes* 8, pp. 19-28, illus.

- (55) HUMPHREYS, W. J.  
1933. REMARKS ON THE THEORY OF THE PSYCHROMETER. U. S. Monthly Weather Rev. 61: 300-302.
- (56) ———  
1940. PHYSICS OF THE AIR. Ed. 3, 676 pp., illus. New York and London.
- (57) JEFFREYS, HAROLD.  
1918. SOME PROBLEMS OF EVAPORATION. London, Edinb. and Dublin Phil. Mag. and Jour. Sci. (Ser. 6) 35: 270-280.
- (58) JOHNSON, N. K., and HEYWOOD, G. S. P.  
1938. AN INVESTIGATION OF THE LAPSE RATE OF TEMPERATURE IN THE LOWEST HUNDRED METRES OF THE ATMOSPHERE. [Gt. Brit.] Met. Off., Geophys. Mem. 77, 50 pp., illus.
- (59) KÁRMÁN, TH. VON.  
1930. MECHANISCHE ÄHNLICHKEIT UND TURBULENZ. Gesell. der Wiss. z. Göttingen, Math.-Phys. Kl., Nachr. 1930: 58-76, illus.
- (60) ———  
1934. TURBULENCE AND SKIN FRICTION. Jour. Aeronaut. Sci. 1: 1-20, illus.
- (61) ———  
1935. SOME ASPECTS OF THE TURBULENCE PROBLEM. 4th Internatl. Cong. Appl. Mech. Proc. 1934: 54-91, illus.
- (62) ———  
1937. TURBULENCE. Roy. Aeronaut. Soc. Jour. 41: 1109-1141, illus.
- (63) KÄRPER, R. E.  
1933. RATE OF WATER EVAPORATION IN TEXAS. Tex. Agr. Expt. Sta. Bul. 484, 27 pp., illus.
- (64) [KELVIN, BARON], WILLIAM THOMSON.  
1872. ON THE EQUILIBRIUM OF VAPOUR AT A CURVED SURFACE OF LIQUID. Roy. Soc. Edinb., Proc. (1869-72) 7: 63-68, illus.
- (65) KENNEDY, ROBERT E.  
1933. LIMITATIONS OF THE DALTON FACTOR IN EVAPORATION. Amer. Geophys. Union Trans. 14: 465-466, illus.
- (66) ——— and KENNEDY, R. W.  
1936. EVAPORATION COMPUTED BY THE ENERGY-EQUATION. Amer. Geophys. Union Trans. 17: 426-430, illus.
- (67) KETTENACKER, L.  
1932. ÜBER THERMOELEKTRISCHE FEUCHTIGKEITSMESSUNG. Ztschr. f. Instrumentenk. 52: 319-324, illus.
- (68) KIESSELBACH, T. A.  
1915. TRANSPIRATION AS A FACTOR IN CROP PRODUCTION. Nebr. Agr. Expt. Sta. Bul. 6, 214 pp., illus.
- (69) KITTEDGE, JOSEPH, JR.  
1938. THE MAGNITUDE AND REGIONAL DISTRIBUTION OF WATER LOSSES INFLUENCED BY VEGETATION. Jour. Forestry 36: 775-778, illus.
- (70) KNIGHT, R. C.  
1922. FURTHER OBSERVATIONS OF THE TRANSPIRATION, STOMATA, LEAF WATER-CONTENT, AND WILTING OF PLANTS. Ann. Bot. [London] 36: [361] 383, illus.
- (71) KÖPPEN, W[ILHELM].  
1900. VERSUCH EINER KLASSIFIKATION DER KLIMATE, VORZUGSWEISE NACH IHREN BEZIEHUNGEN ZUR PFLANZENWELT. Geog. Ztschr. 6: [593] 611, [657] 679, illus.
- (72) ———  
1918. KLASSIFIKATION DER KLIMATE NACH TEMPERATUR, NIEDERSCHLAG UND JAHRESLAUF. Petermanns Mitt. aus Justus Perthes' Geog. Anst. 64: [193] 203, 243-248, illus.
- (73) ———  
1923. DIE KLIMATE DER ERDE. GRUNDRISSE DER KLIMAKUNDE. 369 pp., illus. Berlin and Leipzig.
- (74) ———  
1931. GRUNDRISSE DER KLIMAKUNDE. ZWEITE, VERBESSERTE AUFLAGE DER KLIMATE DER ERDE. 388 pp., illus. Berlin and Leipzig.
- (75) ———  
1936. DAS GEOGRAPHISCHE SYSTEM DER KLIMATE. In Köppen W., and Geiger, R., eds., Handbuch der Klimatologie, Bd. 1, Teil C, 44 pp., illus. Berlin.

- (76) KRAMER, PAUL J.  
1939. THE FORCES CONCERNED IN THE INTAKE OF WATER BY TRANSPIRING PLANTS. *Amer. Jour. Bot.* 26: 784-791, illus.
- (77) KROGH, AUGUST.  
1940. A MICRO-CLIMATE RECORDER. *Ecology* 21: 275-278, illus.
- (78) LANG, RICHARD.  
1920. VERWITTERUNG UND BODENBILDUNG ALS EINFÜHRUNG IN DIE BODENKUNDE. 188 pp., illus. Stuttgart.
- (79) LANGMUIR, IRVING.  
1913. THE VAPOR PRESSURE OF METALLIC TUNGSTEN. *Phys. Rev. (Ser. 2)* 2: [329]-342, illus.
- (80) ——— and LANGMUIR, DAVID B.  
1927. THE EFFECT OF MONOMOLECULAR FILMS ON THE EVAPORATION OF ETHER SOLUTIONS. *Jour. Phys. Chem.* 31: [1719]-1731.
- (81) LANNING, J. H.  
1932. DETERMINATION OF RELATIVE HUMIDITIES BY MEANS OF THERMO-COUPLES. *Indus. and Engin. Chem., Analyt. Ed.* 4: 286-287, illus.
- (82) LEICHLY, JOHN.  
1937. A NOTE ON EVAPORATION. *Ecology* 18: 180-198, illus.
- (83) ———  
1938. THE ROLE OF THE ATMOSPHERIC CIRCULATION IN THE HYDROLOGIC CYCLE OF THE LANDS. *Geog. Rev.* 28: 334-335, illus.
- (84) LETTAU, HEINZ.  
1934. TURBULENTE SCHWANKUNGEN VON WIND UND TEMPERATUR IN DER BODENNAHEN LUFTSCHICHT ALS AUSTAUSCHPROBLEM. *Ann. der Hydrog. u. Marit. Met.* 62: 460-473, illus.
- (85) ———  
1939. ATMOSPHERISCHE TURBULENZ. 283 pp., illus. Leipzig.
- (86) LIVINGSTON, BURTON E.  
1938. INFLUENCES THAT AFFECT TRANSPIRATION FROM PLANT LEAVES. *Sigma Xi Quart.* 26: 88-101, illus.
- (87) ——— and SHREVE, FORREST.  
1921. THE DISTRIBUTION OF VEGETATION IN THE UNITED STATES, AS RELATED TO CLIMATIC CONDITIONS. 585 pp., illus. Washington, D. C. (Carnegie Inst. Wash. Pub. 284.)
- (88) MACCOLL, J. W.  
1930. MODERN AERODYNAMICAL RESEARCH IN GERMANY. *Roy. Aeronaut. Soc. Jour.* 34: 649-689, illus. [Discussion, pp. 679-689.]
- (89) McEWEEN, GEORGE F.  
1930. RESULTS OF EVAPORATION STUDIES CONDUCTED AT THE SCRIPPS INSTITUTION OF OCEANOGRAPHY AND THE CALIFORNIA INSTITUTE OF TECHNOLOGY. *Calif. Univ., Scripps Inst. Oceanog. Bul. Tech. Ser.* 2: 401-415.
- (90) MARSH, GEORGE P.  
1894. MAN AND NATURE; OR, PHYSICAL GEOGRAPHY AS MODIFIED BY HUMAN ACTION. 560 pp. New York.
- (91) MARTIN, EDWARD A.  
1909. SOME OBSERVATIONS ON DEW-PONDS. *Geog. Jour.* 34: 174-195, illus. [Discussion, pp. 191-195.]
- (92) MARTONNE, EM. DE.  
1926. ARÉISME ET INDICE D'ARIDITÉ. [Paris] *Acad. des Sci. Compt. Rend.* 182: 1395-1398.
- (93) MAXIMOV, N. A. [Maksimov, Nikolai Aleksandrovich.]  
[1929.] THE PLANT IN RELATION TO WATER; A STUDY OF THE PHYSIOLOGICAL BASIS OF DROUGHT RESISTANCE. Authorized English trans., ed. with notes by R. H. Yapp. 451 pp., illus. London.
- (94) MEYER, ADOLPH F., and LEVENS, A. S.  
1937. DETERMINING EVAPORATION LOSSES FROM WEATHER BUREAU DATA. *Engin. News-Rec.* 118: 481-483, illus.
- (95) MEYER, ALFRED.  
1926. ÜBER EINIGE ZUSAMMENHÄNGE ZWISCHEN KLIMA UND BODEN IN EUROPA. *Chem. der Erde* 2: [209]-347, illus.
- (96) MILLAR, F. GRAHAM.  
1937. EVAPORATION FROM FREE WATER SURFACES. *Canad. Met. Mem.* 1: 43-65, illus.

- (97) MONTGOMERY, R. B.  
1940. OBSERVATIONS OF VERTICAL HUMIDITY DISTRIBUTION ABOVE THE OCEAN SURFACE AND THEIR RELATION TO EVAPORATION. Mass. Inst. Technol. and Woods Hole Oceanog. Inst., Phys. Oceanog. and Met. Papers, v. 7, No. 4, 30 pp., illus.
- (98) MÜLLER, HANSGEORG.  
1936. STÖRUNG DER WINDSTRÖMUNG UND DES AUSTAUSCHES ÜBER EINEM GEBÄUDE. *Ztschr. f. Geophys.* 12: 173-192, illus.
- (99) NUSSELT, WILHELM.  
1930. WÄRMEÜBERGANG, DIFFUSION UND VERDUNSTUNG. *Ztschr. f. Angew. Math. u. Mech.* 10: [105]-121, illus.
- (100) PAESCHKE, W.  
1935. EXPERIMENTELLE UNTERSUCHUNGEN ZUM RAUHIGKEITS- UND STABILITÄTSPROBLEM IN DER BODENNAHEN LUFTSCHICHT. *Beitr. z. Phys. der Freien Atmos.* 24: [163]-189, illus.
- (101) PHYSICAL SOCIETY OF LONDON.  
1922. A DISCUSSION ON HYGROMETRY. HELD ON NOVEMBER 25, 1921, AT THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, SOUTH KENSINGTON, S. W. 7. [London] *Phys. Soc. Proc.* (1921-22) 34: [1]-XXV, illus.
- (102) POWELL, R. W.  
1936. THE USE OF THERMOCOUPLES FOR PSYCHROMETRIC PURPOSES. [London] *Phys. Soc. Proc.* 48: 406-411, illus.
- (103) PRANDTL, L.  
1925. BERICHT ÜBER UNTERSUCHUNGEN ZUR AUSGEBILDETEN TURBULENZ. *Ztschr. f. Angew. Math. u. Mech.* 5: 136-139, illus.
- (104) ————  
1930. EINFLUSS STABILISIERENDER KRÄFTE AUF DIE TURBULENZ. In Gilles, A., Hopf, L., and Kármán, Th. von, eds., *Vorträge aus dem Gebiete der Aerodynamik und verwandte Gebiete* (Aachen 1929), pp. 1-7, illus. Berlin.
- (105) ————  
1932. METEOROLOGISCHE ANWENDUNG DER STRÖMUNGSLEHRE. *Beitr. z. Phys. der Freien Atmos.* 19: 188-202, illus.
- (106) ————  
1935. THE MECHANICS OF VISCOUS FLUIDS. In Durand, William Frederick, ed., *Aerodynamic Theory: A General Review of Progress* . . . , v. 3, pp. [31]-208, illus. Berlin.
- (107) PUGSLEY, ALFRED J.  
[1939.] DEWPOONDS IN FABLE AND FACT.—A COLLECTION AND CRITICISM OF EXISTING KNOWLEDGE ON THESE CURIOSITIES. 62 pp., illus. London.
- (108) RAMAN, P. K., and SATAKOPAN, V.  
1935. EVAPORATION IN INDIA CALCULATED FROM OTHER METEOROLOGICAL FACTORS. *Indian Met. Dept. Sci. Notes*, v. 6, No. 61, 51 pp., illus.
- (109) RAMDAS, L. A.  
1928. THE VARIATION WITH HEIGHT OF THE WATER VAPOUR CONTENT OF THE AIR LAYERS NEAR THE GROUND AT POONA. *Met. Ztschr.* [Braunschweig], *Klimatische Beibl.* 5: 30-34.
- (110) RENQVIST, HENRIK.  
1939. TILL FRÅGAN OM VATTNETS KRETSLOPP. *Finska Vetensk. Soc., Acta. Soc. Sci. Fenn. Årshok*, v. 17 B, No. 4, 16 pp., illus.
- (111) RICHARDSON, BURT.  
1931. EVAPORATION AS A FUNCTION OF INSOLATION. *Amer. Soc. Civ. Engin. Trans.* 95: [996]-1019. [Discussion, pp. 1012-1019.]
- (112) ———— and MONTGOMERY, CAROL.  
1929. THE MEASUREMENT OF INSOLATION BY MEANS OF A PAN. *Natl. Res. Council Bul.* 68: 56-61.
- (113) RICHARDSON, LEWIS F.  
1919. ATMOSPHERIC STIRRING MEASURED BY PRECIPITATION. *Roy. Soc. London, Proc., Ser. A*, 96: 9-18.
- (114) ————  
1920. THE SUPPLY OF ENERGY FROM AND TO ATMOSPHERIC EDDIES. *Roy. Soc. London, Proc., Ser. A*, 97: 351-373, illus.
- (115) ————  
1921. SOME MEASUREMENTS OF ATMOSPHERIC TURBULENCE. *Roy. Soc. London, Phil. Trans., Ser. A*, 221: [1]-28, illus.

- (116) RIDEAL, ERIC K.  
1925. ON THE INFLUENCE OF THIN SURFACE FILMS ON THE EVAPORATION OF WATER. *Jour. Phys. Chem.* 29: [1585]-1588, illus.
- (117) ROBERTS, J. K.  
1933. HEAT AND THERMODYNAMICS. Ed. 2, 470 pp., illus. London and Glasgow.
- (118) ROHWER, CARL.  
1931. EVAPORATION FROM FREE WATER SURFACES. U. S. Dept. Agr. Tech. Bul. 271, 96 pp., illus.
- (119) ———  
1933. EVAPORATION FROM SALT SOLUTIONS AND FROM OIL-COVERED WATER SURFACES. *Jour. Agr. Res.* 16: 715-729, illus.
- (120) ROSSBY, CARL-GUSTAV.  
1926. THE VERTICAL DISTRIBUTION OF ATMOSPHERIC EDDY ENERGY. U. S. Monthly Weather Rev. 54: 321-332, illus.
- (121) ———  
1927. CONVECTION IN THE FREE ATMOSPHERE AND OVER A HEATED SURFACE. U. S. Monthly Weather Rev. 55: 1-5, illus.
- (122) ———  
1927. THE THEORY OF ATMOSPHERIC TURBULENCE—AN HISTORICAL RESUMÉ AND AN OUTLOOK. U. S. Monthly Weather Rev. 55: 6-10.
- (123) ———  
1932. A GENERALIZATION OF THE THEORY OF THE MIXING LENGTH WITH APPLICATIONS TO OCEANIC AND ATMOSPHERIC TURBULENCE. *Mass. Inst. Technol. Met. Papers*, v. 1, No. 4, 36 pp., illus.
- (124) ———  
1936. ON THE FRICTIONAL FORCE BETWEEN AIR AND WATER AND ON THE OCCURRENCE OF A LAMINAR BOUNDARY LAYER NEXT TO THE SURFACE OF THE SEA. *Mass. Inst. Technol. and Woods Hole Oceanog. Inst. Phys. Oceanog. and Met. Papers*, v. 4, No. 3, pp. 3-20, illus.
- (125) ——— and MONTGOMERY, R. B.  
1935. THE LAYER OF FRICTIONAL INFLUENCE IN WIND AND OCEAN CURRENTS. *Mass. Inst. Technol. and Woods Hole Oceanog. Inst., Phys. Oceanog. and Met. Papers*, v. 3, No. 3, 101 pp., illus.
- (126) SCHLICHTING, H.  
1935. TURBULENZ BEI WÄRMESCHICHTUNG. 4th Internatl. Cong. Appl. Mech. Proc. 1934: 245-246.
- (127) SCHMIDT, WILHELM.  
1915. STRAHLUNG UND VERDUNSTUNG AN FREIEN WASSERFLÄCHEN; EIN BEITRAG ZUM WÄRMEHAUSHALT DES WELTMEERS UND ZUM WASSERHAUSHALT DER ERDE. *Abh. der Hydrog. u. Marit. Met.* 43: 111-124, 169-178, illus.
- (128) ———  
1917. DER MASSENAUSTAUSCH BEI DER UNGEORDNETEN STRÖMUNG IN FREIER LUFT UND SEINE FOLGEN. *Akad. der Wiss. Wien, Math.-Nat. Kl. Sitzber., Abt. 2a*, 126: 757-804.
- (129) ———  
1925. DER MASSENAUSTAUSCH IN FREIER LUFT UND VERWANDTE ERSCHEINUNGEN. 118 pp., illus. Hamburg.
- (130) ———  
1935. TURBULENCE NEAR THE GROUND. *Roy. Aeronaut. Soc. Jour.* 39: 355-376, illus. [Discussion, pp. 368-376.]
- (131) SHARPLEY, B. F., and BOELTER, L. M. K.  
1938. EVAPORATION OF WATER INTO QUIET AIR FROM A ONE-FOOT DIAMETER SURFACE. *Indus. and Engin. Chem., Indus. Ed.* 30: 1125-1131, illus.
- (132) SPILHAUS, ATHELSTAN F.  
1935. THE TRANSIENT CONDITION OF THE HUMAN HAIR HYGROMETRIC ELEMENT. *Mass. Inst. Technol., Met. Course, Prof. Notes* 8, pp. 3-18, illus.

- (133) SPILHAUS, ATHELSTAN F.  
1940. MEMORANDUM ON SUGGESTED INSTRUMENTAL EQUIPMENT FOR THE STUDY OF WIND, TEMPERATURE, AND HUMIDITY GRADIENTS IN CONNECTION WITH QUESTIONS OF THE INTERACTION BETWEEN THE SEA AND THE ATMOSPHERE. Internatl. Geod. and Geophys. Union, Assoc. Phys. Oceanog. Gen. Assembly, Washington, September 1939, Proc.-Verb. 3, pp. 95-102, illus.
- (134) STAPLE, W. J., and LEHANE, J. J.  
1940. THE RESPONSE OF THE LIVINGSTON ATMOMETER TO SINGLE METEOROLOGICAL FACTORS. Sci. Agr. 20: 308-310, illus.
- (135) STEPHAN, J.  
1938. DAS TAU-PROBLEM (SAMMELREFERAT). Met. Ztschr. [Braunschweig] Bioklimatische Beibl. 5: 75-81.
- (136) ——— and MILDEBRATH, ERNST.  
1938. REGISTRIERENDE TAUMESSUNGEN. (EIN BEITRAG ZUM TAU-PROBLEM). Met. Ztschr. [Braunschweig], Bioklimatische Beibl. 5: 34-39, illus.
- (137) SUTTON, O. G.  
1934. WIND STRUCTURE AND EVAPORATION IN A TURBULENT ATMOSPHERE. Roy. Soc. London, Proc., Ser. A, 146: 701-722, illus.
- (138) ———  
1936-37. THE LOGARITHMIC LAW OF WIND STRUCTURE NEAR THE GROUND. Roy. Met. Soc. [London], Quart. Jour. 62: 124-127, 1936; 63: 105-107, illus., 1937.
- (139) ———  
1939. ATMOSPHERIC TURBULENCE. Met. Mag. [London] 74: [97]-103.
- (140) ———  
1939. [REVIEW OF LETTAU'S "ATMOSPHÄRISCHE TURBULENZ."]. Roy. Met. Soc. [London], Quart. Jour. 65: 285-288.
- (141) SYERDREP, H. U.  
1936. THE EDDY CONDUCTIVITY OF THE AIR OVER A SMOOTH SNOW FIELD. RESULTS OF THE NORWEGIAN-SWEDISH SPITZBERGEN EXPEDITION IN 1934. Geofys. Pub. v. 11, No. 7, 69 pp., illus.
- (142) ———  
1936. DAS MARITIME VERDUNSTUNGSPROBLEM. Ann. der Hydrog. u. Marit. Met. 64: 41-47, illus.
- (143) ———  
1936. NOTE ON THE LOGARITHMIC LAW OF WIND STRUCTURE NEAR THE GROUND. Roy. Met. Soc. [London], Quart. Jour. 62: 461-462.
- (144) ———  
1937. ON THE EVAPORATION FROM THE OCEANS. Jour. Mar. Res. 1: 3-14, illus.
- (145) ———  
1939. ON THE INFLUENCE OF STABILITY AND INSTABILITY ON THE WIND PROFILE AND THE EDDY CONDUCTIVITY NEAR THE GROUND. 5th Internatl. Cong. Appl. Mech. Proc. 1938: 369-372, illus.
- (146) ———  
1939. SECOND NOTE ON THE LOGARITHMIC LAW OF WIND STRUCTURE NEAR THE GROUND. Roy. Met. Soc. [London], Quart. Jour. 65: 57-60, illus.
- (147) SZYMKIEWICZ, DEZYDERY.  
1925. ÉTUDES CLIMATOLOGIQUES. V. COMMENT CARACTÉRISER L'HUMIDITÉ D'UN CLIMAT? Soc. Bot. Poloniae Acta 2: [239]-264, illus.
- (148) TAYLOR, E. H.  
1939. VELOCITY-DISTRIBUTION IN OPEN CHANNELS. Amer. Geophys. Union Trans. 20: 641-643, illus.
- (149) TAYLOR, G. I.  
1915. EDDY MOTION IN THE ATMOSPHERE. Roy. Soc. London, Phil. Trans., Ser. A, 215: [1]-26, illus.
- (150) ———  
1918. PHENOMENA CONNECTED WITH TURBULENCE IN THE LOWER ATMOSPHERE. Roy. Soc. London, Proc., Ser. A, 94: 137-155, illus.
- (151) ———  
1922. DIFFUSION BY CONTINUOUS MOVEMENTS. London Math. Soc. Proc. (Ser. 2) 20: 196-211, illus.



- (152) TAYLOR, G. I.  
1927. TURBULENCE. Roy. Met. Soc. [London], Quart. Jour. 53: [201]-211, illus.
- (153) ———  
1931. EFFECT OF VARIATION IN DENSITY ON THE STABILITY OF SUPERPOSED STREAMS OF FLUID. Roy. Soc. London, Proc., Ser. A, 132: 499-523, illus.
- (154) ———  
1932. THE TRANSPORT OF VORTICITY AND HEAT THROUGH FLUIDS IN TURBULENT MOTION. Roy. Soc. London, Proc., Ser. A, 135: 685-705, illus. [With an appendix by A. Fage and V. M. Falkner, Note on Experiments on the Temperature and Velocity in the Wake of a Heated Cylindrical Obstacle, pp. 702-705.]
- (155) THORNTHWATTE, C. WARREN.  
1931. THE CLIMATES OF NORTH AMERICA ACCORDING TO A NEW CLASSIFICATION. Geog. Rev. 21: 633-655, illus.
- (156) ———  
1933. THE CLIMATES OF THE EARTH. Geog. Rev. 23: 433-440, illus.
- (157) ———  
1937. THE HYDROLOGIC CYCLE RE-EXAMINED. U. S. Soil Conserv. Serv., Soil Conserv. 3: [85] 91, illus.
- (158) ———  
1940. ATMOSPHERIC MOISTURE IN RELATION TO ECOLOGICAL PROBLEMS. Ecology 21: 17-28, illus.
- (159) ———  
1941. THE CHEMICAL ABSORPTION HYGROMETER AS A METEOROLOGICAL INSTRUMENT. Amer. Geophys. Union Trans. 22: 429-432.
- (160) ——— and HOLZMAN, BENJAMIN.  
1939. THE DETERMINATION OF EVAPORATION FROM LAND AND WATER SURFACES. U. S. Monthly Weather Rev. 67: 4-11, illus.
- (161) ——— and HOLZMAN, BENJAMIN.  
1939. THE ROLE OF EVAPORATION IN THE HYDROLOGIC CYCLE. Amer. Geophys. Union Trans. 20: 680-685, illus.
- (162) ——— and HOLZMAN, BENJAMIN.  
1940. A YEAR OF EVAPORATION FROM A NATURAL LAND-SURFACE. Amer. Geophys. Union Trans. 21: 510-511.
- (163) ——— and HOLZMAN, BENJAMIN.  
1941. EVAPORATION AND TRANSPIRATION. U. S. Dept. Agr. Yearbook (Climate and Man) 1941: 545-550.
- (164) ——— and OWEN, J. C.  
1940. A DEW-POINT RECORDER FOR MEASURING ATMOSPHERIC MOISTURE. U. S. Monthly Weather Rev. 68: 315-318, illus.
- (165) THURT, HIRSH F.  
1938. RELATIVE HUMIDITY VARIATIONS AFFECTING TRANSPIRATION. Amer. Jour. Bot. 25: 589-595, illus.
- (166) ———  
1939. THE RELATIVE HUMIDITY GRADIENT OF STOMATAL TRANSPIRATION. Amer. Jour. Bot. 26: 315-319, illus.
- (167) TRANSEAU, EUGENE N.  
1905. FOREST CENTERS OF EASTERN AMERICA. Amer. Nat. 39: 875-889, illus.
- (168) TURNAGE, WILLIAM V., and SHREVE, EDITH B.  
1939. NOTE ON ATMOSPHERIC ARIDITY. Ecology 20: 107-109, illus.
- (169) VERHUYER, F. J.  
1938. EVAPORATION FROM SOILS AND TRANSPIRATION. Amer. Geophys. Union Trans. 19: 612-619, illus.
- (170) WAGNER, A.  
1931. ZUR FRAGE DER VERDUNSTUNG. Gerlands Beitr. z. Geophys. 34: 85-101, illus.
- (171) WALLACE, RAYMOND H., and CLEM, HAROLD H.  
1938. LEAF TEMPERATURES. Amer. Jour. Bot. 25: 83-97, illus.
- (172) WALLER, ADOLPH E.  
1918. CROP CENTERS OF THE UNITED STATES. Amer. Soc. Agron. Jour. 10: 49-83, illus.
- (173) WELTON, F. A., and WILSON, J. D.  
1939. COMPARATIVE RATES OF WATER LOSS FROM SOIL, TURF, AND WATER SURFACES. Ohio Agr. Expt. Sta. Bino. Bul. 23: 13-16.

- (174) WEXLER, H.  
1936. COOLING IN THE LOWER ATMOSPHERE AND THE STRUCTURE OF POLAR CONTINENTAL AIR. U. S. Monthly Weather Rev. 64: 122-136, illus.
- (175) WILSON, J. D.  
1939. EVAPORATION STUDIES III. TEN YEARS OF EVAPORATION AT WOOSTER AS MEASURED WITH BLACK AND WHITE ATMOMETERS. Ohio Agr. Expt. Sta. Bimo. Bul. 24: 11-25.
- (176) ———  
1940. AN EVAPORATION-INDEX METER FOR USE IN IRRIGATION PRACTICE. Ohio Agr. Expt. Sta. Bimo. Bul. 25: 3-6, illus.
- (177) ——— and SAVAGE, J. R.  
1936. AN EVAPORATION SURVEY OF OHIO. Ohio Agr. Expt. Sta. Bul. 564, 53 pp., illus.
- (178) WOODROW, A. W.  
1934. A METHOD FOR MEASURING RELATIVE HUMIDITY BY MEANS OF THERMOCOUPLES. Jour. Econ. Ent. 27: 618-624, illus.
- (179) WUNDT, WALTER.  
1939. DIE VERDÜNSTUNG VON DEN LANDEFLÄCHEN DER ERDE IM ZUSAMMENHANG MIT DER TEMPERATUR UND DEM NIEDERSCHLAG. Ztschr. f. Angew. Met. "Das Wetter" 56: 1-9.
- (180) YAMAMOTO, G.  
1937. ON THE RATE OF CONDENSATION OF DEW. Geophys. Mag. [Tokyo] 11: [91]-96, illus.
- (181) YOUNG, A. A.  
1936. DISCUSSION OF "EVAPORATION FROM WATER-SURFACES: STATUS OF PRESENT KNOWLEDGE AND NEED FOR FURTHER INVESTIGATION." Amer. Geophys. Union Trans. 17: 509-512.

## APPENDIX

TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939

Date	Height of observa- tion	Average for hour ending at—																								mean
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
		a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	
Jan.	1	24.5	41.0	36.9	37.8	35.0	36.4	39.9	33.9	33.0	37.7	46.7	50.2	---	55.9	56.6	50.0	55.1	51.3	49.5	49.4	48.2	47.6	45.9	43.3	44.7
	2	37.0	34.0	32.5	31.5	31.5	36.0	32.0	31.0	32.3	37.2	45.2	50.5	---	57.0	57.1	55.2	51.0	44.3	44.5	46.0	45.0	44.5	41.1	38.0	41.5
	3	40.0	41.8	44.9	44.4	41.7	40.3	38.7	41.8	43.1	51.4	58.9	62.7	63.5	62.7	63.5	63.3	61.2	56.2	55.3	49.7	46.2	43.7	40.0	39.0	40.0
	4	35.6	39.8	44.4	39.0	35.4	33.9	32.5	32.7	35.5	49.2	40.0	62.5	63.3	61.9	62.9	62.0	57.0	49.9	48.0	41.6	41.9	38.7	37.4	35.8	45.6
	5	37.8	38.2	38.1	36.5	37.0	39.1	39.9	38.9	41.4	43.2	46.5	51.1	53.8	55.7	57.5	57.6	53.3	47.7	45.7	43.7	42.2	42.0	39.5	33.6	44.1
	6	34.6	34.1	34.5	32.5	32.3	34.0	37.1	37.0	39.1	44.7	48.6	54.2	57.7	58.0	59.6	59.5	53.0	46.7	43.7	41.5	38.7	38.3	37.6	36.4	43.0
	7	38.0	37.5	38.7	36.3	36.2	38.2	38.2	40.6	40.5	40.5	41.5	43.3	44.5	45.8	42.3	40.7	39.3	39.3	39.1	39.1	39.1	39.1	39.1	39.0	39.8
	8	24.9	34.8	35.0	34.8	33.8	35.3	36.2	39.3	40.0	41.2	43.2	45.1	47.1	47.3	43.5	41.3	39.9	39.5	39.4	39.6	39.5	39.5	39.5	39.5	39.5
	9	39.1	39.2	39.3	39.1	39.2	39.4	39.9	40.5	41.4	42.5	43.9	45.7	47.9	49.9	49.7	49.9	55.8	56.0	56.2	56.1	57.8	56.9	56.3	57.9	47.5
	10	39.5	39.6	39.7	39.6	39.7	39.9	40.6	40.9	41.6	43.0	44.3	46.5	48.7	50.2	50.1	49.7	55.4	56.0	56.3	55.3	56.7	54.9	55.2	57.3	47.5
	11	54.1	53.1	53.4	51.5	49.0	50.0	50.2	47.9	45.9	52.4	55.5	56.5	56.5	56.8	56.1	55.6	53.9	51.7	49.1	47.7	46.7	46.2	45.8	42.3	51.2
	12	54.3	52.3	52.3	50.8	48.7	48.8	49.4	45.5	43.5	53.7	57.2	59.0	58.9	59.2	58.4	56.6	54.1	50.8	48.1	45.2	43.4	45.0	43.9	40.5	50.8
	13	39.8	39.0	39.5	34.5	33.6	33.9	33.8	32.2	33.0	39.2	45.4	50.1	52.2	54.0	55.4	57.9	53.9	50.9	48.5	46.2	44.3	43.2	42.1	39.0	43.3
	14	37.4	35.7	34.9	33.9	32.4	32.4	32.4	30.9	32.7	39.0	46.5	53.2	55.5	57.5	58.5	58.1	53.3	46.8	44.6	41.5	40.8	40.9	38.0	37.0	42.2
	15	38.5	37.2	37.2	37.2	37.0	37.2	36.5	36.7	36.5	44.1	52.5	55.9	57.3	58.7	59.7	59.9	58.2	55.2	50.7	47.7	42.2	39.9	37.8	36.5	45.5
	16	38.5	35.2	35.3	36.0	35.1	35.0	35.0	34.8	34.8	41.0	53.0	58.4	60.0	61.5	62.2	61.6	57.0	52.0	45.1	42.4	39.4	37.0	36.2	34.5	44.1
	17	30.0	35.2	35.3	36.0	35.1	35.0	35.0	31.0	32.2	37.8	43.8	51.8	57.7	50.6	60.7	50.7	57.7	53.8	50.7	49.9	48.7	46.4	43.8	42.5	44.4
	18	34.5	34.7	34.5	32.6	34.0	32.1	32.0	31.3	30.3	32.0	38.1	45.0	53.5	61.0	62.5	64.0	61.0	56.5	49.9	46.6	46.2	44.3	42.1	41.9	43.7
	19	43.9	46.3	46.9	47.7	49.3	50.3	51.3	49.9	50.2	51.3	54.4	60.3	57.7	61.2	63.2	63.9	64.2	62.2	61.1	59.9	58.9	58.0	54.0	50.6	51.0
	20	40.9	45.9	46.4	47.0	49.4	50.8	51.9	50.0	50.1	51.5	54.4	67.3	59.8	61.8	63.3	63.7	63.8	60.3	57.4	55.5	51.9	51.1	49.5	46.5	53.3
	21	40.6	55.5	56.9	55.0	53.4	51.4	49.8	48.3	46.5	45.7	46.3	47.0	48.8	49.8	49.7	49.8	49.2	47.7	46.0	45.5	43.5	42.7	41.9	41.7	48.1
	22	44.5	49.7	52.3	51.9	52.6	50.7	48.7	47.2	46.2	47.1	48.6	49.4	52.5	52.5	51.8	51.6	50.0	46.2	43.1	42.2	42.5	42.1	42.1	40.7	47.0
	23	42.1	44.6	43.7	43.7	42.2	43.2	45.4	42.2	40.7	40.7	42.2	43.6	43.9	45.4	45.8	45.7	44.7	43.5	42.3	41.7	41.7	41.2	40.1	39.7	42.9
	24	42.1	42.2	42.2	39.7	38.3	40.7	44.9	42.7	42.1	41.8	43.9	47.5	46.2	47.8	48.1	47.4	45.5	43.5	41.0	40.2	40.2	40.8	40.2	40.0	43.0
	25	39.5	38.8	38.3	37.3	36.6	34.8	31.3	30.8	30.9	31.4	31.6	31.0	30.2	30.0	30.1	30.2	30.2	30.0	29.1	29.1	29.2	29.3	31.2	31.6	32.2
	26	39.9	39.8	39.4	38.1	37.5	36.0	32.5	32.0	32.0	32.1	32.3	31.7	30.9	30.4	30.4	30.6	30.6	30.3	29.4	29.3	29.3	29.0	31.0	31.5	32.5
	27	31.0	30.8	30.1	29.0	29.2	29.6	30.0	30.1	31.2	32.8	34.8	36.3	36.7	36.7	36.5	36.1	34.7	33.2	32.2	31.7	31.6	31.5	31.8	30.9	32.1
	28	31.2	30.9	30.5	29.5	29.5	30.0	30.2	29.5	29.5	31.7	34.3	36.1	36.4	36.1	36.0	35.9	34.0	33.0	31.6	30.6	30.2	30.2	30.3	29.7	31.0
	29	30.1	29.4	28.0	26.9	26.0	23.5	22.7	21.2	24.4	27.8	31.8	35.0	38.5	38.8	38.4	39.5	36.0	32.5	31.2	31.5	29.1	28.6	28.5	29.5	30.5
	30	28.0	26.7	25.2	24.7	24.3	21.3	18.7	21.8	22.7	26.4	30.7	35.4	39.8	39.1	38.7	39.8	35.6	30.4	28.1	27.4	26.3	26.0	26.2	27.5	28.8
	31	29.2	29.0	29.0	29.7	29.9	30.1	30.2	30.1	29.9	30.0	30.6	32.7	35.7	38.9	39.9	39.2	39.7	39.2	36.7	36.3	37.2	40.3	39.9	39.8	34.6
	32	27.6	28.0	27.9	28.1	29.0	29.4	29.5	29.5	29.4	29.4	30.0	32.0	34.5	38.1	38.5	37.9	38.4	37.1	34.1	32.7	33.1	33.1	38.1	37.6	32.8
	33	39.2	37.7	37.2	37.2	36.1	34.7	34.1	34.2	35.5	38.1	38.0	40.0	41.2	43.0	43.6	43.0	41.5	39.0	38.7	37.6	37.2	37.2	37.4	37.5	38.3
	34	37.2	34.8	34.6	35.6	34.0	33.7	32.2	32.7	34.6	36.5	35.1	34.7	34.6	34.5	34.4	43.0	40.0	35.5	36.2	35.8	35.7	35.8	35.9	36.1	36.8
	35	36.6	36.3	36.6	35.6	35.0	35.0	35.6	36.2	35.8	36.5	36.1	34.7	34.6	34.5	34.4	34.4	34.1	33.8	32.4	31.0	29.2	28.8	28.8	28.8	33.8
	36	35.0	34.0	34.2	34.0	33.9	33.9	32.9	34.3	35.1	34.8	34.9	34.8	34.3	34.2	34.1	34.1	33.9	33.8	32.4	31.1	29.9	29.0	29.0	28.5	33.2
	37	28.8	28.6	28.3	26.9	26.5	24.9	24.9	24.9	26.5	28.1	27.4	28.0	32.3	33.4	33.9	33.8	32.7	31.6	30.4	29.7	29.2	27.4	26.9	26.3	29.1
	38	28.4	28.3	27.4	26.9	24.9	22.1	23.4	25.7	25.9	27.4	28.9	30.6	31.8	31.9	31.7	31.0	30.0	28.0	27.5	26.5	24.5	24.2	23.5	23.0	27.2

20	24.5	26.2	26.2	24.8	23.1	23.9	24.5	24.6	23.7	25.2	25.0	28.0	30.4	31.0	31.6	32.5	33.0	32.5	31.5	28.0	28.2	28.6	28.0	20.6	20.7	28.0	
	2	23.0	23.0	21.0	19.5	22.5	23.9	23.9	23.2	23.5	24.4	24.9	31.0	31.9	31.9	32.4	33.0	33.3	32.0	30.9	28.8	28.1	28.0	29.9	30.0	20.9	27.2
21	24.5	29.6	30.5	30.9	30.0	31.1	31.6	31.5	31.0	31.1	32.5	34.6	41.1	45.3	45.0	45.1	44.0	42.8	40.5	40.5	39.2	38.5	39.0	39.7	39.2	36.8	
	2	29.2	29.8	30.5	30.4	31.1	31.9	31.0	30.4	30.8	32.0	34.9	41.0	45.1	44.9	45.1	42.4	41.0	39.4	39.4	38.5	37.0	37.2	37.7	38.7	38.1	36.2
22	24.5	35.7	39.7	38.6	39.2	42.6	45.8	46.2	47.6	48.2	49.5	47.5	45.8	43.2	40.1	39.5	36.5	34.0	30.7	29.5	27.9	27.7	27.8	26.9	38.4	38.4	
	2	37.5	37.4	36.7	36.7	39.9	43.9	44.2	45.6	46.2	48.0	46.1	44.4	42.4	39.9	39.1	36.6	33.6	30.6	30.7	29.5	27.9	27.7	27.8	26.9	38.4	
23	24.5	25.0	24.0	23.2	22.2	21.8	21.2	20.4	20.0	22.1	26.0	28.0	31.0	32.1	34.7	37.0	38.5	36.5	34.3	33.2	32.3	31.1	31.7	32.2	32.9	38.3	
	2	24.1	23.3	22.2	21.3	20.2	19.7	19.2	18.4	21.7	26.4	28.4	32.4	33.7	36.2	38.4	41.4	43.5	43.6	42.5	42.8	41.7	41.2	41.6	42.6	39.1	
24	24.5	35.0	36.2	37.2	37.5	37.4	37.0	34.2	34.0	35.4	34.5	34.9	37.1	39.4	42.0	41.4	43.5	43.6	42.5	40.5	40.3	38.7	38.0	41.9	39.8	38.0	
	2	33.4	35.2	35.7	35.7	35.8	35.9	33.4	33.4	34.5	34.4	35.1	37.4	40.3	43.2	42.2	44.7	43.7	40.5	40.3	38.7	38.0	41.9	41.3	38.0		
25	24.5	40.6	39.0	38.3	37.0	34.6	34.3	32.0	32.3	32.3	33.1	33.0	32.7	31.4	30.2	30.2	30.2	28.0	26.0	25.2	24.0	23.1	22.2	21.5	30.5	30.1	
	2	39.4	37.4	36.8	36.3	33.7	33.5	32.1	31.6	32.6	33.7	33.6	33.5	32.4	30.9	30.8	30.8	28.4	27.9	25.7	24.0	23.0	21.9	21.0	20.0	18.8	30.0
26	24.5	20.3	19.1	19.8	19.2	19.3	19.8	20.3	20.5	22.0	22.0	22.2	23.5	24.5	25.0	27.0	28.4	27.9	27.1	25.5	24.6	23.6	23.8	23.2	22.6	22.2	22.9
	2	19.2	19.2	18.4	17.7	18.4	19.4	19.7	20.4	21.6	21.8	22.4	23.6	24.6	25.6	27.0	28.4	29.1	27.1	25.8	24.8	23.1	21.4	21.0	20.9	22.1	
27	24.5	20.8	20.3	20.1	18.9	18.7	19.3	22.8	23.3	24.0	25.1	26.5	28.5	30.5	32.5	34.0	34.0	34.0	33.0	32.3	31.7	31.0	30.0	28.3	26.5	26.1	
	2	19.4	18.5	17.5	16.5	16.0	16.5	20.5	21.0	22.4	24.9	26.9	29.4	31.9	33.9	34.9	34.9	33.6	32.9	31.4	30.4	29.4	29.4	26.9	22.9	25.4	
28	24.5	25.5	24.4	22.6	22.1	21.0	20.3	20.5	20.0	23.0	28.7	32.0	35.5	36.1	37.0	38.1	38.8	38.4	38.0	37.1	36.9	36.8	37.1	37.0	37.0	31.0	
	2	21.3	19.9	18.4	18.4	17.3	16.2	16.8	16.4	23.4	27.4	31.6	34.6	35.5	36.1	37.2	37.3	36.4	35.5	35.3	34.7	34.6	35.3	35.2	35.3	28.8	
29	24.5	37.4	37.8	38.0	38.3	39.0	39.5	39.6	39.9	40.5	43.0	44.0	44.1	42.3	41.5	40.0	40.0	40.0	41.0	41.0	41.0	40.8	40.5	40.1	40.4	40.4	
	2	35.4	35.6	35.9	36.6	37.3	36.9	37.0	36.9	37.0	41.4	43.4	43.3	41.4	40.0	38.6	38.4	38.9	39.4	39.4	39.4	39.3	39.3	39.4	39.4	38.8	
30	24.5	40.0	39.9	39.8	39.8	39.9	40.0	40.0	40.0	40.0	40.2	41.0	42.0	42.2	44.0	45.0	45.0	45.0	44.0	41.4	40.8	40.5	40.3	39.9	39.9	41.3	
	2	39.4	39.4	39.3	39.3	39.4	39.4	39.4	39.4	39.4	39.4	40.0	41.3	41.4	43.2	44.4	43.6	43.6	42.4	39.9	38.3	38.2	37.5	37.9	40.7		
31	24.5	39.8	39.7	39.7	39.5	39.5	40.5	41.5	39.0	39.2	39.1	38.5	38.0	37.8	37.9	38.3	38.3	38.3	38.2	37.5	36.5	34.8	33.8	32.5	32.0	37.9	
	2	...	...	...	...	36.4	36.6	38.4	38.9	37.4	37.4	38.4	37.9	36.9	36.4	36.6	38.6	37.7	37.0	35.8	34.4	33.5	33.2	32.2	31.4	30.4	36.0
Mean...	24.5	36.0	36.1	35.8	35.0	34.8	34.9	34.6	34.4	34.9	37.0	39.3	41.6	42.3	43.7	44.0	44.1	43.1	41.3	40.0	39.0	38.1	37.7	37.0	36.3	...	
	2	34.0	34.0	33.8	33.2	33.0	33.2	33.2	33.0	33.9	36.7	39.1	42.1	41.8	44.3	44.6	44.1	42.2	39.4	37.8	35.4	34.9	34.6	34.1	33.4	...	

TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																								mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
Mar. 1	Feet	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
	24.5	55.2	54.2	53.5	52.2	50.2	48.7	47.3	47.2	47.2	46.0	46.2	47.0	47.3	48.0	47.2	47.6	47.4	46.7	45.0	43.2	41.3	39.7	38.9	38.2	46.9
2	2	55.8	54.6	53.5	52.0	49.0	48.5	47.0	47.0	47.9	47.0	48.7	49.4	50.5	50.5	49.7	49.6	48.0	47.0	45.0	43.0	41.5	40.3	39.0	38.0	47.7
	2	38.2	37.5	37.2	36.7	36.0	35.2	35.2	34.4	34.2	34.7	35.2	36.2	37.7	39.2	40.2	41.2	40.7	38.7	36.2	35.2	33.3	32.2	31.2	31.7	36.2
3	2	39.0	38.1	38.0	37.0	36.2	35.8	35.2	35.0	35.0	35.0	36.5	38.0	39.8	41.0	42.0	43.0	42.2	40.0	36.5	32.5	31.0	30.0	29.8	29.5	36.5
	2	29.7	28.2	27.3	26.7	25.7	25.4	24.9	27.2	32.7	37.7	40.2	42.2	43.5	45.0	46.2	47.0	46.2	45.2	43.2	41.2	40.2	39.5	39.4	38.7	36.8
4	2	28.5	28.0	28.1	26.0	25.5	25.0	24.8	26.0	32.0	40.2	43.0	45.5	47.0	48.5	50.0	49.8	48.1	45.0	43.0	41.0	40.2	40.0	39.7	38.5	37.6
	2	37.4	37.2	36.6	35.2	34.2	33.2	33.7	35.2	37.2	39.3	39.5	40.8	41.2	41.7	43.7	45.1	47.2	47.5	47.4	46.7	45.7	45.4	45.2	45.0	40.9
5	2	37.0	36.3	34.5	32.5	31.0	31.0	32.0	35.1	39.5	40.0	40.6	42.2	42.2	44.0	46.1	47.0	48.5	48.3	48.0	47.0	46.3	45.9	45.7	45.2	41.1
	2	45.1	45.1	45.1	45.2	45.2	45.5	46.2	48.2	49.4	52.2	54.7	57.1	60.7	65.6	68.0	72.0	74.8	74.0	71.5	69.1	63.5	59.3	62.0	65.1	57.7
6	2	45.6	45.7	45.7	45.7	45.9	46.0	46.5	49.0	50.0	54.0	57.0	58.4	62.5	67.0	70.0	73.9	76.0	74.5	71.5	67.9	61.0	55.5	61.0	65.0	58.3
	2	60.0	67.5	66.6	64.6	61.2	58.2	57.5	57.5	58.0	59.5	60.0	60.7	61.5	62.0	62.5	62.9	63.0	62.8	59.0	54.8	52.2	49.6	47.2	45.3	58.7
7	2	65.2	67.5	67.0	64.5	61.7	59.5	59.0	58.8	59.2	60.6	61.2	61.5	62.0	62.0	62.5	62.9	63.0	62.8	59.0	54.8	52.2	49.6	47.2	45.3	58.7
	2	43.0	40.5	39.3	38.1	37.5	35.2	36.0	37.9	39.9	42.0	44.0	46.1	48.0	49.5	51.0	51.0	51.0	49.5	47.2	44.5	42.0	40.0	38.3	37.0	42.9
8	2	41.4	39.4	38.0	36.8	35.8	32.8	34.3	36.8	40.0	43.4	45.6	47.7	49.7	51.8	51.8	51.7	51.2	48.8	45.3	43.3	40.8	38.3	36.8	35.8	42.4
	2	35.1	34.3	33.2	32.1	31.0	30.0	29.2	29.2	29.5	31.5	34.5	36.7	39.5	41.5	43.0	44.5	44.3	43.0	39.0	37.7	37.0	37.7	37.9	37.9	36.2
9	2	34.8	33.8	32.8	31.8	30.4	29.8	28.4	29.3	30.3	32.8	35.8	38.4	41.3	44.0	45.4	46.8	46.3	43.8	38.3	36.3	36.1	37.0	37.8	37.6	36.6
	2	37.0	37.0	36.6	37.0	38.0	39.0	39.5	40.5	44.1	50.0	55.0	62.0	67.0	69.6	70.0	70.0	68.0	65.0	62.5	60.1	58.5	54.5	51.0	50.0	62.6
10	2	36.8	36.4	36.3	37.3	38.2	38.8	39.1	40.6	45.8	51.7	57.8	63.7	68.3	70.9	70.3	71.3	67.7	63.9	60.3	57.7	56.3	52.8	50.2	47.8	62.5
	2	47.8	45.0	43.5	42.0	41.0	39.5	38.0	37.3	38.1	40.0	41.0	42.6	44.5	47.1	47.6	49.1	50.0	49.5	47.2	43.2	42.0	42.0	41.5	41.5	43.4
11	2	45.8	43.3	41.9	40.8	39.9	38.4	37.0	36.8	38.8	42.4	44.2	45.8	48.0	50.3	50.4	50.4	51.3	48.8	45.7	42.8	41.8	41.8	41.3	43.7	43.7
	2	41.1	40.1	39.0	37.6	36.4	35.0	33.6	33.0	33.5	34.0	34.0	33.5	33.1	32.1	31.9	32.2	33.0	33.7	34.0	34.1	34.3	34.2	34.0	34.2	34.6
12	2	41.8	41.0	39.5	38.1	36.8	35.8	34.8	36.3	34.8	34.9	35.1	34.1	33.8	33.3	32.6	33.3	33.7	33.8	34.1	34.4	34.9	34.9	34.7	34.8	35.5
	2	34.5	35.0	35.1	35.0	35.2	35.5	35.3	35.8	36.0	36.5	37.8	39.0	40.0	41.0	41.5	42.0	41.5	41.5	41.5	41.8	41.5	40.6	39.0	38.3	38.4
13	2	35.0	35.3	35.8	35.6	35.7	35.8	35.8	36.3	36.3	37.4	38.3	39.8	40.8	41.8	41.8	42.0	41.8	41.8	41.5	41.5	41.5	40.9	39.8	38.8	38.6
	2	38.3	38.0	37.5	38.0	40.1	41.9	42.0	42.0	42.0	42.4	43.0	44.8	46.5	48.0	48.2	49.5	49.5	48.5	47.2	45.1	43.9	40.2	40.1	39.3	43.2
14	2	37.8	37.7	37.1	37.3	39.3	40.9	40.8	41.1	41.4	42.3	43.7	45.5	47.3	49.3	49.8	50.3	49.8	47.9	45.8	47.8	40.3	37.8	35.3	34.1	42.5
	2	37.0	35.7	35.5	37.9	37.0	37.0	38.0	40.1	42.5	44.3	46.3	48.0	50.0	52.4	53.4	55.0	55.0	53.5	49.0	45.5	44.3	44.4	44.0	43.5	44.2
15	2	33.6	32.8	31.8	34.8	33.5	33.3	32.9	36.8	40.3	43.8	45.9	48.3	50.8	53.8	54.8	56.3	55.8	54.3	48.8	44.8	42.8	42.3	41.8	41.6	44.2
	2	41.5	40.9	40.1	39.3	39.3	39.5	40.0	40.6	42.8	44.1	47.1	50.5	52.3	54.5	54.4	51.7	51.5	53.0	53.4	53.2	53.0	49.0	48.5	48.2	47.0
16	2	39.9	38.8	38.8	38.3	38.1	38.3	39.6	40.8	43.8	45.8	48.3	51.6	53.7	55.3	54.6	51.8	51.6	51.8	52.4	53.0	53.3	49.3	48.1	47.8	46.8
	2	48.0	47.0	46.3	46.2	46.1	46.6	45.6	44.3	44.3	45.0	45.0	45.0	44.6	45.5	47.0	47.2	47.0	45.6	44.0	42.4	41.0	40.0	39.0	38.8	44.6
17	2	47.4	46.8	46.8	46.1	45.9	46.1	45.7	44.0	43.6	44.8	45.9	45.8	46.1	47.3	48.0	47.9	47.4	44.8	42.4	40.8	39.4	37.9	36.9	36.8	44.4
	2	39.0	36.5	34.0	32.0	30.0	31.8	31.5	34.0	39.0	41.0	42.5	42.3	43.3	45.0	45.5	45.0	44.2	42.8	41.0	39.0	37.2	36.1	35.1	34.4	38.4
18	2	36.4	33.3	30.3	29.8	28.8	28.8	27.9	32.8	39.0	42.8	44.8	44.8	45.7	47.3	47.8	48.0	45.8	45.3	42.3	40.8	39.3	37.8	36.8	36.8	38.8
	2	33.6	32.4	32.0	31.6	30.6	30.0	28.5	30.0	32.5	34.0	35.6	37.5	38.2	38.3	38.0	38.1	36.0	35.2	34.5	33.5	31.4	30.1	29.2	28.8	33.3
19	2	33.6	33.6	30.3	29.8	28.5	28.3	27.3	28.8	33.3	35.8	37.8	39.8	40.8	40.3	40.0	38.8	36.6	35.8	34.4	33.3	30.4	29.8	27.8	26.8	33.5
	2	25.3	28.0	27.0	26.1	25.7	25.0	24.3	25.0	26.5	28.2	30.0	31.6	33.5	36.5	37.8	39.8	39.3	38.5	38.0	34.4	33.0	33.0	32.8	32.1	31.4
20	2	27.8	27.8	26.8	26.1	25.8	25.3	24.8	26.3	28.8	30.8	32.8	34.3	36.0	39.3	40.3	41.7	41.8	39.8	36.3	33.0	31.6	31.5	31.5	32.1	31.4
	2	33.0	35.0	35.0	35.7	36.1	36.9	37.2	39.0	40.5	41.8	45.0	51.0	54.0	55.0	56.0	57.0	58.5	57.0	54.0	51.9	50.0	51.5	47.0	43.0	45.9
	2	32.5	34.1	34.5	35.2	36.0	36.5	37.0	39.5	41.3	42.5	45.5	54.0	55.5	55.5	55.6	57.5	58.5	57.0	50.0	43.8	43.5	48.5	45.5	41.0	45.0

21	24.5	38.5	36.5	34.5	33.0	31.5	30.1	29.8	30.0	31.0	32.5	34.0	36.6	39.0	41.0	42.5	44.4	45.5	46.0	42.5	41.5	41.0	41.0	40.1	40.2	37.6
	2	37.5	35.5	33.5	31.5	30.0	29.0	28.5	30.0	32.0	34.5	36.5	39.0	41.0	42.5	44.0	45.4	45.5	44.5	40.5	37.5	38.1	39.3	38.5	38.5	37.2
22	24.5	39.8	39.2	39.0	39.0	39.0	39.0	39.3	38.1	38.1	38.1	39.0	41.0	42.0	43.5	44.3	45.0	44.8	44.0	42.4	40.5	39.0	37.0	36.4	34.4	40.1
	2	38.1	38.0	37.6	37.7	37.5	37.9	38.5	37.8	38.5	39.0	39.8	42.5	44.0	45.2	45.7	46.0	45.4	43.5	41.0	38.7	37.1	33.6	33.0	31.7	30.5
23	24.5	33.0	31.8	31.0	30.2	30.0	30.0	30.1	33.0	36.5	40.5	44.0	47.5	49.0	51.6	54.0	56.0	56.0	55.6	53.5	50.0	46.0	42.1	40.3	40.0	42.2
	2	30.8	29.1	28.5	28.0	27.4	27.5	27.8	30.7	37.5	45.5	51.8	59.0	68.0	75.0	78.5	80.0	81.5	81.9	81.0	78.1	73.0	69.5	65.5	67.0	41.4
24	24.5	39.1	38.4	37.9	37.8	36.4	36.0	36.2	40.0	45.5	51.5	59.5	69.5	75.3	79.5	81.3	81.3	80.5	78.7	74.0	69.5	68.0	66.0	67.0	50.4	
	2	36.5	34.7	34.5	33.8	33.7	33.3	33.0	37.5	45.5	51.5	59.5	69.5	75.3	79.5	81.3	81.0	82.5	81.0	75.5	71.8	68.5	66.0	65.0	56.0	56.0
25	24.5	65.5	64.5	64.5	64.0	63.8	63.0	62.0	60.5	63.5	65.0	67.0	70.0	76.5	82.5	83.0	84.0	83.0	82.5	79.0	75.5	71.8	69.0	65.8	63.2	68.2
	2	57.5	58.5	60.0	61.0	61.5	60.5	59.5	55.5	59.5	64.5	73.5	79.0	81.5	82.5	83.0	84.0	82.5	79.5	71.5	65.5	63.0	63.0	62.5	58.5	67.6
26	24.5	61.8	59.0	57.0	56.0	55.0	54.2	54.0	54.0	56.0	60.0	64.0	70.0	76.5	80.0	83.0	84.0	83.0	79.0	77.0	74.2	74.0	73.8	72.5	71.0	67.6
	2	60.0	59.0	54.5	53.5	53.0	52.0	51.5	52.0	52.5	57.5	61.0	65.5	75.0	80.3	82.0	83.4	82.6	77.6	74.5	71.5	71.0	72.0	69.9	69.8	65.9
27	24.5	69.0	68.0	67.0	65.8	65.2	65.0	64.1	64.8	64.2	65.0	67.0	68.0	69.2	69.3	68.3	68.3	69.3	68.0	66.0	65.0	63.5	62.0	61.0	56.0	65.9
	2	67.4	66.4	65.3	64.5	63.3	63.5	63.4	63.5	63.8	63.5	65.5	67.0	67.9	70.5	69.3	67.5	68.7	67.4	66.5	63.5	62.5	61.4	59.5	65.5	65.5
28	24.5	51.0	49.0	48.1	48.1	48.0	46.3	46.8	46.0	46.0	46.0	45.7	46.0	47.0	48.5	49.0	49.8	50.0	49.2	48.2	48.0	47.0	45.9	45.0	48.6	
	2	54.0	50.8	49.3	49.0	48.5	47.5	47.4	47.4	46.7	46.5	46.5	46.6	47.8	49.5	50.5	50.5	50.5	49.5	48.9	48.3	47.8	46.5	45.5	48.5	
29	24.5	43.8	42.5	41.0	41.0	39.0	37.2	36.2	37.0	39.0	41.0	43.0	45.8	47.8	48.0	49.3	49.0	48.1	48.0	47.0	45.0	44.0	42.5	41.7	41.0	43.2
	2	44.0	42.5	41.2	39.5	38.5	37.4	37.3	37.4	38.8	41.8	43.8	46.0	49.8	51.8	52.3	52.3	50.6	48.8	48.0	45.8	44.6	42.9	41.0	40.8	44.1
30	24.5	40.5	40.2	40.8	41.5	41.9	42.0	42.1	42.9	43.4	45.0	45.3	46.0	47.0	48.1	50.1	52.0	56.0	57.5	56.0	54.5	55.8	57.0	55.2	54.0	48.1
	2	40.7	40.6	40.7	40.8	41.2	41.5	41.0	42.3	42.8	43.8	44.8	45.6	46.0	47.3	48.8	50.8	52.8	56.8	56.3	52.8	53.3	56.1	54.8	53.8	47.3
31	24.5	52.5	51.8	49.8	48.0	47.0	46.0	46.0	46.9	47.1	48.0	49.0	51.0	51.8	52.8	53.0	52.5	52.0	51.0	50.0	48.0	45.7	45.0	43.0	42.0	48.7
	2	52.3	51.3	50.3	48.3	46.6	46.3	46.3	47.3	47.5	48.4	50.3	52.3	54.3	53.8	55.5	54.5	54.3	52.3	50.3	47.3	43.3	42.8	42.1	40.3	49.1
Mean...	24.5	43.4	42.4	41.6	41.1	40.5	39.9	39.7	40.3	41.9	43.8	45.8	48.2	50.1	51.7	52.6	53.3	53.5	52.6	50.7	48.6	47.1	45.9	44.8	44.0	-----
	2	42.5	41.6	40.7	40.1	39.5	39.1	38.9	39.9	42.2	44.5	47.0	49.4	51.5	53.2	53.9	54.4	54.0	52.4	49.6	47.2	45.4	44.5	43.4	42.7	-----

TABLE 10. *Temperature at indicated levels, Arlington Experiment Farm, Va., 1939*—Continued

Date		Height of observations	Average for hour ending at																								Mean
			1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	12 p. m.	13 p. m.	12 p. m.	
Apr.	1	°F.	41.0	41.8	42.0	42.0	42.3	43.0	45.0	49.8	52.0	54.1	58.0	59.2	58.5	58.1	57.8	55.9	55.5	56.0	56.0	55.0	54.0	51.0	51.5	51.0	51.0
	2	°F.	39.8	39.3	40.0	39.3	40.3	41.3	43.3	45.3	48.8	52.8	58.8	61.3	60.4	59.3	58.3	55.9	55.5	56.1	56.1	55.3	54.0	52.3	50.8	50.4	50.8
3	1	°F.	50.0	49.9	49.8	49.1	48.0	47.0	46.0	46.5	47.0	48.5	49.0	51.0	53.0	55.0	56.0	56.0	55.5	54.5	53.2	52.1	51.2	51.0	50.8	49.8	50.0
	2	°F.	50.1	48.9	47.8	46.3	47.3	47.3	46.3	46.3	47.3	47.3	49.3	51.4	53.6	55.6	56.6	56.6	56.1	54.6	52.6	50.6	48.6	46.6	48.1	46.6	50.0
4	1	°F.	48.1	47.0	46.0	45.0	45.2	46.0	44.0	44.5	47.5	49.0	50.0	49.0	50.0	51.0	51.5	52.5	52.5	52.5	51.1	49.9	48.5	47.0	46.2	45.0	48.0
	2	°F.	43.2	42.8	41.3	39.6	42.6	42.1	42.6	45.6	48.6	50.6	51.4	51.6	51.8	52.1	52.8	53.1	52.8	51.6	49.4	46.8	46.1	45.8	46.0	46.2	48.0
5	1	°F.	41.9	38.6	36.2	41.0	42.5	42.0	41.0	40.0	41.0	42.0	42.5	43.0	45.0	46.0	47.0	48.0	47.5	47.0	46.0	44.2	43.0	41.5	40.4	41.5	43.0
	2	°F.	38.0	37.2	35.5	36.2	35.5	35.0	35.0	35.0	37.5	40.0	43.0	46.5	49.0	51.0	55.0	57.2	58.5	56.0	56.2	55.0	50.2	49.5	48.5	47.5	48.0
6	1	°F.	35.4	34.0	33.2	34.2	34.2	33.0	32.0	33.0	37.4	41.2	41.2	41.2	46.2	49.7	52.7	55.7	57.7	59.0	56.2	54.2	52.2	48.2	47.7	46.2	45.7
	2	°F.	48.2	48.2	48.2	48.2	48.5	49.0	49.0	49.5	50.0	50.5	51.0	51.5	52.0	53.0	53.0	54.5	57.0	57.0	54.5	51.0	53.0	52.0	49.5	47.0	45.0
7	1	°F.	46.7	47.2	47.2	47.2	47.5	47.2	47.0	40.0	40.0	40.0	41.5	43.0	43.0	45.0	47.5	47.5	47.8	47.2	45.0	44.2	43.0	41.5	40.5	39.2	39.0
	2	°F.	43.0	42.5	41.0	40.0	40.0	40.0	40.0	40.0	41.5	43.0	43.0	45.0	47.5	50.7	50.7	50.7	50.7	52.0	50.0	47.5	45.7	43.0	41.5	39.7	37.5
8	1	°F.	42.2	40.7	40.2	39.2	39.2	39.2	39.2	39.2	42.2	44.2	45.5	48.0	48.7	50.7	50.7	50.7	50.7	52.0	50.0	47.5	45.7	43.0	41.5	39.7	37.5
	2	°F.	39.0	38.5	38.0	38.0	38.0	38.0	38.0	38.0	38.5	38.5	41.5	44.7	46.5	47.5	49.7	50.5	49.0	50.5	50.0	48.0	45.0	43.2	42.0	41.5	40.2
9	1	°F.	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	41.5	44.7	46.5	47.5	49.7	50.5	49.0	50.5	50.0	48.0	45.0	43.2	42.0	41.5	40.2
	2	°F.	41.2	41.0	38.2	37.0	36.5	36.0	36.5	37.0	37.5	37.5	39.5	41.0	44.0	46.0	48.0	52.0	53.2	55.5	56.0	56.2	54.0	50.5	50.0	47.2	47.0
10	1	°F.	40.0	40.7	38.5	37.5	36.5	35.0	34.0	39.0	43.5	45.7	48.0	48.3	51.0	51.7	53.7	55.7	56.0	57.7	57.5	55.0	50.0	47.7	46.5	46.0	45.0
	2	°F.	47.0	46.5	41.0	46.2	47.2	48.0	48.5	50.2	54.0	58.0	62.0	67.0	69.5	72.5	73.7	79.7	81.0	82.0	79.5	74.3	72.0	70.4	68.7	68.7	68.5
11	1	°F.	65.5	65.5	65.5	66.0	66.5	66.5	66.5	66.5	67.5	67.5	69.5	69.5	72.5	74.7	79.7	80.0	82.0	82.0	79.5	74.3	72.0	70.4	68.7	68.7	68.5
	2	°F.	68.5	67.7	65.5	64.5	63.0	62.2	62.7	65.5	68.0	71.2	72.0	75.2	76.0	78.0	78.8	77.8	77.2	76.2	59.2	56.0	51.2	52.5	52.0	50.8	60.1
12	1	°F.	49.0	48.2	49.5	46.5	46.2	46.5	47.5	50.0	56.0	57.0	60.0	61.0	63.0	66.0	68.0	70.0	78.5	77.5	68.5	63.5	57.7	55.5	54.3	53.0	51.3
	2	°F.	49.5	49.0	48.5	47.5	47.5	47.0	48.3	50.5	54.5	57.0	54.0	53.5	54.0	54.0	52.0	51.0	50.5	47.0	44.0	41.0	39.0	37.0	38.0	35.5	36.0
13	1	°F.	36.0	35.0	31.0	31.0	33.5	31.5	37.0	39.0	41.0	45.0	45.0	47.0	48.0	49.5	51.0	55.0	53.0	52.5	51.0	49.5	48.0	46.5	45.0	43.5	43.7
	2	°F.	35.0	33.5	33.0	33.0	32.5	34.0	37.0	40.0	42.0	45.0	47.0	48.0	50.0	52.0	53.5	54.0	51.5	52.0	49.0	44.0	44.5	40.0	39.0	38.0	42.9
14	1	°F.	43.5	40.5	39.5	37.0	36.5	36.5	37.5	43.0	47.0	51.0	53.2	60.0	63.0	61.0	63.2	63.8	63.8	63.0	62.0	60.1	61.5	63.0	60.0	56.5	53.2
	2	°F.	37.0	36.0	36.0	33.5	33.0	32.5	35.0	43.0	49.0	56.2	60.2	63.2	65.8	66.0	61.0	61.2	62.2	63.5	63.2	61.0	59.0	59.0	62.0	59.5	57.0
15	1	°F.	57.1	59.2	58.8	59.8	59.8	60.0	59.8	61.0	62.0	65.5	69.8	71.8	71.0	70.0	68.0	66.0	62.8	60.5	58.5	57.5	57.5	57.0	56.0	54.0	61.8
	2	°F.	55.0	54.5	57.0	58.5	58.8	59.8	59.0	60.0	62.5	65.5	71.5	73.8	72.8	72.0	78.0	67.0	63.0	61.5	58.5	57.5	57.0	57.5	57.0	55.0	62.2
16	1	°F.	61.5	50.0	49.0	48.0	47.5	47.5	47.0	47.5	48.0	48.0	47.5	48.0	47.0	48.0	46.0	46.5	47.5	48.0	45.5	45.2	45.0	45.0	44.5	44.0	46.7
	2	°F.	52.0	55.0	39.5	48.0	47.5	46.8	47.5	47.5	48.0	48.0	48.0	47.5	48.0	47.0	46.0	45.5	45.5	45.5	46.0	46.5	46.0	45.0	45.0	44.5	47.3
17	1	°F.	44.0	44.0	41.0	43.5	43.5	43.5	44.0	44.5	44.5	45.0	45.5	46.0	46.0	46.5	47.5	48.0	48.0	48.0	48.0	48.0	48.5	48.5	48.5	48.5	46.1
	2	°F.	44.5	44.8	44.8	44.0	44.0	44.8	45.0	45.0	45.2	46.0	46.5	46.5	46.5	48.0	48.5	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.5	49.5
18	1	°F.	48.0	47.5	47.0	47.0	47.0	47.5	47.8	49.0	50.0	51.0	53.0	56.0	58.0	59.0	61.5	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	56.3
	2	°F.	48.5	48.0	48.0	47.5	47.5	48.0	48.5	49.5	51.0	53.0	54.0	58.5	62.0	65.0	68.0	69.0	69.0	72.0	72.0	68.0	63.0	61.0	65.0	60.0	57.7
19	1	°F.	59.0	50.0	58.0	57.8	57.0	59.0	56.0	57.0	58.0	59.0	61.5	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	56.8
	2	°F.	57.0	57.0	57.5	58.0	56.5	56.0	56.0	57.0	58.5	60.0	62.0	63.5	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	56.4
20	1	°F.	45.0	44.5	44.5	44.0	43.0	44.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	50.0	51.0	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0	60.0	54.0
	2	°F.	43.0	43.0	44.0	43.0	42.0	44.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0

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21	24.5	49.5	48.5	46.0	45.5	46.0	46.0	47.0	49.5	53.0	59.0	65.0	67.0	69.0	69.5	70.5	71.0	70.0	67.5	64.5	62.0	61.0	61.5	59.0	55.4	58.4
	2	49.5	47.5	45.0	43.0	44.0	44.0	42.5	48.5	52.5	58.0	65.0	68.0	69.5	71.0	72.0	72.0	71.0	68.5	65.0	62.0	60.0	60.0	61.0	60.0	58.1
22	21.5	54.0	51.5	55.0	54.0	53.0	52.0	53.0	54.5	57.0	58.0	59.0	59.5	61.0	61.5	62.0	62.0	62.0	62.0	61.0	59.0	57.0	53.0	49.5	56.7	50.7
	2	54.5	55.0	55.5	55.0	52.5	49.5	52.0	55.0	57.0	60.0	61.0	62.5	63.0	63.5	64.0	63.5	63.0	59.0	55.5	52.0	48.5	47.0	46.0	56.5	
23	21.5	46.5	45.0	43.5	43.0	42.5	42.0	45.0	52.0	60.0	65.0	67.0	69.0	71.0	73.5	74.0	74.5	75.5	75.5	73.0	70.0	68.0	62.0	61.0	60.6	
	2	45.0	44.0	43.0	42.0	41.0	41.0	45.5	55.0	61.5	66.0	68.5	69.0	70.0	72.0	73.0	75.0	75.0	71.0	65.0	59.5	58.0	56.5	54.5	58.7	
24	21.5	56.0	53.5	52.5	52.0	51.0	49.0	50.5	57.0	63.0	70.0	75.0	79.0	81.5	83.5	85.0	86.0	86.0	87.0	83.0	79.0	77.0	75.0	73.5	69.9	
	2	51.0	49.0	49.0	49.5	47.5	47.0	53.0	61.0	66.0	72.0	77.0	80.0	82.0	84.0	85.5	86.0	86.0	87.0	83.0	79.0	77.5	74.0	73.0	73.6	
25	24.5	67.5	65.0	61.0	59.0	58.0	58.0	60.0	65.0	71.0	74.0	79.5	82.5	85.5	87.5	87.0	86.0	85.0	82.0	79.0	77.5	74.0	74.0	75.5	71.0	
	2	59.0	58.0	56.0	55.0	53.5	53.0	59.0	67.0	71.0	74.5	79.5	82.0	86.0	88.0	87.0	86.0	85.0	82.0	79.0	77.5	74.0	74.0	75.5	73.6	
26	24.5	66.5	65.5	65.0	64.0	64.0	65.0	65.5	66.0	67.0	68.5	72.0	74.5	76.5	78.0	78.5	78.0	68.0	68.0	68.5	67.0	66.0	64.0	63.0	68.5	
	2	66.0	65.0	64.0	64.0	64.0	65.0	65.5	66.5	68.5	72.0	74.5	76.5	78.0	78.5	78.0	68.0	68.0	68.5	67.0	66.0	64.0	63.0	62.0	68.5	
27	21.5	62.0	62.0	61.0	60.0	60.0	60.0	60.0	60.5	62.0	64.5	67.0	70.0	73.5	77.0	78.0	78.5	69.5	68.5	68.0	68.0	67.0	65.5	64.0	63.0	
	2	62.0	62.0	61.0	60.0	60.0	60.0	60.5	62.0	64.5	67.0	70.0	73.5	77.0	78.0	78.5	69.5	68.5	68.0	68.0	67.0	65.5	64.0	63.0	68.5	
28	24.5	63.5	64.0	64.0	62.5	61.0	60.0	57.0	56.0	55.0	54.0	53.5	52.5	51.0	51.0	49.5	50.0	50.0	49.0	48.0	47.5	47.0	46.5	46.0	53.5	
	2	62.0	63.0	63.0	61.5	60.5	60.0	57.0	56.0	55.0	54.0	53.5	52.5	51.0	51.0	49.5	50.0	50.0	49.0	48.0	47.5	47.0	46.5	46.0	53.5	
29	24.5	46.0	46.0	46.0	46.0	46.0	46.0	44.5	44.0	44.0	43.5	43.5	43.5	45.0	45.5	46.5	47.0	48.5	50.0	50.0	48.0	47.0	46.5	46.0	46.1	
	2	46.0	46.0	45.5	44.5	45.0	45.0	44.0	44.0	43.5	43.0	43.0	42.5	45.0	45.5	46.5	47.5	49.0	49.0	48.0	47.0	47.0	46.5	46.0	46.1	
30	21.5	45.0	50.0	49.5	47.5	47.5	48.5	48.5	49.5	51.3	53.5	54.0	54.0	52.5	53.0	52.0	52.0	52.0	49.0	47.0	48.0	47.0	47.0	45.0	49.3	
	2	40.5	47.0	47.0	44.0	43.0	44.0	45.5	47.0	49.0	51.0	52.5	55.0	55.5	53.0	51.5	51.0	50.5	48.0	46.0	46.0	45.5	45.0	44.0	47.6	
Mean	24.5	49.9	49.4	48.5	48.0	47.7	47.6	48.0	50.1	52.4	54.8	56.7	58.1	59.1	60.0	60.4	60.7	60.5	59.4	57.5	55.7	54.5	53.2	52.2	50.9	
	2	48.4	48.0	47.4	46.8	46.5	46.3	47.3	50.1	52.8	55.4	57.8	59.5	60.6	61.2	61.8	61.1	60.7	59.3	56.3	53.8	52.5	51.5	50.8	49.5	



TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																								mean	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
		a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.		
May 1	Foot	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	
	24.5	43.0	42.5	42.0	42.0	42.0	42.0	43.0	45.0	47.0	50.0	52.0	54.0	55.0	57.0	58.0	59.0	59.5	59.5	58.5	55.0	53.5	51.0	46.5	44.5	50.0	
	2	41.5	40.0	40.0	38.5	40.0	40.0	42.0	44.5	45.5	50.0	52.5	54.0	55.0	58.0	58.0	59.0	58.5	58.5	58.5	55.0	53.5	51.0	45.0	44.0	48.4	
	2	44.0	44.0	43.0	41.0	41.0	41.0	43.0	47.0	48.5	49.0	50.0	57.0	58.5	60.0	60.0	60.0	58.0	58.0	58.0	57.0	55.0	54.0	51.0	54.0	51.0	53.3
	2	40.5	41.5	41.0	42.0	42.0	42.0	43.0	46.5	47.2	51.0	54.5	57.0	57.0	56.0	57.5	58.5	59.0	59.5	60.0	59.0	56.5	54.0	54.0	54.0	53.5	48.6
	2	61.0	49.5	48.5	48.0	47.5	48.0	48.0	49.5	51.0	52.0	53.5	54.0	56.0	57.5	58.5	59.5	59.0	59.5	60.0	60.0	59.0	56.5	54.0	54.0	53.5	53.7
	2	49.5	48.0	46.0	46.0	47.5	47.5	48.5	50.5	52.0	53.5	55.5	56.0	57.5	58.0	59.5	60.0	60.0	60.0	60.0	58.0	55.0	51.0	51.5	51.0	53.3	
	2	46.5	46.0	43.5	44.0	46.0	46.0	47.0	50.0	53.0	56.5	59.0	60.5	62.0	63.0	64.5	65.0	67.0	67.0	66.5	63.0	61.0	59.0	56.0	53.0	56.5	
	2	50.0	49.0	48.0	47.0	45.5	45.0	47.0	52.0	55.0	58.5	68.0	71.0	72.0	73.0	75.0	75.0	76.0	76.5	75.2	72.5	68.0	61.8	59.0	56.2	61.8	
	2	48.5	47.0	45.5	44.5	44.0	44.0	47.5	55.0	62.5	68.0	70.0	72.5	74.0	75.2	77.0	77.8	77.0	76.5	73.0	63.0	59.0	57.5	55.2	53.0	61.1	
	2	54.5	53.2	52.5	52.0	51.0	50.0	51.5	59.0	62.0	69.8	77.2	81.0	83.0	84.8	85.8	86.8	87.0	86.5	85.0	82.0	78.0	74.8	73.0	71.0	70.3	
	2	51.0	50.0	49.8	49.0	48.5	47.8	49.0	56.0	63.0	71.2	79.2	82.0	84.2	85.8	86.8	87.0	87.5	86.0	82.0	78.5	75.0	73.0	70.5	69.0	68.6	
	2	67.8	63.8	61.0	60.5	59.8	57.8	58.0	62.0	67.0	72.0	76.0	80.0	84.0	86.5	86.2	86.0	85.0	83.5	82.0	78.2	76.0	75.0	73.0	72.0	73.0	
	2	63.0	59.8	57.0	56.2	55.2	54.8	56.0	63.0	69.0	74.0	78.0	83.0	86.0	87.5	87.8	86.2	84.0	82.0	80.0	76.0	72.5	71.5	70.5	69.0	71.8	
	2	70.8	69.0	67.0	65.2	65.0	64.5	65.2	65.5	67.5	70.8	73.2	75.2	77.0	78.2	79.0	77.8	76.0	74.0	69.8	69.0	67.0	66.5	65.8	64.8	70.1	
	2	68.0	66.5	64.0	63.5	63.0	63.2	64.0	66.0	69.0	72.0	75.5	76.0	78.5	79.8	80.0	78.0	76.0	73.2	69.0	67.0	66.2	65.0	65.5	64.8	69.8	
	2	64.5	64.5	64.8	66.0	65.0	65.8	66.0	67.8	69.0	72.0	75.0	77.8	79.0	81.0	83.0	82.0	81.8	78.0	73.0	73.0	72.0	70.5	70.0	72.2	72.2	
	2	64.5	64.8	64.8	65.0	65.0	65.8	66.0	68.0	69.8	74.0	77.0	79.0	81.0	84.0	83.0	82.5	81.8	78.0	73.0	72.0	71.2	69.0	68.2	72.4	72.4	
	2	68.5	68.0	67.0	65.0	64.0	63.0	62.8	63.0	64.5	67.2	69.8	71.5	73.0	74.2	75.0	77.0	78.0	77.0	74.0	71.0	69.0	66.0	63.0	61.8	68.0	
	2	66.5	66.2	65.2	64.2	63.0	62.2	62.2	63.0	66.0	69.0	71.0	74.5	75.2	76.5	77.0	79.8	80.0	77.0	71.8	66.0	64.0	62.8	59.0	57.0	65.3	
	2	59.2	57.5	54.5	53.8	53.0	54.0	59.0	70.0	73.0	78.0	77.0	72.5	70.0	70.0	70.0	70.0	69.5	69.0	68.0	67.0	66.0	64.0	63.0	62.5	65.4	
	2	55.0	53.0	52.0	51.8	51.0	52.8	59.0	69.0	72.0	77.0	76.0	73.0	70.0	70.0	70.5	70.0	68.0	67.0	66.0	64.0	63.0	62.0	60.0	58.5	63.6	
	2	61.0	59.0	57.0	55.0	53.0	52.0	52.0	53.0	53.5	55.5	57.0	59.0	61.0	63.0	65.0	65.5	66.0	68.0	65.8	61.8	59.0	57.0	55.2	55.0	58.7	
	2	58.0	56.5	54.5	52.5	51.0	52.0	52.0	53.0	54.0	57.0	59.0	61.0	63.0	65.0	65.5	67.0	66.5	63.0	58.5	57.0	55.0	52.5	50.5	57.7	57.7	
	2	63.8	62.8	61.8	61.0	60.0	60.0	61.0	63.0	64.0	66.0	68.0	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	82.1	
	2	61.5	61.5	60.5	59.5	58.5	58.5	59.5	61.5	63.0	65.0	67.0	69.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	82.1	
	2	50.0	50.0	50.0	49.8	49.5	49.5	50.5	50.5	52.0	53.8	56.0	58.0	60.0	61.8	62.2	62.5	62.5	61.0	59.0	56.0	53.0	50.5	49.0	46.8	54.7	
	2	51.0	51.0	50.5	50.0	49.5	49.5	50.5	51.5	53.0	55.5	58.0	61.5	62.5	64.0	65.0	66.0	65.5	61.5	58.0	54.0	51.0	47.5	47.0	46.0	55.7	
	2	46.2	46.0	45.2	45.0	44.2	44.2	50.0	54.2	58.0	60.5	62.2	63.2	63.2	66.0	65.0	65.5	65.8	64.5	61.0	57.0	56.0	54.0	52.0	51.8	55.8	
	2	45.0	45.0	44.5	45.0	44.0	43.0	51.5	57.0	60.5	62.0	63.5	63.0	65.0	68.0	69.0	69.0	67.0	63.0	60.0	57.0	55.5	54.0	51.5	53.0	56.4	
	2	50.0	50.0	50.2	50.0	50.0	50.0	51.0	53.0	56.0	57.0	58.8	60.0	62.0	63.8	64.8	63.8	63.2	62.8	59.8	57.0	55.8	53.2	52.0	51.0	56.0	
	2	49.5	50.0	50.5	50.0	50.0	50.5	51.5	54.0	58.0	60.0	61.5	63.0	65.8	67.2	68.0	66.8	65.8	61.0	60.0	56.0	54.0	51.0	49.5	49.0	56.9	
	2	49.0	48.0	47.8	46.8	46.2	47.0	50.5	56.0	60.5	62.0	65.0	67.0	70.0	72.2	74.8	75.8	75.2	73.2	70.0	67.0	64.0	61.8	60.0	61.9	61.9	
	2	48.0	47.2	46.2	46.5	45.0	46.0	51.0	57.0	61.2	64.8	67.8	70.0	73.2	75.5	77.8	78.0	76.8	74.8	72.2	67.2	65.2	62.2	60.0	53.2	62.1	
	2	58.2	57.0	56.0	55.8	54.8	55.8	59.0	64.0	70.0	75.0	79.8	83.0	86.2	81.0	80.2	81.0	81.8	80.0	75.0	71.8	69.0	66.0	63.2	61.2	69.5	
	2	50.0	55.0	54.8	53.2	53.2	54.0	59.0	65.8	72.0	76.2	81.0	81.8	86.8	89.0	81.0	82.2	82.2	79.2	74.0	71.0	68.0	64.8	62.2	61.0	69.2	
	2	59.8	59.0	58.2	57.0	55.0	55.5	58.8	62.0	67.0	70.0	75.2	80.0	81.0	87.8	88.5	88.2	87.8	87.0	83.0	80.5	79.0	77.0	75.5	74.2	72.9	
	2	59.0	58.0	57.0	55.0	53.2	55.0	59.0	64.8	69.0	73.0	78.0	83.0	87.0	89.8	89.2	88.0	87.0	83.0	78.8	76.0	74.2	73.0	71.0	73.1	73.1	
	2	73.0	71.0	70.0	69.0	67.2	68.8	68.2	69.2	72.0	78.0	82.2	83.0	85.5	85.5	85.5	85.5	85.2	81.2	81.0	79.8	77.0	74.2	73.2	69.8	76.5	
	2	71.0	69.5	68.0	67.2	66.2	65.8	68.8	70.0	73.0	79.0	83.0	81.0	86.5	86.8	85.8	85.8	85.5	85.2	81.0	76.0	73.8	72.0	73.0	69.2	76.1	

21	24.5	69.0	68.2	69.5	63.0	64.0	65.0	68.0	72.2	75.0	78.0	81.0	83.5	84.8	83.8	81.0	85.5	85.8	83.2	80.2	76.0	73.5	70.5	71.5	70.0	75.0
	2	68.5	67.5	65.8	64.0	63.0	64.0	68.0	73.2	76.2	79.0	82.8	85.0	86.5	85.8	86.4	86.8	87.0	84.0	79.8	76.0	73.0	68.8	70.0	68.8	75.4
22	24.5	69.0	68.8	68.5	69.0	69.0	68.8	72.0	74.2	77.0	79.0	82.0	83.2	85.0	79.0	74.0	70.0	79.0	78.2	78.0	75.8	73.0	72.0	70.8	69.0	74.6
	2	67.5	67.0	67.5	67.8	67.8	68.0	73.0	75.0	78.8	82.0	84.0	86.0	86.8	79.0	74.0	76.8	79.5	79.0	77.0	74.0	72.0	70.8	69.0	67.8	74.6
23	24.5	68.0	67.0	66.2	66.0	65.8	66.0	69.0	73.8	77.0	81.5	83.0	85.0	87.5	88.0	87.5	86.5	86.5	85.2	83.0	80.5	79.0	77.0	75.8	76.0	77.5
	2	66.8	66.0	65.2	64.8	64.0	65.0	70.0	74.8	78.0	83.0	84.5	86.0	89.0	90.0	90.0	88.0	87.5	86.0	83.0	79.0	78.0	75.5	75.0	75.0	77.7
24	24.5	74.5	75.0	74.2	73.0	73.0	71.8	70.5	71.0	71.5	73.5	75.0	77.0	78.0	79.0	79.0	78.2	77.5	77.0	75.0	71.0	67.5	65.5	64.0	63.0	73.1
	2	73.0	73.0	72.0	71.0	71.5	71.5	71.0	72.0	73.0	74.0	76.5	78.5	80.5	82.0	82.5	81.5	80.5	78.0	76.0	71.5	63.0	60.0	64.0	62.0	73.7
25	24.5	62.2	61.0	60.5	61.5	62.0	62.0	63.0	64.5	67.0	69.5	72.0	74.5	77.0	78.0	78.5	78.5	76.5	76.0	73.0	70.5	68.2	68.5	67.5	66.5	69.1
	2	61.0	61.5	60.0	61.0	61.5	62.0	63.5	65.0	67.5	71.5	74.0	77.0	79.0	80.0	81.0	80.0	77.0	76.0	73.0	69.0	66.0	66.5	65.5	65.0	69.3
26	24.5	67.5	67.5	67.5	67.5	67.0	68.0	69.0	71.0	72.0	73.0	77.0	79.0	82.0	84.0	84.5	83.5	83.0	82.0	78.5	76.0	74.0	73.0	71.5	71.0	74.5
	2	66.0	66.0	66.0	66.0	66.0	67.0	69.0	72.0	73.0	74.0	78.0	81.0	84.0	86.8	87.5	85.0	84.0	82.5	78.0	75.0	73.0	72.0	71.0	70.0	74.7
27	24.5	69.5	68.0	67.0	66.5	67.0	67.5	69.0	71.5	74.0	79.0	83.5	86.5	88.5	89.0	89.5	89.0	87.0	85.0	82.5	82.0	81.0	79.5	79.0	78.5	78.3
	2	69.0	68.0	66.0	65.0	65.5	68.0	70.0	72.5	76.0	84.0	86.0	88.0	90.0	91.0	92.0	89.0	86.5	84.0	82.0	80.0	79.0	78.0	78.0	76.0	78.5
28	24.5	77.0	76.0	76.0	76.0	75.5	75.5	77.5	79.5	83.0	85.0	86.5	89.0	92.5	90.0	91.0	92.0	89.5	83.0	80.5	79.5	78.5	76.0	75.5	74.5	81.5
	2	74.5	74.5	74.5	74.5	74.0	75.5	78.0	80.5	84.0	86.5	88.0	90.0	90.5	91.5	92.5	93.0	89.5	83.5	80.0	78.5	77.0	74.5	73.5	72.5	81.3
29	24.5	73.5	71.5	71.0	70.0	70.0	70.5	72.5	75.0	78.5	83.5	86.5	88.5	87.5	88.5	88.0	89.5	86.5	85.0	82.5	79.5	78.0	74.5	72.0	70.5	78.9
	2	71.5	69.5	68.5	67.5	67.5	68.0	71.5	75.0	78.5	83.5	87.5	90.5	88.0	89.0	89.0	91.0	88.0	85.5	82.0	78.0	77.5	72.5	70.0	68.5	78.3
30	24.5	69.5	68.5	68.0	68.0	67.5	68.0	70.0	75.0	80.0	83.0	84.5	85.5	87.0	88.0	88.5	88.5	88.5	88.5	86.5	83.0	80.5	78.5	77.5	76.5	79.1
	2	67.5	66.5	66.0	65.5	65.5	66.0	69.5	76.0	81.5	84.5	86.5	87.5	89.0	89.0	89.0	90.0	89.0	89.0	86.5	85.0	78.0	76.0	75.0	74.0	78.6
31	24.5	76.5	75.0	74.0	73.0	70.0	69.5	72.5	78.5	83.5	85.0	86.5	87.5	90.0	92.0	93.0	93.0	92.5	90.5	88.0	82.5	78.0	76.0	75.0	73.5	81.8
	2	72.5	71.5	70.5	69.5	65.5	66.0	73.0	79.5	84.0	86.5	88.0	90.0	92.5	94.0	95.0	95.0	93.5	89.5	87.0	82.0	78.0	72.5	70.5	69.0	80.6
Mean...	24.5	61.4	60.3	59.4	58.9	58.4	58.4	58.5	62.9	65.9	68.8	71.7	73.5	75.2	75.2	76.1	76.4	76.6	76.3	75.3	73.1	70.5	68.5	66.4	64.9	63.6
	2	59.4	58.7	57.8	57.1	56.8	57.3	60.0	63.8	67.0	70.6	73.3	75.2	75.0	77.9	78.1	78.0	78.0	77.1	75.3	71.9	68.1	65.9	64.0	62.9	61.7

TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939—Continued

Date	Height of observation	Average for hour ending at—																								Mean
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
		a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	
June	1	21.5	72.0	70.5	70.5	70.0	69.0	69.5	71.5	75.0	78.5	82.0	84.0	84.5	84.0	85.0	86.0	84.5	81.5	79.5	76.5	71.5	69.5	67.5	66.0	75.2
	2	2	68.5	67.5	67.5	66.0	66.0	67.5	70.5	74.0	80.0	82.5	84.5	85.0	84.5	86.5	87.0	85.5	82.0	79.0	76.0	70.5	69.5	67.5	66.5	74.4
	3	2	65.5	65.0	64.5	64.5	64.0	63.5	64.0	64.0	64.0	62.5	63.0	63.5	63.5	64.0	64.5	64.5	65.5	67.0	67.0	67.0	66.5	65.5	65.0	64.7
	4	2	64.5	64.0	64.0	63.5	62.5	62.5	63.0	63.0	63.5	65.0	65.5	66.0	66.0	66.5	67.0	66.5	68.5	69.0	68.0	67.5	67.0	66.0	65.0	67.0
	5	2	64.0	63.5	63.0	63.0	62.5	62.0	62.0	62.5	63.5	65.0	67.0	71.0	73.0	75.0	75.0	74.5	73.0	72.0	71.0	70.0	69.5	69.0	68.5	73.3
	6	2	65.5	66.5	65.0	65.0	64.5	64.0	61.5	65.0	67.0	69.0	71.0	75.0	77.0	79.0	80.0	77.8	76.0	74.0	71.8	70.0	68.5	68.0	68.0	70.8
	7	2	67.0	66.5	66.0	65.5	65.5	66.0	67.0	69.0	72.0	74.0	74.5	75.0	74.5	74.0	75.0	78.0	81.0	81.0	79.5	77.5	72.0	69.5	69.5	73.3
	8	2	68.5	68.5	68.0	67.5	67.5	68.5	69.0	72.0	75.0	77.0	77.5	78.0	77.0	76.0	78.0	81.0	81.0	82.0	82.0	78.5	72.0	69.5	68.5	72.6
	9	2	67.5	65.5	65.0	65.0	61.0	61.0	65.0	67.0	70.0	73.0	75.5	77.0	79.0	80.0	81.0	82.0	82.0	82.0	78.5	74.0	71.5	67.2	65.8	71.9
	10	2	63.0	66.5	63.5	61.5	60.0	63.0	68.0	71.0	74.0	77.0	79.5	81.5	83.0	85.0	85.5	86.0	86.0	84.8	80.2	74.0	71.5	68.0	67.0	73.6
	11	2	67.5	65.8	63.0	62.5	60.5	64.8	71.8	77.0	80.0	82.0	83.5	85.0	86.5	87.8	89.0	89.8	89.8	89.0	85.0	79.0	74.0	71.5	68.0	73.6
	12	2	67.8	66.0	63.0	62.0	61.0	64.0	73.0	79.0	82.0	85.2	87.0	88.5	90.5	91.5	92.0	92.5	91.5	90.0	87.0	84.0	82.0	78.0	73.8	78.1
	13	2	71.2	68.5	66.2	65.8	64.0	63.2	64.8	67.0	69.0	71.0	73.2	74.0	76.5	77.2	77.8	78.0	78.0	77.8	75.0	72.5	70.0	68.5	64.8	79.5
	14	2	72.0	69.2	66.5	65.0	64.0	62.5	65.2	71.0	72.8	74.8	77.5	79.0	81.0	82.0	82.2	82.0	81.8	80.8	78.0	75.0	72.0	69.0	67.2	70.7
	15	2	63.2	62.2	62.0	62.0	63.0	66.0	68.8	71.2	75.0	80.0	85.2	87.8	87.8	84.0	86.0	87.0	89.0	89.0	86.5	80.0	75.0	70.0	68.5	72.8
	16	2	64.0	62.8	62.0	62.0	62.8	65.8	70.0	72.8	77.0	82.0	87.0	91.2	92.8	96.0	98.5	90.0	91.0	91.0	88.0	80.0	75.0	68.5	67.0	75.0
	17	2	72.5	73.0	72.0	71.5	72.0	72.5	73.0	75.0	77.0	79.0	80.5	82.5	83.0	83.5	84.0	85.5	86.0	86.5	85.5	80.0	75.0	70.0	68.5	78.5
	18	2	71.0	71.5	71.0	71.0	71.5	72.5	74.0	77.0	79.0	81.5	83.0	85.0	85.5	86.0	86.5	87.5	87.5	87.5	84.0	78.0	73.0	70.0	68.5	78.5
	19	2	75.0	73.5	73.0	72.0	71.5	71.0	71.5	75.5	77.0	79.0	82.0	84.0	85.0	86.0	88.0	88.5	90.5	90.5	88.0	80.0	75.0	70.0	68.5	79.0
	20	2	74.5	73.0	72.0	71.0	71.5	75.5	75.0	79.0	82.0	85.0	86.0	88.0	88.5	90.5	90.5	90.5	88.5	88.5	85.0	78.0	73.0	70.0	68.5	79.0
	21	2	74.0	73.0	72.0	71.0	71.5	75.5	75.0	79.0	82.0	85.0	86.0	88.0	88.5	90.5	90.5	90.5	88.5	88.5	85.0	78.0	73.0	70.0	68.5	79.0
	22	2	73.0	72.5	72.0	71.5	71.5	73.0	77.0	79.0	81.0	85.0	87.0	89.0	91.0	91.5	92.5	91.0	89.0	88.0	85.0	78.0	73.0	70.0	68.5	79.0
	23	2	73.0	73.0	71.0	69.0	67.0	67.0	71.5	75.0	75.5	76.0	77.0	79.0	81.0	83.0	83.0	82.0	81.0	80.0	80.0	78.0	75.0	72.0	71.5	78.1
	24	2	75.0	71.5	70.5	68.5	66.0	68.0	73.0	76.5	77.0	79.0	79.5	82.0	84.0	86.0	85.5	84.5	84.0	82.5	79.5	77.0	75.0	72.0	71.5	78.1
	25	2	68.0	67.0	66.5	66.0	66.0	70.0	74.5	76.5	77.0	78.0	75.0	75.5	80.0	83.5	82.5	83.0	81.0	74.0	68.5	65.0	63.5	68.5	68.5	73.0
	26	2	68.5	68.5	68.5	68.5	68.5	69.0	69.5	72.5	73.5	74.0	74.5	75.5	75.5	76.8	76.8	77.0	77.0	76.5	75.5	73.0	71.0	69.0	68.5	72.9
	27	2	68.0	68.0	68.0	68.0	68.0	68.5	69.5	73.0	75.0	76.0	77.0	77.8	77.8	79.0	80.0	80.8	81.0	80.8	80.0	77.8	75.5	74.0	73.0	73.2
	28	2	67.0	65.5	61.0	62.0	61.0	63.0	68.0	71.8	75.0	77.8	79.0	80.0	82.0	82.5	83.0	83.8	83.8	82.8	81.0	78.0	76.2	74.8	73.5	74.5
	29	2	73.8	73.2	72.0	71.0	71.8	72.5	76.0	78.2	82.5	86.5	89.0	91.0	92.0	93.0	93.8	94.0	93.0	92.0	91.0	90.0	87.0	85.0	84.0	82.8
	30	2	80.5	80.0	77.0	75.5	75.2	75.8	78.5	81.0	84.0	86.0	88.8	88.8	91.0	91.8	92.0	92.0	92.0	90.5	87.0	85.0	83.8	82.8	81.0	79.0
	31	2	80.5	80.0	77.0	75.5	75.2	75.8	78.5	81.0	84.0	86.0	88.8	88.8	91.0	91.8	92.0	92.0	92.0	90.5	87.0	85.0	83.8	82.8	81.0	79.0
	32	2	78.5	77.0	72.0	69.8	67.0	67.0	65.8	65.5	65.8	64.8	65.2	65.0	65.8	65.8	66.0	66.0	65.2	65.8	65.8	65.2	65.0	64.5	64.2	64.0
	33	2	64.0	64.0	63.0	62.0	62.0	63.0	62.0	62.5	63.8	65.0	66.5	68.0	69.8	71.5	72.0	72.0	72.0	71.8	71.0	69.5	68.0	69.0	69.0	67.2
	34	2	65.2	65.0	64.0	64.0	64.2	64.0	63.5	63.8	65.0	66.8	68.0	70.0	72.0	74.5	74.0	73.8	73.8	73.0	69.5	68.5	68.0	68.0	68.0	68.1
	35	2	69.0	69.0	69.0	69.0	69.5	70.5	72.0	74.5	76.0	78.0	80.5	82.0	84.5	86.0	87.0	88.0	88.0	86.5	83.0	82.0	81.0	79.0	76.5	77.8
	36	2	69.0	69.0	69.0	69.0	68.5	70.0	72.5	76.0	80.5	84.5	88.0	88.0	91.5	91.5	92.5	92.5	91.5	88.5	80.5	79.0	77.5	74.5	71.5	70.5

21	24.5	75.0	74.0	72.0	70.0	69.5	70.0	71.0	73.5	77.0	79.0	80.5	81.5	82.5	83.0	81.0	85.0	85.0	85.0	84.5	80.5	76.0	73.5	72.0	71.0	77.3
22	2	73.0	72.0	70.5	69.0	68.0	70.0	72.0	75.5	78.0	80.0	82.0	83.5	84.5	85.5	86.0	86.0	86.0	85.0	83.5	77.5	74.0	72.0	71.0	69.5	77.2
23	2	69.5	69.5	69.5	70.5	71.5	73.5	76.0	78.0	81.0	84.5	85.0	86.0	88.0	89.0	88.0	86.5	85.0								78.1
24	2	21.5																								79.5
25	2	21.5																								
26	2	21.5																								
27	2	21.5																								
28	2	21.5																								
29	2	21.5																								
30	2	21.5																								
Mean...	24.5	70.4	69.5	68.4	67.9	67.4	68.1	70.0	72.1	74.0	76.0	77.4	78.7	80.0	80.3	81.0	80.9	80.6	79.5	77.4	75.5	73.6	72.2	71.2	70.7	---
	4	70.0	69.2	68.0	67.3	66.9	68.2	71.0	73.5	75.8	78.2	79.6	81.0	82.2	82.7	83.2	82.9	82.0	80.5	77.4	74.8	72.9	71.7	70.7	70.1	---

TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939—Continued

[illegible]

	21	21.5	22	22.5	23	23.5	24	24.5	25	25.5	26	26.5	27	27.5	28	28.5	29	29.5	30	30.5	31	31.5	Mean	SD	
1	67.5	65.0	68.0	66.5	67.0	66.0	67.5	66.5	67.0	66.0	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0
2	68.0	65.5	68.5	66.0	67.5	66.5	67.0	66.0	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0	66.5	67.0
3	67.3	65.3	68.3	66.8	67.3	66.3	67.8	66.8	67.3	66.3	67.8	66.8	67.3	66.3	67.8	66.8	67.3	66.3	67.8	66.8	67.3	66.3	67.8	66.8	67.3
4	71.2	69.2	70.2	69.7	70.2	69.2	70.7	69.7	70.2	69.2	70.7	69.7	70.2	69.2	70.7	69.7	70.2	69.2	70.7	69.7	70.2	69.2	70.7	69.7	70.2
5	73.0	71.0	72.0	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0
6	78.3	76.3	77.3	76.8	77.3	76.3	77.8	76.8	77.3	76.3	77.8	76.8	77.3	76.3	77.8	76.8	77.3	76.3	77.8	76.8	77.3	76.3	77.8	76.8	77.3
7	79.3	77.3	78.3	77.8	78.3	77.3	78.8	77.8	78.3	77.3	78.8	77.8	78.3	77.3	78.8	77.8	78.3	77.3	78.8	77.8	78.3	77.3	78.8	77.8	78.3
8	79.8	77.8	78.8	78.3	78.8	77.8	79.3	78.3	78.8	77.8	79.3	78.3	78.8	77.8	79.3	78.3	78.8	77.8	79.3	78.3	78.8	77.8	79.3	78.3	78.8
9	80.5	78.5	79.5	79.0	79.5	78.5	80.0	79.0	79.5	78.5	80.0	79.0	79.5	78.5	80.0	79.0	79.5	78.5	80.0	79.0	79.5	78.5	80.0	79.0	79.5
10	77.4	75.4	76.4	75.9	76.4	75.4	76.9	75.9	76.4	75.4	76.9	75.9	76.4	75.4	76.9	75.9	76.4	75.4	76.9	75.9	76.4	75.4	76.9	75.9	76.4
11	79.1	77.1	78.1	77.6	78.1	77.1	78.6	77.6	78.1	77.1	78.6	77.6	78.1	77.1	78.6	77.6	78.1	77.1	78.6	77.6	78.1	77.1	78.6	77.6	78.1
12	79.5	77.5	78.5	78.0	78.5	77.5	79.0	78.0	78.5	77.5	79.0	78.0	78.5	77.5	79.0	78.0	78.5	77.5	79.0	78.0	78.5	77.5	79.0	78.0	78.5
13	77.0	75.0	76.0	75.5	76.0	75.0	76.5	75.5	76.0	75.0	76.5	75.5	76.0	75.0	76.5	75.5	76.0	75.0	76.5	75.5	76.0	75.0	76.5	75.5	76.0
14	73.0	71.0	72.0	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0	71.0	72.5	71.5	72.0
15	73.1	71.1	72.1	71.6	72.1	71.1	72.6	71.6	72.1	71.1	72.6	71.6	72.1	71.1	72.6	71.6	72.1	71.1	72.6	71.6	72.1	71.1	72.6	71.6	72.1
16	76.5	74.5	75.5	75.0	75.5	74.5	76.0	75.0	75.5	74.5	76.0	75.0	75.5	74.5	76.0	75.0	75.5	74.5	76.0	75.0	75.5	74.5	76.0	75.0	75.5
17	77.0	75.0	76.0	75.5	76.0	75.0	76.5	75.5																	

TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																								mean
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	12	13	12	
		a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	
Aug.	<i>Feet</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	
	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	
1	24.5	75.5	75.0	74.0	73.0	71.5	69.0	72.0	77.0	81.0	83.0	85.0	86.0	87.0	88.5	89.0	89.5	89.5	89.0	87.0	84.0	82.5	81.0	80.0	80.5	81.2
2	24.5	74.5	73.5	72.5	70.5	71.0	68.5	72.0	77.0	82.5	84.5	86.5	88.0	89.0	90.0	91.0	91.0	90.5	89.5	87.5	83.5	81.5	79.5	78.5	79.5	81.3
3	24.5	80.0	79.0	78.0	76.0	74.5	76.0	77.0	79.0	81.0	83.0	85.5	87.0	89.5	89.5	90.0	90.0	89.5	87.5	86.5	83.5	81.0	79.0	78.0	77.0	82.4
4	24.5	79.0	79.0	77.5	75.5	73.0	75.0	77.0	79.5	82.5	83.5	87.5	90.5	92.0	92.0	91.5	91.0	91.0	87.0	86.0	82.5	80.0	78.0	77.0	76.0	82.6
5	24.5	75.5	74.0	73.5	72.5	72.0	72.0	74.5	77.0	82.0	84.0	87.5	89.0	90.0	90.5	90.5	90.5	89.5	87.0	82.5	78.0	72.5	72.0	72.5	72.0	80.0
6	24.5	75.0	73.0	72.5	71.5	71.0	71.0	75.0	79.0	84.0	87.0	89.5	91.5	92.5	93.0	93.0	93.0	91.0	86.0	82.5	77.0	73.0	72.5	72.0	72.0	80.7
7	24.5	71.0	70.5	70.5	71.0	71.5	71.5	72.0	72.5	73.0	76.5	79.0	82.0	83.5	84.5	84.5	85.0	86.5	85.5	83.0	80.5	78.0	77.0	73.0	73.5	77.4
8	24.5	71.0	70.0	70.0	71.0	71.5	71.5	72.0	72.5	74.5	76.5	80.0	85.0	86.0	87.5	87.5	88.5	86.5	82.5	79.5	77.5	75.5	74.0	73.0	73.0	78.4
9	24.5	73.0	73.0	72.5	71.0	70.0	69.5	69.0	71.5	74.5	79.5	82.0	83.0	84.5	85.0	85.5	84.5	84.5	82.0	77.0	74.5	71.5	70.5	70.0	70.0	76.8
10	24.5	72.5	72.5	71.5	70.0	69.0	68.5	69.5	72.0	76.0	80.0	84.0	85.5	87.0	87.5	88.5	85.5	85.0	82.0	74.5	72.0	70.0	69.0	68.5	70.0	76.8
11	24.5	69.5	69.0	68.0	67.5	67.0	68.0	70.0	71.0	75.0	79.5	82.0	84.0	85.0	84.0	85.0	85.0	84.0	83.0	81.5	78.5	75.5	74.5	73.0	71.5	76.3
12	24.5	68.0	67.5	66.5	66.0	66.0	67.5	70.0	71.5	76.0	81.5	84.5	86.5	88.0	87.5	88.0	87.0	86.0	84.0	81.5	76.5	73.5	73.0	70.0	70.0	76.5
13	24.5	70.5	69.0	68.5	67.0	66.5	66.5	70.0	74.0	79.0	83.0	84.5	85.5	87.0	87.0	87.0	87.0	86.0	85.0	82.0	80.0	79.0	77.5	76.0	78.1	
14	24.5	69.5	69.0	68.0	66.0	65.0	65.0	69.5	75.0	80.0	86.0	88.0	89.0	90.5	90.0	89.0	89.0	87.5	84.5	81.5	78.5	78.0	77.0	75.5	76.0	78.7
15	24.5	70.5	69.0	68.5	67.0	66.5	66.5	70.0	74.0	79.0	83.0	84.5	85.5	87.0	87.0	87.0	87.0	86.0	85.0	82.0	80.0	79.0	77.5	76.0	78.1	
16	24.5	76.0	76.5	75.5	75.0	73.5	74.0	75.0	76.0	83.0	83.5	85.0	86.0	87.0	88.0	88.5	89.0	89.5	88.5	85.0	82.0	80.0	79.0	78.0	77.5	81.4
17	24.5	76.0	76.0	75.0	74.0	72.5	73.5	75.0	79.5	84.0	85.0	87.0	88.5	89.0	89.5	90.5	90.5	91.0	89.0	84.5	80.5	78.5	77.0	76.0	76.0	81.6
18	24.5	76.5	77.0	76.0	76.0	75.0	74.5	76.5	80.0	83.5	87.0	89.5	93.0	93.5	94.0	94.0	93.5	93.5	93.0	90.0	84.5	78.5	78.5	79.0	79.0	84.0
19	24.5	75.0	75.0	75.0	74.0	73.0	73.0	77.0	81.0	85.0	89.0	92.0	95.0	96.0	97.0	96.5	95.0	94.5	92.5	89.0	82.2	78.2	78.2	77.5	78.0	84.2
20	24.5	78.0	78.0	77.5	76.0	74.5	73.0	74.0	75.0	77.0	78.0	79.0	81.0	83.0	85.0	86.0	86.5	87.0	87.0	84.5	81.5	79.5	79.0	77.5	76.0	79.7
21	24.5	77.0	77.0	76.0	74.5	72.0	71.5	75.0	77.0	79.0	81.0	83.0	85.0	87.0	89.0	88.5	88.0	88.0	86.5	80.5	76.5	77.0	77.0	76.0	74.5	79.8
22	24.5	74.5	74.0	73.0	72.5	70.5	70.0	73.0	77.0	79.0	81.5	83.5	85.5	87.5	89.0	89.5	90.0	89.0	87.5	84.5	81.0	78.0	75.0	74.5	74.0	80.0
23	24.5	73.0	72.5	71.0	71.0	71.0	70.5	73.0	77.0	79.0	82.0	85.0	86.0	87.5	88.0	89.0	88.5	87.5	87.0	85.0	82.0	80.0	79.0	77.5	76.5	86.6
24	24.5	71.0	70.5	69.5	69.0	68.5	68.5	73.0	78.5	81.0	85.0	88.0	90.0	92.0	92.0	92.0	91.0	90.5	88.5	84.5	81.0	79.0	78.0	77.0	75.5	80.6
25	24.5	75.0	74.5	73.0	72.5	71.5	71.5	73.5	77.5	81.0	84.0	87.0	87.5	88.5	89.0	88.5	88.5	88.5	86.5	84.0	83.5	82.5	81.0	79.5	81.5	
26	24.5	74.5	73.5	72.0	71.0	70.5	70.5	75.0	80.5	84.5	88.0	91.0	92.0	93.0	92.5	93.0	92.0	91.5	90.5	86.5	84.0	83.5	83.0	81.0	80.0	83.1
27	24.5	78.5	77.5	77.5	76.5	75.5	74.5	75.0	76.0	77.5	80.5	82.5	84.0	85.0	85.5	85.5	84.5	83.5	82.0	81.0	79.0	78.0	77.0	75.5	75.0	
28	24.5	77.5	76.5	77.0	76.5	75.0	73.5	75.0	77.0	78.5	82.0	84.0	87.0	89.0	89.1	88.5	85.5	83.5	82.5	81.0	79.0	77.5	76.5	75.0	74.0	80.0
29	24.5	74.0	73.5	73.5	74.0	74.0	74.0	73.5	74.5	76.5	79.5	82.0	85.5	87.5	89.0	90.0	91.0	90.0	89.0	85.5	82.5	80.0	78.5	77.5	80.5	
30	24.5	73.0	72.5	73.0	74.0	74.0	74.0	74.0	76.0	79.0	82.0	86.0	90.5	91.5	93.0	94.0	94.0	92.0	89.5	84.5	81.0	79.0	77.0	76.5	76.0	81.5
31	24.5	76.5	76.0	75.5	75.5	75.5	76.0	76.5	77.0	77.5	83.5	85.0	87.0	90.5	93.0	93.5	93.0	87.0	83.0	80.0	79.0	79.0	79.0	77.0	75.0	81.3
32	24.5	75.5	75.0	74.5	74.5	75.5	76.0	76.5	78.0	80.0	85.5	86.0	90.5	93.0	95.5	96.0	93.5	86.5	82.5	79.5	79.0	79.5	79.0	77.0	74.5	81.8
33	24.5	73.5	73.0	72.0	71.5	71.0	71.5	74.5	77.5	81.0	85.0	87.0	89.0	90.5	91.5	90.5	88.5	90.0	89.0	86.5	83.0	81.0	79.5	78.0	76.5	81.3
34	24.5	72.5	72.0	72.0	71.0	70.5	71.0	75.0	78.5	82.5	87.0	90.0	92.5	93.5	94.5	92.5	86.5	90.5	90.0	86.0	82.0	80.5	79.0	77.0	75.0	81.7
35	24.5	76.0	76.0	75.0	74.0	74.0	74.5	76.0	79.5	81.5	83.0	84.0	84.5	84.5	84.5	84.0	83.0	82.5	81.5	81.0	79.5	78.0	77.5	76.5	79.5	
36	24.5	75.0	75.0	73.5	72.5	72.0	72.5	75.0	80.0	83.5	84.5	87.0	86.5	86.0	86.0	85.0	84.0	83.0	81.0	80.5	79.0	77.5	77.5	77.0	75.5	79.5
37	24.5	76.5	75.5	75.0	75.0	74.5	74.5	75.0	75.5	75.5	75.5	76.5	78.0	79.0	80.0	80.0	80.5	81.5	81.0	77.0	73.5	72.5	71.5	71.0	70.5	76.0
38	24.5	75.5	74.5	74.0	74.0	74.0	74.0	74.5	75.0	75.5	76.0	77.5	79.5	81.0	81.0	80.5	80.5	82.5	80.5	76.0	72.5	72.0	71.0	70.5	70.0	75.9
39	24.5	76.0	69.0	68.0	67.5	67.0	67.0	69.5	73.0	77.0	80.0	83.0	85.0	87.0	89.5	90.0	90.5	89.5	87.0	85.0	81.5	78.0	76.0	74.5	74.5	78.3
40	24.5	69.0	67.5	67.0	66.5	66.5	66.5	70.0	74.0	78.5	82.5	86.0	88.0	90.5	92.5	91.0	92.0	89.5	86.0	84.0	80.5	77.0	75.5	74.5	74.0	78.7

21	24.5	74.0	74.5	74.0	73.5	73.5	73.0	74.0	75.5	78.0	80.5	83.0	85.0	86.5	87.5	87.5	87.0	86.5	86.0	83.0	80.0	77.5	76.0	75.5	75.0	79.4
	2	73.5	74.0	73.5	72.5	72.5	72.5	73.5	76.0	79.0	80.5	84.5	86.0	87.5	89.0	88.5	88.5	87.5	85.5	81.5	78.0	76.5	75.0	74.5	74.0	79.3
22	24.5	74.5	74.5	75.5	75.0	73.0	72.0	73.0	74.0	75.0	77.0	78.0	79.0	81.0	82.0	82.5	82.5	83.0	80.5	80.5	75.0	73.0	71.0	69.5	68.5	76.3
	2	73.5	74.5	75.0	74.0	72.5	72.0	73.5	75.0	76.5	79.0	80.5	82.5	84.0	84.5	84.5	84.0	84.5	84.5	78.5	73.0	70.5	69.5	68.5	68.0	76.7
23	24.5	68.5	68.5	68.0	67.5	67.5	67.5	69.5	72.5	76.5	80.0	82.5	83.5	84.5	86.0	85.5	85.5	84.5	83.0	81.0	79.0	77.5	77.0	76.0	75.0	76.9
	2	67.5	67.5	67.0	67.0	66.5	66.5	69.5	73.5	78.0	82.5	85.0	85.5	87.5	88.5	87.5	87.0	85.0	82.5	80.5	78.5	77.5	76.5	75.0	74.5	77.4
24	24.5	74.5	74.0	73.0	72.5	72.5	72.5	73.5	76.0	79.0	83.0	84.2	85.0	88.0	88.0	89.0	88.5	88.0	87.0	82.0	78.5	76.0	74.0	73.5	73.0	79.4
	2	74.0	72.5	72.0	71.5	71.5	72.5	75.0	78.5	82.0	86.5	87.5	88.5	90.0	90.5	89.5	88.0	85.5	82.5	79.5	77.5	74.5	73.5	73.0	72.5	79.8
25	24.5	72.0	72.0	71.5	71.0	71.5	72.0	72.0	72.0	73.0	74.0	75.5	77.5	79.0	77.0	78.0	79.0	78.0	78.0	77.0	76.0	75.0	74.0	73.5	72.5	74.3
	2	72.5	72.5	71.5	70.5	71.5	72.0	72.5	73.0	74.0	75.5	77.5	79.5	79.5	79.5	79.5	78.5	77.0	76.0	74.5	73.5	73.0	72.0	70.5	70.5	73.9
26	24.5	71.5	71.0	71.0	71.0	72.0	71.0	70.5	71.5	73.0	74.0	74.0	75.5	79.0	79.0	79.0	79.5	80.0	79.5	77.0	72.5	72.0	72.0	72.0	72.0	74.1
	2	70.0	70.0	70.0	70.5	71.0	70.0	70.5	72.5	74.0	74.5	75.0	77.0	80.0	80.0	80.5	80.5	80.0	79.5	76.5	72.0	71.5	71.5	71.0	71.0	74.1
27	24.5	71.0	71.0	71.0	71.0	71.0	71.0	71.0	72.0	72.5	73.5	76.0	78.0	79.0	80.0	80.0	79.5	79.0	78.0	77.0	75.5	75.0	74.5	73.0	72.5	74.7
	2	70.5	70.5	70.0	69.5	69.5	69.5	70.0	72.0	74.0	74.5	76.5	78.5	80.5	80.5	80.0	80.5	78.5	77.0	75.5	74.5	74.5	73.0	72.0	71.0	74.3
28	24.5	72.0	71.0	70.0	70.5	70.0	69.5	70.5	73.5	75.5	77.5	77.5	78.5	80.5	80.5	80.0	80.5	78.5	77.0	75.5	74.5	74.5	73.0	72.0	71.0	74.3
	2	70.5	69.5	69.5	70.0	69.0	69.5	70.0	72.0	74.0	76.0	77.0	77.5	77.5	77.0	76.0	75.0	74.5	74.0	72.5	71.5	70.5	70.5	70.0	69.0	72.8
29	24.5	68.0	68.0	68.5	68.0	68.0	68.0	68.0	69.0	71.0	72.0	74.5	75.5	77.0	77.0	77.0	77.0	72.0	68.0	66.5	65.5	66.0	66.0	67.0	68.0	69.8
	2	67.5	68.0	68.0	67.5	67.5	67.5	68.0	69.5	71.0	74.5	76.0	77.0	77.0	77.0	76.0	75.0	74.5	73.5	72.5	71.5	70.5	69.5	69.0	68.5	72.5
30	24.5	68.0	67.5	67.0	68.0	68.0	68.0	69.0	69.5	71.0	75.5	77.5	79.5	81.5	82.0	82.0	78.0	76.0	67.0	65.0	65.0	65.5	65.5	65.0	67.0	69.6
	2	67.5	67.0	67.0	67.5	67.5	67.5	68.5	70.0	72.0	77.0	78.0	81.0	82.0	82.5	81.5	79.0	76.5	75.0	72.5	72.0	71.5	71.5	71.0	71.0	73.0
31	24.5	71.0	69.0	68.5	69.0	68.5	69.0	69.5	71.0	75.0	77.0	78.0	79.0	80.0	81.0	81.5	82.0	81.0	81.0	76.5	72.5	71.0	70.5	69.5	69.5	73.0
	2	70.0	69.0	68.0	68.5	68.0	68.0	69.0	73.0	77.0	79.0	80.0	81.5	84.0	84.5	84.5	84.5	83.0	78.0	74.0	71.0	69.0	67.0	66.5	66.0	74.4
Mean...	24.5	73.5	73.0	72.5	72.0	71.5	71.3	72.4	74.7	77.2	79.8	81.8	80.9	82.3	85.5	85.7	85.4	84.8	83.7	81.2	78.8	76.6	75.5	74.6	74.0	79.4
	2	72.6	72.1	71.6	71.0	70.5	70.6	72.7	75.8	78.7	81.7	84.0	86.3	87.6	87.8	87.9	86.9	85.7	83.6	80.4	77.2	75.6	74.0	73.7	73.0	79.4



TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939—Continued

Date	Light in observatory	Average for hour ending at—												Mean
		1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 p.m.	
Sept. 1	24.5	65.0	65.0	67.0	66.0	66.0	67.0	68.5	71.5	74.0	77.5	81.0	83.0	74.5
2	21.5	62.0	62.0	65.0	64.0	64.0	65.0	66.5	69.5	73.0	77.0	80.0	82.5	74.5
3	24.5	67.5	67.5	67.0	68.5	68.5	69.0	69.5	70.5	71.0	72.0	73.0	74.0	73.8
4	24.5	71.0	70.5	69.5	69.5	70.0	70.0	71.0	71.0	71.5	72.0	73.0	74.0	74.4
5	24.5	67.5	67.0	66.5	66.5	66.5	67.0	67.0	68.0	68.5	69.0	69.5	70.0	69.8
6	24.5	65.0	65.0	65.0	65.0	65.0	65.0	65.5	66.0	66.5	67.0	67.5	68.0	67.2
7	24.5	63.0	63.0	64.0	64.0	64.0	64.0	64.5	65.0	65.5	66.0	66.5	67.0	65.9
8	24.5	61.0	61.0	62.5	62.5	62.5	63.0	63.0	63.5	64.0	64.5	65.0	65.5	64.7
9	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
10	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
11	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
12	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
13	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
14	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
15	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
16	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
17	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
18	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
19	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9
20	24.5	61.0	61.0	62.0	62.0	62.0	62.0	62.5	63.0	63.5	64.0	64.5	65.0	63.9

21	24.5	65.5	65.0	61.5	63.0	63.0	62.0		65.5	68.5	70.5	72.0	73.0	71.5	71.0	71.5	71.0	72.5	69.0	65.5	61.0	63.0	62.0	61.0	67.5
	2	65.0	61.0	64.5	63.5	63.0	62.0			71.0	72.5	71.0	75.0	75.5	75.5	75.5	74.5	73.0	68.5	64.0	63.0	62.0	61.0	60.5	67.7
22	24.5	60.0	59.5	59.5	59.0	58.5	58.5	59.0	60.0	63.0	67.0	70.5	71.0	72.5	71.0	72.0	72.0	70.0	61.0	61.0	60.0	59.0	57.5	56.5	63.0
	2	59.0	58.5	58.0	58.0	57.0	58.0	57.0	58.5	61.5	66.0	72.5	73.5	71.5	73.5	71.0	73.5	73.0	69.5	62.0	59.0	57.0	56.5	54.0	63.3
23	24.5	55.5	55.0	53.5	53.0	53.0	53.0	51.5	59.0	61.0	69.0	72.5	75.0	78.0	79.5	80.0	80.0	79.0	75.0	71.0	69.5	68.0	67.0	65.0	66.4
	2	53.5	53.0	52.0	51.5	51.0	51.5	52.5	58.0	61.5	69.5	74.0	77.0	79.5	81.0	82.0	81.5	80.0	74.0	68.0	67.0	65.5	64.0	62.0	65.5
24	24.5	61.0	60.0	58.5	57.5	56.5	56.0	56.5	61.5	67.0	72.5	75.0	78.0	81.0	83.0	83.0	81.5	77.0	73.0	70.0	68.5	67.0	65.0	61.0	68.2
	2	59.0	57.5	56.0	55.5	54.5	53.5	51.0	69.5	67.0	73.5	77.0	80.0	83.0	85.0	86.0	83.5	78.5	72.5	69.0	66.0	65.0	63.0	61.0	67.5
25	24.5	63.0	61.0	60.0	59.0	58.5	59.0	60.0	61.0	68.0	72.0	75.0	77.0	79.5	81.0	82.0	81.0	80.0	77.0	74.0	72.0	71.0	70.0	69.5	70.1
	2	60.0	59.0	58.0	57.0	56.5	56.0	57.5	62.5	68.0	73.0	77.0	79.0	82.0	83.5	81.5	83.0	81.0	76.0	71.0	69.0	68.5	67.5	67.0	69.3
26	24.5	68.0	66.5	66.0	65.0	65.0	61.5	63.5	66.0		75.0	79.0	83.0	85.0	85.0	82.5	83.5	82.0	77.5	73.0	73.5	72.0	70.5	69.0	73.2
	2	66.0	64.0	63.5	62.5	62.5	61.0				77.5	81.5	85.0	88.0	86.5	83.0	83.5	81.0	76.5	71.0	72.5	71.0	69.0	67.5	73.0
27	24.5	67.0	65.5	63.5	61.5	62.0	60.5	60.0	60.5	61.0	61.5	63.5	63.0	61.5	65.5	67.0	67.0	66.5	66.0	65.5	65.0	65.0	61.5	63.5	63.9
	2	66.0	64.5	62.0	61.0	61.0	60.5	60.0	60.5	61.5	62.0	61.0	63.5	65.5	69.5	67.5	67.0	66.0	65.5	65.0	64.5	61.5	63.5	63.5	63.8
28	24.5	63.0	62.0	61.5	61.5	61.0	60.5	61.0	61.5	62.0	63.0	63.5	64.5	67.5	71.0	73.5	73.5	71.0	70.5	67.5	66.5	65.5	65.0	66.0	65.3
	2	63.0	62.0	61.5	65.0	61.0	60.5	61.0	61.5	62.5	61.0	61.5	66.5	69.0	72.5	71.5	73.5	70.5	68.5	67.0	65.5	64.0	63.5	65.0	65.5
29	24.5	66.0	66.0	66.5	67.0	67.5	68.5	69.0	69.5	71.0	71.5	72.5	73.0	74.0	75.0	76.5	77.5	77.0	76.0	75.0	73.5	73.0	72.5	72.5	71.8
	2	66.0	66.5	66.5	67.0	67.5	68.5	69.0	69.5	70.5	72.0	72.5	73.0	74.0	75.0	78.0	79.0	77.5	75.0	73.5	72.0	71.5	72.0	71.5	72.5
30	24.5	71.5	71.5	71.5	71.5	72.0	72.5	73.0	74.0	76.0	78.0	81.0				89.0	88.0	86.0	77.5	72.0	72.5	72.5	73.0	73.0	75.7
	2	73.0	71.5	71.0	71.0	71.0	71.5	72.0	73.0	71.5	76.0	78.0	81.0			86.0			85.0	82.0	71.0	68.0	68.0	68.0	73.5
Mean	24.5	66.1	65.4	64.6	64.0	63.7	63.5	64.2	66.3	67.0	72.4	71.7	76.2	77.9	78.8	76.2	70.4	78.5	76.5	73.0	70.9	69.8	68.8	67.8	67.1
	2	64.7	63.9	63.2	62.9	62.5	62.6	63.3	66.0	69.2	73.0	75.6	77.5	78.9	79.7	79.5	78.9	78.1	75.0	71.0	68.8	67.5	66.7	65.9	65.5



19	24.5	42.5	41.0	41.0	42.0	42.0	42.0	41.0	45.0	-----	58.5	57.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	63.0	61.0	61.5	62.0	61.0	60.5	56.3
20	2	40.5	39.5	39.5	40.0	40.5	41.0	40.0	45.5	58.5	60.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	62.0	58.0	56.5	58.5	59.0	58.0	58.5	55.2
	2	60.5	60.0	60.5	60.0	60.0	60.0	60.0	60.0	60.5	60.5	60.0	60.5	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.5	60.5	60.0	60.0	60.5	61.2
21	2	58.0	54.5	52.5	51.0	50.0	49.5	50.0	55.5	58.5	60.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	62.0	58.0	56.5	58.5	59.0	58.0	58.5	62.2
	2	55.5	54.5	53.5	53.0	53.0	52.5	52.5	55.0	58.0	60.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	62.0	58.0	56.5	58.5	59.0	58.0	58.5	60.3
22	2	52.5	51.0	51.0	50.0	50.0	50.5	50.5	53.5	56.0	60.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	62.0	58.0	56.5	58.5	59.0	58.0	58.5	60.3
	2	65.0	62.0	58.5	57.0	56.0	55.5	55.0	55.0	55.0	60.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	62.0	58.0	56.5	58.5	59.0	58.0	58.5	61.5
23	2	60.5	58.0	55.0	53.5	53.0	52.5	51.5	51.0	50.5	60.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	62.0	58.0	56.5	58.5	59.0	58.0	58.5	63.4
	2	55.0	54.0	53.0	51.5	51.0	51.0	50.5	51.0	50.5	60.5	61.0	65.0	69.0	71.0	71.5	71.0	67.5	62.0	58.0	56.5	58.5	59.0	58.0	58.5	60.7
24	2	52.5	51.5	50.5	50.0	49.5	49.0	48.5	50.0	50.0	49.5	51.0	53.0	55.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	54.2
	2	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	53.4
25	2	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	52.0
	2	48.0	48.0	49.0	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	51.3
26	2	46.5	47.0	48.0	48.0	48.5	49.0	49.5	50.0	50.5	50.5	51.0	52.5	53.5	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	53.8
	2	56.5	57.0	57.0	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	53.4
27	2	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	65.8
	2	61.5	61.0	60.5	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	64.8
28	2	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	69.6
	2	70.5	70.0	69.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	67.1
29	2	69.5	69.0	67.0	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	60.2
	2	43.0	42.0	41.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	59.9
30	2	39.0	37.5	35.5	35.0	34.5	33.5	35.0	37.5	41.0	43.5	46.5	49.0	43.5	47.5	50.5	53.5	55.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	42.8
	2	43.5	43.0	43.5	43.0	43.0	43.5	45.0	46.5	47.5	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	47.4
31	2	39.0	38.5	38.0	39.0	39.5	41.5	43.5	44.5	44.5	45.0	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	48.1
	2	50.0	50.0	50.0	51.0	52.0	51.5	51.0	51.0	51.5	52.0	52.5	53.0	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	44.3
	2	48.0	47.5	47.5	48.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	50.3
Mean...	24.5	54.0	53.6	52.8	52.5	52.7	52.3	51.7	53.3	56.6	59.6	62.1	65.2	67.0	67.3	67.7	67.2	65.7	63.2	60.4	58.7	57.5	56.4	55.5	54.7	-----
	2	52.1	51.2	50.5	50.2	50.1	49.8	50.3	52.8	56.6	59.7	63.0	66.2	68.1	68.7	68.7	66.9	64.6	60.6	57.8	56.3	55.0	53.9	53.2	52.0	-----



21	24.5	38.5	38.5	38.5	37.5	36.5	36.5	37.0	37.5	38.0	39.0	39.5	40.0	40.5	41.0	41.0	41.5	41.5	41.5	41.0	41.0	40.5	40.0	40.0	39.5	39.4
	2	37.5	37.5	37.0	38.0	36.0	36.0	36.5	37.0	38.0	38.5	39.0	39.5	40.0	40.5	40.0	40.5	40.5	40.0	40.0	39.5	39.5	39.0	38.5	38.0	38.5
22	24.5	39.0	38.5	38.0	38.0	37.5	37.5	37.5	37.5	36.0	36.0	39.5	41.0	41.0	40.0	39.5	38.5	38.5	39.0	39.0	39.0	39.0	39.0	39.0	39.0	38.6
	2	37.5	37.0	37.0	36.5	36.0		37.5	37.0	36.5	37.0	40.0	41.5	41.0	29.5	39.0	37.0	37.5	37.5	37.0	37.0	37.5	37.5	37.0	37.5	37.8
23	24.5	39.0	39.5	39.5	39.5	40.0	40.0	40.0	40.5	42.5	44.0	44.5	46.5	47.0	47.5	47.5	47.0	45.0	44.0	43.0	42.0	41.5	39.5	39.0	38.0	42.4
	2	37.5	38.0	38.0	38.0	38.5	38.5	39.0	40.5	42.5	44.0	45.5	46.0	47.5	47.0	46.5	46.0	46.0	45.0	44.5	43.5	43.0	42.0	40.0	39.5	38.0
24	24.5	37.0	37.0	37.0	36.5	35.5	34.5	34.0	35.0	37.5	39.0	41.0	43.0	45.5	47.5	48.0	47.5	47.0	45.5	45.0	44.0	43.5	42.0	40.0	39.0	40.1
	2	34.0	34.5	34.5	33.0	32.0	31.5	32.5	35.0	39.0	41.0	44.0	46.0	46.5	46.0	46.0	46.0	45.0	44.5	43.5	43.0	42.0	40.0	39.5	38.0	40.3
25	24.5	37.0	36.0	36.0	37.0	36.5	35.5	35.0	35.0	35.5	36.0	36.0	36.5	37.0	38.5	38.5	38.0	38.0	38.0	38.0	38.0	35.5	35.0	35.0	35.0	40.1
	2	34.0	33.0	33.5	35.5	36.0	35.5	35.0	35.0	35.5	36.0	36.0	36.5	37.0	38.5	38.5	38.0	38.0	38.0	38.0	35.5	35.0	35.0	35.0	35.0	36.4
26	24.5	35.5	35.5	35.0	35.0	34.5	34.0	34.0	34.0	33.5	33.5	34.5	37.0	39.0	40.0	41.5	42.0	45.0	46.0	45.5	44.0	41.5	37.5	33.0	32.0	37.6
	2	35.0	35.0	35.0	34.5	34.0	33.5	33.5	33.0	34.0	34.5	37.0	39.0	40.0	41.5	42.0	45.0	46.0	45.5	44.0	41.5	37.5	33.0	32.0	33.5	34.0
27	24.5	31.0	30.5	35.0	38.0	38.5	38.0	38.0	38.0	38.5	38.5	39.5	41.0	42.0	44.5	45.5	46.0	44.0	41.0	39.0	33.5	29.5	28.0	28.5	30.5	36.6
	2	28.5	27.5	32.0	37.0	37.0	37.0	36.5	38.0	42.0	43.5	44.5	47.0	50.5	52.5	53.5	55.0	53.0	51.5	48.0	47.0	45.5	45.5	45.0	44.5	43.7
28	24.5	43.5	42.0	41.0	40.0	39.0	39.0	37.5	35.5	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	43.0
	2	42.5	41.0	39.5	38.5	37.0	35.5	34.0	31.5	36.0	41.5	49.0	56.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	47.4
29	24.5	46.0	45.0	45.0	44.5	44.5	44.0	44.0	44.0	47.0	51.0	53.0	55.0	58.0	60.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	48.5
	2	43.0	42.0	41.5	41.5	42.0	41.0	41.5	42.5	46.0	51.0	54.0	56.5	59.5	61.0	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	49.1
30	24.5	43.0	43.0	43.5	43.5	43.5	43.5	43.5	43.5	45.0	47.0	51.5	53.0	53.0	53.5	52.5	50.0	47.0	45.5	42.0	40.5	39.0	38.0	37.5	38.0	47.2
	2	41.0	41.0	41.0	40.5	40.0	39.0	40.0	40.5	43.0	46.0	50.5	52.0	52.0	53.0	52.5	50.5	47.0	45.5	42.0	40.5	39.0	38.0	37.5	38.0	45.0
Mean---	24.5	43.0	42.2	41.8	41.5	40.8	40.1	39.9	40.1	42.6	45.8	48.6	50.8	52.3	53.3	53.7	53.3	51.9	49.8	48.0	46.4	45.3	44.4	43.9	43.8	42.4
	2	40.6	40.4	40.2	39.7	39.2	38.1	38.0	38.8	42.1	46.2	49.6	51.8	53.3	54.1	53.9	52.6	49.5	46.6	45.1	43.6	42.6	41.5	41.3	40.8	40.8

TABLE 10.—Temperature at indicated levels, Arlington Experiment Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																										Mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	12 p. m.	13 p. m.	12 p. m.			
Dec. 1	24.5	37.0	35.5	35.0	35.0	34.5	34.5	33.5	35.0	36.5	39.0	43.0	45.5	48.5	49.5	49.5	49.5	49.0	49.0	48.5	48.0	48.5	48.5	48.5	48.5	48.5	42.9	
	2	32.5	31.0	31.0	30.5	30.0	30.5	30.5	31.5	35.0	34.0	43.0	45.0	47.5	48.0	47.5	47.5	46.5	46.5	46.5	46.5	47.0	47.0	47.0	47.0	47.0	40.4	
2	24.5	49.0	49.0	49.5	49.5	50.0	50.0	49.0	40.5	50.0	50.5	51.0	51.5	51.0	51.5	51.5	52.0	51.5	51.5	50.5	49.0	47.5	47.0	46.5	46.5	46.5	49.8	
	2	47.5	47.5	48.0	48.0	48.0	48.0	47.5	48.0	48.5	49.0	49.5	50.0	50.0	50.0	50.5	50.5	50.5	50.5	49.0	47.0	46.0	45.0	43.5	42.5	48.1	48.1	
3	24.5	46.0	44.0	43.0	42.0	41.0	40.5	41.5	46.5	47.5	48.5	49.5	49.5	49.5	50.0	50.5	49.0	47.0	46.0	44.0	43.0	41.0	39.0	38.0	38.5	44.8		
	2	41.5	41.0	39.5	39.0	37.0	34.0	36.5	41.0	45.5	47.0	49.5	49.5	49.5	49.5	50.5	49.5	47.0	45.0	43.0	41.0	40.0	37.5	35.0	31.5	42.8	42.8	
4	24.5	38.0	38.5	39.0	38.0	36.0	37.5	38.0	39.0	41.5	47.0	47.0	47.5	47.0	46.5	45.0	44.5	43.5	43.0	42.5	41.5	41.5	41.0	41.0	41.0	41.0	41.9	
	2	34.5	33.0	35.0	35.0	32.5	32.0	33.5	36.0	39.0	43.0	46.5	47.0	47.5	47.0	45.5	45.0	44.0	43.0	42.5	41.0	40.5	40.5	40.0	40.0	40.1	40.1	
5	24.5	41.0	40.5	40.5	40.0	40.0	40.0	40.0	39.5	39.5	41.0	43.5	45.5	46.0	47.5	47.0	47.0	45.5	44.0	44.0	43.5	43.0	42.0	41.0	41.0	41.0	42.7	
	2	40.0	40.0	40.0	39.5	39.5	39.5	39.0	39.0	39.0	40.5	43.5	47.5	46.0	47.5	47.0	47.0	46.0	42.0	41.5	41.5	41.0	41.0	40.5	40.0	40.0	42.0	
6	24.5	40.5	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.5	43.0	43.5	46.0	44.0	49.0	49.0	47.0	45.5	43.5	43.0	40.5	38.5	37.0	35.0	33.5	33.5	41.8	
	2	39.5	39.5	39.0	38.5	39.0	39.0	39.0	39.0	41.0	42.5	44.0	47.5	49.0	49.5	49.0	47.5	44.0	42.0	40.0	37.8	35.0	34.0	33.0	32.0	32.0	40.8	
7	24.5	33.0	32.0	31.5	31.0	30.5	29.0	28.5	29.5	33.5	37.5	40.5	40.5	55.0	59.0	59.0	61.0	60.5	59.0	58.5	57.0	59.0	63.0	58.0	53.0	46.2	46.2	
	2	30.0	29.5	29.5	29.0	28.0	27.5	27.0	28.5	32.0	37.0	44.0	51.0	56.0	59.0	58.5	62.0	61.5	59.5	58.5	56.5	55.5	61.5	62.0	56.5	45.8	45.8	
8	24.5	51.0	49.0	47.0	46.0	45.0	44.0	44.5	45.0	46.0	47.0	48.0	49.0	50.5	51.0	51.5	50.5	49.0	47.0	45.0	45.0	43.5	43.0	42.0	42.0	42.0	46.7	
	2	53.0	51.0	50.0	46.0	46.0	45.0	44.0	45.0	45.0	47.0	49.0	51.0	51.5	52.5	53.0	53.0	52.0	51.0	50.0	45.0	44.0	43.0	41.0	38.5	47.8	47.8	
9	24.5	40.0	40.0	39.0	36.0	35.5	33.5	32.0	34.5	39.5	45.0	52.0	54.5	57.0	60.0	60.5	60.0	57.5	55.5	54.0	53.5	53.0	52.0	50.5	47.7	47.7	47.7	
	2	39.0	36.0	37.5	36.5	34.0	32.5	32.0	31.5	31.5	39.0	49.0	53.5	56.5	60.5	62.5	63.0	62.0	59.0	56.0	54.0	54.0	53.0	50.5	47.5	47.5	47.5	
10	24.5	49.0	48.5	48.0	47.0	46.5	46.0	43.0	45.5	51.0	58.0	63.0	65.0	68.0	67.0	64.5	64.0	63.0	62.0	61.5	58.0	55.5	55.0	55.0	54.0	55.8	55.8	
	2	49.0	48.0	47.5	46.5	46.5	45.5	42.5	40.0	47.5	57.5	64.5	68.0	71.0	70.5	66.5	65.0	63.5	62.5	62.5	59.5	58.0	56.0	55.5	54.0	56.1	56.1	
11	24.5	53.0	54.0	53.5	53.5	53.0	52.0	50.0	49.5	48.5	47.5	47.5	47.0	46.5	45.5	45.0	44.0	43.0	41.0	40.0	39.0	37.0	36.0	35.0	34.5	45.6	45.6	
	2	52.5	53.0	53.0	53.0	54.0	54.5	52.0	51.0	50.5	49.5	49.5	49.0	48.0	46.5	45.0	43.0	42.0	40.0	39.0	38.0	37.0	36.0	36.5	36.0	47.1	47.1	
12	24.5	33.5	33.0	32.0	31.0	30.5	30.0	29.5	31.0	34.0	37.0	39.5	43.5	44.5	44.0	45.0	45.5	45.5	41.0	38.0	37.0	36.0	35.5	35.5	36.0	37.0	35.6	
	2	35.0	34.0	33.0	32.0	31.0	30.5	30.0	29.5	31.0	35.0	37.0	41.0	43.0	44.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	35.6	
13	24.5	38.0	39.0	40.0	39.5	39.0	39.0	40.0	40.5	42.0	45.0	45.0	45.0	42.5	40.5	40.0	40.0	40.0	40.0	39.0	37.5	37.0	38.0	40.0	42.0	40.4	40.4	
	2	36.0	37.5	38.0	37.5	37.0	36.5	37.0	38.0	41.5	44.5	44.5	43.5	41.0	40.0	40.0	39.5	39.5	39.0	36.5	35.0	35.5	37.0	39.5	41.5	39.0	39.0	
14	24.5	42.0	41.0	41.0	40.0	39.5	39.5	39.0	39.0	39.5	39.5	39.5	40.0	40.0	40.0	39.0	38.5	38.0	37.5	36.5	36.0	35.0	33.5	34.5	35.0	38.4	38.4	
	2	40.5	40.0	39.5	38.5	38.0	38.0	37.5	39.0	39.0	39.5	39.5	40.0	40.0	40.0	39.0	38.5	37.5	36.0	35.5	35.0	33.0	32.0	33.5	34.0	37.5	37.5	
15	24.5	35.0	34.0	33.5	32.5	32.0	31.5	31.0	31.0	31.0	32.5	35.5	39.5	41.0	41.0	39.5	39.0	37.0	37.0	37.0	36.5	36.0	35.5	35.0	35.5	35.5	35.5	
	2	33.0	32.0	31.5	30.0	30.5	30.0	29.0	31.0	31.0	33.0	37.5	46.5	45.0	42.5	42.0	39.5	37.5	36.0	35.0	35.5	35.0	35.0	35.0	35.0	35.2	35.2	
16	24.5	36.0	36.5	36.5	36.5	37.0	37.0	37.5	38.0	39.0	40.0	41.0	41.0	46.0	48.5	49.0	48.5	48.0	47.5	47.0	46.0	47.0	49.0	48.0	48.0	48.0	48.0	
	2	35.5	36.0	36.0	36.5	37.0	37.5	38.0	38.5	39.0	40.5	41.5	43.0	46.0	48.5	49.0	48.0	46.5	45.0	44.0	44.0	42.5	43.5	46.5	46.5	46.5	46.5	
17	24.5	47.0	45.5	45.0	43.5	43.0	43.5	44.5	45.5	48.5	47.5	48.0	51.0	56.5	61.5	63.0	65.0	65.0	62.5	59.5	57.0	55.0	54.0	50.0	47.5	52.0	52.0	
	2	44.0	41.0	40.0	39.0	39.0	40.0	40.5	41.0	46.0	46.0	46.0	50.0	56.0	62.5	64.0	65.0	64.0	61.0	58.5	54.0	52.5	51.0	47.0	43.0	49.6	49.6	
18	24.5	45.5	44.5	42.0	41.0	39.5	39.0	37.0	37.0	38.0	41.5	48.5	57.0	59.5	62.0	63.5	64.0	62.5	58.0	54.0	52.0	49.5	49.0	47.5	47.0	49.1	49.1	
	2	41.0	40.0	38.0	38.0	37.5	36.0	36.0	35.0	34.5	35.0	39.0	46.0	56.0	61.0	63.5	64.5	64.0	62.5	54.0	50.0	47.0	46.0	45.0	44.0	43.0	46.6	46.6
19	24.5	45.0	43.0	42.0	41.0	40.5	39.0	38.5	38.0	39.0	44.5	50.0	54.0	56.0	59.5	62.5	62.5	60.0	57.0	55.0	52.0	51.0	50.0	50.5	50.5	49.2	49.2	
	2	41.5	39.5	38.0	38.0	37.0	36.5	36.0	35.5	35.0	36.0	43.5	51.0	55.0	58.0	62.0	63.5	63.0	60.5	53.0	52.5	48.0	47.5	47.0	48.5	49.0	47.3	47.3
20	24.5	53.0	53.0	52.5	54.5	56.5	56.0	55.0	55.5	56.5	50.0	49.5	49.0	48.0	47.5	47.5	48.0	47.5	46.0	45.5	45.0	44.5	42.5	40.0	38.5	49.2	49.2	
	2	51.5	51.5	51.0	53.5	56.0	56.0	54.5	56.0	57.0	50.5	50.5	50.0	49.0	49.0	49.0	49.0	48.0	46.5	46.0	45.0	44.0	41.0	36.0	36.5	49.0	49.0	

21	24.5 2	38.0 37.5	38.0 37.0	37.0 36.0	37.0 36.0	35.0 34.0	34.5 34.0	35.5 36.5	36.0 37.0	37.0 36.0	38.0 39.5	40.5 41.0	41.0 41.0	40.0 41.0	40.0 40.0	39.5 37.0	38.5 37.0	36.5 35.0	37.5 35.5	35.0 35.0	31.0 34.0	33.5 33.0	34.5 34.5	34.5 35.0	37.0 37.1
22	24.5 2	35.0 36.0	35.0 35.5	34.5 35.0	34.5 35.5	35.0 36.0	35.0 35.5	35.0 36.0	36.0 37.5	36.0 37.5	37.0 38.5	42.0 40.5	42.0 42.5	41.0 41.5	40.0 39.0	39.0 39.0	38.0 38.0	35.0 37.0	35.5 37.0	35.0 37.0	34.0 34.5	33.0 36.5	34.5 36.5	35.0 36.5	36.8 36.8
23	24.5 2	36.0 36.0	35.5 35.0	35.0 34.0	35.5 33.0	36.0 33.0	35.5 33.0	36.0 34.0	37.5 37.5	37.5 39.0	40.5 40.0	42.0 41.5	42.5 44.0	42.5 43.0	42.5 42.0	41.0 43.0	39.5 41.0	38.0 46.5	38.0 37.5	37.0 37.5	37.0 36.5	37.0 36.0	37.0 36.0	37.0 34.0	37.7 37.6
24	24.5 2	36.0 35.5	35.0 35.0	33.0 35.0	31.5 32.5	32.5 32.0	32.5 30.5	36.0 29.0	38.5 28.0	41.0 27.5	42.5 25.5	44.0 39.0	44.0 30.5	43.0 31.0	43.0 32.0	41.0 33.0	40.5 31.5	38.0 31.5	36.5 31.0	34.5 30.0	33.5 30.0	31.0 30.0	33.0 31.0	34.0 31.0	37.1 31.5
25	24.5 2	34.0 31.0	33.5 30.0	33.5 20.0	32.0 20.0	32.0 31.5	30.5 34.0	29.0 34.0	28.0 34.5	28.0 36.5	29.0 37.0	30.0 38.0	31.5 32.5	33.0 33.0	32.0 38.5	33.0 37.0	31.5 36.5	30.0 36.0	29.5 36.0	29.0 29.0	29.5 30.0	28.5 29.5	30.0 28.5	30.9 35.3	
26	24.5 2	30.0 37.5	29.5 37.0	27.5 38.0	28.5 38.5	29.5 38.5	32.5 38.5	33.0 38.5	33.5 39.0	35.5 40.0	37.5 40.0	39.0 41.0	40.0 41.0	40.0 41.5	40.0 41.5	40.0 37.5	38.0 38.0	35.5 38.0	35.5 37.5	36.0 37.5	36.5 37.0	37.5 37.0	37.5 37.5	38.0 34.0	
27	24.5 2	36.0 37.5	35.5 37.0	35.0 36.5	37.0 35.0	37.0 31.5	37.5 29.0	37.5 27.0	37.5 26.0	39.0 25.0	40.0 25.0	41.5 25.0	42.0 25.0	42.5 25.0	42.5 25.0	41.0 26.5	40.5 26.0	38.0 25.5	36.0 25.5	35.5 25.5	35.0 25.0	34.5 25.0	35.0 25.0	37.8 28.5	
28	24.5 2	30.0 25.0	35.5 25.5	35.5 25.0	34.5 24.0	31.5 23.5	28.5 24.0	27.0 24.0	25.5 25.0	24.5 24.5	24.5 27.5	24.5 28.0	24.5 29.0	24.5 31.0	24.5 32.0	26.0 31.0	26.0 31.5	25.5 31.5	25.0 31.0	25.0 31.0	25.0 31.5	24.5 31.5	24.5 31.5	27.0 28.2	
29	24.5 2	24.5 31.0	24.5 32.0	24.5 32.0	24.0 32.0	23.5 31.0	23.5 31.5	24.0 31.0	25.5 32.0	25.5 32.5	26.0 33.0	26.0 35.0	29.0 35.5	30.0 36.0	32.0 36.5	32.0 36.0	32.0 36.0	32.0 36.0	32.0 36.0	31.5 35.0	31.5 35.5	31.5 35.5	31.0 34.5	28.1 33.9	
30	24.5 2	31.5 33.5	31.0 34.0	31.5 34.0	31.5 33.0	31.0 32.0	29.5 31.0	31.5 32.0	32.0 30.0	32.5 32.0	33.0 33.0	35.0 37.0	35.5 37.5	36.0 39.0	37.0 39.5	37.0 37.5	36.0 38.5	35.5 35.0	35.5 33.0	35.5 32.0	35.0 29.0	34.5 27.0	34.5 26.0	33.0 24.0	33.6 29.5
31	24.5 2	33.5 27.5	33.5 25.0	33.5 25.0	33.0 24.5	32.0 25.5	31.5 28.0	31.0 29.0	32.0 30.0	32.0 31.0	32.0 34.0	32.0 35.0	32.0 34.0	32.0 34.0	32.0 33.5	32.0 33.5	32.0 33.0	32.0 32.0	32.0 31.5	32.0 29.0	27.0 26.0	26.0 25.0	25.0 24.0	24.0 23.0	33.5 20.5
Mean...	24.5 2	39.4 38.4	38.8 37.7	38.4 37.4	37.9 37.1	37.6 36.9	37.2 36.7	37.0 36.2	37.5 36.4	38.5 37.0	40.1 40.1	41.9 42.0	43.7 45.0	45.0 45.0	45.0 47.3	45.0 47.5	46.7 46.4	45.9 45.0	47.5 42.5	45.0 41.4	44.0 40.6	43.3 39.2	43.0 39.0	39.3 38.2	



1942)

ISDA TECHNICAL BULLETINS

UR DATA

MEASUREMENT OF EVAPORATION FROM LAND AND WATER SURFACES

THORNTON, H. L. & HOLZMAN, G.

2 OF 2

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939

Date	Height of observation	Average for hour ending at—																								Mean
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
		a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	
Jan. 1	Feet	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	
	24.5	2.4	2.5	2.6	3.1	2.9	2.6	2.9	3.1	3.2	2.8	2.8	2.7	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
2	2	2.8	2.9	3.0	3.2	2.8	2.8	3.0	3.2	3.2	3.3	3.1	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	
	24.5	3.3	3.4	3.2	3.2	3.1	3.1	3.1	2.9	2.8	2.9	2.7	1.9	2.0	1.9	2.1	2.2	2.2	2.4	2.5	3.2	3.5	3.7	3.7	3.7	
3	2	3.4	3.2	3.6	3.2	2.9	3.0	3.0	2.9	3.0	3.0	2.8	2.2	2.3	2.3	2.6	2.6	2.8	3.2	3.4	3.5	3.8	3.7	3.8	3.8	
	24.5	3.7	3.6	3.7	3.8	3.8	3.5	3.6	3.0	3.9	3.8	3.9	4.0	3.9	3.8	3.3	3.2	3.7	4.3	4.6	4.6	4.9	5.0	4.9	4.7	
4	2	3.8	3.7	3.8	3.7	3.7	3.4	3.4	3.3	3.4	4.1	3.8	3.9	4.1	4.2	4.2	3.6	3.8	4.1	4.6	4.7	4.8	4.8	4.7	4.5	
	24.5	4.6	4.4	4.6	4.3	4.3	4.6	4.3	4.4	4.4	4.4	4.3	4.3	4.2	4.2	4.4	4.6	4.6	4.8	4.8	4.8	4.8	4.8	4.8	4.8	
5	2	4.2	4.2	4.2	4.2	4.0	4.3	4.4	4.5	4.5	4.5	4.6	4.6	4.5	4.4	4.5	4.7	4.8	4.9	5.0	5.0	5.0	5.0	5.0	5.0	
	24.5	4.8	4.8	4.8	4.8	4.8	4.9	5.0	5.1	5.2	5.1	5.3	5.6	5.9	6.5	7.0	7.0	8.0	7.8	7.8	8.0	8.6	8.5	8.6	8.9	
6	2	5.0	5.0	5.0	5.0	5.0	5.1	5.2	5.3	5.3	5.3	5.4	5.7	6.1	6.5	7.2	7.1	8.4	8.0	8.1	8.2	8.7	8.4	8.6	8.9	
	24.5	6.1	7.9	7.6	7.1	6.8	6.6	4.6	4.4	4.8	4.0	3.3	3.4	3.4	3.3	3.2	3.3	3.2	3.2	3.4	3.4	3.5	3.5	3.6	3.8	
7	2	8.4	7.9	7.8	7.2	6.9	5.9	5.0	4.7	5.1	4.7	4.0	4.0	3.9	3.8	3.8	3.7	3.8	3.8	3.7	3.8	4.0	4.1	4.1	4.5	
	24.5	4.0	3.8	4.0	4.0	3.9	3.9	4.0	3.7	3.8	4.1	4.0	3.8	3.5	3.5	3.6	4.0	3.5	3.4	3.7	3.8	3.9	4.2	4.2	4.2	
8	2	4.3	4.0	4.0	4.0	3.8	3.8	3.8	3.6	3.9	4.4	4.4	4.2	4.0	4.0	4.1	4.2	4.2	4.3	4.4	4.4	4.5	4.6	4.4	4.2	
	24.5	4.2	4.1	4.3	4.1	3.9	3.8	3.8	3.6	3.6	3.8	3.8	3.0	1.8	1.9	1.8	1.8	1.9	1.8	1.8	2.1	2.8	3.1	3.2	3.2	
9	2	4.2	4.1	4.2	4.3	4.0	3.9	3.9	3.7	3.8	4.2	3.3	2.4	2.4	2.4	2.6	2.4	2.5	2.5	3.0	3.4	3.6	3.6	3.6	3.4	
	24.5	3.2	3.3	3.2	3.4	3.2	3.3	3.3	3.3	3.4	3.5	3.5	3.4	2.4	2.4	2.6	2.6	2.5	2.7	2.9	3.1	3.4	3.6	3.7	4.0	
10	2	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.5	3.6	3.8	4.1	3.6	2.9	3.0	3.2	3.2	3.5	3.7	3.9	4.0	4.2	4.3	4.4	4.5	
	24.5	4.0	4.3	4.4	4.5	4.7	4.8	5.0	5.8	6.1	6.1	6.0	5.9	5.7	6.2	6.4	6.5	6.6	6.6	6.9	6.9	6.8	6.0	5.7	6.0	
11	2	4.5	4.8	4.8	4.9	5.0	5.1	5.4	6.7	6.6	6.6	6.2	6.0	6.2	6.3	6.4	6.6	6.8	6.8	6.9	7.1	7.2	6.2	5.8	6.0	
	24.5	6.1	4.7	4.5	4.5	3.9	3.4	3.3	3.2	3.0	2.8	2.8	2.8	2.7	2.5	2.4	2.2	2.2	2.2	2.3	2.4	2.6	2.7	2.8	3.0	
12	2	5.8	5.1	5.1	4.6	4.0	3.6	3.3	3.4	3.2	3.1	3.1	3.1	3.2	2.8	2.6	2.6	2.4	2.8	3.2	3.2	3.4	3.4	3.6	4.0	
	24.5	2.8	2.8	3.0	2.7	2.9	2.8	2.9	3.0	3.1	3.1	2.9	2.8	2.5	2.4	2.2	2.0	2.0	2.0	2.0	2.2	2.4	2.0	2.0	2.5	
13	2	3.8	3.6	3.7	3.6	3.6	3.6	3.2	3.4	3.6	3.4	3.1	3.2	2.8	2.6	2.4	2.4	2.2	2.2	2.6	2.6	2.4	2.4	2.4	3.0	
	24.5	2.1	2.0	1.9	1.9	1.9	2.2	3.6	3.4	3.4	3.4	3.3	3.2	3.1	3.1	3.1	3.1	3.2	3.1	2.9	2.8	2.8	2.9	3.1	3.0	
14	2	2.4	2.4	2.2	2.2	2.2	2.5	3.7	3.8	3.6	3.7	3.7	3.4	3.4	3.4	3.3	3.3	3.4	3.4	3.1	3.0	3.0	3.1	3.3	3.2	
	24.5	3.0	3.0	3.1	2.9	2.9	2.8	2.8	2.8	2.7	2.4	2.2	2.0	1.8	1.7	1.7	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.7	
15	2	3.2	3.3	3.4	3.2	3.2	3.1	3.1	3.0	2.9	2.5	2.4	2.2	1.9	1.9	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.8	2.2	
	24.5	1.7	1.6	1.6	1.6	1.5	1.6	1.6	1.7	1.7	1.7	1.5	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.6	1.6	1.8	2.0		
16	2	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.8	1.7	1.7	1.6	1.4	1.4	1.4	1.4	1.4	1.4	1.7	1.7	1.7	1.7	1.9	2.1	2.4	
	24.5	2.4	2.5	2.6	2.4	2.4	2.4	3.6	3.0	3.2	3.3	3.2	3.1	2.9	2.8	2.9	3.1	3.2	3.3	3.4	3.6	3.4	3.1	3.1	3.0	
17	2	2.5	2.8	2.7	2.6	2.6	2.6	2.8	3.0	3.2	3.1	3.0	3.0	2.8	2.8	2.8	3.0	3.1	3.2	3.2	3.3	3.3	3.0	3.0	2.9	
	24.5	2.8	2.6	2.4	2.2	2.1	2.1	2.1	2.0	2.0	2.0	2.0	2.0	1.9	1.9	2.0	2.0	2.0	2.0	2.2	2.6	2.7	2.8	3.1	3.4	
18	2	2.7	2.6	2.3	2.1	2.0	2.1	2.1	2.0	2.0	1.9	2.0	2.0	1.8	1.8	2.0	2.0	2.1	2.2	2.3	2.5	2.7	2.8	3.0	3.2	
	24.5	4.3	4.5	4.5	4.3	4.2	4.2	4.3	4.4	4.4	4.1	4.1	4.1	4.0	4.0	3.7	3.6	3.8	3.2	3.2	3.0	2.6	2.4	2.4	3.7	
19	2	3.9	4.0	4.1	4.0	4.0	4.0	4.1	4.1	4.1	4.0	4.0	4.1	3.8	3.8	3.6	3.6	3.4	3.3	3.2	3.0	2.8	2.5	2.4	3.6	
	24.5	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.5	2.4	2.4	2.2	2.5	2.4	2.2	2.1	2.1	2.0	2.0	1.8	1.8	1.8	1.6	1.6	2.2	
20	2	2.3	2.4	2.4	2.5	2.2	2.2	2.3	2.4	2.3	2.4	2.4	2.3	2.3	2.2	2.0	2.0	1.9	1.8	1.8	1.6	1.6	1.6	1.5	2.1	





## 101

Mean...	24.5	3.9	3.9	3.9	3.9	3.9	3.8	3.7	3.8	3.8	3.9	3.9	3.8	3.8	3.8	3.8	3.7	3.8	3.9	4.0	3.9	3.9	4.2
	2	4.2	4.2	4.1	4.1	4.1	4.0	3.9	4.0	4.0	4.0	4.1	4.1	4.0	4.1	4.1	4.0	4.0	4.1	4.2	4.2	4.2	4.2

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																								mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
Apr. 1	Feet	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.
	24.5	4.5	4.6	4.8	4.8	5.0	5.2	5.6	6.1	6.1	5.4	4.9	4.6	4.8	5.5	6.6	8.1	8.3	8.1	8.1	8.5	8.5	7.0	5.4	4.8	6.0
2	2	4.7	4.5	4.5	4.6	4.8	5.1	5.5	5.4	5.5	5.3	5.2	5.1	5.2	5.8	7.0	8.1	8.4	8.3	8.2	8.5	8.5	7.8	5.8	4.8	6.1
	24.5	4.4	4.5	4.6	4.2	3.8	3.5	2.6	2.4	2.4	2.4	2.3	2.1	2.1	2.3	2.2	2.1	2.0	2.2	2.1	2.0	2.2	2.2	2.1	2.1	2.7
3	2	4.7	4.5	4.6	4.1	4.0	3.7	2.7	2.6	2.6	2.6	2.4	2.4	2.3	2.2	2.2	2.4	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.2	2.8
	24.5	2.2	2.2	2.2	2.2	2.2	2.6	3.0	3.2	3.2	2.9	2.7	2.4	2.4	2.6	2.6	2.4	2.2	2.2	2.0	2.1	2.0	2.0	2.0	2.0	2.4
4	2	2.4	2.5	2.6	2.6	2.6	3.0	3.2	3.4	3.2	2.9	2.8	2.6	2.6	2.5	2.5	2.4	2.2	2.0	2.0	1.9	1.9	1.9	1.9	2.0	2.5
	24.5	2.0	2.1	2.2	2.6	2.7	2.8	2.8	2.6	2.4	2.4	2.3	2.2	2.3	2.4	2.4	2.4	2.5	2.5	2.4	2.4	2.4	2.4	2.5	2.4	2.4
5	2	2.0	2.4	2.4	2.6	2.8	2.9	2.9	2.4	2.4	2.4	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4
	24.5	2.5	2.5	2.5	2.6	2.6	2.6	2.7	2.5	2.8	2.8	3.0	3.0	2.9	3.0	2.8	2.8	2.7	2.8	3.0	3.6	3.9	4.0	3.0	4.4	3.0
6	2	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.8	2.8	3.0	3.0	3.0	2.8	3.0	2.8	2.8	3.0	3.6	3.9	3.8	3.8	4.3	3.0
	24.5	5.0	5.1	5.4	6.5	5.9	6.3	6.6	6.6	6.9	7.4	7.8	7.8	8.0	8.0	8.5	9.3	9.3	8.3	7.4	6.8	4.9	4.6	4.2	3.6	6.6
7	2	4.8	5.1	5.1	5.2	5.9	5.9	6.1	6.2	6.7	7.0	7.2	7.6	7.6	7.7	8.3	9.0	9.0	7.9	7.6	6.3	5.1	4.5	4.2	3.6	6.4
	24.5	3.3	3.0	2.6	2.4	2.2	2.2	2.2	2.2	2.3	2.0	2.2	2.0	2.0	2.0	2.1	2.1	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.6	2.1
8	2	3.1	2.8	2.6	2.4	2.2	2.1	2.1	2.4	2.4	2.4	2.6	2.6	2.4	2.4	2.6	2.4	2.2	2.1	2.0	2.2	2.0	2.0	2.0	2.0	2.3
	24.5	1.7	1.6	1.6	1.4	1.4	1.5	1.7	2.0	2.2	2.4	2.2	2.3	2.2	2.4	2.4	2.4	3.0	3.0	3.2	3.5	4.0	4.4	4.4	4.4	2.6
9	2	2.1	1.9	1.8	1.8	1.9	2.0	2.0	2.2	2.4	2.6	2.6	2.6	2.6	2.8	2.8	2.8	3.0	3.2	3.6	4.1	4.1	4.3	4.4	4.5	2.8
	24.5	4.6	4.7	4.3	3.6	3.2	3.0	3.0	2.7	2.6	2.6	2.6	2.6	2.7	2.7	2.4	2.6	2.6	2.5	2.2	2.6	3.0	3.2	3.8	4.4	3.1
10	2	4.7	4.8	4.4	3.7	3.4	3.3	3.4	2.0	2.8	2.8	2.9	2.9	2.9	3.0	2.8	2.7	2.8	2.8	2.4	3.0	3.4	3.7	4.2	4.4	3.3
	24.5	4.6	4.7	5.3	5.6	5.6	5.0	5.1	5.2	5.2	5.6	5.7	6.6	6.5	6.6	6.4	5.6	4.8	4.8	4.4	4.2	4.4	4.8	5.1	5.2	5.3
11	2	4.7	5.2	5.7	5.6	5.6	5.1	5.4	5.2	5.2	5.7	6.0	6.5	6.6	6.4	6.7	5.8	5.0	4.6	4.2	4.2	4.2	4.5	4.9	5.0	5.3
	24.5	5.2	5.6	6.1	6.6	7.1	7.4	7.8	7.9	8.0	7.9	7.1	7.0	7.0	7.4	7.6	7.4	7.0	7.3	8.6	8.6	8.0	7.4	6.6	5.8	7.2
12	2	5.1	5.0	5.9	6.4	7.0	7.3	7.7	7.9	7.9	8.0	8.0	7.8	7.7	7.8	7.8	7.6	7.4	9.0	8.8	8.9	8.7	8.1	7.1	6.1	7.5
	24.5	5.4	4.6	4.5	4.1	4.3	4.0	3.9	3.8	3.9	4.3	4.1	3.3	2.6	2.3	2.1	2.1	2.0	1.8	1.7	1.7	1.6	1.6	1.6	1.8	3.0
13	2	5.6	5.1	4.6	4.5	4.6	4.5	4.3	4.2	4.3	4.4	4.1	3.4	3.3	3.0	2.6	2.4	2.1	2.2	1.8	1.8	1.7	1.6	1.8	1.8	3.3
	24.5	2.0	2.0	1.8	1.8	1.8	1.9	2.1	2.2	2.4	2.5	2.7	2.8	2.9	2.8	2.9	3.1	3.0	2.8	2.6	2.6	2.5	2.4	2.4	2.4	2.4
14	2	1.9	1.9	1.9	1.9	1.9	2.0	2.2	2.4	2.6	2.8	3.0	3.0	3.2	3.4	3.4	3.3	3.4	3.0	2.8	3.0	2.9	3.1	3.1	3.2	2.7
	24.5	2.6	2.5	2.6	2.5	2.6	2.9	2.8	3.2	3.8	3.9	3.5	3.1	3.4	2.7	2.2	2.5	2.8	2.8	3.1	3.3	3.9	4.4	4.4	4.2	3.2
15	2	3.0	3.3	3.3	2.8	3.0	3.2	3.2	3.5	4.4	4.4	3.8	4.2	4.5	3.9	3.6	3.7	4.5	4.8	5.5	5.4	5.5	5.6	5.8	5.4	4.2
	24.5	5.4	7.2	7.8	7.9	7.8	8.4	7.0	7.2	7.5	8.4	8.6	8.6	8.4	8.6	8.0	9.0	9.4	10.3	9.4	9.2	9.2	9.1	8.8	8.2	8.3
16	2	6.2	7.2	7.3	7.7	7.4	7.0	6.8	6.9	7.5	8.0	8.8	9.0	9.1	9.2	9.4	9.2	9.7	11.0	10.2	9.9	9.8	9.6	9.6	8.8	8.6
	24.5	6.2	7.0	6.7	6.5	6.4	6.4	6.2	5.4	5.0	5.0	5.5	6.2	5.8	5.9	5.9	5.8	5.8	5.9	5.9	5.8	5.9	5.8	5.7	5.6	6.0
17	2	7.5	7.3	7.0	6.6	6.5	6.5	6.2	5.4	5.2	5.2	5.7	6.2	6.1	6.3	6.2	6.1	5.9	6.0	6.2	6.2	6.4	6.2	6.1	6.2	6.2
	24.5	5.6	5.4	5.1	5.0	4.9	4.9	5.0	5.1	5.2	5.5	5.8	5.1	5.6	6.1	6.2	5.5	5.0	5.1	6.2	6.7	6.7	6.7	6.8	6.7	5.7
18	2	6.1	6.1	6.2	6.0	6.0	6.2	6.2	6.2	6.2	6.5	6.6	6.7	7.0	7.2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.8	7.8	6.8
	24.5	6.5	6.4	6.3	6.3	6.3	6.5	6.6	6.2	6.9	7.2	7.8	8.9	9.5	10.0	11.3	12.9	13.8	14.2	12.2	11.1	10.8	10.8	10.4	10.1	9.1
19	2	7.1	7.0	7.0	6.9	6.9	7.0	7.1	7.4	7.8	8.0	8.2	8.8	9.4	10.2	10.8	10.8	11.4	11.7	12.4	12.1	11.2	11.1	11.1	10.5	9.2
	24.5	9.7	9.6	8.9	8.7	8.9	8.2	7.8	7.2	7.4	7.3	7.6	7.1	6.4	5.1	4.8	5.0	4.8	4.8	4.0	3.8	3.6	3.6	3.8	4.0	6.3
20	2	9.7	9.7	9.8	9.8	8.7	8.0	7.0	6.8	7.1	7.5	8.0	7.7	6.8	6.2	5.5	5.0	5.0	5.0	5.0	4.1	4.5	4.7	4.8	4.9	6.7

20	21.5	4.2	5.4	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0
21	21.5	4.8	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
22	21.5	4.5	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
23	21.5	5.0	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
24	21.5	5.5	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
25	21.5	5.2	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
26	21.5	5.7	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
27	21.5	5.3	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
28	21.5	5.1	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
29	21.5	5.6	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
30	21.5	5.4	5.5	5.0	5.5	5.9	5.7	4.4	12.6	11.1	9.3	5.4	5.0	
Mean--	21.5													

Mean--

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939—Continued

Date	Height of observation, ft.	Average for hour ending at—																								mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 a. m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
May	1	24.5	4.0	4.1	4.2	4.1	4.0	4.0	4.1	4.1	4.0	4.1	4.0	4.0	3.6	3.8	3.4	3.3	3.3	3.4	3.2	3.1	3.3	3.4	3.9	3.7
	2	24.5	4.0	4.1	4.1	3.6	3.8	3.7	3.9	3.8	3.6	3.9	3.9	3.9	3.8	4.0	3.5	3.6	3.6	3.6	3.3	3.8	4.1	4.1	4.3	3.9
	3	24.5	4.3	4.4	4.6	4.4	5.2	5.2	5.0	3.9	3.3	3.0	3.7	3.5	3.5	3.6	3.6	3.4	3.4	3.4	3.4	3.6	3.6	3.5	3.4	3.8
	4	24.5	4.7	4.9	4.8	4.8	5.1	5.2	4.6	4.0	3.8	3.3	3.7	3.5	3.6	3.8	4.0	4.1	4.2	3.9	3.9	4.2	4.2	4.1	4.0	4.3
	5	24.5	3.6	3.7	3.7	3.8	3.8	3.9	3.8	3.8	3.9	3.9	4.1	4.2	4.0	4.0	3.8	3.8	3.8	3.6	3.5	3.8	3.6	3.6	3.6	3.8
	6	24.5	3.8	3.8	4.2	4.2	4.3	4.4	4.5	4.6	4.6	4.8	5.0	5.0	4.9	4.8	4.6	4.6	4.6	4.4	4.3	4.3	4.4	4.3	4.3	4.4
	7	24.5	4.4	4.3	4.4	4.4	3.9	3.8	4.0	4.4	4.6	4.7	5.0	5.0	5.2	5.3	5.0	5.2	5.2	4.8	5.0	5.4	5.6	5.1	6.0	4.9
	8	24.5	5.4	5.3	5.0	4.9	4.9	4.9	5.1	5.4	5.9	6.0	5.0	5.1	5.1	5.1	5.3	5.4	5.4	6.5	5.2	5.0	5.1	6.6	6.1	5.4
	9	24.5	5.7	5.7	5.8	5.0	5.7	5.5	6.3	6.5	6.6	6.1	5.8	6.0	6.0	6.0	6.2	6.3	6.2	5.0	6.1	6.3	6.6	6.6	6.4	6.1
	10	24.5	6.2	6.1	6.6	6.9	7.0	6.5	6.6	7.1	7.8	7.1	6.8	7.3	7.6	8.0	8.2	8.2	8.1	8.1	8.1	7.8	7.4	7.6	7.3	7.3
	11	24.5	6.8	6.8	7.8	7.3	7.2	6.9	7.3	7.8	8.2	8.3	7.9	8.2	8.4	9.1	9.1	8.9	9.0	8.0	8.5	9.3	9.2	8.6	8.2	8.1
	12	24.5	7.2	7.2	7.8	7.6	7.7	7.7	7.6	8.4	8.6	9.6	10.3	9.3	7.6	7.8	7.6	8.0	8.4	8.6	8.4	8.0	8.2	8.2	8.4	8.2
	13	24.5	7.6	7.8	8.4	8.5	8.2	8.0	8.1	9.9	9.5	10.9	11.3	11.6	9.9	9.9	9.7	9.0	9.8	10.2	9.9	8.9	9.0	8.9	9.1	9.3
	14	24.5	8.7	9.0	9.2	9.3	9.8	9.8	9.9	10.2	10.4	10.3	9.9	10.0	9.7	9.1	9.0	9.2	9.3	10.8	10.9	11.7	12.4	12.4	12.4	10.0
	15	24.5	9.5	9.6	9.7	10.5	10.6	10.6	10.6	11.2	11.6	11.5	12.8	12.4	12.5	12.1	11.7	11.0	10.7	10.4	10.5	10.9	11.6	11.9	8.9	10.7
	16	24.5	8.4	8.6	8.7	8.2	7.7	7.5	7.0	6.9	7.2	7.1	7.2	6.3	5.8	5.5	5.3	5.4	5.6	6.0	6.0	6.3	6.9	9.1	9.0	11.7
	17	24.5	8.0	9.2	9.8	9.0	8.1	7.8	7.4	7.5	8.1	8.3	7.8	7.5	6.8	7.1	6.6	6.7	7.1	7.4	7.6	6.8	7.2	7.7	8.2	6.8
	18	24.5	6.6	6.6	6.4	6.5	6.4	6.8	7.0	8.6	8.4	8.0	7.5	8.0	7.2	6.8	7.1	7.0	7.1	7.1	7.1	7.0	6.2	5.0	4.9	6.8
	19	24.5	7.8	7.4	7.3	7.2	7.2	7.7	8.0	8.6	8.4	7.9	8.1	8.8	7.4	7.3	7.4	7.4	7.4	7.3	7.8	7.0	6.2	5.4	5.0	7.3
	20	24.5	5.0	4.6	4.6	4.2	4.2	4.2	4.2	4.3	4.2	4.2	4.2	4.5	4.5	4.4	4.4	4.3	4.4	3.9	4.0	5.2	5.4	5.2	5.8	4.6
	21	24.5	5.1	5.0	4.5	4.2	4.3	4.4	4.4	4.5	4.5	4.5	4.7	4.9	4.9	4.9	4.9	4.7	4.5	5.0	4.6	5.8	6.0	6.3	6.6	5.0
	22	24.5	5.8	6.1	6.2	6.3	5.7	5.3	5.2	6.1	6.9	6.8	7.0	7.1	7.2	7.0	6.9	6.5	6.6	6.5	6.3	6.5	6.4	6.3	6.3	6.0
	23	24.5	6.4	6.8	6.7	6.9	5.5	5.6	5.8	6.5	7.7	7.8	7.6	7.8	8.0	7.7	7.6	7.3	7.4	7.3	6.9	7.1	7.0	7.1	7.0	6.4
	24	24.5	6.6	6.6	6.6	6.5	6.1	5.8	5.8	6.3	4.9	5.0	5.3	5.3	5.3	5.0	4.9	4.6	4.6	4.7	4.5	4.4	4.7	5.2	6.0	5.4
	25	24.5	6.2	6.3	6.1	6.1	6.7	6.6	6.6	5.9	5.8	6.1	6.3	6.5	6.2	6.1	6.1	5.8	5.6	5.4	5.2	5.4	5.9	6.1	6.2	6.3
	26	24.5	6.2	6.2	6.1	6.2	5.9	5.6	6.2	5.8	5.2	4.0	3.5	2.7	2.8	2.8	3.0	3.1	3.2	3.4	3.8	4.4	4.7	4.8	5.6	4.6
	27	24.5	6.4	6.3	6.3	6.2	5.8	5.6	6.8	6.4	5.3	4.8	4.2	3.5	3.4	3.6	3.7	3.7	3.9	3.8	4.2	4.9	5.2	5.4	6.0	5.7
	28	24.5	6.8	6.6	6.4	6.2	5.9	5.8	5.8	5.8	5.6	5.7	5.6	5.7	6.0	6.1	6.1	6.3	6.1	5.6	6.0	6.4	6.5	6.8	7.2	6.2
	29	24.5	7.0	6.8	6.8	6.6	6.3	6.4	6.8	6.9	6.4	6.4	6.6	6.0	6.6	6.9	7.4	7.5	7.9	8.2	8.1	8.3	8.2	8.5	8.0	8.4
	30	24.5	8.9	9.1	9.1	8.7	8.7	8.7	8.5	8.8	9.0	8.9	7.4	7.5	7.9	8.2	8.3	8.2	8.2	8.0	8.2	7.5	7.6	8.3	7.9	7.8
	31	24.5	9.1	9.0	9.0	8.4	8.4	8.7	9.1	9.2	9.6	10.0	9.2	7.6	8.0	8.9	8.8	9.1	8.8	8.5	8.3	8.0	8.2	8.6	8.3	8.7
	32	24.5	7.8	7.9	8.1	8.6	8.4	8.5	8.1	8.7	9.2	9.9	11.0	10.6	9.9	9.6	9.3	8.9	8.9	8.6	8.8	9.0	9.2	9.5	9.5	9.0
	33	24.5	8.2	8.4	8.7	8.5	8.4	8.7	8.7	9.2	9.9	10.7	11.3	11.6	10.4	10.1	9.5	9.5	9.5	9.2	9.5	9.9	10.1	10.1	10.3	9.5



20	24.5	9.9	9.8	10.1	10.1	10.2	10.4	10.3	10.6	11.0	11.3	11.1	10.9	11.1	11.0	11.1	11.3	12.2	12.7	13.3	14.6	13.0	13.0	12.5	11.4
	2	10.8	11.0	10.8	10.8	11.0	11.2	11.3	11.4	11.5	11.9	11.7	11.8	12.5	12.4	12.4	12.3	14.5	15.0	15.7	15.2	14.0	13.7	12.6	12.4
21	24.5	12.2	12.5	13.3	12.5	12.0	12.0	11.5	10.9	11.3	10.1	10.1	10.1	10.5	10.9	11.0	10.5	9.6	9.5	10.1	10.6	10.9	11.7	12.5	11.2
	2	12.8	13.2	13.3	12.5	12.1	12.0	12.1	11.3	11.8	10.2	10.9	10.8	12.2	11.7	11.4	11.2	11.0	12.3	11.7	11.5	12.5	12.0	13.8	12.0
22	24.5	13.6	13.7	13.7	13.6	13.7	13.6	13.6	12.7	13.1	13.1	13.2	12.8	12.4	14.8	16.0	14.9	15.2	15.3	15.5	15.9	15.7	15.8	14.4	14.2
	2	13.7	13.8	13.7	13.6	13.5	13.6	13.3	13.0	13.5	13.7	14.0	13.3	13.5	16.2	16.7	15.8	16.0	16.0	16.7	16.7	16.4	16.5	14.4	14.7
23	24.5	14.0	13.5	13.1	13.0	13.0	13.0	13.2	13.8	13.9	12.2	11.3	11.3	9.7	9.7	10.8	12.2	12.5	12.4	13.1	14.3	15.4	15.8	16.3	15.7
	2	13.8	13.4	12.9	12.9	12.5	13.0	13.7	14.2	14.1	13.4	13.0	12.5	11.2	11.5	12.6	13.9	14.1	11.4	13.5	15.7	16.4	16.1	17.6	17.0
24	24.5	16.1	13.8	12.7	12.2	10.7	9.5	9.0	8.7	7.2	7.2	7.1	6.8	7.1	7.5	7.9	7.8	7.7	7.8	7.7	9.3	10.2	10.6	10.4	9.4
	2	16.5	15.1	14.2	13.5	11.7	10.0	9.3	9.5	8.0	7.7	7.6	7.5	7.4	8.2	8.4	8.8	8.6	8.2	8.5	12.2	10.9	11.3	10.9	10.8
25	24.5	16.6	10.3	10.6	10.3	10.6	10.5	9.8	9.8	10.0	9.8	9.8	10.2	10.3	10.5	10.6	11.1	11.4	11.5	10.2	9.1	9.0	9.6	10.3	10.7
	2	10.7	10.8	10.8	10.5	10.4	10.3	10.0	9.7	9.7	10.0	9.1	10.5	10.4	10.6	11.0	11.6	11.7	11.6	10.9	9.5	9.5	9.8	10.7	11.5
26	24.5	11.3	11.7	12.0	12.2	12.1	12.5	12.3	11.8	11.5	11.2	12.0	12.6	13.3	14.1	14.3	14.7	14.9	15.5	14.7	14.5	14.2	14.5	13.9	13.8
	2	11.5	11.7	11.8	12.3	12.5	12.4	12.2	11.7	12.7	11.3	9.8	12.8	13.6	14.7	15.0	15.2	15.4	15.7	15.1	14.8	14.2	14.5	13.9	13.7
27	24.5	13.3	13.4	13.3	13.3	13.2	13.1	12.4	14.1	14.1	14.1	14.1	13.8	13.0	12.3	12.5	13.5	13.5	14.8	13.7	14.5	14.0	15.4	14.8	14.8
	2	13.7	13.8	13.1	12.8	12.9	13.7	13.7	14.2	14.7	14.9	14.1	13.4	13.0	13.2	13.8	14.5	15.2	15.5	15.2	14.7	15.8	15.8	15.3	15.0
28	24.5	15.0	14.8	14.7	14.5	14.3	14.5	15.1	15.3	15.5	14.9	15.4	14.3	15.0	15.0	15.0	14.8	14.3	15.4	15.9	16.7	16.2	17.1	17.7	17.4
	2	15.5	15.2	14.8	14.4	14.2	14.7	15.3	15.7	15.2	15.2	15.6	14.2	15.8	16.1	16.3	15.6	15.3	15.6	16.3	16.7	16.6	17.4	17.0	16.6
29	24.5	16.6	15.6	15.8	15.3	15.8	15.7	14.6	13.5	13.4	12.5	11.5	11.8	11.9	12.0	11.7	11.6	13.2	12.6	13.3	13.7	13.4	13.1	14.6	14.4
	2	16.2	15.1	13.9	13.0	12.7	12.9	14.0	13.5	13.2	12.1	11.8	12.3	12.1	12.3	11.9	12.2	13.7	12.6	13.1	13.9	13.7	12.9	14.2	14.0
30	24.5	14.8	14.7	14.5	14.1	14.3	13.7	13.4	12.2	11.6	10.5	10.7	10.2	10.1	10.9	10.9	11.7	11.7	12.0	12.8	14.0	14.8	15.7	15.8	15.2
	2	13.8	13.3	12.9	12.5	12.4	12.4	13.0	12.6	11.9	10.9	11.2	10.9	10.8	11.2	11.2	12.1	11.9	12.2	12.6	14.2	14.8	15.3	15.6	15.2
31	24.5	13.4	12.7	12.5	12.6	13.5	13.6	13.5	13.1	11.3	11.1	11.1	10.7	11.1	10.1	10.4	10.2	10.6	11.1	11.6	11.5	11.6	13.0	14.0	13.6
	2	13.7	12.7	12.4	12.4	12.9	12.2	12.6	12.7	11.3	11.4	11.4	11.4	11.2	10.8	11.1	11.2	11.0	11.4	12.1	11.9	12.3	13.4	13.6	12.1
Mean	24.5	9.1	9.0	9.0	8.9	8.8	8.7	8.7	8.6	8.7	8.5	8.5	8.4	8.2	8.3	8.4	8.4	8.5	8.7	8.7	8.9	9.1	9.3	9.4	9.4
	2	9.4	9.3	9.2	9.0	8.8	8.8	9.0	9.0	9.0	9.1	9.0	9.0	9.0	9.2	9.2	9.2	9.3	9.4	9.5	9.7	9.8	9.8	9.8	9.8

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at —																								mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 a. m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
June	Feet	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.
	24.5	12.9	12.0	12.6	13.4	13.2	13.6	14.6	14.8	14.4	14.2	13.7	14.1	15.0	16.0	16.4	16.2	14.4	14.4	15.6	15.2	13.6	14.0	13.8	13.1	14.2
1	2	12.8	12.4	12.7	12.8	13.0	13.9	15.2	14.2	14.6	14.4	13.9	13.0	14.9	16.0	16.4	15.8	13.8	13.8	15.2	14.6	13.5	13.3	13.2	12.6	14.0
2	24.5	12.1	11.3	12.3	12.1	12.0	11.9	11.8	11.7	11.6	11.5	11.8	12.3	12.5	13.3	13.8	13.6	12.8	13.2	10.2	10.5	9.6	9.4	9.1	7.5	10.0
3	2	12.2	11.9	12.3	12.1	12.0	11.9	11.8	11.7	11.6	11.5	11.8	12.3	12.5	13.3	13.8	13.6	12.8	13.2	10.2	10.5	9.6	9.4	9.1	7.5	10.0
4	24.5	7.4	7.6	8.0	8.9	8.5	8.8	9.4	9.6	9.5	9.8	9.7	9.6	9.0	9.0	7.7	7.5	7.5	9.1	10.6	10.7	10.5	11.2	11.0	11.6	9.2
5	2	9.0	9.3	9.7	10.0	10.1	10.4	11.3	11.4	11.5	11.7	11.4	11.1	10.7	10.3	9.2	9.2	9.4	12.2	12.7	12.6	13.0	14.1	12.7	13.9	11.1
6	24.5	12.0	12.0	12.0	12.0	11.8	11.8	12.0	12.2	12.1	11.6	11.7	12.2	12.2	12.2	12.8	11.1	9.5	9.1	9.2	9.6	10.4	11.1	10.8	9.3	11.3
7	2	13.6	13.7	13.9	14.0	14.0	14.2	13.8	13.9	13.5	13.3	14.1	14.1	14.4	14.3	14.6	12.4	11.0	10.8	11.5	12.5	13.2	13.2	12.0	10.4	13.2
8	24.5	7.2	6.8	6.9	7.1	7.1	7.0	6.7	6.3	7.0	6.6	6.3	5.2	5.7	5.6	5.3	5.5	5.5	6.4	7.1	8.0	8.6	9.6	10.0	10.0	7.0
9	2	8.5	8.2	8.4	8.5	8.4	8.4	7.7	7.3	7.9	7.6	7.4	6.8	6.4	6.0	6.1	6.5	6.5	7.2	8.8	9.8	10.3	11.2	11.7	11.3	8.2
10	24.5	10.2	10.3	11.0	11.0	10.4	10.9	10.5	8.8	8.7	8.7	8.6	8.8	8.8	9.1	9.2	9.1	9.1	9.3	8.7	8.8	9.1	6.6	5.4	5.2	9.0
11	2	11.0	11.5	12.0	11.7	11.3	11.5	11.2	10.2	9.9	10.1	10.1	10.1	10.6	10.4	10.4	10.5	10.4	10.3	10.2	10.1	10.4	7.0	6.0	5.9	10.2
12	24.5	5.6	6.6	7.1	7.0	7.3	8.5	9.4	9.8	8.6	7.9	8.1	8.1	8.2	8.0	8.3	8.0	8.0	8.7	7.9	7.7	7.4	7.7	7.8	7.2	8.3
13	2	7.3	8.4	9.0	9.7	10.3	11.2	11.5	11.7	12.0	12.2	12.7	12.7	13.3	11.9	16.0	14.3	14.5	15.8	17.1	17.1	13.8	14.5	14.8	13.5	12.8
14	24.5	13.4	12.9	13.0	12.7	12.7	12.5	12.3	12.6	12.4	12.1	11.7	12.2	11.8	11.8	11.7	11.9	11.6	11.7	12.4	14.1	13.4	14.0	15.2	14.0	12.7
15	2	9.4	10.3	10.5	10.7	11.7	12.1	12.3	12.3	12.3	12.8	13.2	12.7	12.6	12.9	12.8	13.0	15.1	12.9	12.7	12.5	14.6	16.1	15.2	15.6	16.2
16	24.5	12.8	12.8	12.4	12.6	12.7	12.5	12.5	13.1	12.9	12.7	12.6	12.9	12.8	13.0	15.1	12.9	12.7	14.1	11.3	11.7	14.9	15.3	16.0	15.7	16.4
17	2	15.2	15.2	15.8	14.7	14.8	15.0	14.6	14.5	14.5	14.7	13.7	14.2	14.3	12.9	12.7	14.1	11.3	11.7	14.9	15.9	16.0	16.5	16.6	17.5	16.7
18	24.5	15.3	16.0	15.8	15.1	14.9	15.5	15.7	15.1	15.2	15.6	14.7	15.6	16.2	15.0	13.7	15.6	16.2	15.0	15.1	15.1	12.9	12.9	12.9	12.4	12.0
19	2	16.9	16.6	16.5	16.2	15.5	14.3	13.7	13.3	13.2	13.3	13.4	13.0	12.5	12.1	13.2	12.5	12.8	13.2	13.2	12.5	12.0	12.6	12.5	12.3	14.1
20	24.5	16.0	16.4	16.1	15.6	15.2	14.8	14.7	14.1	13.8	14.4	14.6	14.3	14.1	13.0	13.1	13.1	13.1	13.1	13.1	9.1	9.4	9.8	9.7	9.7	10.1
21	2	12.1	12.8	13.2	13.4	13.5	12.7	11.2	9.0	8.4	8.3	8.4	8.5	9.1	8.8	9.2	8.9	9.1	8.8	6.0	6.7	10.1	11.0	11.4	11.3	11.3
22	24.5	12.8	13.1	13.6	13.7	13.0	13.0	12.6	10.1	9.2	9.3	9.1	9.5	10.0	9.9	10.1	9.9	10.0	10.0	9.7	10.1	11.0	11.4	11.4	11.4	11.0
23	2	10.1	9.9	10.7	10.5	9.6	9.3	10.1	11.9	13.9	15.1	15.3	15.3	15.0	14.5	15.2	14.3	13.7	15.5	14.7	14.3	14.6	14.6	14.4	14.3	13.2
24	24.5	11.6	11.7	11.9	11.6	10.7	9.5	10.6	13.0	13.9	15.3	15.0	15.3	15.1	14.7	16.0	14.9	13.9	15.5	14.2	13.4	13.8	13.8	13.6	13.6	13.4
25	2	14.3	14.2	14.2	14.2	14.0	14.1	13.7	13.1	13.7	11.8	13.3	13.1	11.9	12.2	10.5	10.0	10.2	9.8	9.2	9.0	9.0	9.2	9.5	9.7	9.1
26	24.5	13.5	13.5	13.5	13.3	13.3	13.4	13.3	13.0	13.2	12.0	14.3	13.5	12.8	12.2	11.9	11.8	11.2	10.8	10.2	10.6	10.9	10.9	11.0	10.7	12.3
27	2	9.0	8.7	9.8	10.2	10.0	9.1	10.0	9.9	10.9	11.5	11.2	12.0	12.1	12.4	13.1	13.2	13.3	13.6	14.1	15.9	16.6	16.7	16.2	16.4	12.3
28	24.5	10.3	10.5	11.7	11.0	11.0	10.1	10.2	10.2	11.8	12.3	12.4	12.8	13.3	13.9	14.5	14.6	15.0	15.0	15.5	16.7	17.5	17.8	17.0	16.4	13.4
29	2	16.1	15.6	15.7	15.5	15.4	15.7	16.2	16.0	16.5	15.2	14.3	14.1	13.6	13.8	13.8	13.8	14.2	14.4	15.4	16.5	17.3	16.8	16.8	16.8	15.3
30	24.5	16.1	15.6	15.3	15.2	15.2	15.4	16.0	16.8	17.2	16.7	15.8	15.9	15.2	15.6	15.7	15.5	16.0	16.5	17.4	18.7	18.8	18.3	17.8	17.0	16.4
31	2	15.5	15.6	16.3	16.6	16.6	16.0	17.3	17.6	17.2	17.5	18.3	18.6	18.7	18.2	17.2	18.0	17.5	18.0	17.5	18.1	18.8	18.6	18.5	17.9	17.7
32	24.5	16.7	16.9	17.0	16.7	16.4	17.0	17.3	17.2	18.3	19.0	19.0	19.4	18.8	18.3	19.0	18.4	19.0	18.8	19.2	20.1	20.2	19.6	20.2	19.9	18.4
33	2	19.4	16.8	15.0	14.4	13.4	12.6	12.1	11.8	12.2	12.1	12.0	12.1	11.8	11.8	12.0	11.3	11.1	11.1	10.8	10.3	10.1	9.9	9.8	9.8	12.2
34	24.5	10.8	17.3	15.5	14.6	13.4	13.3	12.2	12.0	12.4	12.3	12.2	12.3	12.5	12.4	12.4	11.6	11.5	11.4	11.3	11.0	10.7	10.4	10.3	10.5	12.6
35	2	9.6	9.6	9.9	10.2	9.9	10.2	11.6	11.6	11.8	11.9	12.2	12.2	12.4	12.8	13.2	13.4	13.7	13.8	14.0	13.7	14.6	15.2	15.0	14.9	12.5
36	24.5	10.3	10.2	10.4	10.6	11.0	10.8	11.9	12.2	12.2	12.5	12.8	13.1	13.6	14.2	14.3	14.7	14.9	15.0	14.0	15.3	14.8	14.8	14.8	14.6	13.0

20	24.5	15.1	15.1	15.4	15.3	15.5	16.1	16.2	15.8	16.1	15.8	14.2	12.9	13.8	13.6	14.8	14.7	14.3	14.6	14.6	15.0	14.4	14.8	15.1	14.4	14.9
21	2	14.6	14.1	14.1	14.1	14.8	15.1	15.6	15.5	16.4	16.0	14.8	13.7	15.1	14.7	15.5	15.4	14.8	15.3	16.2	15.4	15.1	15.7	15.2	14.5	15.1
22	2	11.6	10.7	10.2	9.5	9.2	9.2	9.2	9.2	8.6	8.3	8.5	8.8	8.9	9.0	9.3	9.8	10.0	10.2	10.7	11.8	12.6	13.5	13.8	13.7	10.3
23	2	11.4	10.6	10.2	9.8	9.5	9.7	9.9	10.3	9.5	9.2	9.6	10.1	10.5	10.8	11.0	11.2	11.3	11.2	11.8	12.4	13.0	14.4	14.5	14.1	11.1
24	2	13.7	13.8	14.2	14.5	13.8	10.9	10.5	10.0	9.4	9.5	9.6	9.9	11.3	12.8	13.8	13.2	13.9								12.0
25	2	11.4	14.5	14.5	14.9	15.0	11.8	11.4	10.8	10.6	11.3	11.1	11.4	13.2	11.7	15.2	15.2	15.5								13.3
26	2																									
27	2																									
28	2																									
29	2																									
30	2																									
Mean	24.5	12.5	12.4	12.6	12.5	12.4	12.3	12.4	12.2	12.3	12.1	12.0	12.0	12.1	12.2	12.4	12.4	12.4	12.4	12.6	12.7	12.8	12.8	12.9	12.7	.....
	2	12.9	12.8	12.9	12.8	12.7	12.7	13.0	12.8	12.9	13.0	12.9	13.1	13.2	13.4	13.5	13.4	13.3	13.6	13.6	13.6	13.6	13.4	13.2	.....	.....

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																								mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 a. m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
July	1	Feet	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.
		24.5	15.7	15.6	14.0	13.9	12.8	11.7	10.9	10.4	10.0	9.3	9.2	8.9	8.8	9.0	9.3	8.8	8.9	9.2	10.2	11.4	11.1	10.4	10.1	10.8
	2	24.5	15.4	15.2	13.9	13.9	13.6	12.3	12.1	11.8	11.3	9.5	9.3	9.3	9.3	9.0	9.3	8.8	8.8	9.0	11.5	13.0	12.3	10.9	9.7	10.2
		24.5	10.1	11.6	11.2	11.3	11.2	11.1	11.3	9.9	10.1	10.3	9.2	7.8	8.0	8.1	8.3	8.1	8.3	8.4	9.8	11.1	12.1	12.4	10.3	9.5
	3	24.5	19.0	10.8	10.8	10.7	10.6	10.7	11.4	10.0	10.0	10.4	9.7	7.9	8.6	8.5	8.5	8.3	8.3	8.2	10.2	11.7	12.3	12.2	10.9	10.0
		24.5	9.4	9.2	9.2	8.7	8.3	8.5	8.4	8.2	8.0	8.3	8.6	8.8	8.9	9.2	9.7	10.3	10.7	10.8	11.8	11.3	11.0	12.0	13.7	14.5
	4	24.5	10.2	9.8	9.8	8.2	7.8	8.2	8.2	7.7	7.7	8.4	8.7	8.6	9.1	8.6	10.0	10.1	10.3	10.4	11.0	11.3	10.8	11.7	12.9	13.8
		24.5	14.9	14.9	15.0	15.0	14.9	14.7	14.2	14.4	13.9	13.9	14.1	14.5	14.5	13.5	14.6	16.1	16.0	15.9	16.3	17.0	17.2	15.9	14.4	15.1
	5	24.5	13.4	13.6	13.7	14.0	14.2	14.5	14.0	14.3	14.2	14.2	14.1	14.7	15.6	13.3	13.7	16.1	15.6	15.6	16.0	16.3	16.4	16.4	15.3	14.1
		24.5	13.5	12.8	12.7	12.5	12.3	12.4	12.6	12.7	13.7	15.9	15.5	15.8	13.8	15.8	15.5	15.5	15.9	16.0	14.7	14.7	14.5	14.3	14.3	14.1
	6	24.5	13.3	12.5	12.4	12.3	12.3	12.4	12.4	12.6	13.3	15.0	14.7	15.2	15.1	15.2	15.2	15.2	15.3	14.7	14.0	14.1	13.6	13.7	13.6	13.0
		24.5	13.9	13.9	13.9	13.9	14.1	14.1	14.3	13.9	14.9	17.8	17.1	15.8	14.6	11.6	14.2	14.3	14.5	14.1	15.1	16.8	16.8	16.0	16.5	16.3
	7	24.5	13.9	13.9	13.7	13.9	14.4	15.2	15.7	15.7	15.2	17.2	16.8	16.5	16.3	16.2	16.8	16.9	16.6	17.2	17.7	18.5	17.8	17.3	17.3	18.2
		24.5	16.0	16.5	16.5	16.6	16.9	17.1	17.5	17.3	17.2	16.6	17.2	17.1	16.7	17.7	16.9	16.6	16.2	16.5	16.7	16.1	17.3	20.0	20.0	21.0
	8	24.5	17.2	16.7	17.0	16.5	16.5	17.6	17.8	17.8	18.2	17.4	19.5	18.1	17.9	20.0	18.2	17.6	17.5	18.2	18.2	17.8	18.4	20.0	20.5	20.5
		24.5	20.0	19.8	19.8	19.5	20.5	19.5	17.9	18.5	17.9	17.7	18.1	17.9	17.9	17.8	17.6	19.0	19.5	20.0	22.0	24.0	22.5	23.5	25.0	19.9
	9	24.5	19.8	18.8	19.0	19.5	19.5	20.0	19.2	19.5	20.5	20.8	21.0	21.0	21.5	21.5	(21.0) (19.5)	19.5	19.8	19.5	21.5	23.0	21.5	20.5	23.0	21.0
		24.5	23.0	24.0	23.0	20.5	21.0	21.0	18.5	16.3	16.7	16.0	17.3	17.5	17.2	17.4	17.0	17.6	16.9	16.1	16.7	17.7	20.0	20.0	22.0	19.0
	10	24.5	20.5	20.5	20.5	17.9	18.0	18.5	17.2	16.1	16.3	17.1	17.7	17.5	18.5	17.9	18.0	18.6	17.5	16.5	16.7	19.0	19.5	19.6	19.5	18.3
		24.5	19.0	18.5	18.5	17.9	17.3	17.9	17.8	15.8	13.9	12.3	12.2	11.6	11.5	11.1	11.4	12.0	12.6	12.5	15.3	15.7	16.8	16.2	13.0	11.8
	11	24.5	18.5	17.3	17.5	17.0	16.3	17.0	16.6	16.6	14.7	13.3	12.8	12.6	12.5	12.2	12.7	13.0	12.8	15.1	15.5	15.9	15.3	12.8	11.2	14.7
		24.5	10.7	10.5	10.2	10.0	10.1	10.5	10.2	9.5	9.5	9.4	9.2	8.5	7.8	7.8	7.9	8.0	7.6	7.8	8.1	8.6	9.0	8.8	8.7	8.0
	12	24.5	10.3	10.0	10.0	9.5	9.6	10.0	9.8	9.4	9.6	9.4	9.4	9.0	8.7	8.7	9.0	8.8	8.3	8.3	8.8	9.5	10.2	9.5	9.1	9.4
		24.5	8.5	8.6	8.6	8.6	8.5	8.9	9.0	9.4	9.6	10.1	10.1	10.6	10.2	10.1	9.9	10.2	10.6	11.0	10.9	11.1	11.3	12.5	12.7	13.3
	13	24.5	9.1	8.9	8.9	8.9	8.9	9.5	10.1	10.1	10.3	11.1	11.2	11.8	11.8	10.9	11.0	10.8	11.6	11.8	11.5	11.8	12.3	13.4	14.1	14.5
		24.5	13.7	13.3	13.2	13.6	13.3	14.0	15.3	15.5	15.2	14.9	14.8	14.5	13.9	13.3	13.6	14.1	14.8	17.3	17.4	17.4	17.5	17.6	17.1	15.0
	14	24.5	14.7	13.8	14.2	14.1	14.3	15.0	16.3	15.9	15.6	15.1	15.6	15.4	15.4	14.7	14.0	14.4	14.9	16.4	18.1	17.8	17.8	18.5	17.5	17.1
		24.5	15.7	14.9	15.0	15.3	15.0	15.3	17.7	17.8	16.2	17.0	15.9	14.8	14.4	13.4	12.8	11.1	10.5	9.7	9.1	8.7	8.5	8.1	8.0	8.1
	15	24.5	15.4	14.8	15.0	15.3	15.0	15.0	17.1	17.2	17.5	19.2	17.7	17.2	16.1	15.4	14.6	13.3	11.7	11.1	10.2	10.2	9.7	9.3	9.4	9.0
		24.5	8.0	8.3	8.4	8.6	7.9	7.9	7.7	7.6	7.1	7.0	7.0	7.1	7.1	7.3	7.4	7.6	7.5	7.4	7.5	7.3	7.2	7.1	7.3	7.5
	16	24.5	9.3	9.0	9.6	9.7	9.2	8.8	8.8	8.2	8.0	8.0	8.2	8.3	8.4	8.6	8.7	8.6	8.7	8.6	8.3	8.2	8.8	9.5	9.7	9.2
		24.5	7.8	7.7	7.8	7.4	7.8	7.8	6.9	7.1	6.7	6.7	6.4	6.4	6.5	6.5	6.4	6.4	6.4	6.6	6.8	6.9	6.9	7.6	8.0	8.3
	17	24.5	9.2	8.8	8.6	8.7	8.5	8.2	7.8	7.5	7.4	7.5	7.3	7.3	7.5	7.5	7.5	7.5	7.6	7.0	7.0	8.6	8.9	9.5	9.7	10.6
		24.5	8.5	8.8	9.0	9.4	8.8	8.9	9.8	9.1	8.4	8.4	7.7	7.9	8.3	8.4	9.2	9.7	10.2	10.2	10.8	11.3	12.0	12.2	12.0	12.4
	18	24.5	9.6	10.0	9.6	9.6	9.2	9.5	9.8	9.5	8.5	8.4	8.8	8.8	9.4	9.7	10.3	10.9	11.1	11.4	13.1	13.4	13.3	13.1	13.0	13.0
		24.5	13.2	13.2	13.6	13.9	13.0	12.4	11.6	11.2	10.8	10.8	11.2	11.4	12.4	12.6	12.8	12.4	12.3	12.9	12.6	12.2	12.4	12.6	12.6	12.4
	19	24.5	14.2	14.2	14.6	14.5	14.0	13.5	12.0	11.9	11.7	12.4	13.0	13.7	13.0	13.2	13.0	13.0	13.1	13.3	12.5	11.8	11.9	11.8	11.8	12.9

19	24.5	12.6	12.6	12.6	12.5	12.6	12.5	12.1	10.7	9.3	10.6	12.1	11.9	11.9	11.7	11.6	11.2	10.9	11.0	10.9	11.1	12.5	12.5	13.2	13.3	11.8
20	2	11.9	11.7	11.7	11.7	11.7	11.7	11.3	10.4	9.3	11.3	13.8	13.3	13.3	13.0	12.8	12.7	12.2	12.0	11.9	12.7	13.4	14.5	14.4	14.0	12.4
21	24.5	13.8	13.3	13.2	13.3	12.8	12.2	12.1	12.3	13.2	14.2	12.2	11.0	11.0	11.0	12.1	12.5	12.2	12.4	12.9	12.8	12.8	12.1	12.3	12.2	12.5
22	2	14.2	14.1	14.0	13.4	12.6	13.0	12.3	12.7	13.3	14.3	12.3	12.0	11.9	11.3	12.8	12.4	12.4	12.4	13.1	12.6	12.6	12.3	12.3	12.2	12.8
23	24.5	11.4	9.8	9.6	10.7	10.7	10.6	11.1	11.3	11.5	12.1	11.9	11.2	9.9	10.3	9.6	9.1	9.7	10.0	9.8	9.8	10.0	11.9	11.8	12.0	10.7
24	2	11.3	10.4	9.9	11.0	11.1	10.9	11.3	12.1	12.4	13.9	13.9	12.5	11.0	11.1	10.4	10.1	10.2	10.5	9.9	10.2	10.1	11.9	11.8	12.0	11.2
25	24.5	11.9	11.5	11.5	11.4	11.0	10.3	10.1	9.5	9.3	10.1	10.2	10.6	11.4	11.8	11.7	11.0	11.2	11.5	11.8	11.9	11.1	11.7	11.8	11.8	11.1
26	2	12.2	11.9	11.8	11.4	11.0	10.4	10.5	9.9	9.7	10.5	10.7	10.9	11.8	12.1	12.0	11.2	11.7	11.8	12.4	11.9	11.0	11.9	11.8	11.8	11.4
27	24.5	12.0	12.3	12.1	12.2	12.1	11.7	12.4	12.2	12.2	12.2	12.2	12.4	12.1	12.8	13.3	13.6	13.9	14.3	14.7	15.8	15.9	15.9	15.0	15.0	13.3
28	2	12.0	12.1	11.8	11.7	11.5	11.1	12.0	12.6	12.3	13.2	13.3	13.1	13.1	14.5	15.0	15.1	15.6	15.9	16.3	17.3	18.3	15.2	14.5	15.0	14.3
29	24.5	14.0	13.3	12.9	12.8	13.1	13.1	13.2	13.8	16.1	16.8	15.8	14.6	14.8	15.0	14.9	13.1	12.8	13.2	14.1	15.7	17.9	15.6	15.1	15.5	10.2
30	2	15.4	14.9	14.6	14.9	15.4	15.9	16.4	17.0	18.0	17.8	17.1	15.9	16.4	17.1	17.5	14.7	15.0	15.5	17.5	18.8	18.3	16.0	15.4	14.0	14.3
31	24.5	14.9	14.6	14.6	13.8	14.3	14.5	14.2	14.3	13.6	13.8	14.2	14.2	13.1	14.1	14.2	14.2	14.5	14.6	15.4	15.3	17.9	15.6	15.1	15.5	10.2
32	2	15.7	15.5	15.5	14.8	15.1	15.0	15.1	15.8	15.8	15.8	16.2	16.3	15.6	16.0	16.2	16.3	16.5	16.6	16.8	16.8	16.7	17.8	17.0	16.4	14.0
33	24.5	15.2	14.7	14.0	14.2	13.8	14.2	15.0	15.3	15.0	14.5	14.3	13.5	13.1	12.7	12.5	13.0	13.2	12.8	12.4	14.0	16.1	16.4	16.2	15.9	14.3
34	2	15.5	14.8	15.0	15.3	15.3	15.6	15.8	16.3	16.5	15.9	14.7	14.7	14.2	13.4	13.5	13.5	13.4	15.5	16.1	16.3	17.3	16.7	16.0	16.7	10.7
35	24.5	15.2	14.7	15.5	15.7	15.5	15.9	16.5	17.5	18.0	17.7	16.3	17.0	15.8	15.2	15.9	14.8	14.2	16.3	16.6	16.8	16.6	16.7	17.3	15.4	14.3
36	2	17.5	17.6	17.6	18.0	18.0	18.1	17.7	17.2	16.3	16.5	15.0	14.6	14.5	14.8	16.4	16.0	15.0	14.9	16.3	16.9	16.8	16.5	17.0	16.2	10.2
37	24.5	17.2	17.6	17.6	17.6	17.6	18.0	18.1	17.5	16.7	16.5	17.0	15.6	15.7	15.7	17.0	17.9	16.7	16.0	15.3	16.4	17.6	17.7	17.9	16.7	10.7
38	2	18.0	18.0	18.0	17.6	17.6	17.7	17.2	17.2	16.6	15.4	11.9	14.4	14.6	14.3	14.4	14.7	17.4	18.8	18.5	18.5	18.5	17.3	17.7	17.5	17.0
39	24.5	16.7	17.0	17.4	17.5	17.5	17.4	17.1	17.1	16.8	16.8	15.7	15.8	15.9	15.9	15.2	15.8	15.0	18.1	18.0	17.6	17.6	18.1	18.0	17.6	16.9
40	2	17.3	17.4	17.1	16.4	16.2	16.2	16.3	15.7	14.7	14.9	14.8	14.9	14.6	15.2	15.5	15.2	14.6	14.9	16.0	16.7	14.9	15.0	15.0	15.1	15.6
41	24.5	17.7	17.4	16.7	16.3	16.3	16.6	16.5	16.4	15.8	16.0	15.7	16.1	16.0	16.6	16.8	16.7	15.9	16.2	17.3	17.1	14.8	15.3	15.8	15.2	10.3
42	2	14.7	14.4	13.9	13.6	13.4	13.6	13.9	13.7	11.6	11.0	11.2	11.2	11.1	11.2	10.8	10.9	10.9	11.4	12.5	13.1	13.5	13.3	12.3	11.5	12.5
43	24.5	14.6	13.9	13.6	13.4	12.9	13.3	14.3	13.2	12.7	12.2	12.0	12.0	12.1	12.1	11.7	11.7	11.6	12.1	13.0	13.9	14.0	14.5	14.4	14.2	13.0
Mean	24.5	13.9	13.8	13.6	13.5	13.4	13.4	13.3	13.0	12.8	12.9	12.7	12.5	12.3	12.3	12.4	12.5	12.6	12.8	13.3	13.8	14.1	14.2	14.1	14.0	-----
2	13.9	13.7	13.6	13.5	13.3	13.5	13.6	13.5	13.4	13.7	13.7	13.7	13.5	13.4	13.4	13.5	13.4	13.3	13.5	14.0	14.5	14.5	14.6	14.4	14.2	-----

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939—Continued

Date		Height of observations	Average for hour ending at—																								Mean
			1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	12 p. m.	13 p. m.	12 p. m.	
Aug. 1	Feet	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.
	24.5	11.4	11.5	11.4	11.6	12.4	12.8	12.5	11.7	11.6	12.2	12.5	12.2	12.5	13.0	12.8	13.1	13.4	13.9	14.6	15.4	15.9	15.8	15.2	14.4	13.1	13.1
2	2	12.2	12.3	12.6	12.8	13.7	13.3	13.5	12.9	12.6	12.7	13.2	13.3	13.5	13.6	13.7	13.7	13.7	14.0	14.8	16.4	16.7	17.5	17.0	14.8	13.9	13.9
	2	13.7	13.1	13.2	14.0	14.5	13.7	13.4	13.9	14.3	14.6	14.7	14.0	14.6	14.7	14.8	14.7	14.7	15.3	16.0	16.4	17.2	17.6	17.4	16.6	14.9	14.9
3	2	14.3	13.5	13.6	14.1	15.1	15.0	13.8	14.4	14.9	14.8	15.7	15.5	15.1	15.7	15.7	15.3	15.3	15.5	16.1	17.2	17.9	18.5	17.9	17.0	15.5	15.5
	2	16.3	16.3	16.1	15.8	15.5	15.3	15.2	15.0	15.8	15.8	14.8	13.5	13.0	12.7	13.0	13.5	13.7	13.6	12.5	12.7	15.1	14.9	14.8	14.9	14.5	14.5
4	2	16.4	16.1	15.8	15.0	14.3	14.2	15.4	16.0	16.6	16.8	16.1	14.8	11.1	13.6	13.9	14.6	14.1	13.3	12.6	12.1	14.8	15.0	14.9	14.7	14.8	14.8
	2	14.9	14.6	14.1	14.4	-----	-----	14.4	14.6	14.6	14.9	13.1	14.7	13.2	13.2	13.3	13.1	13.0	12.9	12.9	13.0	13.5	13.5	13.4	13.8	13.8	
5	2	14.5	13.7	13.5	14.1	-----	-----	15.1	15.3	13.3	16.1	14.3	14.8	15.0	14.4	14.3	14.5	14.3	14.3	14.5	14.3	14.4	15.0	14.6	14.2	14.4	14.5
	2	13.2	12.2	10.8	9.9	9.1	9.0	9.4	9.9	10.2	9.5	9.1	9.1	9.4	9.6	10.0	9.8	10.3	10.1	10.5	11.4	12.2	12.6	13.7	10.6	10.6	
6	2	14.0	12.9	11.3	10.3	9.6	9.3	9.9	10.2	10.8	9.8	9.9	10.0	10.4	10.7	10.8	10.7	11.5	10.9	11.8	12.7	13.0	13.3	14.0	11.3	11.3	
	2	13.9	14.1	14.3	14.2	13.9	14.4	15.4	16.1	16.1	14.4	11.7	11.0	11.1	10.7	9.8	9.7	9.3	9.4	10.4	11.2	12.2	12.2	13.1	13.8	12.6	
7	2	13.7	14.0	13.6	13.4	13.4	14.1	15.4	16.2	16.3	15.3	13.3	11.7	12.1	12.2	11.0	10.6	10.2	10.3	11.4	12.6	13.1	13.0	13.9	13.1	12.9	
	2	13.5	13.7	13.7	13.0	13.6	13.6	13.4	13.1	11.6	11.2	10.8	10.8	10.4	10.0	10.4	10.9	11.5	12.6	13.4	14.0	14.2	15.5	16.0	12.6	12.6	
8	2	14.1	14.4	14.2	13.4	13.0	13.0	14.3	13.6	12.1	11.4	11.3	10.9	11.1	10.5	10.4	10.5	11.1	11.7	13.1	13.8	14.3	15.2	15.0	16.4	12.9	
	2	16.0	16.1	16.3	16.2	15.4	15.3	15.1	13.4	11.8	11.9	12.1	12.0	12.3	12.3	12.3	12.7	12.0	13.7	14.7	15.3	15.7	16.4	16.1	16.2	14.9	
9	2	16.5	16.3	16.2	15.4	14.2	14.6	15.1	14.2	12.0	12.1	12.4	12.3	12.6	12.4	12.6	12.9	12.8	13.5	15.0	16.2	16.6	16.5	16.4	16.2	14.4	
	2	17.1	16.3	15.6	15.5	15.9	16.0	15.9	15.0	15.0	14.2	13.6	12.7	12.9	13.3	13.4	13.7	14.7	14.6	15.1	18.1	19.2	19.0	18.0	17.3	15.5	
10	2	16.6	16.1	15.4	15.2	15.3	15.1	15.7	15.1	15.2	14.8	13.8	12.8	12.6	12.9	13.2	13.3	14.0	13.7	14.7	17.5	18.5	17.9	17.6	17.1	15.2	
	2	17.4	15.7	15.4	13.5	11.8	11.1	10.1	9.2	9.1	8.7	8.8	8.6	8.5	8.3	8.2	8.5	8.6	8.8	8.7	8.8	8.1	7.9	8.2	8.5	10.6	
11	2	17.0	15.9	15.6	14.0	12.5	12.3	11.1	10.2	9.8	9.4	9.3	9.5	9.3	9.2	8.6	8.6	8.9	9.3	9.9	9.3	8.4	8.8	9.0	10.6	10.6	
	2	9.7	10.1	10.1	-----	-----	-----	10.9	11.4	10.4	9.4	9.6	9.0	9.1	9.5	9.8	10.4	10.5	10.7	10.8	10.6	11.7	12.6	13.5	13.9	10.7	
12	2	10.1	10.4	10.6	-----	-----	-----	11.7	12.0	11.2	11.1	11.2	11.1	11.2	11.1	11.2	11.1	11.4	11.1	10.7	10.9	11.3	12.3	13.7	14.5	14.6	
	2	14.7	15.0	14.6	14.5	14.5	13.8	14.3	15.2	14.7	12.9	12.4	12.0	11.9	11.4	11.1	11.0	11.9	12.5	12.9	14.2	15.0	16.1	16.0	16.5	13.8	
13	2	14.6	14.3	13.6	13.5	13.2	12.7	14.0	15.5	14.8	13.4	13.2	13.2	13.2	12.6	12.0	-----	12.9	13.0	12.9	14.2	15.3	16.2	16.4	16.6	14.0	
	2	16.5	16.4	16.0	16.9	16.6	16.6	17.6	15.3	14.9	13.2	13.2	13.1	12.4	13.6	13.5	13.6	14.2	14.0	15.1	15.7	15.1	14.9	15.9	15.1	15.0	
14	2	16.6	16.3	16.1	15.9	15.7	15.7	16.8	16.3	15.7	14.8	14.4	14.3	13.9	14.4	14.6	14.5	14.0	15.3	15.7	16.4	15.7	15.8	15.6	16.2	15.5	
	2	16.2	16.0	16.1	16.1	16.1	17.1	16.6	16.3	16.5	16.1	16.0	16.1	16.4	15.9	15.4	15.7	16.8	17.6	17.6	16.7	16.7	17.2	15.5	15.3	16.4	
15	2	17.1	16.3	16.1	16.7	17.0	16.6	16.8	16.9	17.1	17.0	16.6	17.0	17.1	17.1	17.4	16.4	17.9	18.1	18.0	16.9	17.2	17.4	17.3	17.2	17.1	
	2	17.6	17.3	17.3	17.4	17.4	17.4	17.3	17.1	16.5	16.2	15.3	14.2	14.3	14.3	13.9	12.3	12.8	12.6	14.4	17.2	17.8	18.0	18.8	19.3	16.1	
16	2	17.0	16.8	17.0	17.5	17.4	17.4	17.3	17.5	17.0	16.7	16.7	16.4	16.1	14.9	15.3	14.7	14.1	13.5	13.1	15.3	17.7	17.9	18.1	18.5	18.5	16.4
	2	19.0	19.1	18.8	18.8	18.8	19.6	20.0	19.1	18.1	16.3	16.5	15.1	14.6	13.8	13.2	13.0	13.4	12.7	12.7	14.6	16.0	15.2	14.5	14.8	16.2	
17	2	18.6	18.5	18.0	18.0	19.0	19.4	20.0	20.2	20.0	16.7	16.3	16.0	14.2	13.7	13.4	12.9	13.3	13.1	13.1	15.1	16.2	15.4	14.6	15.4	16.3	
	2	15.3	15.4	15.1	14.9	14.5	14.5	15.3	15.3	14.3	13.4	13.2	13.6	13.8	13.5	13.8	15.5	12.3	12.3	13.4	14.2	14.9	16.7	17.5	17.4	14.6	
18	2	15.4	15.1	14.9	14.5	14.0	14.1	15.2	15.2	14.4	13.7	13.3	13.8	13.9	13.6	14.4	17.2	12.6	12.6	14.6	15.0	16.0	17.2	17.5	17.3	14.8	
	2	17.1	17.1	16.4	15.5	15.3	15.6	16.2	17.4	15.7	15.2	14.6	14.3	14.6	14.6	14.5	15.6	15.5	16.2	16.6	17.8	18.6	18.0	17.8	17.1	16.1	
19	2	16.2	16.1	15.1	14.1	13.7	14.0	15.3	17.3	15.7	15.4	15.0	14.5	14.6	14.6	14.6	15.9	15.7	16.0	16.5	17.8	17.8	17.4	17.1	16.1	15.5	
	2	16.8	15.9	15.7	16.0	16.2	16.6	16.1	16.3	16.5	16.5	17.0	17.4	15.8	16.3	15.9	14.9	14.5	15.2	14.9	14.4	13.9	13.7	13.3	13.2	15.6	
	2	16.2	15.5	14.7	15.2	15.6	15.4	15.5	15.7	16.2	16.9	17.4	18.0	17.0	16.6	16.3	15.5	15.6	15.4	15.1	14.6	14.2	14.0	13.7	13.7	15.5	

20	24.5	13.5	13.7	13.9	13.7	13.6	13.4	13.2	12.6	12.7	13.7	14.3	15.4	15.6	17.1	16.6	17.2	17.1	17.4	19.0	18.2	17.4	17.3	17.7	15.1
	2	13.6	13.8	13.8	13.7	13.7	13.4	13.7	13.4	13.5	14.0	16.1	17.1	18.0	17.1	16.6	17.2	17.1	17.4	20.5	19.0	18.2	17.4	17.7	15.1
21	24.5	16.6	16.5	16.3	16.3	15.6	15.1	14.7	13.9	13.4	13.6	16.1	17.1	18.0	17.1	16.6	17.2	17.1	17.4	19.0	18.2	17.4	17.7	15.1	15.1
	2	16.6	16.3	16.2	16.2	15.5	15.1	14.7	14.7	14.3	14.1	13.5	12.5	13.0	13.5	13.7	14.1	14.5	15.2	17.1	17.6	18.0	18.0	17.5	15.4
22	24.5	17.3	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
	2	17.3	17.9	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
23	24.5	13.7	13.1	13.2	13.3	11.7	11.8	11.3	11.1	10.7	10.8	10.9	11.5	12.5	12.7	13.3	14.4	15.6	16.4	17.6	18.0	17.7	17.9	17.9	14.8
	2	14.1	14.0	13.7	13.3	12.9	13.1	12.8	12.5	12.2	13.1	13.1	13.1	14.3	14.7	14.4	15.0	15.6	16.4	17.6	18.0	18.3	15.3	15.3	15.2
24	24.5	18.0	17.6	17.0	16.7	16.7	16.7	17.1	16.6	16.0	15.4	15.6	15.6	14.5	13.2	12.7	11.2	12.4	14.1	14.7	11.9	14.3	15.3	15.3	16.2
	2	17.6	16.7	16.5	16.2	16.2	16.7	18.5	18.5	17.9	17.4	17.8	17.2	16.5	15.5	14.8	13.4	14.2	16.4	15.5	12.8	15.2	16.0	15.9	16.2
25	24.5	15.3	15.5	15.5	15.8	15.9	15.7	15.5	15.3	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
	2	16.6	16.3	16.0	15.7	16.2	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
26	24.5	16.2	15.9	15.8	15.9	14.2	14.0	12.8	12.7	11.7	11.4	11.3	11.1	11.4	11.7	11.2	11.5	12.3	12.6	13.7	13.0	12.9	13.4	14.1	13.1
	2	15.4	15.4	15.4	15.6	14.3	14.1	13.1	13.2	12.8	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4
27	24.5	14.6	14.7	14.4	14.0	12.4	11.4	10.8	10.2	10.6	10.9	11.7	11.7	10.8	10.3	10.6	10.8	11.0	10.7	10.5	10.7	10.6	10.7	11.1	11.5
	2	14.7	14.7	14.3	13.9	12.2	11.5	11.3	10.9	11.2	11.8	12.4	12.5	12.0	11.4	11.4	11.9	11.5	11.0	10.9	11.4	11.5	11.1	11.7	12.0
28	24.5	11.2	11.7	11.5	11.7	12.2	12.4	12.5	12.9	11.4	9.6	8.7	9.0	9.3	9.1	9.3	8.8	8.9	9.1	9.6	10.2	11.0	10.8	10.9	10.5
	2	11.8	12.0	12.0	12.3	12.5	12.8	13.0	13.3	11.9	10.3	9.7	10.1	9.9	9.8	10.1	9.4	9.3	9.5	10.4	11.1	11.7	11.3	11.0	11.1
29	24.5	10.9	11.0	11.0	10.9	11.1	11.5	12.0	12.5	12.9	10.8	10.4	9.4	8.7	8.8	9.2	9.4	9.6	11.3	10.2	9.7	9.8	9.5	9.5	10.1
	2	11.5	11.6	11.4	11.5	11.6	11.8	12.0	12.5	12.9	10.9	10.4	9.4	8.7	8.8	9.2	9.4	9.6	11.3	10.2	9.7	9.8	9.5	9.5	10.1
30	24.5	9.3	9.3	9.2	8.5	8.7	8.9	9.1	9.2	8.7	7.9	6.3	6.1	7.0	7.4	7.5	9.0	9.4	9.5	10.9	11.7	11.9	11.8	11.5	9.2
	2	9.7	9.8	9.9	9.1	9.1	9.3	9.6	10.0	10.9	9.7	7.4	7.4	8.3	7.7	7.1	8.0	10.2	9.8	11.0	12.1	12.6	12.4	12.0	9.9
31	24.5	10.8	11.0	11.1	10.8	10.5	10.5	11.0	11.1	9.8	9.6	9.5	8.3	7.7	7.1	6.8	6.9	7.1	8.0	11.1	12.1	12.8	14.5	13.9	10.3
	2	11.1	11.4	11.7	11.2	10.9	11.0	11.3	12.4	10.8	10.5	10.3	9.8	9.8	9.6	9.4	9.6	9.7	10.7	13.4	13.3	13.8	13.1	12.8	11.2
Mean...	24.5	14.8	14.6	14.4	14.2	14.0	13.8	14.0	13.7	13.2	12.6	12.3	12.1	12.0	11.9	11.9	12.0	12.3	12.6	13.4	13.9	14.4	14.6	14.7	14.7
	2	14.9	14.6	14.3	14.2	13.9	13.8	14.2	14.2	13.9	13.5	13.2	13.2	13.0	13.1	12.9	13.0	13.2	13.4	14.1	14.6	15.1	15.1	15.1	15.0

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																								Mean
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
		a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	
	Feet	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	
Oct. 1	24.5																									
	2																									
2	24.5																									
	2																									
3	24.5																									
	2																									
4	24.5	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.2	8.6	7.1	7.1	6.6	6.4	6.6	6.7	6.8	8.1	6.8	7.9	7.5	7.2	6.8	6.8	6.8	7.5
	2	8.1	8.1	8.1	8.1	8.1	8.1	8.3	8.4	8.8	7.2	7.8	7.8	6.9	7.0	7.1	7.1	7.0	7.2	8.5	7.6	7.3	6.9	6.8	6.5	7.6
5	24.5	6.7	6.6	6.4	6.6	6.7	6.9	6.7	6.8	7.2	8.1	8.7	8.1	8.3	8.7	9.3	9.4	9.6	10.1	10.2	11.8	10.8	10.2	9.8	10.1	8.5
	2	6.5	6.5	6.6	6.8	6.9	7.1	7.3	7.4	7.8	8.5	9.8	8.6	9.0	9.3	9.4	10.0	10.4	10.1	10.4	10.9	10.3	9.8	9.6	9.8	8.7
6	24.5	9.8	9.1	9.5	9.7	9.7	0.7	0.7	0.7	10.1	9.0	11.0	10.4	10.8	9.8	9.6	10.6	11.1	10.9	12.0	14.3	14.2	13.1	11.8	11.0	10.7
	2	10.0	9.6	9.4	9.8	9.9	10.1	10.3	10.5	11.7	10.6	11.2	11.0	11.3	10.9	10.9	11.7	11.7	13.0	12.4	13.0	12.3	11.7	10.7	11.0	11.0
7	24.5	7.2	9.8	9.7	9.7	9.0	8.7	8.7	10.4	9.3	9.9	10.7	9.2	7.1	7.0	7.6	8.2	8.6	10.1	10.3	10.1	10.2	11.9	11.5	11.0	9.4
	2	9.3	9.2	8.8	8.8	8.6	8.3	8.4	9.8	9.8	10.1	10.8	9.3	7.4	7.6	8.5	9.0	10.5	11.2	11.0	10.8	10.8	10.9	10.5	10.3	9.6
8	24.5	10.8	10.6	10.2	10.0	9.8	9.8	10.1	10.8	9.6	9.8	9.6	9.4	9.4	9.8	8.9	9.8	10.5	12.6	12.6	12.7	14.1	13.3	13.2	12.6	10.8
	2	10.1	9.8	9.8	9.4	9.3	9.0	9.0	10.3	10.3	9.8	9.6	9.4	9.4	9.9	9.2	10.2	12.3	13.2	12.8	12.8	13.0	12.5	12.2	11.9	10.6
9	24.5	12.6	12.4	12.2	12.1	11.8	11.8	11.8	13.1	12.3	12.2	11.7	10.9	11.3	11.2	10.7	11.2	11.9	14.3	14.7	17.4	16.4	15.6	15.3	14.6	12.9
	2	11.7	11.5	11.2	11.2	11.1	10.9	11.1	12.7	12.2	11.8	11.4	11.2	11.4	11.3	11.2	11.8	13.1	15.4	15.3	16.0	15.6	14.9	14.4	13.9	12.6
10	24.5	14.3	13.6	13.3	13.1	12.9	12.9	12.6	14.0	13.2	13.5	13.0	10.3	8.7	8.8	8.8	9.3	10.2	11.2	11.6	11.6	11.7	11.4	11.4	11.7	
	2	13.4	13.0	12.7	12.5	12.3	12.2	12.2	13.6	13.5	13.7	13.3	10.4	10.1	9.0	9.6	10.1	11.8	13.0	12.4	12.3	12.0	12.1	12.0	12.1	
11	24.5	10.9	10.9	11.4	11.2	10.8	10.9	10.2	9.2	9.2	8.2	7.4	7.2	7.0	7.1	6.8	6.9	6.7	6.4	6.2	6.2	6.2	6.3	6.6	6.3	8.2
	2	11.4	11.6	13.0	11.3	11.0	10.9	9.0	9.4	9.2	8.2	7.4	7.6	7.4	7.4	7.4	7.3	7.4	7.4	7.4	9.1	10.0	9.6	9.2	7.2	8.0
12	24.5	6.2	6.3	6.2	6.3	6.5	7.1	9.0	9.4	7.2	6.8	7.2	7.4	7.0	7.1	6.8	6.9	7.0	6.8	6.5	6.0	7.0	7.0	6.7	6.7	8.5
	2	6.8	7.2	7.4	7.2	7.9	8.5	9.2	9.8	7.7	7.2	7.7	7.4	7.3	7.4	7.4	7.4	9.1	10.0	9.6	9.7	10.1	9.8	9.2	7.2	8.0
13	24.5	4.3	3.8	3.8	3.7	3.6	3.4	4.3	5.2	4.3	4.3	4.3	4.2	4.4	4.4	4.6	4.4	4.6	5.0	5.2	5.8	6.1	6.1	6.4	6.6	4.7
	2	4.5	3.9	4.5	4.5	4.4	4.5	4.9	5.3	4.5	4.3	4.1	4.4	4.5	4.7	4.9	4.7	4.8	6.2	6.1	6.0	5.8	6.0	6.3	6.6	5.0
14	24.5	6.8	7.2	7.4	7.7	8.3	7.8	7.4	6.0	5.2	4.8	4.2	4.2	3.5	3.5	3.5	3.5	3.4	3.4	3.2	3.1	3.0	2.9	2.8	4.8	
	2	6.3	6.4	6.2	7.1	7.4	7.3	6.1	6.0	5.1	4.4	4.5	4.0	3.7	3.6	3.2	3.3	3.2	3.2	3.4	3.7	4.2	4.6	4.4	4.9	3.5
15	24.5	2.8	3.0	3.0	3.4	3.4	3.5	3.7	3.7	3.3	3.0	3.2	3.3	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.1	3.0	3.0	2.9	2.8	4.8
	2	2.8	2.9	3.1	3.3	3.5	3.7	3.1	3.7	3.2	2.9	3.1	4.1	3.3	3.4	3.5	3.4	3.6	3.8	4.2	4.1	4.1	4.2	4.6	4.9	3.5
16	24.5	5.0	4.8	4.6	4.4	4.2	4.1	4.1	4.8	4.5	3.7	3.4	3.5	3.4	3.6	3.8	3.9	3.9	3.8	4.5	4.8	4.8	5.0	5.1	5.4	4.3
	2	4.5	4.4	4.3	4.1	4.1	4.0	4.0	4.8	5.3	4.1	3.8	3.9	4.0	4.1	4.2	4.2	4.1	4.1	4.8	5.1	5.1	5.0	5.2	5.1	4.4
17	24.5	5.5	5.3	5.2	5.0	4.7	4.6	5.0	5.1	4.5	3.8	4.3	4.6	4.8	4.8	4.5	4.4	4.1	3.0	3.9	3.8	3.6	3.3	3.2	3.0	4.4
	2	5.3	5.2	5.1	4.8	4.8	4.6	5.2	5.2	5.5	4.3	4.9	5.1	5.2	5.0	4.9	4.4	4.1	3.8	4.0	3.9	3.7	3.5	3.4	3.2	4.5
18	24.5	2.9	2.9	2.8	2.6	2.6	2.8	2.8	2.7	2.5	2.6	2.8	2.8	2.8	2.9	3.0	3.2	3.4	3.4	3.2	3.4	3.4	3.6	3.9	4.4	3.1
	2	3.1	3.2	3.1	3.1	3.1	3.2	3.2	3.0	2.8	3.1	3.2	3.2	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.7	3.9	4.1	4.5	3.2
19	24.5	4.8	5.0	5.1	5.3	5.1	5.2	5.2	5.5	5.5	5.5	6.1	6.5	7.0	7.2	7.1	7.4	7.2	8.5	8.5	8.4	8.9	9.4	9.7	6.8	
	2	4.7	4.8	4.9	5.1	5.2	5.1	5.1	5.5	5.5	5.5	6.1	6.3	6.6	6.9	7.2	7.1	7.4	7.2	8.4	8.6	8.3	8.5	8.9	9.3	6.8



20	24.5	9.9	10.0	9.3	8.6	8.1	7.8	7.4	8.0	9.0	9.0	9.6	9.2	8.4	8.2	8.2	8.2	8.2	8.3	8.4	8.5	8.8	9.0	8.9	8.6
21	2	0.2	8.8	8.2	7.7	7.3	7.2	7.3	9.0	9.6	9.0	9.2	8.8	8.5	8.0	8.0	8.0	7.8	8.5	8.5	8.7	8.4	8.4	8.2	8.4
22	2	7.9	7.5	7.6	7.3	7.2	7.4	7.4	8.3	9.9	9.2	8.8	8.4	8.3	7.8	7.7	7.4	7.0	8.2	8.6	9.6	11.4	11.1	10.0	9.4
23	2	9.1	9.0	8.7	8.3	8.2	8.0	7.7	8.1	8.4	8.2	8.2	7.5	6.3	3.8	3.9	4.8	4.4	4.2	4.0	3.9	3.9	3.9	3.8	8.6
24	2	3.8	3.7	3.8	3.8	3.8	3.9	3.9	4.0	4.1	4.2	4.4	4.2	4.1	3.8	3.8	3.8	3.6	3.6	3.6	3.6	3.7	3.7	3.9	7.3
25	2	5.1	5.2	5.4	5.5	5.6	5.2	5.0	5.0	5.2	5.0	4.4	4.5	4.5	4.4	4.3	4.6	4.6	5.0	5.0	5.1	5.1	5.1	5.4	4.0
26	2	5.7	5.8	5.8	5.8	6.0	6.0	6.0	6.6	6.7	6.7	6.7	7.1	7.1	7.5	7.8	8.2	8.6	8.8	9.3	9.4	9.4	9.4	9.4	5.0
27	2	6.0	6.0	5.7	6.0	6.8	6.8	6.8	6.6	6.4	6.8	6.9	7.0	7.2	7.5	7.8	8.0	8.3	8.6	8.9	9.1	9.0	8.9	8.9	4.9
28	2	8.9	8.9	8.9	8.9	8.9	8.3	8.2	8.3	9.6	10.4	10.0	10.1	10.1	9.4	9.7	9.8	9.4	9.4	10.8	11.1	11.2	11.1	11.2	10.5
29	2	10.5	10.4	10.4	10.7	10.5	10.5	10.8	11.3	11.3	10.2	10.1	10.2	9.7	9.9	10.2	10.6	10.5	10.2	10.7	11.0	10.8	9.9	9.6	9.8
30	2	0.1	9.1	9.1	9.1	9.1	9.1	9.3	9.8	11.2	12.0	11.9	12.4	13.3	14.6	14.5	14.1	13.9	13.6	12.9	12.0	12.5	12.4	12.1	12.2
31	2	12.0	12.2	12.6	13.2	13.3	13.2	12.9	12.9	10.6	7.2	12.8	13.2	14.2	14.4	15.1	15.1	15.4	13.6	13.6	13.6	13.5	13.5	14.8	13.8
Mean...	2	13.2	13.5	13.4	13.1	12.8	12.7	12.5	12.6	12.3	8.6	5.8	5.4	5.2	4.9	4.3	3.4	3.0	2.7	2.5	2.4	2.5	2.5	2.3	2.3
	2	2.5	2.0	2.0	2.0	2.0	2.0	2.9	3.1	3.1	3.2	3.3	3.2	3.2	3.1	3.2	3.2	3.0	3.0	4.1	3.7	3.7	3.8	4.3	4.5
	2	4.8	4.8	4.8	4.9	4.9	4.9	4.9	5.0	5.0	5.7	6.1	6.5	7.4	7.4	7.1	7.1	7.0	7.0	6.9	6.9	7.0	7.1	7.0	7.2
	2	4.6	4.6	4.6	4.8	4.8	4.8	4.8	5.0	5.0	5.7	6.1	6.5	7.4	7.4	7.1	7.1	7.0	7.0	6.9	6.9	7.0	7.1	7.0	7.2
	2	7.0	7.0	7.0	7.4	7.4	7.4	7.5	7.3	6.9	6.5	6.8	7.2	7.5	7.3	7.4	6.6	6.2	6.3	6.3	6.3	6.3	6.3	6.4	6.4
	2	6.4	6.3	6.3	6.5	6.8	6.8	6.6	6.6	6.6	6.8	7.0	7.2	7.2	6.8	6.7	6.6	6.1	5.7	5.8	5.7	5.3	5.2	4.8	6.3

TABLE 11.—Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939—Continued

Date	Height of observations	Average for hour ending at—																							
		1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	12 p.m.
Nov.	Feet	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.
	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5
1	2	4.4	4.3	4.4	4.5	4.3	4.0	3.9	4.0	3.7	3.4	3.0	3.0	3.2	3.1	3.2	3.0	3.2	3.3	3.6	3.8	4.2	4.7	4.7	4.7
2	2	4.2	4.2	4.4	4.3	4.2	4.0	3.8	3.8	3.8	3.6	3.6	3.2	3.4	3.7	3.5	3.3	3.4	3.8	4.0	4.1	4.5	4.5	4.4	4.4
3	2	4.4	3.8	4.2	4.0	4.0	4.0	4.0	4.1	4.4	3.9	3.7	3.4	3.1	3.0	3.0	2.9	2.8	2.7	2.7	2.8	2.7	2.5	2.6	2.6
4	2	4.2	4.6	3.4	4.9	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5	2	2.8	2.7	2.7	2.6	2.8	3.0	3.1	3.0	3.0	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.4	4.3	4.8	4.8	4.7	4.8	4.8	4.8
6	2	2.9	2.8	2.8	2.8	2.8	2.7	3.0	3.0	2.9	3.0	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.4	4.3	4.8	4.8	4.7	4.8	4.8
7	2	4.7	4.5	4.7	4.6	4.7	4.5	4.8	4.6	4.7	4.8	4.6	4.6	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
8	2	3.6	3.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
9	2	3.1	3.4	3.4	3.3	3.3	3.2	3.2	3.3	3.4	3.5	3.9	4.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
10	2	4.3	4.2	4.1	4.2	4.8	4.4	4.4	4.4	4.6	4.6	4.8	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
11	2	4.6	6.5	6.5	6.6	6.8	5.0	5.1	5.1	5.0	5.2	5.2	3.8	3.5	3.4	3.3	3.1	3.1	3.0	3.2	3.1	3.6	3.0	3.0	3.0
12	2	2.6	2.6	2.6	2.7	2.7	2.6	2.6	2.6	2.8	2.8	2.9	2.8	3.0	2.9	2.8	2.8	2.9	2.8	3.1	3.0	2.8	3.1	3.2	3.2
13	2	2.7	2.6	2.7	2.8	2.7	2.9	2.9	3.1	3.2	3.2	3.2	3.2	3.4	3.2	3.1	3.1	2.9	3.1	3.4	3.5	3.6	3.3	3.6	3.6
14	2	3.5	3.3	3.4	3.6	3.6	3.5	3.3	3.0	3.0	3.0	2.8	2.8	3.0	2.9	2.8	2.8	2.9	2.8	3.4	3.3	3.3	3.4	3.4	3.4
15	2	3.7	3.6	3.6	3.7	3.6	3.8	3.7	3.3	3.3	3.3	3.6	3.6	3.0	3.5	3.5	3.4	3.3	3.3	3.4	3.3	3.3	3.4	3.4	3.4
16	2	5.1	5.4	5.3	4.8	5.0	4.2	4.0	3.9	3.2	3.2	3.1	3.0	3.2	2.8	2.7	2.6	2.5	2.6	2.4	2.4	2.2	2.2	2.2	2.2
17	2	0.2	0.0	6.0	5.2	4.4	3.8	3.7	3.7	3.8	4.0	3.8	3.8	3.8	3.6	3.4	3.3	2.9	3.1	3.3	3.0	3.0	3.0	3.0	3.0
18	2	2.2	2.3	2.2	2.5	2.5	2.5	2.4	2.4	2.7	2.0	3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.2	3.4	3.3	3.3	3.4	3.4	3.4
19	2	3.0	3.0	3.0	3.0	3.1	3.2	3.2	3.4	3.5	3.4	3.7	3.5	3.7	3.8	3.7	3.6	3.4	3.5	3.6	3.6	3.6	3.6	3.6	3.6
20	2	3.5	3.4	3.2	3.1	3.1	3.2	3.2	3.1	3.1	3.2	3.2	3.3	3.4	3.4	3.3	3.2	3.3	3.3	3.2	3.4	3.3	3.3	3.4	3.4
21	2	4.0	4.1	4.0	4.0	3.8	3.4	3.3	3.2	3.2	3.7	4.2	3.6	3.6	3.7	3.5	3.4	3.5	3.5	3.7	3.6	3.4	3.5	3.5	3.5
22	2	4.0	4.1	4.0	4.0	3.8	3.4	3.3	3.2	3.2	3.7	4.2	3.6	3.6	3.7	3.5	3.4	3.5	3.5	3.7	3.6	3.4	3.5	3.5	3.5
23	2	4.3	4.1	4.0	3.9	4.0	3.8	3.8	3.9	4.1	4.6	4.8	5.3	5.5	4.6	4.5	4.4	4.4	4.4	4.7	4.6	4.6	4.6	4.6	4.6
24	2	4.0	4.0	4.1	3.8	3.5	3.7	3.6	3.6	3.7	3.6	2.7	2.6	2.5	2.5	2.6	2.3	2.2	2.1	2.2	2.6	2.5	2.7	2.7	2.7
25	2	3.9	3.8	3.6	3.4	3.4	3.4	3.2	3.2	3.2	3.0	3.2	3.4	3.1	2.9	3.2	3.0	2.8	2.5	2.7	3.1	2.8	2.7	2.7	2.7
26	2	2.0	2.4	3.6	3.4	3.2	3.4	3.6	3.5	3.8	4.2	4.3	4.4	4.3	4.2	4.3	4.2	4.1	3.8	4.2	4.1	4.2	4.2	4.2	4.2
27	2	2.8	3.1	3.4	3.7	3.6	3.6	3.8	4.0	4.5	4.9	4.8	4.9	4.8	4.7	4.6	4.5	4.5	4.0	4.2	4.6	4.5	4.5	4.5	4.5
28	2	4.2	4.3	4.5	4.6	4.6	4.6	4.5	4.7	4.8	4.2	5.6	4.8	4.3	4.2	4.5	4.8	4.9	4.8	5.0	5.4	5.4	5.7	6.1	6.8
29	2	4.0	4.6	4.8	4.7	4.7	4.6	4.6	4.7	4.8	4.2	5.1	4.8	4.2	4.1	4.8	4.2	4.7	4.8	5.0	5.2	5.3	5.3	5.0	5.0
30	2	7.2	8.5	8.8	8.8	8.9	9.0	8.6	8.4	8.4	8.2	7.9	8.5	8.2	8.1	7.7	6.6	6.0	5.8	5.3	5.0	4.8	4.6	4.4	4.1
	2	0.6	7.3	7.6	7.6	7.0	7.5	7.4	7.6	7.6	8.1	7.5	7.5	7.4	7.7	6.9	6.0	5.6	5.2	4.7	4.5	4.5	4.2	4.0	3.8

## EVAPORATION FROM LAND AND WATER SURFACES

[illegible]

TABLE 11. - Specific humidity at indicated levels, Arlington Experimental Farm, Va., 1939 Continued

Date	Height of observation Feet	Average for hour ending at--																							Mean	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
		a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	a. m.	m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	p. m.	
		Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	Gm. per mg.	
1	24.5	4.4	4.1	4.2	4.2	4.2	4.2	4.1	4.2	4.4	4.6	4.8	4.7	4.7	4.3	4.3	4.3	4.0	4.2	4.3	4.6	5.1	5.5	6.3	6.8	4.6
2	24.5	3.8	3.6	3.5	3.4	3.3	3.4	3.4	3.5	4.0	4.2	4.6	4.7	4.5	4.2	4.0	4.3	3.9	4.0	4.2	4.6	5.2	5.6	6.3	6.8	4.3
3	24.5	7.0	7.0	7.1	7.1	7.2	7.2	6.9	7.1	7.3	7.4	7.6	7.8	7.6	7.6	7.6	7.6	7.6	6.6	6.6	5.7	5.5	5.2	5.3	5.0	4.3
4	24.5	4.6	4.5	4.4	4.2	4.2	4.1	1.3	3.6	3.1	3.0	3.1	3.0	3.0	2.9	2.9	2.9	2.9	3.0	3.0	3.1	3.1	3.1	3.4	3.4	3.5
5	24.5	4.6	4.5	4.5	4.3	4.2	4.1	1.0	3.8	3.3	3.2	3.2	3.1	3.0	2.9	3.0	2.9	2.9	2.8	2.8	3.0	3.0	3.2	3.4	3.4	3.0
6	24.5	3.3	3.4	3.3	3.2	3.3	3.4	3.4	3.4	2.7	3.6	3.1	3.0	2.3	2.5	2.4	2.5	2.5	2.6	2.6	2.6	2.7	2.7	2.7	2.7	3.0
7	24.5	3.4	3.3	3.3	3.2	3.0	2.9	3.1	3.3	3.5	3.4	3.3	3.0	2.8	2.9	2.7	2.8	2.8	2.9	2.9	2.9	3.0	3.0	2.9	2.9	3.0
8	24.5	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.1	2.1	2.2	2.4	2.4	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.7	2.8	2.9	2.9	2.9	2.6
9	24.5	2.8	2.7	2.7	2.7	2.7	2.7	2.6	2.3	2.3	2.4	2.5	2.8	2.8	2.6	2.7	2.8	2.8	3.2	3.1	3.1	3.1	3.1	3.1	3.1	2.6
10	24.5	4.2	4.3	4.5	4.6	4.6	4.6	4.8	4.8	4.7	4.5	4.4	4.6	4.2	4.1	3.8	3.5	3.4	3.3	3.3	3.3	3.5	3.6	3.6	3.6	4.1
11	24.5	4.3	4.4	4.6	4.7	4.7	4.6	4.8	4.8	4.7	4.6	4.6	4.8	4.4	4.2	3.8	3.7	3.5	3.5	3.4	3.3	3.5	3.6	3.6	3.6	4.2
12	24.5	3.6	3.5	3.4	3.4	3.4	3.3	3.2	3.4	3.9	4.0	4.3	4.5	3.9	3.6	3.5	3.6	3.4	3.4	3.4	3.4	3.4	3.6	3.4	3.4	3.6
13	24.5	3.2	3.2	3.2	3.2	3.0	3.0	2.9	3.1	3.6	4.4	4.7	4.6	4.0	3.7	3.6	4.0	3.8	3.6	3.6	3.6	3.6	3.6	3.4	3.4	3.6
14	24.5	2.8	2.8	3.0	3.3	2.9	2.4	2.3	2.2	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.4	2.4	2.6
15	24.5	3.4	2.9	2.9	3.1	3.2	2.7	2.5	2.4	2.3	2.4	2.5	2.5	2.5	2.5	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
16	24.5	2.4	2.6	2.6	2.6	2.7	2.8	2.9	3.0	3.0	2.8	3.1	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.5
17	24.5	2.5	2.7	3.0	3.0	3.1	3.0	3.0	3.0	3.0	3.3	3.3	3.0	2.6	2.4	2.4	2.4	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.7
18	24.5	2.8	2.7	2.8	2.8	2.8	3.0	3.0	3.0	3.0	2.6	4.6	4.7	4.9	4.8	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
19	24.5	6.6	5.5	5.5	5.0	5.0	4.7	4.2	4.0	3.6	3.2	3.1	2.8	2.7	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
20	24.5	7.4	7.4	6.8	6.2	5.6	5.4	5.0	4.8	4.5	4.2	4.0	3.8	3.2	3.0	2.7	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
21	24.5	2.2	2.2	2.2	2.1	2.0	1.9	2.0	2.0	2.0	2.0	2.0	1.8	1.5	1.4	1.4	1.5	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.8
22	24.5	2.3	2.3	2.3	2.3	2.3	2.2	2.1	2.1	2.1	2.1	2.1	1.8	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.8
23	24.5	2.0	2.0	2.2	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.0	3.3	4.2	4.8	5.0	4.6	4.9	5.0	4.2	4.6	4.7	4.8	4.1	4.1	1.9
24	24.5	2.2	2.0	2.1	2.1	2.2	2.3	2.6	2.6	2.8	2.9	2.9	3.2	4.0	4.6	4.8	4.5	4.6	4.9	4.2	4.6	4.7	4.8	4.1	4.1	4.3
25	24.5	4.1	3.6	3.0	2.8	2.8	2.7	2.7	2.7	2.6	2.5	2.4	2.4	2.5	2.5	2.5	2.5	2.4	4.6	3.0	4.1	4.1	4.3	4.1	4.1	4.2
26	24.5	3.8	3.3	2.8	2.7	2.6	2.6	2.5	2.7	2.4	2.4	2.3	2.3	2.5	2.5	2.5	2.5	2.5	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2
27	24.5	2.1	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.5
28	24.5	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.9	2.6	2.3	2.1	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.2
29	24.5	2.7	2.6	2.5	2.5	2.5	2.5	2.6	2.6	2.8	2.9	2.8	2.7	2.9	3.2	3.1	3.2	3.2	3.2	3.3	3.4	3.4	3.4	3.4	3.4	2.8
30	24.5	2.6	2.5	2.4	2.4	2.5	2.6	2.6	2.6	2.6	2.7	2.6	2.7	3.2	3.2	3.1	3.2	3.2	3.2	3.3	3.4	3.4	3.4	3.4	3.4	2.1
31	24.5	4.1	4.3	4.4	4.6	4.8	4.9	4.9	4.9	4.8	4.8	5.0	5.1	5.3	5.0	4.8	5.0	5.0	4.8	4.3	3.6	3.4	3.4	3.4	3.4	4.2
32	24.5	4.1	4.2	4.5	4.5	4.5	4.7	4.7	4.6	4.6	4.7	5.2	5.0	5.1	5.1	5.0	5.0	4.5	4.5	4.3	3.6	3.5	3.5	3.5	3.5	3.9
33	24.5	4.2	4.4	4.3	4.6	4.5	4.3	4.3	4.5	4.5	4.5	5.0	4.9	4.6	4.1	3.7	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4.4
34	24.5	4.4	4.3	4.4	4.4	4.2	4.0	4.0	4.0	3.9	4.3	4.7	4.5	4.6	4.1	3.7	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.1
35	24.5	5.2	5.1	5.2	5.2	5.1	4.9	4.8	4.8	5.0	5.3	4.5	4.2	4.1	4.1	4.3	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.8
36	24.5	4.9	4.7	4.5	4.3	4.2	4.1	4.3	4.2	4.4	5.1	5.0	4.5	4.4	4.3	4.8	4.9	4.6	5.0	5.3	5.1	5.4	5.6	5.9	6.3	4.8





19	25	3.5	2.8	2.5	3.5	1.8	1.8	4.0	4.5	1.8	3.8	6.5	9.0	14.0	12.0	11.8	7.5	8.5	6.0	9.0	6.5	6.5	6.5	5.2	4.0	6.0
	1	2.0	1.0	1.5	1.5	1.5	1.5	1.5	2.8	1.8	2.5	4.8	5.8	10.5	9.8	9.2	5.8	5.0	3.8	6.2	3.5	4.0	4.5	4.5	1.8	4.5
	25	4.8	3.0	3.2	4.0	4.5	3.2	2.2	1.8	6.0	4.2	3.8	4.0	5.5	8.8	6.5	6.8	6.2	6.0	3.5	4.0	4.5	4.5	1.8	4.5	
20	1	2.2	1.2	1.8	1.8	3.0	1.0	0	1.0	4.8	2.8	3.0	3.2	4.2	7.2	6.2	5.8	5.5	4.5	2.0	1.5	2.2	2.8	1.5	3.0	
	25	1.0	.8	2.0	.8	1.2	2.2	2.0	2.2	5.2	3.8	3.5	.5	1.0	2.8	3.0	3.5	0	4.2	4.0	4.5	2.0	3.8	7.2	2.8	
21	1	0	0	1.2	0	0	0	0	0	3.5	3.0	2.0	0	.8	.8	2.6	2.5	0	1.8	3.5	.5	2.2	4.5	1.8	1.3	
	25	2.2	1.5	1.5	1.0	5.8	6.0	6.5	8.8	7.2	6.2	16.2	22.5	19.5	21.2	18.8	27.0	30.0	21.5	16.5	12.5	17.5	19.5	16.8	13.3	
22	1	1.8	1.0	.8	.8	3.8	4.0	4.2	6.5	5.2	3.5	12.5	15.5	14.8	15.2	13.8	18.8	21.2	15.2	12.0	8.5	12.2	13.2	8.8	9.5	
	25	10.0	14.0	14.0	11.2	9.0	8.2	8.2	6.5	8.0	7.0	3.8	5.8	12.2	9.5	7.5	4.0	5.0	.8	1.2	1.8	4.2	6.5	6.8	5.0	
23	1	15.8	11.0	11.0	10.5	7.5	6.8	6.2	4.2	4.8	5.0	2.2	5.0	9.5	7.8	5.8	2.5	2.2	.5	0	1.8	4.0	3.8	3.8	5.5	
	25	5.8	8.0	8.0	11.2	10.0	10.0	13.0	10.2	9.2	9.8	6.8	10.5	7.8	7.5	6.0	5.0	2.8	2.5	3.0	1.5	2.2	17.0	11.0	7.7	
24	1	3.2	4.8	8.0	7.2	7.2	10.0	7.5	6.2	7.5	5.0	7.5	5.8	5.0	8.2	4.2	3.2	.8	.8	0	0	0	12.2	6.2	5.0	
	25	19.5	10.5	9.8	21.2	18.5	26.8	20.0	18.2	21.8	19.2	19.8	19.8	22.0	22.2	28.5	27.5	24.0	21.5	14.5	15.0	11.5	8.2	3.8	18.0	
25	1	13.2	6.5	6.5	14.2	12.8	17.8	14.2	13.8	14.2	13.0	14.5	14.0	14.0	15.5	17.0	18.0	16.8	12.5	9.8	9.2	7.2	5.0	3.5	11.8	
	25	6.5	9.8	7.5	5.0	4.2	3.2	2.5	2.0	4.5	4.8	5.5	5.2	6.8	6.2	5.2	5.0	2.5	4.0	4.2	2.2	3.0	2.5	3.8	4.6	
26	1	4.2	6.8	4.8	2.8	0	0	0	.2	1.2	4.0	3.5	3.2	3.0	3.0	3.2	2.5	.5	1.2	3.2	1.5	1.8	1.2	2.5	2.4	
	25	5.0	3.8	4.0	1.8	1.5	3.5	9.0	5.8	13.5	12.8	19.2	12.5	13.5	15.2	14.8	12.2	14.5	11.2	8.0	7.2	5.0	3.5	2.8	4.3	
27	1	3.2	2.0	1.8	1.0	.2	1.5	5.8	3.5	7.5	8.2	12.8	8.5	9.2	10.5	9.8	9.8	9.0	8.0	5.0	4.2	2.8	1.8	1.2	5.3	
	25	6.5	3.2	2.8	2.0	.5	.5	2.2	1.5	4.8	9.5	15.0	13.2	18.8	17.0	17.2	18.2	13.5	10.8	11.5	12.2	10.0	12.8	10.5	9.3	
28	1	4.2	.8	0	.5	0	.2	.5	0	3.8	7.2	10.0	10.5	14.8	12.8	14.0	13.8	9.0	7.2	7.8	7.5	8.8	7.5	8.0	6.4	
	25	9.5	11.0	11.0	12.0	10.8	7.5	7.8	5.2	4.8	6.2	5.5	6.5	3.5	4.2	4.2	2.2	3.2	2.0	2.5	2.8	3.2	2.8	5.2	5.6	
29	1	7.0	8.5	8.0	8.0	4.2	5.5	3.0	2.8	4.8	4.0	4.0	4.0	2.5	2.2	1.5	0	1.8	.5	.2	.8	1.5	2.2	3.2	3.6	
	25	5.5	7.0	5.0	7.8	7.8	10.5	8.5	7.0	5.5	7.0	4.8	4.5	4.5	2.8	4.5	4.5	2.2	10.0	5.0	2.5	7.0	4.2	4.0	5.6	
30	1	4.2	5.2	4.2	7.0	6.5	6.0	5.0	4.2	5.0	5.0	4.0	3.8	2.8	2.2	2.8	3.0	1.5	5.8	2.8	1.0	4.0	2.2	1.5	3.9	
	25	1.8	2.2	1.8	1.2	2.2	6.5	17.0	16.0	19.8	16.0	18.0	17.8	17.0	18.2	12.2	14.0	8.8	6.5	6.2	5.8	10.0	10.8	7.8	10.1	
31	1	.5	1.0	.5	1.0	1.0	4.0	12.2	11.5	13.2	10.0	11.5	9.5	10.5	14.2	7.2	8.2	4.5	3.5	3.5	3.0	3.0	5.5	4.8	6.3	
Mean...	25	5.4	5.0	5.2	5.3	5.1	5.4	5.4	5.1	6.2	6.7	8.4	9.3	10.4	10.3	9.7	9.2	7.9	5.9	5.3	5.2	5.4	5.3	5.2	4.8	-----
	1	3.3	3.1	3.2	3.2	3.1	3.0	3.2	3.0	3.9	4.4	5.8	6.5	7.5	7.3	6.8	6.2	5.0	3.6	3.1	2.9	3.1	3.2	3.2	2.6	-----

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date		Height of observation	Average velocity for hour ending at—																								Mean
			1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
			Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
Mar. 1	25	13	13.5	13.5	16.0	18.2	14.2	11.0	10.2	8.5	13.5	11.8	12.5	11.2	10.8	10.2	8.5	8.5	7.0	6.5	4.2	3.0	1.8	1.5	1.2	0.8	0.7
	13	12.5	13.2	14.8	16.8	14.0	12.5	10.2	8.5	13.2	11.5	10.2	8.5	8.5	7.0	6.5	4.5	4.0	4.2	3.8	2.8	2.2	1.5	1.2	0.8	0.7	
	7	12.5	13.2	17.0	17.0	14.8	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	
	1	6.2	8.5	11.5	11.2	10.2	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
	2	11.2	11.8	8.5	7.5	7.5	6.5	7.8	7.8	7.2	9.2	13.5	11.8	12.5	11.2	10.8	10.2	8.5	8.5	7.0	6.5	4.2	3.0	1.8	1.5	1.2	
	13	10.8	11.2	8.5	6.8	6.8	5.2	7.5	7.0	6.2	10.2	12.8	10.5	11.0	10.0	10.2	8.5	8.5	7.0	6.5	4.2	3.0	1.8	1.5	1.2	0.8	
	7	12.2	14.2	11.5	10.5	8.8	9.2	9.0	10.0	9.2	14.0	15.5	13.8	13.2	12.8	11.8	12.5	12.2	11.5	10.2	8.5	7.0	6.5	4.2	3.0	1.8	
	1	5.8	6.8	4.8	3.5	3.2	4.0	3.8	3.5	3.0	3.0	6.8	5.8	7.2	6.5	6.8	12.5	12.2	11.5	10.2	8.5	7.0	6.5	4.2	3.0	1.8	
	25	1.8	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	4.5	8.8	10.0	11.2	12.2	11.5	11.0	11.8	11.2	10.5	9.5	8.5	7.5	6.5	5.5	4.5	
	13	1.8	1.8	1.0	0	0	0	0	0	0	1.5	8.5	9.8	10.5	11.8	11.0	10.5	10.8	9.5	7.0	6.5	5.5	4.5	3.5	2.5	1.5	
	7	3.0	1.8	2.0	2.0	1.2	3.0	2.2	2.0	3.0	9.5	12.8	13.5	14.5	13.5	13.0	13.2	12.8	12.5	11.8	10.8	9.8	8.8	7.8	6.8	5.8	
	1	5.5	2.0	0	0	1.2	0	0	0	1.0	4.8	5.8	6.5	7.5	7.0	7.0	6.8	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	
25	5.2	3.5	3.5	1.8	1.2	1.2	1.0	1.0	1.0	1.8	3.5	4.0	4.8	4.5	4.8	4.8	4.8	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0		
13	5.0	3.5	2.0	1.5	1.5	0	1.0	1.5	1.0	1.5	3.0	4.2	5.8	3.8	3.5	3.0	3.0	2.5	2.0	1.5	1.0	0.5	0.5	0.5	0.5		
7	8.5	6.0	4.5	2.0	2.5	2.0	2.5	2.5	2.8	4.0	5.0	6.8	9.0	7.8	4.0	7.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5	0.5		
1	2.0	1.0	0	0	0	0	0	0	0	1.2	1.5	2.0	3.2	3.5	2.8	5.8	3.5	3.2	2.8	2.5	2.0	1.5	1.0	0.5	0.5		
25	3.0	3.0	3.5	1.8	3.2	3.2	4.0	5.8	4.5	5.5	5.0	8.5	9.5	11.2	10.2	10.2	8.5	8.5	7.5	6.5	5.5	4.5	3.5	2.5	1.5		
13	2.7	2.5	3.0	1.5	3.0	2.0	3.7	5.5	4.3	5.3	4.7	7.5	8.8	10.2	9.8	10.2	12.2	10.2	8.5	7.5	6.5	5.5	4.5	3.5	2.5		
7	2.2	2.2	2.8	1.8	2.8	2.8	4.0	5.8	4.8	5.5	5.5	7.8	8.5	7.2	7.5	8.2	11.0	9.8	8.5	7.5	6.5	5.5	4.5	3.5	2.5		
1	2.5	2.2	2.2	1.2	2.0	1.5	1.8	4.8	3.8	4.2	4.0	5.8	5.0	7.8	6.8	7.2	8.0	5.8	4.5	3.5	2.5	1.5	1.0	0.5	0.5		
25	8.8	11.8	7.8	4.8	7.0	8.2	5.2	5.0	6.0	7.0	7.5	10.5	11.5	12.8	15.8	13.8	14.0	15.5	18.8	18.0	18.0	18.0	18.0	18.0	18.0		
13	8.0	11.0	7.2	4.2	6.8	7.8	5.5	4.8	4.5	7.0	7.2	9.5	12.5	10.8	11.0	13.5	11.0	13.2	10.2	22.0	18.0	18.0	18.0	18.0	18.0		
7	2.0	5.8	3.8	1.2	1.5	5.0	1.8	1.8	1.8	3.8	5.8	7.5	7.8	10.0	11.8	8.8	8.5	8.5	14.0	17.2	14.2	10.0	7.8	6.5	5.5		
1	4.5	8.0	4.8	2.5	5.0	4.5	3.2	3.0	3.2	4.8	4.5	6.0	6.8	5.0	7.8	9.5	8.2	9.5	10.8	12.8	9.8	7.8	6.5	5.5	4.5		
25	13.0	16.5	13.2	7.2	7.0	4.0	5.5	6.0	5.5	10.2	14.0	15.8	13.8	14.8	9.8	11.0	11.0	8.5	11.5	10.0	12.8	7.5	9.5	10.0	11.5		
13	11.5	15.5	11.5	7.2	6.2	3.2	5.2	5.5	4.5	8.8	12.0	13.2	13.2	12.2	7.2	12.0	12.0	6.5	8.5	9.0	12.2	6.8	6.5	10.5	9.0		
7	7.5	10.0	6.2	3.5	3.8	1.5	2.0	3.5	4.0	6.0	8.2	9.5	8.0	9.5	4.0	12.0	12.0	6.5	8.5	9.0	12.2	6.8	6.5	10.5	9.0		
25	8.0	9.0	6.8	9.8	6.5	5.8	2.2	4.0	5.0	4.5	1.5	3.0	3.8	4.5	4.0	4.2	6.0	5.5	5.0	5.2	5.5	5.5	5.5	11.2	5.6		
13	8.2	9.5	6.8	10.2	7.2	7.0	2.0	4.8	6.2	6.5	1.5	2.8	3.8	4.5	4.0	4.2	6.5	5.5	5.0	5.2	5.5	5.5	5.5	11.2	5.8		
7	7.5	9.8	6.2	9.5	4.8	3.8	1.8	1.2	4.8	5.8	1.5	2.5	3.0	3.8	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	8.8	4.6		
1	5.0	5.5	5.0	5.2	5.5	4.8	1.8	4.0	2.5	3.2	1.0	1.8	2.8	2.8	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	8.8	4.6		
25	9.0	6.5	5.8	6.0	5.8	10.2	7.8	9.2	13.8	11.2	14.2	15.8	14.0	16.8	15.8	23.8	21.8	18.8	10.5	7.2	11.8	14.0	6.5	5.2	11.7		
13	9.0	7.2	5.0	5.0	5.5	10.0	11.0	9.5	11.0	13.2	16.2	14.8	14.0	16.8	11.5	23.2	19.5	16.5	8.2	6.0	9.5	12.8	6.0	4.2	11.2		
7	7.2	5.8	4.0	3.8	4.5	9.0	9.0	8.0	9.2	11.8	13.0	13.5	12.2	15.0	12.5	20.8	17.2	15.5	7.8	4.2	8.5	10.8	5.8	4.0	9.7		
1	4.5	2.2	1.5	1.2	1.8	4.8	4.8	4.2	7.0	9.2	11.8	11.0	9.8	13.0	9.8	16.0	13.0	10.0	4.0	4.0	4.2	5.5	2.8	4.0	9.7		



## EVAPORATION FROM LAND AND WATER SURFACES

[illegible]

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date	Height above ground in feet	Average velocity for hour ending at—																								mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
Mar	21	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	14.0	13.5	10.0	11.0	9.5	9.2	10.2	14.8	8.8	10.2	10.8	9.2	9.5	11.5	6.2	6.8	4.2	2.5	1.5	2.2	3.2	2.0	1.8	5.2	8.1
	13	12.8	12.0	14.5	10.0	8.5	8.0	9.0	12.5	7.8	9.5	9.8	8.5	8.8	10.5	5.5	6.2	3.5	1.2	1.5	0	1.0	1.2	3.8	6.0	6.0
	1	1.5	11.2	13.0	9.2	7.0	8.2	8.0	11.8	7.2	8.8	9.8	7.0	7.5	9.2	5.2	4.8	4.0	1.3	1.2	1.5	2.0	1.2	1.0	3.2	6.5
	1	8.5	8.0	9.5	0.2	5.2	5.2	5.2	5.8	5.8	7.0	7.5	6.8	6.2	7.0	4.8	4.5	3.0	1.3	1.8	1.8	1.0	1.2	1.0	2.0	4.0
	25	5.5	3.8	2.0	5.5	2.8	3.0	4.8	9.5	14.2	9.0	11.5	13.8	19.5	16.2	14.5	16.2	13.2	11.8	8.8	3.8	3.5	2.0	1.5	3.0	5.4
	13	5.0	3.2	1.0	5.0	2.0	2.0	6.8	9.8	13.0	8.5	11.2	13.2	18.8	15.2	14.0	13.5	15.5	11.5	7.8	3.2	2.8	0	1.8	1.8	7.6
	1	4.0	2.2	1.5	4.2	2.0	2.8	5.8	8.0	11.0	8.0	11.2	12.0	17.0	14.0	13.5	14.8	11.8	10.2	7.2	3.0	1.8	1.8	1.0	1.8	7.1
	25	3.5	2.8	1.0	3.2	1.2	1.5	4.8	6.8	10.0	6.2	8.0	10.0	13.8	11.2	10.5	11.5	8.5	8.5	5.2	1.8	1.8	1.6	1.0	1.8	5.7
	13	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.5	6.2	6.2	7.8	10.2	12.2	12.5	9.8	10.2	10.2	9.0	6.0	5.2	3.0	1.0	1.0	1.0	4.8
	1	0	0	0	.5	.8	1.0	1.0	0	5.0	5.5	6.2	7.2	9.5	10.8	9.0	10.0	8.8	8.8	5.2	4.5	2.8	0	0	0	4.1
	25	1.5	1.2	1.0	1.0	1.5	2.0	1.8	1.2	3.8	3.8	4.2	5.2	6.0	9.2	8.8	6.5	7.5	6.5	3.8	3.2	1.2	1.0	1.0	1.2	3.7
	13	1.5	1.0	.5	1.2	1.2	.8	.8	.8	1.0	1.0	1.0	1.2	3.8	5.8	7.8	7.0	6.2	5.5	3.8	3.2	1.0	1.0	1.0	1.0	3.1
	1	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	2.8	3.2	3.2	3.8	5.2	7.5	13.0	11.8	11.8	7.2	5.5	4.2	4.5	4.5	4.5	4.5	4.5
	25	0	0	0	0	0	1.0	1.0	0	1.0	3.0	3.0	4.5	11.0	7.5	10.8	10.2	6.8	3.8	3.8	3.8	2.8	4.5	4.5	4.5	4.5
	13	1.2	1.0	1.5	.8	1.2	1.5	1.2	1.0	2.5	2.8	1.8	1.8	9.8	6.8	11.8	10.2	6.8	3.8	3.8	3.8	2.8	4.5	4.5	4.5	4.5
	1	1.0	1.0	1.2	.8	1.0	1.0	1.0	1.0	1.8	1.8	1.8	1.8	6.2	4.2	10.0	9.2	3.8	2.0	1.8	1.8	2.8	3.0	3.0	3.0	3.3
	25	6.0	1.0	9.2	9.5	8.5	6.5	2.8	2.2	3.2	7.8	11.0	10.5	12.2	11.8	12.8	9.2	3.8	5.0	1.8	3.0	1.8	1.8	1.8	2.5	6.8
	13	4.8	6.0	8.2	8.0	7.2	6.2	2.0	1.2	2.0	6.8	11.0	9.0	11.5	10.8	10.8	9.2	7.0	4.2	4.2	1.5	3.0	1.2	1.8	2.5	5.6
	1	4.8	4.8	6.0	7.0	6.0	4.8	2.0	1.5	2.0	5.8	9.8	8.5	7.0	10.8	10.8	9.0	3.8	3.2	4.5	1.8	2.0	1.2	1.8	2.5	4.8
	25	2.8	3.8	5.2	6.0	5.2	4.0	1.8	1.2	1.2	2.5	3.2	6.0	6.5	7.0	6.5	6.5	3.5	1.8	4.5	1.2	1.2	1.2	1.2	2.0	4.8
	13	1.2	0	0	0	0	0	0	1.2	1.0	1.8	2.5	3.0	8.2	14.8	17.5	10.8	11.5	10.5	8.8	8.2	7.5	6.2	6.2	6.2	6.2
	1	2.0	1.2	.5	1.0	0	1.0	.5	1.0	1.8	1.2	1.5	2.0	6.5	13.0	16.2	15.0	10.0	8.5	6.8	6.5	6.0	5.0	4.2	4.8	4.8
	25	1.8	0	0	0	0	1.0	1.0	1.0	1.8	2.0	2.0	2.5	8.2	13.2	11.0	11.0	7.5	5.5	3.8	4.8	4.2	3.2	2.8	2.8	3.5
	13	8.2	7.2	9.5	6.8	9.2	8.0	8.0	8.0	9.2	12.0	10.0	9.5	6.0	13.2	12.8	10.8	7.0	5.0	4.2	4.2	4.8	3.2	4.5	4.0	3.5
	1	7.8	6.8	8.2	6.5	6.8	7.8	8.0	8.8	8.8	11.5	9.5	8.8	8.0	12.8	10.8	5.0	3.2	4.2	1.2	5.5	4.8	6.5	5.2	8.0	7.5
	25	6.0	6.2	6.0	5.2	6.2	7.8	8.0	8.8	8.8	11.5	9.5	8.8	8.0	12.8	10.8	5.0	3.2	4.2	1.2	5.5	4.8	6.5	5.2	8.0	7.5
	13	4.8	4.2	6.0	3.5	4.2	3.5	4.5	5.0	4.8	7.2	6.0	6.0	6.8	11.2	5.0	3.5	2.2	1.8	1.8	3.5	2.0	4.2	4.2	4.2	4.0
	1	10.8	15.2	10.5	10.0	11.2	14.0	10.5	10.5	12.8	9.5	10.8	9.8	4.5	8.5	3.5	2.2	1.2	1.5	2.2	2.0	1.8	2.5	4.8	4.8	4.0
	25	10.8	15.0	10.5	10.0	11.2	13.5	7.0	10.5	10.8	9.5	9.8	8.8	4.8	11.8	9.5	10.2	10.5	8.0	7.2	9.5	9.0	6.2	8.0	4.5	9.4
	13	9.0	13.0	9.2	8.2	9.8	11.8	6.5	9.2	9.8	8.0	8.5	8.0	10.5	10.2	8.2	8.2	9.5	6.2	6.0	8.0	7.5	5.2	2.2	4.5	7.9
	1	7.0	9.0	6.0	5.5	6.2	7.5	3.2	6.5	10.0	7.0	5.8	5.2	6.2	7.5	5.2	6.0	6.5	4.0	4.8	5.8	5.0	2.2	1.0	1.5	5.6

29	25	8.5	8.2	11.0	7.8	7.8	6.5	12.2	10.8	9.0	9.2	7.0	6.2	7.0	6.2	6.8	11.0	11.0	11.2	12.5	12.5	13.0	11.0	9.0	8.8	9.3
	13	8.5	8.2	11.0	8.5	8.2	7.0	11.8	11.2	9.0	9.2	7.2	6.0	6.2	6.0	5.5	10.8	9.8	10.8	11.2	11.8	11.8	10.0	8.2	8.5	9.0
	1	4.2	4.2	6.5	4.0	4.0	2.5	6.8	7.0	6.0	5.0	4.0	3.2	3.8	3.5	3.8	6.2	5.2	5.5	5.8	6.0	5.8	4.0	3.5	3.2	4.7
30	25	9.2	7.2	6.2	5.0	5.5	6.2	4.5	5.2	6.8	6.5	3.2	2.8	3.5	5.8	6.2	4.8	3.5	4.0	1.5	3.8	3.8	11.0	7.5	0.5	5.5
	13	7.8	6.2	6.0	4.5	5.2	5.5	4.5	5.8	7.0	6.5	3.5	3.2	3.8	6.0	6.5	5.0	3.5	3.0	2	2.5	2.5	10.0	6.8	0.0	5.2
	1	6.2	5.2	4.0	3.0	4.8	4.2	4.2	4.5	5.2	5.2	3.5	3.5	4.2	6.0	7.0	5.0	3.8	3.0	1.0	2.8	3.2	8.0	5.8	7.2	4.6
31	25	8.0	11.5	13.0	7.2	12.0	7.5	6.8	8.2	9.8	13.8	12.0	13.5	12.2	8.0	11.0	9.2	10.5	6.2	3.8	1.5	1.2	3.0	1.0	1.2	7.9
	13	5.0	11.0	11.5	7.5	11.2	7.2	6.8	9.0	10.8	12.8	12.2	13.0	12.5	8.8	11.2	9.2	10.5	6.2	4.2	1.8	1.2	3.0	2.8	9.2	8.3
	1	6.0	9.0	9.5	6.0	9.8	5.8	6.5	8.2	10.2	11.5	11.5	11.8	11.0	7.8	9.8	8.5	9.0	6.0	4.2	1.2	2.0	2.0	1.5	2.0	7.1
Mean	25	8.5	8.2	11.0	7.8	7.8	6.5	12.2	10.8	9.0	9.2	7.0	6.2	7.0	6.2	6.8	11.0	11.0	11.2	12.5	12.5	13.0	11.0	9.0	8.8	9.3
	13	8.5	8.2	11.0	8.5	8.2	7.0	11.8	11.2	9.0	9.2	7.2	6.0	6.2	6.0	5.5	10.8	9.8	10.8	11.2	11.8	11.8	10.0	8.2	8.5	9.0
	1	4.2	4.2	6.5	4.0	4.0	2.5	6.8	7.0	6.0	5.0	4.0	3.2	3.8	3.5	3.8	6.2	5.2	5.5	5.8	6.0	5.8	4.0	3.5	3.2	4.7
Mean	25	5.9	6.3	6.3	5.8	6.3	6.3	6.0	6.0	7.7	8.2	9.1	9.1	9.8	10.3	9.9	9.8	9.1	7.9	6.6	6.0	6.3	6.0	5.5	5.9	---
	13	5.6	6.0	5.9	5.4	5.9	5.6	5.7	6.5	7.2	8.3	9.0	9.5	9.7	10.1	9.3	9.5	8.3	7.2	5.5	5.5	5.4	5.2	4.9	5.8	---
	1	5.2	5.6	5.3	4.7	5.2	5.3	5.1	5.8	6.4	7.5	8.3	8.5	8.6	9.0	8.3	8.3	7.5	6.3	5.0	3.3	3.2	3.1	2.9	3.4	---

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date	Height in feet above ground	Average velocity for hour ending at—																								Mean
		1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	12 p.m.	
		Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
Apr. 1	13	1.2	1.0	1.0	1.0	1.2	2.2	3.5	2.8	11.0	10.5	16.5	15.0	16.0	12.2	8.0	8.0	8.0	6.2	2.2	2.5	2.8	5.8	12.0	9.5	6.7
	7													15.0	11.0	6.5	7.2	7.2	5.5	2.0	2.5	2.8	5.5	11.5	9.2	6.7
	1													13.2	10.2	6.2	6.5	7.0	5.5	1.8	2.0	2.0	5.2	10.5	8.0	6.7
	25		5	5	5	5	5	1.5	1.0	5.2	6.8	9.8	8.5	9.2	6.0	3.5	4.5	5.0	3.8	1.2	1.2	1.5	3.5	8.0	5.2	3.7
	13	10.2	6.8	5.0	7.8	10.2	14.8	18.2	17.5	17.2	15.8	17.2	13.8	19.2	17.0	18.0	17.5	13.0	10.0	4.2	5.0	4.5	10.8	8.0	4.2	12.0
	7	10.0	5.8	4.2	7.5	9.8	13.5	17.5	17.5	17.0	15.5	17.2	13.0	18.8	16.5	17.5	17.0	11.8	9.2	4.0	4.2	4.5	10.0	7.0	4.2	11.4
	1		5.8	2.5	6.8	8.0	11.5	15.8	14.2	14.0	13.2	15.2	11.5	16.0	13.5	14.8	14.5	9.5	7.2	3.0	3.2	3.5	9.0	5.5	3.5	9.6
	25		3.5	1.5	4.5	5.2	8.2	11.5	11.2	10.5	9.5	11.0	8.5	11.5	10.2	11.2	10.5	7.0	4.5	1.2	1.2	1.5	3.5	8.0	5.2	6.7
	13	1.8	4.5	3.2	4.5	8.0	4.5	8.5	9.0	14.0	18.8	22.2	17.8	21.8	19.8	21.8	16.8	16.2	18.5	13.2	10.8	10.8	13.0	14.2	12.0	12.7
	7	4.5	4.5	3.5	3.8	7.5	4.5	3.5			17.8	20.5	16.5	20.2	17.8	20.5	16.0	15.5	15.2	14.0	9.5	9.5	11.8	13.2	10.5	11.8
	1	3.5	3.5	2.2	2.8	6.2	3.5	3.2	5.8	13.0	17.0	18.0	15.8	19.0	16.8	19.0	14.2	13.8	14.5	12.8	2.5	9.5	10.8	11.5	8.8	10.3
	25	1.0	1.8	1.0	1.5	3.5	1.5	1.8			3.8	6.5	11.0	14.0	10.2	12.8	11.2	13.2	10.0	9.2			10.5	11.5	8.8	10.3
	13	8.5	5.5	8.0	8.2	10.0	7.2	7.8	12.8	15.0	15.8	21.8	16.2	16.5	20.0	18.5	15.5	17.8	13.8	7.8	4.8	5.0	6.8	6.8	5.2	6.6
	7	7.8	4.8	6.8	8.2	10.0	7.2	7.2	12.8	14.8	15.2	20.8	15.0	16.0	10.2	17.8	17.5	15.8	12.0	10.5	6.5	4.5	6.8	5.8	6.5	11.8
	25	6.8	4.0	5.5	7.0	8.5	6.5	6.5	11.0	12.8	13.5	18.2	13.2	13.2	18.8	15.0	15.5	14.2	11.8	8.0	4.8	3.5	5.8	5.0	4.8	10.9
	13	3.0	1.2	2.8	4.0	5.0	3.2	4.0	7.2	8.5	9.2	11.0	10.2	11.8	11.2	10.8	11.0	9.8	8.0	7.8	4.5	3.5	5.8	4.8	4.8	9.7
	7	6.0	3.8	2.2	7.8	6.0	6.0	1.2	6.5	7.2	5.2	2.2	4.2	4.8	5.2	7.0	3.5	7.2	8.0	4.8	1.5	1.2	3.8	4.0	2.5	6.1
	25	4.2	1.5	1.2	6.0	4.5	3.0	0	6.8	7.2	5.0	1.8	4.0	5.2	5.2	7.0	3.2	8.2	4.8	4.8	7.0	6.2	5.8	4.8	5.5	5.2
	13	3.8	2.0	2.2	5.0	4.0	3.0	2.0	5.8	6.2	4.5	3.0	5.0	5.2	5.2	2.2	5.5	6.5	4.5	5.0	7.5	6.2	5.5	4.8	5.8	4.9
	7	1.2	0	1.0	3.5	1.8	1.2	.8	2.8	3.8	2.5	1.5	3.0	3.2	3.0	3.0	2.5	3.8	1.8	4.8	6.2	5.5	5.8	4.5	5.2	4.5
	25	7.5	8.5	7.0	6.8	5.0	6.5	7.5	7.8	6.0	4.2	1.8	1.0	1.0	0	.8	4.2	4.5	10.5	13.7	11.7	12.0	17.8	14.6	19.7	7.9
	13	7.8	8.2	7.0	6.5	4.8	7.0	7.8	7.5	5.8	5.0	1.0	0	0	.8	1.2	4.0	4.0	13.7	12.0	10.8	11.0	17.0	13.8	19.5	8.1
	7	7.8	7.5	6.5	6.2	4.5	7.2	7.2	7.0	5.8	4.0	1.2	2	1.8	1.2	1.8	2.8	4.8	12.2	10.8	8.8	9.2	17.0	13.8	19.5	8.1
	25	3.8	2.5	2.8	2.5	1.8	3.2	4.0	3.2	2.2	1.2	.2	1.0	1.5	1.5	1.2	1.2	4.0	10.7	7.5	6.7	6.7	15.0	11.5	16.5	6.5
	13	15.7	15.5	14.2	12.2	10.2	9.4	6.5	7.2	11.7	17.2	13.0	15.5	16.0	13.2	13.2	12.0	12.2	7.5	5.7	6.7	6.7	11.5	9.5	12.5	4.0
	7	14.8	14.8	13.5	11.8	10.2	8.8	6.5	7.2	11.8	17.2	13.2	15.5	15.0	12.8	12.8	12.2	12.5	7.7	5.7	3.7	3.7	1.5	3.5	12.5	10.1
	25	12.8	13.0	11.5	9.5	8.5	7.5	6.0	6.8	11.0	15.5	12.5	14.2	13.2	11.5	11.5	11.2	11.2	8.0	6.7	3.5	4.0	1.8	3.5	2.8	10.0
	13	9.0	8.7	8.0	6.7	6.0	4.7	3.2	4.5	7.0	11.5	8.4	9.0	9.2	8.0	7.2	7.2	7.5	3.7	2.0	3.2	1.5	1.0	1.5	2.8	9.0
	7	4.0	6.2	7.2	5.0	3.5	2.7	3.0	2.7	3.0	3.2	3.7	6.2	6.2	6.2	6.2	6.2	6.5	3.7	2.0	1.7	1.5	1.0	1.5	2.8	5.7
	25	4.2	6.2	8.0	6.0	3.8	3.0	4.0	4.8		2.5	3.0	5.5	5.2	5.2	5.2	5.2	5.5	3.7	2.7	3.2	2.7	3.7	2.5	1.7	5.0
	13	4.2	6.2	8.0	5.8	4.0	3.2	3.5	4.8		2.5	3.5	5.5	6.0	6.2	6.2	6.2	6.5	3.7	2.7	3.2	2.7	3.7	2.5	1.7	4.8
	7	4.2	6.2	8.0	5.8	4.0	3.2	3.5	4.8		2.5	3.5	5.5	6.0	6.2	6.2	6.2	6.5	3.7	2.7	3.2	2.7	3.7	2.5	1.7	4.8
	25	1.7	3.0	4.5	2.7	1.5	1.2	1.2	1.7	1.5	1.0	1.7	2.2	2.2	2.2	3.5	3.2	4.0	3.5	2.0	1.5	1.2	0	1.0	1.8	4.7

9	25	3.2	10.2	9.2	7.7	4.2	2.0	1.5	4.2	4.7	10.2	8.2	13.5	10.7	12.5	10.7	12.7	10.5	5.5	1.8	1.0	7.0	5.8	8.0	7.0	7.2
	13	1.8	9.0	9.2	7.5	3.8	2.0	.5	2.5	5.2	10.5	8.2	12.8	10.0	12.0	10.7	11.2	9.5	4.5	1.5	0	5.5	5.0	7.0	5.5	6.7
	7	2.8	10.5	6.5	6.5	3.5	1.0	1.5	3.5	6.8	10.5	8.0	12.8	9.8	11.2	10.2	10.2	9.0	4.2	1.2	0	5.5	5.0	7.0	5.5	6.2
	1	1.5	7.0	4.0	3.2	1.2	1.2	.2	1.5	4.2	7.0	6.0	7.8	2.6	7.0	6.0	6.0	5.5	2.2	0	0	2.5	2.5	6.5	1.5	3.8
10	25	2.0	1.5	2.0	2.8	2.2	1.0	1.5	2.0	4.8	6.8	8.5	8.2	8.2	8.2	11.0	10.5	20.5	10.2	15.2	17.0	15.5	15.5	14.7	14.7	9.2
	13	1.2	1.8	1.5	1.5	1.5	.8	1.2	1.5	4.8	7.8	6.2	7.8	6.8	8.2	11.0	10.5	15.0	16.5	15.2	15.5	14.8	14.5	12.8	12.8	8.8
	7	1.2	1.5	2.0	2.5	2.0	1.0	1.5	1.5	4.8	6.2	7.2	6.8	5.5	8.2	11.0	10.5	13.8	16.0	12.0	15.5	14.8	11.0	14.5	14.5	7.7
	1	.8	0	.8	.8	0	0	.5	.8	4.5	4.5	5.2	3.8	6.5	4.0	6.5	6.5	10.0	13.2	8.2	15.5	10.0	9.5	14.0	12.8	6.0
11	25	17.2	15.7	16.5	13.7	14.5	13.5	15.5	17.0	30.0	18.2	15.2	17.2	17.2	20.5	16.0	20.5	20.7	16.2	13.0	8.7	8.7	11.0	9.5	14.8	14.8
	13	16.5	15.0	15.5	13.5	13.8	12.8	15.0	17.0	15.0	18.2	14.8	17.0	13.2	10.5	13.2	10.5	14.8	14.8	13.0	13.2	10.2	11.0	9.2	9.2	14.2
	7	15.8	14.5	14.5	12.8	12.8	12.0	13.5	15.2	13.2	15.0	11.5	12.0	11.2	12.5	14.8	12.7	17.2	10.0	10.8	13.2	12.5	10.0	9.2	9.2	12.3
	1	10.7	9.2	7.7	8.5	8.2	7.7	10.2	12.0	10.0	11.7	10.2	11.2	10.2	10.2	12.7	21.0	24.5	25.0	25.0	22.0	9.5	9.5	4.7	4.0	8.8
12	25	10.5	10.7	8.7	5.5	1.7	6.7	4.0	6.7	33.0	15.2	18.0	17.5	17.5	21.5	18.2	21.8	21.8	25.0	21.0	14.0	11.0	9.2	17.5	14.4	14.4
	13	10.5	10.5	8.8	5.5	1.5	6.8	4.0	7.0	13.2	18.0	17.2	17.5	17.2	21.5	18.2	21.8	21.8	25.0	21.0	14.0	11.0	9.2	17.5	14.4	14.4
	7	9.2	9.5	8.0	5.5	2.0	6.2	4.5	6.5	12.0	15.5	15.5	15.5	15.5	21.5	18.2	21.8	21.8	25.0	21.0	14.0	11.0	9.2	17.5	14.4	14.4
	1	4.7	5.0	4.2	11.7	.2	3.0	1.7	3.5	7.7	10.5	10.0	10.0	10.0	21.5	18.2	21.8	21.8	25.0	21.0	14.0	11.0	9.2	17.5	14.4	14.4
13	25	14.7	9.5	10.2	5.2	6.5	15.2	13.7	14.2	21.5	14.0	21.2	16.5	13.0	13.0	13.0	13.0	14.5	12.8	9.5	13.2	8.5	4.0	15.8	11.4	7.8
	13	13.5	8.8	9.0	4.5	6.0	13.8	13.0	14.0	10.0	17.0	17.0	15.2	13.0	13.0	13.0	13.0	14.5	12.8	9.5	13.2	8.5	4.0	15.8	11.4	7.8
	7	12.5	8.5	8.8	5.0	6.0	12.5	11.2	12.0	17.5	14.0	16.0	13.8	13.0	13.0	13.0	13.0	14.5	12.8	9.5	13.2	8.5	4.0	15.8	11.4	7.8
	1	8.2	4.5	5.0	2.0	2.2	7.0	7.7	8.2	11.7	9.7	11.2	9.2	7.2	8.5	7.2	8.5	8.5	4.7	4.7	7.7	7.7	4.0	15.8	11.4	7.8
14	25	2.5	4.5	4.0	1.0	1.0	7.0	7.7	2.2	6.2	7.0	6.2	6.2	6.2	6.2	6.2	6.2	6.2	4.1	2.5	2.5	2.2	2.2	2.2	2.2	2.2
	13	1.5	4.2	0	.8	.8	.8	.8	1.2	5.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	4.1	2.5	2.5	2.2	2.2	2.2	2.2	2.2
	7	2.2	3.2	.8	.8	.8	.8	.8	2.5	5.0	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	4.1	2.5	2.5	2.2	2.2	2.2	2.2	2.2
	1	.2	.5	0	0	0	0	0	1.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	2.0	1.5	1.5	1.5	1.5	1.5	1.5
15	25	1.5	4.2	6.0	8.0	8.0	7.0	6.7	8.2	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	13	.5	5.2	5.8	8.2	8.2	6.0	6.0	7.5	7.8	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	8.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	7	1.5	3.0	5.5	6.8	6.8	5.8	6.2	6.2	7.2	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	8.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	1	0	2.5	3.5	3.5	3.5	3.5	4.5	5.5	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	8.2	5.2	4.8	2.0	2.0	2.0	2.0	2.0
16	25	10.0	10.8	12.0	10.5	9.0	8.5	10.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	10.0	9.5	9.0	9.0	9.0	9.0	9.0	9.0
	13	9.2	10.2	10.8	9.5	8.5	8.5	10.0	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	10.0	9.5	9.0	9.0	9.0	9.0	9.0	9.0
	7	7.5	8.5	8.5	8.5	8.2	8.2	9.0	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
	1	4.7	5.5	6.5	5.7	5.2	3.5	5.2	5.2	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
17	25	8.8	6.0	8.0	8.5	8.8	8.0	8.2	8.2	8.0	8.2	10.5	9.8	9.8	9.8	9.8	9.8	9.8	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	13	8.0	5.8	8.0	8.2	8.2	7.2	7.2	9.5	8.8	8.2	9.5	9.8	9.8	9.8	9.8	9.8	9.8	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	7	8.0	5.5	8.0	8.5	8.2	7.0	7.8	9.8	8.5	8.2	10.5	9.8	9.8	9.8	9.8	9.8	9.8	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	1	3.5	2.5	4.2	4.0	4.2	3.0	3.0	4.7	4.0	4.5	8.0	8.0	8.0	8.0	8.0	8.0	8.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
18	25	5.0	6.0	4.7	3.7	3.2	2.7	2.2	1.2	1.0	1.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	13	4.5	5.2	4.0	3.0	1.2	2.7	2.7	1.2	1.0	1.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	7	4.8	4.0	3.2	1.5	1.5	.5	.5	1.0	1.0	1.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	1	2.2	1.7	1.2	1.2	.7	.7	.7	.5	.5	.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
19	25	2.7	3.0	3.7	8.0	6.7	4.0	6.7	8.0	9.0	8.2	11.0	9.5	9.5	9.5	9.5	9.5	9.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	13	2.2	2.0	1.2	7.5	5.2	3.0	5.8	7.0	7.5	7.5	9.5	7.5	7.5	7.5	7.5	7.5	7.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	7	2.0	2.0	3.2	5.0	5.2	2.0	5.0	6.2	6.2	6.2	9.5	7.5	7.5	7.5	7.5	7.5	7.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	1	1.5	1.2	1.2	2.5	2.7	.7	.7	7.5	7.5	7.5	9.5	7.5	7.5	7.5	7.5	7.5	7.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
20	25	1.5	1.0	0	1.0	0	0	0	1.8	1.8	1.8	5.5	4.2	4.2	4.2	4.2	4.2	4.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	13	0	0	0	0	0	0	0	1.8	1.8	1.8	5.5	4.2	4.2	4.2	4.2	4.2	4.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	7	0	0	0	0	0	0	0	1.8	1.8	1.8	5.5	4.2	4.2	4.2	4.2	4.2	4.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	1	0	0	0	0	0	0	0	1.8	1.8	1.8	5.5	4.2	4.2	4.2	4.2	4.2	4.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date	Height of observation	Average velocity for hour ending at—																								Miles per hour
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
Apr. 21	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	1.7	1.7	1.0	1.0	1.2	1.2	1.7	5.0	5.5	9.7	18.2	18.0	18.7	19.7	19.2	18.0	10.2	14.0	9.2	7.7	10.0	10.5	8.7	2.0	9.2
22	13	.8	.2	0	0	0	0	.8	4.2	5.5	10.5	16.8	18.2	17.5	18.5	18.0	16.8	15.2	12.5	9.0	7.8	9.2	10.2	9.2	1.0	8.4
	7	1.8	1.2	1.0	1.0	1.2	1.2	.2	2.8	4.0	5.8	15.5	14.2	14.5	14.8	15.8	15.2	13.5	9.8	8.2	6.5	7.0	7.8	7.8	4.2	7.3
23	1	.2	.5	.2	.2	.2	.2	0	1.0	2.5	4.2	10.0	9.5	9.2	9.7	10.2	10.5	9.7	6.0	5.0	3.2	4.0	5.0	4.7	1.7	4.5
	25	1.0	2.7	2.0	1.5	1.3	2.2	8.2	11.5	17.7	12.5	11.7	13.7	15.2	15.5	13.2	9.2	11.5	7.2	5.5	3.5	3.2	2.2	1.2	7.5	7.5
24	13	0	2.8	1.5	1.5	1.0	2.0	8.2	10.8	5.0	16.0	11.5	10.5	12.5	14.5	14.2	12.2	8.5	10.5	6.5	4.5	2.0	1.5	1.5	.8	6.7
	7	1.0	3.2	2.5	1.8	1.8	2.5	6.8	8.5	5.0	14.8	10.2	9.8	11.5	13.0	13.0	10.8	8.2	9.8	6.5	4.5	2.5	2.5	1.8	1.8	6.4
25	1	0	.7	0	0	.2	.2	3.5	5.0	3.0	9.0	6.7	5.7	6.5	8.5	7.2	5.7	4.2	5.2	2.7	1.7	.5	.2	0	3.2	3.2
	25	1.5	1.0	1.2	1.0	.7	1.2	1.0	2.0	5.7	6.2	7.5	5.7	11.0	7.5	8.2	8.5	8.2	8.2	3.7	3.5	4.2	1.7	2.0	1.7	4.3
26	13	.8	0	0	0	.2	.5	0	0	5.0	5.5	8.2	5.2	11.0	8.0	8.8	7.8	9.0	7.8	2.5	3.2	3.0	0	.8	1.0	3.7
	7	1.2	1.0	1.2	1.0	1.5	1.0	1.0	1.8	4.8	5.5	7.2	4.8	8.5	6.8	7.5	6.5	7.2	6.5	2.5	3.0	3.2	1.0	1.8	1.8	3.7
27	1	.2	0	0	0	0	0	0	0	3.5	2.7	4.7	2.7	6.0	3.7	4.2	3.7	4.2	3.0	0	0	.2	0	0	0	1.6
	25	4.0	1.2	1.5	1.0	1.0	1.0	1.0	2.2	2.5	5.0	4.7	4.0	11.0	12.7	12.2	13.5	10.5	8.2	7.2	7.0	5.2	4.7	3.7	3.2	5.3
28	13	3.8	0	1.2	.8	1.0	1.0	1.2	2.0	4.5	4.8	2.8	9.5	11.2	11.8	12.8	10.2	8.0	5.5	5.5	4.2	4.0	3.0	2.0	4.7	4.7
	7	3.0	1.0	1.0	1.5	1.0	1.0	1.2	2.0	4.5	4.2	3.2	7.8	10.0	10.8	11.8	9.0	7.5	5.0	5.0	4.0	3.8	3.0	2.2	4.5	4.5
29	1	.2	0	0	.2	0	0	0	0	0	3.5	3.0	2.2	6.0	7.0	7.5	8.0	7.5	5.0	2.7	3.0	1.7	1.2	1.0	1.5	2.6
	25	2.2	1.2	1.0	1.2	1.2	.5	1.2	1.7	3.5	4.7	5.2	6.0	5.7	5.2	4.5	7.2	9.5	5.0	2.2	2.2	1.0	2.2	6.2	8.0	3.7
30	13	1.2	0	0	0	0	0	.5	0	4.0	4.2	5.0	4.5	4.2	3.8	3.5	5.8	8.0	3.8	.8	1.8	0	0	5.5	7.2	2.6
	7	2.8	1.2	1.2	1.5	1.5	1.0	1.5	2.0	4.0	4.2	5.0	4.2	4.0	3.5	3.0	5.8	7.0	4.0	1.0	1.8	1.0	1.0	5.0	7.0	3.1
31	1	1.5	1.0	.5	1.0	1.0	.2	1.2	1.2	2.0	2.7	2.2	2.0	1.7	1.7	1.5	3.5	4.7	.5	0	0	0	2.5	3.5	1.5	5.8
	25	5.0	3.5	5.7	5.2	5.7	7.7	5.5	6.0	6.2	10.0	7.7	9.7	8.0	10.7	12.0	8.5	2.7	2.0	2.7	5.7	2.5	3.2	1.2	2.0	5.8
32	13	2.0	0	5.0	4.2	5.5	7.5	6.0	6.2	9.5	7.2	9.2	6.8	9.8	11.0	7.8	1.0	0	0	0	3.5	0	3.0	.5	0	4.6
	7	4.8	3.2	4.5	4.0	5.2	7.0	5.5	5.8	8.8	7.0	7.2	6.2	9.0	9.8	7.8	2.5	2.0	2.2	5.2	2.0	3.2	2.0	2.0	5.0	5.1
33	1	2.2	1.5	2.0	1.5	2.0	3.5	2.5	2.7	3.0	6.0	5.0	5.7	4.5	6.0	7.2	5.2	1.3	.7	1.0	3.0	.7	2.2	.7	3.0	3.0
	25	1.5	2.5	2.5	3.0	1.5	1.7	2.2	1.2	2.5	4.2	3.0	7.0	9.0	9.0	7.7	7.5	6.7	5.5	3.2	4.0	3.5	4.2	3.2	1.0	4.0
34	13	0	0	0	0	0	1.8	0	1.2	2.2	3.2	2.0	6.5	7.2	5.5	5.0	6.0	6.0	4.8	2.8	3.5	2.8	3.5	1.5	0	2.4
	7	1.4	2.5	2.5	2.2	1.5	1.7	2.0	1.5	2.8	3.8	3.0	6.0	5.5	6.8	6.0	5.8	5.2	4.2	2.8	3.0	2.7	3.5	1.8	.5	3.3
35	1	.5	.7	1.2	1.0	1.0	1.0	1.2	.7	1.7	2.2	2.0	4.2	3.0	3.7	2.5	2.5	2.5	1.7	1.0	.7	.7	1.7	.7	.2	1.6
	25	2.2	7.5	8.2	10.7	9.5	6.5	11.5	10.2	11.5	13.7	12.7	12.0	12.2	8.7	10.0	12.2	12.7	12.5	10.7	10.5	11.2	9.5	8.0	8.2	10.1
36	13	1.5	6.8	7.0	10.8	5.8	6.0	12.0	10.5	11.0	12.5	12.0	11.0	11.5	9.2	10.0	11.2	11.5	12.2	10.8	10.2	11.2	9.5	7.0	8.0	5.6
	7	1.2	6.8	6.0	8.8	9.0	5.0	10.2	9.8	10.5	10.8	11.8	10.8	11.2	9.8	10.2	10.2	10.2	12.0	9.8	10.5	9.5	10.2	7.0	6.2	9.0
37	1	.7	2.5	2.7	4.5	3.5	2.0	5.5	5.5	3.7	5.5	5.5	5.2	6.0	3.7	4.5	5.7	5.2	6.0	5.7	5.5	5.5	5.0	3.0	3.7	4.5

20	25	10.0	11.0	9.2	10.7	10.5	11.0	10.5	9.7	-----	9.7	9.5	7.5	11.0	12.0	10.0	9.5	5.0	4.7	3.7	4.0	3.7	2.7	4.0	1.7	7.6
	13	9.5	9.5	8.5	10.0	9.5	10.2	9.8	9.0	9.2	9.0	1.8	-----	10.2	10.8	9.0	9.0	4.2	4.5	3.8	3.5	3.8	2.0	2.5	1.5	7.0
	7	7.1	4.5	5.0	7.0	7.0	8.5	9.8	7.5	8.2	7.5	4.0	-----	9.2	10.0	8.2	8.2	4.5	4.5	3.8	3.8	3.8	2.0	2.8	1.5	6.4
	1	4.0	4.2	11.0	4.0	4.7	4.5	4.0	4.2	3.5	3.5	2.0	-----	5.0	5.0	3.7	4.0	1.0	2.2	1.0	1.5	1.0	1.0	1.0	.7	3.0
30	25	4.8	9.8	8.8	3.8	3.0	3.5	4.0	6.2	5.5	8.2	6.2	8.5	10.0	7.8	6.8	9.2	7.5	14.5	12.5	11.0	10.0	9.2	9.0	10.0	8.4
	13	2.8	9.8	8.8	3.8	3.0	3.5	4.0	6.2	5.5	8.2	6.2	8.5	10.0	7.8	6.8	9.2	7.5	14.0	11.8	9.5	8.8	8.2	7.8	9.0	7.5
	7	3.0	8.8	8.5	3.8	2.8	3.5	3.5	6.0	5.5	7.8	5.8	8.5	9.5	7.2	6.0	9.0	6.5	12.0	11.0	8.2	7.8	7.5	7.2	9.0	7.0
	1	1.2	4.0	3.7	1.0	4.7	1.2	1.0	3.5	2.5	4.5	3.2	5.2	5.7	4.2	3.7	5.2	4.0	7.5	7.0	5.7	5.5	4.2	4.0	5.0	4.0
Mean...	25	5.7	5.9	5.8	5.8	5.2	5.4	5.7	6.9	8.2	10.0	10.5	10.4	11.6	12.1	11.5	11.0	10.5	9.0	7.1	6.4	6.0	6.2	6.6	6.2	-----
	13	5.0	5.2	5.2	5.2	4.6	5.0	5.4	6.7	8.4	9.4	9.3	9.6	11.0	10.8	10.4	9.7	9.8	8.6	6.5	5.7	5.1	5.5	5.8	5.6	-----
	7	5.0	5.2	5.0	4.9	4.6	4.5	5.2	6.3	7.8	8.7	8.7	8.3	9.5	8.7	9.5	9.1	8.4	7.0	5.9	5.1	4.9	5.3	5.6	5.4	-----
	1	2.5	2.5	2.5	2.8	2.3	2.2	2.8	3.5	4.4	5.6	5.8	5.5	6.2	6.1	6.1	5.8	5.7	4.2	3.2	2.6	2.4	2.7	2.8	2.8	-----

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1930—Continued

Date	Height of observation	Average velocity for hour ending at—																							
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 m.
May 1	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	7.5	4.2	8.5	9.8	10.5	11.5	10.2	13.2	12.0	12.0	8.0	11.7	9.7	10.7	7.5	8.5	5.7	7.7	3.5	3.7	3.2	2.2	1.0	1.2
	13	6.8	3.5	7.0	9.5	10.0	11.2	9.8	12.5	10.5	11.2	8.0	10.7	8.7	10.0	7.0	7.5	5.2	6.5	3.0	3.2	1.5	1.2	1.0	1.2
	7	5.5	2.0	6.0	7.8	8.8	10.5	8.8	11.5	10.0	10.0	6.5	9.0	7.2	8.5	6.5	6.5	5.2	6.2	2.5	2.2	1.7	1.5	1.0	1.2
	1	4.0	2.2	4.0	5.8	5.8	6.2	5.8	7.0	6.0	6.7	5.0	6.5	5.5	5.7	4.5	5.2	3.2	3.7	1.5	1.0	1.5	1.7	1.0	1.2
	25	1.7	1.0	1.2	.7	.7	4.5	3.2	6.2	7.0	7.5	6.5	5.2	5.2	5.7	4.5	8.7	9.5	8.5	6.5	5.2	5.2	6.0	6.5	6.1
	13						3.2	2.0	5.0	6.5	6.5	5.7	4.7	4.5	6.5	8.2	8.7	8.7	8.0	5.5	4.2	5.0	5.2	6.2	5.8
	7						3.5	2.5	4.7	5.5	5.5	4.7	3.7	3.7	5.6	7.7	7.7	8.2	7.5	5.0	3.7	4.7	4.7	5.5	4.3
	1						2.7	3.7	3.2	3.5	3.0	2.7	4.5	4.5	4.5	4.2	4.2	5.0	5.0	3.0	1.7	1.7	2.5	5.7	2.6
	25	1.0	1.5	1.0	.5	.5	1.5	1.5	2.7	9.0	10.0	11.7	12.2	14.2	16.7	17.5	13.2	13.5	12.7	4.5	4.2	3.0	5.2	9.2	7.5
	13	4.7	7.5	10.7	11.0	10.2	9.2	7.7	9.0	8.2	9.5	11.0	11.0	13.7	15.5	17.5	12.0	12.5	11.7	4.0	3.7	2.2	4.0	8.0	6.5
	7	4.5	7.2	9.7	9.2	9.2	8.2	6.5	8.5	8.2	9.0	10.5	10.2	13.2	14.7	15.7	11.2	11.7	10.2	4.0	4.0	2.2	3.2	7.0	6.2
	1	2.0	3.5	5.0	5.2	6.0	5.0	3.5	5.2	4.5	5.5	6.7	6.5	7.7	9.5	10.0	7.2	7.5	6.7	2.2	1.0	1.7	1.7	3.7	3.5
	25	5.7	4.2	3.7	10.2	11.5	13.7	14.0	9.2	11.0	11.7	11.7	9.7	9.0	11.2	9.5	9.2	7.7	4.7	3.0	5.7	8.2	5.7	2.2	1.2
	13	5.5	3.5	3.0	9.5	11.0	12.7	12.5	7.7	10.2	10.5	10.5	9.0	8.7	10.2	8.2	8.7	8.2	4.0	3.2	5.0	6.5	4.5	2.2	1.7
	7	5.2	2.2	2.2	7.2	8.7	11.5	11.2	8.7	7.0	11.0	8.7	9.2	7.7	9.2	7.7	8.7	7.2	4.5	2.7	4.0	6.0	5.0	1.7	1.7
	1	2.2	1.0	1.5	5.0	6.0	7.5	6.5	4.5	5.7	7.0	6.0	5.2	5.5	6.5	5.5	5.2	4.2	1.5	1.5	1.0	2.7	1.5	1.0	1.2
	25	1.0	1.5	.7	1.0	1.0	1.0	1.0	1.7	4.5	10.2	8.0	8.7	8.5	6.7	7.5	6.5	6.5	5.5	4.0	5.0	2.7	1.0	1.2	1.2
	13	.7	2.2	.7	1.0	.7	.7	.7	1.7	4.5	10.2	8.0	8.0	8.2	7.0	6.5	6.2	6.5	5.2	3.7	4.7	1.0	1.7	1.0	1.0
	7	.5	1.5	1.2	1.0	1.0	1.0	1.0	1.7	4.0	8.5	7.0	7.0	7.2	6.0	7.5	5.7	6.0	4.7	3.5	4.7	1.5	1.5	1.7	1.7
	1	.7	.7	.7	.7	.7	.7	.7	.7	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	4.0	5.0	2.7	1.0	1.0	1.0
	25	1.2	1.0	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	13	1.7	.7	.7	1.5	1.2	1.5	1.2	1.0	2.0	3.0	8.0	7.0	10.7	8.0	9.0	4.7	6.5	6.2	4.5	3.7	4.5	4.0	4.7	4.5
	7	1.5	.5	.7	1.2	1.0	1.2	1.2	1.0	2.0	3.0	7.2	6.5	10.0	6.7	8.0	4.5	6.0	5.7	3.7	3.7	4.7	4.2	4.7	4.2
	1	0	0	0	0	.2	.2	.2	.7	2.0	3.5	5.2	6.5	4.7	4.7	3.5	3.2	4.2	2.5	2.0	2.0	2.0	2.7	1.7	1.7
	25	1.0	2.0	1.0	1.5	1.0	1.0	1.0	4.7	4.0	6.2	8.0	13.0	6.0	6.2	13.0	6.7	7.2	5.7	3.0	1.5	4.5	4.5	4.2	4.2
	13	.7	1.7	1.7	2.2	.5	.5	.5	4.0	3.5	5.5	7.2	11.7	6.0	6.7	11.7	6.0	6.7	5.2	2.2	1.5	3.0	3.5	3.2	3.2
	7	1.2	2.0	1.2	1.2	1.2	1.2	1.2	4.0	3.2	5.5	6.5	11.0	5.5	6.0	4.2	5.5	6.0	4.2	2.0	1.0	2.0	2.7	2.2	2.2
	1	1.0	.7	.7	0	0	0	0	2.7	2.0	3.2	4.5	6.7	6.7	6.7	3.2	3.2	3.2	2.2	1.2	1.0	1.0	1.2	1.2	1.2
	25	4.2	2.0	1.0	1.0	1.0	4.7	5.5	7.2	11.0	11.7	14.5	15.0	15.0	15.0	12.0	14.0	12.5	9.5	9.5	9.2	9.0	9.2	6.5	6.5
	13	3.5	1.5	.7	.5	.5	3.2	5.0	6.0	10.7	10.7	13.7	13.7	14.0	14.0	11.2	13.0	12.0	12.5	8.5	8.0	7.5	8.2	6.0	6.0
	7	3.0	1.5	.7	3.0	.5	2.5	4.5	6.0	9.0	10.0	12.7	12.0	12.5	13.0	9.0	11.0	10.2	11.0	6.8	7.2	7.5	7.2	5.2	5.2
	1	1.0	1.0	1.0	1.0	.5	1.0	2.7	4.0	5.7	6.5	8.7	8.0	8.2	6.2	8.0	7.0	6.0	3.0	3.0	3.2	3.0	3.0	1.2	1.2



9	25	7.2	6.8	5.2	5.8	7.2	8.0	10.5	7.8	8.2	8.8	15.8	17.5	16.8	20.2	10.2	22.0	17.0	10.0	10.2	6.8	7.2	7.0	8.2	8.5	8.5	10.5	
	13	6.0	5.5	4.5	5.2	6.2	7.5	9.2	8.5	8.0	8.8	13.2	15.5	16.2	18.2	17.8	20.8	15.2	10.0	10.2	7.2	7.5	6.5	7.0	7.2	7.2	10.0	
	7	5.2	4.8	4.2	4.5	5.5	6.5	7.8	7.0	7.0	7.0	13.2	15.5	16.2	18.2	17.8	20.8	15.2	10.0	10.2	7.2	7.5	6.5	7.0	7.2	7.2	10.0	
	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
10	25	5.5	5.5	4.2	5.5	7.2	8.5	10.5	7.8	8.2	8.8	15.8	17.5	16.8	20.2	10.2	22.0	17.0	10.0	10.2	6.8	7.2	7.0	8.2	8.5	8.5	10.5	
	13	4.2	4.2	3.0	4.5	5.5	6.5	7.8	7.0	7.0	7.0	13.2	15.5	16.2	18.2	17.8	20.8	15.2	10.0	10.2	7.2	7.5	6.5	7.0	7.2	7.2	10.0	
	7	3.0	2.5	2.0	3.0	4.0	5.0	6.0	5.5	5.5	5.5	10.5	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	
	1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
11	25	4.5	3.0	2.0	3.0	4.0	5.0	6.0	5.5	5.5	5.5	10.5	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	
	13	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	7	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
12	25	10.2	9.5	11.2	9.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
	13	8.2	7.5	8.0	7.5	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	7	7.2	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	1	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
13	25	1.5	1.5	1.2	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	13	1.5	1.5	1.2	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	7	1.5	1.5	1.2	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	1	1.5	1.5	1.2	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
14	25	5.0	3.7	3.7	6.5	4.5	3.5	4.2	3.2	1.2	1.5	2.7	5.7	3.2	2.7	1.7	4.5	4.5	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0	4.0
	13	4.2	4.2	4.5	5.7	6.2	3.7	4.5	4.0	2.5	1.5	3.7	5.3	3.0	3.0	2.2	4.2	4.2	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0	4.0
	7	4.2	4.2	4.5	5.7	6.2	3.7	4.5	4.0	2.5	1.5	3.7	5.3	3.0	3.0	2.2	4.2	4.2	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0	4.0
	1	4.2	4.2	4.5	5.7	6.2	3.7	4.5	4.0	2.5	1.5	3.7	5.3	3.0	3.0	2.2	4.2	4.2	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0	4.0
15	25	2.0	1.2	2.0	1.2	1.5	2.7	1.5	3.0	5.7	6.2	8.0	7.5	9.5	6.0	3.7	2.5	3.5	4.5	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0
	13	2.0	1.2	2.0	1.2	1.5	2.7	1.5	3.0	5.7	6.2	8.0	7.5	9.5	6.0	3.7	2.5	3.5	4.5	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0
	7	2.0	1.2	2.0	1.2	1.5	2.7	1.5	3.0	5.7	6.2	8.0	7.5	9.5	6.0	3.7	2.5	3.5	4.5	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0
	1	2.0	1.2	2.0	1.2	1.5	2.7	1.5	3.0	5.7	6.2	8.0	7.5	9.5	6.0	3.7	2.5	3.5	4.5	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0
16	25	5.7	6.2	5.0	3.5	5.0	5.2	3.5	3.0	5.7	6.2	8.0	7.5	9.5	6.0	3.7	2.5	3.5	4.5	6.5	5.2	2.7	7.7	2.2	4.0	4.0	4.0	4.0
	13	6.0	3.7	3.2	6.7	5.7	6.0	4.7	4.0	3.0	3.5	4.7	3.2	3.2	3.0	2.7	5.7	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
	7	3.5	3.7	3.2	3.5	2.2	3.5	4.7	4.0	3.0	3.5	4.7	3.2	3.2	3.0	2.7	5.7	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
	1	2.5	2.7	2.2	2.7	2.2	3.2	2.2	2.0	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
17	25	1.5	0	1.2	1.2	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	13	2.7	1.2	1.2	1.5	1.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	7	1.7	0	1.2	1.2	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	1	0.7	0	1.2	1.2	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	25	7.7	5	1.0	5	1.0	5	1.0	1.7	1.5	2.2	4.7	3.2	3.5	11.0	9.7	9.2	11.2	13.0	10.5	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
	13	7.7	5	1.0	5	1.0	5	1.0	1.7	1.5	2.2	4.7	3.2	3.5	11.0	9.7	9.2	11.2	13.0	10.5	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
	7	7.7	5	1.0	5	1.0	5	1.0	1.7	1.5	2.2	4.7	3.2	3.5	11.0	9.7	9.2	11.2	13.0	10.5	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
	1	7.7	5	1.0	5	1.0	5	1.0	1.7	1.5	2.2	4.7	3.2	3.5	11.0	9.7	9.2	11.2	13.0	10.5	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
19	25	6.0	4.7	3.7	4.5	1.2	1.0	1.5	1.5	3.2	5.5	12.0	11.0	14.7	16.2	16.2	13.0	9.7	8.0	0.5	10.0	11.5	10.2	7.7	7.7	7.7	7.7	7.7
	13	6.0	4.7	3.7	4.5	1.2	1.0	1.5	1.5	3.2	5.5	12.0	11.0	14.7	16.2	16.2	13.0	9.7	8.0	0.5	10.0	11.5	10.2	7.7	7.7	7.7	7.7	7.7
	7	6.0	4.7	3.7	4.5	1.2	1.0	1.5	1.5	3.2	5.5	12.0	11.0	14.7	16.2	16.2	13.0	9.7	8.0	0.5	10.0	11.5	10.2	7.7	7.7	7.7	7.7	7.7
	1	4.5	4.5	3.0	1.2	1.2	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
20	25	6.2	6.0	6.0	6.0	3.7	4.2	7.2	7.7	7.7	7.0	5.5	5.5	5.7	5.0	3.5	3.2	2.5	3.2	3.7	3.7	1.0	8.2	13.2	6.0	5.5	5.5	5.5
	13	5.7	5.0	5.2	5.2	3.0	3.5	6.5	7.5	7.0	6.2	5.5	4.5	4.7	4.5	3.0	3.2	2.2	3.2	3.5	3.2	1.7	8.0	11.7	5.2	4.0	4.0	4.0
	7	5.0	4.5	5.0	4.7	3.0	3.5	6.2	7.0	7.0	5.7	5.2	4.5	4.7	4.5	3.0	3.2	2.2	3.2	3.5	3.2	1.7	8.0	11.7	5.2	4.0	4.0	4.0
	1	5.0	4.5	5.0	4.7	3.0	3.5	6.2	7.0	7.0	5.7	5.2	4.5	4.7	4.5	3.0	3.2	2.2	3.2	3.5	3.2	1.7	8.0	11.7	5.2	4.0	4.0	4.0

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date	Height of observation	Average velocity for hour ending at--																								Mean	
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.		
May 21	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour		
	25	1.5	4.5	3.2	1.0	1.5	3.5	3.5	3.5	4.0	4.0	4.7	5.7	7.2	8.7	5.5	5.2	4.2	7.5	9.5	2.2	1.2	5.5	1.7	4.3		
	13	1.7	4.5	3.5	1.2	1.0	3.5	3.2	3.2	3.7	4.0	4.7	5.7	7.0	8.0	5.5	4.5	4.0	4.7	8.5	2.0	1.0	5.0	1.5	4.0		
	7	.7	2.7	1.5	.7	.5	2.5	2.5	2.2	3.0	3.2	3.0	4.3	6.2	1.7	4.5	3.7	3.5	7.2	8.2	2.0	.2	4.2	1.5	3.0		
	1												1.3	2.7	3.5	2.7	2.0	.7	2.5	3.0	.2	0	1.5	0	1.7		
	25	1.0	2.5	2.7	1.2	1.7	1.2	5.2	9.0	8.7	8.5	8.5	11.0	11.5	8.0	4.0	4.0								5.5		
	13	.7	2.5	1.7	1.2	1.5	1.0	5.5	8.5	8.0	8.0	8.0	10.5	11.2	7.7	3.7	4.0								5.2		
	7	1.5	2.2	1.5	1.5	1.5	1.0	5.2	8.5	6.5	6.7	7.2	10.0	9.7	7.7	3.2	3.5								4.8		
	1	0	0	0	0	0	0	1.0	2.2	3.0	3.0	2.5	3.7	3.0	4.0	1.2	1.0								1.5		
	25									3.0	2.7	3.2	2.5	4.2	5.2	9.0		7.5	7.0	4.7	6.5	6.0	4.2	4.0	2.7	4.8	
	13									3.0	2.5	3.5	2.2	3.2	5.2	8.7		6.2	6.5	3.7	5.2	5.2	4.0	2.0	2.5	4.2	
	7									3.2	2.2	2.7	2.2	3.2	4.7	8.0		6.2	6.0	3.2	5.0	5.0	3.5	1.5	2.5	3.9	
May 22	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour		
	25	1.5	3.5	1.7	3.2	6.7	10.0	10.7	6.5	9.0	7.0	6.5	7.7	7.5	5.7	8.5	8.2	7.2	6.7	5.2	6.0	7.5	6.5	7.5	4.0	6.4	
	13	1.0	2.2	1.5	2.5	5.7	10.0	10.2	6.0	8.7	6.7	5.7	7.2	7.5	5.0	8.7	8.5	7.2	6.5	5.2	5.7	7.7	8.5	0.7	3.7		
	7	1.0	1.7	1.0	2.7	5.0	9.0	9.2	5.5	7.0	6.0	5.5	6.7	6.5	4.7	7.5	7.2	6.2	5.7	4.2	5.0	6.5	5.5	0.5	3.0		
	1																										
	25	3.2	4.2	2.2	3.0	3.2	3.5	5.0	4.0	4.2	4.0	3.0	5.5	5.0	5.5	5.5	6.7	8.3	7.0	7.5	4.2	1.5	2.0	2.5	1.5	4.2	
	13	2.5	3.7	1.5	1.7	2.5	2.7	5.0	3.5	4.7	4.2	3.5	6.0	5.0	5.2	7.0	7.5	9.3	8.0	6.7	3.5	1.2	2.0	2.0	1.2	4.2	
	7	2.2	3.2	1.2	2.0	2.2	2.5	3.7	3.2	3.2	3.0	2.0	4.5	4.0	4.2	4.2	5.7	7.3	7.7	6.0	3.0	1.2	1.5	1.7	1.2	3.3	
	1																										
	25	1.7	3.0	2.0	1.0	1.5	1.7	4.2	3.7	4.2	4.0	3.7	5.2	8.2	7.7	6.5	8.5	7.0	8.5	6.7	4.7	6.7	5.0	5.7	4.5	4.8	
	13	1.2	2.5	1.7	1.2	1.2	1.5	3.5	3.7	4.0	4.0	4.5	5.0	8.0	7.0	6.2	7.7	6.2	8.0	6.5	4.2	6.0	4.7	4.5	4.2	4.5	
	7	1.5	3.0	1.7	1.5	1.2	1.5	3.5	3.5	4.2	3.2	3.5	5.0	7.7	6.2	6.0	6.7	5.0	6.7	5.0	3.5	5.5	4.0	4.0	3.7	4.0	
May 23	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour		
	25	3.5	2.2	1.5	1.0	2.5	3.0	2.5	2.5	2.7	4.2	7.5	10.0	12.2	14.7	14.2	15.2	13.0	9.2	9.0	8.2	7.5	5.5	7.7	6.0	6.9	
	13	3.0	2.2	1.0	1.2	1.7	2.7	2.7	2.2	2.0	4.5	7.0	9.2	11.0	13.5	12.7	14.0	12.7	8.5	8.7	7.2	6.5	5.0	6.7	5.2	6.3	
	7	3.0	1.5	.7	1.2	1.5	2.5	2.5	2.2	1.7	4.0	6.5	8.5	10.0	13.2	12.8	13.0	12.8	7.0	7.8	6.8	6.0	4.2	6.2	4.5	5.8	
	1																										
	25	4.2	5.0	6.8	8.8	9.2	11.8	10.5	10.8	13.0	13.0	14.2	11.8	9.3	12.2	15.3	13.0	9.8	13.5	3.5	4.2	2.0	4.2	2.5	2.2	6.5	
	13	4.0	4.5	6.2	8.2	8.7	11.0	9.5	10.7	12.5	12.5	13.5	11.5	9.0	11.5	15.0	12.0	9.0	12.8	3.2	4.2	1.5	3.5	1.5	2.8	8.3	
	7	3.5	4.2	6.0	8.0	8.5	10.2	8.7	9.0	12.2	11.5	13.0	10.5	8.3	11.0	14.5	12.0	9.0	12.0	3.2	3.5	1.5	3.5	1.8	2.5	7.5	
	May 24	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	
		25	4.2	5.0	6.8	8.8	9.2	11.8	10.5	10.8	13.0	13.0	14.2	11.8	9.3	12.2	15.3	13.0	9.8	13.5	3.5	4.2	2.0	4.2	2.5	2.2	6.5
		13	4.0	4.5	6.2	8.2	8.7	11.0	9.5	10.7	12.5	12.5	13.5	11.5	9.0	11.5	15.0	12.0	9.0	12.8	3.2	4.2	1.5	3.5	1.5	2.8	8.3
		7	3.5	4.2	6.0	8.0	8.5	10.2	8.7	9.0	12.2	11.5	13.0	10.5	8.3	11.0	14.5	12.0	9.0	12.0	3.2	3.5	1.5	3.5	1.8	2.5	7.5

29	25	2.2	1.0	2.2	2.2	2.2	2.5	6.5	8.0	7.3	9.5	11.8	10.8	9.2	9.5	10.8	11.8	9.5	9.5	5.8	5.5	8.5	3.8	2.2	1.5	6.4
	13	2.2	1.0	2.2	1.5	2.0	2.0	6.2	7.8	8.2	9.2	11.5	10.2	9.0	8.8	10.2	11.5	9.0	9.5	5.5	5.5	7.8	3.0	2.0	1.5	6.1
	7	2.0	.5	1.8	1.8	1.0	2.5	6.5	7.0	6.8	8.8	11.2	9.5	8.5	8.2	10.0	10.2	7.0	8.8	5.0	4.8	7.2	1.5	2.0	1.0	5.6
	1																									
30	25	1.0	1.2	1.2	2.0	1.0	1.5	2.5	2.2	7.5	13.0	13.8	12.0	11.0	9.5	10.5	10.2	6.8	7.0	5.2	4.5	5.2	6.5	5.5	4.8	6.1
	13	.8	1.2	1.5	2.2	.8	1.8	2.2	2.8	7.2	12.5	13.0	10.2	10.2	8.8	9.5	9.5	6.8	6.8	4.8	4.2	4.2	6.2	4.8	4.8	5.7
	7	.5	.2	1.2	1.8	1.0	1.0	1.8	2.0	6.8	11.0	12.0	9.2	9.5	8.2	8.5	8.8	6.2	6.0	3.5	3.8	3.2	5.8	4.5	3.8	5.0
	1																									
31	25	4.2	6.8	5.0	2.5	1.2	1.0	1.0	5.2	9.8	12.5	8.8	8.5	6.8	6.2	6.5	7.0	9.0	8.5	4.0	5.5	2.2	2.5	1.2	1.5	5.3
	13	3.7	6.5	5.2	1.8	1.0	.8	1.5	5.0	9.2	11.8	8.2	7.8	6.2	6.2	6.5	6.5	9.0	7.8	3.0	5.0	2.2	2.5	1.2	1.5	5.0
	7	1.5	5.0	4.2	1.8	1.5	1.2	1.8	4.8	7.2	10.5	7.0	6.5	5.5	5.0	6.5	6.0	7.8	7.2	3.0	3.8	2.0	2.0	1.0	1.5	4.3
	1																									
Mean...	25	3.8	3.7	3.6	4.2	4.0	5.1	5.5	6.0	6.8	7.5	7.8	8.4	8.3	8.7	8.8	9.0	7.8	7.7	5.8	5.6	5.0	4.7	4.8	4.1	---
	13	3.2	3.3	3.2	3.5	3.5	4.4	4.9	5.3	6.3	7.3	7.6	8.1	8.0	8.4	8.7	8.6	7.6	7.4	5.2	5.1	4.4	4.3	4.1	3.8	---
	7	2.9	2.8	2.7	3.2	3.0	4.0	4.4	5.0	5.6	6.6	6.6	7.2	7.2	7.5	7.8	7.6	6.5	6.7	4.7	4.4	3.8	3.7	3.6	3.3	---
	1	1.4	1.4	1.5	2.0	1.9	2.3	2.4	2.7	3.4	4.2	4.5	4.4	4.6	5.1	4.9	4.4	3.8	3.2	2.1	1.7	1.5	1.4	1.5	1.6	---

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date		Height of observation	Average velocity for hour ending at—																								Mean
			1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
June		Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
1	25	1.0	1.5																								7.9
	13	1.0	1.5																								7.3
	7	1.5	1.5																								6.1
2	25	12.8	9.5	8.2	8.2	6.2	7.5	9.8	10.5		10.5	10.2	7.2	7.8	5.2	4.5	4.2	2.8	9.8	6.5	2.8	4.2	3.2	5.0	5.8	7.2	7.2
	14	11.8	8.8	7.8	7.8	8.5	6.8	9.2	10.0		9.8	9.8	6.2	6.8	4.2	3.8	4.0	2.8	9.2	5.8	2.0	4.0	3.2	4.2	5.2	6.6	
	7	11.8	7.8	6.0	5.8	6.8	5.2	7.2	8.5	8.0	8.2	8.8	6.0	6.5	4.0	3.2	2.8	2.8	8.0	4.8	1.2	2.2	2.5	2.8	3.5	5.6	
3	25	7.2	6.2	5.8	5.5	5.8	6.2	3.5	5.8	6.2	4.2	2.8	2.5	3.0	3.2	5.8	4.8	5.5	6.0	4.8	4.2	1.0	1.0	2.5		4.5	
	14	6.5	5.7	5.0	5.2	5.0	5.5	3.5	5.8	5.5	4.5	2.8	1.8	2.8	3.2	5.0	4.2	5.0	5.8	5.0	4.2	1.0	1.0	2.5		4.2	
	7	4.8	4.0	3.0	4.0	3.2	4.5	1.8	3.5	4.5	3.5	.5	1.5	1.2	2.2	3.5	3.5	3.0	4.5	3.8	2.8	0	2.0	5.0		2.9	
4	25	5.2	5.8	4.5	3.0	2.0	3.0	3.0	3.0	3.2	2.5	3.6	5.5	8.0	7.5	9.0	7.5	7.8	7.2	4.8	1.8	1.8	1.2	1.8	1.8	4.4	
	14	5.0	4.5	3.8	2.8	1.8	2.8	2.8	3.0	3.2	2.5	3.2	5.0	7.8	7.5	7.8	6.8	7.0	7.2	3.8	1.8	1.5	1.0	1.8	1.2	4.0	
	7	4.2	4.2	2.5	2.2	1.8	2.0	2.8	3.0	3.2	2.2	2.7	4.3	7.2	6.0	7.0	6.0	6.8	6.0	3.8	1.5	1.2	1.0	1.2	.8	3.5	
5	25	9.2	11.2	5.5	4.8	3.8	4.5	4.2	4.2	4.8	5.0		6.5	3.8	7.2	6.5	3.8			5.2	4.8	5.2	5.2	2.8	2.0	5.2	
	14	7.5	9.5	3.8	3.2	2.8	3.5	3.5	3.8	3.8	4.5	3.0	5.8	3.0	7.0	6.2	4.2	5.7		4.2	4.2	5.0	5.0	1.8	2.0	4.5	
	7	6.2	8.0	3.5	2.5	1.5	1.8	2.0	2.5	2.8	3.2	1.8	5.5	2.0	5.8	5.2	2.5	5.7	5.0	4.5	4.2	5.0	4.2	1.5	.5	3.6	
6	25	4.5	4.8	2.0	1.8	1.0	1.0	1.8	14.0	11.0	14.0	11.8	11.5	11.5	9.5	11.5	10.2	10.5	9.2	5.0	6.0	10.8	10.2	9.5	7.5	1.9	
	14	4.2	4.2	2.8	1.8	1.0	1.0	2.2	12.8	10.0	14.2	13.8	13.8	11.0	8.5	10.5	9.5	9.8	8.8	5.0	5.2	9.8	9.0	8.8	7.2	7.2	
	7	3.0	3.8	2.2	2.0	1.0	1.5	1.8	11.2	7.8	12.8	13.8	12.0	9.5	7.0	8.8	8.2	8.5	7.5	4.0	4.0	9.2	8.0	8.2	6.5	6.8	
7	25	2.0	2.2	2.2	.8	.5	.8	1.0	6.8	5.0	7.8	7.2	6.8	6.2	5.2	5.5	5.5	5.5	4.8	1.8	2.0	5.5	5.0	5.2	4.0	4.1	
	14	7.0	7.8	4.5	5.8	2.2	1.8	2.0	6.0	5.8	5.3	5.5	6.8	5.0	6.8	10.2	9.0	9.5	6.5	8.0	10.2	6.8	6.2	4.0	1.8	6.0	
	7	6.8	6.5	4.8	4.8	2.2	1.2	2.0	5.5	5.5	4.3	4.8	6.2	4.2	6.0	9.2	8.5	8.8	6.5	7.5	9.0	6.5	5.2	3.5	1.5	5.4	
8	25	6.8	5.8	3.8	3.8	1.2	1.2	1.8	5.5	5.5	2.4	4.7	4.8	4.8	4.0	6.0	8.8	8.0	8.2	6.2	7.5	7.8	6.0	5.0	2.8	5.0	
	14	2.5	3.2	2.2	2.5	.5	.5	1.0	3.0	2.8	2.3	2.0	2.5	3.8	2.8	4.0	5.2	5.2	5.0	3.8	3.8	4.0	3.2	2.8	1.0	1.0	
	7	1.8	1.0	2.0	1.8	1.5	3.5	7.8	8.2	7.8	5.5	1.5	0	0	6.0		6.5	7.2	8.2	3.2	11.8	13.2	6.5	3.8	3.8	5.1	
	25	1.5	.2	1.2	1.8	1.5	3.5	7.2	8.5	7.5	5.8	5.6			5.8	7.7	7.0	8.2	10.0	2.5	14.0	13.8	6.2	3.8	3.8	8.0	6.0
	14	1.2	.2	1.5	1.0	1.5	3.0	6.0	7.2	7.5	5.0	4.5	3.8	6.2	5.8	5.7	5.8	6.0	7.5	1.8	9.5	12.0	5.2	3.2	3.2	5.2	4.8
	7	1	.8	1.0	1.0	1.0	1.5	4.2	5.0	4.5	4.2	3.2	2.2	3.8	3.0	2.5	4.5	3.5	5.5	1.5	6.5	7.8	3.5	3.2	4.2	4.8	

9	25	8.0	9.0	9.0	10.8	10.5	12.8	14.8	13.2	8.8	8.5	6.8	9.2	9.5	6.8	4.8	8.0	3.8	2.8	2.5	5.0	3.2	.8	4.2	7.4
	13	7.0	9.2	8.2	10.0	9.5	12.0	13.0	11.5	7.7	8.0	6.5	8.2	9.2	6.8	4.2	6.0	3.8	2.0	2.8	4.5	3.5	.8	4.2	6.8
	7	3.2	3.8	3.0	4.5	3.8	5.2	6.0	4.2	3.8	3.5	3.5	4.2	4.2	4.2	2.5	4.2	2.0	1.0	1.8	2.2	1.8	0	2.5	4.8
10	25	2.0	1.5	2.8																					
	13	1.8	1.8	2.5																					
	7	.2	0	1.0	0																				
11	25	1.2	1.0	1.8	1.5	1.8	1.2	1.5	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5
	13	1.2	1.6	1.8	1.5	1.8	1.2	1.5	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5
	7	1.2	1.5	1.5	1.5	1.5	1.2	1.5	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5
12	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	13	3.5	5.0	4.8	3.0	1.8	2.0	4.8	6.5	11.0	10.5	8.2	11.2	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
	7	3.6	3.5	4.5	3.0	1.8	1.5	4.0	5.8	10.2	6.8	8.2	11.2	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
13	25	2.2	2.5	2.8	1.5	1.0	1.0	3.0	2.8	8.0	5.5	5.2	4.5	1.8	3.2	3.2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	13	2.2	1.2	1.8	1.2	1.5	5.0	6.5	7.0	10.2	8.8	8.0	10.2	8.0	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
	7	2.2	1.2	1.5	1.5	1.5	4.0	4.8	5.5	10.2	8.8	8.0	10.2	8.0	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
14	25	4.0	7.0	3.2	4.2	2.5	3.2	3.0	3.5	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
	13	4.2	6.2	3.2	4.0	2.5	3.0	4.0	2.5	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
	7	4.2	5.2	2.7	3.2	2.0	2.7	3.5	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
15	25	3.8	1.5	1.2	1.0	2.5	2.8	1.2	2.2	2.0	1.2	1.2	2.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	13	2.2	1.8	1.0	1.8	2.5	2.5	1.8	1.0	10.8	8.2	8.8	11.8	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
	7	2.2	1.8	1.2	1.2	2.0	1.8	1.0	3.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
16	25	4.0	1.0	1.0	1.0	1.5	1.2	1.8	2.0	3.8	6.2	8.2	11.2	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
	13	3.5	1.2	3.5	4.0	3.2	3.0	7.0	8.0	6.7	7.5	8.5	11.2	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
	7	2.7	1.2	3.0	3.5	3.2	2.5	7.2	6.2	6.7	7.5	8.5	11.2	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
17	25	2.0	2.7	1.5	1.7	1.5	1.7	4.7	5.2	5.0	5.5	5.2	6.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	13	6.5	2.5	1.5	3.7	3.2	4.0	2.2		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	7	6.5	1.5	1.2	2.7	2.2	3.5	5.2		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
18	25	4.5	12.0	15.5	11.5	13.5	13.7	11.0	9.5	10.2	9.2	8.7	11.2	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
	13	4.5	11.7	14.7	10.7	14.0	12.7	10.0	9.2	10.2	9.0	8.5	11.2	9.8	11.8	8.5	8.8	5.5	5.2	5.0	3.0	3.0	3.0	3.0	3.0
	7	4.0	9.7	13.2	9.0	11.2	10.5	9.2	8.2	6.7	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
19	25	6.2	7.0	8.7	6.5	8.0	7.2	5.5	5.0	6.0	6.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
	13	6.0	4.5	6.0	5.2	4.5	5.8	7.8	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	7	4.0	2.8	3.8	4.0	3.0	6.2	3.0	6.2	4.2	4.8	4.8	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
20	25	2.8	2.0	3.2	1.5	2.8	3.0	4.2	2.5	2.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	13																								
	7	2.0	1.5	1.5	1.0	1.2	.7	.5	3.0	2.5	4.2	5.5	9.5	8.2	5.7	1.7	7.2	9.0	5.2	3.2	2.0	1.0	2.0	1.0	3.3
	1	.7	.2	.2	.7	.2	.2	.2	1.7	1.5	3.5	4.2	7.0	5.2	3.2	1.2	4.7	6.7	3.5	2.2	1.2	.7	.7	1.0	2.1

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date	Height of observation	Average velocity for hour ending at—																								Mean
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.	
	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
June 21	25	4.5	4.5	4.7	5.2	4.7	4.2	3.5	2.5	5.2	5.3	8.3	6.5	7.5	8.0	9.8	10.6	5.0	5.8	6.5	2.2	1.2	7.5	4.2	4.8	4.6
	13	2.7	3.7	2.0	2.7	1.7	2.5	3.5	1.7	4.5	5.0	6.2	4.5	7.2	7.0	8.5	9.0	5.0	5.2	6.5	2.0	1.0	6.2	3.5	4.4	4.3
	7	1.0	1.0	1.0	1.0	2.5	4.2	6.0	5.0	5.5	5.0	6.0	6.2	5.8	6.8	6.8	8.2	5.0	5.2	6.5	2.0	1.0	6.2	3.5	4.4	4.3
22	25	1.2	1.0	1.0	1.3	2.2	4.0	6.0	5.0	4.5	4.5	4.5	4.2	5.5	5.8	6.2	8.2	5.0	5.2	6.5	2.0	1.0	6.2	3.5	4.4	4.3
	13	1.2	1.0	1.0	1.3	2.2	4.0	6.0	5.0	4.5	4.5	4.5	4.2	5.5	5.8	6.2	8.2	5.0	5.2	6.5	2.0	1.0	6.2	3.5	4.4	4.3
	7	1.5	1.5	1.0	1.2	2.0	3.5	5.5	4.2	5.5	4.5	4.5	4.2	5.5	5.8	6.2	8.2	5.0	5.2	6.5	2.0	1.0	6.2	3.5	4.4	4.3
23	25	5.0	3.8	2.5	2.2	2.8	6.8	2.5	2.5	1.5	3.8	6.0	7.2	10.8	9.8	9.5	9.5	11.0	8.2	6.5	2.2	1.2	7.5	4.2	4.8	4.6
	13	5.0	3.8	2.8	2.2	2.5	6.0	2.0	2.8	2.2	3.2	5.0	7.2	10.8	8.5	9.0	8.5	9.5	7.5	5.5	3.5	5.0	4.2	3.2	3.0	3.7
	7	4.0	2.8	2.2	1.8	1.8	4.5	1.5	1.8	1.5	1.5	1.8	7.0	9.2	7.8	6.5	6.5	4.5	3.5	3.5	2.0	1.0	1.8	1.0	1.0	1.0
24	25	2.2	1.8	1.0	1.0	1.2	2.8	1.0	1.8	1.0	1.8	3.5	4.2	5.8	4.5	4.2	4.0	4.0	2.5	2.5	1.0	1.8	1.2	1.2	2.5	5.0
	13	3.0	3.5	6.0	7.8	5.5	5.0	6.2	7.0	7.0	5.0	6.2	6.5	5.2	6.2	4.5	4.0	6.2	5.5	5.0	1.5	4.6	4.2	3.2	3.2	4.6
	7	2.5	3.0	5.8	6.8	4.5	4.2	5.5	6.5	6.8	4.2	5.5	6.0	5.0	5.8	4.5	4.0	5.5	5.5	5.0	1.5	1.2	4.2	2.5	2.5	4.6
25	25	2.0	1.5	2.8	2.8	1.5	2.5	2.8	3.0	3.5	1.5	3.0	2.0	2.5	3.0	2.5	4.5	3.8	3.0	1.5	1.5	1.0	1.8	4.2	2.5	2.4
	13	1.0	1.2	2.0	2.8	2.2	2.0	2.5	3.0	3.2	3.8	2.5	3.5	3.0	3.5	2.5	4.5	3.5	3.0	1.5	1.2	1.0	1.0	2.5	1.0	2.4
	7	3.5	2.8	2.0	10.2	11.5	10.8	10.2	9.0	10.5	9.0	9.8	11.2	12.0	12.8	11.0	10.5	10.8	10.8	8.0	7.0	2.0	1.8	2.8	2.8	7.0
26	25	2.5	2.5	1.5	9.2	10.2	9.2	9.2	8.2	9.0	7.2	8.0	10.2	10.8	11.5	9.2	9.2	10.2	10.0	7.0	2.5	2.0	1.5	1.5	2.8	7.2
	13	1.0	2.0	1.0	5.2	7.8	7.8	8.0	7.0	7.2	7.2	8.0	8.0	8.5	11.0	7.2	6.0	5.0	4.8	5.0	1.8	1.0	1.5	1.5	1.5	5.3
	7	1.0	1.0	1.0	3.5	4.5	4.5	4.2	3.8	4.5	4.5	5.0	5.2	5.2	6.0	4.5	4.5	4.8	5.2	4.8	0.8	1.0	1.0	1.0	1.0	3.6
27	25	4.8	2.8	1.2	2.8	2.0	3.5	8.0	8.0	5.5	5.8	4.8	4.5	3.0	5.5	5.0	4.2	5.2	6.0	6.2	3.0	2.0	1.0	1.2	1.0	4.0
	13	4.5	1.8	1.2	2.2	1.8	2.8	7.8	7.8	5.5	5.8	5.8	5.2	3.0	6.2	6.0	5.0	5.2	6.8	7.2	3.2	1.8	1.0	1.0	1.0	3.9
	7	4.2	2.2	1.8	1.0	1.5	1.8	3.8	3.8	5.0	5.2	5.0	5.0	2.8	4.8	5.0	3.2	4.5	4.5	5.5	2.0	1.5	1.0	1.0	1.0	3.0
28	25	1.2	1.2	1.8	1.0	1.0	1.0	3.8	2.0	5.0	5.2	3.0	2.8	1.2	3.0	3.5	2.8	2.2	2.8	2.8	1.0	0.8	1.0	1.0	1.0	2.1
	13	1.8	1.2	1.2	1.0	1.2	1.2	1.5	1.5	4.5	5.5	4.8	4.5	3.0	5.5	5.8	5.2	5.2	6.8	7.2	0.8	0.0	0.2	2.8	2.8	6.8
	7	1.5	1.5	1.5	0	1.2	1.2	1.5	1.5	5.0	5.5	5.8	5.2	3.0	5.5	5.8	5.2	5.2	6.8	7.2	0.8	0.0	0.2	2.8	2.8	6.8
29	25	2.2	1.5	1.5	0	1.2	1.2	1.5	1.5	5.0	5.5	5.8	5.2	3.0	5.5	5.8	5.2	5.2	6.8	7.2	0.8	0.0	0.2	2.8	2.8	6.8
	13	2.2	1.5	1.5	0	1.2	1.2	1.5	1.5	5.0	5.5	5.8	5.2	3.0	5.5	5.8	5.2	5.2	6.8	7.2	0.8	0.0	0.2	2.8	2.8	6.8
	7	2.2	1.5	1.5	0	1.2	1.2	1.5	1.5	5.0	5.5	5.8	5.2	3.0	5.5	5.8	5.2	5.2	6.8	7.2	0.8	0.0	0.2	2.8	2.8	6.8
30	25	5.0	4.2	1.5	1.0	3.8	2.0	4.0	3.5	4.5	3.0	3.8	7.0	4.8	5.0	5.8	5.2	4.2	4.8	5.2	4.5	4.5	4.0	4.0	4.0	4.1
	13	4.8	3.8	1.0	1.0	3.2	1.8	3.8	3.2	4.2	3.0	3.8	6.2	5.0	6.0	6.5	4.2	4.0	4.0	5.0	4.0	3.8	3.8	3.8	3.8	3.8
	7	4.0	3.0	0	1.0	3.0	1.8	3.2	3.0	3.8	3.5	3.0	5.2	4.0	5.8	6.2	3.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.3
31	25	1.8	1.5	1.0	1.0	1.2	1.8	1.8	2.0	2.0	1.8	1.8	3.5	2.8	3.0	3.2	2.0	1.8	1.8	2.0	1.5	1.5	1.0	1.0	1.0	1.8
	13	1.8	1.5	1.0	1.0	1.2	1.8	1.8	2.0	2.0	1.8	1.8	3.5	2.8	3.0	3.2	2.0	1.8	1.8	2.0	1.5	1.5	1.0	1.0	1.0	1.8
	7	1.8	1.5	1.0	1.0	1.2	1.8	1.8	2.0	2.0	1.8	1.8	3.5	2.8	3.0	3.2	2.0	1.8	1.8	2.0	1.5	1.5	1.0	1.0	1.0	1.8

20	25	1.2	1.8	3.2	1.5	2.5	4.5	4.2	5.5	3.0	3.8	6.2	5.0	6.5	7.2	8.8	7.0	4.0	1.2	3.2	8.2	5.5	3.5	3.5	3.6	4.4
	13	1.8	2.0	3.0	1.5	2.0	4.2	4.0	4.8	3.0	3.5	5.8	4.5	6.2	7.0	8.0	7.0	3.5	1.8	3.2	7.5	5.0	3.0	2.5	2.2	4.0
30	1	1.2	1.5	2.5	1.2	2.0	4.0	4.0	4.5	3.0	3.5	5.2	4.5	5.8	5.5	7.8	6.0	2.2	1.5	2.2	7.2	4.2	2.0	3.0	2.8	3.6
	7	1.8	1.0	1.2	1.0	1.0	2.0	1.5	2.5	1.0	2.0	2.8	2.8	3.5	3.2	3.8	2.8	2.0	1.0	1.2	4.5	2.8	1.5	1.5	1.5	2.0
Mean	25	6.5	5.2	5.5	5.0	3.0	3.0	4.5	7.0	6.5	6.2	8.2	7.2	7.8	11.0	10.0	9.2	6.0	1.2	9.0	2.0	2.5	2.8	3.0	3.8	5.7
	13	6.0	5.0	5.0	4.8	2.8	2.5	4.2	7.0	6.8	5.8	7.2	7.2	8.0	10.7	9.3	8.8	6.2	---	8.2	2.2	2.0	2.8	3.2	3.2	5.7
	7	5.5	4.2	4.2	4.2	1.8	2.2	4.2	6.8	6.0	5.8	7.2	6.8	7.5	9.3	7.7	7.5	5.8	1.2	5.8	2.5	1.0	2.0	2.5	2.8	4.8
	1	3.2	2.2	2.5	1.8	1.0	1.2	2.0	4.0	3.8	3.5	4.5	4.2	4.8	5.7	5.5	5.2	4.0	1.0	4.8	1.5	1.0	1.5	1.8	1.6	3.0
Mean	25	4.6	4.4	4.2	4.4	4.2	4.0	5.8	7.2	6.0	7.0	7.2	7.3	7.8	8.3	8.2	8.2	8.0	6.8	5.8	5.7	5.1	4.7	4.2	3.8	---
	13	4.2	3.9	3.7	3.9	3.8	4.3	5.4	6.8	6.3	6.6	6.8	7.0	7.6	7.9	8.0	7.9	7.4	7.0	5.3	5.3	4.7	4.5	3.8	3.5	---
	7	3.5	3.2	2.8	2.0	2.9	3.4	4.2	5.1	5.3	5.6	5.8	5.8	6.4	6.7	6.4	6.3	5.9	5.1	4.2	4.0	3.6	3.3	3.1	2.8	---
	1	1.8	1.8	1.7	1.8	1.7	2.1	2.8	3.5	3.7	4.0	4.0	4.2	4.4	4.4	4.3	4.4	4.1	3.4	2.9	2.6	2.5	2.2	1.8	1.6	---

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

		Average velocity for hour ending at -																								
Date	Height of observation	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	12 p.m.	Mean
		Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
July 1	25	3.0	3.5	3.0	2.0	3.2	4.8	7.5	6.8	10.3	10.0	7.8	10.0	10.8	8.8	6.5	9.0	8.0	6.5	3.0	4.0	5.2	5.5	7.0	4.0	6.3
	13	3.0	3.0	2.8	1.8	2.5	4.5	6.8	6.2	9.7	9.2	7.0	20.0	10.5	8.0	26.0	27.8	26.2	23.0	3.5	4.5	4.2	6.5	3.8	5.7	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
	13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2	
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
1	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.2	28.0	27.8	25.0	3.2	4.0	3.8	5.5	3.2	5.2		
13	2.2	2.5	2.0	1.2	1.5	2.2	3.5	3.5	9.0	9.0	6.8	8.2	9.5	7.0	22.											



## EVAPORATION FROM LAND AND WATER SURFACES

[illegible]

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels <sup>1</sup> Arlington Farm, Va., 1939—Continued

Date	Height of observation	Average velocity for hour ending at -																								Mean
		1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	12 p.m.	
July 21	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	
	25	5.8	6.0	5.0							4.0	4.5	8.2	10.8	11.0	10.2	14.0	9.2	10.2	7.5	8.8	8.8	9.0	6.5	5.8	
	13	5.8	5.2	4.0							4.2	5.0	8.2	10.0	9.8	10.0	12.8	8.2	9.8	7.0	8.8	8.5	6.0	5.5	7.6	
22	7	5.2	4.8								4.5	4.2	7.8	9.5	7.0	10.0	12.2	6.8	8.5	6.0	9.0	7.8	7.2	5.8	7.2	
	1	3.0	2.2	4.0	3.5						2.5	2.5	4.2	5.0	4.0	5.5	6.0	3.0	4.0	2.5	4.8	3.8	4.5	3.0	2.8	
	25	6.5	10.8	7.5	7.0	6.5	7.5	7.5	9.0	6.8	9.8	11.0	8.5	8.2	8.0	7.3	7.5	6.0	7.5	6.2	4.8	3.8	1.8	2.0	1.2	
23	13	6.0	10.0	7.5	7.0	6.5	7.5	7.5	8.8	6.5	9.5	10.8	8.2	7.8	7.2	7.3	7.2	6.0	7.0	5.8	3.8	1.8	1.8	1.0	1.0	
	7	5.5	8.8	7.0	7.2	4.2	5.8	6.2	7.2	5.2	8.0	8.5	6.2	6.2	5.2	7.3	7.2	6.0	7.0	5.2	4.0	1.2	1.2	1.0	1.0	
	1	2.5	4.2	1.0	1.0	3.2	3.8	4.0	5.2	3.5	3.0	5.8	4.2	4.0	3.8		4.0	3.5	3.0	3.8	2.2	2.0	1.0	1.0	1.0	
24	25	1.0	3.0	1.5	1.5	1.0	1.2	2.8	6.8	5.8	5.8	5.2	6.5	6.8		3.8	6.8	5.5	6.0	4.0	3.8	2.8	2.8	2.5	1.2	
	13	1.0	3.0	1.5	1.5	1.0	1.0	2.5	6.0	5.0	5.5	5.0	5.2	6.2		3.0	5.5	5.5	5.2	2.8	3.2	2.2	2.2	2.0	1.0	
	7	1.0	1.2	1.0	2.2	1.0	1.0	1.2	2.8	3.0	2.8	2.5	3.0	3.8	3.0	1.5	3.0	2.8	2.8	2.5	1.5	1.2	1.2	1.0	1.0	
25	25	1.5	1.5	1.0	1.0	1.0	1.0	1.8	1.0	2.2	2.8	4.5	3.5	4.2	4.5		4.2	5.2	4.8	3.5	2.0	1.8	7.0	6.8	8.8	
	13	1.2	1.2	1.0	.8	1.0	1.0	1.5	1.0	2.0	2.8	4.2	3.0	4.0	3.5		4.0	5.0	4.5	3.5	1.8	2.0	6.0	6.0		
	7	.8	1.2	.5	.5	.5	1.0	.8	.5	2.0	2.0	4.5	2.5	3.5	4.2		4.5	4.0	4.8	3.5	1.2	1.0	5.0	5.8		
26	25	1.0	1.0	3.2	1.0	1.0	1.0	.8	.8	1.5	1.5	2.0	1.5	2.2	3.0		2.8	2.0	3.0	1.5	1.2	0	3.8	3.8		
	13	4.0	4.0	4.5	5.5	11.0	4.0	2.5	2.8	3.5	5.2	2.8	4.5	4.5	8.0	6.0	8.5	8.0	8.2	7.0	4.7	5.0	3.2	2.5		
	7	3.8	3.5	4.2	4.8	10.2	3.2	2.2	2.8	3.2	4.2	3.5	3.8	4.5	7.5	6.2	10.2	8.2	8.0	6.2	4.7	3.0	2.0	2.2		
27	25	4.2	2.5	5.0	3.8	10.0	3.5	2.2	1.5	3.0	4.2	3.8	3.5	3.5	6.8	6.2	9.0	8.2	7.8	7.5	3.2	2.5	2.8	.8		
	13	2.5	1.8	1.5	.5	6.2	2.5	1.2	1.2	1.2	2.5	2.2	2.5	2.0	4.0	4.0	5.5	5.2	4.8	4.8	2.0	1.2	1.2	1.2		
	7	1.5	1.2	2.5	1.8	1.0	1.5	1.0	1.2	2.2	2.2	7.0	8.0	7.5	7.5	5.8	7.8	9.5	8.8	4.2	2.5	1.0	1.0	1.5		
28	25	1.5	1.0	2.0	1.8	1.0	1.2	1.0	1.2	2.5	2.2	6.2	7.8	6.8	6.2	5.5	7.2	8.5	8.0	4.0	2.2	1.0	1.8	1.5		
	13	1.5	.5	2.5	1.0	1.2	1.0	1.0	1.5	2.2	2.8	7.0	6.2	6.5	7.0	4.2	7.0	7.5	8.5	2.8	1.0	1.0	1.0	1.0		
	7	1.0	1.0	2.0	1.0	1.0	1.0	1.0	.5	1.2	1.2	3.2	3.8	3.2	4.0	2.8	3.5	4.0	3.5	1.0	1.2	1.0	1.0	1.0		
29	25	1.0	1.2	1.2	1.8	2.5	1.0	1.8	2.2	4.0							9.0	5.8	3.0	1.2	1.0	1.0	1.0	1.5		
	13	1.0	1.2	1.0	1.8	2.2	.8	1.8	2.0	3.2							7.2	5.5	2.8	1.0	1.0	1.0	1.0	1.5		
	7	1.0	1.5	.5	1.0	2.0	.5	2.0	1.2	2.8							6.8	4.2	2.8	1.0	1.0	1.0	1.0	1.0		
30	25	1.0	1.2	1.2	1.8	.5	.2	.8	.8	1.5							6.5	3.5	1.8	.8	1.0	1.0	1.0	1.0		
	13	3.2	2.2	2.5	1.5	1.5	2.5	1.8	3.2	2.5	2.5	1.5	3.0	4.0	3.2	5.0	4.0	2.8	3.0	5.5	1.8	1.8	2.0	1.0		
	7	2.5	1.5	2.2	1.5	1.8	2.2	1.8	3.2	3.0	2.5	1.5	4.0	4.0	3.5	3.5	3.2	3.2	1.8	2.8	4.0	4.2	2.0	1.0		
31	25	2.2	1.5	1.2	.5	.8	2.0	1.8	2.8	2.2	1.5	4.0	4.0	3.5	3.5	3.2	4.0	2.8	3.0	4.5	5.0	2.5	1.8	2.0		
	13	2.2	1.5	1.2	.5	.8	2.0	1.8	2.8	2.2	1.5	4.0	4.0	3.5	3.5	3.2	4.0	2.8	3.0	4.5	5.0	2.5	1.8	2.0		
	7	.8	.8	2.0	2.0	1.0	1.0	1.0	1.2	1.2	1.0	.8	2.2	1.8	2.0	2.2	2.5	1.0	1.8	2.8	4.0	4.2	1.2	1.0		

29	25	1.0	1.8	5.0	3.0	5.0	4.8	7.2	6.5	5.2	-----	-----	-----	-----	7.5	5.5	4.0	3.8	2.0	3.0	2.5	2.2	3.0	3.8	4.0
	13	1.0	1.5	5.0	2.8	5.2	4.2	6.8	6.0	6.0	-----	-----	-----	-----	6.8	5.8	3.5	3.5	2.0	2.2	2.2	2.0	2.8	3.8	3.8
	7	.8	1.5	4.0	2.2	4.2	3.8	6.8	5.5	5.8	-----	-----	-----	-----	6.2	4.5	3.5	3.0	1.8	2.5	2.0	.8	1.8	3.0	3.4
	1	.5	.5	2.0	1.0	2.2	2.0	3.2	2.8	3.2	-----	-----	-----	-----	3.8	2.5	1.8	1.8	1.2	.8	1.0	1.0	1.0	1.2	1.8
30	25	5.8	5.0	5.0	4.0	4.0	2.5	3.8	4.2	-----	-----	-----	-----	4.8	5.0	9.0	8.5	7.0	2.8	5.2	9.0	3.2	2.5	3.5	5.1
	13	5.0	4.8	4.8	4.0	4.0	2.5	3.8	3.8	-----	-----	-----	-----	4.0	8.0	8.5	8.0	6.0	2.0	4.5	8.0	3.0	2.5	3.0	4.6
	7	4.5	3.8	4.2	3.2	3.8	2.2	3.5	4.2	5.0	2.2	-----	-----	3.0	4.0	7.8	7.8	5.5	2.5	4.2	6.8	1.2	1.8	2.0	4.1
	1	2.2	1.2	1.0	1.0	1.8	1.2	2.0	2.5	3.5	1.5	-----	-----	1.8	4.0	5.0	4.5	3.5	1.8	4.2	4.2	2.5	1.5	1.2	2.6
31	25	2.0	1.2	1.8	1.0	-----	-----	-----	15.2	13.0	14.2	10.8	11.0	10.0	10.5	7.2	4.0	4.0	4.0	4.0	5.5	5.2	7.2	7.2	7.3
	13	1.8	1.0	1.5	1.0	-----	-----	-----	13.0	1.0	13.0	10.0	10.5	9.0	10.0	6.5	4.0	3.5	5.0	4.8	6.5	6.5	6.5	6.0	6.0
	7	1.5	1.0	1.2	1.0	-----	-----	-----	12.5	10.5	12.0	9.0	10.5	8.8	9.8	6.2	3.5	3.5	4.5	4.0	6.0	5.2	6.2	6.2	6.2
	1	1.2	1.0	1.0	1.0	-----	-----	-----	7.8	8.0	7.8	3.5	7.5	6.2	7.0	4.8	2.5	2.0	3.2	1.5	4.2	3.8	4.1	4.1	4.1
Mean...	25	4.0	4.1	3.7	3.4	3.7	3.5	4.2	5.7	6.3	6.7	7.4	7.9	8.0	8.4	8.2	8.7	7.5	6.3	4.8	4.1	3.5	3.4	3.5	3.9
	13	3.6	3.8	3.4	3.1	3.5	3.3	4.0	5.2	6.2	6.4	6.6	6.9	7.5	7.8	7.6	8.2	7.0	5.9	4.5	3.6	3.1	3.0	3.2	3.5
	7	3.2	3.2	2.9	2.7	3.0	2.6	3.4	4.8	5.6	5.6	6.2	6.4	6.8	7.1	7.0	7.5	6.4	5.4	4.0	3.2	2.7	2.6	2.7	3.0
	1	1.8	1.8	1.7	1.6	1.7	1.6	2.1	2.9	3.3	3.4	3.5	3.9	4.0	4.2	4.2	4.4	3.8	3.1	2.2	1.7	1.4	1.5	1.6	1.7

See footnotes at end of table.

TABLE 12.—Wind velocity at indicated levels, Arlington Farm, Va., 1939—Continued

Date	Height of observation	Average velocity for hour ending at—												Mean
		1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 p.m.	
Aug. 1	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	5.0	4.0	3.0	3.0	3.5	4.2	5.5	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
2	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
3	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
4	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
5	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
6	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
7	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
8	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour
	25	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1
	13	3.5	4.5	4.0	3.5	3.5	3.5	4.0	5.0	8.0	8.0	8.0	8.0	6.1

9	25	2.0	2.8	2.8	4.0	1.2	1.0	1.2	5.5	6.8	9.5	9.8	10.2	12.0	10.0	11.5	10.8	11.8	8.2	4.0	9.2	3.8	1.0	1.8	1.8	5.9
	13	1.8	2.2	2.2	3.5	1.2	1.8	1.8	5.8	6.5	9.0	9.8	10.0	10.5	9.8	11.2	10.2	11.2	8.0	3.8	8.2	3.5	1.0	1.0	1.0	5.6
	7	1.5	1.5	1.2	1.5	1.0	1.0	1.0	4.8	8.5	8.5	8.5	8.5	10.5	9.2	10.2	9.5	10.5	7.0	3.2	7.2	3.5	1.0	1.0	1.0	5.0
	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.8
10	25	1.5	4.0	4.0	4.0	1.0	1.0	1.0	4.5	6.5	10.0	9.8	12.0	8.2	10.5	7.8	7.5	6.3	5.0	4.2	4.0	5.2	7.5	8.5	6.5	5.0
	13	1.2	3.5	3.5	3.5	1.0	1.0	1.0	3.5	4.5	8.0	8.5	11.2	7.8	10.0	4.8	4.5	6.3	4.5	4.0	3.5	2.2	4.8	7.5	6.5	4.8
	7	1.0	3.0	3.0	3.0	1.0	1.0	1.0	3.0	4.0	7.0	7.5	10.5	7.0	9.5	4.5	4.5	5.0	4.2	3.5	2.2	1.8	4.2	7.5	6.5	4.5
	1	1.2	3.2	3.2	3.2	1.0	1.0	1.0	3.0	4.0	7.0	7.5	10.5	7.0	9.5	4.5	4.5	5.0	4.2	3.5	2.2	1.8	4.2	7.5	6.5	4.5
11	25	6.8	3.8	3.8	4.8	1.0	1.0	1.0	6.5	6.5	6.2	5.5	5.5	5.8	4.5	4.8	5.8	5.0	7.2	7.2	3.2	1.0	1.2	1.0	1.2	4.3
	13	6.0	3.5	3.5	4.5	1.0	1.0	1.0	6.0	6.0	6.2	5.5	5.5	5.8	4.5	4.8	5.8	5.0	7.2	7.2	3.2	1.0	1.2	1.0	1.2	4.3
	7	3.8	3.0	3.0	3.8	1.0	1.0	1.0	3.8	4.8	5.8	5.8	5.2	5.0	4.0	4.5	5.2	4.8	6.2	6.5	2.8	1.8	1.2	1.0	1.0	3.8
	1	3.2	3.0	3.0	3.8	1.0	1.0	1.0	3.2	4.8	5.8	5.8	5.2	5.0	4.0	4.5	5.2	4.8	6.2	6.5	2.8	1.8	1.2	1.0	1.0	3.8
12	25	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	13	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	25	2.2	2.8	2.8	2.8	1.0	1.0	1.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	13	2.2	2.8	2.8	2.8	1.0	1.0	1.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
14	25	3.0	5.5	5.5	5.5	1.8	1.8	1.8	3.0	3.0	2.0	1.5	6.0	8.2	10.5	8.2	7.5	6.0	5.8	7.2	4.5	4.5	3.5	3.5	1.0	4.6
	13	2.5	5.2	5.2	5.2	1.8	1.8	1.8	3.0	3.0	2.0	1.5	6.0	8.2	10.5	8.2	7.5	6.0	5.8	7.2	4.5	4.5	3.5	3.5	1.0	4.6
	7	1.8	4.5	4.5	4.5	1.8	1.8	1.8	3.0	3.0	2.0	1.5	6.0	8.2	10.5	8.2	7.5	6.0	5.8	7.2	4.5	4.5	3.5	3.5	1.0	4.6
	1	1.0	3.0	3.0	3.0	1.8	1.8	1.8	3.0	3.0	2.0	1.5	6.0	8.2	10.5	8.2	7.5	6.0	5.8	7.2	4.5	4.5	3.5	3.5	1.0	4.6
15	25	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	13	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
16	25	4.2	1.8	1.8	1.8	1.2	1.2	1.2	2.5	3.3	1.2	2.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
	13	3.5	1.8	1.8	1.8	1.2	1.2	1.2	2.5	3.3	1.2	2.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
	7	3.5	1.8	1.8	1.8	1.2	1.2	1.2	2.5	3.3	1.2	2.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
	1	2.0	1.5	1.5	1.5	1.0	1.0	1.0	2.0	2.0	2.0	1.5	3.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
17	25	1.0	2.2	2.2	2.2	1.0	1.0	1.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	13	2.0	2.2	2.2	2.2	1.0	1.0	1.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	7	1.8	1.5	1.5	1.5	1.0	1.0	1.0	1.8	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	1	1.8	1.5	1.5	1.5	1.0	1.0	1.0	1.8	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
18	25	2.8	2.0	2.0	2.0	1.0	1.0	1.0	2.2	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	13	2.5	2.0	2.0	2.0	1.0	1.0	1.0	2.2	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	7	2.2	1.8	1.8	1.8	1.0	1.0	1.0	2.2	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	1	1.8	1.8	1.8	1.8	1.0	1.0	1.0	2.2	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
19	25	16.8	10.5	11.5	15.0	5.5	2.0	5.8	2.8	3.8	2.0	1.0	8	10.5	12.0	11.0	8.5	13.2	10.5	8.5	7.8	9.0	5.2	3.2	2.2	7.5
	13	15.8	9.5	10.0	14.2	5.5	1.8	7.2	5.5	4.8	5.2	2.0	4.0	11.2	12.8	11.5	8.2	12.5	10.0	7.5	7.0	8.2	4.8	2.8	2.5	7.7
	7	12.8	8.2	9.0	12.8	4.8	1.2	6.2	5.2	4.8	5.8	7.8	7.0	11.0	12.0	11.0	8.0	11.2	9.2	6.5	5.8	7.2	4.2	3.0	1.8	7.2
	1	9.8	6.5	6.0	9.5	3.8	1.5	4.2	4.0	3.5	4.0	0	0	0	0	0	0	8.0	6.8	5.0	4.0	4.8	3.5	2.0	1.5	5.3
20	25	1.5	1.8	2.0	1.2	3.0	4.8	4.5	2.5	2.0	0	0	0	0	0	0	0	9.5	6.0	5.0	2.8	5.2	5.0	3.8	2.0	2.5
	13	1.0	1.5	2.0	1.8	2.5	4.0	4.2	2.5	2.0	0	0	0	0	0	0	0	1.0	1.8	5.0	1.5	4.8	5.0	1.5	2.8	2.0
	7	1.0	1.0	1.0	1.2	2.0	4.0	4.0	2.5	1.5	3.8	4.0	5.0	6.5	3.0	7.2	5.8	4.5	4.5	1.5	1.5	3.8	4.5	1.2	3.0	2.4
	1	1.0	1.0	1.0	1.2	2.0	4.0	4.0	2.5	1.5	3.8	4.0	5.0	6.5	3.0	7.2	5.8	4.5	4.5	1.5	1.5	3.8	4.5	1.2	3.0	2.4

See footnotes at end of table

TABLE 12.—Wind velocity at indicated levels,<sup>1</sup> Arlington Farm, Va., 1939—Continued

Date	Height of observation	Average velocity for hour ending at—																								Mean	
		1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	12 p. m.		
Aug. 21	Feet	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour	Miles per hour		
	25	3.2	5.0								5.5	0	0	0	1.0	6.0	4.8	5.2	3.8	2.5	1.0	1.0	1.0	1.0	.5	2.4	
	13	3.0	4.7								5.2	.8	1.2	1.0	1.0	1.0	1.0	3.8	2.2	1.0	1.0	1.0	1.0	1.0	1.2	2.0	
	7	3.8	1.5								4.8	4.2	1.8	2.5	5.8	5.5	4.2	5.0	3.2	2.2	1.0	1.0	.5	.2	1.0	2.8	
	1	2.0									4.0	3.0	1.8	2.0	4.0	4.0	3.2	3.8	2.5	1.5	1.0	1.0	.8	1.0	1.0	2.3	
	22	25	1.5	1.8	6.5	11.5	9.0	8.8	6.0	5.2	7.2	9.0	10.5	6.2	6.0	7.5	6.5	6.5	4.2	1.2	1.0	1.0	2.0	1.2	1.8	5.1	4.8
	13	1.8	1.8	6.0	10.2	8.0	8.2	4.8	5.2	6.5	8.0	9.2	6.5	5.8	7.2	5.5	6.0	4.0	1.5	.5	1.0	1.8	1.5	1.5	2.0	4.8	
	7	.8	1.2	5.8	8.8	7.0	7.0	4.0	4.5	6.5	6.5	8.0	6.0	5.5	1.2	5.0	5.8	3.8	1.0	.2	.3	0	1.5	.5	1.8	3.9	
	1	0	.5	3.2	6.0	4.0	4.5	3.2	3.0	4.5	4.5	5.8	3.5	3.5	4.2	3.2	3.8	2.5	1.2	.8		.8	1.0	1.0	1.2	2.9	
	23	25	1.2	1.5	1.2	1.0	1.2	1.0	1.8	1.5	3.2	3.5	7.0	9.2	7.5	8.8	9.2	9.2	9.8	6.5	4.8	4.0	4.8	3.5	1.8	0	4.3
	13	1.0	1.5	1.8	1.0	1.2	0	1.8	1.8	2.5	3.8	7.0	8.8	7.5	8.2	8.8	8.5	9.0	6.2	4.0	3.5	4.5	2.8	2.2	1.0	4.1	
	7	.2	.8	1.2	.2	1.2	0	1.5	1.0	2.2	3.2	6.5	7.8	6.5	7.2	7.8	7.2	7.8	5.2	3.2	3.2	4.2	2.8	1.8	.8	3.5	
1	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.0	1.8	2.2	4.2	5.0	4.5	5.0	5.0	4.8	5.5	3.5	2.0	1.8	2.5	2.2	1.0	.2	2.5		
24	25	1.5	.8	1.0	1.0	1.0	.8	1.5	1.0	2.0	4.5	3.0	4.5	6.2	6.5	5.8	6.0	7.0	4.0	4.2	9.8	4.2	2.5	2.0	1.2	3.4	
13	1.2	1.0	1.0	.8	2.0	0	2.0	2.0	4.5	2.0	3.2	3.8	5.5	5.5	5.2	5.8	6.0	3.5	3.8	8.0	4.2	2.2	1.5	.8	3.0		
7	1.0	.8	0	.5	1.2	1.0	.8	3.0	2.0	4.5	2.2	3.0	3.5	3.0	3.0	3.8	4.0	2.5	2.2	5.2	2.8	1.2	1.0	.5	2.2		
1	1.0	1.2	1.0	1.0	1.0	1.0	1.0																				
25	25	.5	1.0	.8	1.0	1.8	3.0	2.0	3.5	3.2	2.2	1.0	3.0	4.2	4.8	5.0	2.2	3.8	4.2	1.2	3.5	1.0	2.2	1.5	1.8	2.4	
13	.5	1.0	.5	.8	1.5	2.2	2.2	3.0	2.8	2.0	.8	2.8	3.2	4.2		2.2	3.2	2.8	1.0	2.8	.2	1.2	1.0	.8	1.9		
7	.5	.8	1.0	.2	.5	1.5	1.0	1.5	1.8	1.5	1.0	2.2	2.8	3.0		1.5	2.2	2.0	.5	1.5	.5	.8	1.0	.2	1.3		
26	25	1.0	1.2	1.5	.5	3.5	4.5	3.8	2.5	0	.5	3.8	6.5	2.8	7.8	6.8	4.5	6.8	7.8	7.2	6.8	2.8	3.0	2.8	3.0	3.8	
13	0	.5	.5	.5	1.8	4.5	3.8	3.2	4.5	5.2	5.0	5.8	7.8	7.0	6.0	4.0	4.5	6.0	5.5	5.0	2.2	3.0	3.2	2.2	3.8		
7	0	.5	.2	0	1.0	3.0	2.2	2.0	3.2	8.2	3.5	4.0	5.2	4.5	4.0	3.0	4.2	4.8	4.5	3.8	1.5	1.5	2.0	1.8	2.6		
27	25	3.5	3.2	3.0	3.5	5.0	6.5	6.7																		4.3	
13	3.0	2.8	2.8	3.5	4.8	6.5	5.3																			4.1	
7	1.8	1.8	1.5	2.2	2.5	3.2	3.0																			2.3	
28	25									5.0	12.5	10.8	14.8	10.8	14.8	11.5	9.8	10.2	11.2	8.2	6.5	4.0	4.0	5.0	4.8	8.7	
13										12.3	10.8	13.8	8.8	13.2	9.2	8.0	8.0	8.0	6.0	4.0	3.0	3.0	2.8	1.8	7.2	7.2	
7										8.0	8.2	9.0	6.0	8.8	7.5	6.2	5.0	6.8	2.2	1.8	2.0	1.0	0	.5	4.8		

29	25	6.2	7.2	8.8	7.2	10.0	5.2	6.0	7.2	0	8.7	12.2	13.0	15.8	15.8	12.8	11.5	9.2	8.8	7.5	3.2	3.8	5.2	7.0	9.8	8.4
	13	2.5	4.0	5.0	5.5	7.0	3.8	3.5	7.8	10.7	7.2	7.2	3.8	3.2	3.0	4.2	7.2	5.8	5.5	3.8	2.2	3.8	5.2	7.0	9.8	8.4
	1	0	2.8	3.8	3.8	5.5	3.2	3.2	3.8																	5.1
30	25	10.5	9.0	8.5	8.8	6.8	9.2	7.5	6.0	7.2	8.8	10.0	8.2	11.0	9.5	13.0	13.3	5.0	5.8	6.2	4.0	1.8	3.0	4.5	5.2	5.4
	13	7.1	10.5	9.0	8.5	6.8	9.2	7.5	6.0	7.2	8.8	10.0	8.2	11.0	9.5	13.0	13.3	5.0	5.8	6.2	4.0	1.8	3.0	4.5	5.2	5.4
	1	0	2.8	3.8	3.8	5.5	3.2	3.2	3.8																	3.3
31	25	6.8	6.5	4.0	6.5	4.2	5.5	6.8	6.5	9.5	12.2	10.0	6.2	10.0	10.8	4.8	7.8	4.2	5.5	6.2	2.8	1.2	1.2	1.0	1.2	5.0
	13	5.8	6.0	3.0	5.8	4.0	5.0	6.0	6.0	9.0	11.8	9.8	5.2	5.0	5.2	3.0	4.2	2.2	2.8	2.8	1.2	1.0	1.2	1.0	1.0	4.5
	1	4.2	4.8	2.5	4.8	3.2	3.8	5.0	6.0	8.2	11.0	8.5	4.8	5.0	5.2	3.0	4.2	2.2	2.8	2.8	1.2	1.0	1.2	1.0	1.0	5.6
Mean...	25	3.4	3.3	3.4	3.7	2.9	2.9	3.5	4.2	5.1	5.7	6.3	6.8	7.3	7.0	7.2	7.8	7.3	6.1	4.8	4.3	4.2	3.7	3.2	3.0	3.0
	13	3.3	3.2	3.3	3.6	3.2	3.1	3.6	4.2	4.6	5.7	6.3	6.9	7.3	7.2	7.2	6.6	6.9	5.8	4.4	4.2	3.7	3.3	3.0	3.1	3.1
	1	2.3	2.4	2.5	2.6	2.5	2.3	3.0	3.9	4.0	5.4	6.0	6.3	6.9	6.2	6.5	6.2	6.3	5.2	3.8	3.7	3.3	2.9	2.5	2.4	2.4
	1	1.7	1.8	1.8	2.0	1.7	1.8	2.2	2.7	3.5	3.9	4.3	4.7	5.0	4.7	4.7	4.5	4.5	3.6	2.5	2.5	2.2	2.0	1.8	1.6	1.6

<sup>1</sup> The instrument at 13 feet was often in error, which accounts for the questionable averages of observations made at this level.

<sup>2</sup> Estimated values.

**END**