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BROWNING

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AUTUMN

IN THIS ISSUE

- El Niño conditions arrived in late August. For technical reasons, it is not yet an officially declared El Niño event, but it is affecting weather.
- Typically, El Niños bring warmer than average autumn weather in the northern tier of states and wetter conditions in the East, South, Southwest, Rocky Mountains and Northern Plains states. While the overall season is warm, it is not uncommon for September to have an early cold spell.
- A small, relatively short-lived Madden Julian Oscillation has entered the El Niño, diminishing its ability to suppress tropical storm development. This has allowed the development of Isaac, Joyce, Kirk and Leslie.
- Since the strength and timing of Asian monsoons depends upon the flow of winds from cool to warm areas, ocean cycles that transport heat are critically important for Asian agriculture.
- A succession of three climate factors, an early negative Indian Ocean Dipole, a July Madden Julian Oscillation and the late summer evolution of an El Nino combined to create India's weak monsoon.
- The long-term Pacific Decadal Oscillation is currently in a phase to shape stronger monsoons for India, Japan and Northern and Central China. It also tends to create weaker monsoons for Pakistan, North Korea and Southern China. El Niños interrupt and counter this trend which will probably last another 15 to 20 years.

SUMMARY

El Niño has begun and most models expect it to be moderate in strength by November. Meanwhile the Atlantic continues to be warm off the East Coast, creating negative NAOs that are slowing weather patterns. Expect a decent harvest season and a wetter autumn (especially in the East) that begins to reduce the US drought conditions.

El Niño is here. The peak of the Atlantic Hurricane Season has started. The harvest season will begin. Planners are beginning to plan for the upcoming heating season.

Welcome to the beginning of a very busy fall.

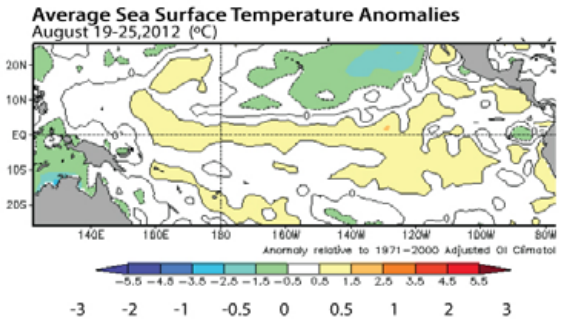


fig. 1 **El Niño arrives with a whimper.**
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

The Arrival of El Nino

It is not official, but the El Niño has begun. It is still weak.

Notice, it is not official yet. The official definition of an El Niño is technical. In the words of NOAA Operational Definitions for El Niño:

"CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5°C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months."

Last week, the area between 170°W to 120°W in the Tropical Pacific were more than 0.5°C (0.9°F) warmer than normal. This means El Niño conditions began. However, the temperatures must continue to be this warm or warmer for three consecutive months for the conditions to be declared an official El Niño event. Therefore, even though El Niño conditions will be affecting global weather, authorities will not declare an El Niño for a few more weeks. Like I said, technical.

CONTENTS

This newsletter contains articles, observations and facts to support our contention that man is significantly influenced by the climate in which he exists. Our calculations show the climate, over the next term, will cause dramatic changes in our social and economic patterns.

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

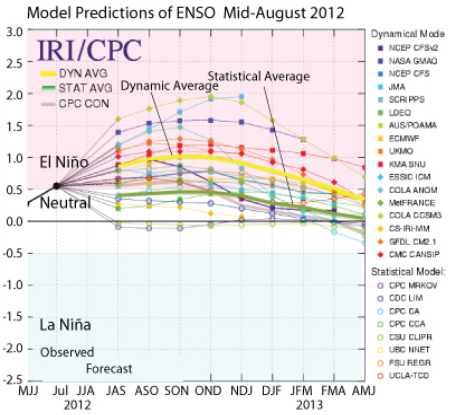


Figure provided by the International Research Institute (IRI) for Climate and Society

fig. 2 Dynamic models favor a mild to moderate El Niño that fades by spring.

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

The current El Niño conditions are still weak, but most official forecasters predict stronger conditions to develop and peak in November or December. As the combined International Research Institute (IRI) for Climate and Society and US Climate Prediction Center summary of forecast models show, most dynamic models (based on evolving conditions) show the event reaching moderate strength by November, beginning to weaken in January and fading to neutral by April. So far, these dynamic models have been far more accurate than the statistical models, which are based on a fifty-year history of the events.

This has been another very fast development transition for an El Niño. We had two winters of La Niñas, where the Tropical Pacific is unusually cool. The last La Niña ended in March and the Pacific warmed to an El Niño in only 5 months. Normally there is a year or more between the events. To go from one extreme to the other in such a short period has produced a "weather whiplash" effect. **Many regions of the Earth, such as the continental US, did not have time to recover from the La Niña-induced droughts before the El Niño dry events began to develop.**

The developing El Niño has already been shaping this year's weather. What will its impact be for the rest of the year?

The US Climate Prediction Center has studied the impact of the event since 1950. Figures 3 through 6 show the most common effects, taking evolving weather trends as part of their calculations. Typically, El Niños bring warmer than average autumn weather in the northern tier of states and wetter conditions in the East, South, Southwest, Rocky Mountains and Northern Plains states. In wintertime, we see warmer temperatures in the northern tier of states and cooler conditions from Texas to the Mid-Atlantic States. The coasts, particularly California and the Pacific Northwest, have more precipitation.

Climate, MJOs and Hurricanes

One climate event, even one as massive as over a million square miles of warmer ocean waters, is not the sole factor shaping the global climate. To understand the upcoming fall and winter for North America, one has to look at a number of factors shaping the climate. Basically, to understand natural climate change, you have to follow the energy.

- How much solar radiation the earth receives – The sun provides the energy that runs the weather system. Currently the sun is reaching the peak of a sunspot cycle. According Thomas Woods, solar scientist at the University of Colorado in Boulder, this supplies enough energy to temporarily raise global temperatures 0.1˚C (0.2˚F).
- The patterns of where the solar radiation falls or is reflected – Clouds and volcanic debris can block incoming solar radiation, changing temperatures, precipitation and wind patterns. We had two large polar eruptions last winter and saw extremely strong circumpolar winds that trapped the cold Arctic air mass north. The volcanic debris is still in the stratosphere
- Where the heat from the solar radiation is stored – Seventy percent of the Earth surface is ocean water and the currents in the water transport heat and energy. The main cycles that shift temperatures and alter global weather are shown in Figure 7.

Notice, a short – lived, relatively small oscillation, the Madden Julian Oscillation, flows eastward around the Earth's tropics. Each pulse is a strengthening or weakening of tropical winds that alternate, a strong pulse following a weak pulse, followed by a strong pulse. Strong winds ruffle the surface of the sea, and waters in these areas cool. Weak winds allow the ocean surfaces to bask in the sun and grow warmer. Literally, each pulse of an MJO acts like a mini-El Niño or mini-La Niña. They affect weather, allowing more rain and storm development (cool pulses) or suppressing the rain (warm pulses).

Recently a strong wind/cool water MJO has flowed through the warming El Niño waters. Wherever the MJO was, it cooled the El Niño. The first sign of its presence was when it weakened the Southwestern monsoon and the winds that would have veered the moisture northeast into New Mexico, west Texas and the Southern/Central High Plains.

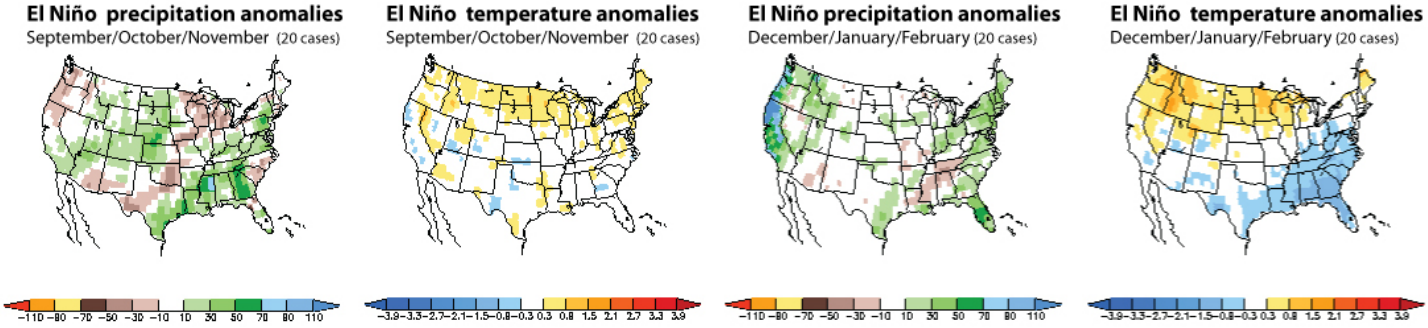


fig. 3-6 **Autumn *(left)* and Winter anomalies typical of El Niños**

http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ENSO/composites/elnino

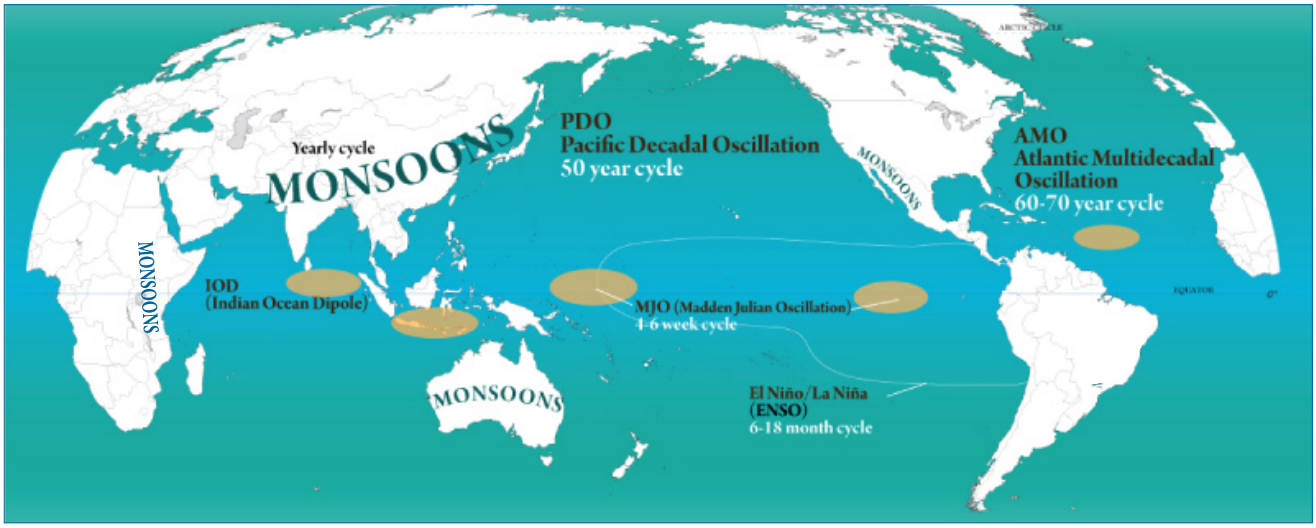


fig. 7 **World water patterns large and small, ephemeral and persistent, shape world climate**

Instead the rains poured straight north into Arizona and Nevada. Now, as the MJO progress continues, it is affecting the west coast and Caribbean areas of the Americas.

Normally El Niños reduce the number of Atlantic Hurricanes. They alter high altitude tropical wind patterns around the globe. In particular, the phenomenon creates winds over the Caribbean that sheer off the tops of developing tropical storms. Additionally, the winds have either tended to force Atlantic storms south into Mexico or force more northern storms to veer north.

However, right now a cool MJO has drifted into a strategic area and is interacting with the El Niño. The El Niño is still weak and this cool MJO is unusually strong. It has stopped the eastward sheer of the high altitude winds. Tropical Storm Isaac was able to grow. As it entered a zone where the MJO countered the El Niño, it grew in strength and was able to progress to the west. Instead of hitting Florida and the Republican Convention in Tampa, as experts expected, it sailed west to the Central Gulf of Mexico. In the process, Isaac swept through the heart of the Gulf gas and oil country.

(The US Climate Projection Center showed this positioning of the MJO back on August 21.)

While headlines have compared it to Katrina, its path was more similar to other Central Gulf hurricanes that developed in El Niño years, traveling from the tip of Florida to Louisiana, slowing as it entered the zone where MJO winds battled El Niño winds, and growing in strength as it approached the shoreline. Fortunately, unlike 1992's Hurricane Andrew and 2002's Hurricane Lili, El Niño storms that followed similar tracks in the Gulf, it did not intensify into a major hurricane. Its major damage was due to storm surge, not wind power.

Still, it did have a major impact on energy. US oil prices were already rising from the impact of the Venezuelan refinery fire and Isaac accelerated the increase. More than three-fourths of daily oil production in the Gulf of Mexico was closed, eliminating more than 1 million barrels per day of crude oil, equivalent to 78 percent of the Gulf of Mexico's crude production. Addition several companies shut their Louisiana refineries and Louisiana and Alabama temporarily closed their ports or suspended tanker unloading. Additionally, the Capline crude oil pipeline, which has a capacity of 1.2 million barrels per day and transports oil to refineries in the Midwest, was shut down Monday.

When the slow-moving storm, progressing north with the speed of a brisk walk, hit the Louisiana coastline, it forced the Mississippi River to flow backward as far north as Baton Rouge. This forced water levels to surge as much as 11 feet. More than 900,000 people have been left without power, 3000 have been evacuated and two person is known dead. Fortunately, all but one of the region's levees have held. Gasoline prices rose five cents, their biggest one-day hike in eighteen months as refineries closed. However, the oil and gas industry in the Gulf region has so far reported no major storm-related damage to infrastructure, and companies began to

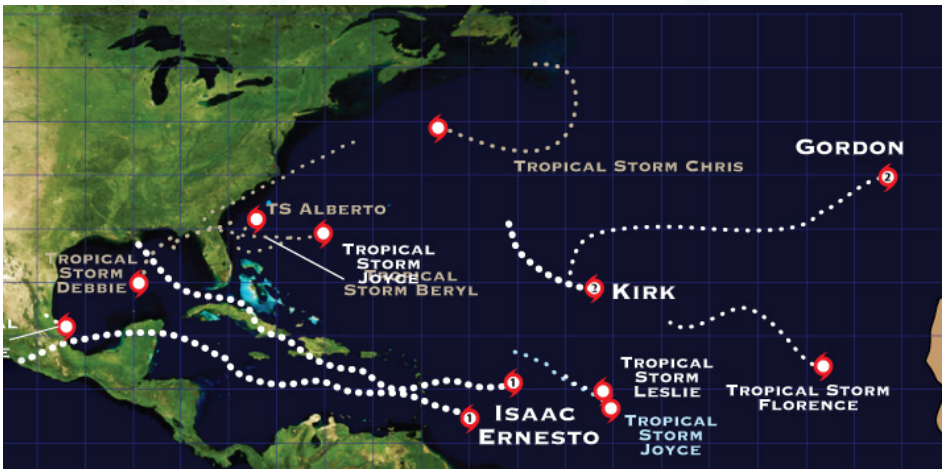
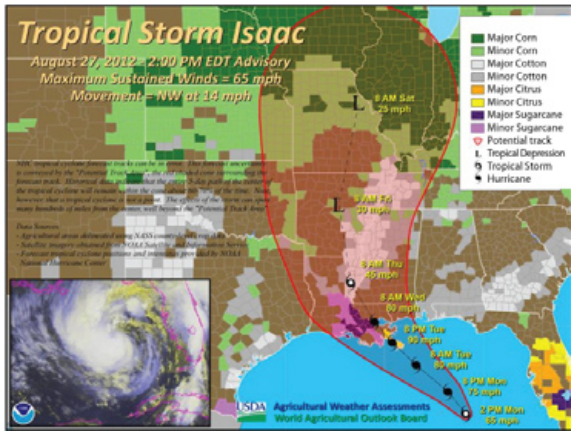
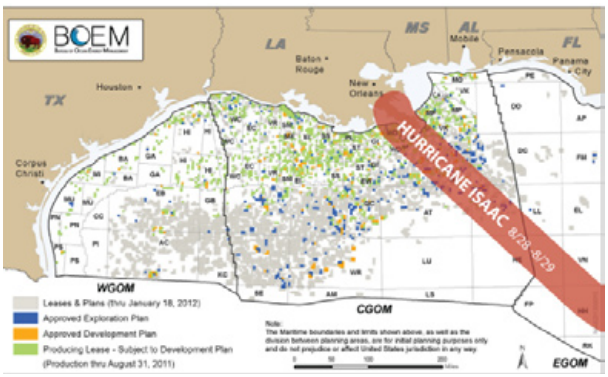


fig. 8 **The Atlantic Hurricane season heats up**





figs.9-10 **Isaac brings relief to Midwestern farmers, problems for offshore oil rigs.**

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bottom: http://www.doi.gov/news/pressreleases/upload/Final-Report.pdf

restart production and refineries by the end of the week.

As the week progressed, the remnants of hurricane Isaac carried, much needed moisture to the Midwest. While it arrived too late to help corn and much of the soybean crop, it provided good condition for planting winter corn.

Currently, the MJOs have shifted so that they will offer more protection for the Gulf but continue to allow tropical storms to generate in the mid-Atlantic. The *Browning Newsletter* projection is, as it was last month, that the Atlantic Hurricane season will have a normal number of storms with winds keeping the storms out of the Western Gulf (due to the 4 pre-July storm. As the El Niño settles in, the season will slow and probably end early. It is highly probable that this is the last storm to hit the Central Gulf, but eastern Gulf waters are still vulnerable.

The Changing Atlantic and Arctic

While the changes in the Pacific have been relatively rapid, the changes in the Atlantic have been much slower.

The Atlantic Thermohalene current, which includes the Gulf Stream) has been very rapid this year. It is still flowing unusually fast and unusually far north. (This is common following a winter that, like last winter, had an unusually strong Arctic Oscillation or polar jet stream trapping the Arctic air north.) The rapid flow of these tropical currents has shifted warm tropical waters unusually far north. We are seeing some record heat and ice melting in the North Atlantic. Indeed, headlines on August 28 reported that "It's official: Arctic ice lowest ever and still shrinking." (It should be noted that measuring the Arctic ice began in the 1970s.)

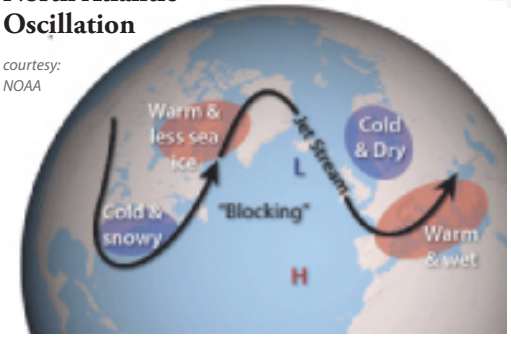
The rapid flow of the Atlantic currents is now bringing cooler water from the southern Atlantic to the tropics. However, this is a relatively slow process. For now most of the waters around the East Coast is hot.

All of these are shaping conditions for a weather pattern known as a negative North Atlantic Oscillation **(NAO)**. What this means is that the polar jet stream is weaker over the Atlantic. It has been negative most of this summer, meaning that instead of flowing strong and hard around the Arctic, it has meandered over the North Atlantic. When this happens, it blocks the eastward flow of weather patterns. Instead, North American weather patterns stall.

The NAO was negative almost all this summer. It blocks the flow of warm fronts, causing them to slow down and cause heatwaves. In winter, it blocks the flow of cold fronts, causing unusually cold weather, as we saw in the winter of 2009/2010 and 2010/2011. It has produced some very strange weather. Much of the weather that we saw this August followed patterns (not how hot it was, but patterns of where the precipitation falls and where the heat and cooling took place) that were more typical of early September.

fig. 11 **This year's likely negative North Atlantic Oscillation**

courtesy: NOAA



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

figs. 12-14 *, **Moderate eruptions in the North Pacific will bring more moisture to the west.**

This fall, with all that hot Atlantic water near the poles, the NAO will be negative most of the time, especially in early winter. This will slow the eastward flow of weather. As a result, we can expect a great deal of precipitation along the East Coast, as cooler fronts collide with unusually warm water and stall. This slower movement of fronts will create extreme swings of temperatures as autumn evolves.

In short, this autumn will be molded by a strengthening El Niño, a still hot Atlantic off the East Coast and a largely negative NAO that slows down the movement of fronts.

In past years with similar climate factors, we saw the following weather patterns between 60 – 80% of the time.

Overall, the autumn appears to be relatively benign for US and Canadian agriculture. Eighty percent of the time, September has a cool spell but only 20% of the years had an early frost. (Early frosts would not pose much of a risk since most US and Canadian crops were planted early.) After the effects of Isaac finish, wetter early autumn conditions should be enough to begin relieving the long-term drought in most areas without being wet enough to ruin the harvests. (Even parched Texas should be seeing some relief late in the season.) Expect unusual weather with some extremes, just as we have seen for most of the year. But compared to the simmering summer of 2012, the weather should be more benign.

Typically, this autumn would be followed by a relatively warm El Niño winter in the US and Canada. As the El Niño winter of 2009 showed, this doesn't always happen. The evolution of the El Niño in September, balanced with the continuing slower evolution of North Atlantic temperatures will shape the upcoming winter and heating season. Tune in next month.

OCEAN TRENDS AND THEIR IMPACT ON ASIA

SUMMARY

The combination of El Niño and other oscillation patterns in the Indian and Pacific Ocean have altered monsoon patterns in Asia. While some of these changes were temporary, like this summer's diminished Indian monsoon, others will last for another two decades.

El Niño is a global event. However, the impact of this Tropical Pacific phenomenon is most intense around the Pacific Rim. This summer North America felt the impact of the rapid evolution from La Niña to El Niño but so has Asia. As 2012 draws to a conclusion, Australia and South America will also have their growing seasons affected by the deepening climate event.

As important as El Nino events are, however, they are not the only climate factor that shaped this summer's growing season in the Northern Hemisphere. The heat, droughts and floods that plagued the global breadbaskets have been influended by numerous factors. In the case of Asia, homeland of more than four billion of the Earth's estimated 7+ billion people; their weather was largely controlled by the oscillations that dominated the Indian and Pacific Oceans.

What makes Asia so vulnerable to the influence of the impact of ocean oscillations is the heavy dependence of Asian agriculture on monsoons. Monsoon weather is the seasonal flow of winds between land and water. Hot air rises and is replaced by air flowing from cooler areas. In winter, oceans are warmer, so the cold, dry winds flow from the land out to sea. In summer, the land heats up quicker than water, so cooler ocean breezes flow inland bringing bountiful rain. Between one and a half to two billion people in Asia directly depend on the timing of these cycles of wet and dry seasons.

Since the strength and timing of Asian monsoons depends upon the flow of winds from cool to warm areas, ocean cycles that transport heat are critically important.

The Oscillations of The Indian Ocean

The cycles in the Indian Ocean this year have been particularly unfavorable for India's monsoon. During most of the summer, the Indian Ocean was in a phase knows as a negative Indian Ocean Dipole (IOD). Basically, this is a cycle where the warm waters are concentrated towards the eastern or western sides of the Indian Ocean. In a positive IOD, the warmth was concentrated in the western side of the ocean, strengthening the monsoons in East Africa and India. In a negative IOD, the warmth and stronger monsoons were concentrated in the east bringing the stronger rains to Southeast Asia, China, Korea and Japan.

This summer, the Indian Ocean had a negative IOD and India had a very weak monsoon. During June, the nation suf-

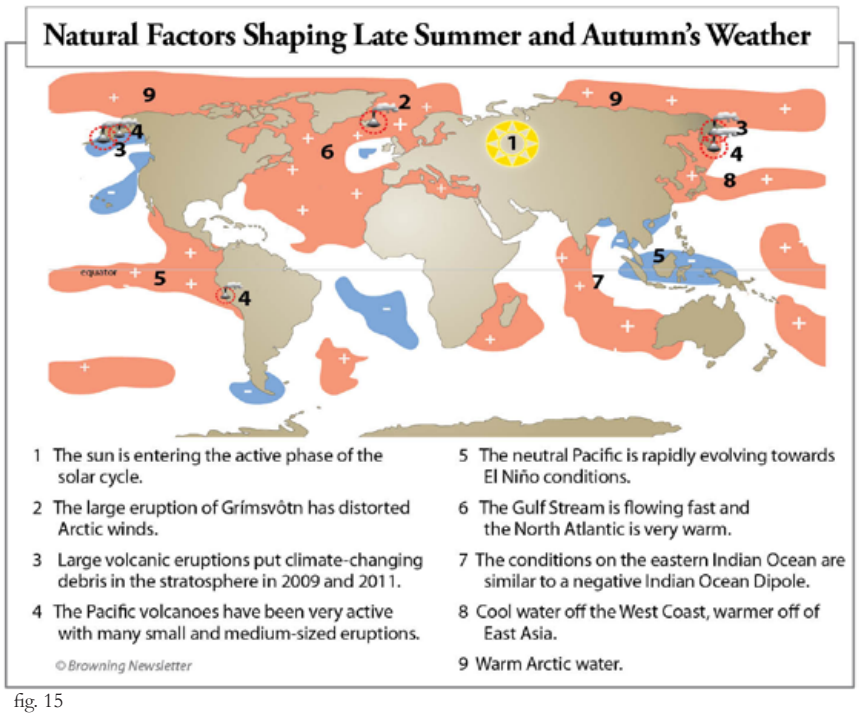


fig. 15

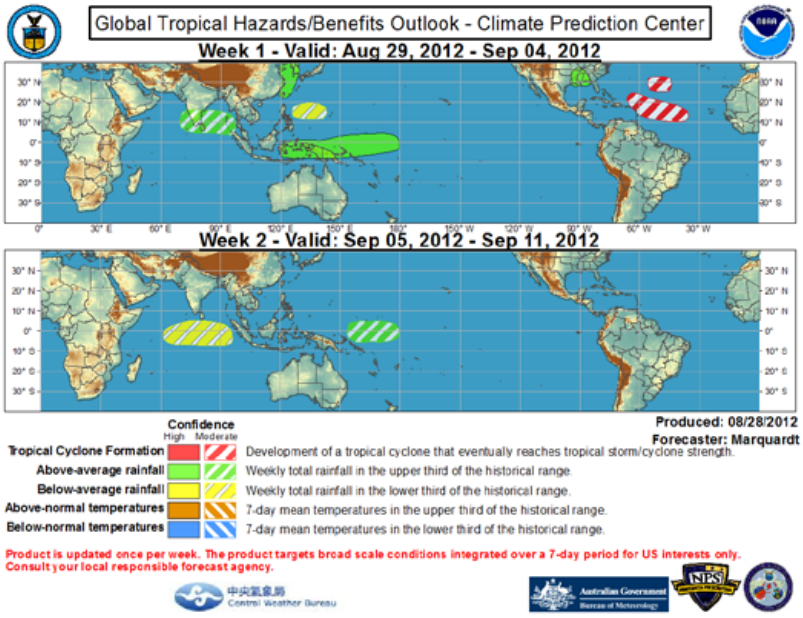


fig. 16 **The impact of MJOs on tropical weather August 29-Sept 4** *(top)* **and Sept 5-11** *(bottom)*

http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

fered as much as a 29% rain shortfall with over 70% of India reporting drought conditions. Meanwhile, in Burma, torrential monsoon rains forced 85,000 people to flee their homes and destroyed 200,000 acres of rice. The East Asian monsoons were heavier than usual. Japan and Korea suffered intense rains and flooding while parts of China, including Beijing, suffered some of its worst flooding in over 60 years.

The western portion of the Indian Ocean began to warm, which should have been good news for India. However, the Madden Julian Oscillation (MJO), mentioned in the first article, affect tropics around the world. These pulses of alternately warmer and cooler waters traverse the tropics, from the shores of East Africa through the Indian Ocean and Pacific.

In July, a MJO pulse lingered over India, continuing to weaken the monsoon. As the nation's farmers turned to electricity to help irrigation, India suffered massive blackouts. The good news is that in August the pulse moved on and was followed by a precipitation enhancing pulse that revived the monsoon. India's moisture deficit has dropped from 29% to only 12%. The rains will be particularly beneficial for rice, sugar, and oilseeds. Since the pulses tend to last 4 – 6 weeks, the late monsoon should be stronger.

Meanwhile, as Figure 16 shows, the current locations of the MJO pulses are still encouraging flooding and typhoons in parts of East and Southeast Asia. When combined with combined with the developing El Niño, China has had a record breaking six typhoon landfalls this year including two that lashed Hong Kong and one that lashed Shanghai.

The Oscillations of the Pacific Ocean

The cycles of the Pacific Ocean are equally important for shaping the current and upcoming weather in Asia.

The impact of El Niños on Asia has been studied since the 1880s, especially in India. The event typically warms the waters in the central and eastern Tropical Pacific, but the waters in the west are cooler. By altering the water temperatures, it alters the seasonal flow of the monsoons.

In India, Farm Secretary Ashish Bahuguna is reporting that the El Niño will not impact the nation's September rains. As Figure 17 shows, the event normally reduces the South Asian monsoon. It was partially responsible for the dismal monsoon of 2009. However, since the event is just beginning, Indian officials feel that it should be too weak to have a major impact on the monsoon. Expect a September "Battle of the Oscillations" as the rain enhancing position of the MJO counters the rain suppressing El Niño. The result should probably be a near draw, with a September rainfall only slightly below average.

The event will have a more benevolent impact on China. Typically, El Niños lengthen the monsoon for China's southern provinces, regions that received below average precipitation over the past two years. Since some of the most important rivers in Asia, from the Brahmaputra to the Mekong to the Yangtze have their headwaters in these provinces, this is great news for hydroelectricity. At the same time, as Figure 18 shows, lands from Pakistan through Southeast Asia, as well as most of China, Japan and Korea tend to have warmer winters. This should reduce heating demand.

The El Niño is less benign to Southeast Asia. Typically, the region, especially the southernmost nations of Indonesia and Malaysia will have reduced rainfall. This reduces rice and palm oil production. Some El Niños, such as the giant event of 1997 – 98 have had a profound impact on the area's agricultural production as well as the regional economy. Fortunately, there is a strong probability that this year the El Niño will be only moderate and partially countered by the effects of the warmer waters still lingering in the eastern Indian Ocean. In the words of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), "This [Indian] oceanic condition is similar to a negative Indian Ocean Dipole mode." This may reduce the seasonal El Niño drought. Historically, similar years show as much as a 10% reduction in Indonesian and Malaysian palm oil.

Finally, the largest and lengthiest of the Pacific's cycles, the Pacific Decadal Oscillation has long-term implications for all of Asia.

The Pacific Decadal Oscillation **(PDO)** or as some papers call it – the Pacific Decadal Variation – is a long and complex shift of water temperatures and high and low pressure areas with accompanying changes in wind speeds and ocean currents. Basically, for the layman, it is a shift of warm and cool waters in the Pacific, particularly in the northern portions of the ocean. In the positive (warm) phase, the tropics and eastern Pacific waters are warm and the polar and western waters are cooler than normal. In the negative phase, the reverse is true. The complete cycle takes more than

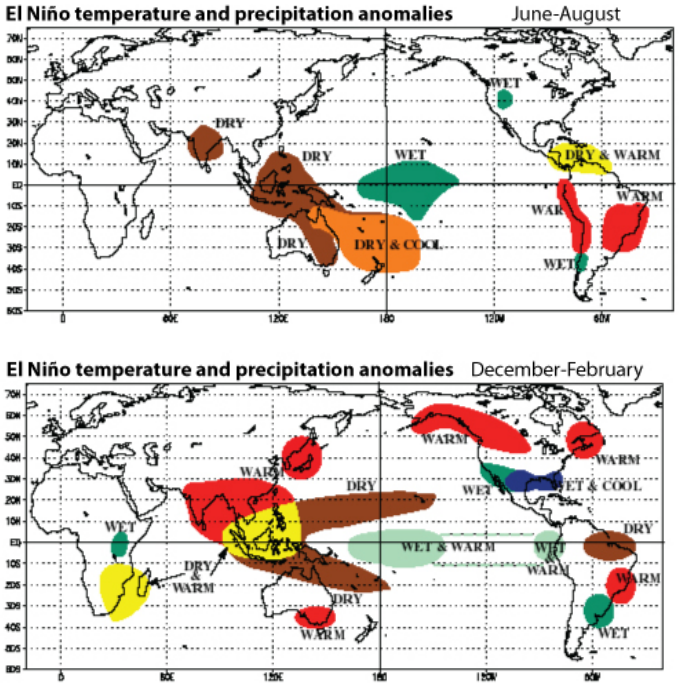
50 years with each phase lasting roughly 20 – 30+ years.

Let's look at the climate impact of each phase of the PDO. In the early 1970s, the PDO began to switch to its positive phase and settled into its warm pattern by 1976/1977. When the PDO switched to its positive phase, the waters off Asia cooled in some areas and warmed in others. Since monsoons are shaped by land and water temperatures, huge areas of Asia had weaker monsoon seasons. This reduced the wet season, leaving huge areas with less water. It created some enormous problems, especially for agriculture and hydroelectricity.

Starting in 1999, the Pacific Decadal Oscillation began to turn negative. In the new negative phase, the tropical ocean currents and waters off the western coasts of the Americas became cooler. The Western Pacific and the polar waters warmed. The Pacific remained this way for a few years, and then switched back. In 2006, they switched again. Now scientists are claiming that the PDO is in its cool phase. It will stay this way (with occasional exceptions during El Niños) for the next 20 to 30 years.

The waters off Asia have warmed which has increased most of the continent's monsoons. This has meant stronger monsoon seasons, both the lush wet season and the harsh, frequently cold, dry season.

A 400+ year tree-ring study by Rosanne D'arrigo and Rob Wilson, "On the Asian Expression of the PDO", in the International Journal of Climatology, Vol. 26: 1607-1617 (March 29, 2006) showed the impact of the changed PDO on global precipitation patterns. The impact can be summed up as winners and losers of precipitation. **Historically India, Northern and Central China and Japan are "winners" with stronger wet seasons. This is why, with the exception of the El Niño year of 2009, India had 5 years of good monsoons and improved agriculture. This is why Northern and Central China, the nation's corn, soybean and wheat regions had a relatively good year.**



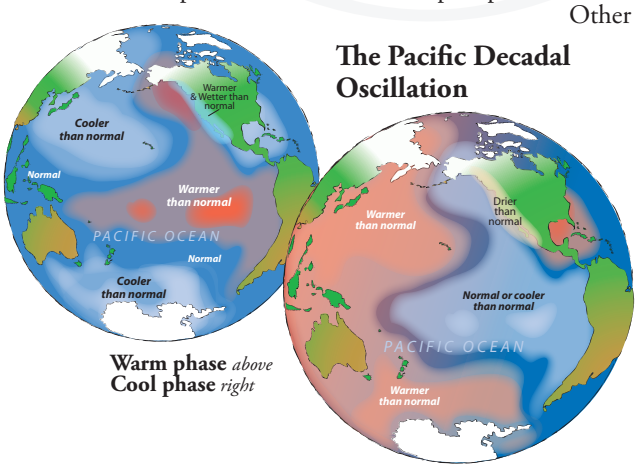
figs. 17-18 **El Niño will alter worldwide temperature and precipitation**
www.cpc.ncep.noaa.gov/products/analysis_monitoring/impacts/warm.gif

History shows that these cycles correlate with improved food production in India, Japan and Northern and Central China. However, the increased precipitation is not without problems. The winter monsoons are also stronger, which means colder, drier weather and harsher conditions for winter wheat. There is also, as we have seen this year, an increased risk of flooding, especially in the early years of the PDO phase when neglected levees need maintenance. Finally, the wetter conditions create food storage problems, with wet crops facing an increased risk of disease and spoilage. It is notable that China, which in the past has done most of its agricultural investment in production, is now planning to invest more in updating the nation's food storage facilities.

Other regions of Asia will not be as fortunate. In particular, this phase of the PDO weaken the monsoons for North Korea, Pakistan and Southern China. (Notice, the changed PDO has surprisingly little impact on South Korea and Southeast Asia.) What this means is that the summer rainy season monsoons in these areas will not penetrate as far inland. Weather becomes more extreme, with most of the rain concentrated near the coast and the inland areas enduring hotter, drier summers.

This drier weather will have multiple consequences. The most obvious are increasing problems with agriculture, hydroelectricity and river transportation. These can lead to higher prices and social unrest. A more subtle problem of lower rainfall is that part of the affected region includes southwestern China, the source of the headwaters of many major Asian rivers, from India's Brahmaputra through Southeast Asia's Irrawaddy and Mekong and China's Pearl and Yangtze.

It should be noted, the PDO is a trend, not an absolute change. It interacts with other ocean oscillations, particularly the El Niño and La Niña. When a cool negative PDO phase interacts with a cool tropical La Niña, the effects on the weather can become extreme as we saw during the in 2010 and 2011. On the other hand, the cool PDO can moderate some of the more damaging effects of a hot tropical El Niño, particularly for more northern regions.



figs. 19-20 **The Pacific is trending toward a cool phase since 2006**
© Browning maps

Conclusions

Asian weather is produced by multiple ocean oscillations that last for

varying lengths of time. Some of these effects will be relatively short, like this year's diminished Indian monsoon, which is shaped by a negative Indian Ocean Dipole, a July MJO and the evolving El Niño. Other effects, such as the stronger monsoons in Northern and Central China, drier weather in Southwest China and weather problems for Pakistan and North Korea, are long-term trends that will shape the next two decades.

News Notes

The worst drought to hit the United States in at least 50 years has produced a few positive side effects:

July recorded the lowest number of tornadoes in 60 years. While normally the month averages more than 120 twisters, this year there were only 24.

The lack of fresh-water runoff has created the smallest "dead zone" in the Gulf of Mexico in years. Oceanography professor Steve DiMarco, one of the world's leading authorities on the dead zone, says he and other Texas A&M researchers and graduate students analyzed the Gulf Aug. 15-21. The team found no hypoxia off the Texas coast while only finding hypoxia near the Mississippi River delta on the Louisiana coast. "In all, we found about 1,580 square miles of hypoxia compared to about 3,400 square miles in August 2011."

The combination of the negative Indian Ocean Dipole, the positions of the Madden Julian Oscillations and developing El Niño led to 15 destructive storms slamming into East Asia this summer. As this newsletter was being written, Typhoon Bolaven – the strongest to hit South Korea for almost a decade – has left a trail of death and damage, killing 17 people. About 1.9 million homes and businesses lost power. The storm surged north.In North Korea, the storm caused blackouts in a country already struggling to rebuild from earlier flooding last month. It then crossed into China, the fourth typhoon to cross into China this month.

Did you see the headlines? "The Arctic Is Becoming a Giant Slushie!" On August 26, 2012, the Arctic sea ice dipped to its smallest extent ever recorded in more than three decades of satellite measurements. Scientists from NASA and the National Snow and Ice Data Center explained that every summer the Arctic ice cap melts down to a "minimum" before colder weather builds the ice cover back up. However, over the last three decades, satellites have observed a 13 percent decline per decade in the minimum summertime extent of the sea ice. The thickness of the sea ice cover also continues to decline. The ice extent on Aug. 26, 2012 broke the previous record set on Sept. 18, 2007. But the 2012 melt season could still continue for several weeks!

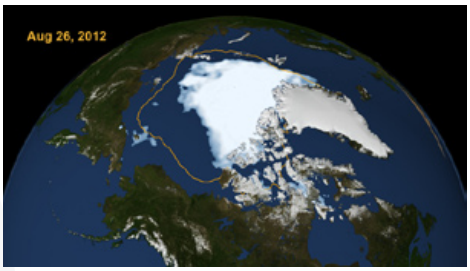


fig. 21 **Arctic sea ice extent, August 26, 2012** *http://www.nasa.gov/topics/earth/features/arctic-seaice-2012.html*

This offers some important clues for this winter's weather. Last winter, the circumpolar winds that blow around the Arctic were so strong that they trapped the cold air north. Temperatures dropped and there was a dramatic increase in snow and ice buildup reported in Alaska. Now, however, the circumpolar winds are weaker, and the Arctic jetstream is wandering. It is allowing polar winds to scatter the Arctic ice into the Atlantic and Pacific where it is rapidly melting. Meanwhile, the warm currents in the Atlantic and Pacific are pouring into the Arctic Ocean. If this pattern of weak circumpolar circulation continues, then Arctic air will be able to dip further south this autumn and winter. We have seen this happen in the past, and historically warm winters are frequently followed by near normal winter temperatures, even during El Niño years.

The opinions expressed are those of the writer, and although they are based on extensive studies of physical data and phenomena, many statements published here are not entitled to be regarded as rigorously proved in a scientific sense. Some decades must pass before these issues are resolved. Meanwhile, decisions must be based on the best available information and estimates.

This newsletter will **not** contain:

- *Analysis of, or recommendations concerning, any investment possibilities.*
- *Recommendations on any particular course of action.*

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