MONITORING EL NINO IN REAL TIME: THE 2002-03 WARM EPISODE

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El Nino progresses through a life cycle, which includes strengthening, maturing, and declining phases. Typically El Nino's weather extremes are strongest December-February, but the current warm episode peaked in December and has been declining ever since. As El Nino weakened, "signature weather" disappeared and was replaced by the opposite weather extremes. The changes were felt simultaneously in widely separated areas of the globe. El Nino's erratic behavior proves it can't be used to predict crop production. This is especially true in the Southern Hemisphere, where sudden changes in mid-summer may irreversibly alter crop potential. In some instances, El Nino created predictable weather; for example the drought in Indonesia. But it failed the test in the American Great Plains, where serious drought, not wetness developed this winter.

Introduction

El Nino's arrival in the summer, 2002, was a source of great interest to me. As an agricultural meteorologist, I monitor global weather conditions for changes that affect world production of grains and oilseeds. El Nino, I knew, had the potential to disrupt global growing conditions from Indonesia to South America and perhaps the United States.

Learning about El Nino

El Nino weather relationships have been identified by experts at the Climate Prediction Center. Figure 1 summarizes "El Nino Weather Relationships". It is the culmination of years of study on the behavior of El Nino by scientists at the Climate Prediction Center. Weather abnormalities tend to be strongest December-February and most pronounced in the tropics. However North America is also affected with wetness in the southern United States and winter warmth in the northern states.

El Nino weather extremes became painfully apparently in the fall, 2002: Severe drought developed in Malaysia and Indonesia (Figures 2 and 3), damaging rice and palm fruit crops. Drought in the western Pacific Basin is classic El Nino weather, the alter-ego of the excessive wetness in the central Pacific Ocean near the dateline. These weather extremes come about because of the "Southern Oscillation", a reversal in the normal air pressure and wind patterns hundreds of miles apart in the Pacific Ocean.

Drought had inflicted a heavy toll on Australian wheat, subject to the same Southern Oscillation. Wheat production ultimately fell more than 50% from the previous year, shrinking an already small world wheat supply. Meanwhile, the Indonesian drought had implications for American soybean oil exports. Reduced palm oil supplies must be replaced with other vegetable oils, including soybean oil, sunflower, canola, and peanut oil. Strong demand for soybean oil would hike up prices.

South American Weather Extremes

El Nino works at cross purposes in South America, producing favorable wetness in the South and detrimental heat and dryness in the Central states (Figure 3). Soybeans were traditionally grown in Rio Grande do Sul and Parana in the South, but Central Brazil is rapidly becoming Brazil's leading soybean region. Growers in Mato Grosso are converting native scrubland into soybean fields at and astonishing pace. In fact, Mato Grosso has replaced Rio Grande do Sul as the top soybean state in the land. All together, tropical soybean states could produce more than 55% of Brazil soybeans in 2003. The message is clear: El Nino-related drought could have an enormous impact on world soybean supplies (Figure 4).

It was hot and dry in Central Brazil at the start of the growing season (Figures 5 and 6). And it was super wet in southern Brazil and Argentina. Thus, the real world matched El Nino predictions with uncanny accuracy. I was beginning to believe El Nino would be a powerful prediction tool.

Weather Reversed mid December

The weather suddenly reversed in mid December. Rains fell with a vengeance in Central Brazil, boosting soybeans and erasing the drought. The rainfall came just in time to save the crop, during the critical pod-setting and bean development stage. At the same time, hot, dry weather developed in Argentina, damaging corn that was filling kernels and stressing the flowering soybean crop (Figure 7).

El Nino was weakening. This was confirmed by cooling sea surface temperatures in the tropical Pacific Ocean (Figure 8). Was the sudden disappearance of El Nino-type weather a coincidence? Apparently not. Dramatic changes occurred in the United States at the very same time. In essence, El Nino's weather extremes were replaced by the exact opposite weather.

- Pacific Northwest drought was replaced by wetness (Figure 9)
- The strong subtropical jet stream vanished. Wetness in Southern US was replaced by dryness (Figure 10).
- Balmy Midwest temperatures turned abruptly colder (Figure 11)

More Conflicting Evidence on El Nino

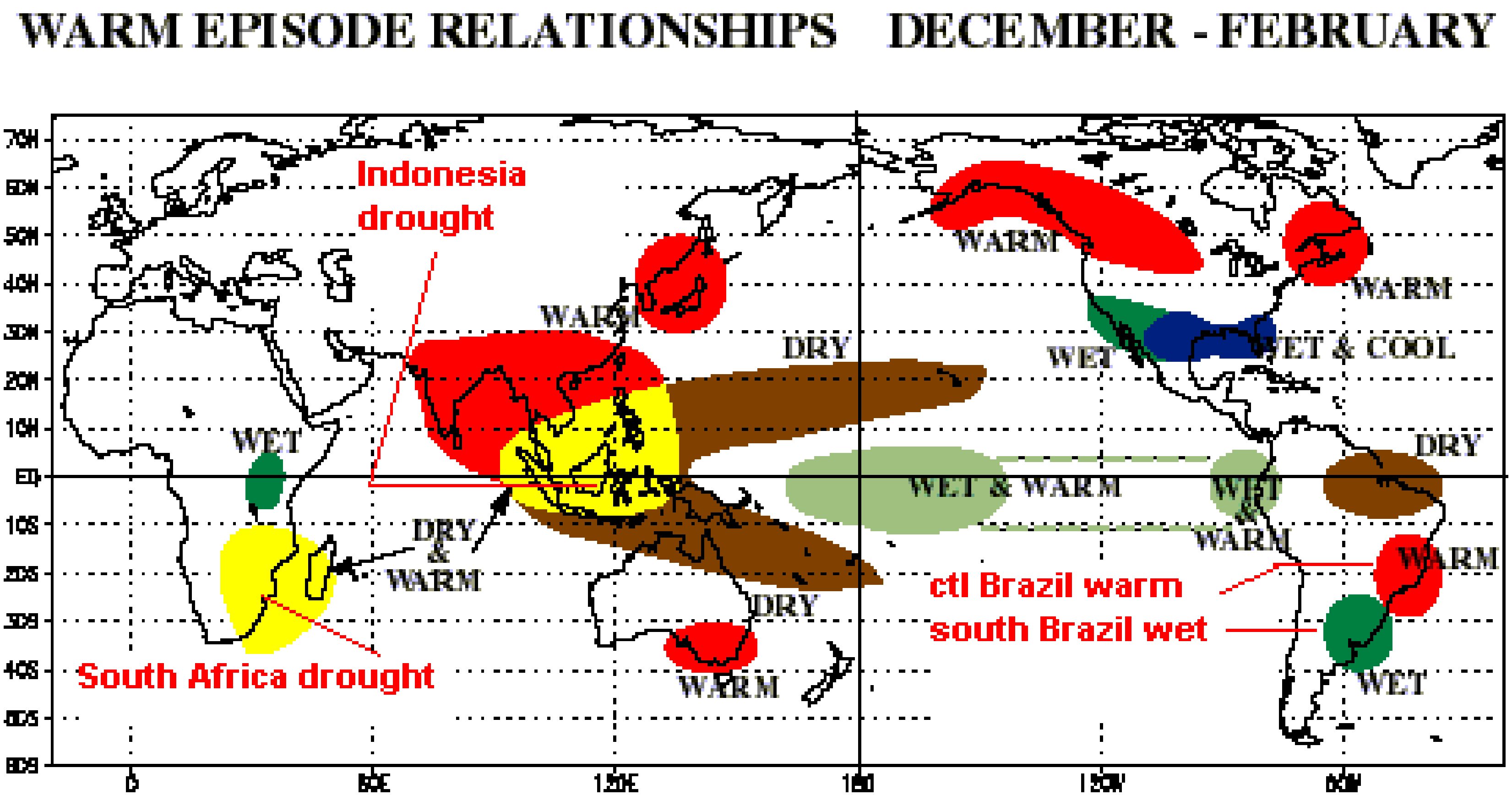
El Nino produced both excellent and poor soybean crops in Argentina (Figure 12). What's surprising about this revelation is both bad and good harvests occurred in strong El Nino years (1982-83 and 1997-98). I had reasoned El Nino's erratic behavior was due to its weak nature. Compared with the strong 1997-98 El Nino, the current warm episode is "moderate" according to scientists at the Climate Prediction Center.

Kansas Drought

Here's another conundrum. El Nino winters should be wet in the Great Plains (Figure 13), but instead it was very dry. Indeed, the November-January period was one of the driest on record in Kansas, the top US wheat state (Figure 14). Winter wheat deteriorated badly with the worsening drought (Figures 15 and 16).

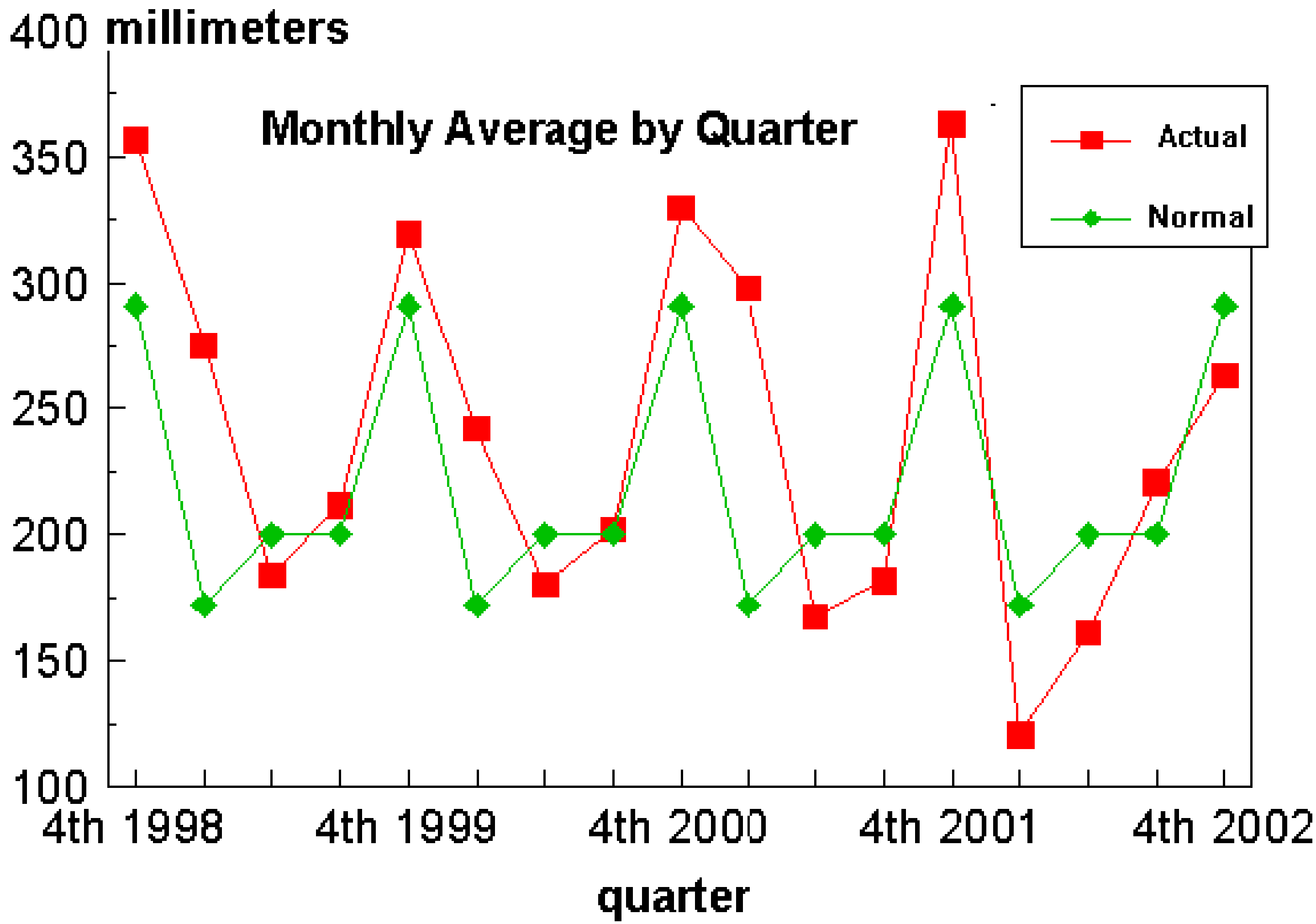
Summary

El Nino relationships do not always hold strong during the December-February period. Therefore, it's hazardous to make crop production estimates based on "typical" El Nino weather. This is especially true in the Southern Hemisphere, where mid-summer weather changes could reverse crop potential. El Nino peaked in December, but it weakened January-February and classical El Nino-type weather disappeared. Similar mid-course changes apparently occurred in other El Nino episodes. Argentina's soybean production history shows strong differences in production in El Nino years.

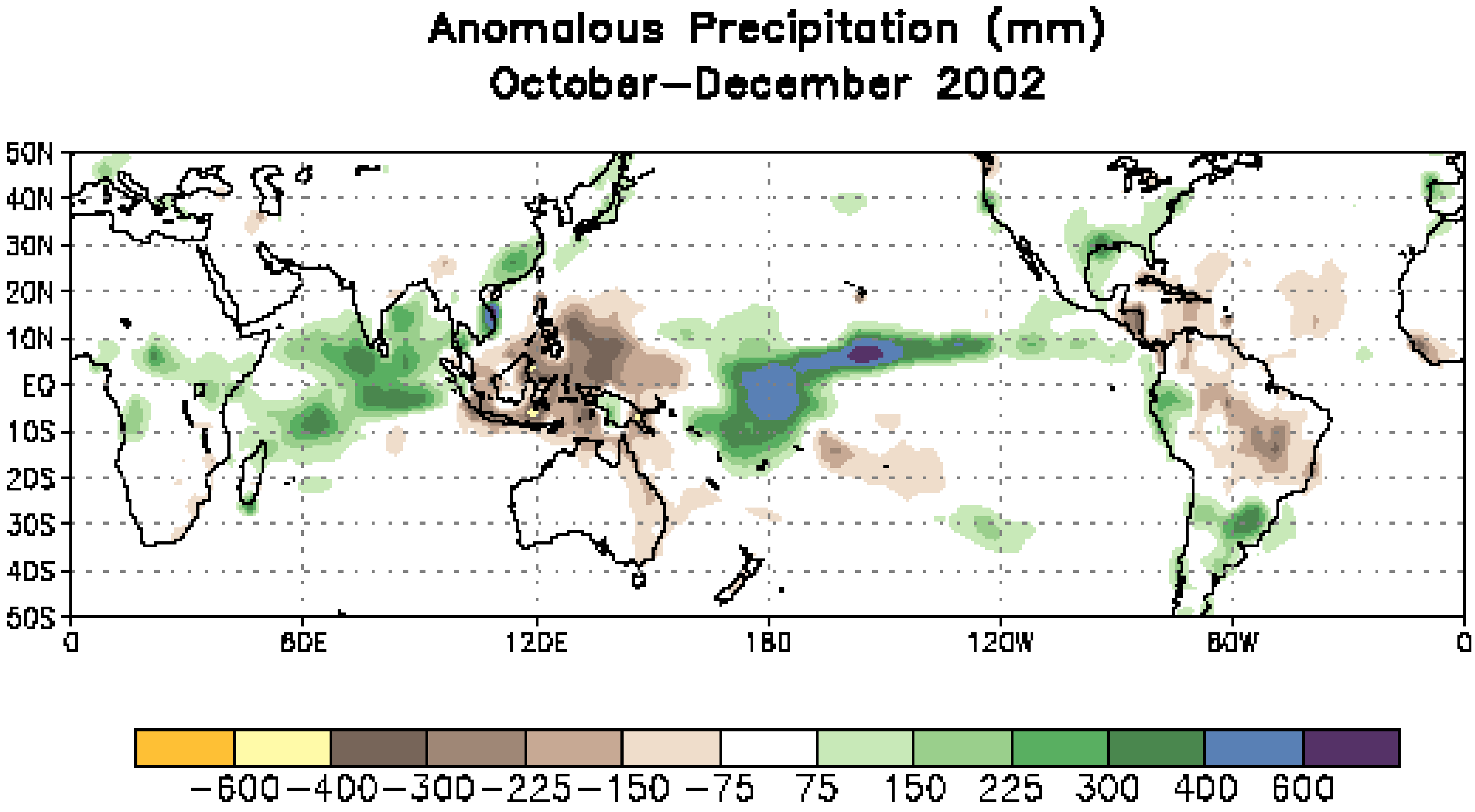


Weather extremes develop in certain parts of the world when El Nino occurs. Abnormal weather is felt most strongly in December-February.

Malaysian Palm Oil Rainfall

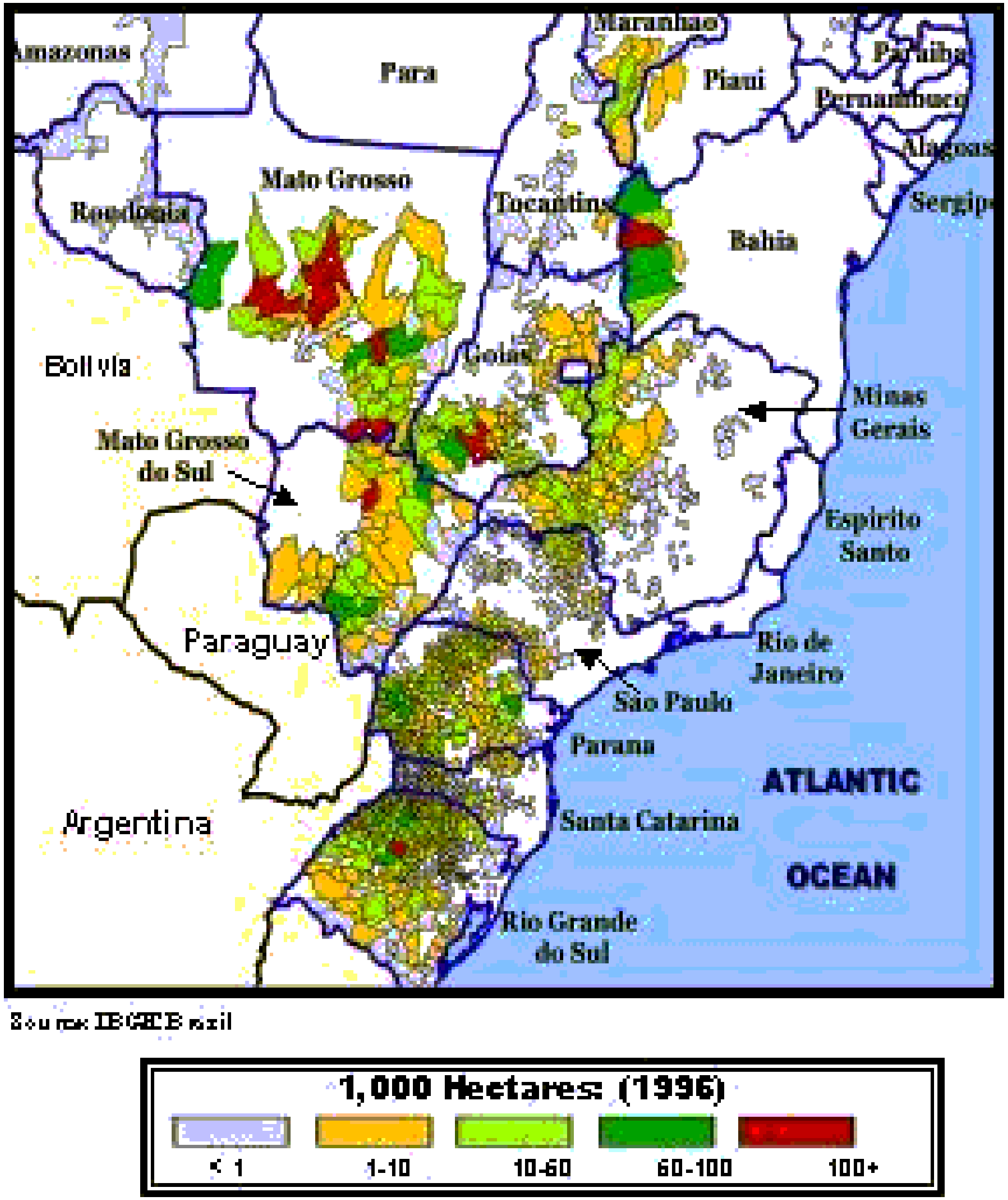


Rainfall was below-normal for the first, second, and fourth quarters of 2002. Drought was harmful for palm fruit development.



Real world conditions matched El Nino predictions.

BRAZIL: Soybean Area Distribution

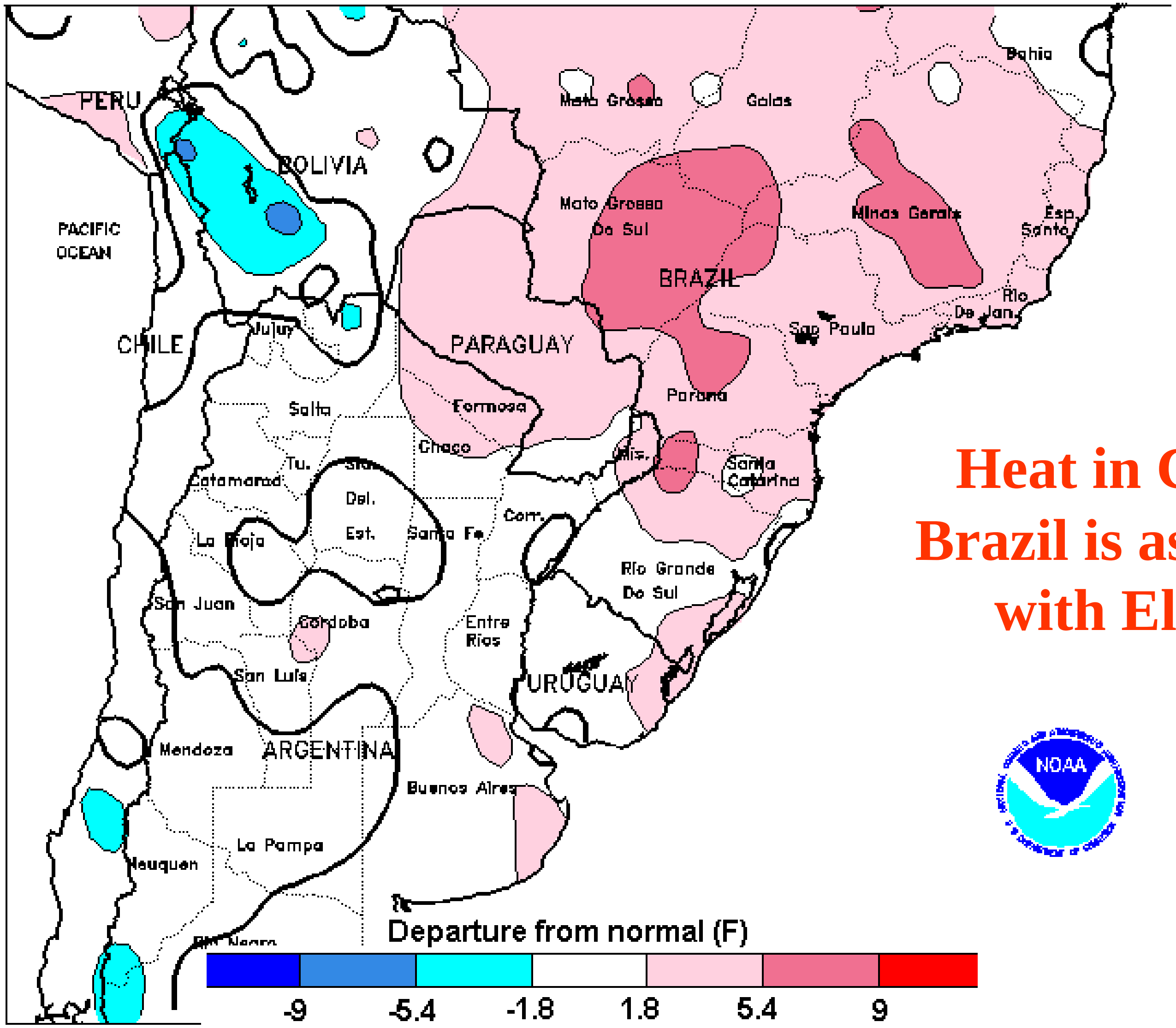


Production is shifting into tropical states.

- **Mato Grosso**
- **Goias**
- **Mato Grosso do Sul**

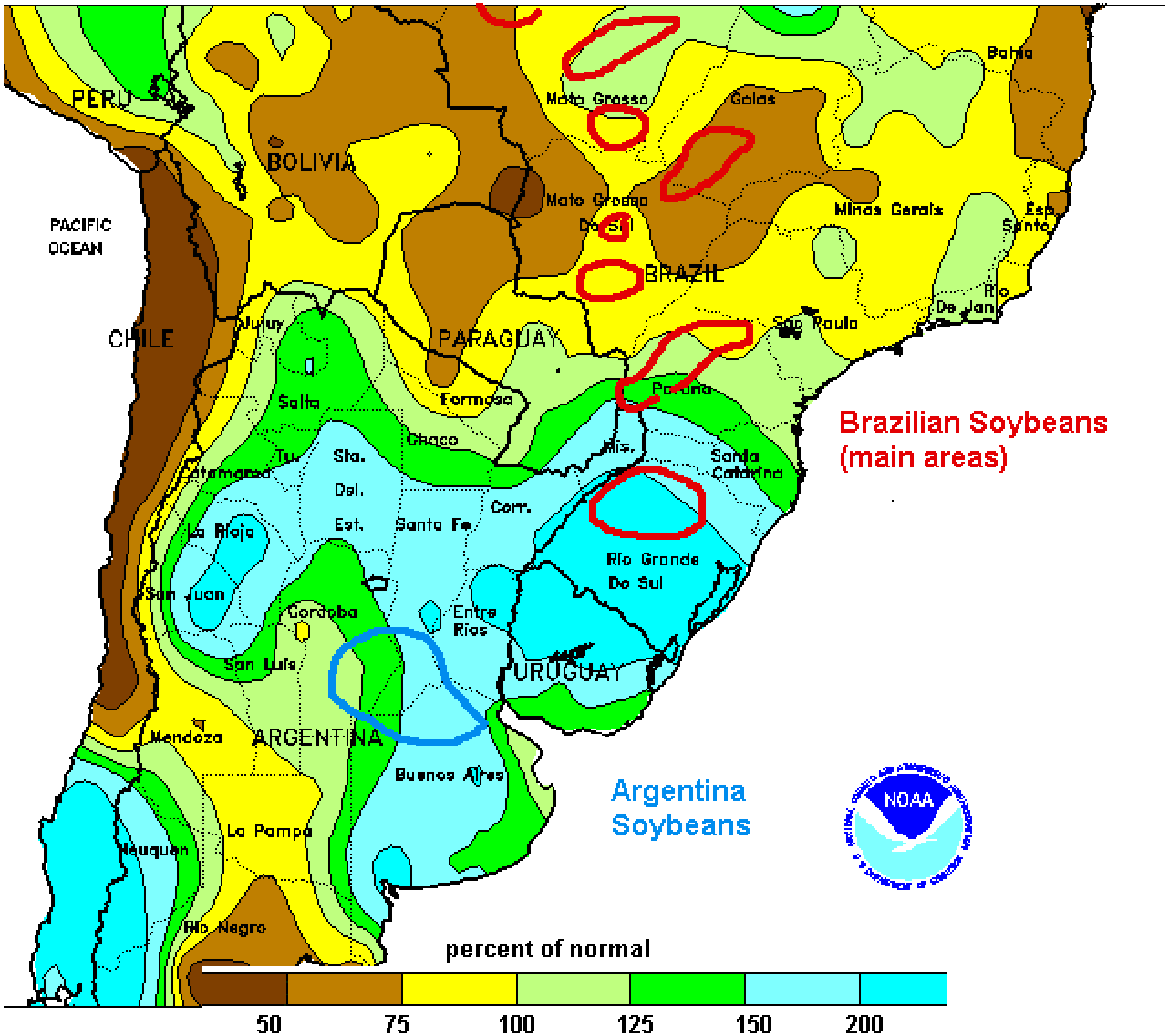
El Nino-related drought would have a bigger impact on Brazilian soy output

South America Temperatures, October-December 2002



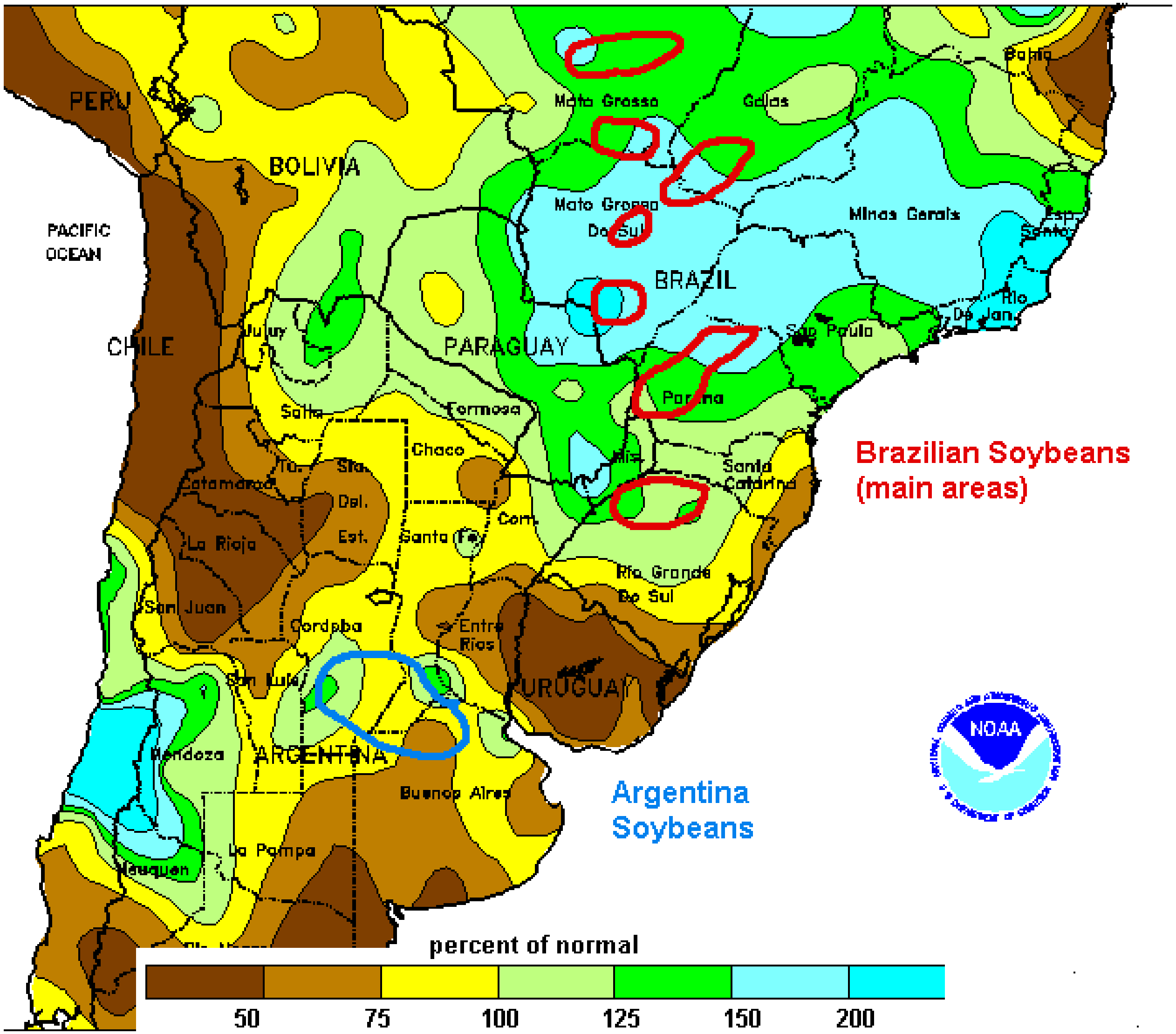
Heat in Central Brazil is associated with El Nino

October-December Rainfall % of normal



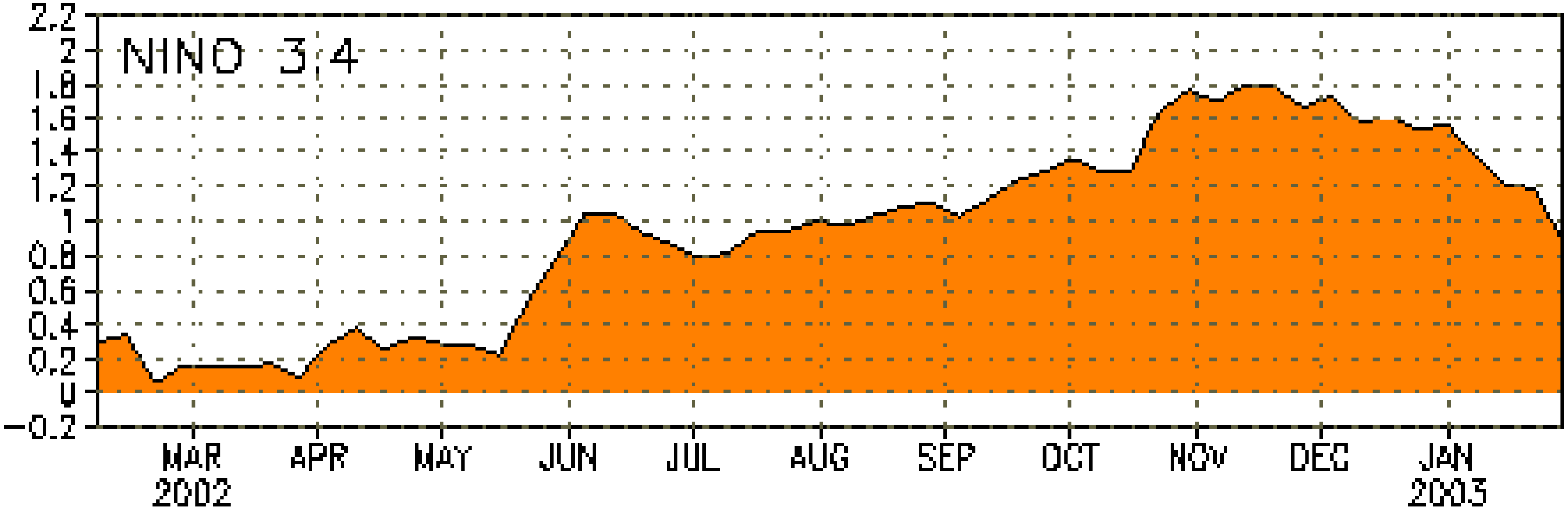
Classical El Nino Weather: Dryness Central Brazil, wetness South

January Rainfall % of Normal

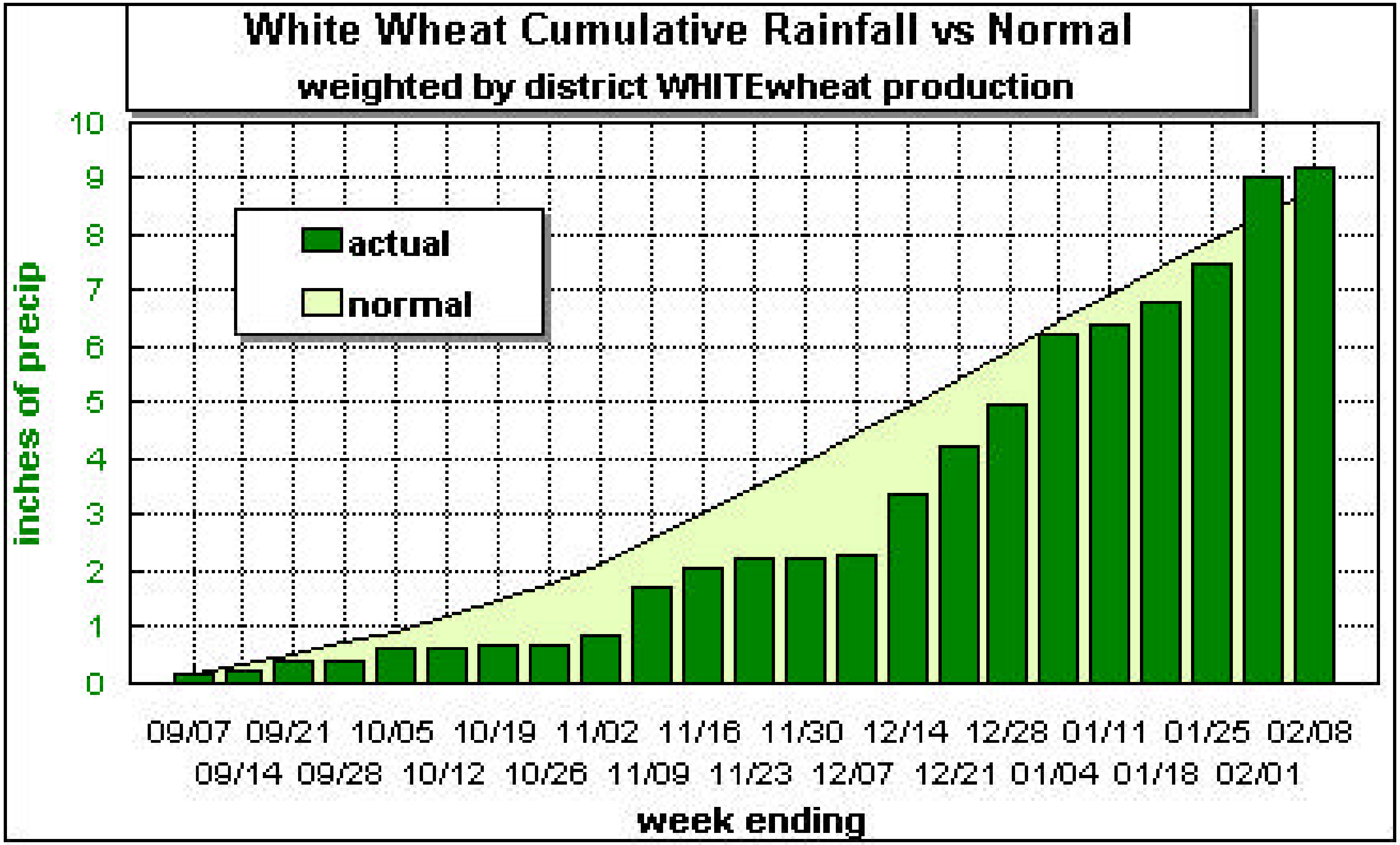


El Nino faded, weather extremes reversed

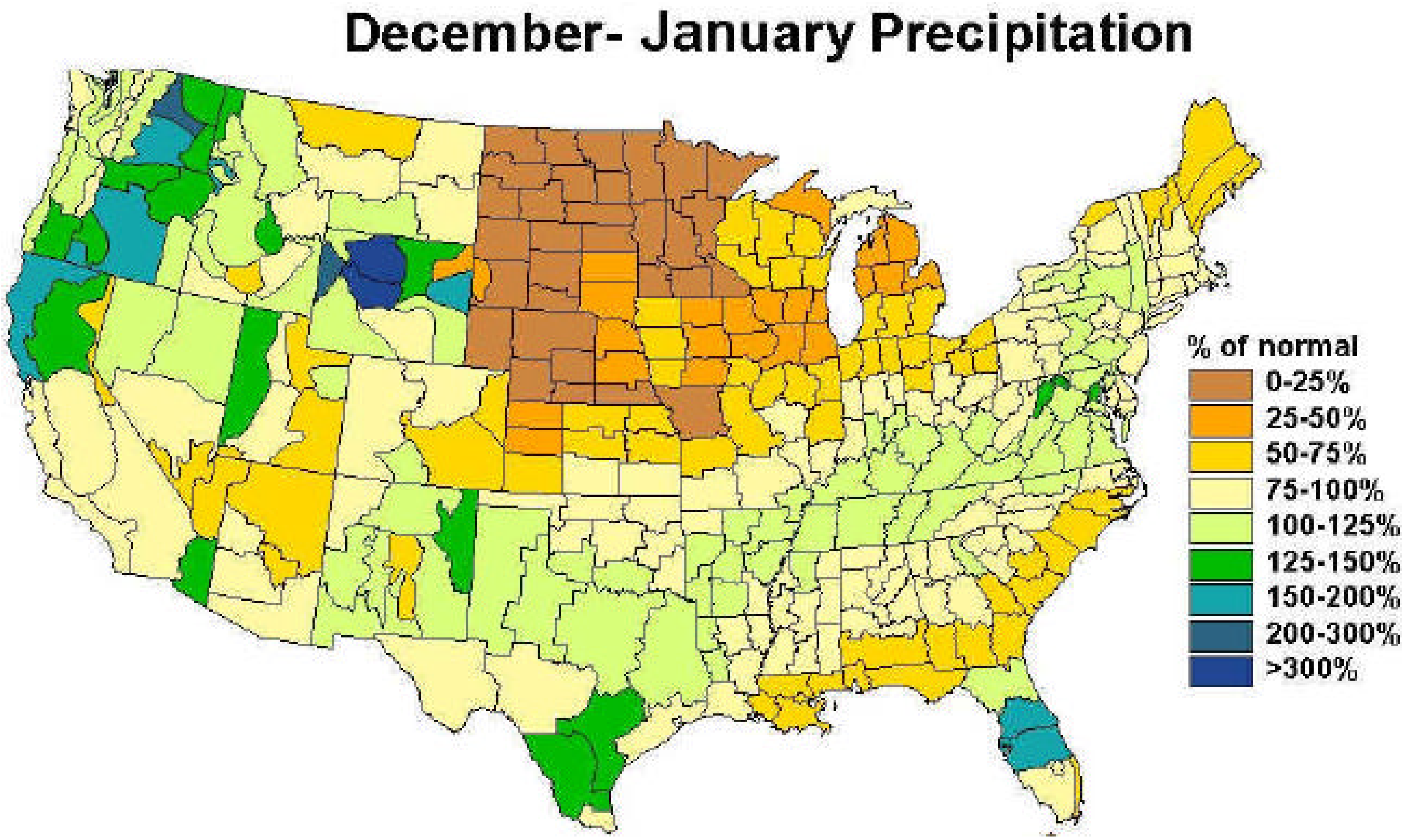
Sea surface temperatures Central Equatorial Pacific



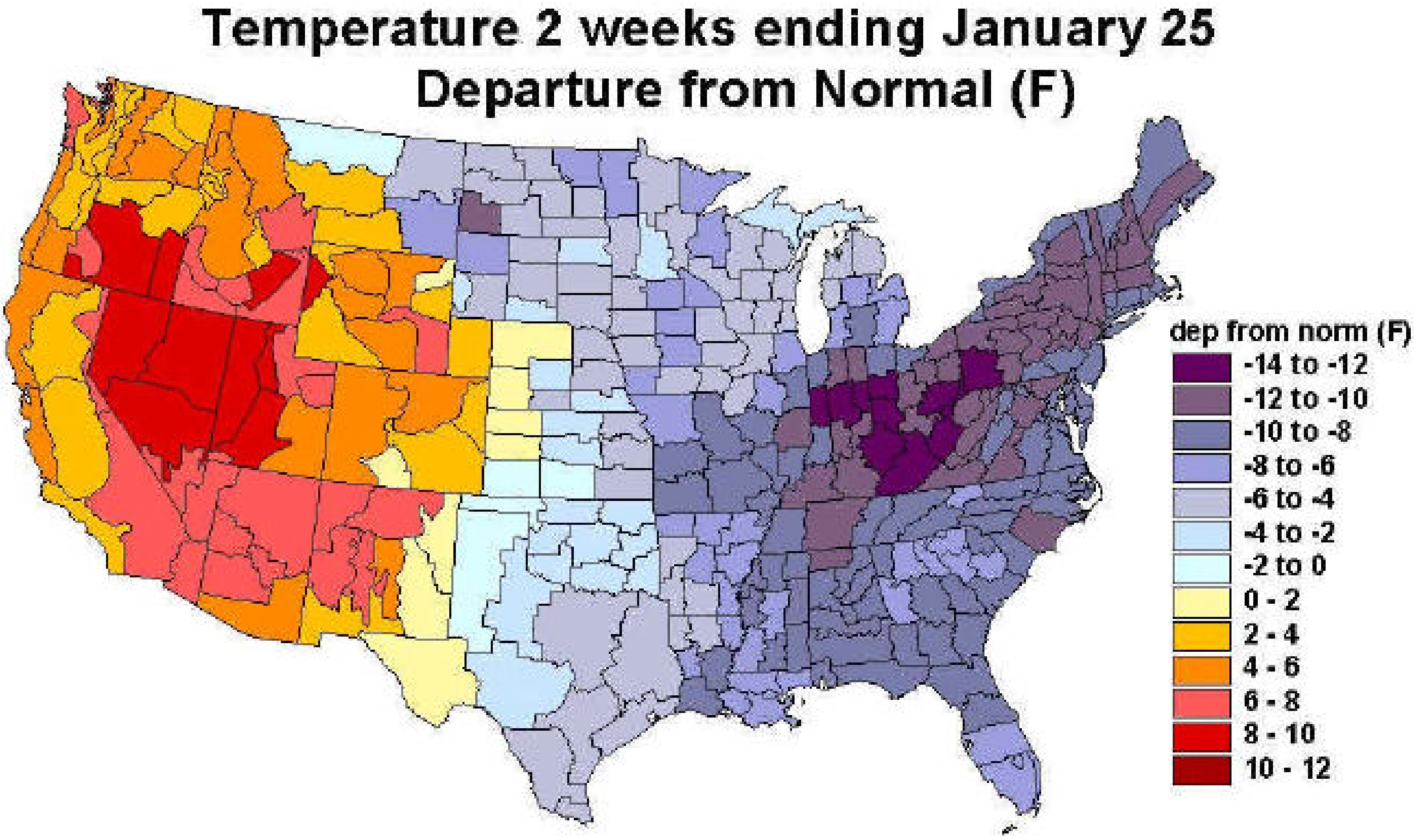
El Nino peaked in November and began declining rapidly in December and January. As El Nino weakened, the classical El Nino weather relationships disappeared.



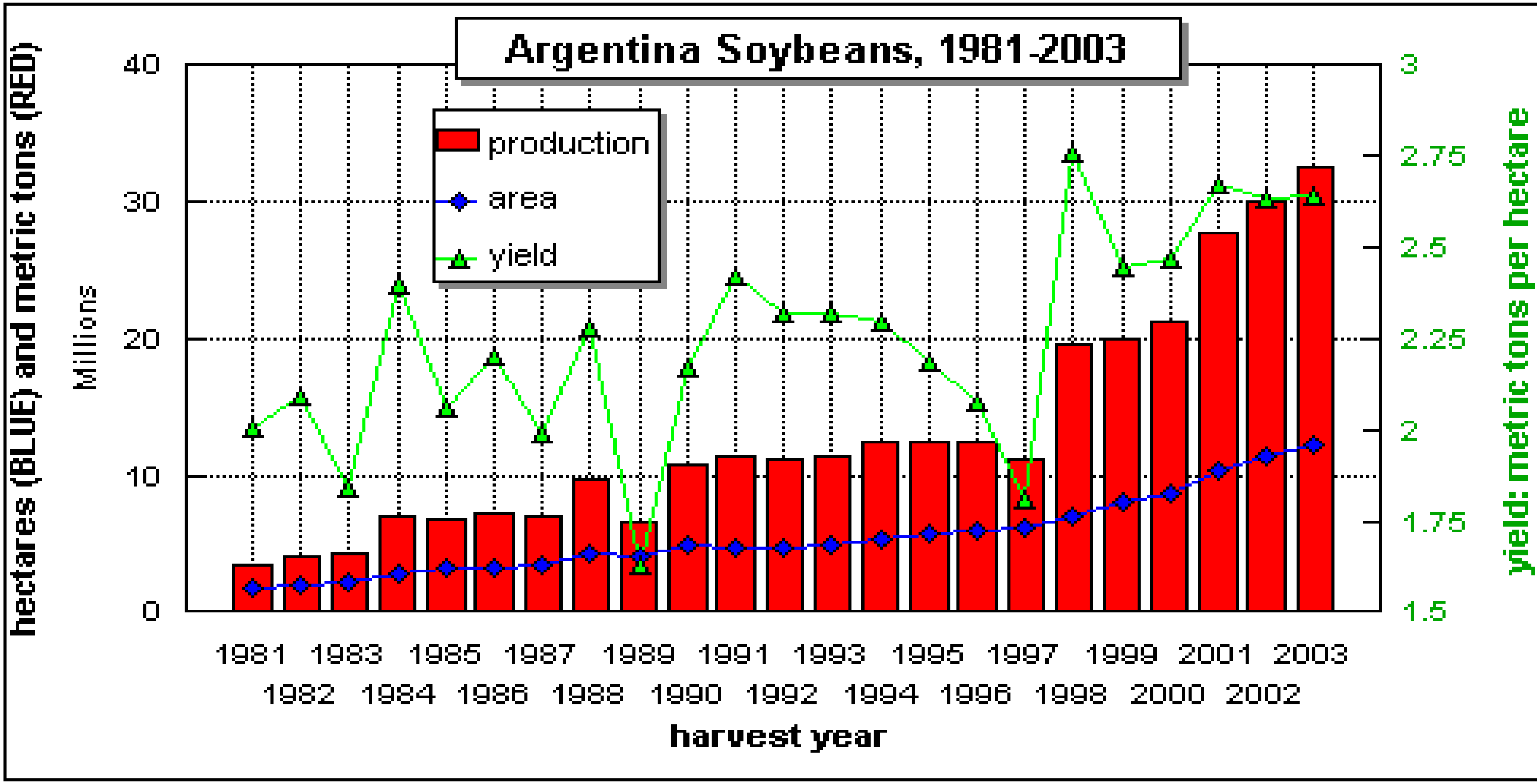
Fall wheat planting was hindered by drought in the Pacific Northwest but precipitation increased after El Nino weakened in December.



Precipitation lightened up in December and January in the southern states when the subtropical jet weakened.



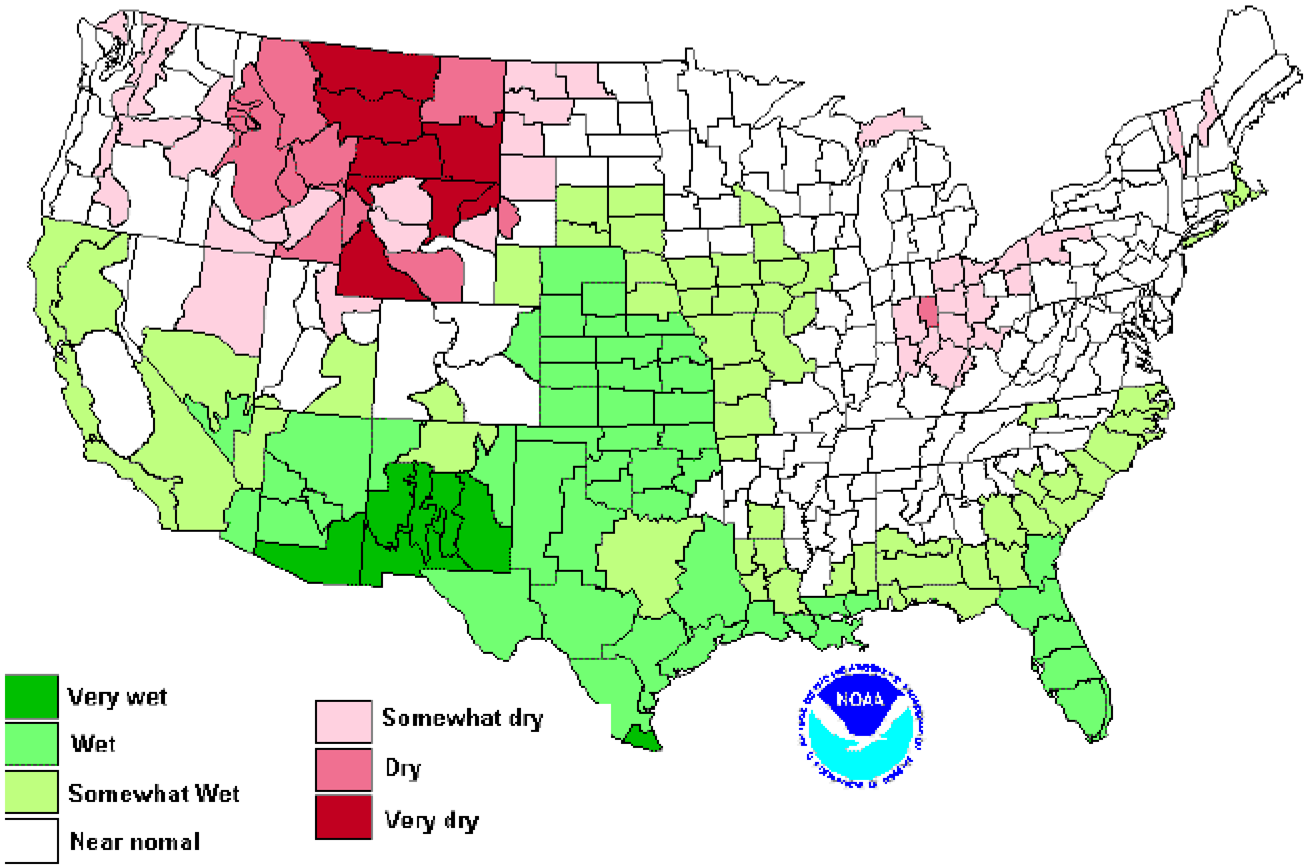
January turned sharply colder in the Midwest, when El Nino weakened.



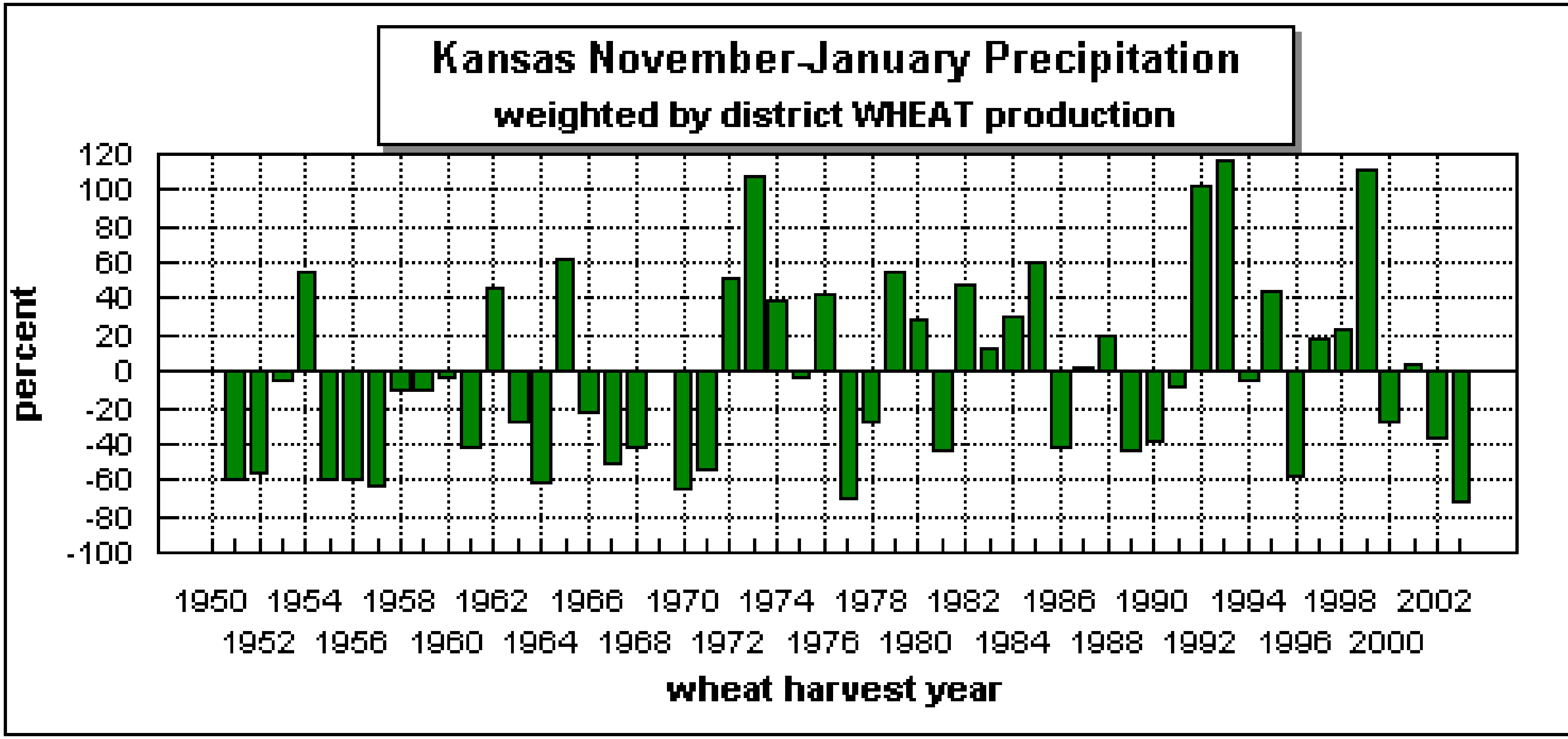
El Nino produced both poor and excellent crops in Argentina -- compare 1983 to 1998. El Nino weakened in 1983, resulting in a brief but damaging drought and poor yields.

Average December-February Precipitation Rank During ENSO Events

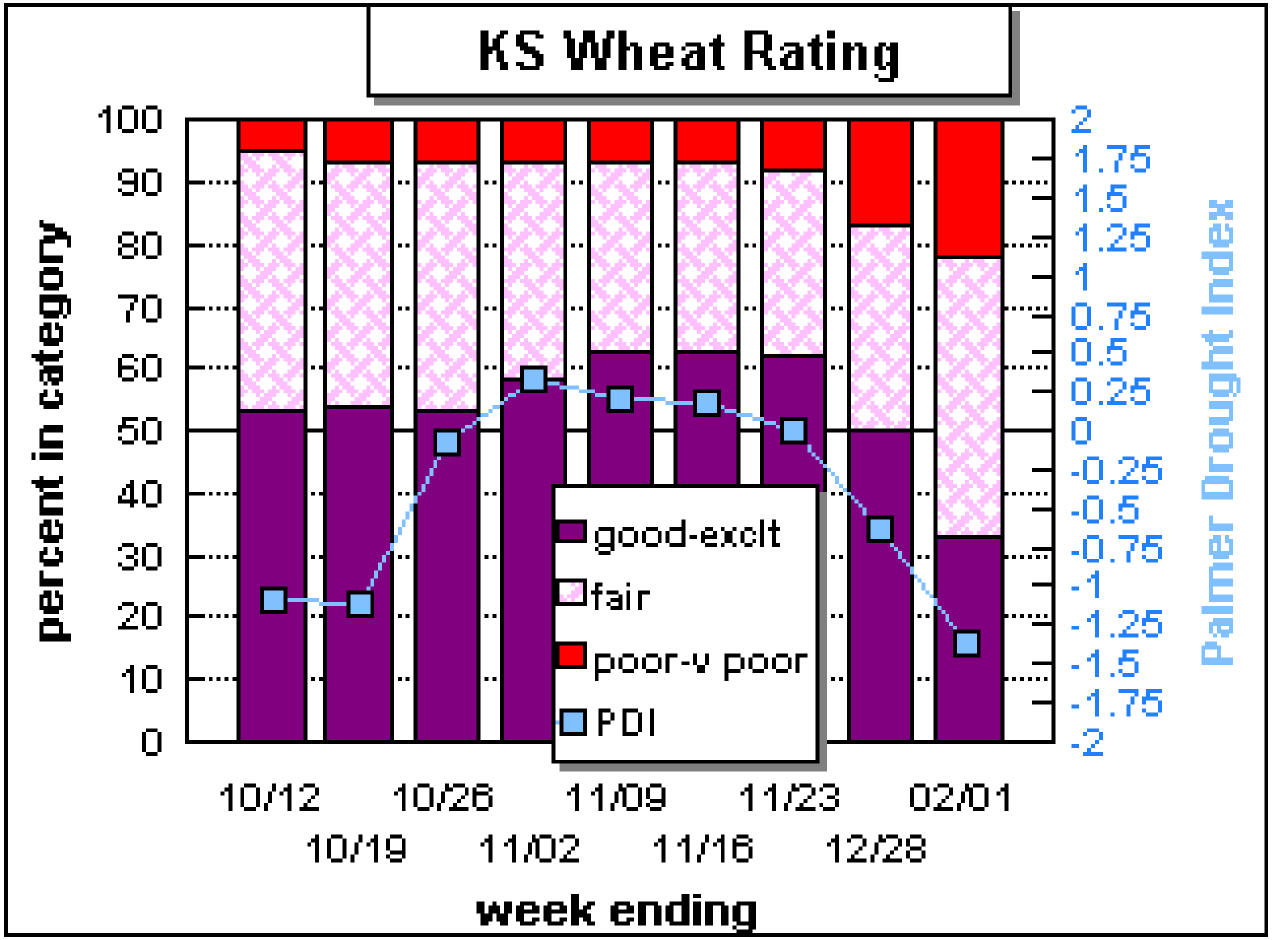
1919. 1941, 1958, 1966, 1973, 1983, 1987, 1988, 1992, 1995, 1998



Most El Nino winters are wet in the Great Plains, benefiting winter wheat

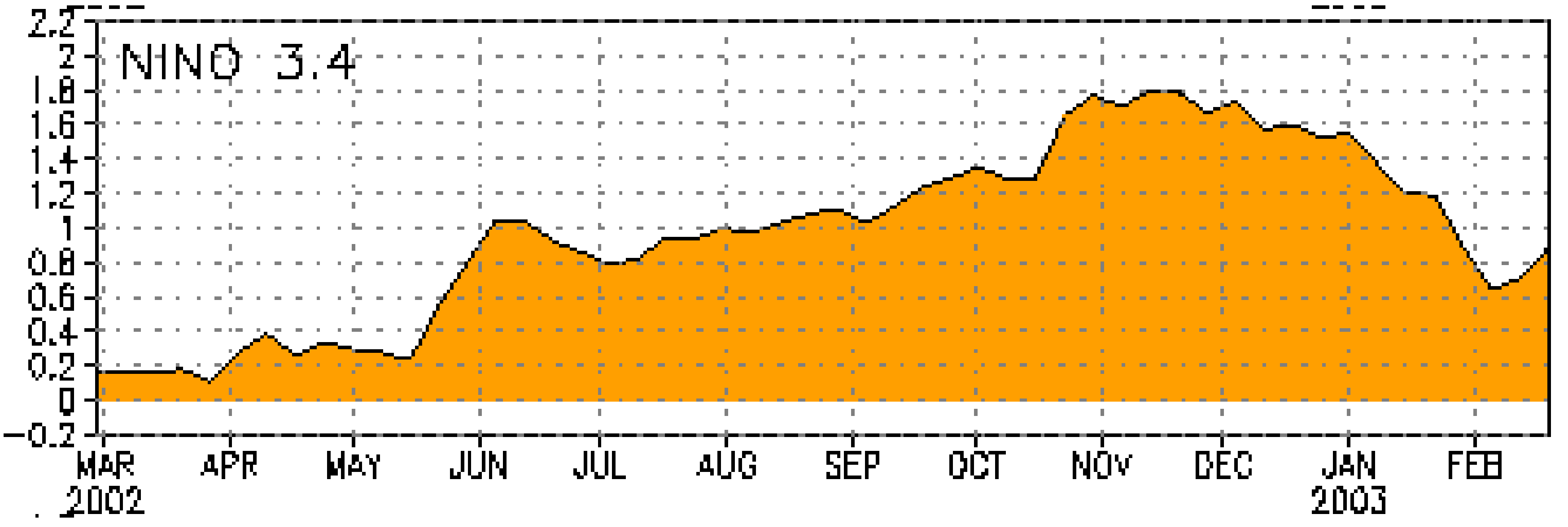


November-January precipitation was nearly 80% below normal in Kansas, the top US wheat state



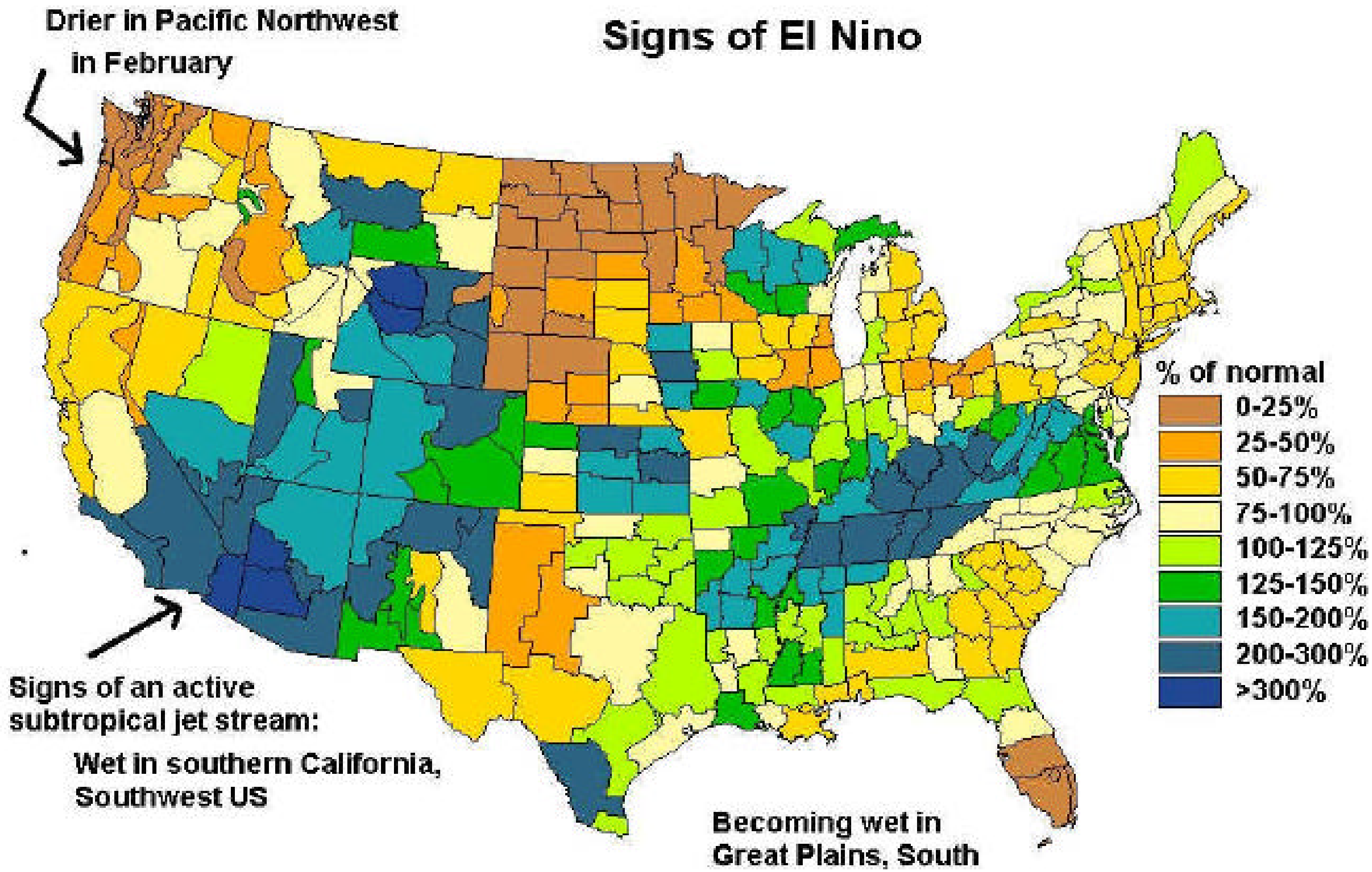
Only one-third of Kansas wheat was good-excellent in early February and 22% was poor-very poor. Winter drought has taken a toll on the crop.

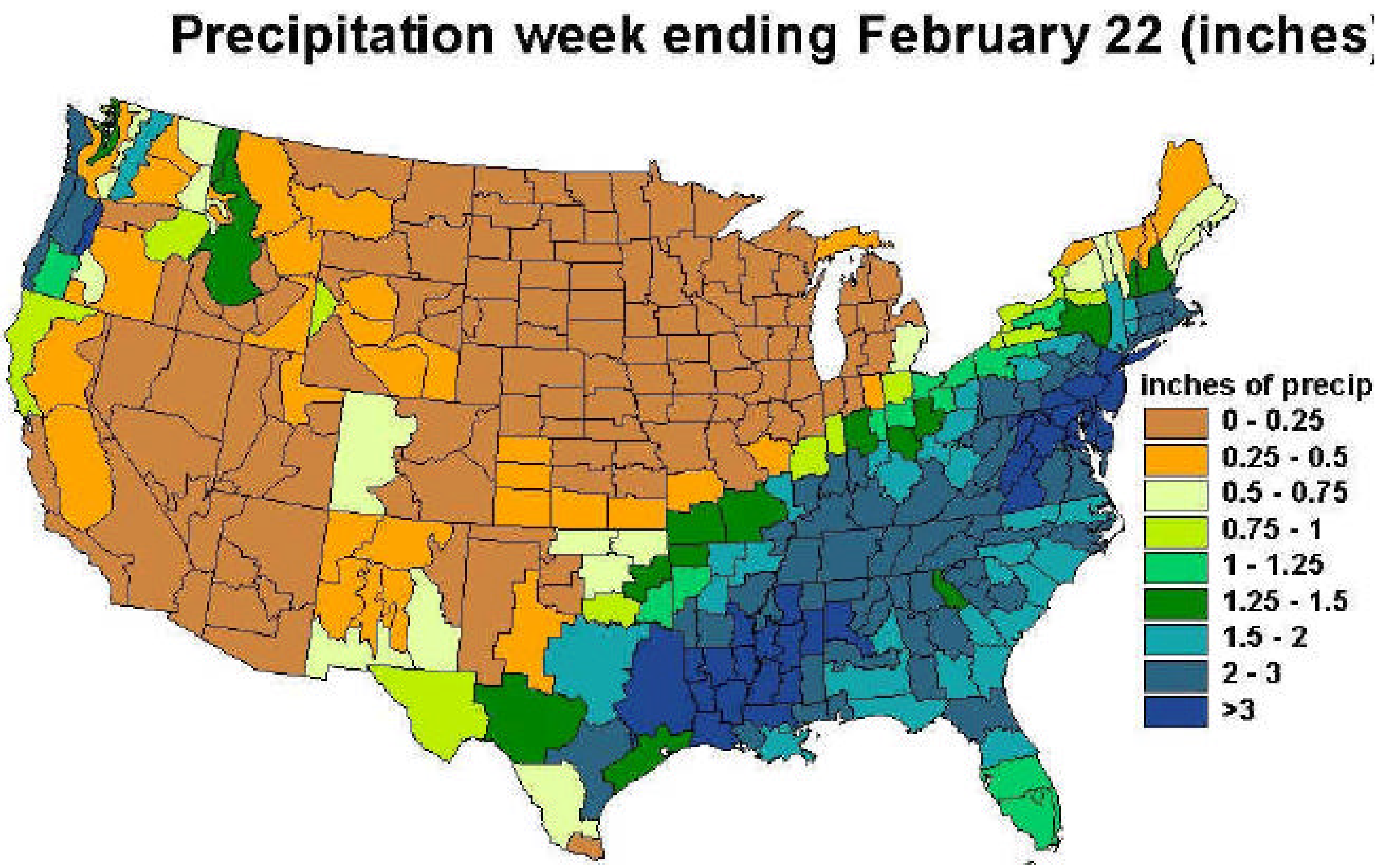
Sea Surface Temperatures Central Equatorial Pacific Ocean



Sea surface temperatures began rising again in February indicating a resurgence in El Nino’s strength.

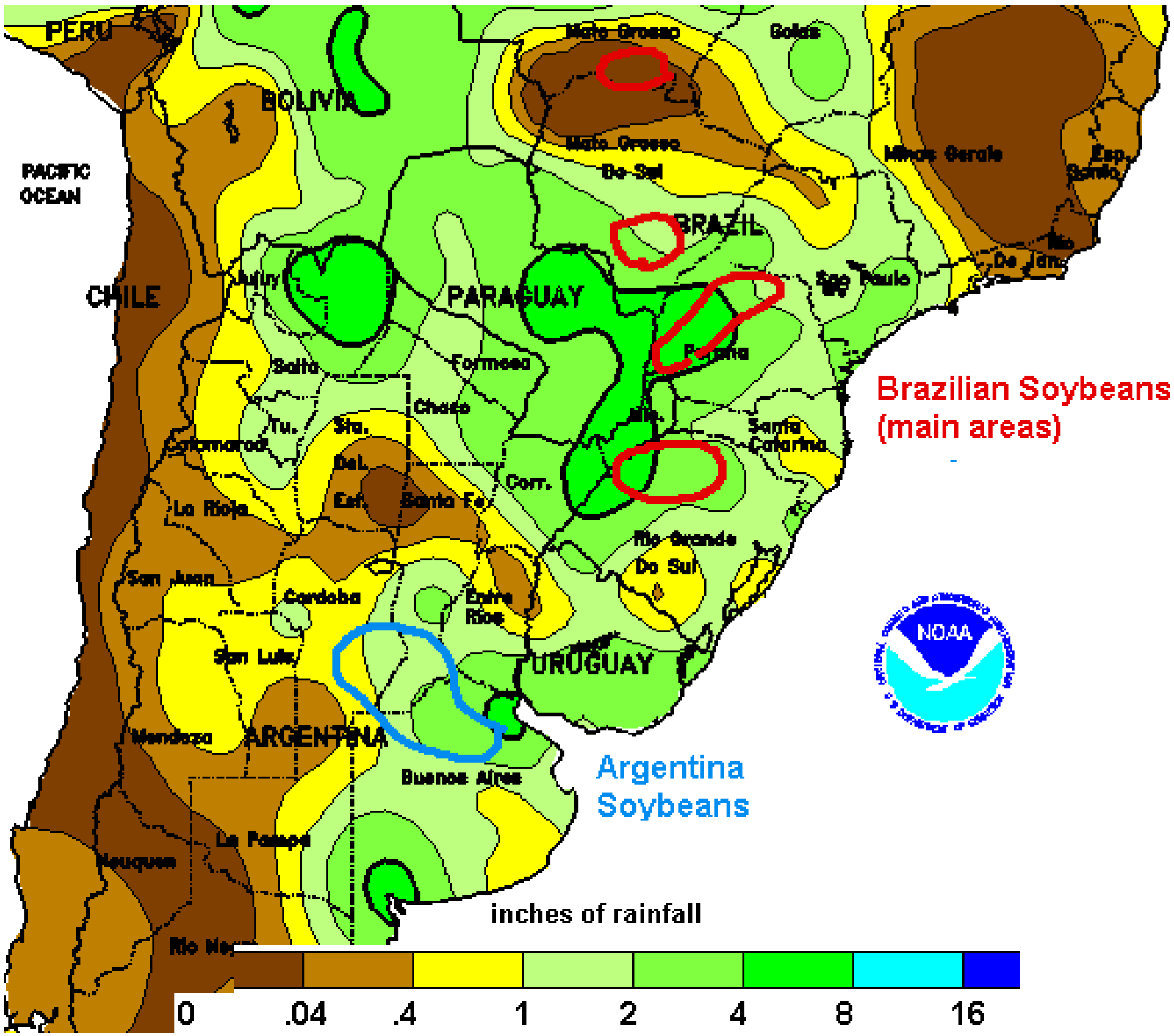
Precipitation 2 weeks ending February 15





The subtropical jet stream strengthened in mid February, increasing storminess in the South and East.

Rainfall week ending February 15



El Nino traits: Dry in Central Brazil, wet in Argentina, south Brazil