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BROWNING NEWSLETTER

A Fraser Management Publication

STRANGE WINTER, STRANGE LA NIÑA, STRANGE SPRING AND SUMMER?

IN THIS ISSUE

- The volcanic eruption of Grímsvötn volcano has distorted North Atlantic air pressure (the Icelandic Low) enough that it has protected central and eastern North America from Arctic cold and encouraged the cold to pour into Eastern Europe and Asia.
- The La Niña is rapidly fading and may be gone by the end of March. This would be good news for the drought stricken portions of the US and Canada.
- Almost one-third of the world weather models expect the La Niña to evolve into a warm El Niño, which would be good news for US crops and bad news for India's monsoon.
- New reports show that the Himalayan glaciers have almost no net loss of ice. What is happening is that some of the glaciers, particularly southern and western glaciers are melting while more northern glaciers are gaining.
- The glaciers that are retreating supply water to major rivers a in India and the Yunnan province of China. This poses some long-term concerns to some, but certainly not all, of Asia's rivers.

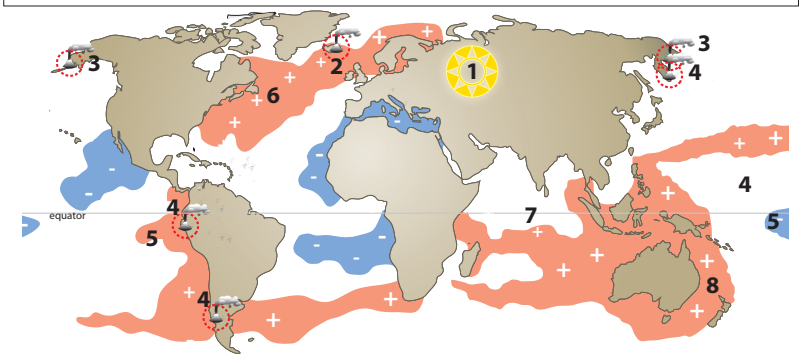
SUMMARY

Summary – The Icelandic volcano has shaped the Icelandic Low so that the North Atlantic Oscillation has steered the Arctic cold away from North America and into Siberia, Europe and Asia. Meanwhile, the La Niña in the Pacific is fading extremely rapidly. This will shape the spring and summer weather, crop and prices.]

It's official – this year's weather is crazy.

Specifically, it has been schizophrenic. This winter, the Western Hemisphere has been warm and the Eastern Hemisphere has been freezing. If that isn't enough, the La Niña has barely affected the Northern Hemisphere while it has had a huge impact on the Southern Hemisphere.

Natural Factors Shaping Spring's Weather



1 The sun is entering the active phase of the solar cycle.

2 The large eruption of Grímsvôtn has distorted Arctic winds.

3 Large volcanic eruptions put climate changing debris in the stratosphere in 2009 and 2011.

4 Several volcanoes continue to have small and medium-sized eruptions.

5 La Nina is rapidly weakening.

6 Warm phase of the AMO.

7 The Indian Ocean Dipole is warm with a neutral Dipole.

8 Warm water off Asia and Australia (a cool PDO/IPO)

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.

A Schizophrenic Winter

As noted in the last issue, the eruption of Iceland's Grímsvötn volcano has disrupted this winter's weather patterns. In 2011, for the first time since 1783/1784, we had a large volcanic eruption in the North Atlantic and North Pacific. The ash and debris from Grímsvötn and Russia's Mt. Sheveluch entered the stratosphere, blocking out incoming sunlight and altering Arctic temperatures and air pressures. This, in turn, distorted normal Arctic wind patterns.

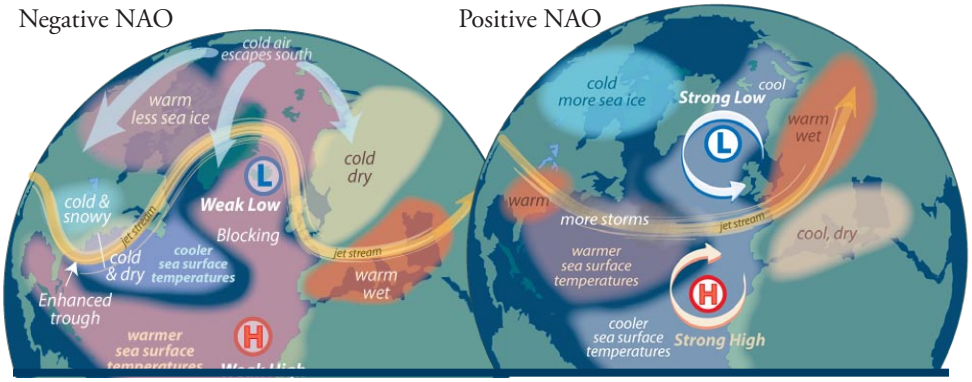
In particular, the eruption of Grímsvötn has altered the air pressure around Iceland, the Icelandic Low. This particular air pressure area helps to shape two major winter patterns, the Arctic Oscillation and the North Atlantic Oscillation.

The Arctic Oscillation (AO) is the patterns of winds blowing around the North Pole. If the AO is positive, the winds are strong and trap the cold polar air in the north. In December and early January, the Icelandic low was very low. This created strong circumpolar winds and the Arctic air remained trapped. While temperatures tumbled in polar areas like Alaska, most of Europe, Asia and North America remained relatively warm.

Then on January 22, the AO turned negative. The circumpolar winds weakened. The cold was going to escape south. The only question was where. That's where the North Atlantic Oscillation **(NAO)** came in.

For North America, the NAO is a gatekeeper. It lets cold fronts cross the Atlantic. If it is positive, it lets cold fronts whiz through the Midwest and Eastern states and dash out to sea. If it is negative, it stops them. They linger on the shore, freezing everything. If it stops them long enough, several cold fronts pile up and it gets frigid.

When scientists discuss the North Atlantic Oscillation, they are talking about air pressure. When the low-pressure area around Iceland is similar to the high-pressure around the Azores Islands in the mid-Atlantic, they say it is negative. In their words, negative NAOs cause blocking. It blocks cold fronts and eventually steers them north. Cold front after cold front enters North America and lingers. The temperatures drop and the frozen air plunges south. That is what happened last year. That's why the winter of 2010/2011 was so cold.



figs. 2-3 **The Negative NAO shaped last winter and the Positive NAO shaped this winter.**

When the two air pressures are very different, the NAO is positive. Thanks to the eruption, the NAO remained positive all December and early January. By January 14, it became neutral. Cold fronts could finally drop south of the Arctic area. However, nothing blocked them, so they could quickly sail out to sea.

Since the middle of January, the NAO has been positive or near neutral. When it becomes near neutral, Arctic air shoots south and then east across the Atlantic. Then warm air from the Atlantic, here the Gulf Stream is carrying tropical heat north, warms everything up again.

For Europe, the NAO acts as a shield. When it is positive, it protects most of Europe from Atlantic storms. When it is negative, it doesn't.

This year, the positive to neutral NAO shielded Europe from cold fronts hitting them from the west. Unfortunately, it offered no protection from the east. Land gets colder than water, so Siberian colds are much worse than Atlantic storms.

As Arctic air poured into Siberia, it swept through Eastern Europe, the Balkans, parts of the Middle East, Western Europe and finally snowed out in the West Sahara. For three weeks average temperatures dipped 15, 20 and even 25˚F (8.3, 11.1 and 13.9˚C) below normal over much of central and eastern Europe, including European Russia. The cold spell was the worst in at least 26 years, killing more than 600 people. Parts of the Danube River—an important commerce route in Europe—froze over for the first time in 25 years. When the cold mixed with moist air from the Mediterranean, heavy precipitation caused massive flooding in Greece and Bulgaria.

The cold has hit Northern China, particularly Northwest China, with freezing Siberian air as well. The result has been that the rapeseed (canola oil) and winter wheat crops of Eurasia have faced winterkill. Similarly, between the NAO blocking of Atlantic moisture and the severely dry winter monsoons in Asia, there are large areas where dry conditions are hampering emergence.

The Schizophrenic La Niña

The impacts of Arctic volcanoes have only affected weather in the Northern Hemisphere. The La Niña, by contrast, has had very limited effects in the north but it has dominated the tropics and the Southern Hemisphere. It has brought characteristic drought to South America and floods

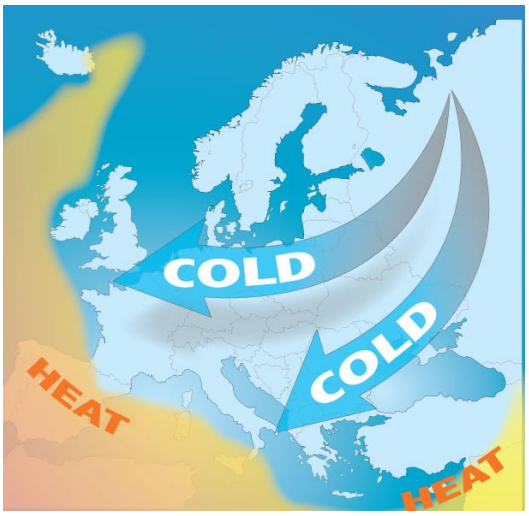


fig. 4 **The Beast from the East**

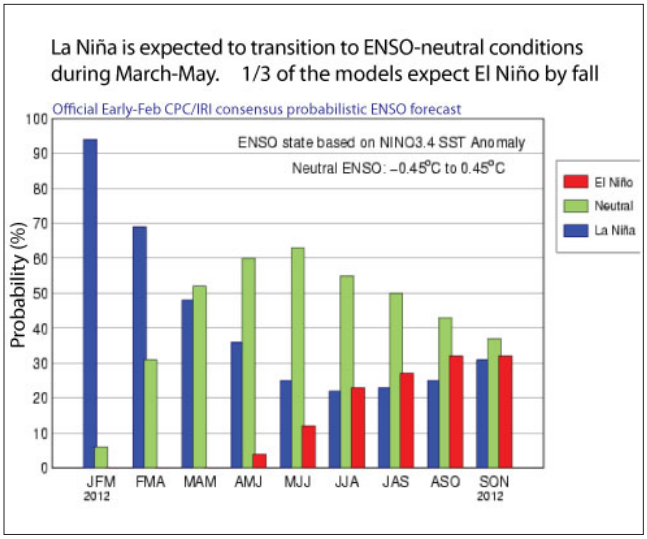


fig. 5 **La Niña is fading fast. Over 50% of the models expect the Pacific to be neutral by April.**

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

in Australia and Indonesia. As a result, we have seen corn and soybean problems in Argentina and Brazil, while Australia's wheat crop has flourished.

The La Niña is only one Pacific oscillation. The impact of the event has been increased by larger factors, like the cool ocean-wide Interdecadal Pacific Oscillation. At the same time, the length of the La Niña seems to be surprisingly shortened by the 4 to 8 week Madden Julian Oscillation, a blip of alternately weak and strong winds (with accompanying warm or cool waters called Kelvin waves) that zip across the Indian and Pacific Oceans. Since late January, a relatively strong warm MJO has entered the Tropical Pacific. Its Kelvin wave has warmed the waters and dramatically weakened the La Niña. Currently only the central portion of the Pacific is still cooler than normal while the eastern ocean is actually warmer than normal!

As a result, models that in January were stating the La Niña would linger until mid or late spring are predicting that it may end as early as March! Even more dramatically, almost one third of the international models expect the Pacific to have a warm El Niño by next fall.

This evolution of Pacific conditions needs to be monitored carefully. It would occur too late to salvage most of the South American crops but it would be helpful in limiting the flooding in Australia. For the Northern Hemisphere, the return to neutral conditions before or during spring planting, should result in good to average crop production.

If, as a third of forecasters project, the Pacific evolves into an El Niño, it would mean fewer hurricanes and beneficial moisture to the US, particularly Texas and the South. It also would provide relief and encourage a stronger monsoon for Southern China. But, when combined with the neutral conditions in the Indian Oceans which appear to be evolving into a negative Indian Ocean Dipole, it could hamper India's all important South Asian monsoon.

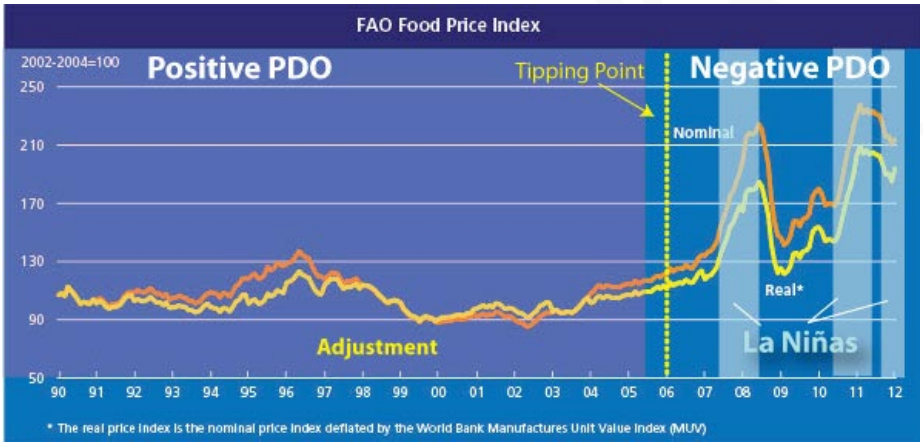
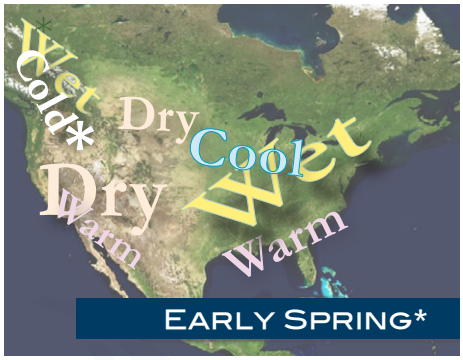


fig. 6 **Food prices reflect changes in the PDO**

http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/

Spring Outlook

With the rapid change currently occurring in the Pacific, the spring outlook for North America is very hard to project. Most scientists, looking at the extreme cold in the Arctic and tropical heat in the Atlantic are predicting a record tornado season. The closest historical analogies are based on events where the La Niña faded in early spring and its impact lasted through the middle of the season. Notice, many of the current concerns with Midwestern drought will probably diminish as spring continues.



Cool	Cold	Warm	Dry	Wet
2°C or more lower than normal temps.	5°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.7-9 * Moderate eruptions in the Pacific Northwest will bring more moisture to the west.

ASIAN RIVERS AND THE HIMALAYAN GLACIER MELT: CRISIS, FRAUD OR BOTH

SUMMARY

Since 2007 there has been scientific concern that the Himalayan glaciers are rapidly diminishing and this will affect the flow of some of Asia's most important rivers. The latest findings show that some glaciers are growing and some are shrinking. The impact on Asia's rivers varies with where some are receiving more snowmelt and some receiving less.

In 2007, the world learned that the Himalayan Mountains had something scarier than the Abominable Snowman – rapidly melting glaciers. In a doomsday scenario man-made global warming would, by 2035, destroy those glaciers and rivers that supply over a billion people with water.

To comprehend this threat, it is important to understand something about Asian geography. The Himalayan Mountains have about 15,000 glaciers that provide yearly melt water to some of the world's major rivers, including:

- The **Huang He (Yellow)** (China)*,
- **Tarim River** (China),
- **Pearl River** (China),
- **Yangtze** (China)*,
- **Mekong** (China, Burma, Laos, Thailand. Cambodia and Vietnam)*,
- **Salween** (China, Burma and Thailand)*,
- **Ganges** (China, India and Bangladesh),
- **Brahmaputra** (China, India and Bangladesh),
- **Indus** (China, India and Pakistan),
- **Yuan River** (China and Vietnam),
- **Syr Darya** (Kyrgyzstan, Uzbekistan and Kazakhstan),
- **Irrawaddy** (Myanmar) and
- The **Amu Darya** (Tajikistan, Kyrgyzstan, Afghanistan, and Turkmenistan and Uzbekistan).

The combined drainage basin of these rivers is home to some 3 billion people – almost half of Earth's population.* At least 1.4 billion directly depend on the rivers for agriculture. A reduction of snowmelt to this region has the potential to be catastrophic.

fig. 10 **Almost half the earth's population is affected by Himalayan glaciers that feed Asia's major rivers** © Browning Maps

The 2007 IPCC

In 2007, the United Nations Intergovernmental Panel on Climate Change (IPCC) issued its Fourth Assessment Report. Called Climate Change 2007, it was the largest and most detailed summary of the climate ever undertaken. It was the product of thousands of authors from dozens of countries, citing over 6,000 peer-reviewed studies.

This comprehensive study made several statements that caused enormous concern for nations that depend upon the Himalayan snowmelt. In section 10.6.2, the study declared:

> "Glaciers in the Himalaya are receding faster than in any other part of the world and, if the present rate continues, ***the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at the current rate.*** Its total area will likely shrink from the present 500,000 to 100,000 km2 by the year 2035."

Other comments were particularly worrisome for India and China.

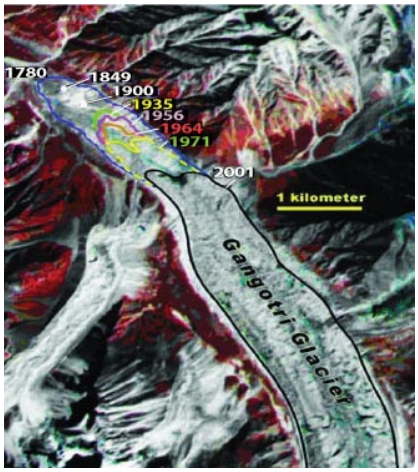


fig. 11 **Retreating glaciers attract headlines and controversy. Gangotri Glacier, source of the Ganges River** *1780-2001*
http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch10s10-6-2.html

"The current trends of glacial melts suggest that the Ganges, Indus, Brahmaputra and other rivers that criss-cross the northern Indian plain could likely become seasonal rivers in the near future as a consequence of climate change and could likely affect the economies in the region.

Some other glaciers in Asia – such as glaciers shorter than 4 km length in the Tibetan Plateau – are projected to disappear and the glaciated areas located in the headwaters of the Changjiang [Editor: Yangtze] River will likely decrease in area by more than 60%."

The report made a major impression around the world. In December 2007, the Norwegian Nobel Committee granted the Nobel Peace Prize jointly to the Intergovernmental Panel on Climate Change **(IPCC)** and Albert Gore Jr. The panel's reasoning was that the large-scale climate changes announced by the panel's study could "alter and threaten the living conditions of much of mankind." In particular, they could lead to large-scale migrations and an increased risk of violent conflicts and wars, within and between states. They saw the panel's warnings and suggestions as potentially helping the world to avoid massive hardship and bloodshed.

Controversy Over The Report

The reported melting of the Himalayan glaciers had the potential to be disastrous. It would cause enormous social and economic damage if it were true. Scientists began to study the problem.

At first glance, the claim seemed preposterous. Glaciologists almost immediately pointed out that most Himalayan glaciers are hundreds of feet thick and could not melt fast enough to vanish by 2035 unless there was a huge global temperature rise. Currently the maximum amount of melting is only two to three feet a year and it is far lower for most glaciers.

A closer examination of the report showed that the prediction was based on a 2005 World Wildlife report that obtained the estimate from a 1999 article in the journal *New Scientist*. However, the 1999 article was not a research paper – it was from two short telephone interviews with Dr. Syed Hasnain of Jawaharlal Nehru University in Delhi. Dr. Hasnain has said that he had merely been speculating during the interview, not discussing any formal research.

Many glaciologists were quite angry over the IPCC's use of the purely speculative comment. The IPCC report was supposed to be based on carefully scrutinized, peer-reviewed science. India's environment minister, Jairam Ramesh, accused the IPCC of being "alarmist".

By January 2010, Dr. Murari Lal, who oversaw the chapter on glaciers in the IPCC report, recommended that the claim be dropped from the report. In an interview with *The Mail*, Dr. Lal admitted, "We thought that if we can highlight it, it will impact policy-makers and politicians and encourage them to take some concrete action."

The entire report and its chairman, Dr. Rajendra Pachauri, came under intense attack, including charges (disproven) of financial malfeasance. The organization responded with new reports during the 2011 UN Conference on Climate Change the showed that Himalayan glaciers are melting. One was a three-year study, funded by Sweden that found that 10 regional glaciers were shrinking, and the melting accelerated between 2002 and 2005. The other study found a reduction in snow cover over the region during the last decade. Overall, it was estimated that the Himalayan region was losing 50 billion tons of melt water each year that was not being replaced by snowfall.

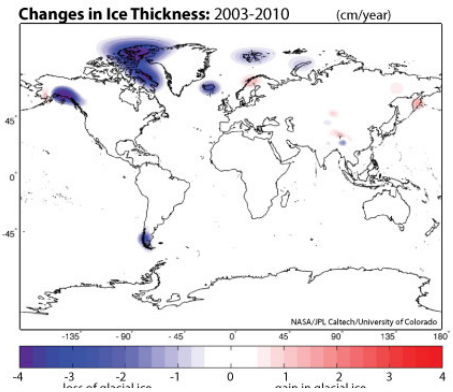


fig.14 **GRACE satellites offer new data on glacial conditions.**

top: http://www.nasa.gov/topics/earth/features/grace20120208i.html

Critics noted that it was impossible to make broad generalizations since only 10 of the 54,000 glaciers in the region have been studied regularly. The conference noted this problem and encouraged more studies.

The Latest Data – Zero Loss?

This February scientists at the University of Colorado, Boulder did just that. Using data from the Gravity Recovery and Climate Experiment **(GRACE)** satellites, the team began a more comprehensive global inventory of melting glaciers from 2003 to 2010. GRACE measures tiny changes in the Earth's gravitational pull and gravity is related to mass. When glaciers lose ice, their gravitational pull weakens. The two satellites fly at 500km (310.7 miles), so they can detect this loss even for the hard-to-reach, high-altitude glaciers around the globe. The scientists published their findings in the February 8, 2012 issue of *Nature*, with global images showing the annual changes in ice thickness (in centimeters).

Shifting to other areas, the total global ice mass lost from Greenland, Antarctica and Earth's glaciers and ice caps was about 4.3 trillion tons (1,000 cubic miles), enough to add 0.5 inches (12 millimeters) to global sea level. That's enough ice to cover the United States 1.5 feet (0.5 meters) deep. A quarter of the average annual ice loss came from glaciers and ice caps outside

fig.12-13 **According to the report, several of the world's most important rivers are threatened . Ganges,** *left*, **Yangtze,** *right*

Ganges ???????? http://blogs.usembassy.gov/roemer/tag/water/
Yangtze ©Peter Morgan http://en.wikipedia.org/wiki/File:Yangzi_River_-_by_Peter_Morgan.jpg

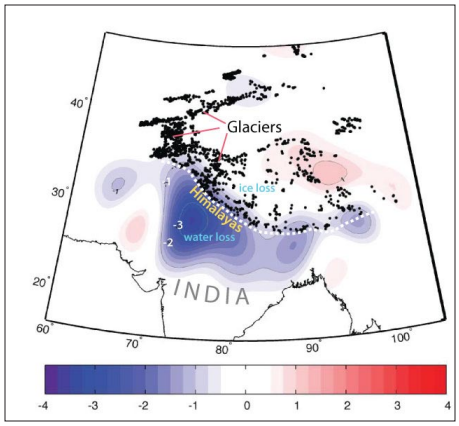


fig. 15 **India suffers loss of water and ice, but other areas are gaining ice.**

http://www.jpl.nasa.gov/news/news.cfm?release=2012-036#3

of Greenland and Antarctica while ice loss from Greenland and Antarctica averaged 385 billion tons (100 cubic miles) a year.

However, this is 30% less than scientists had previously thought. Greenland and Antarctica are melting as much as experts expected, but the rest of the world was a surprise. The biggest discrepancy was in Asia.

The 2012 study showed the Himalayas and nearby peaks have lost almost no ice during the past 10 years. The scientists are careful to point out that lower-altitude glaciers in the Asian mountain ranges – sometimes dubbed the "third pole" – are definitely melting. Satellite images and reports confirm this. However, over the study period from 2003-10 enough ice was added to higher and more northern peaks to compensate.

As Dr. John Wahr, one of the team leaders, explained in a NASA bulletin,

> "The GRACE results in this region really were a surprise. One possible explanation is that previous estimates were based on measurements taken primarily from some of the lower, more accessible glaciers in Asia and extrapolated to infer the behavior of higher glaciers. But unlike the lower glaciers, most of the high glaciers are located in very cold environments and require greater amounts of atmospheric warming before local temperatures rise enough to cause significant melting. This makes it difficult to use low-elevation, ground-based measurements to estimate results from the entire system."

Overall, this is good news. However, what it shows is that the melting is concentrated in some river basins more than others. Think location, location, location. Some rivers, particularly in the Ganges and Indus region, have more rapidly melting glaciers while others, further north, have growing supplies of snow. Northern Chinese rivers, like the Tarim and Huang He (Yellow River) are in a better position than those that depend on waters from the southeastern portions of the mountain region like the Yangtze, Salween and Mekong. It is certainly not the dire situation of the 2007 report, but it is worth monitoring.

The Other Part of The Climate Equation – Natural Factors Like Monsoons

While the IPCC primarily focuses on man-made warming, humanity is not the only influence on weather. This year, the weather in Asia, including the Himalayans and Tibet were shaped by the cycles in the Pacific and Indian Ocean that affect monsoons.

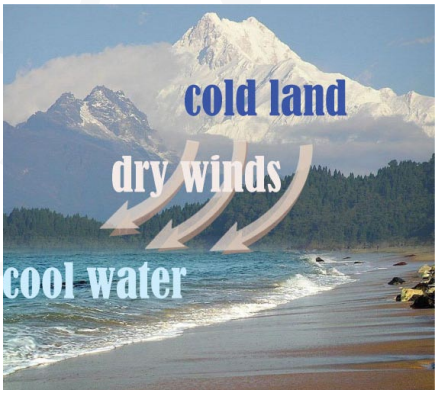
Remember, monsoons are seasonal winds that blow from cooler areas to hotter areas. In summer, when land heats up quicker than the surrounding ocean, the monsoons blow moist marine air inland. The land experiences a wet season. In winter, the land cools quicker than the waters, so the dry, cold wind blows out from Siberia towards the oceans. This is the dry season.

Changes in temperatures in the Indian and Pacific Oceans affect the strength of these monsoons. Three cycles, or oscillations, are currently affecting the ocean temperatures.

1. **THE INDIAN OCEAN DIPOLE** – This cycle is currently neutral and is not having any impact on the Asian monsoons. The Japan Agency for Marine-Earth Science and Technology predicts that is will become weakly negative this summer, which would weaken India's South Asian monsoon and the Northwest Pacific Monsoon that affects Northern China. It would strengthen the monsoon for southern China.
2. **THE PACIFIC DECADAL OSCILLATION** – This decades long PDO cycle is currently negative, meaning that it strengthens India and Northern China's monsoons and weakens the South China Sea monsoon.
3. **LA NIÑA** – The La Niña peaked last month and should become neutral in spring. It typically strengthens the Indian and Northern Chinese monsoons and weakens the Southern Chinese monsoons.

Last year, the La Niña of 2010/2011 lingered until June. A new La Niña started in September. Over the past fourteen months, Asia has endured eleven months of La Niña conditions.

Since the PDO tipped into its current phase in 2006, the trend in Asia has



figs. 16-17 **In summer, monsoon winds blow from sea toward land, bringing moisture onshore,** *left.* **In winter, the winds reverse, with dry air rushing down mountain slopes, parching the land,** *right.*

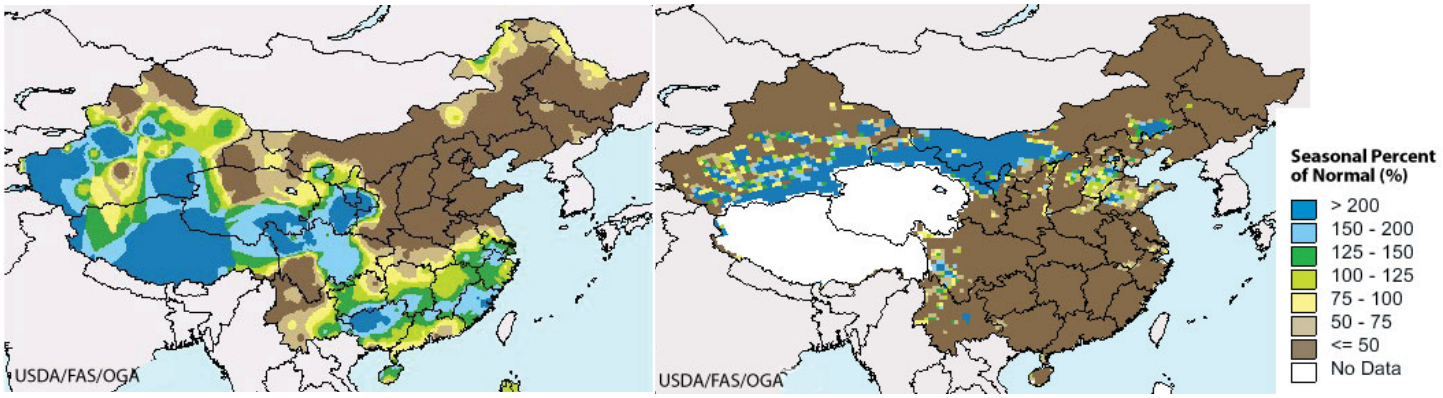


fig.18-19 **Much of China faces severe drought. Chinese precipitation anomalies, WMO, *left,* and CMORPH, *right.* Different agencies disagree on the degree of drought** *January 1-February 20*

http://www.pecad.fas.usda.gov/cropexplorer/imageview.cfm?ftypeid=23&fattributeid=8&stypeid=&sattributeid=&startdate=2012-02-01%2000%3A00%3A00.0&imenddate=2012-02-10%2000%3A00%3A00.0&regionid=che

http://www.pecad.fas.usda.gov/cropexplorer/imageview.cfm?ftypeid=12&fattributeid=8&stypeid=&sattributeid=&startdate=2012-02-01%2000%3A00%3A00.0&imenddate=2012-02-10%2000%3A00%3A00.0&regionid=che

been for the monsoons in Northern China and India to be stronger and for them to be weaker in Southern China. A strong monsoon has a colder, drier winter and a wetter summer. The moisture penetrates deeper inland. A weaker monsoon means the winds are not as strong. The wet season does not penetrate as far inland.

In the case of India, what this has meant is that their winters have, on average, been cooler. Their summers have tended to be hotter and wetter. Part of the reason for the increased melt has been the penetration of warm rains deeper into the mountains, melting the snow. This trend has been increased over two years of La Niñas. (As the weak 2009 monsoon showed, hot El Niños stifle India's monsoon.) Overall, any problems with river flows are being compensated with by natural factors strengthening the summer rains.

In China, the current situation is good news for the north and bad news for the south. In the north, the glaciers are growing and the monsoon summer is carrying more moisture inland to the foothills. Rivers are stronger and rainfall is more plentiful. Historically, this phase of the PDO is good for agriculture. The only problems that the region faces are:

- More risk that the cold, dry winters where northern regions experience drought. This increases the risk for winter wheat and may leave dry conditions for early spring planting.
- Paradoxically, the dry winters are followed by increased risk of flooding, particularly during the late spring/ early summer following La Niñas.
- The wetter conditions can increase fungus and mold on stored grains and soybeans. There is some indication that China is having some severe spoilage problems in some areas with food quality, particularly for livestock feed.

The problem is more critical for Southern China. The monsoon has not penetrated as deeply into Southwest China, particularly Yunnan province. At the same time, the glaciers in the region are retreating. The region has less rain and less river water. Unfortunately, the region includes the headwaters for six very major river systems – the Yangtze, Pearl, Mekong, Red (Yuan), Salween and the Irrawaddy Rivers.

Currently China is undergoing droughts from both the stronger dry season in the North. At the same time, the Southwest has undergone 18 months of reduced precipitation due to the weaker South China Sea Monsoon. While official pronouncements state that the amount of drought in China is less than normal. (China is large enough that there is always some area that is dry.) At the same time, satellite maps of the nation indicate that there is widespread drought throughout the nation. If one looks at two different maps, one that shows the most moisture and another that shows the most droughts, it is obvious that China is extremely dry in many of its crop regions.

At the same time, China has experienced a prolonged cold spell since the Arctic Oscillation finally went negative in mid-January.

The combination of natural factors has increased China's concerns about its crops and food supply. When combined with the global food production problems, we are seeing the Chinese increase agricultural purchases. As one looks forward at the declining La Niña, the increasingly negative Indian Ocean Dipole and the continuing negative phase of the Pacific Decadal Oscillation, it is apparent that the problems will continue through spring and should ease by early summer.

The same factors might produce a normal to slightly weaker than normal monsoon for India. The big concern for South Asia is whether the La Niña evolves into a warm El Niño that would suppress the wet season. Stay tuned.

Conclusion

Despite initial scientific concerns, the Himalaya/Tibet region is not losing huge amounts of glacier cover. However, the areas of melt to the south, feeding many of South Asia, Southern China and Southeast Asia are increasing while regions that are more northerly are gaining increasing snow cover. It is as if the snow belt in Asia is moving north. Actually it did.

The problems that this shift might produce will, for the next decade or so, be compensated by natural climate factors in South Asia, particularly India. However, any lower glacier melt problems for Southern Chinese rivers will be in addition to a longer-term trend to weaker monsoons in the area.

News Notes

Chicken Little was right! The sky is falling… sort of. Over the last 10 years, the height of clouds has been shrinking, according to new research. If you are worried by global warming – this is great news!

A scientific team, led by Roger Davies of the University of Auckland in New Zealand has published a study in this month's journal *Geophysical Research Letters.* For a decade the Multi-angle Imaging Spectro-Radiometer on NASA's Terra spacecraft has been watching Earth's clouds. Davies and colleagues analyzed the device's cloud-top height measurements from March 2000 to February 2010. They found that global average cloud height decreased by around 1% over the decade, a distance of 100 to 130 feet (30 to 40 meters). Most of the reduction stemmed from fewer clouds forming at very high altitudes.

Clouds are a wildcard in the study of Earth's climate. They are so brief that they are poorly understood and factors such as height and location make a huge difference in climate. Clouds that are lower in the atmosphere would allow Earth to cool more efficiently, potentially offsetting some of the warming caused by greenhouse gases.

Just in case you weren't worried enough about the forests in the wild, a new study is showing that the U.S. urban forests are losing ground. A recent U.S. Forest Service study has shown that tree cover in urban areas of the United States is declining at a rate of about 4 million trees per year.

A satellite study of 20 sample cities showed that 85% had a decline in tree cover and 80% replaced the trees with impervious cover, including pavement and rooftops. Scientists are concerned, since urban trees play an important role in cleaning pollution and reducing heat. Atlanta has the greatest percentage of trees while Denver had the least. The cities that lost the most tree cover were New Orleans, Houston and Albuquerque.

The role of the sun in climate change has been a subject of intense debate. A new paper published yesterday in February's journal *Geophysical Research Letters* is linking it to rain and snow in the Northeastern USA. Significantly, it was written by scientists from NASA, Columbia University and Brown University, institutions that had previously disclaimed solar impact.

The study of 6,800 years of plants preserved in peatlands showed that winter/spring precipitation changed in sync with solar forcing. Small changed in solar radiation were amplified by the Arctic and North Atlantic Oscillations. When the sun entered quiet periods, the Northeastern states had more storms and flooding. The authors noted that this could be significant since we are currently entering a period of quieter solar cycles. After a winter like this last winter, a bit of snow might actually be welcome.

A recent study of the Mayan civilization had results for spookier than any superstition about 2012 and the Mayan Long Count. Scientists at the Yucatan Center for Scientific Research in Mexico discovered that the ancient Mayan civilization was destroyed by relatively minor droughts!

Most scientists believed that it took a major drought event to crush the 650-year-old civilization. However, climate studies from three lakes and a cave in the area showed that modest reductions of summertime rainfall unbalanced the Mayans. The region was so hot that prolonged rain shortfalls, coupled with higher temperatures and increased evaporation severely depleted the Mayan's stored water during the height of their planting season. With no local rivers, there was no other source of water. The Maya relied on continuous rainfall supplies, and had stretched the capacity of their farmlands to a fine limit based on normal rains. Even minor shortfalls caused the number of people to decline catastrophically to a fraction of the empire's former size. As modern populations soar to the limits of their resources, this is a sobering thought

Talk about carrying coal to Newcastle – this winter has been so balmy in Canada that Winnipeg had to import snow! Anyone who has spent a winter in that Manitoba provincial capital knows that it is normally frigid. So it was incredible that "Winterpeg" had to import 200 truckloads of snow to celebrate their Festival du Voyageur!

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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