NATIONAL WEATHER SERVICE, NEWPORT/MOREHEAD CITY, NC

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CAROLINA SKY WATCHER

SUMMER 2012 EDITION

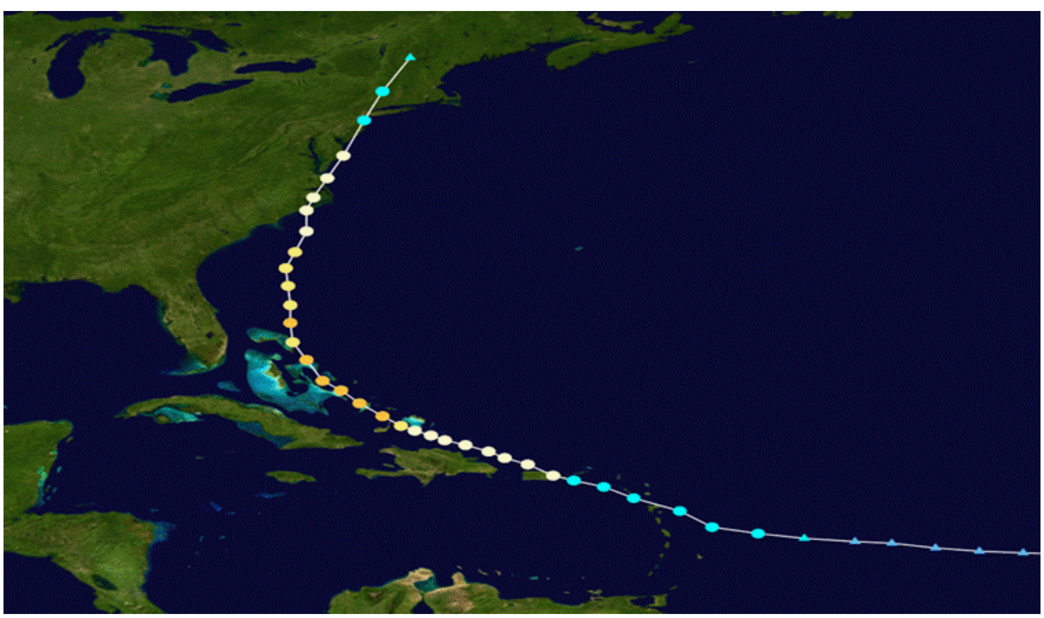
TROPICAL SEASON 2012

by Chris Collins, Meteorologist

The 2012 Atlantic hurricane season officially began on June 1 and will end on November 30. The 1961-2009 yearly average for the Atlantic Basin, which includes the Atlantic Ocean, Caribbean and Gulf of Mexico, is 11.3 named storms (tropical storms and hurricanes), including 6.3 hurricanes and 2.3 major hurricanes (Category 3 or higher), according to NOAA.

Eastern North Carolina is quite familiar with tropical storms and hurricanes. National Hurricane Center research shows that the Outer Banks of North Carolina experiences hurricane force winds every 5 years and a major hurricane every 16 years, the highest of anywhere along the United States coast. In 2011, Hurricane Irene brought downed trees, flooding rain and storm surge to most all of Eastern North Carolina and the Outer Banks.

The latest hurricane forecasts from NOAA indicates that the number of tropical systems are expected to be near average this year. Warmer-than-average Atlantic basin sea-surface temperatures and the presence of a La Nina enhanced the number of named storms during each of the past two seasons. In May, Tropical Storm Alberto moved well east of the North Carolina coast, while Tropical Depression Beryl produced heavy rainfall and a EF-1 tornado in Peletier in Carteret County (see Page 2).



Path of Hurricane Irene, August, 2011

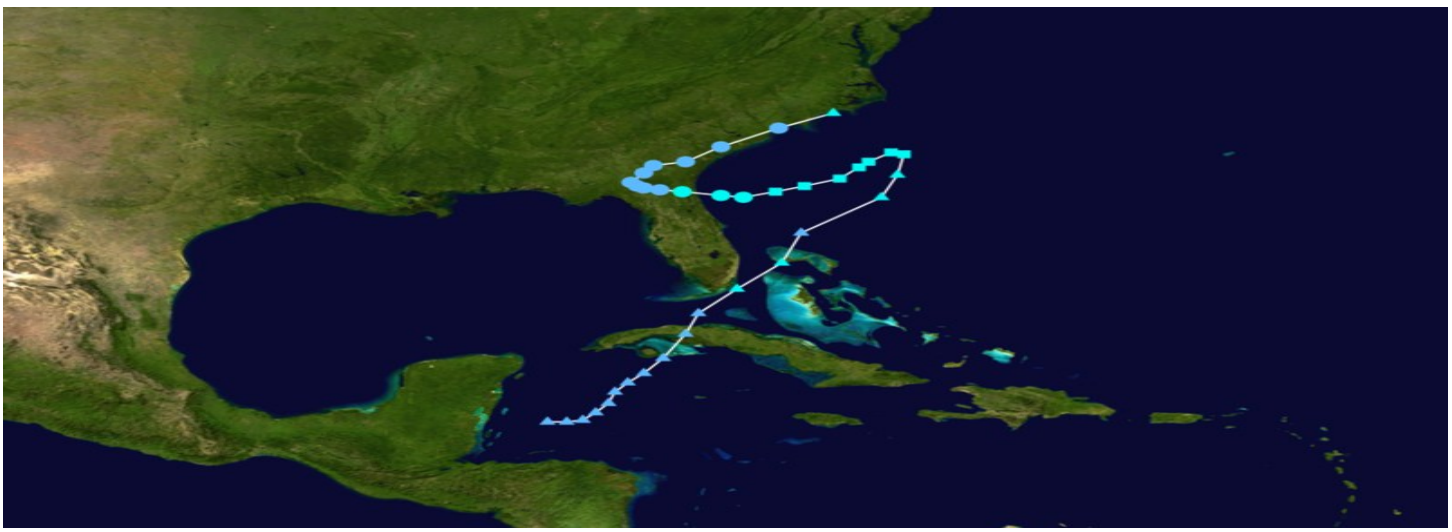
INSIDE THIS ISSUE

Beryl Visits the Area

by Chris Collins, Meteorologist

Tropical Storm Beryl was the strongest off-season Atlantic tropical cyclone to make landfall in the United States on record. Beryl developed on May 26 from a low-pressure system near the East Coast of the United States and was classified as a Subtropical Storm on May 27. Late on May 27, Beryl transitioned into a tropical cyclone while less than 120 miles from North Florida. Early on May 28, the storm moved ashore near Jacksonville Beach, Florida, with peak winds of 70 mph . It quickly weakened into a tropical depression, and dropped heavy rainfall while moving slowly across North Florida and South Georgia. A cold front turned the storm to the northeast, and Beryl affected Eastern North Carolina during the morning and afternoon hours of May 30.

Beryl produced widespread 2 to 4 inch rainfall amounts across Eastern North Carolina, with amounts of up to 6 inches reported in Hyde County. Beryl produced a brief EF-1 tornado in Peletier in Carteret County around 10:34 AM. The tornado touched down near the intersection of Little Kinston Road and Buster Road and then progressed west-northwest along Little Kinston Road and Carter Shores Road and lifted as it moved into the White Oak River. Approximately 67 homes were damaged and 3 modular or mobile homes as well as one garage and several small outbuildings were destroyed. Nearly one hundred fifty pine trees were snapped in half with many other trees uprooted. No injuries were reported.



Track of Tropical Depression Beryl, May 26 through 30, 2012 (courtesy Wikipedia)

Tornado damage in Peletier, May 30, 2012

Satellite image of Tropical Depression Beryl (courtesy NASA)

2012 Hurricane Season Outlook

by Hal Austin, Meteorologist

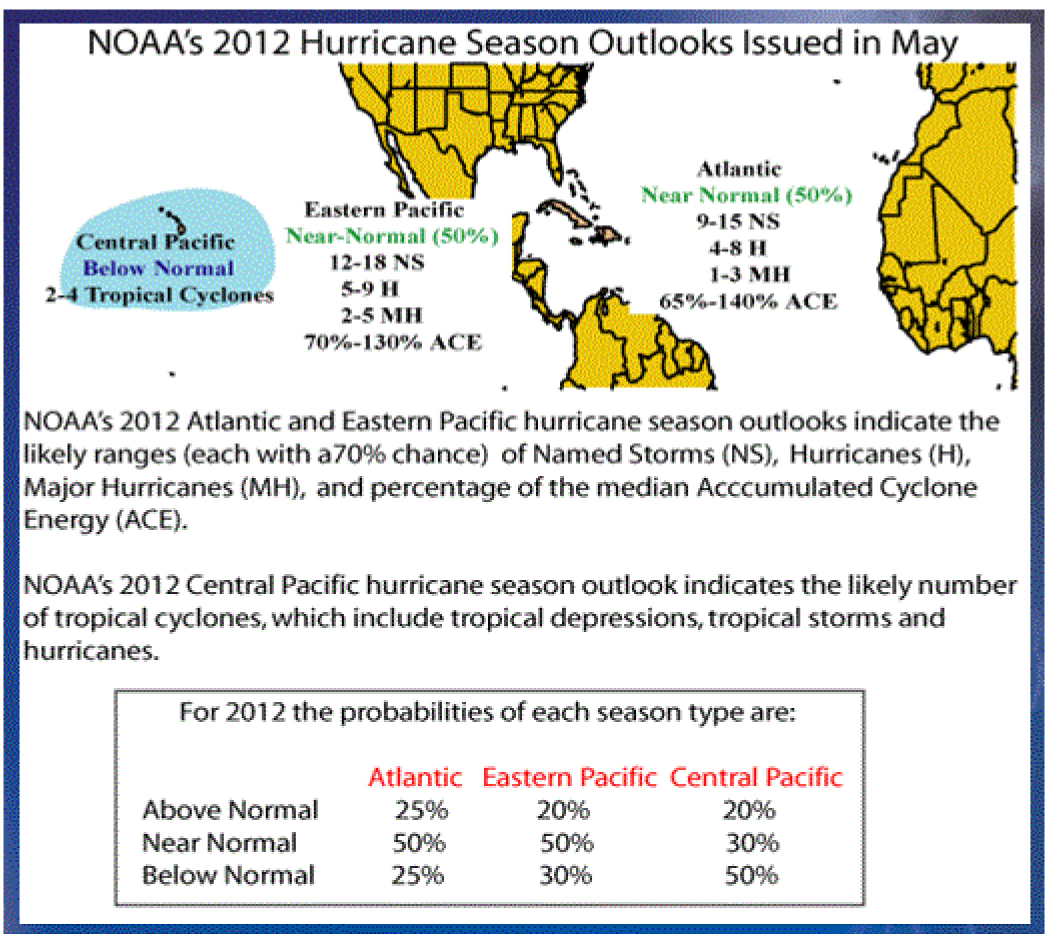
NOAA's 2012 hurricane season outlook, released May 24, predicts a near normal season is most likely. The outlook calls for a 50% chance of near normal conditions, 25% of below normal and a 25% chance of above normal. Why a near normal season? There are several competing factors, along with several sea surface temperature and circulation features that suggest a less active season as compared to many in recent years. Favoring an above-normal season is the continuing conditions that have been associated with increased Atlantic hurricane activity since 1995, combined with expected near-average sea surface temperatures across much of the tropical Atlantic Ocean and Caribbean Sea.

A potential competing climate factor that would work against an above normal season is the possible development of El Niño during the season. If El Niño develops, it could make conditions less conducive for hurricane formation and intensification during the peak months (August-October) of the season, thus shifting the activity toward the lower end of the predicted range. If they persist, two other factors that are now present could also compete with conditions associated with the high-activity era. These are: 1) enhanced vertical wind shear in the upper atmosphere, and 2) cooler-than-average sea surface temperatures in the far eastern tropical Atlantic.

Given the current and expected conditions, combined with model forecasts and possible competing factors, NOAA estimates a 70% probability for each of the following ranges of activity during 2012:

9-15 Named Storms, 4-8 Hurricanes and 1-3 Major Hurricanes (category 3 or higher).

NOAA will update the Atlantic hurricane season outlook in early August, which coincides with the onset of the peak months of the hurricane season. Regardless of the overall activity predicted in the outlook, it only takes one storm hitting your area to cause a disaster! Therefore, residents, businesses, and government agencies of coastal and near-coastal regions are urged to prepare every hurricane season.



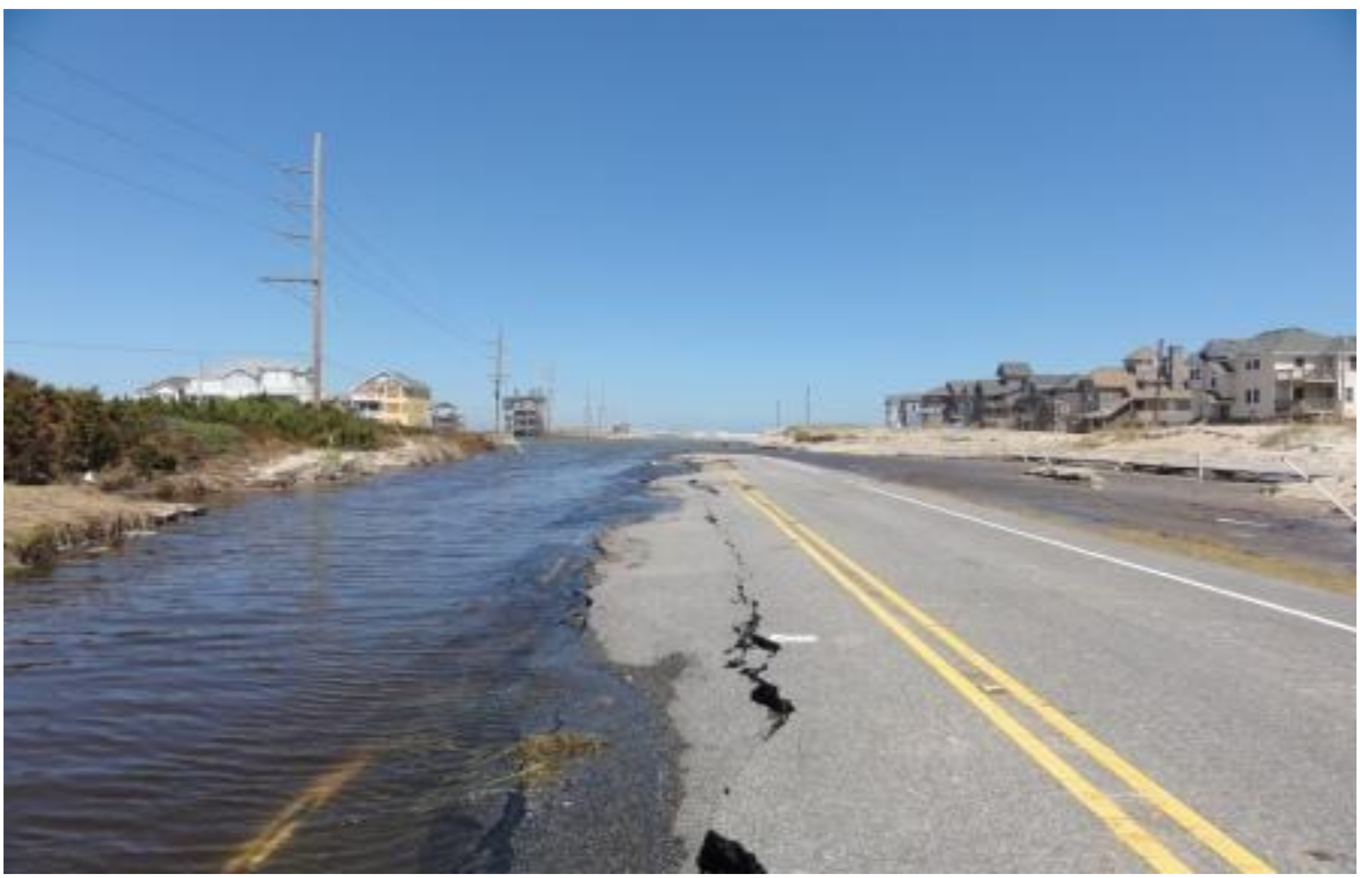
Hurricane Irene Review

by Chris Collins, Meteorologist

Hurricane Irene was a large and powerful Atlantic hurricane that left extensive flood and wind damage along its path through the Caribbean, the United States East Coast and as far north as Canada. Irene made landfall near Cape Lookout at around 7:30 AM EDT on August 27, 2011 as a strong category 1 storm. Irene caused 5 deaths in North Carolina. On the evening of August 26, well ahead of landfall, Hurricane Irene also spawned several tornadoes. One EF-2 tornado near Columbia in Tyrrell County demolished at least 4 homes and overturned cars.

Precipitation totals associated with Irene were particularly high with totals ranging from around 5 inches over the Northern Outer Banks, to around 15 inches in Beaufort County. Bunyan in Beaufort County reported 15.66 inches. Doppler Radar estimated totals of over 17 inches in portions of Beaufort, Craven and Pamlico Counties. Extensive storm surge and wind damage also occurred with Irene. The peak wind gust recorded was 115 mph at the Cedar Island Ferry Terminal in Carteret County as the eye was moving ashore. Trees were down throughout eastern North Carolina and thousands were left without electricity. Ocean and Sound overwash created numerous breaches of Highway 12 along the Outer Banks.

As the eye wall of Irene moved ashore, a low pressure reading was observed at Beaufort with 28.11 inches of mercury or around 951 millibars at 8:56 AM. Strong winds and driving rains pounded most of Eastern North Carolina into the mid-afternoon hours on Saturday. As the eye moved inland, strong westerly winds on the backside of the storm gusted to near 100 mph at Atlantic Beach around 10:30 AM. Storm surge levels of over 10 feet were observed at Ocracoke and several breaches of Highway 12 were noted all along the Outer Banks.



Hurricane Irene storm surge damage on Highway 12 along the Outer Banks

CHANGES TO THE SAFFIR-SIMPSON SCALE

by Chris Collins, Meteorologist

The Saffir-Simpson scale was originally developed in 1971 by civil engineer Herbert Saffir and meteorologist Bob Simpson, who at the time was director of the National Hurricane Center. The scale was introduced to the public in 1973, and saw widespread use after Neil Frank replaced Simpson at the helm of the NHC in 1974.

The initial scale was developed by Saffir, who in 1969 went on commission for the United Nations to study low-cost housing in hurricane-prone areas. While performing the study, Saffir realized there was no simple scale for describing the likely effects of a hurricane. Similar to the Richter magnitude scale in describing earthquakes, he devised a 1–5 scale based on wind speed that showed expected damage to structures. Saffir gave the scale to the NHC, and Simpson added the effects of storm surge and flooding.

In 2009, the NHC made moves to eliminate pressure and storm surge ranges from the categories, transforming it into a pure wind scale, called the Simpson Hurricane Wind Scale (Experimental). The new scale became operational on May 15, 2010. The scale excludes flood ranges, storm surge estimations, rainfall, and location, which means a Category 2 hurricane which hits a major city will likely do far more cumulative damage than a Category 5 hurricane that hits a rural area. The agency cited various hurricanes as reasons for removing the "scientifically inaccurate" information, including Hurricane Katrina and Hurricane Ike which both had stronger than estimated storm surge and Hurricane Charley which had weaker than estimated storm surge.

The Saffir-Simpson Hurricane Wind Scale is undergoing a minor modification for 2012 in order to resolve awkwardness associated with conversions among the various units used for wind speed in advisory products. The change broadens the Category 4 wind speed range by one mile per hour (mph) at each end of the range, yielding a new range of 130-156 mph. This change does not alter the category assignments of any storms in the historical record, nor will it change the category assignments for future storms.

Summary of the SSHWS change (highlighted in yellow):

Category	Previous range	New range
1	74-95 mph 64-82 kt 119-153 km/h	74-95 mph 64-82 kt 119-153 km/h
2	96-110 mph 83-95 kt 154-177 km/h	96-110 mph 83-95 kt 154-177 km/h
3	111-130 mph 96-113 kt 178-209 km/h	111-129 mph 96-112 kt 178-208 km/h
4	131-155 mph 114-135 kt 210-249 km/h	130-156 mph 113-136 kt 209-251 km/h
5	156 mph or higher 136 kt or higher 250 km/h or higher	157 mph or higher 137 kt or higher 252 km/h or higher

Advanced Hydrologic Prediction Service

by Brian Cullen, Meteorologist

The Advanced Hydrologic Prediction Service (AHPS) is an essential component of the Climate, Water, and Weather Services here at the National Weather Service office at Newport/Morehead City NC. AHPS is a web-based suite of accurate and information-rich hydrological forecast products. AHPS displays the magnitude and uncertainty of occurrence of floods, from hours to days and months, in advance. These graphical products enable government agencies, private institutions, and individuals to make more informed decisions about risk-based policies and actions to mitigate the dangers posed by floods.

Weather influences our economic and social lives in many ways. Severe weather can have impact on revenues and profits of businesses, large and small. Weather can also disrupt and disorganize communities. As our nation's population grows and infrastructure costs increase, natural disasters can threaten social stability. Weather forecasting was initially developed in response to the need of societies to protect themselves from storms, severe heat and cold, floods, etc., and minimize consequent economic losses. It is estimated that inland flooding claims 133 lives and property losses from flooding exceed $4 billion in an average year in the U.S. The National Weather Service (NWS) is the nation's agency entrusted with the mission to protect life and property and to enhance the economy.

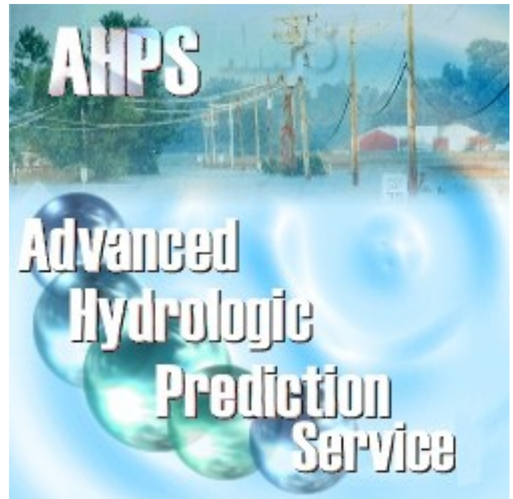
Impelled by experiences with major floods in 1993 in the Midwest, the Des Moines river basin was selected as a test site for AHPS product development. The successful demonstration of AHPS on the Des Moines river was favorably received by local water resource and emergency management agencies. The devastating floods in the upper Midwest and Plains states in 1997 provided an increased sense of urgency. The NWS began AHPS implementation at offices in Wisconsin, Minnesota, Michigan, Iowa, Missouri and North Dakota. AHPS was quickly expanded to include tributaries within the Ohio River basin in parts of Kentucky, Ohio, and western Pennsylvania. Today, AHPS is available nationwide at over 2,500 locations from coast to coast, including Alaska. While floods are impossible to prevent completely and there is not a way to guarantee protection of property, the NWS and other federal, state, and local agencies have proved the loss of life can be greatly reduced with better forecasting.

The vast majority of the observed water level data displayed on the AHPS web pages originates from the Hydrometeorological Automated Data System (HADS) operated by the Office of Hydrologic Development. HADS is a data acquisition, data processing, and data distribution system. HADS acquires and processes raw hydrological and meteorological observational data from thousands of ground based Data Collection Platforms (DCPs) owned and operated by hundreds of federal, state, and local agencies around the United States. Following the processing of the raw data, HADS delivers the observational data to the Weather Forecast Offices (WFOs) and River Forecast Centers (RFCs) in the form of collective data products tailored for each office's use. The WFOs and RFCs subsequently use the data in their hydrologic models and create the informational displays that may be viewed on the AHPS web pages.

Using sophisticated computer models and large amounts of data from a wide variety of sources such as super computers, automated gauges, geostationary (GOES) satellites, Doppler radars, weather observation stations, and the computer and communications system, called the Advanced Weather Interactive Processing System (AWIPS), the NWS provides hydrologic forecasts for almost 4,000 locations across the United States. These forecasts are developed by our River Forecast centers and distributed by our field offices for a wide range of customers.

The current group of AHPS products covers forecast periods ranging from hours to months. It also includes valuable information about the chances of flood. This information is presented through user-friendly graphical

AHPS (CONTINUED)



products. The information, such as the flood forecast level to which a river will rise and when it is likely to reach its peak or crest, is shown through hydrographs. Other information includes,

1.) the chance or probability of a river exceeding minor, moderate, or major flooding,

2.) the chance of a river exceeding certain level, volume, and flow of water at specific points on the river during 90 day periods, and

3.) a map of areas surrounding the forecast point that provides information about major roads, railways, landmarks, etc. likely to be flooded, the levels of past floods, etc.

AHPS forecast products are a basis for operation and management of flood-control structures. Emergency management officials at local and state levels use these forecasts to fight floods, evacuate residents, and to take other measures to mitigate the impact of flooding. As the population grows, people increasingly choose to live near water, creating an increased need for the NWS to educate the public about flood hazards and to improve flood forecasts. These products can be used by a wide range of people, such as barge operators, power companies, recreational users, farmers, households, businesses, and environmentalists.

Additional information on the Advanced Hydrologic Prediction Service may be obtained on line at http://www.nws.noaa.gov/oh/ahps.

Newport/Morehead City NWS AHPS Web Page

AHPS Hydrograph for the Roanoke River

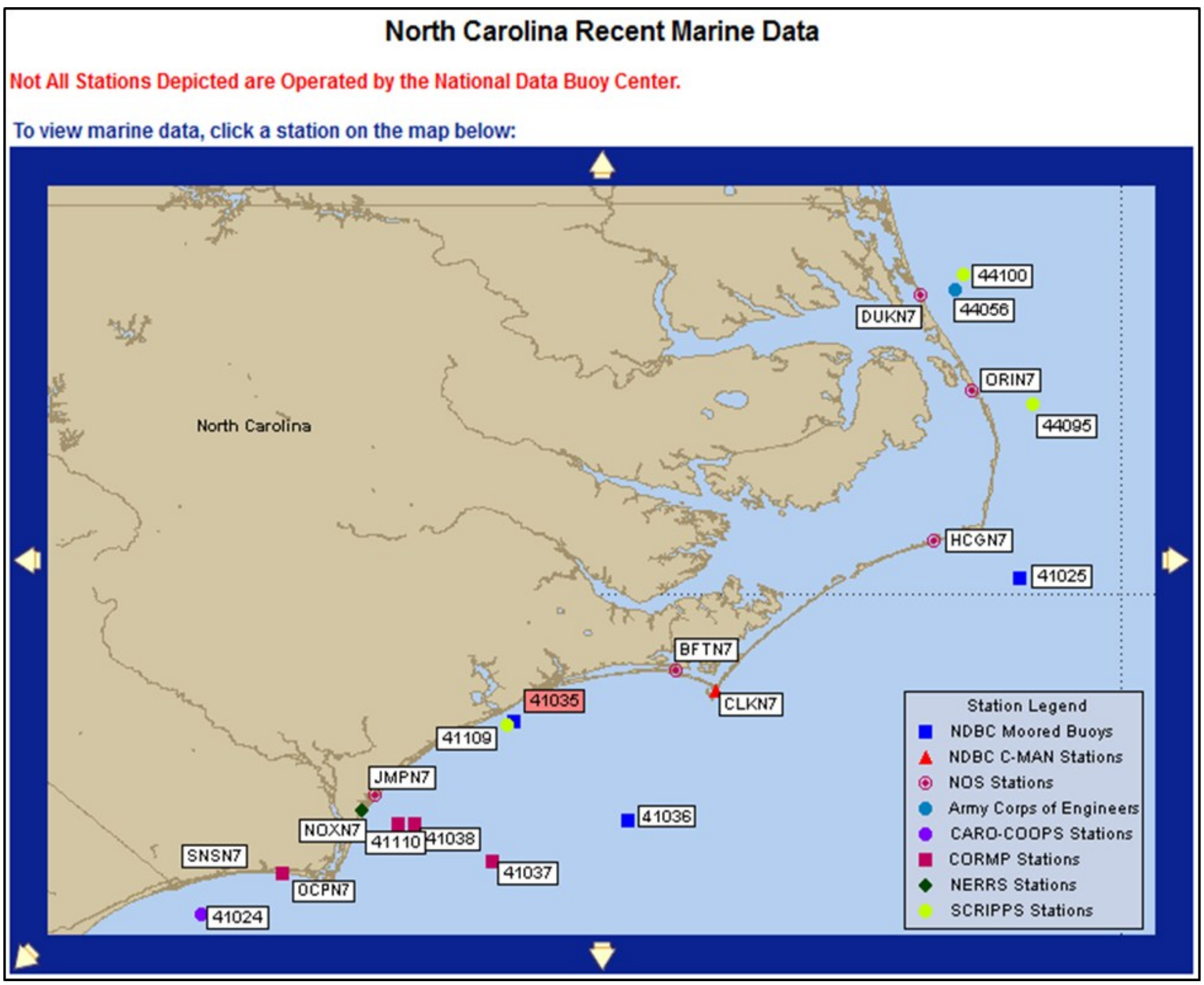
Eastern North Carolina Buoy Update

by David Glenn, Meteorologist

Diamond Shoals Buoy (41025) went out prior to Hurricane Irene in early August 2011. It was replaced with a new 3-meter discus buoy on June 28th and has been reporting successfully since its upgrade. In fact, the line of severe thunderstorms that crossed Eastern North Carolina on July 1st pushed offshore where Diamond Shoals observed a 43 knot gust. The 43 knot gust also verified a special marine warning we had in place for the severe storms.

In April of this year the Scripps Institution of Oceanography established two new Waverider Buoys along the North Carolina coastal waters. Buoy 41109 is located approximately 4 miles off the entrance to New River Inlet and buoy 44095 is located about 13 miles east of Oregon Inlet (see map below). The two new buoys provide valuable wave information for the nearshore waters of Onslow Bay and off Oregon Inlet.

The Outer Onslow Bay buoy (41036) had wind direction and wind speed failures in mid October 2011. On June 26th, buoy 41036 was serviced and now has a full suite of meteorological, wave, swell, and ocean current data.



Map of buoys off the North Carolina coast (courtesy National Data Buoy Center).

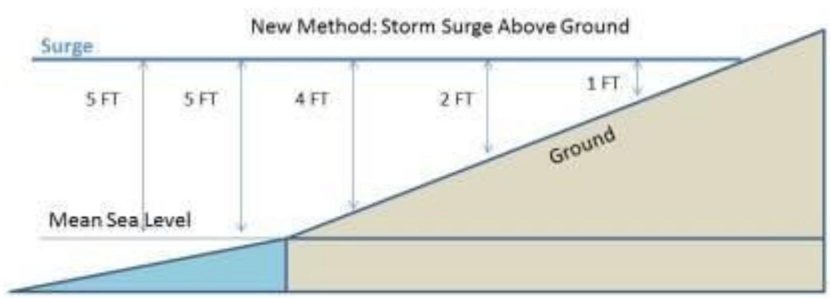
Changes in Storm Surge Forecasting

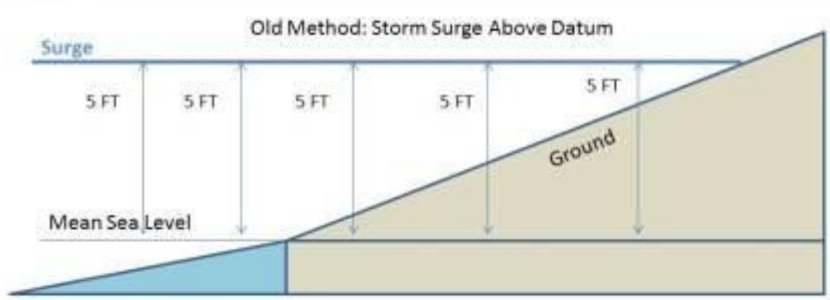
by Chris Collins, Meteorologist

Along the coast, storm surge is often the greatest threat to life and property from a hurricane. In the past, large death tolls have resulted from the rise of the ocean associated with many of the major hurricanes that have made landfall. Hurricane Katrina (2005) is a prime example of the damage and devastation that can be caused by surge. At least 1500 persons lost their lives during Katrina and many of those deaths occurred directly, or indirectly, as a result of storm surge. Storm surge is an abnormal rise in water level, over and above the regular astronomical tide, caused by forces generated from a hurricane's wind, waves, and atmospheric pressure.

Whenever a hurricane watch and/or warning is in effect for any portion of the Gulf or Atlantic coasts of the continental United States, the National Hurricane Center produces a Probabilistic Hurricane Inundation Surge Heights (PHISH) Product. The Probabilistic Tropical Cyclone Inundation Guidance products consist of two suites of probability products for the Gulf of Mexico and Atlantic coastal areas. The first suite of products shows probabilities, in percent, of inundation exceeding 0 feet though 20 feet above ground level, at 1 foot intervals (e.g., the probabilities in percent, of inundation exceeding 0 feet, 1 feet, 2 feet and 20 feet). The second set of products show the probabilities of inundation heights (above ground level) being exceeded, from 10 to 50 percent, at 10 percent intervals. These products are intended to provide users with information to enhance their ability to make preparedness decisions specific to their own situations. Users have requested additional tropical cyclone probabilistic information, and the National Research Council's Fair Weather Report encourages the development of probabilistic products. For many years, surge guidance products were provided in terms of the vertical datum NGVD-1929. A vertical datum is a set of constants that establish a consistent zero point so elevations can be compared with one another. Based on feedback, the NWS anticipates it will be easier for users to understand inundation guidance in terms of "above ground level".

The PHISH model is based on the p-surge model, however it is designed to output surge above ground instead of above datum. The datum currently used by p-surge is NGVD-29, but is approximated as Mean Sea Level in the picture below. The National Hurricane Center in 2012 will provide both probabilities of surge above ground level and surge above datum. Local office storm surge forecasts contained in our Hurricane Local Statements will also provide information both above MSL and above ground





North Carolina Landfalling Hurricanes

by Chris Collins Meteorologist

Between 1851 and 1996, North Carolina was hit by 38 hurricanes, more than any other state but Louisiana. Seven of North Carolina's coastal counties have return periods of 10 years or less. A hurricane's return period is the inverse annual probability of it occurring. More simply, it is the average time between two events. The return periods for each of the coastal counties of North Carolina range from 6.5 years (Carteret) to 10.8 years (Pender). So it is not unreasonable to expect a hurricane once very 6 to 10 years along the coast of Eastern North Carolina.

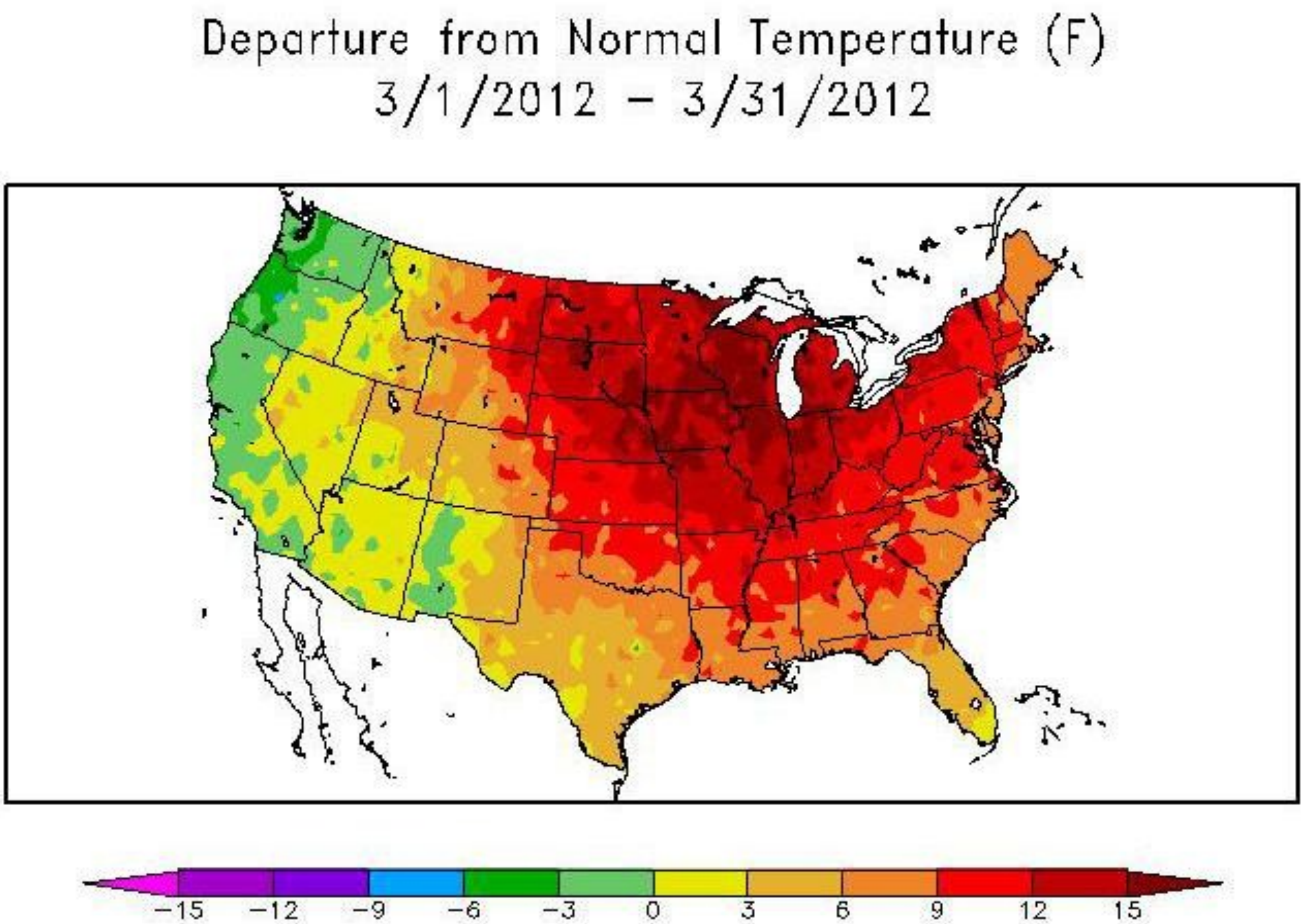
WARMEST MARCH EVER IN 2012

by Chris Collins, Meteorologist

The month of March 2012 was the warmest March since record-keeping began in 1895 over the Eastern United States, according to the National Oceanic and Atmospheric Administration. The average temperature was 51.1 degrees Fahrenheit, which is 8.6 degrees higher than the 20th-century average for March. All 50 states recorded at least one record daily temperature during the month. In all, over 15,000 temperature records were broken, including a staggering 7,755 record high temperatures.

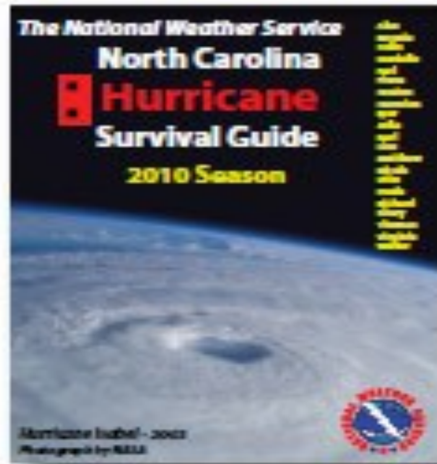
Eastern North Carolina was no exception to the unusually warm weather. At New Bern, the average high temperature for the month was 72.7 degrees, well above the normal of 65.0 degrees. Three record high temperatures were set in the month of March at New Bern, with 81 degrees on the first and the 20th and 80 degrees on the 17th. The average high temperature at Cape Hatteras was 68.2 degrees, nearly 10 degrees above the normal average high of 58.7 degrees. Two records were also set at Cape Hatteras during March, 77 degrees on the 20th and 75 degrees on the 25th. Beaufort recorded an average high of 70.8 degrees in March, well above its normal monthly high of 61.9 degrees. Finally, here at the National Weather Service office in Newport, our average high temperature of 70.5 degrees was 6.5 degrees above the normal monthly March high of 64.0 degrees. Eight daily record highs were broken here in Newport.

In addition to the warm temperatures in March, rainfall was also up to two inches below normal across the region. Most of Eastern North Carolina was characterized as "Abnormally Dry" in Drought outlooks, with a small portion of our southern areas classified in a "Moderate Drought".



Hurricane Checklist - Before the Storm

Here are some steps you can take to prepare before the storm. You can also download our North Carolina Hurricane Survival Guide at http://www.erh.noaa.gov/PDF/2012/NC_Hurricane_Guide_Web_Version.pdf .



YOUR HOME

- Know the hurricane risks for your area.
- Find out if your home is subject to storm surge flooding.
- Inspect your property for potential problems that may arise during a hurricane.
- Consider installing permanent protection for your windows. Learn how to install any manual window protection that you may have so that you can do so quickly if a hurricane threatens the area.

YOUR PROPERTY/INSURANCE

- Investigate flood insurance. Your local Emergency Management office or insurance agent can inform you about the National Flood Insurance Program.
- Inventory your property by making a list, taking photographs, or making a video. Store in a secure, dry place like your safety deposit box.

YOUR FAMILY

- Devise an emergency communications plan with your family so that you will know what to do in the event you are separated.
- Also, ask an out-of-state friend or relative to be the family contact. If family members need to call this person, it will be easier since local lines may be disrupted.
- Make sure that family members know how to respond during a hurricane emergency. Teach them how and when to turn off gas, electricity, and water.

EVACUATION/SHELTERS

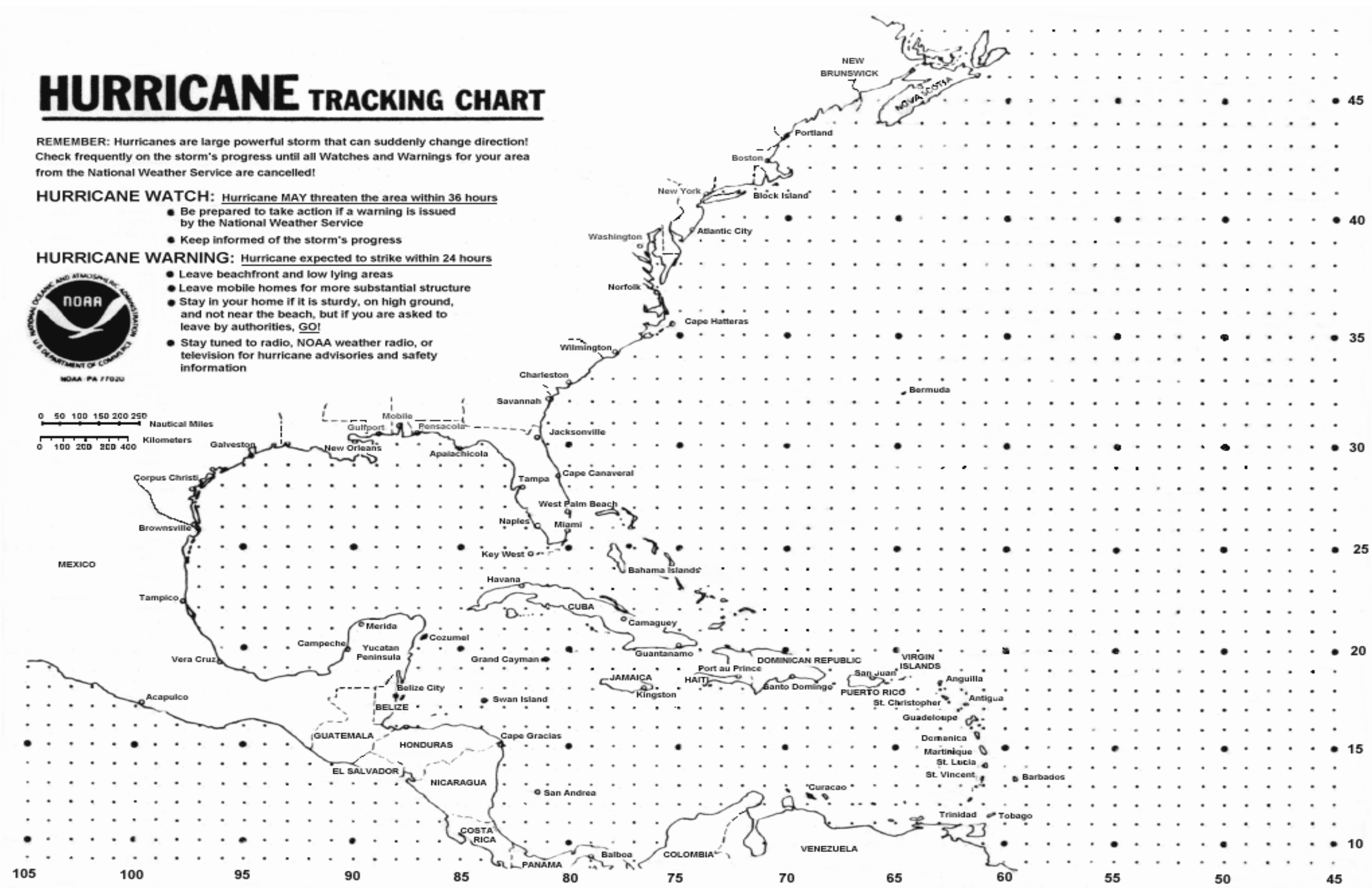
- Plan your evacuation route to an area well inland. This plan should include information about the safest routes and nearby emergency shelters.
- Check how long it will take you to reach your safe area during peak evacuation traffic.
- Make advance arrangements for pets. EMERGENCY SHELTERS CANNOT TAKE PETS!

National Weather Service

530 Roberts Road
Newport, NC 28570

Phone: 252-223-5122
Fax: 252-223-3673

Website: www.erh.noaa.gov/mhx



To report adverse weather conditions 24/7, please call us at:

1-800-889-6889