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BROWNING NEWSLETTER

A FRASER MANAGEMENT PUBLICATION

IN THIS ISSUE

- The impact of the warm Atlantic Ocean will dominate this year's spring and summer weather in North America.
- Expect adequate rainfall for a good North American spring planting but not enough precipitation to end the drought west of the Mississippi. This will leave the US crop vulnerable to a summer heat wave. The outlook for Canadian crops is good.
- This year, the Tropical Pacific is dominated by the short-lived MJOs. A series of cool MJOs broke up last year's developing El Niño, is hurting Argentinian wheat and pasturelands and has a strong possibility of bringing drier conditions sometime in early summer.
- The global weather patterns are bringing good precipitation to Brazil and providing moisture for spring planting in most of the Northern Hemisphere.
- Thailand and parts of Vietnam are experiencing dry weather. India, which is incorporating new techniques for growing rice has moved into number 1 as global rice exporter.

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Spring and Early Summer in North America

SUMMARY

The US and Canada should have adequate spring rainfall for a good spring planting but not enough precipitation to end the drought west of the Mississippi. This will leave the US crop vulnerable to a summer heat wave caused by the still unusually warm Atlantic Ocean.

After two years of global food prices rising faster than the rate of inflation, a key question for consumers and national economies is whether this growing season will be better than last year's. In particular, will the US, the world's largest food exporter, have a good year? Will the drought that covered as much as 70% of the continental US finally end? The answer depends upon the Atlantic Ocean – how much heat and precipitation it generates.

Snow! For farmers, it's "white gold"! For drivers, it's a mess. No matter how you feel about it, late winter brought snow and desperately needed moisture to much of the United States. Snow covered nearly 60% of the US. Storms carried 6.3 inches (16.0 cm) of snow as far south as Paradise, Arizona, 40 miles (64.4 km) from the Mexican border.

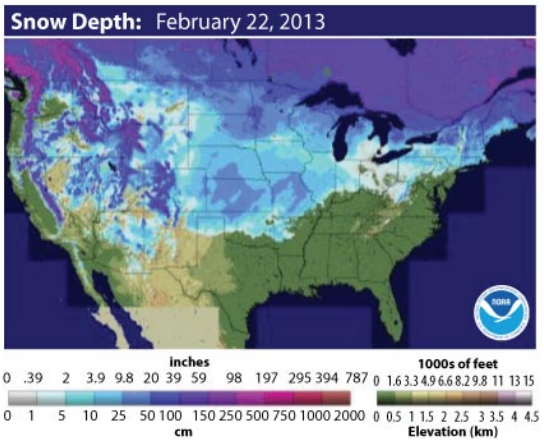


fig. 1 During the last week of February, 57.5% of the contiguous US was buried in snow. *nsm_depth_2013022205.jpg*

The good news is that the snowstorms have been widely scattered. Initially, they pounded the Northeast with a vicious Nor'easter, (disarmingly named Storm Nemo by the Weather Channel), then lashed the Midwest and the Southern Plains. The month finally ended with another Nor'easter. Every section of the nation received rain or snow. By the end of the month, over 1500 snowfall and 1800 precipitation records were broken.

The US desperately needed the moisture. For two years, a drought baked the nation. By the beginning of February, 69.7% of the contiguous 48 states were dry or in drought conditions. Even now, almost two-thirds of the country is dry.

The multi-million dollar question is whether we will continue to see more precipitation. Will there finally be enough to break the drought?

fig. 2 2,268 daily precipitation records were set or tied in February *http://www.ncdc.noaa.gov/extremes/records/daily/prcp/2013/02/00?sts[]=US#records_look_up*

This newsletter contains articles, observations and facts to support our contention that humanity is significantly influenced by changing climate.

Our calculations show the 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.

The Atlantic is the Key to Spring Weather

The cool Pacific La Niña pattern in the first three months and the hot Atlantic pattern during the rest of the year shaped last year's drought in the US. Initially most of the US, particularly the Midwest, had abundant spring moisture. However, the Atlantic was so hot that it created summer heat waves and accelerated evaporation. During the peak of the corn silking, when the crop is most vulnerable, large areas of the US were losing half an inch (a little over a centimeter) of moisture a day.

The keys to US agriculture this year will be:

- whether there will be enough moisture for a strong spring planting and
- how hot will this summer get?

In general, the Atlantic is going through a long-term trend – the warm phase of the 60 – 70 year Atlantic Multidecadal Oscillation (AMO) cycle. The Gulf Stream and other northward flowing tropical currents are flowing very rapidly. The faster they flow, the more tropical waters flow north and the hotter the North Atlantic becomes. Last year, the fast flowing waters off US shores were as warm in May as they normally are in July.

The Atlantic waters are still warmer than normal. With the exception of a small area off the coast of North Florida/Southern Georgia, the entire Gulf and East Coastlines are between 0.5˚ – 2.5˚C (0.9˚ – 4.5˚F) hotter than average. When cold continental air hits the warm moist marine air mass, it forces the moisture to precipitate out. When there is a strong temperature contrast between the air masses, as there currently is, we see record-breaking storminess. This is why the Nor'easters were so strong in the Northeast and the blizzards that hit Texas and the Southern Plains had hurricane-force winds.

In late winter and spring, these warm waters will continue to encourage storms. The average temperatures will not necessarily be colder than average, but there will be heavier winds and snow along the coastlines and in portions of the Midwest. This means snow and, when warmer, a busy tornado season in early to mid-spring. Most of this time we will see a negative NAO pattern with polar air masses pushing into the East Coast and Greenland high pressure slowing the eastward movement of the storms out to sea. This slows fronts and prolongs the storms' impact.

The good news is that the hot waters will continue to generate moisture and encourage spring rainfall, particularly for the US east of the Mississippi. There will be enough moisture for a large spring planting. **However, the severity of the previous drought conditions means that there needs to be eight feet of snow to return the Plains to pre-drought conditions. We are getting snow and will see enough for planting, but not enough to replenish the sub-soil deficit, particularly for region west of the Mississippi.**

During the five most similar years to the current situation – the eastern portions of the Midwest were in good shape, while the crops in the rest of the Midwest and the Great Plains did not have deep roots. The crops were very vulnerable to heat waves. The quality of the crops depends on two factors:

1. **Will there be heat waves this summer?**
2. **Will they be as destructive as last year?**

fig. 3 Natural factors that will shape North American weather this spring *above* © Browning Newsletter

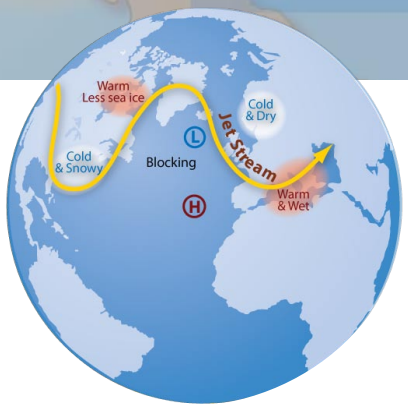


fig. 4 *right* The Negative NAO © Browning Newsletter

Understanding the Simmering Atlantic

This month I traveled to a large number of agricultural communities, consulting with farmers and crop insurers. When I told them we are in the warm phase of the long-term AMO cycle because the Gulf Stream is flowing so fast, they ask," WHY is the Gulf Stream so rapid? What will slow it down?"

The answer is the nature of the Gulf Stream and the other tropical currents of the globe. Salt and heat shape their behavior. They form a huge current that circles the globe, both on the surface and along the dark floor of the oceans. This continuous flow is called the Great Conveyor Belt and/or the Thermohalene (meaning heat and salt) Current. What shapes the temperatures of the Atlantic is the branch of this giant flow that moves through the Atlantic.

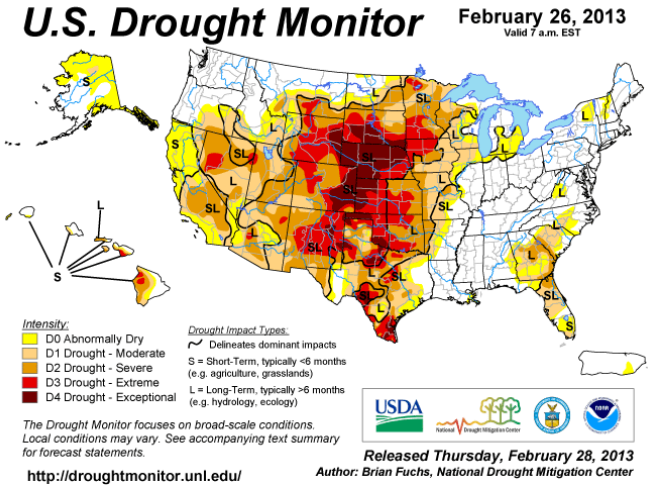


fig. 5

Three facts drive this vast current:

- Dense water sinks below water that is less dense.
- Cold water is denser than hot water.
- Salty water is denser than fresh water.

Notice, the saltiest areas of the global oceans are near the equator, where the heat of the tropical sun is evaporating the surface waters, concentrating their saltiness. The least salty areas are near the poles, where melting ice dilutes its saltiness. Notice, all four known areas where the hot surface currents sink below to the ocean depths are in polar waters.

The Atlantic Thermohalene Current (made up of the Gulf Stream and several other tropical flows) flows north. The warm water is less dense than the cooler water so it flows on top. In northern water, its heat melts any floating ice, making the surrounding waters even fresher. Around Iceland, Arctic winds hit the current and cool it. Since it is salty, once it is close to the temperature of the fresher polar waters, it sinks.

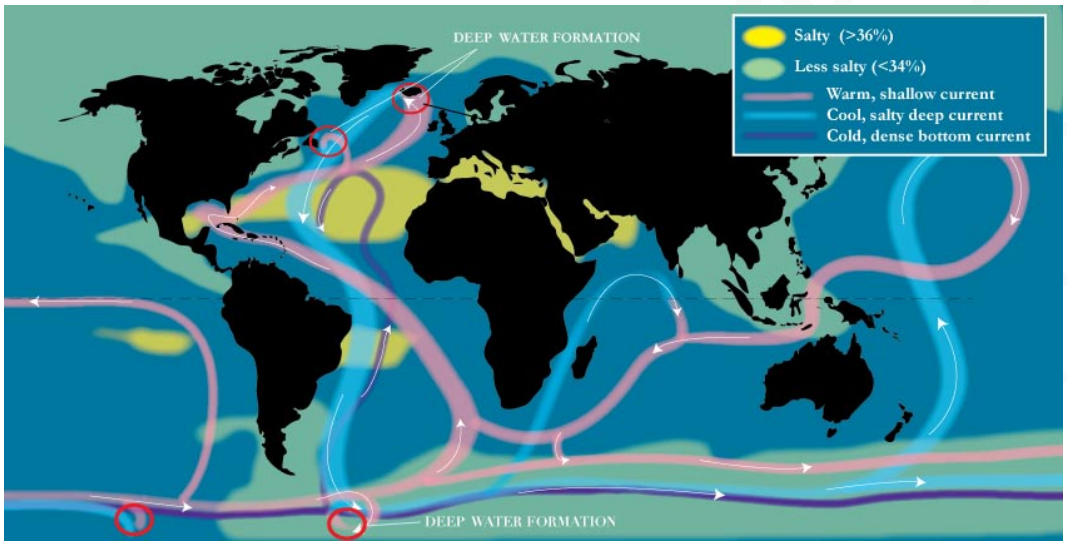
The faster the water sinks, the faster the current behind it flows. More heat is carried north and the more Arctic ice melts, freshening the polar waters and making them less dense. [see figure 7A] The North Atlantic enters its warm phase. It is a self-perpetuating cycle until so much ice melts that it dilutes not only the surrounding ocean, but also even the northward flowing current.

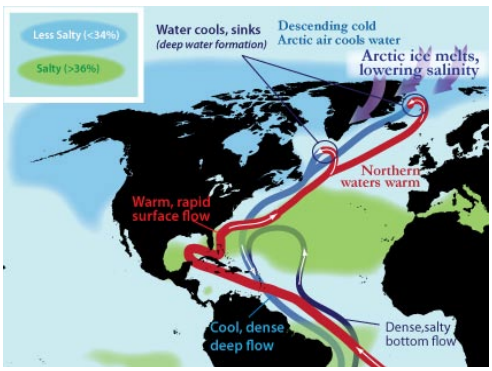
When that happens, the cycle reverses itself. The diluted waters of the current don't sink as fast and as a result, the current begins to flow more slowly. The slower current doesn't warm up the northern waters as quickly. The North Atlantic cools. [see figure 7B] Ironically, a cooler Atlantic creates fewer blocking Greenland highs and allows more storm fronts to sweep through the ocean. The storms churn up the ocean surface, stirring up cold sub-surface waters and chilling the North Atlantic even more. The ocean enters a prolonged cooling cycle.

Eventually, enough Arctic ice has refrozen that the northern waters no longer dilute the flowing Gulf Stream. The saltier current begins to sink faster. The waters behind begin to flow faster. The North Atlantic enters its warm phase again.

History has shown us that the North Atlantic goes through a roughly 70-year cycle of forty years of warmer waters followed by thirty years of cooler water. The current warm phase began in 1995 and has roughly twenty more years to go before enough ice melts to begin the cool phase.

However, measurements of ocean temperatures show us that this cycle, the Atlantic Multidecadal Oscillation, is not smooth. A very hot year may melt enough ice that the current is more diluted and flows more slowly the next year. The strength of the ocean, like the ocean itself, ebbs and flows. If the waters flow too rapidly for a year or two, they trigger enough melting that the cycle slows for a short while. This means you can have a cool year even in the middle of a warm cycle. Measurements of the AMO index since 1856 – 2009 show us that this happened repeatedly.





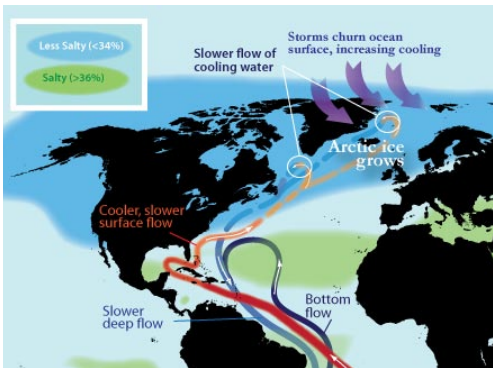


fig. 6, *top* Salinity and worldwide water circulation

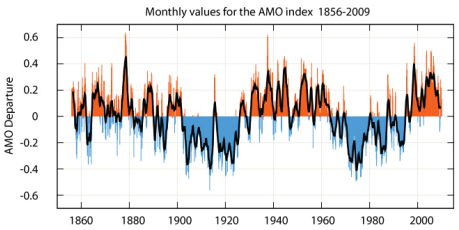


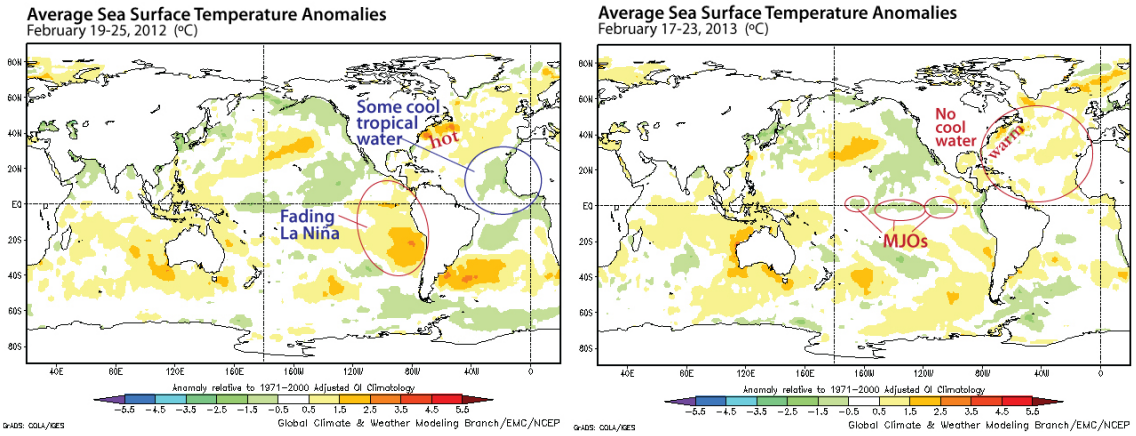
fig. 8 The AMO goes through cycles
http://www.esrl.noaa.gov/psd/data/correlation/amon.us.long.data

fig. 7A, *bottom left,* The warm phase of the AMO when the Gulf Stream is sinking and flowing rapidly.

fig. 7B *bottom right,* The cool phase of the AMO when the Gulf Stream is sinking and flowing slowly.

3 maps © Browning Newsletter

If you look at the current temperatures in the North Atlantic, they are not as warm as they were this time last year. More of the waters have above average temperatures, but the temperatures off the East Coast are not as extreme. Last winter, when strong Arctic winds penned the polar air masses north, there were no winter storms to stir and cool the ocean waters. This year's storms, as messy as they are, are chilling the waters as well as the land.



figs. 9A-B *left* Last year's Atlantic had more extremes. *right* This year's Atlantic is more consistently warm.
left: http://www.emc.ncep.noaa.gov/research/cmb/sst_analysis/images/archive/weekly_anomaly/wkanomv2_20120222.png,
right http://www.emc.ncep.noaa gov/research/cmb/sst_analysis/images/archive/weekly_anomaly/wkanomv2_20130220.png

What it all seems to indicate is that the Atlantic will not be as extreme as last year. Yes, the southern and tropical waters that will stream by North America this spring and summer are warmer than last year. However, they are currently within a degree of normal. All indications are that they will create heat waves but not as severe as last summer's record-breakers. The croplands west of the Mississippi will face stress, but the Eastern Midwest, the Mid-Atlantic States and much of the Southeast should be able to have good growth. Similarly, eastern Canadian crops should thrive.

In short, there will be heat and stress for the western portions of the US croplands, with resulting loss of crop yields, but eastern regions will have a better growing season.

The Frozen Arctic

The reason that this issue has focused so strongly on the Atlantic is that the other natural factors shaping this spring and summer's weather are more variable and much more complex. The retreating Arctic air mass and winds from the Atlantic and Pacific shape the US springtime weather. As spring and summer progress, the tropical waters of those two oceans have a growing impact.

Surges of Arctic air dominate North American winter weather. In 2011, two volcanoes, Grimsvötn in the North Atlantic and Sheveluch in the North Pacific, altered the polar air pressures so much that the circumpolar winds were unusually strong. They circled the Arctic and trapped the polar winds north. This winter, the winds were weaker and large volumes of polar air surged south.

In early winter, most of the cold air surged into Russia and Asia, with Moscow having record snow and Northern China suffering brutal temperatures. Starting in late winter, the cold air finally began to surge deep into North America. Cold air holds relatively little moisture, so this initially created cold, dry conditions in the Midwest, bringing little drought relief.

However, when the cold air hit warm moist air from the Gulf of Mexico and the Atlantic, we saw record snowfall and severe storms. Part of this is because we are finally seeing much of the volcanic debris, both ash and chemical aerosols (solid or liquid particles) finally precipitating out. This creates heavier snow and rainfalls.

Currently most of the storms and precipitation are near the coastlines, with tornado swarms in Alabama and Mississippi and Nor'easters hitting the East Coast. As the Arctic retreats and warm spring temperatures surge north, expect grain belt to get enough rainfall for planting, if not enough to end the drought.

The Fluctuating Pacific

The giant Pacific, covering over 30% of the Earth's surface is a complex swirl of currents, gyres and oscillations. When they work in harmony, they dominate global weather. When they oppose each other, as they do now, they have a wide range of conflicting effects. For two years, we saw patterns that increased North American drought working in harmony. Now some patterns will prolong drought while others bring more moisture.

THE PACIFIC DECADAL OSCILLATION (PDO)– The largest and longest lasting of these patterns to affect North America is the PDO. Since 1999, this has increasingly been in a negative pattern, and since 2006, the cool negative pattern has dominated the North Pacific.

This 50 – 60 year cycle shifts the warmth in the North Pacific and tends to shape temperatures throughout the rest of the ocean, particularly in the tropics. In its current negative phase, the waters off the West Coast are cooler and it frequently cools the Tropical Pacific as well. Unfortunately, cool waters cool the overhead atmosphere, so the offshore air masses hold less moisture. The prevailing westerly winds produce less precipitation.

Last summer and fall, the PDO was strongly negative, quelling much of the moistening impact that El Niño conditions normally produce. This winter it has remained negative, but has been fading in strength. It was less of a drying influence during the crucial winter snowpack season in the Western US than last winter. (The melting snowpack is the source of up to 70% of the water used in western

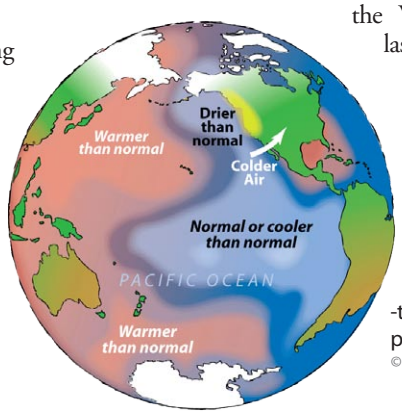


fig. 10
The Negative PDO -the current long-term phase of the Pacific
© Browning Newsletter

states.) This allowed a near-normal snowpack to form in some western ranges, particularly in the Pacific Northwest, but has done little to alleviate water shortages in the Southwest and Eastern Rockies. This is not good news for western irrigation supplies.

THE TROPICAL PACIFIC – The Tropical Pacific is swinging from warm to cool to warm. Last summer and fall's warm El Niño conditions faded in three months, too quickly for the warm tropical waters to qualify, scientifically, as an official El Niño event. The ocean waters cooled rapidly and by late January, much of the Tropical Pacific was as cool as a cold La Niña. That too is fading. Recent measurements show that the trend is for the Tropical Pacific to warm up again and we are seeing this in the central and eastern tropical waters.

Currently, most ocean labs and weather services predict the Tropical Pacific will be neutral through this summer with a better than average possibility of evolving into a warm El Niño by next winter.

MADDEN JULIAN OSCILLATIONS (MJO) – This summer's warm developing El Niño conditions were broken up by a small strong cold pattern called a Madden Julian Oscillation **(MJO).** Each MJO normally lingers in any one area 4 – 6 weeks. A MJO is a relatively small wind and water pattern that drifts eastward from the Western Indian Ocean through the Pacific to the shores of South America. Typically, a cool MJO is followed by a warm area, which is, in turn, followed by another cool oscillation.

These oscillations can be weak, barely changing water temperatures or weather, to very strong. This autumn and now again, in winter, we have seen very strong MJOs. They have disrupted any steady warming or cooling pattern in the Pacific. Instead, we are getting a "neutral" Tropical Pacific by averaging short, strong swings in the Pacific, from mini-El Niño to mini-La Niña and back again. Recently we have had mini-La Niña conditions, which have encouraged storms and cold fronts in North America.

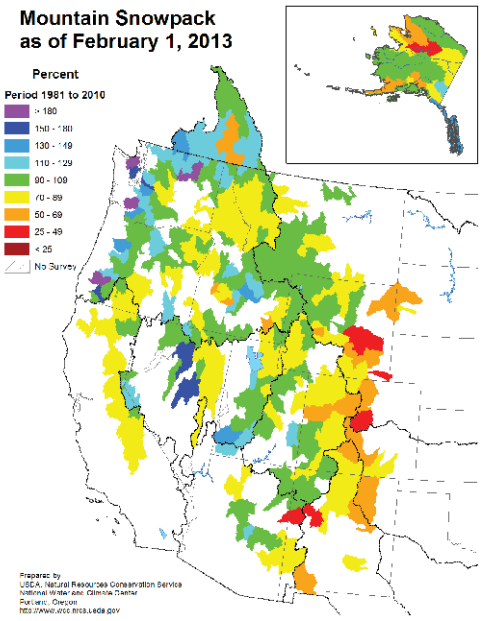


fig. 11 The western snowpack is relatively low. This is bad news for the rivers flowing eastward.
http://www.wcc.nrcs.usda.gov/ftpref/support/water/westwide/snowpack/wy2013/snow1302.gif

A warm MJO has developed and is moving into position. If this continues, we will swing to a mini-El Niño during spring; it should bring generous moisture from Texas and the Southern Plains to New England. Indeed, the storm track of the current blizzard that is sweeping the US during the last week of February is a classic late winter/early spring pattern.

It will be important to see if these strong MJO swings continue.

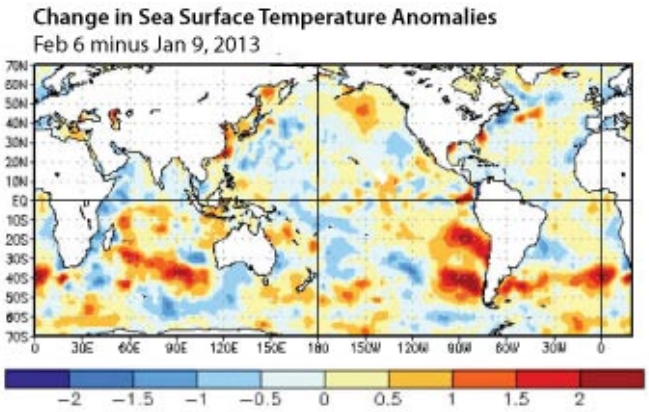


fig. 12 The Eastern and Central Tropical Pacific waters have warmed over the last month.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

It would be very unfortunate to have a "mini-La Niña" drying the Plains during the peak of summertime heat. The timing for this drying event is right, but there is a high probability that the MJO swings may weaken by mid-summer. The weaker the MJO is, the less severe its impact will be.

Putting The Pieces Together

When all of these patterns are put together, it historically created a troublesome year for US crops – not disastrous, but difficult. On the other hand, in 80% of similar years, Canada had a good crop. Conditions may change, particularly if the Atlantic cools by mid-summer but the current outlook is:

EARLY SPRING – In 80% of similar years, the early spring brought promising rain for most of US croplands, particularly the Midwest and Great Plains. By the end of March, temperatures in southern states were warmer than average, indicating an earlier than normal spring by at least two weeks. The Western states and most of Canada had near normal temperatures. Unfortunately, in 60% of similar years, California and much of the Central Rockies continue to have below normal rain and snow.

MID SPRING – In similar years, a warm MJO created more El Niño- like conditions by mid-spring. This allows warmer and wetter conditions in the Western States and Canada's Prairie Provinces.

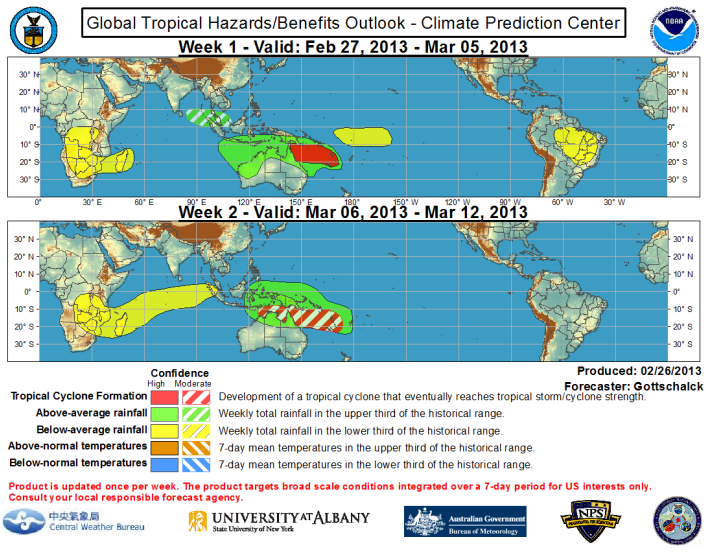


fig. 13 The shifting MJOs are shaping weather patterns around the globe
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

The Midwest experienced near normal conditions in 60% of similar years and the East Coast continued to be wet and, in some sections, stormy. Check for Midwestern tornados. Typically, there is a loose correlation – the stormier the mid-spring season is, the more risk there is of summer heat waves.

LATE SPRING –Because short-lived MJOs dominated the Pacific, no single weather pattern appeared in 80% of all five similar years. The strength and speed of the MJO movements made this time of the season a time of transition. However, in 60% of similar years, the Central Rockies and Plains were experiencing dry weather and most of the Western states were either hot or warm with some of that warmth extending to the Canadian Prairies. In 60% of similar years, (but not the same 3 years) the Great Lakes, the Northeast and the Atlantic Provinces were wet and Georgia was dry. In 40% of similar years, the Upper South had cooler than normal temperatures. As this time period grows closer, and the developments in the tropical Pacific and warming Atlantic become plain, the outlook will grow clearer.

It should be noted that in 80% of similar years the western heat and Central Plains dry weather occurred in either late spring or early summer.

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

figs. 14 A-C Spring conditions will be extremely volatile with multiple fronts.

* Moderate eruptions in the North Pacific will bring more moisture to the west.

Conclusion

The variability of both the Pacific Ocean and Arctic patterns will make the warming Atlantic the dominate force shaping this spring and early summer's weather. While the spring will provide enough rain for widespread planting, the US west of the Mississippi will not fully recover from its previous two years of drought. In most similar years, crops and livestock were vulnerable to heatwaves and accelerated evaporation rates.

None of the similar 5 years were as hot or dry as last year. In 80% of similar years, there were concerns with warm and dry conditions by late spring or early summer, but 60% of similar years saw some relief in mid-to-late summer. In short, the five most similar years were near normal for Canada and stressful, but not disastrous for the US agriculture.

A Quick Global Survey

SUMMARY

The current global weather patterns are creating some problems for Southern Hemisphere crops, particularly in Argentina and Australia. However, the widespread precipitation is creating beneficial moisture for spring planting in the Northern Hemisphere.

The same conditions that are shaping the spring in North America will affect the spring planting in the rest of the Northern Hemisphere and the approaching harvest season in the Southern Hemisphere.

Most of the global focus has been on the developing South American crop. Agricultural development is exploding in the continent, particularly in Brazil. Between the fencepost-to-fencepost planting and the excellent early season conditions, the outlook for South American crops has looked excellent.

Then the El Niño conditions faded and a strong cool MJO created "mini La Niña" conditions in the Tropical Pacific. Unfortunately, Argentina is as vulnerable to drought during La Niña as Texas is. While the mini La Niña conditions were not strong enough to reduce Brazilian crop production, they did hit Argentina, particularly in the more southern wheat and livestock pasturelands. (While easternmost Brazil has low surface moisture, most of that region has sub-soil reserves.)The more northern Argentinian soybean and corn regions have received enough timely rainfall that the crop, while reduced from January expectations, will still be average to above average.

Meanwhile Australia has been on a roller coaster. The warm Indian Ocean as increased the number of tropical storms slamming the southern continent. Cyclone Rusty, for example, is currently buffeting the Perth region and is dumping more rain in three days than the entire region normally gets all winter. Nearly Port Hedland closed three main iron ore ports in the Pilbara region, the world's largest source of iron ore.

This is just one of a string of weather problems that have plagued Australia. Early El Niño conditions created record heat,

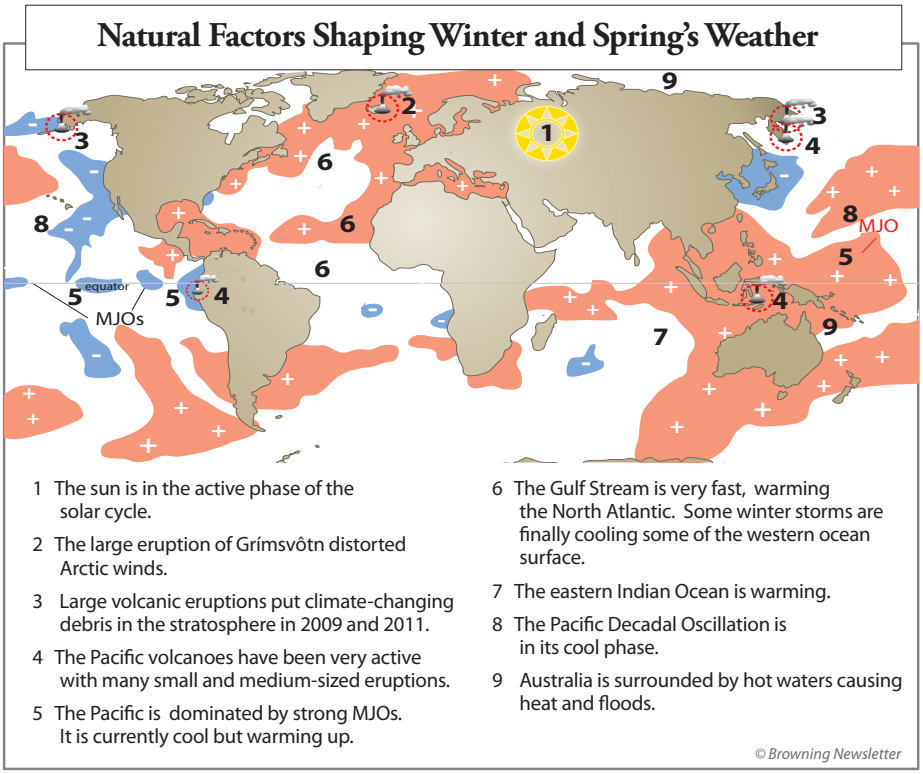
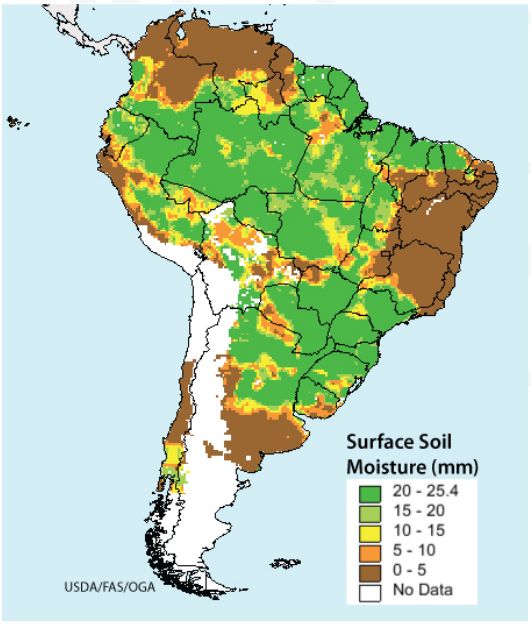


fig. 15

so intense that mapmakers had to include a new color in their national temperature maps. Then the mini-La Niña hit, sweeping the continent with floods from the Perth in the northwest y to parts of Queensland in the southeast. The result has not been favorable for crops and pasturelands in Eastern Australia. While satellite pictures show near-normal plant development in Southeastern and Northern Australia, much of the eastern region show severely stressed plant life.

Ironically the very volatility that is creating problems for the Southern Hemisphere is creating favorable conditions for future spring plantings in much of the Northern Hemisphere. In Europe, the current warmth of the Atlantic has directed storm after storm through the continent. While the storms have occasionally created some severe travel problems and record amounts of snowfall in parts of Russia, the result has been that most of the continent has saturated soil. If, as seems probable, the warm ocean creates hot temperatures, the growing season will at least start with plentiful moisture.

Similarly, the volatility has been good for bringing moisture to most of Asia south of Siberia and portions of Central Asia. India's winter monsoon, its dry season, has seen good moisture for tropical crops. Similarly, China has had a strong monsoon, bringing extreme cold and widespread snow and precipitation.



The one exception has been Southeast Asia north of Indonesia, where large regions, particularly in Thailand. experienced severe dry conditions. The impact on rice production will be felt less acutely than in most years, since Thailand has (due to government policies) dropped from number one to number three global rice exporter. India has risen to the world's largest rice exporter while Vietnam remains second. The growing use of aerobic rice production methods, which uses fewer seeds and less water, has spread through India and parts of Southeast Asia, increasing yields dramatically even in dry years.

(It should be noted that the *Browning Newsletter* has projected since 2011 that as the Pacific Decadal Oscillation shifted precipitation patterns, traditional farming societies would become more open to accepting new farming ideas. The current spread of aerobic production is a case in point and India currently claims that it has increased rice production "exponentially".)

Next month there will be a closer examination of the Asian and European spring outlook. For now, however, expect professional projections for 2013 global food production to be very optimistic.

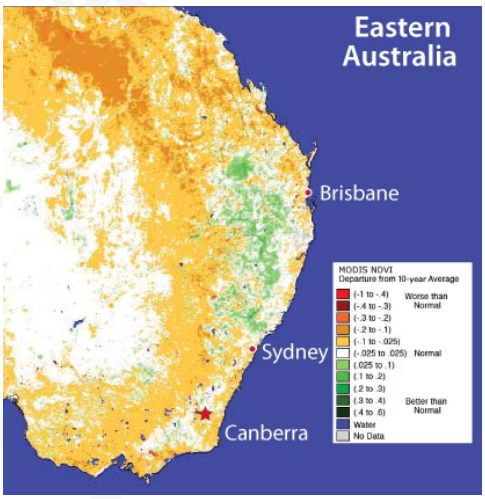


fig. 16 A *left* Most South American corn and soybean areas have good soil moisture. The cool MJO hurt some areas of Argentina.

http://www.pecad.fas.usda.gov/cropexplorer/continentview.aspx?regionid=samerica&startdate=2%2f11%2f2013&imenddate=2%2f20%2f2013&ftypeid=25&fattributeid=1&stypeid=25&sattributeid=7

fig. 16 B *above* This summer's extreme heat has hurt crops and pastureland Eastern Australia.

Plant development and stress map *http://www.pecad.fas.usda.gov/cropexplorer/modis_ndvi/modis_ndvi.aspx?regionid=as&ndvi_folder=australia_east*

News Notes

Chicken Little was right – the sky fell and it landed on Russia the day after Valentine's Day. A few hours later, the 150-foot-wide (45 meters) asteroid 2012 DA14 zoomed by Earth in an extremely close flyby. (It was actually 17,200 miles away, but that's getting cozy in space.)

The Russian meteor was about 55 feet (17 m) wide and flew 40,000 mph. It exploded three times before hitting the Earth. The largest explosion, an air blast 15 to 20 miles above Chelyabinsk, Russia, was 20–30 times more powerful than the atomic bombs detonated at Hiroshima and Nagasaki. Nearly 1200 people were injured, mostly from shattered windows. No one was killed and only two people were seriously hurt. Now resourceful Russians are turning the whole event to a moneymaking enterprise and selling videos and meteor (and pseudo-meteor) fragments.

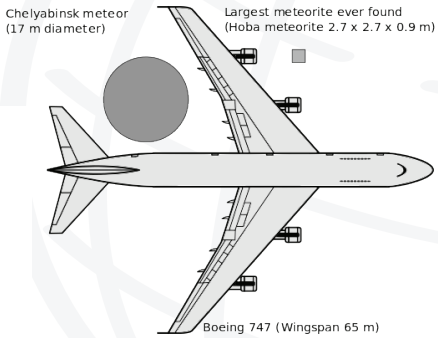


fig. 17 The high speed of meteors means even relatively small objects can create enormous energy.

©Tobias84, Wikimedia http://www.almanac.com/sites/new.almanac.com/files/images/800px-Chelyabinsk_meteor_size_comparison_svg%282%29.png

People don't realize how common these hits are. Most meteors are less than a yard in diameter and burn up in space. An estimated 500 hit the Earth every year. Only five or six of the 500 are large enough to track on our weather radar. Their speed, however, generates a lot of energy. Over two decades, meteors have caused more than 90 blasts large enough that our government had to check to make sure they weren't atomic bombs!

Speaking of explosions – the *Browning Newsletter* hasn't discussed volcano eruptions much recently. This is because the number of eruptions large enough to affect weather has plunged over the past six months. However, we are continuing to monitor the Russian volcanoes on the Kamchatka Peninsula north of Japan. Currently seven volcanoes are active with four of them labeled orange, meaning they are already erupting at low levels and are at risk for having an explosion large enough to interfere with air traffic. Over the last decade, two volcanic eruptions Sheveluch and Sarachev Peak were large enough to affect polar climate. Even a moderate eruption can cause a cold spell downwind in North America during spring. Recently, however, the most active volcano Plosky Tolbachik is releasing massive amounts of lava rather than erupting huge amounts of high altitude aerosols.

At the same time, recent reports show that volcano scientists have learned that they have been severely underestimating the amount of debris volcanoes, particularly polar volcanoes, emit. The 2010 eruption of Iceland's unpronounceable Eyjafjallajökull volcano (which closed European air travel for weeks) is now believed to have emitted up to 100 times more debris than originally reported. It was truly dangerous! Scientists at the University of Bristol have published a more accurate measuring method that will improve air travel safety enormously.

The latest update from Australia was that Cyclone Rusty missed the major iron exporting port of Port Hedland and shipping will reopen.

The latest global warming warning is chilling. A new study by UK and Ethiopian scientists now predicts that if climate changes as dramatically as some models predict – coffee will become extinct at the end of the century! Most scientists are dismissing the study as alarmist, since it used only the extreme models. However, just the thought of losing my morning caffeine is enough to drive this writer to her coffeepot. Enjoy it while you can!

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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