SKYWARNEWS

National Weather Service State College, PA

Fall 2011

"Working Together To Save Lives"

Summer in Review

By John La Corte, Senior Forecaster

So far 2011 has been an amazing year of weather extremes. We started the warm season off with a record setting number of devastating tornadoes and we transitioned into one of the hottest summers on record. While much of Texas remains parched even as autumn is beginning, parts of the east coast are recovering from historic flooding courtesy of Hurricane Irene and Tropical Storm Lee and an unnamed storm that stalled over the region in the last days of September.

Locally, each month of the traditional summer, June through August was above normal temperature-wise but it was July that really saw the blow torch turn on.

In Harrisburg the summer ended up 1.8 degrees above normal. July soared to 4 degrees above normal which made it the 3rd warmest on record. A full 19 days out of the month saw high temperatures of at least 90 degrees while for the entire summer there were 21 days reaching or exceeding 90 degrees. This was 3 days more than in a normal year. The heat peaked on the 21st and 22nd of July when the mercury hit 101 and 103 respectively.

At Williamsport the summer ended up 2.2 degrees above normal. July was nearly 5 degrees warmer than normal which was good enough to make it the 6th warmest on record. The 21st and 22nd were scorchers there as well with highs of 100 and 103 on those days. In a normal summer, the high temperature reaches 90 or higher about 13 times. This year it did so 18 times with 14 of those days occurring in July.

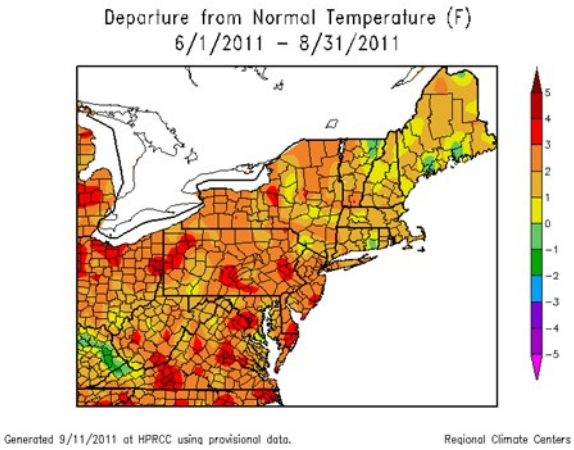

Figure 1. Summer of 2011 average temperature departures.

For the region Figure 1 shows that the entire state was warmer than normal during the summer with several pockets of average temperatures some 3 to 5 degrees above normal.

Precipitation for the summer was less straightforward across the region. Figure 2 shows that much of the central and western Pennsylvania saw below normal precipitation while the far southwest and all of the east were wetter than normal.

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The map shows that Williamsport was right in the transition zone between drier and wetter than normal with the airport ending up measuring 12.71 inches of rain for the 3 month period, which was .59 inches above normal.

Harrisburg, while not nearly as wet as the border counties shared with New Jersey and New York, still ended up 6.19 inches above normal rain-wise for the season. This was mainly courtesy of a very wet August that had rain on nearly half the days. Three of those days saw more than 1.50 inches of rain with nearly 3 inches of rain falling over the course of 2 days late in the month courtesy of the western fringes of Hurricane Irene.

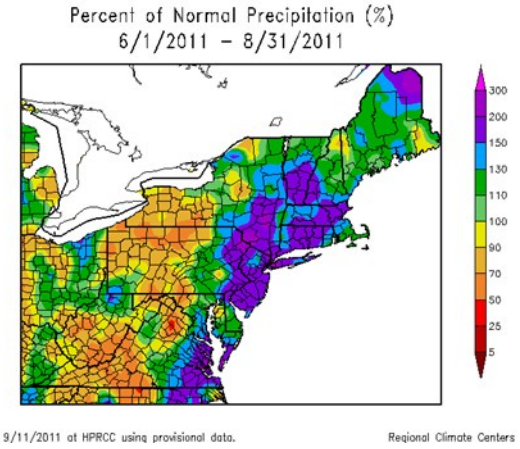


Figure 2. Summer of 2011 precipitation departures.

Some other events that are worthy of mention include more on Hurricane Irene. It hit North Carolina as a category 1 storm on August 27th and helped bring record rains and flooding to much of the eastern seaboard up into northern New England. Irene was the first hurricane to make landfall in the US since 2008 when Ike hit Texas as a category 2 storm on September 13th.

For many locations the 100 degree heat that hit in the 3rd week of July represented the hottest temperatures most sites had seen in in more than 20 years. While Harrisburg reached 100 degrees last summer, State College, Altoona and York had not seen the mercury reach the century mark since July 1988. In Williamsport they had not done so since mid-July in 1995.

Winter Outlook

The reader might recall that last winter we saw temperatures cooler than normal over most of the region with snowfall pretty close to normal in most areas except the lake effect snow belt regions which saw heavier than normal accumulations.

This year with a weak La Nina expected to last through the winter months, the seasonal forecast from the Climate Prediction Center is described as one where there is little or no predictive signal here in the northeast. What this means is that there is an equal chance of it ending up near normal, warmer than normal or colder than normal. As for precipitation, chances are only slightly in favor for it to be wetter than normal. Not very encouraging or enlightening but experience shows that La Nina's have more predictability over the southern and southwestern US than here in Pennsylvania.

At this time of year we also like to take a look at true Guru's of long range forecasting, ***The Old Farmer's Almanac***. These sages have been the source of weather wisdom and folklore for over two hundred years so it is only fitting we consult with them on the seasonal outlook.

Snow lovers in Central Pennsylvania have reason to be optimistic as the almanac calls for above normal snowfall for most of our region. Overall however they call for the winter to end up being milder and drier than normal. They site the state of the weak La Nina as well as weak sunspot activity. According to their own verification, they did very well forecasting temperature and snowfall last winter so snow-lovers, keep your fingers crossed that they are on target again this season.

Remembering Hurricane Carla 50 years later

By Ron Trumbla NWSNews

On September 11, 1961, Hurricane Carla slammed into Port Lavaca, Texas, as a strong Category Four hurricane, with sustained winds of 145 mph., gusts up to 175 mph. and a devastating 22 foot storm surge. By the time Carla had spent her fury, 46 lives were lost and the damage totaled $325 million ($2.5 billion in 2011 dollars).

By any measure, hurricane Carla was a monster, with hurricane force winds extending out from the center for 150 miles and tropical storm force winds extending out for 250 miles. It was so large, the entire Texas coast was affected and damage was reported as far inland as Dallas. The storm also prompted the largest peacetime evacuation in U.S. history at the time, with more than half a million people scurrying to leave the vulnerable coastline behind them.

"Our first and primary assignments were to help evacuate all the area residents, quickly and safely, while directing the heavy flow of traffic northward to higher ground," recalls **Nolan Maxie**, a freelance writer and former highway patrolman. "Gridlock became common along the primary evacuation routes."

When the storm peaked on the September 11, Maxie was on duty in the Brazoria County seat of Angleton, Texas. While sitting in his squad car on the lookout for looters, he experienced enormous amounts of wind and rain and felt as if the car was being sand blasted. In fact, the next day he noticed the highway patrol decal had been completely blown away. After the storm, he also recalled seeing living and dead livestock hanging in treetops; and thousands of rattlesnakes clustered on levees and high ground to escape the floodwaters.

While the early evacuation was credited with saving many lives, hundreds of people had to be rescued in the days following the storm. Former newspaper reporter **Murray Montgomery** read an Associated Press story about **Robert Dunn**, a friend of his who lost his family and spent three days floating on the roof of his parents' home in Angleton.

When he caught up with his friend later, Montgomery said he was given a first-hand account. "Robert said that he thought he was miles out in the Gulf of Mexico because he was surrounded by water. He even saw a buoy with a red light on top. What he actually saw was the radio antenna above the Brazoria County Courthouse. The courthouse was five stories tall."

As the eye of the storm pushed ashore at Port Lavaca, a local television reporter was struggling against the wind and rain slashing the Galveston Seawall about 125 miles up the coast. The reporter was doing the first live broadcast of a hurricane; setting a precedent that has been repeated frequently during land falling hurricanes to this day. His innovative coverage of the storm soon led to a job offer as a CBS correspondent and eventually to the anchor position on *The CBS Evening News with Dan Rather.* Extreme peak wind gusts were estimated to be near 170 mph at Port Lavaca, as the wind equipment blew away after reaching 153 mph.

While far from the deadliest hurricane, Carla was the most intense hurricane to strike Texas in the 20th century. It is also ranks as the tenth most intense hurricane to strike the United States since 1851.

2011 Hurricane Season

By John La Corte, Senior Forecaster

Earlier this year NOAA released its 2011 hurricane season forecast. In it they called for 12 to18 named storms. Of those, as many as 10 were predicted to become hurricanes with 3 to 6 reaching major hurricane strength (at least category 3 on the Saffir-Simpson Scale).

As of mid October we have had 18 named storms. Only 5 have become hurricanes to date but of those 3 became category 3 storms or higher.

The impact on the United State from hurricanes has been so far a little misleading. Irene was the strongest storm and the first land falling on the US mainland since 2008. Irene hit the coast of North Carolina on August 27th and proceeded up the New Jersey coast into New England as a weakening category 1 storm, bringing just tropical storm force winds to most areas north of the Carolinas. Irene's claim to fame would be record setting rainfall and deadly flooding that extended all the way to Vermont.

Fig 1. Flooding at the Roller Soaker at Hershey Park, Pa

The other hurricanes that have formed managed to stay well out to sea not impacting the United States with anything more than some rough surf. However another storm that caused a major impact was Tropical Storm Lee.

Lee was a weak tropical cyclone for barely two days at the beginning of September but it will be what Lee did in conjunction with a slow moving frontal system over the eastern and northeastern United States that will earn the storm much acclaim.

The slow moving storm dropped more than a foot and a half of rain over portions of the Gulf Coast before beginning to move slowly north though the lower Tennessee Valley toward the northeast states. The storm got caught up under a deep and slow moving upper low that resulted in nearly a week of deep tropical moisture and heavy rains from parts of the Appalachians into New England and New York.

When the rain finally stopped, widespread amounts of more than 10 inches had been observed with over 15 inches being measured in Lancaster county.

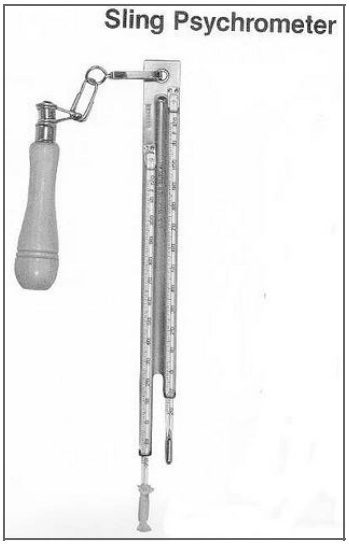
Flooding was once again devastating resulting in numerous deaths including nearly a dozen here in Pennsylvania. Many rivers also flooded and crested at record levels. It was the worst flooding since the great Hurricane Agnes floods of 1972 devastated the region.

In addition, the heavy rains helped push the annual total at Harrisburg to a new record. As of mid October more than 64 inches of rain has fallen. Williamsport has also set a record with more than 62 inches of rain to date.

The following is taken from the 2012 edition of ***The Old Farmer's Almanac***

The psychrometer is a scientific instrument for the exact measurement of relative humidity. It's a clever little rig, invented around 1890 by a German physician and meteorologist, which works because of the different rates at which wet and dry objects cool. Two thermometers are mounted in a tube, protected against outside heat and cold.

The bulb of one thermometer is dry; the other, wet. Because the moisture on the wet bulb evaporates and cools the bulb more quickly than the dry bulb cools, a comparison of their readings indicates the water content of the ambient air.



Today's humidity meters rely on electronics to measure the air's moisture. Those who prefer their psychrometry low-tech, however, need not despond, at least not in this house. We measure humidity by a device so simple it has only one moving part-the old plank door leading to the cellar. Each year on a day in November, this door, which has been stuck tight since late spring, suddenly opens easily. All summer, the damp air has been swelling the door's pine planks, causing them to expand into its frame and jam. Now, with cooler, drier outdoors and heating indoors, the boards give up their moisture and shrink. In June the door will jam up again, but for now it's back in business and furnishes as good a humidity gauge as we will ever need.

Ever heard of space weather? The following was taken from NWS News. . .

Strong solar storm delivers glancing blow to Earth

Submitted by NWSN Staff

The National Weather Service's Space Weather Prediction Center — the nation's official source of warnings and alerts about space weather and its impacts on Earth — issued a warning in late September for a strong, G3 geomagnetic storm on Earth resulting from a significant explosion from the sun's corona.

G-scale solar storms range from G1 (minor) to G5 (extreme). The coronal mass ejection — a burst of charged particles and magnetic field that streamed out from the sun at about five million miles an hour — delivered a glancing blow to the planet. Impacts arrived on Earth, jolting the planet's magnetic field and triggering strong "geomagnetic storming" in some regions. If it had been directed straight at Earth, the geomagnetic storming could have reached "severe" to "extreme" levels.

"There's a belief that as we build a society that depends more on technology we become more vulnerable to space weather," SWPC's Doug Biesecker told Time.com's Eccco-centric blog.

Geomagnetic storms on Earth can impede the operation of electrical grids and temporarily damage radio and satellite telecommunications. No impacts to the power grid, satellite or other technological systems have yet been reported from the geomagnetic storm, which persisted for several hours.

The spot on the sun that produced the coronal mass ejection remains active and is well positioned to deliver more storm activity. NOAA's SWPC will continue to watch the active region for activity, and will continue to inform its customers — grid operators, satellite operators, airlines and more — about what to expect, so they can protect infrastructure and the public.

Space weather can also trigger spectacular aurora (northern and southern lights). This latest solar storm has provided viewers in northern Asia and Europe with an opportunity to see the aurora.

If you want to see what a CME looks like, check out the following YouTube link: http://www.youtube.com/watch?v=5ghMaiH1sEg&feature=player_embedded

If for some reason the link doesn't work, do a search on "Space Weather Model Animation Showing Coronal Mass Ejection (CME) Impacting Earth". Enjoy the viewing and the fact that you don't need an umbrella to weather this kind of storm.

What is Happening in Alaska?

Portions Taken from a Reuters article by

Yereth Rosen

Permafrost is well, permanent, no? Not when it thaws and causes mudslides that block roads that have been used for years as a main thoroughfare for busses and sightseers.

These busses have been bringing tourists to see glaciers from convenient viewing areas, but the glaciers have suddenly become camera shy and are receding forcing tour guides to hike through areas that used to be buried under deep ice. Panoramic views of arctic tundra are suddenly becoming obscured by newly sprouted bushes that not too long would not survive in the harsh climate.

What is going on? It seems that many of Alaska's national parks are seeing the first effects of the warming of our climate.

While NOAA's official term for what is happening is "global climate change", in may areas this change is manifesting itself in the form of warmer temperatures, plant life that has no precedent in recent history, birds and insects being seen in areas that human inhabitants have not experienced before, even the melting of sea ice in areas where local people do not have words in their language for things such as "shoreline" and "tides". Some of these same people also had no name for "thunderstorm" since it was never warm enough for them to occur there before.

Since the mid-1970's Alaska, and more generally the Arctic has warmed at three times the rate of the lower 48 states, and this fits the scenario predicted by climate scientists who state that the changes at high latitudes will be more pronounced than at the mid latitudes, but even in the lower 48 change is in the air.

Mosquitoes and other insects are showing up earlier and later in the year than ever seen before, as are certain birds that like to dine on them. Ski areas in New England have recorded the skiing and snowmobiling season has shortened by as much as 3 weeks on average over the last several decades. Blueberries that used to be almost exclusive to some areas of Maine are now being harvested north of the border in Canada as well. There are numerous examples such as these.

Some still debate whether the warming is a short term cycle buried in the long term variability which is our climate. Others acknowledge the warming but debate the cause. Whatever one's opinion on the matter, it will remain a big challenge for meteorologists, climate researchers as well as the public in general to learn and adapt to changes that in many areas are happening at an ever accelerating rate.

Global Warming and Theories

By Richard Grumm, Science Officer

Global warming is an issue often in the news and is often cited as being just a "*theory*". This raises two important points. First is global warming real and second what is the definition of a theory? Both points will be examined starting with three often misunderstood scientific terms.

There are three critical terms often used in science to explore, define, and explain things. The simplest starting point is a *hypothesis*, which is an educated guess, often based on observation. The classic story of an apple falling upon Newton is often cited as the roots of the *theory of gravity*. He observed the apple's fall and hypothesized that a force called gravity caused this action. In biology, the story of Fleming seeing his cultured bacteria dying in the presence of bread mold led the hypothesis that there was a substance that could be used to kill bacteria. The theory of recent global warming grew out of basic observations of warming over the oceans and land sites during the 1970s and 1980s (Fig. 1). From these observations a hypothesis was presented which has undergone several decades of testing.

Theories evolve out of testing and retesting a hypothesis. Newton developed his theory of gravity, without resorting to personally testing it from any great heights, and Fleming went on to develop penicillin to help fight bacterial infections. Of course Einstein developed the theory of relativity too. While we may not understand all the science behind all the theories, most of us accept these as sound and factual. After all we know to not test the theory of gravity by jumping off a building, we take antibiotics to fight infections, and we know travelling faster than the speed of light is currently not possible. We accept these theories and do not mistake them for hypothesis. For all practical purposes, a theory is a well-tested hypothesis and is accepted to be true until proven otherwise. We do know and can demonstrate that the climate has been warming for several decades and as of October 2011, this year ranks as the 11th warmest on record (NOAA-State of the Climate). The American Meteorological Society (AMS) publishes the State of the

Climate for each year in Bulletin of the American Meteorological Society. These data generally show a marked warming trend over the past 20-30 years.

In science, after repeated tests and repeated observations, when no exceptions have been found, a theory become a *law*. Newton's theory of gravity evolved into the Law of Gravity. Though Newton developed an equation for the law of gravity and could explain how bodies interact and that the force of gravity would accelerate an object to the Earth if dropped from a tall building, he offered no explanation as to *why*. Thus, the Law of Gravity is accepted by all but to date we do not know what drives this force.

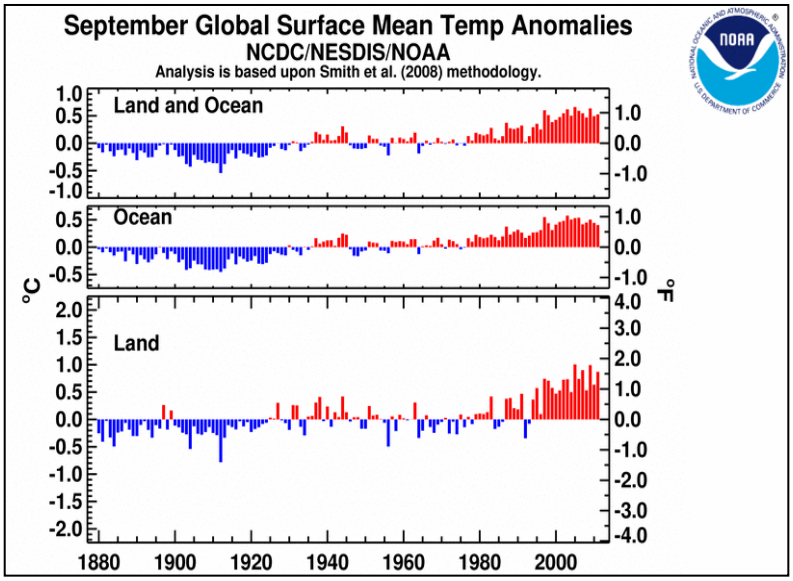


Figure 1. The trends in temperature anomalies since 1880 over the combined land-ocean areas, the oceans, and over land. Based on NOAA data sets.

Global warming is sort of like the Law of Gravity. We know that the climate system of the Earth is warming. We know the extent of arctic sea ice is diminishing (AMS State of Climate 2010) and that 2007-2010 were 4 years with the smallest areal coverage of Arctic Sea Ice on record. Thus, the coveted Northwest Passage (Henry Hudson's Third Voyage), or ice free route in the Arctic Ocean was present during September 2010. The signs of global warming are quite obvious, observable, and measureable.

We also know that the Earth's land and ocean based temperatures have been rising. We also know that there have been warm and cold periods in the past. The current theory about recent global warming seems well supported by the data. We are getting warmer.

Similar to what causes gravity, the more interesting question is what is causing this period of warming? Most of the controversy about global warming centers on this single issue. Climate modelers and scientists attribute a significant portion of global warming to the increase of carbon dioxide (CO2) in the atmosphere (Fig. 2). Data suggest that since the Industrial Revolution the burning of carbon based fuels has increased the level of CO2 which in turn has led to an increase in global temperatures. The concentration of CO2 has been reconstructed for a period extending back about 420,000 years. These data suggest that prior to the Industrial Revolution, CO2 concentrations ranged from a low around 200 parts per million during glacial periods to a high of about 280 parts per million during interglacial periods. The concentration of CO2 has risen

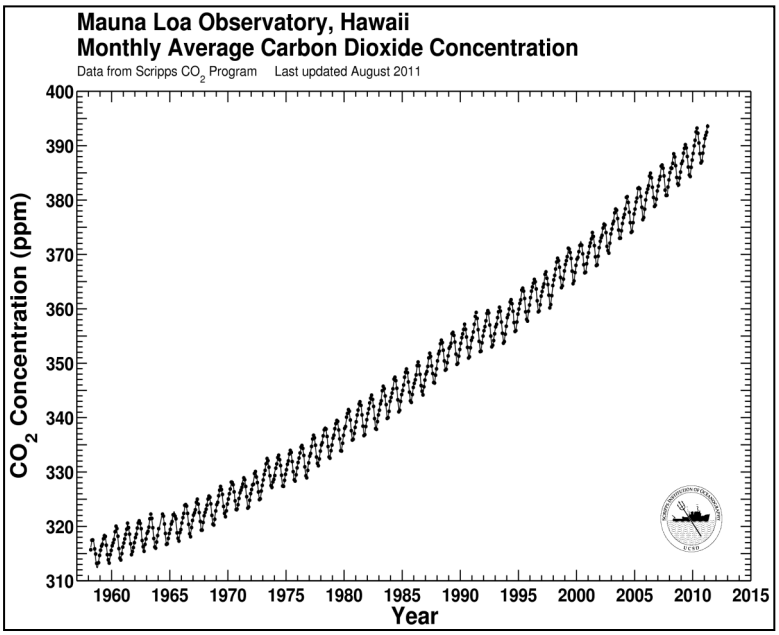


Figure 2. Trends in concentrations of carbon dioxide in the atmosphere from 1957 through 2010. Data are from the Mauna Loa Observatory in Hawaii and

sharply in the last 100 years to over 380 parts per million and in the near future will top 390 ppm.

The Earth's climate system is quite complex and has undergone many periods of extraordinary warmth and alternate periods where glaciers have covered vast expanses of the planet. CO2 is only one of several greenhouse gases and is generally in low concentrations relative to the others. Despite this, climate modelers have shown that there is a significant impact on trends in the Earth's temperature based on the amount of this gas in the atmosphere. Thus, the theory of climate change and the recent period of global warming is testable and provable based on repeated observations. There may be many contributing factors including the increase in other greenhouse gases such as methane (CH4), but like gravity, while we know it is happening we may not know exactly why.

So while almost all of us have a very high confidence level that gravity is real and few of us would really want to personally test it from high heights, it is left to the reader to decide at what level of confidence we should consider the potential that global warming is real and a serious issue?

Finally, the next time someone tells you "*it is just a theory*" you can explain to them the difference between a tested theory and a hypothesis.

Editor's note: NOAA officially refers to the whole subject that includes warming as "Global Climate Change" and our official position is that we will continue to strive to provide information for understanding the issue, but not offer opinions as to the actual causes.

Anybody Around Here Happen to See an NEO Lately?

By Barry Lambert, Senior Forecaster

The advent of new and rapid improvement of current observing systems has allowed astronomical scientists to discover asteroids and comets having unusual orbits with increasing frequency. A very small percentage of these Near Earth Orbiters (NEOs) has the potential to become a hazard to Earth and its inhabitants.

What is an NEO?

NEOs comprise a spectrum of objects from asteroids, meteors, meteorites to comets and potentially hazardous objects (such as weather or other observational satellites falling out of orbit).

A meteor is the somewhat elusive streak of light through the sky created by a meteoroid (the smaller cousin of an asteroid and comet). When the piece of "space rock" reaches the earth's surface, it's called a meteorite. Meteors have been observed by residents of this planet since prehistoric times, but it's only became known around the year 1800 that they were caused by rocks falling from space and racing through the earth's atmosphere at speeds between 11 and

Figure 1. Types of Near Earth Objects

Meteoroid Class	Meteoroid Mass/Size	Primary Origin	Phenomenon Descriptor	Visual Magnitude	Comments
1	<100µ	Comets	Micrometeorites	None	Survive entry without vapourisation. No detectable meteor. Add 30,000-40,000 tons to Earth mass / year. Interplanetary dust.
2	100µ - 1mm	Comets	Submeteors	10 to 5	Can be detected by radio/radar. Do not survive atmospheric entry.
3	1mm - 3cm	Comets	Meteors	5 to -4	Visible. Do not survive ablative re-entry process.
4	3cm - 30cm	Cmts/Ast	Fireballs	-4 to -12	Bright meteor. IAU current designation.
5	10cm - 1m	Asteroids	Bolides	-12 to -20	Very bright meteor. Old IAU designation of a fireball. At this size the meteoroid penetrates below 50km and often produces sounds.
6	100kg-100t 0.4m - 4m	Asteroids	Meteorites	-16 to -23	Meteor must generally by brighter than mag -18 and body has to penetrate below 20 km altitude. Impacts at about 100m/s. Possible pit if large.
7	100-10000t 4m - 20m	Asteroids	Impactors	< -22	Meteoroid is so large that the column of air it encounters is insufficient to reduce its speed. Vapourises on impact making crater.
8	10^4-10^{10}t 20m - 1km	Asteroids	Disasters	< -30	Impact releases enormous energy. Tidal wave, earthquake, dustcloud.
9	> 1km > 10^{10}ton	Asteroid	Catastrophe	??	Global hazard. > 25% global deaths. If >4km then mass extinction.

Table 1. Meteoroid Sizes

73 km per hour. This high velocity meteoroid collides with air molecules and heats the surface of the meteoroid and the air to incandescence. This streak of light is composed of about 95% heated air, and about 5% vaporized rock.

Meteoroids typically range in size from a grain of sand to small gravel (or a millimeter to centimeter in diameter). Larger meteoroids (called fireballs or bolides) can range in size from a gravel-sized stone to about the size of a large boulder (1 meter in diameter). A nice video summary of these celestial objects is found here – http://news.discovery.com/videos/asteroids-and-meteorites/

Meteors typically become visible to the casual observer between 100 and 120 km in altitude, while the more imposing and hazardous larger asteroids and comets can become visible at over 200 million km (about 100 million miles) from earth.

A subset of Near Earth Orbiters (NEOs) is a Near Earth **Asteroid** (NEA). If there is a (typically very small) chance it will collide with the Earth and cause significant damage at some point in the future, it is also labeled a Potentially Hazardous **Asteroid** (PHA). NEAs are classified as PHAs if their Minimum **Orbit** Intersection **Distance** (MOID; their closest possible approach to Earth) is less than 0.05 **AU** (roughly 4.6 million miles) and their **absolute magnitude** is less than 22 mag (110-240m).

The minimum size for this type of asteroid is between 110m and 240m in diameter. At this minimum size, the effects of the impact will be significant but mostly localized. However, by the time we reach kilometer-sized objects (magnitude ~ 18), areas the size of whole countries will be directly affected, and the impact will have global consequences.

Once they're discovered, PHAs are monitored continuously, since their **orbits** may be perturbed slightly through gravitational interactions with the **planets** and other bodies. These perturbations may significantly reduce the MOID of the **asteroid** over a short **period** of time and increase the risk of collision. Alternatively, the MOID may increase, essentially removing the hazardous threat of the object. At present, there are 719 PHAs catalogued, 154 of which have diameters of 1 km or greater.

Recent and Upcoming NEO's

The table found at this link http://neo.jpl.nasa.gov/ca/ shows NEO close approaches to Earth during the next several months.

The relatively small (10 meters wide) asteroid, 2009 TMB recently passed within 0.0023 solar distance (0.9 lunar distance or only 400,000 miles) from Earth on October 17, 2011. Earlier this year, a car-sized asteroid named CA7 flew within ~64,300 miles of Earth's surface at 2:25 pm EST on Feb 11. Less than 1 week earlier (on Feb 4, 2011), a smaller asteroid (CQ1) cruised by harmlessly at an altitude of 3400 miles.

http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2009%20TM8;orb=1;cov=0;log=0;cad=0#orb

1). ***2005 YU55*** This relatively large (400 meters in diameter) asteroid will pass within 0.85 lunar distances (about 200,000 miles) from the earth at 628 pm EST on

November 8, 2011. It should be emphasized that although this asteroid is classified as a potentially hazardous object, 2005 YU55 poses no threat of colliding with Earth over at least the next 100 years. However, this will be the closest approach to date by an object this large that we know about in advance.

YU55 orbits the sun every 14 years and last passed the earth in April 2010 at a distance of 1.5 million miles. If it were to hit the earth, the asteroid, named YU55, would have an impact equivalent to 65,000 atom bombs and would leave a crater more than six miles wide and 2,000 ft deep.

"The close Earth approach of 2005 YU55 on Nov. 8, is unusual since it is close and big. On average, one wouldn't expect an object this big to pass this close but every 30 years," said Don Yeomans, manager of NASA's Near-Earth Object Program Office and the Jet Propulsion Laboratory in Pasadena, Calif.

2005 YU 55 will initially pass just inside the Earth's orbit with the sun and will be too faint for optical observers during the daylight hours. However, later in the evening on Nov. 8, the asteroid could reach about 11th magnitude for several hours before it fades as its distance rapidly increases.

An excellent tutorial showing the asteroid's precise track with respect to the earth and moon is available on YouTube at –

http://www.youtube.com/watch?v=bML29gjUAHA

You can also check out the animated track of 2005 YU55 at this link - http://earthsky.org/space/2005-yu55-asteroid-will-sweep-near-earth-november-8-2011

An event of this type will not happen again until 2028 when asteroid (153814) 2001 WN5 will pass to within 0.6 lunar distances.

2). ***2001 WN5*** is 630-1400m in diameter and belongs to the Apollo family. It was first discovered by the LONEOS Project at Anderson Mesa on November 20, 2001, and was later classified as a Potentially Hazardous Asteroid (PHA). 2001 WN5 will pass within 250,000 km (0.65 lunar distances) from the Earth on June 26, 2028. It will make an initial pass (38 lunar distances, 0.0975 AU), travelling at 8.35 km/second, to the Earth-Moon system at 3:14 am EDT on the 27th August, 2019.

3). The previously "Apocalyptic" Apophis -

Asteroid 99942 2004 MN4 called "Apophis" is currently the "most infamous" near earth orbiter. Its size is between 1100 and 1500 feet long. Upon its discovery in 2004, Apophis was briefly estimated to have a 2.7% chance of impacting the Earth in 2029. The possibility of impact kept Apophis at Level 1 on the Torino Impact Hazard Scale. It broke the record on the Torino Scale because it went to Level 4 before it was lowered.

- In February of 2008 the Planetary Society asked companies and students to submit space probe designs that would place a type of tracking device on or at least near Apophis. The award would be $50,000.

In 2005 it was said that this asteroid would pass right below the geosynchronous satellites which sit at 22,236 miles above earth. An asteroid that comes in that close to Earth happens on once in every 1,300 years.

Actually, two potential dates had been set for Apophis' collision with earth: April 13, 2029, and April 13, 2036. On October 7, 2009, NASA's Jet Propulsion Lab recalculated the path of Apophis. It confirmed the most likely date is April 13, 2036, but the odds were extremely slim (4 in 1 million) that the collision with earth would actually occur.

Apophis will pass within 0.0966 AU (14,450,000 km; 8,980,000 mi) of the Earth in 2013, thus allowing astronomers refine and better specify the trajectory for future close passes.

Its closest approach to earth will be on Friday, April 13, 2029, when it will pass Earth within the orbits of geosynchronous communication satellites. Check out the animation of its passage here – http://www.youtube.com/watch?v=RisIljntt2c

It will return for another close Earth approach in 2036. It's interesting to note that the 2029 pass will actually be much closer than first predicted. However, the uncertainty is such that an impact is basically ruled out. Similarly, the pass on April 13, 2036 carries little risk of an impact.

The following link gives a time table of Apophis' past and future close approaches to earth.
http://www.howcloseisapophis.com/encounters.asp

Figure 4. Photo of Apophis Asteroid

Here are some additional links of interests to learn more about NEOs:

http://rst.gsfc.nasa.gov/Sect19/Sect19_22.html

http://pan-starrs.ifa.hawaii.edu/public/asteroid-threat/asteroid_threat.html

http://www.pbs.org/wgbh/nova/teachers/viewing/3313_01_nsn.html

Update your Spotter Contact Information

By Bill Gartner, General Forecaster

Please help us to keep your contact information up to date. If any of your information (name, phone number, addresses, etc.) has changed recently, please let us know. Send an email or 'snail mail' note to us at one of the addresses below.

email: william.gartner@noaa.gov

U.S. mail:

William Gartner/Skywarn Spotter Update

NWS/WFO State College

328 Innovation Blvd, Rm #330

State College, PA 16803

If you are not sure that we have the most up to date information on file, please send an email or note with your current information and we will update it.

Note that your personal information is NOT shared with or given to anyone outside of the NWS (without permission) and is used only to contact you in the event of severe weather, mail SkywarnNews, or communicate important program changes.

Go Green...Save a Tree

In our continuing efforts to save natural resources (use less paper) and conserve government resources (reduce printing and mailing costs), we provide spotters the option of being notified by email when a new issue of *SKYWARNEWS* is available. If you currently get the printed version and would prefer to be notified by email, contact wilam.gartner@noaa.gov and include 'SKYWARNEWS via email' or similar in the subject line. Please include your name, spotter ID # and your county in the email.

We Need Your Reports Year-Round

As we head in to winter, we need to hear from you. Your spotter reports help us to monitor ongoing winter storms, determine the need for possible changes to advisories and warnings, and provide real-time snowfall totals to the public, media and other NWS offices. Your reports are also used to verify our watches and warnings, as well as to prepare storm summaries of winter events. So even if you are not able to call in reports during a storm, but can give us a post-storm total snowfall, we'd still love to hear from you.

Please report the following:

Snow:
- When snow accumulation reaches 3 inches or 6 inches
- Storm total after the snow ends (also water equivalent if possible)
- If snow is falling at the rate of more than 1 inch per hour

Ice:
- Any occurrence of or accumulation of freezing rain
- Accumulation of ice of ¼ inch or more on trees or wires

Other:
- When forecast winter precipitation differs significantly from observed (i.e. snowing with no snow in forecast, sleet...when only snow is forecast...)
- Any other significant weather occurrence/oddity (i.e. flooding due to snow melt/ice jam, damage from strong winds not associated with a thunderstorm)

*Remember thunderstorms that produce wind damage and flooding rains are still possible even in winter.

A list of reporting criteria is available on our web page, www.weather.gov/statecollege. Click on "~Send Us Reports" in the left-hand column. It is the fourth selection under the ***Current Hazards*** header.

SKYWARNEWS

National Weather Service
328 Innovation Blvd
Suite #330
State College, PA 16803

TO: