SKYWARNEWS

National Weather Service
State College, PA
Spring 2010

How We Got Here

By Mike Dangelo, Senior Forecaster and

Tony Mach, Meteorological Technician

Before the Revolutionary War, Benjamin Franklin and other individuals like Thomas Jefferson were some of the earliest weather observers in the U.S. Jefferson even collected synchronized observations from such distant locations as Quebec and points along the Mississippi. During the War of 1812, the Surgeon General of the Army ordered hospital surgeons to take observations, and keep climatological records. During the mid-1800s, several diverse organizations also collected weather data, including the U.S. Navy, the Smithsonian Institute, and lighthouse keepers. This loose organization of weather observers became more official and regimented when the U.S. Army Signal Corps began sharing regular weather observations around 1870 using telegraph transmissions. The first civilian-government agency dedicated to weather observation and prediction, the U.S. Weather Bureau, was created by Congress in 1890 as a part of the Department of Agriculture. At that time, agriculture was the most weather-dependent business in the Nation. By the end of the century the Weather Bureau published its first local weather map (1895), established the first hurricane warning service (1896) and began regular kite observations (1898). Kite

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Inside this issue:

HEAT WAVES

By David Martin, General Forecaster

While flash floods and severe storms account for a large number of injuries and fatalities across the country, including Pennsylvania; heat is often an even bigger hazard. Heat waves are not a stranger to Pennsylvania. This is especially the case across southeastern areas, where high dewpoints are common, and the larger urban areas magnify the effects of the heat. Dewpoints take into account the moisture in the air. The higher the moisture content, the harder it is for the body to cool and the warmer it feels.

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How we Got Here cont.

observations grew into balloon observations, which continue, twice-daily, to this day. The Weather Bureau developed a dense network of observations throughout our nation and territories. It also developed practical forecasts, using scientific prediction tools and methods. The Weather Bureau was transferred to the Department of Commerce in the 1930's due to the growing importance of aviation safety and interstate commerce, which are both highly dependent on weather conditions.

Weather observations using radar developed during World War II, were a major leap in technology during the mid-1900s. The first launch of a weather observing satellite (Tiros-I) occurred on April Fool's Day 1960. But this was no joke, and began a revolution in weather observing and forecasting. For the first time, pictures from high above the earth allowed forecasters to view clouds and storm systems from a new and very significant vantage point. In 1965, Congress established the Environmental Science Services Administration (the fore-runner of NOAA).

On October 3, 1970, The National Oceanic and Atmospheric Administration (NOAA) was established. The reasons why NOAA is a part of the Commerce Dept. are best summed up by then-President Richard Nixon: An agency like NOAA would afford "better protection of life and property from natural hazards...for a better understanding of the total environment...[and] for exploration and development leading to the intelligent use of our [natural] resources..." Congress has more-recently authorized a $4.5 billion modernization program that began in the early 1990's, but continues today in continual technological enhancements, like dual-polarization Doppler radars, advanced observing platforms, and highly sophisticated computers loaded with programs that simulate expected weather patterns. The greatest asset of NOAA and the National Weather Service (NWS) is the highly-trained and highly-skilled workforce which issues more than 1.5 million weather, river, and flood forecasts each year. The NWS also issues around 50,000 potentially life-saving severe weather warnings annually. Skywarn Spotters assist us in this mission, by helping us know what is happening on the ground (ground truth).

The benefits of weather prediction are many and varied, but most of all, they protect lives and enhance the economy by allowing our citizens (and businesses) to prepare for the upcoming weather. One study estimates that NOAA forecasts, warnings, and the associated responses produce approximately **$3 billion** in savings during a typical hurricane season. Two-thirds of this savings (**$2 billion**) is attributed to the reduction in hurricane-related deaths, and one-third (**$1 billion**) is attributed to a reduction in property-related damage due to social action and preparedness.

HEAT WAVES cont.

It is not uncommon for severe winters to be followed by early season heat waves. The 16-22 April 1976 heat wave resulted in a temperature of 94 degrees in State College. Readings of 90 degrees or higher in April at State College have also occurred during the heat waves of 24-29 April 1990 and the 25-28 April 2009. These early heat events can be dangerous because most people have not yet been acclimated to the warm weather and could more easily be adversely affected by the heat.

While early season warmth is not unheard of, the hottest temperatures are traditionally reserved for the height of summer. The highest temperature ever recorded in Pennsylvania occurred in July 1936 when the mercury

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HEAT WAVES cont.

reached 111 degrees on the 10th in Chester County.

Heat waves across the eastern states usually occur when there is a large high pressure area across or just east of the region. This helps suppress shower and thunderstorm activity and allows a southerly flow of tropical air to build across the area over the course of several days.

A heat wave (informally defined as 3 or more days with 90 degree readings) becomes a concern at some point during most summers. A couple of noteworthy heat waves occurred in 1980 across portions of the Great Plains, and in the Chicago area during July 1995.

Heat waves can be dangerous. Persons engaging in outside activities in the heat should take frequent breaks and drink plenty of non-alcoholic fluids. Other recommended ways to avoid overheating include: dressing in lightweight, light-colored clothes; eating lighter meals; and spending time in air conditioning.

Another warm season danger is sunburn. To prevent this, use plenty of sun screen and limit exposure to the sun. Some signs of too much sun and heat are red, burning or dry skin, painful spasms in the legs, rapid pulse, headaches, fainting, and vomiting.

So pay attention to the forecast to stay cool and beat the heat!

No matter how rich you become, how famous or powerful, when you die the size of your funeral will still pretty much depend on the weather – Michael Pritchard

The Winter of 2009-10

By Richard Grumm, Science Officer and John LaCorte Senior Forecaster

Meteorologically, winter is defined as the months of December through February. And for the first time in a while the three winter months were snowier and colder than normal here in central Pennsylvania (figures 2 and 3). It should be noted that winter weather can occur sporadically from October through April, and it has even snowed on occasion in May.

The first bout of winter weather struck central Pennsylvania on 15-16 October when a record early snow was observed. October was a cool month which was followed by an exceptionally mild November. So, when cold weather set in during December, it was in sharp contrast to the recent warmth. The cold episodes of December, January and February all were associated with a strongly negative phase of the Arctic Oscillation (which also was strongly negative during the October snow event).

The Arctic Oscillation, also referred to as the AO is a measure of the flow at the higher latitudes of the northern hemisphere. The Antarctic Oscillation is the southern hemispheric version. Another index of the flow that dominates our weather is the North Atlantic

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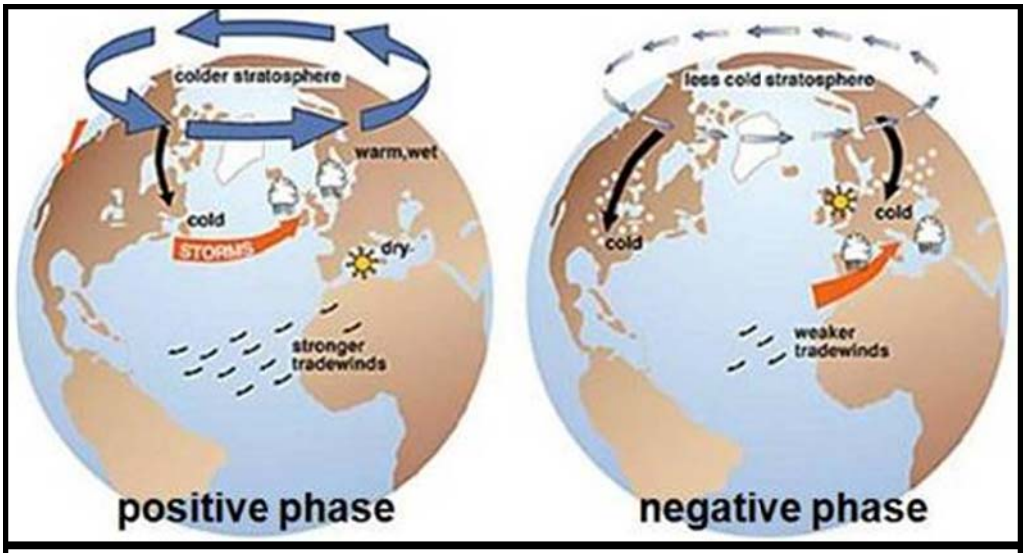

Figure 1 Arctic Oscillation phase and the flow in the northern hemisphere. Courtesy of Columbia

The Winter of 2009-10 cont.

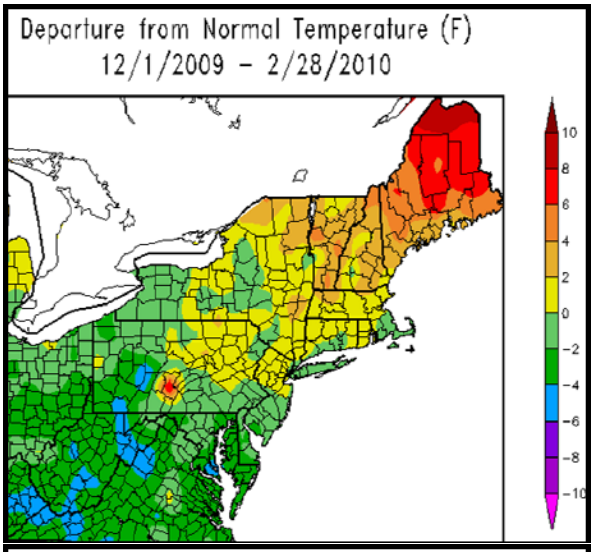

Fig 2. Winter Temperature Departures

In addition to the negative AO throughout the winter, the El Nino Southern Oscillation or ENSO was positive, which we normally call El Nino. The outlook for the winter weather across the United States was based on the prediction of a positive ENSO winter. The sign of ENSO is relatively predictable by National Weather Service Climate models. However, the sign of the more variable AO is not as easy to predict beyond just a few weeks. The relatively cold and snowy winter of 2009-2010 was likely due to the combination of the positive ENSO event which provided storms tracking across the southern United States and the negative AO which provided cold air favoring snow.

The big winter storm events including 19-20 December 2009, 5-6 February, 10-11 February and 25-26 February 2010 were due in part to the negative AO. These storms provided heavy snow to many locations of the Commonwealth. The three storms of February 2010 produced new snowfall records for many cities across the Commonwealth. These included several daily records, the snowiest February on record (Pittsburgh); the snowiest month ever (Harrisburg) and even the snowiest winter on record (Philadelphia).

Laurel Summit in Somerset County set a new record for the state with the snowiest February ever, recording a staggering 107.3 inches of snow.

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Oscillation or NAO. The NAO and AO often have the same *sign*. Both tend to be negative when there is high pressure at the higher latitudes and low pressure is suppressed to lower latitudes. This forces higher latitude air southward and shifts the storm track to the south. A negative AO and NAO are often associated with colder and drier conditions in our region. However, we tend to get more snow from winter storms as we are often on the cold side of these systems.

While the relatively cold and snowy periods of our winter were associated with strongly negative values of the AO, the warm ups in mid-January and in March were associated with the AO trending and then becoming positive. The snow event and cold weather of October 2009 was associated with a negative AO and conversely the AO was strongly positive during the warm month of November 2009.

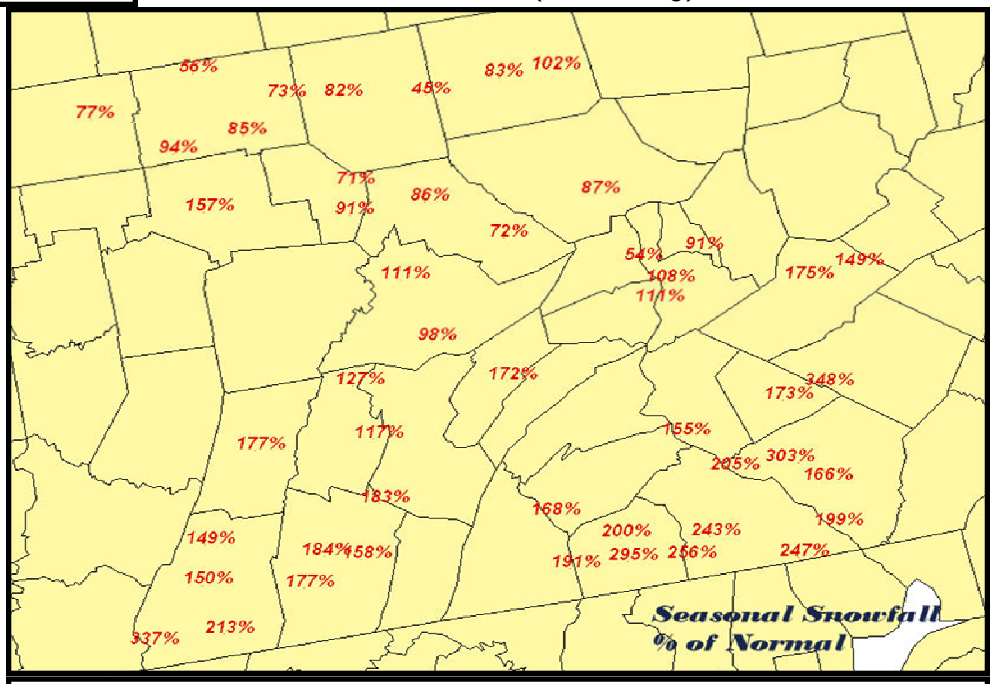

Fig 3. Seasonal Snowfall as a Percent of Normal

The Winter of 2009-10 cont.

So while the winter was just a bit colder than normal, it was one for the record books with regards to snowfall and will live long in our memories.

A Fond "Farewell" – THANK YOU for your service!!

By Dave Ondrejik, Senior Hydrologist; Mid-Atlantic River Forecast Center

Hello friends! I wanted to take a moment to inform you that as of April 11, 2010 I have accepted a new position in the National Weather Service (NWS). So, I am no longer the Warning Coordination Meteorologist (WCM) at the State College, PA office. Although my job has changed, I am only moving about 30 feet across the office to the Middle Atlantic River Forecast Center (MARFC). As a "Senior Hydrologist" at the MARFC, I am excited to begin a new and extraordinary opportunity.

There are various things I will miss in my old job as the WCM, but mostly working with the Skywarn program and the uniquely dedicated group of people that comprise it. It has been a true pleasure to meet and speak with you over the last 9 years. Hopefully my presentations were informative as well as fun for everyone who attended. Your attention, questions and witty comments made each Skywarn talk distinctive.

When it comes to severe weather (i.e. tornadoes, damaging winds, hail), as good as the Doppler Radar is in helping us identify developing severe thunderstorms… it cannot see what is actually happening on the ground. There

fore, Skywarn Observers will continue to be an essential component in the NWS's warning operations.

As some of you may know, I grew up in Johnstown, PA. The deadly and devastating flood of 1977 was one of the reasons I chose to become a Meteorologist. So flooding (and other aspects of Hydrology) is in my blood and I

am thrilled to be working for MARFC.

Anyway, I wanted to take this opportunity to say good-bye for now. It has been my distinct pleasure working with and serving you for the last 9 years. As I write this article, my replacement has not been selected yet. However, I am sure that you will welcome that new person and treat him or her with the same kindness and friendship shown me.

Finally, I want to 'Thank You' one last time for your service and dedication my friends.

Be prepared…and STAY SAFE!

Why Examine Temperature *Anomalies*?

From March Issue of NOAA News

Temperature anomalies refer to the difference from average. The Global temperature is calculated using anomalies because they give a more accurate picture of temperature change. In calculating an average temperature for a region, factors like station location or elevation affect the data, but when looking at the *difference from the average* for that same location, those factors are less critical. For example, while the actual temperature on a hilltop will be different than in a nearby valley on a given day or month, stations in both places will show a similar trend in temperature when you calculate the change in temperature compared to average for that station.

Figure 1 Shows the global temperature anomalies for the first 3 months of 2010. While much has been said about the severity of the local winter, especially with regard to snowfall, it can be seen that most of the globe was actually warmer than normal.

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Anomalies cont.

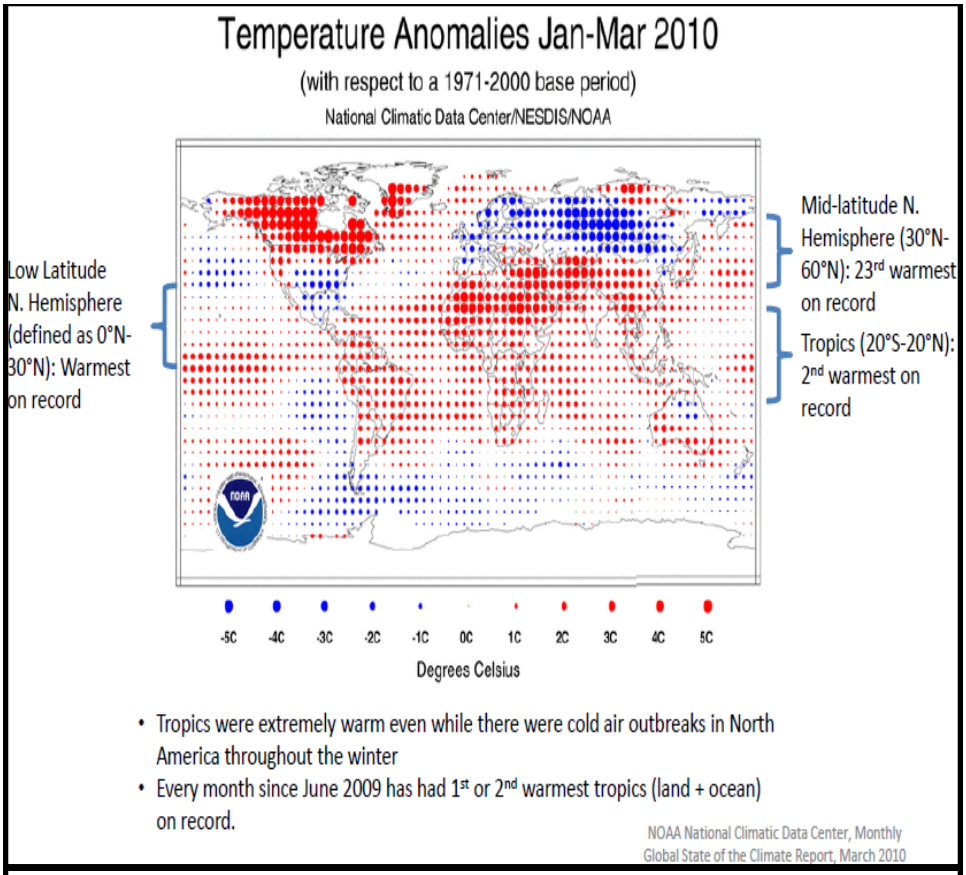

Figure 1. Global Temperature Anomalies Jan-Mar 2010

March ended the winter in a grand and very warm fashion (Fig 2.). The combined global land and ocean average surface temperature for March 2010 was the warmest on record at 56.3°F (13.5°C), which is 1.39°F (0.77° C) above the 20th century average of 54.9°F (12.7°C). In fact, it marked the **34th consecutive March** that the average global temperature was warmer than the 20th century average!

The worldwide ocean surface temperature was also the highest for any March on record, averaging 1.01°F (0.56°C) above the 20th century average of 60.7°F (15.9°C).

Separately, the global land surface temperature was 2.45°F (1.36°C) above the 20th century average of 40.8 °F (5.0°C) — the fourth warmest on record.

Warmer-than-normal conditions dominated the globe, especially in northern Africa, South Asia and Canada. Cooler-than-normal regions included Mongolia and eastern Russia, northern and western Europe, Mexico, northern Australia, western Alaska and the southeastern United States.

Other Highlights

Arctic sea ice covered an average of 5.8 million square miles during March. This is 4.1 percent below the 1979-2000 average expanse, and the fifth-smallest March coverage since records began in 1979. Ice coverage traditionally reaches its maximum in March, and this was the **17th consecutive** March with below-average Arctic sea ice coverage! This year the Arctic sea ice reached its maximum size on March 31st, the latest date for the maximum Arctic sea ice extent since satellite records began in 1979.

Lastly, the winter got off to a fast and furious start, setting a record for the most North American snow cover since this parameter started being tracked in 1967. Conversely, March ended the winter with much below normal snow cover. On a related note, Great Lakes ice cover was also at record low levels by mid March.

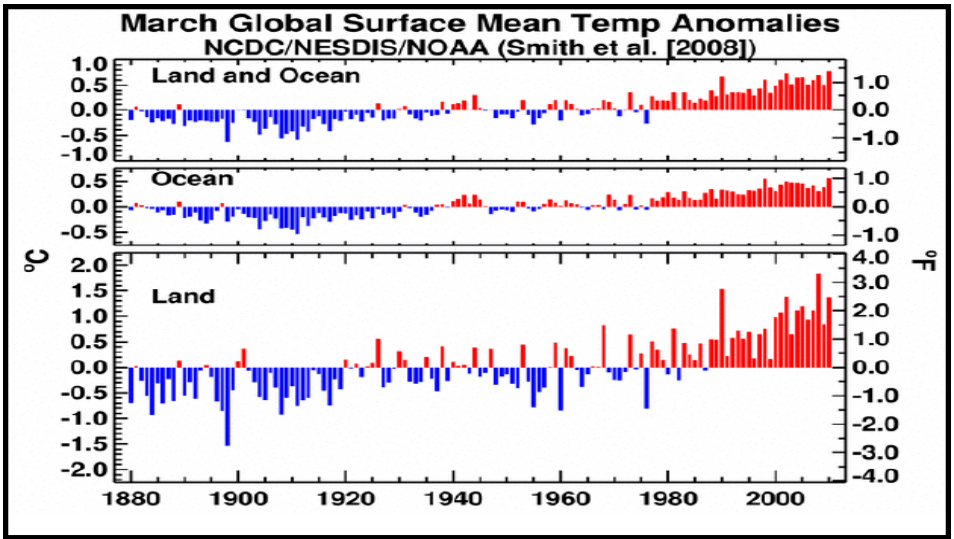

Figure 2. March Global Temperature Anomalies

"Big" Changes to Severe Hail Criteria

By Bill Gartner, General Forecaster

Hailstones will now have to be bigger for them to be considered severe. Starting this year, the hail size criteria used by the National Weather Service (NWS) to issue and verify severe thunderstorms has been increased from three quarters of an inch in diameter (penny-size) to one (1) inch (quarter-size).

This change is based on research that indicates significant property or crop damage does not occur until hail size reaches 1 inch in diameter and is in response to requests by NWS partners in emergency management and the media. Particularly in areas of the Central U.S., it is believed that the frequency of severe thunderstorm warnings issued for penny-size and nickel-size hail might have desensitized the public to take protective action during severe thunderstorm warnings.

For the past few years, NWS offices that cover areas of Kansas have experimented using warning criteria of one inch diameter hail. During the spring and early summer of 2009, this experiment expanded to other areas in the Central and Western U.S. Beginning January 5, 2010, the minimum size for severe hail nationwide was officially increased to one inch (quarter-size) diameter. There will not be a change to the wind gust criteria of 58 mph at this time.

Despite the change in hail size criteria, ***we still want your reports of hail smaller than 1 inch***. In fact, reports of hail of any size are useful to our office. NWS Doppler radar rainfall estimates are usually very accurate, but due to the design of the radar and the physical properties of ice, Doppler radar does not detect hail as well as rain. Sometimes there are signatures in the radar imagery that indicate that hail is present in a thunderstorm, but not always. And given the meteorological conditions of the day, we generally have a good idea on what days hail will be a significant threat, but it is spotter "ground truth" that helps us to confirm where hail is occurring and how big it is. So please keep those hail reports coming!

Update Your Spotter Contact Information

By Bill Gartner, General Forecaster

Have you moved recently? Gotten a new phone number? Please help us to keep your contact information up to date. From time to time we call spotters when significant weather is in their area to provide us additional 'ground truth'. Thus it is important to keep your contact information current. If any of your contact information (name, phone number(s), addresses, etc) has recently changed, please let us know.

Also, if you *no longer wish to be a spotter* or *no longer wish to receive SKYWARNEWS*, please drop us a note.

Thank you!

SKYWARN

email: william.gartner@noaa.gov

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William Gartner/Skywarn Spotter Update

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New Hurricane Wind Scale on the Way

From NOAA Public Affairs /National Hurricane Center

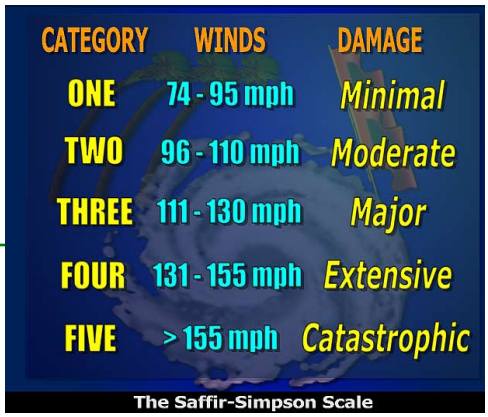
Edited by Bill Gartner, General Forecaster

NOAA's National Weather Service will use a new hurricane scale this season called the Saffir-Simpson Hurricane Wind Scale. The scale keeps the same wind speed ranges as the original and previously used Saffir-Simpson Scale for each of the five hurricane categories, but no longer ties specific storm surge and flooding effects to each category.

Herbert Saffir, a consulting engineer, and Robert Simpson, who was director of the National Hurricane Center from 1967 through 1973, developed the original scale which was a useful tool to convey the threats of tropical cyclones. Changes were made to the Saffir-Simpson Scale because storm surge values and associated flooding are dependent on a combination of the storm's intensity, size, motion and barometric pressure, as well as the depth of the near-shore waters and local topographical features. As a result, storm surge values can be significantly outside the ranges suggested in the original scale.

For example, Hurricane Ike in 2008 was a very large storm that made landfall on the upper Texas coast as a Category 2 hurricane with a peak storm surge of 15 to 20 feet.

In contrast, Hurricane Charley struck Southwest Florida in 2004 as a Category 4 hurricane, but produced a peak storm surge of just 6 to 7 feet. Storm surge forecasts will continue to be included in hurricane advisories and statements issued by the National Hurricane Center and local National Weather Service forecast offices. Beginning with the 2009 hurricane season this information has been expressed in terms of height above ground level, giving residents a better understanding of the potential for flooding at their location.



The Saffir-Simpson Scale

Meteor Gazing in 2010

By Barry Lambert, senior Forecaster (taken from a variety of sources)

In the wake of a very snowy winter across parts of Pennsylvania, we can look forward to milder nights of putting on just a light jacket and viewing some spectacular celestial displays during the months of May through October.

Clear nighttime skies and low humidity will hopefully accompany the majority of these celestial displays, since an "unfavorable moon phase" will coincide with several of the events.

Most months during the remainder of this year contain one or more meteor showers, which occur as a result of the earth passing through the debris trail left behind by comets. Some comets (such as 1P/Halley – whose location is now at the orbital distance of and opposite to Neptune) have taken a path through the solar system that leads to the earth intersecting its debris trail twice in a year.

The meteor showers derive their names from the constellation where most of the fleeting and faint flashes of light are seen. Occasionally, a slightly larger piece of debris (ice or dust particles) can lead to a more pronounced "fireball" leaving a thin, glowing trail across a long arc in the sky (Figs 1-3).

Fig 1. A large and brilliant Geminid meteor fireball over the Mojave Desert

Meteor activity picks up towards the April-May boundary, though of the two shower maxima in late

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Meteors cont.

April, only the Lyrids have a short, Moon-free observing window.

Fig 2. A photo of the amazing Bolide meteor that tracked in perfect view of a police officer's dashboard camera over Iowa on the night of April 14, 2010. The video can be accessed via the link below.

http://uk.news.yahoo.com/4/20100416/twl-meteor-shower-across-midwest-us-41f21e0.html

Fig 3. The April 14 Fireball was also captured on a rooftop Webcam from the University of Wisconsin's Atmospheric and Oceanic Science Department. See the New York Times article about this meteor at

http://www.nytimes.com/2010/04/17/us/17meteorite.html?src=me

Our focus will be on the May through December period which contains the some of the more "brilliant" and "reliable" meteor showers. Following the description of the more prominent celestial displays (below) is a map of the "radiants" where the meteor showers will occur.

Coming to your local sky on Wednesday-Thursday May 5-6th is the *ETA Aquarids*, from the debris of comet 1P/Halley. The peak time to view this shower will be the early morning of Thursday, May 6th.

There will be a rather low frequency of meteors, and we'll be lucky to see only about 10 ETAs in an hour. Also, the moon is near the low radiant of this meteor shower this year which will greatly obstruct viewing the fleeting grains of sand or pebble sized objects.

The ETAs will be most visible in the Southern Hemisphere, but even there it will be somewhat difficult to view. The key is to watch during the last hour or so before dawn.

The low radiant elevation means that the earliest ETAs you catch a glimpse of will be "earthgrazers" – which are the long, relatively slow-moving ones that often trace paths along the Earth's horizon. Bright earthgrazers are spectacular. Unfortunately, because of their greater distance from the observer, earthgrazers tend to be faint. As the radiant gets a bit higher, the ETAs take on more of their typical appearance: fast meteors, bright on average and often leaving a glowing train. You'll only catch a few of them, though, because dawn is approaching.

Most meteors will be found looking east and fairly low on the horizon within the constellation Aquarius, and just east of Pegasus (Figure 4).

The second of the upcoming meteor showers will be the Arietids emanating from the constellation Aries (Figure 5). It's a fairly strong shower of up to about 60 per hour, but spread out over a rather long period from May 22-July 2 with its peak around Monday June 7th.

A few days before and after this date is typically the best time to view this meteor shower.

Coming in mid June will be the *Lyrids* (June 14-16).

This meteor shower was discovered on the evening of June 15, 1966, by S. Dvorak (California, USA) while camping out in the San Bernardino mountains. His attention had been drawn to the region of Lyra by a very bright meteor that moved swiftly to the northeast through that constellation. Another meteor was noted a short time later and Dvorak began plotting additional meteors. After 1.5 hours he managed to plot a total of 16 meteors, of which 13 appeared to originate from an unknown radiant located at RA=278°, DECL=+30°.

Meteors cont.

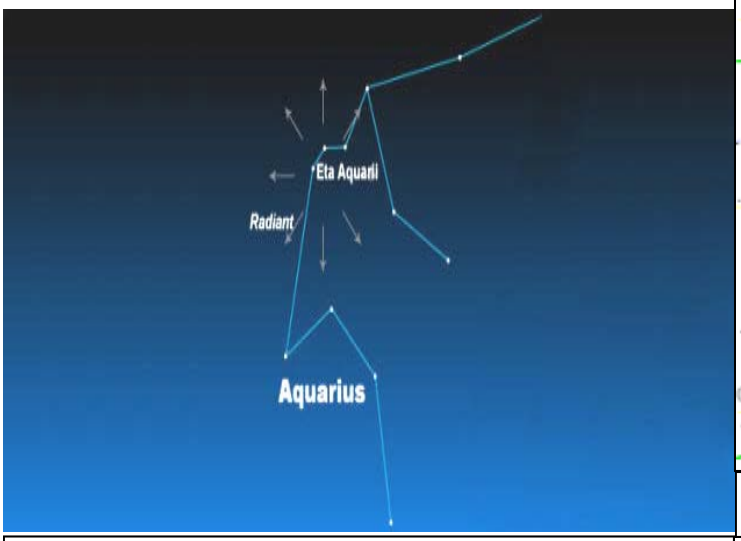

Fig 4. Constellation Aquarius

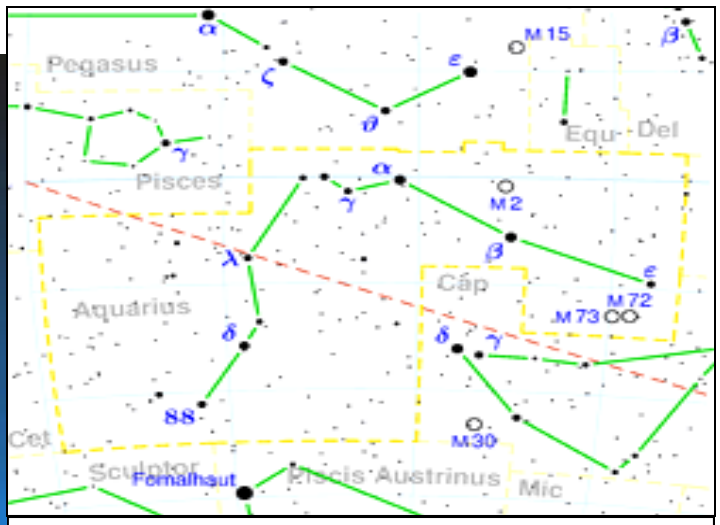

Fig 7. Constellation Aquarius

Just a few hours later, F. W. Talbot (Cheshire, England) independently discovered the radiant at RA=275.5°, DECL=+30°, and noted an hourly rate near 9. The moon will be in its "waxing crescent" phase during this event (or about 12% illumination).

The South Delta Aquarids (Figure 7, July 27 – July 29) normally produces between 5 and 10 meteors per hour, with as many as 30 per hour. This shower will be seen during the early morning hours (1 am to 4 am) and will be low on the southern horizon. Moon phase is waning "gibbous" (where about 66% of the moon is illuminated).

The *Capricornids* (July 29 – July 30). The peak of this mid Summer meteor shower will be on Friday, July 30th. The small dust grains are distributed along the parent comet's (45P Honda-Mrkos-Pajusakova) orbit. This event is not known for being a strong shower, since even during their peak dates of July 31st and August 1st they only produce a maximum rate of around ten meteorites per hour.

The best time to view the Capricornids (Figure 8) is between midnight and early dawn, and the shower is most easily viewed from the southern hemisphere. The Capricornids may not produce a large number of meteors, but the one thing they are noted for are their "bright yellow" meteorites that create "beautiful fiery streaks" across the sky. What the Capricornids lack in quantity, they certainly make up for in quality.

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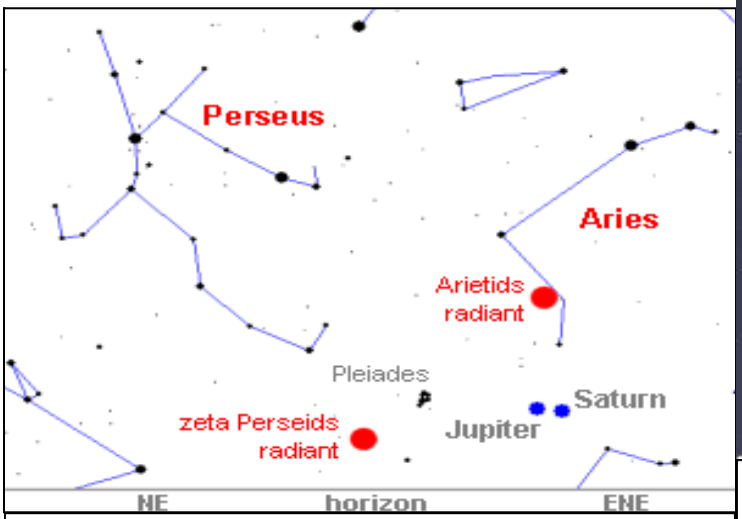

Fig 5. Constellation Aries

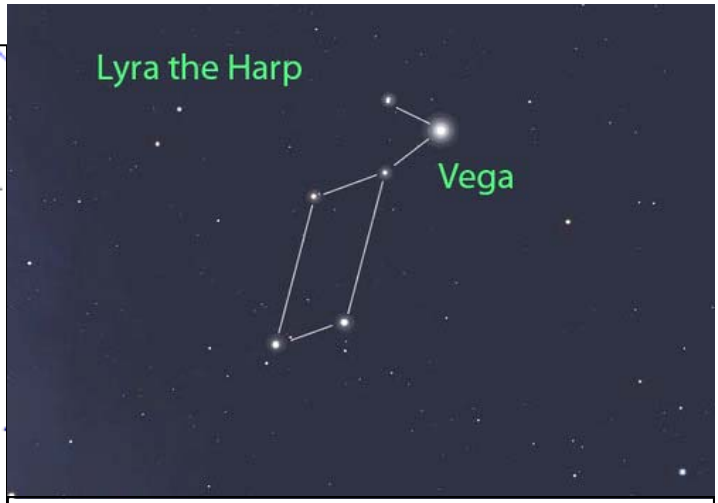

Fig 6. Constellation Lyra

Meteors cont.

The moon during the Capricornids is in its waning gibbous phase.

The *Perseid Meteor Shower* has a very long duration from about July 15 to August 25, with its peak early Wednesday to Friday morning August 11-13 just before dawn. The Perseids are probably the most widely viewed annual meteor shower. The meteors may fall at a rate of up 100 per hour, and an occasional longer lasting "fireball" is also seen. You can view this display the entire night as the radiant is above the horizon all night at latitudes above 32 deg N (Figure 9). The best of the show occurs during the predawn hours when the moon is low, and the radiant relatively high in the mid summer sky. The moon will be in its waxing crescent phase.

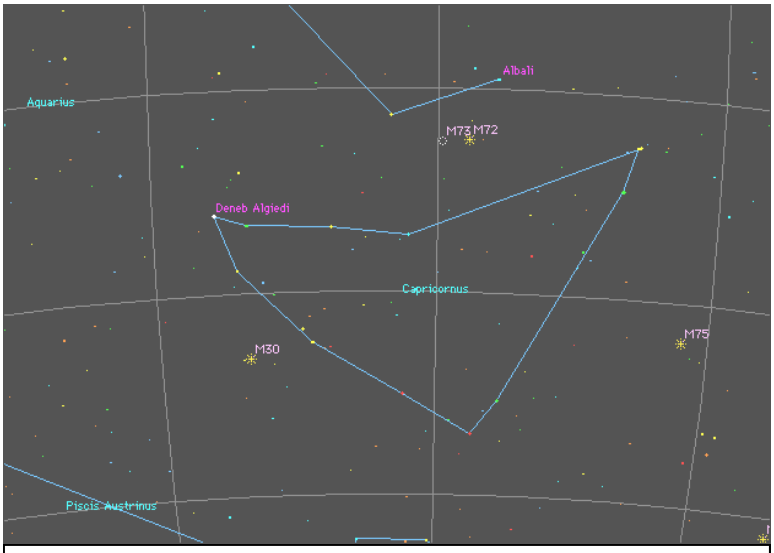

Fig 8. Constellation Capricorn

Last up will be the *Orionids (*Oct 20 - Oct 21, figure not shown). This is quite an interesting meteor shower. It will display a medium rate of around 20 shooting stars per hour, but it is known for producing meteors that are a unique yellow and green color. It often produces large meteors described as fireballs. It can be an erratic meteor shower though that is spread out over a period of time but usually the best is from Oct 17-25.

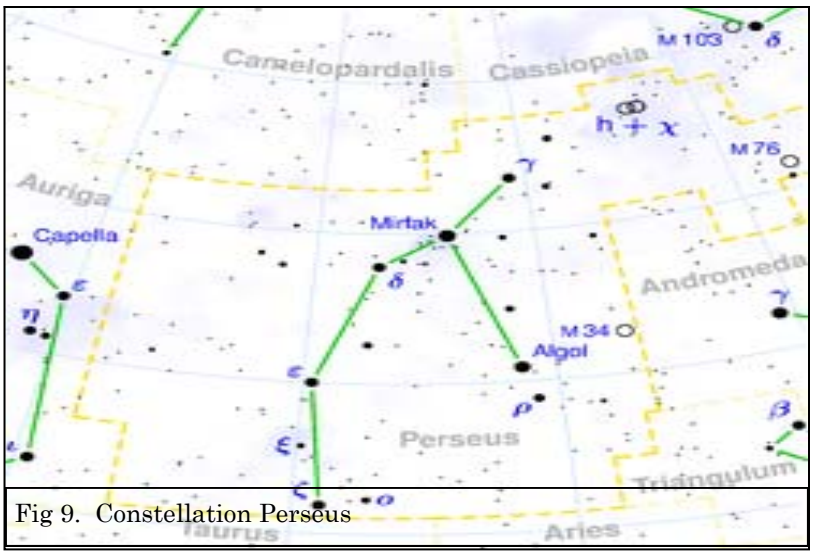

Fig 9. Constellation Perseus

Viewing of these meteor showers could be greatly hampered by the presence of a Full Moon (the only major event of the year to be impacted by the unwanted light!)

The link below is a highly useful one for locating the radiant of the meteor showers, along with helping you become familiar with the many constellations.

http://www.astro.wisc.edu/~dolan/constellations/constellationjavalist.html

The following are a host of links to further explore the fascinating world of meteors, and check out some of the more interesting astronomical dates. Some of the links contain a comprehensive Listing of all meteor shower occurrences during 2010, along with where in the sky to locate them

- http://skytour.homestead.com/met2010.html
- http://www.amsmeteors.org/
- http://www.amsmeteors.org/showers.html#2010
- http://www.theskyscrapers.org/meteors/
- http://stardate.org/nightsky/meteors/
- http://www.seasky.org/astronomy/astronomy_calendar_2010.html
- http://www.amsmeteors.org/fireball/fireball_log2010.html#pennfb

The final link has a comprehensive listing of the many fireball sightings already reported in 2010.

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