

formerly known as:

BROWNING
NEWSLETTER

September 2015 Vol. 40, No.9

World Reports Covering Climate, Behavior,
and Commodities

Original Papers – Historical Perspectives
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BROWNINGTM
WORLD CLIMATE BULLETIN

IN THIS ISSUE

- The El Niño will be large but shows signs of not being as large as the 1997/98 giant. While it will bring more water to California than last winter, it will not end the drought.
- The El Niño is effectively reducing Atlantic tropical storm activity.
- In similar years, the North American harvest was large in the Midwest and Great Plains but poor in Western Canada. At the same time heat increased wildfires and reduced crops and hydroelectricity in the West.
- The combination of the El Niño and warm Atlantic and Indian Oceans are creating a hot, dry summer with diminished harvests in Europe, a 90% monsoon in India which most agriculture has adjusted to and unacknowledged problems in North China's crops.
- Australia and Indonesia should have the drying impact of the El Niño partially ameliorated by the growing warmth and neutrality of the IOD (Indian Ocean Dipole). Most of South America's agricultural land faces heavy moisture with potential flooding but historically a good growing season for grains and oilseeds.

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Godzilla Weather?



figure 1 A water mirage -Don't get caught up in the illusion.

image; <https://commons.wikimedia.org/wiki/File:Desertmirage.jpg>

Summary: The El Niño will be large but will not bring enough precipitation to end California's drought. It will limit the hurricane season and allow a large, but difficult harvest in the Midwest and Great Plains. It will provide good conditions for winter wheat planting and most pastures.

Think of a movie – our noble hero is crawling through the desert, parched with thirst. Ahead of him a beautiful lake of cool water sparkles in the sand. Everyone knows the punchline – it's a mirage, an illusion of water.

We are seeing a similar illusion – headlines promising a “Godzilla” El Niño that will end the California drought. There is a strong El Niño in the Pacific, but any promises that it will end California's water problems are as much an illusion as that shimmering lake.

Science - A Monster El Niño

Remember – **timing is everything.** El Niños bring wintertime rain and snow to California. Just because the El Niño is a monster now in a good alignment to deliver rainfall, doesn't mean it will remain at this strength and configuration for the next six months.

Right now, the latest models project a giant, long-lasting El Niño. Some scientists are

claiming it will be the strongest El Niño in history. Headlines are glorifying its potential to end drought and warm the upcoming winter in the Midwest. Scientists are more cautious.

The El Niño is very strong – which scientifically means that area 3.4 in the Tropical Pacific is 1.5° C (2.7°F) warmer than average. Roughly 90% of the models used by the world's top 25 weather and oceanology agencies predict it will last through winter and most forecast it will remain strong. They also give an 85% chance that a weaker El Niño, will linger through spring.

What does this mean for North American weather?

To understand that, look at history. There have been seven El Niños since 1950 (when we finally had scientific observation of the Tropical Pacific Ocean) that have been strong events, exactly fitting the precise scientific definition. The following maps show their wintertime precipitation patterns. The maps are arranged from the greatest to the merely strong El Niños (*see figures 3A-G*)

Our research shows that climate, over the next term, will cause dramatic changes in our social and economic patterns.

We feel that readers, attuned to the changes that are occurring, may develop a competitive edge; and, by understanding their current and future environment, can use the momentum of change to their advantage.

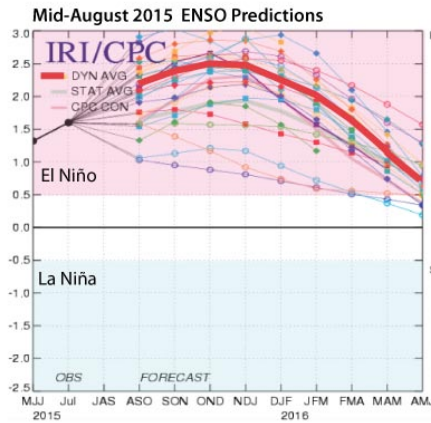
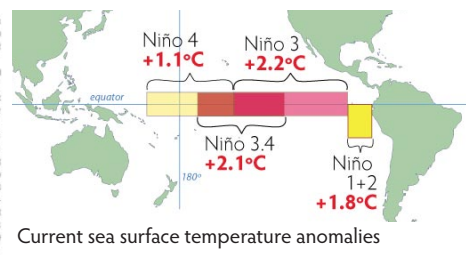


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 18 August 2015).



Gorgo, a really big mother.) El Niño must stretch from the Central Pacific all the way to the West Coast of South America. It did in the giant events of 1997/98 and 1982/83 and California received abundant rainfall. The Midwest and Northeast had a balmy winter with low heating bills. In 2009/10, the El Niño spent more time as a Central Pacific event and the crucial regions of California were dry and received merely normal precipitation. The Midwest and Mid-Atlantic states, as well as most of the US, were cold, raising energy costs.

What the Godzilla headline writers do not report is that scientists are studying how El Niños are different and how these events shape the weather. We are seeing some results that can help our clients plan.

Western Drought Relief - Godzilla vs. The Blob

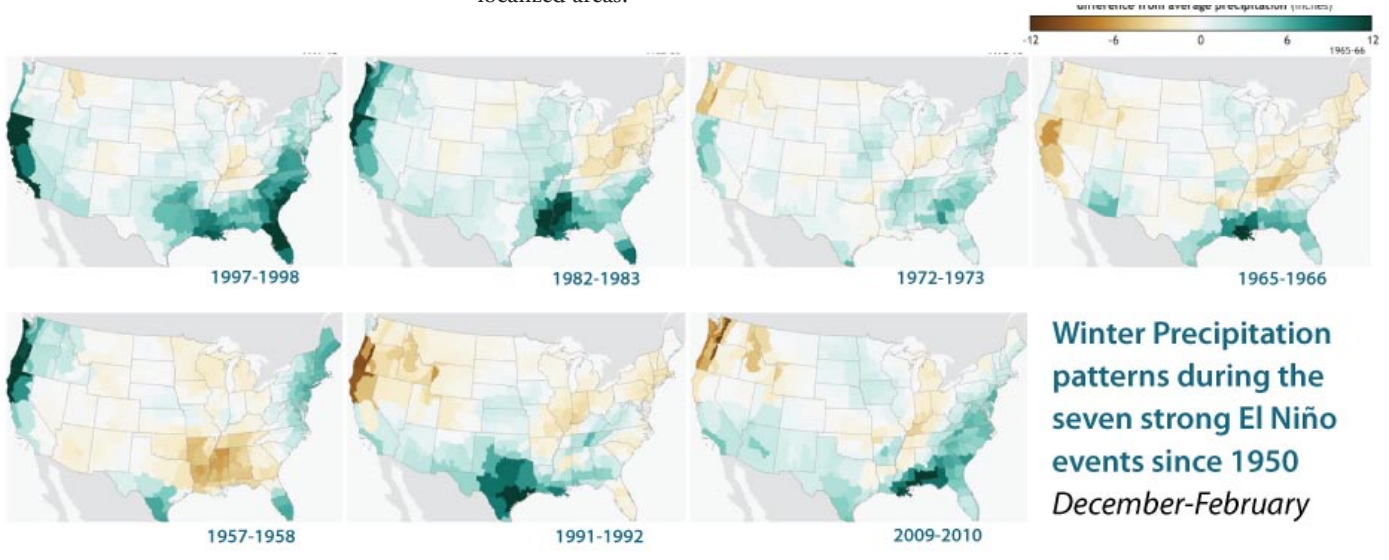
Godzilla will not end California's drought. According to Kevin Werner, director of climate services for the National Weather Service's Western Region, the state would need roughly 2.5 to 3 times its annual average precipitation over the year to end the drought. Even monsters don't deliver that much rain and snow except in localized areas.

For an El Niño to bring strong drought relief, as seen in 1997/98 and 1982/83, it needs to be strong across the Pacific. Work by Ken Takahashi, of the Instituto Geofísico del Perú (IGP) studied not just the limited area of El Niño 3.4 but the entire phenomenon, particularly the area next to South America (El Niño 1 + 2). In the August 24 climate.gov site, he noted that most events have the two areas very similar. However in the two super events, the eastern areas next to South America were three times hotter than the 3.4 region.

We are not, at this time, seeing that pattern. The winds would have to alter their current behavior to create the type of super event that some are predicting. The event seems to be very strong but not showing the same pattern the major rainmakers did.

There is one other difference. The Godzilla El Niño is not the only monster in the Pacific. In the North Pacific, off the West Coast is a large pool of water that Californian weather people have been nick-naming "The Blob". It has been associated with a high pressure area that has blocked incoming Pacific storms for the past year. Climatologist Bill Patzert at NASA's Jet Propulsion Lab states, "It's kind of like a bad '50s horror movie: 'Godzilla' El Niño versus The Blob. El Niño will bring rain and snow while the Blob and the High pressure area above it may block the storms from landing in California and the Pacific Northwest."

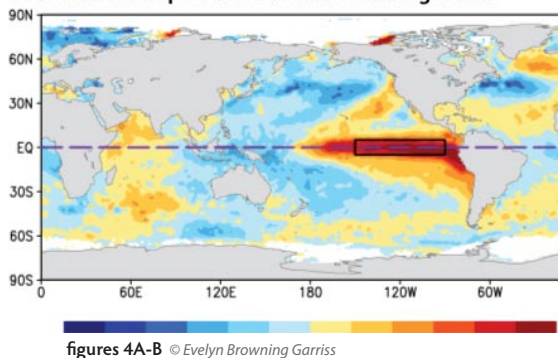
In short, expect rain and snow for California and the West, but not a miracle. There will be storms and some will be very strong, like those we saw last December.



figures 3A-G Even strong El Niños can produce very different weather. https://www.climate.gov/sites/default/files/ENSO_USimpacts_precip_lrg.jpg

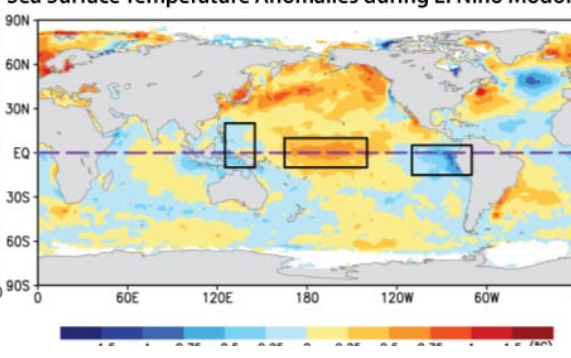
Standard El Niño vs. El Niño Modoki

Sea Surface Temperature Anomalies during El Niño



figures 4A-B © Evelyn Browning Garriss

Sea Surface Temperature Anomalies during El Niño Modoki



The alignment is good for two weeks of potential storminess in the Eastern Atlantic and Pacific and increased wind shear in the Western Atlantic.

- Typically few tropical storms and almost no hurricanes hit the Western Gulf and its oil and gas platforms during El Niños.

Storms tend to torque west, usually going into the Eastern Gulf or out into the Atlantic.

The parched soil and widespread fire damage will make floods and landslides more common. There will not, however, be enough moisture to end the drought in most of the West, particularly the West Coast.

of September, haven't started. Here are observations that are buzzing in the hurricane community:

- El Niños, particularly strong ones in a standard configuration, create high wind shear in the Caribbean which typically create quieter hurricane seasons. Experts expect fewer than the average 12 storms and 6 hurricanes.
- The water along the East Coast and Gulf of Mexico is warmer than normal while the waters along the US and Canadian coastline north of the Carolinas are between 1.5° and 3.5°C (2.7 – 6.3°F) warmer than average. This means any storm that flows north of the tropical wind shear will be given extra energy, making it wetter and stronger, as with this season's first three storms.
- Cool Madden Julian Oscillations are flowing through the tropics, allowing tropical storms to form, shown in Figure 6 as red and green areas. Warm MJOs create shearing winds and quiet areas. For the next two weeks, the usual busiest time of the year for Atlantic hurricanes, warm MJOs will protect most of the Caribbean while cooler ones will encourage storm development in the East Atlantic.

HARVESTS – Midwestern or Great Plains farmers have had timely rains and benevolent weather this August. They were also hit by an early cool spell. Since large areas of this year's crop was planted late due to the wet late spring and early summer, the cool wet rain is worrisome. Expect a large harvest that is difficult, late and expensive for portions of the Central and Eastern Corn Belt. The crop should be good, but for farmers, the low prices, difficult harvest and a higher than average need for drying in storage, will eat into profits.

Canada is not sharing the good weather, although it will have to share the low prices. The combination of El Niño and the hot "Blob" blocked rainfall to the Western and Prairie Provinces throughout most of this growing season. (Alberta officially declared its drought a disaster.) Eastern Canada had better rain but dealt with cooler weather. This dramatically lowered wheat and canola production in the West, as well as wrecking western pasturelands. Eastern Canada will have better crops, but like the Midwest will worry about a wet, cool harvest season.

Another concern is the economic turmoil in China, a huge customer of US and Canadian agricultural products. If these economic problems continue, they may limit China's imports, another consideration that has driven down global food prices. However signs that Chinese stock markets are improving have allowed soy prices to begin to improve.

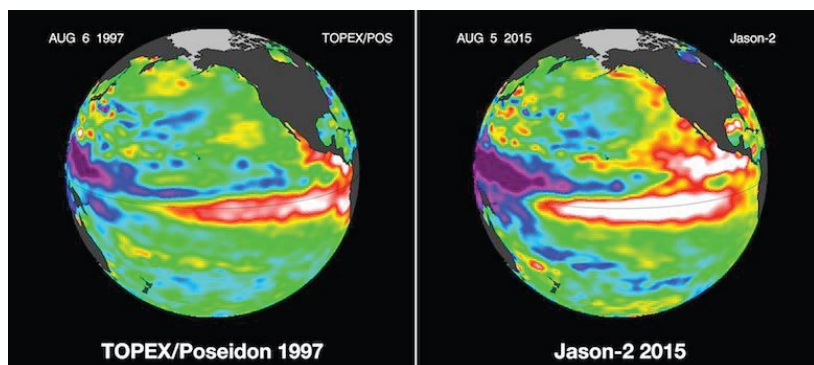
Autumn

We now fade from an El Niño summer to an El Niño fall. Godzilla will continue to shape the hurricane season and it will determine the harvest.

Expect rain and snow for California, but not a miracle. There will be storms and some of them will be very strong.

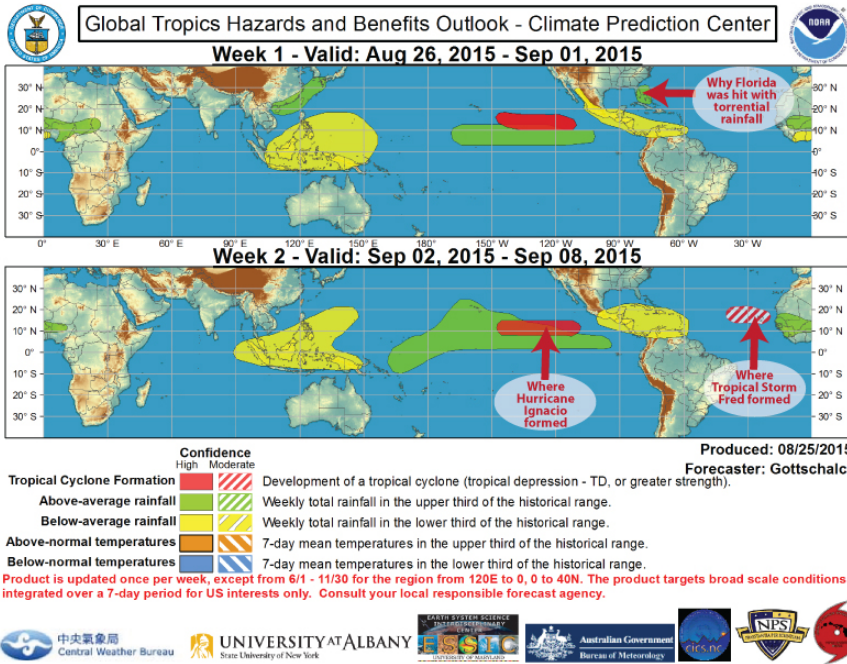
HURRICANES – As this is being written, Florida is awash with the remnants of Tropical Storm Erika. After killing at least 30 people and inflicting more than \$29 million in damages, Erika died in the mountains and wind shear over Cuba. The remnants are currently pouring over Florida and the Southeast. Meanwhile, Tropical Storm Fred has formed near Africa.

Six storms have already formed and the busiest part of the season, the first two weeks



figures 5A-B This year's El Niño (right) appears even larger than the 1997 event and El Niño area 1.2 (the coast of South America) is cooler.

courtesy NASA https://cdn3.vox-cdn.com/thumbor/41SX1FLKsNUKNxDiyT4ZpKlnJw=/cdn0.vox-cdn.com/uploads/chorus_asset/file/3975750/jpl-1997-2015.0.jpg



This year it is Godzilla [winter warmth] vs. the Icelandic volcano Bardarbunga [cooling].



Hot	Warm	Cool	Dry	Wet
5°C or more higher than normal temps.	2-4°C or more higher than normal temps.	2-4°C or more lower than normal temps.	75% or less of normal moisture.	125% or more of normal moisture.

figures 6A-B A week ago, maps showed the cool MJO that has made Tropical Storm Erika aim for Florida and Hurricane Ignacio surge towards Hawaii http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/images/gth_full.png

None of this should be a surprise. Historically prices for grains and oilseed products go down in El Niño years, typically bottoming out after the harvest.

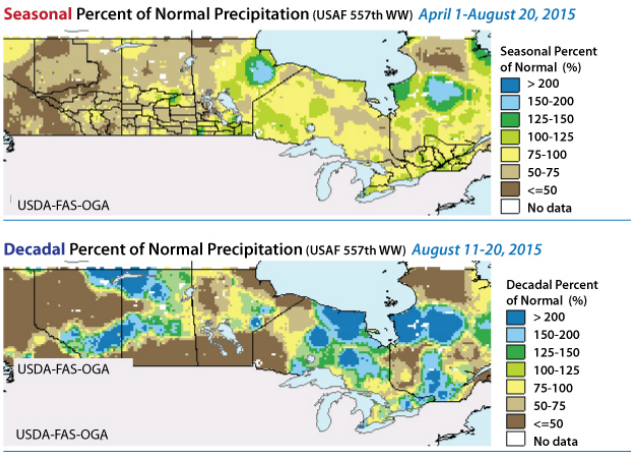
- Causing a difficult harvest but large harvest for the Midwest and Great Plains.
- Creating good conditions for pastures and winter wheat in the Southern Plains.

Conclusions- Autumn And Beyond

So far summer's weather has followed the normal pattern of a large strong El Niño. Autumn shows every sign of doing the same. So far Godzilla shows signs of:

- Increasing California and Southwestern rainfall but not enough to end California's drought.
- Continuing to reduce Northwest Pacific and Western Canadian rainfall.

What is not clear is the power of "Godzilla" on winter warmth. Typically strong El Niños create warm winters, especially mid-winters in Canada and the northern tier of states. However this year it is Godzilla vs. the Icelandic volcano Bardarbunga. That volcano released an enormous amount of cooling sulfur into the polar air mass in 2014 and 2015. Which will win – monstrous heat or volcanic cooling? Tune in next month . . .



figures 7 A & B Western Canada has had a dry growing season <http://www.pecad.fas.usda.gov/cropeplorer/>

figures 8A-C A moderate Russian volcanic eruption will make this region colder. *If El Niño conditions continue. © Evelyn Browning Garriss/Browning Media

A Bountiful Harvest – The Outlook In The Northern Hemisphere

Summary: The combination of the El Niño and warm Atlantic and Indian Oceans are creating a hot, dry summer with diminished harvests in Europe, a 90% monsoon in India which most agriculture has adjusted to and unacknowledged problems in North China's crops, especially with the quality control of stored crops.

The International Grain Council ended August by raising its forecast for global grain crops, particularly wheat and corn. The council estimated wheat and coarse grains combined will rise by 2m tons to 447m tons, "a 29-year peak." Naturally this has sent global food prices down.

This should be no surprise. History shows that when the Pacific is trending in the cooler phase of the Pacific Decadal Oscillation, the giant long-term trend that moves warmer water and energy east and west as well as towards and away from the equator, global food production goes up and prices go down during El Niños. They soar when a cool La Niña is enhanced by the cool Pacific. Since 2006 we have seen volatile food prices dance to the tune of El Niños and La Niñas. The main driver of lower prices is that El Niños create good conditions for most North American agriculture. (Sorry California and Western Canada!) Their effect on the rest of the Northern Hemisphere varies.

Europe

European agriculture has suffered from drought. The combination of strong spring and summer El Niño conditions, which reduce western and southern rainfall and a hot Atlantic, which created heatwaves and enhanced evaporation, has taken its toll. France, Benelux, western Germany,

northern Italy, northern Spain, the Czech Republic, Poland, Ukraine and Belarus reported an April to August rainfall deficit of about 50 - 60%, or even 80% locally, in comparison to the long term average. When this was coupled with the massive late June, early July heatwave, it created the worst drought conditions since the deadly summer of 2003.

While the warmth and dry conditions allowed an excellent winter wheat harvest, it created an estimated 5 - 6% drop in summer corn and oilseed crops as well as pasturelands. Fortunately late July brought some good rain, reducing losses, but expect the dry conditions to return in September. There is some concern about the impact on winter wheat planting.

Anecdotal evidence also shows the drought has had negative impact on civil and industrial water use, energy production (especially hydroelectric and nuclear), forestry and human health, as well as increases in forest wildfires and energy consumption.

India

Agriculture in India has been saved by the Indian Ocean and good storage of the surplus June water supply.

El Niños typically reduce India's summer monsoon rainfall. There was a great deal of consumer awareness and stress over this summer's event. Indeed, consumer prices skyrocketed more than 5% in June with food prices rising 5.5%. Then a random cool MJO brought heavy June rainfall, 16% more than normal giving the

nation a moisture reserve. This was followed by a positive Indian Ocean Dipole (IOD) which usually strengthens rainfall and counters the worst effects of El Niño. (It should be noted that temperatures in the Indian Ocean are currently rising to record warmth across the basin. This is expected to counter the impact of the El Niño this winter around the entire ocean towards the end of the year, both in India as well as Southeast Asia and Australia.)

The impact of the El Niño was settled in July. That month saw 17% less rainfall, followed by a 20% deficit in August. Fortunately, (and largely due to the IOD) 65% of the nation received normal rainfall, so drought was concentrated in the north and eastern states along the Arabian Sea. September shows signs of being stronger, but still below normal. Overall, the rainy season is expected to be at 90% of average. Despite the shortfalls, inflation dropped to 3.8% with food inflation only 2.2% as the worst fears eased.

China

Three facts have affected Chinese agriculture and potential imports:

1. The El Niño typically reduces Northern Chinese grain and oilseed production and increases its rice production. Also China typically reports high storage supplies and good production in order to drive prices down while they import. We are now hearing of a record Chinese corn crop and huge supply in storage. One of the things to note is that some crops in storage, such as its

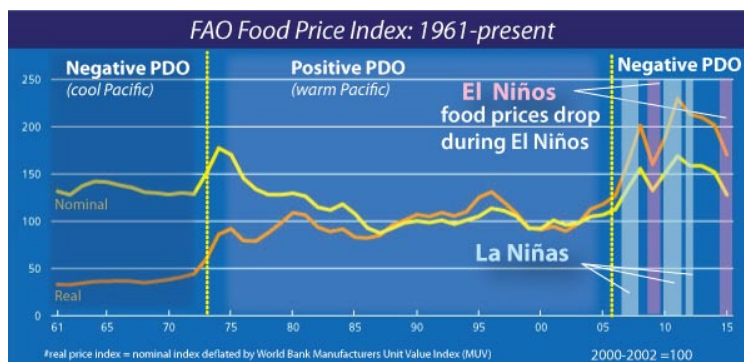


figure 9 Since the Pacific entered the cool PDO phase, global food prices have risen with cool La Niñas and dropped with warm El Niños courtesy UN Food and Agriculture Organization

European Soil Moisture Levels August 2015

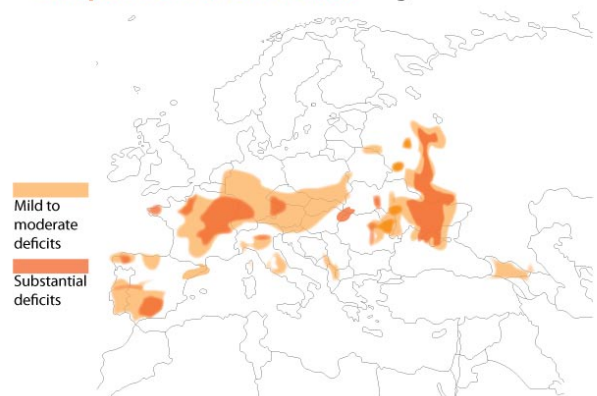


figure 10 Between high temperatures and low rainfall, massive areas of European agriculture has gone dry data: European Drought Observatory

current glut of winter wheat are of very poor quality. Chinese crop storage, particularly in the north, is susceptible to water damage and much of the stored grain has gotten wet with sprouting and mold problems, making it unsalable.

2. China has had an enormous cull of its hog herds. Due to gluts in 2012 and 2013, as well as the expense of pork production, the nation reduced its pork supply by nearly 100 million head in the last two years, including 10 million of its breeding herd. As reported by Rabobank, 100 million reduction is equivalent to the entire US, Canadian and Mexican pork sectors.

This dramatically reduces the need for animal feed but the Chinese will have to import pork through late 2015 and early 2016.

3. The current economic situation and currency devaluation will have an impact on purchasing decisions.

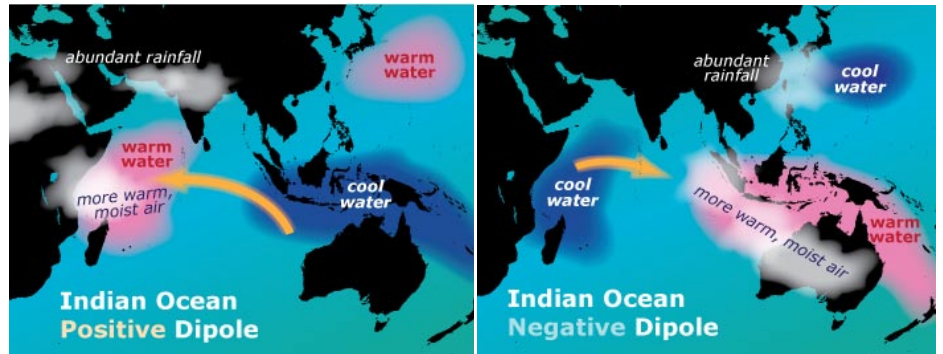


figure 11 The Indian Ocean Dipole is expected to be neutral this winter, with warm water on both sides of the Indian Ocean. data: JAMSTEC

Glorious Springtime - Planting Season In The Southern Hemisphere

Summary: Australia and Indonesia should have the drying impact of the El Niño partially ameliorated by the growing warmth and neutrality of the IOD. Most of South America's agricultural land faces heavy moisture with potential flooding but historically a good growing season for grains and oilseeds.

As the harvest begins along the Northern Hemisphere, the Southern Hemisphere is planning for planting. South America, Southern Africa, Australia and parts of Indonesia are preparing for the reality of El Niño continuing through the next two seasons. Many hold the belief that El Niño means good weather for crops, and in the US, this is true. With the current oceanic trends of the cold PDO and warm AMO, an El Niño offsets the drought coming from the Pacific and weakens hurricanes in the Atlantic. The Southern Hemisphere holds a different story. El Niño is not as

benevolent. Australia swaps its normal growth pattern, Africa receives less moisture and South America receives potentially excessive rainfall. El Niños are not necessarily bad to the Southern Hemisphere, merely different, and for the unprepared, potentially disastrous.

Australia & Indonesia

Australia has been known to declare a coming El Niño sooner than almost any other observation center. One possible reason for this is that El Niños dramatically change Australia's weather patterns. When an El Niño strikes, the East becomes severely drought-ridden. The West does not gain rainfall in return leaving Australia dealing with drought throughout the country. This can be made worse when the Indian Ocean Dipole or IOD (See Figure 11A & B) is in a positive phase, which weak-

ens the Australian monsoon, providing even less rainfall during Australia's wet season. When the IOD is negative or in warm phase for Australia, it can partially nullify the El Niño.

According to current studies, models indicate the current IOD will fade from its current positive phase and become neutral, warm across its entire tropical expanse by the end of the year. This is going to offset the drying El Niño effects on Australia and to a lesser extent Indonesia. While rainfall will be below normal in these two regions, drought will not be as severe as one would normally expect from a strong El Niño. This means a rough planting and growing season for crops. However as the El Niño begins to wane the chances of the IOD taking stronger effect and bringing in late season moisture increases.

Rice, sugar cane, wheat and corn will struggle as they are primarily grown in the South-eastern parts of Australia, normally much hotter from an El Niño and less affected by the IOD. Wool is likely to have a minimal change as in two thirds of all El Niño years' wool production drops on average about 3%.

The El Niño should last through [southern] Africa's planting season and with it, drought.



figure 12 Spring Forecast for the Southern Hemisphere © Evelyn Browning Garriss/Browning Media

In Indonesia, The IOD and El Niño will act against each other. This does not bode as well for Indonesian crops as sugar cane and rice are high water crops. The limited amount of precipitation will create lower yield and poorer quality. Due to the normal plentiful rainfall within the country, there is little to no water storage to offset the lower than average rainfall. Unless the El Niño ends very quickly, which studies have shown to not be likely, crop yield will be lower than average.

Africa

Africa has the distinction of being split by the equator. As such, Northern, Central and Southern Africa each have to cope with their own climate. Northern Africa has already faced the El Niño's effect on the planting and growing season. While they attempt to harvest, Central and Southern Africa now need to plan for planting after a dry season with little precipitation and slightly higher than average temperatures.

The normal trend of the PDO is for the most part positive for Africa. It creates better than average rainfall along Western, Central and Southern Africa. Unfortunately most of Africa is unprepared when El Niños strike as only 5% of agricultural land is properly irrigated with water storage and routing. When precipitation doesn't occur for a region, there is no back-up plan. This is the case for Africa this year. The El Niño should last through Africa's planting season and with it, drought.

In similar years, Western, Central and Southern Africa experienced lower than average precipitation and higher temperatures September through November. Because the El Niño has continued throughout the year, the amount of soil moisture will also be low. This will lead to hard dry soil for planting in regions with little to no irrigation or water storage. Cattle, cocoa, peanut and tobacco regions are all under long term drought conditions from the El Niño. Rice and wheat regions also have at least 80% of their land under drought conditions.

Eastern Africa is experiencing the exact opposite of normal weather trends. The El Niño is giving much needed rainfall. This is coming at a price as the Eastern region has had a long term drought. The land is ill prepared for strong rains an El Niño can bring. The northern hemispheric parts of Eastern Africa experienced flooding, it's likely the southern hemispheric portion can expect the same within the next two months. This allows for very wet but good planting and growing conditions. Although Eastern Africa does not have a large agricultural region, soy and to a lesser degree coffee have the potential to do well.

South America

While the upcoming El Niño has brought drought to northern portions of South America, history suggests it will bring heavy precipitation to the southern hemispheric portions of South America.

Peru, Ecuador, Chile and Northern Argentina have had to deal with flooding. While potentially devastating for cities and mining, this creates difficult but otherwise good planting opportunities.

With large amounts of rainfall coming, Southern Brazil and Argentina will be forced to avoid root drowning. The El Niño brings high potential for flooding. This is especially true for Argentina as they have been struggling with mild to moderate drought over the past few years. As such, the soil moisture is lower in Argentina creating a higher possibility of flash flooding which damages newly planted crops. Chile actually has lower than average precipitation during this time, but due to the high amount of rainfall received in previous months, soil moisture will allow for easier planting. In fact, Chile has perhaps the best situation with good soil moisture but little risk of flooding.

Conclusion

Indonesia and Australia may have a break from the normally drought creating El Niño. With the negative warm IOD creating warm water around those countries, it will help offset the cold water an El Niño creates. This will lead to average to slightly below average yields for crops in Australia with much worse yields in Indonesia for water heavy crops. Africa is in for drought but its central and southeastern regions are receiving too much rain. South America will have very good rainfall with potential flooding in Argentina and Southern Brazil.

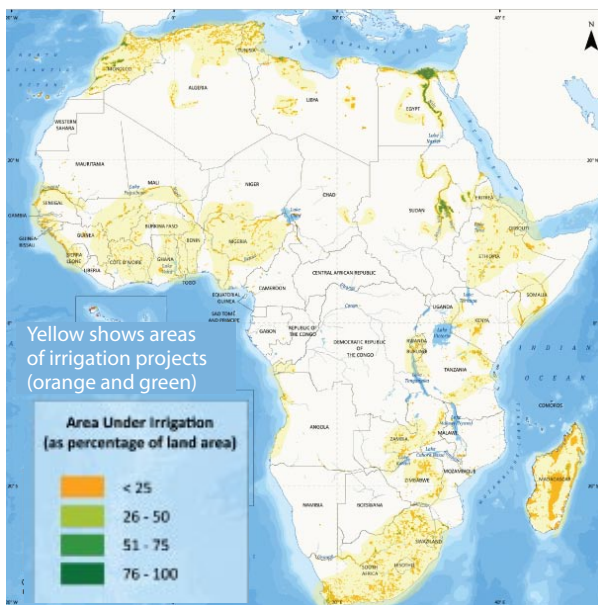


figure 13 Irrigated lands of Africa

<http://na.unep.net/atlas/africaWater/images/maps/pngs/irrigated-areas.png>

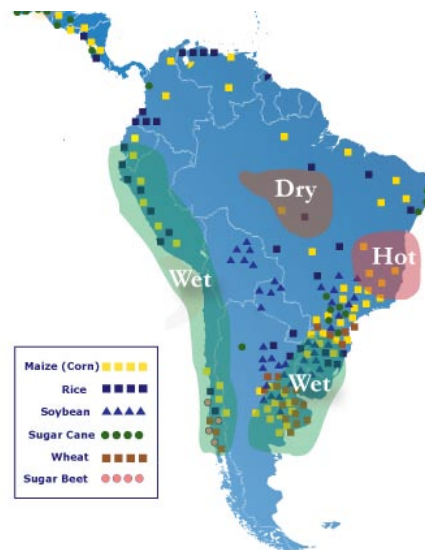


figure 14 Major crops of South America in an El Niño planting season

© Evelyn Browning Garriss / Browning Media

Fear Fred! Despite the fact that most violent Atlantic hurricanes are called “Cape Verde hurricanes because they start near the off-Africa islands and build up strength crossing the Atlantic, tropical storms don’t actually hit the islands. They are rainfalls that become deadly storms west of the Cape Verdes – except for Fred. While there have been a rare couple of tropical storms that have lashed the Cape Verdes, Fred is the first recorded hurricane to threaten the islands. The end of August saw the islands receive their first ever hurricane warning.

Who needs hurricanes? The heat off of Western Canada and the Pacific Northwest not only is blocking most storms, it also pours enormous energy into the storms that actually make it to shore. The massive storm that killed two people and left a million people without power in Washington state and the Vancouver, Canada area are a warning. Typically this type of El Niño causes droughts and violent, flash-flooding storms in British Columbia and the Pacific Northwest.

Fires burn and bureaucracies bicker. Most of the news from the Pacific Northwest has been about the record-breaking fire season. The US Forest Service has had to call in help from the army, Canada, Australia and New Zealand. This has been one of the worst — and most expensive — wildfire seasons ever, costing the service over a billion dollars, more than half its budget. There have been drastic cuts in every other wildlife function the Service provides at the expense of programs that prevent future fires.

Since the PDO changed, making western North America drier, the **fire season has grown 78 days longer** and we are seeing vast mega-fires. The Service has asked for FEMA help in dealing with the new mega-fire disasters. In return FEMA refuses, since it is kept busy with hurricanes, tornadoes, floods and blizzards. Expect more fires, damage and deaths – and little change.

Hot times in Ecuador Cotopaxi volcano in Ecuador woke up with a boom and a series of violent explosions in mid-August. The explosions, 8 km (5 mile) high, were large enough to affect local and downwind weather for a few weeks but too small to

enter the stratosphere and alter climate. It was large enough to risk melting the mountaintop glacier – creating a deadly lahar landslide and to scatter the surrounding area with dangerous, glassy volcanic ash. Since the region around the volcano is highly populated, Cotopaxi has a deadly reputation. One question – could the localized cooling created by this eruption be reducing warmth in the off-shore area of El Niño 1+2? As noted earlier – this area is key in determining how strong an El Niño becomes and how much it will affect North American weather.

The Case of the Disappearing El Niño One of our El Niños has gone missing! Earlier this year, last winter was classified as an El Niño winter. It created typical El Niño weather from October through December and Central Pacific or El Niño Modoki weather from January through April. This month the 2014/2015 El Niño completely disappeared from the records.

Here’s what happened – the Tropical Pacific Ocean temperatures were recalculated and caused the records of February’s temperatures to drop 0.1°C (0.2°F) in area El Niño 3.4. Even though the region had been warm enough to be an El Niño for five to six months, it was slightly too cool on the seventh month, therefore it did not last long enough to meet the technical definition of being an El Niño. Farmers, ranchers, weather related businesses and investors need to realize – you can have half a year of El Niño weather shaping your lives without it meeting the scientific definition of an El Niño.

Recently NOAA’s National Center for Environmental Information has changed and updated the techniques for recording and estimating global temperatures. It does this every few years. This time the recalibration has eliminated the pause in global warming and the most recent El Niño.

El Niño brings water and wolves Californians (or at least Californians that don’t raise livestock) were delighted in August to discover the first wolf pack in the state since the breed was exterminated in 1924. They have twice had wandering Oregon lone wolves enter the state, but to their shock they discovered a pack with two adults and five healthy four-month-old pups. The El Niño has brought intense drought and wildfires to Oregon, reducing game. The new pack settled near the Mt. Shasta glacier, an area that always has downslope water. This makes California the fourth state, after Montana, Washington and Oregon, where the first pack settled near a glacier. Cool!

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