



A Decade of Progress in Predictions, Outlooks, and Decision Support

Hurricane Katrina: 10 Years Later

NOAA.gov

Hurricane Katrina, one of the most significant, deadly, and costly hurricanes in United States history made landfall along the Northern Gulf Coast on Monday, August 29, 2005. The storm ultimately caused the loss of over 1,200 lives and \$108 billion in property damage.

Although NOAA's forecast for Katrina was accurate, the resulting devastation motivated a concerted effort to significantly advance modeling, prediction, and warning capabilities within NOAA, in conjunction with the broader scientific community.

The significant, harmful impacts of hurricanes like Katrina can be mitigated through accurate and timely short-term (minutes to days) predictions and warnings delivered to the public.

In order to provide this information, **NOAA fosters a robust research enterprise and real-time capability to model and observe environmental conditions associated with the development and impact of hurricanes and to provide advanced warning products to the public.** NOAA also works to ensure that research advances are used to improve real-time forecasts and services.

Decision Support

Alerts communicated to the public provide the critical bridge between NOAA's modeling and forecasting work and the protection of lives and property.

Life-Saving Information: The National Hurricane Center (NHC), working in conjunction with National Weather Service regional offices and National Ocean Service (NOS), have **developed a prototype storm surge watch and warning system, which provides life-saving hazard information to coastal communities.** The system is based on simulations by the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model. Storm surge and wind speed probabilities provide critical information related to impacts; this type of information was only beginning to be produced in 2005.

Extending Forecasts: National Hurricane Center forecasts have been extended from **three to five days, while watches and warnings were each extended by 12 hours in 2010 to 48 hours and 36 hours in advance, respectively.** The Tropical Weather Outlook, a gateway NHC product, has been extended from two to five days.

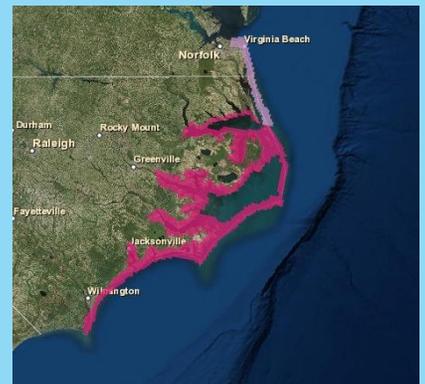
Hurricane watches and warnings now give **12 more hours of notice.**

PROTECTING THE PUBLIC



Damage to beach front homes on Dauphin Island, AL, due to storm surge from Hurricane Katrina, 2005. Credit: NOAA

The greatest loss of life and property due to hurricanes results from storm surge and flooding.



A prototype storm surge watch (light purple) and warning (magenta) product has been developed and is being tested starting in 2015.

Given that a significant portion of lives and property lost during a hurricane results from the flooding, this product is critical for protecting the public.

Figure from NHC.

Predictions

Predictions on hourly to seasonal timescales help communities, managers, and businesses prepare for hurricane impacts, reducing loss of life and property.

Improving Forecasts: New techniques, including the enhanced use of observations as well as the development of higher-resolution and more-realistic computer models have provided improvements in short-term (hours to days) forecasts of a hurricane's track and intensity. A concerted effort behind these improvements, called the Hurricane Forecast Improvement Project (HFIP), was initiated by NOAA in 2008. Many elements of NOAA contribute to HFIP including the Atlantic Oceanographic and Meteorological Laboratory (AOML), the Environmental Modeling Center (EMC), and the National Hurricane Center (NHC).

Average 48-hour track error in 2005: 110 nautical miles.
In 2014: 65 nautical miles.

10 Years of Improvement: In 2005, the seasonal prediction of hurricane activity by the NOAA Climate Prediction Center alerted the public to the probability that the season would be significantly more active than normal. This prediction, based off the limited tools available at the time, proved accurate, as the 2005 Atlantic hurricane season broke a number of records.

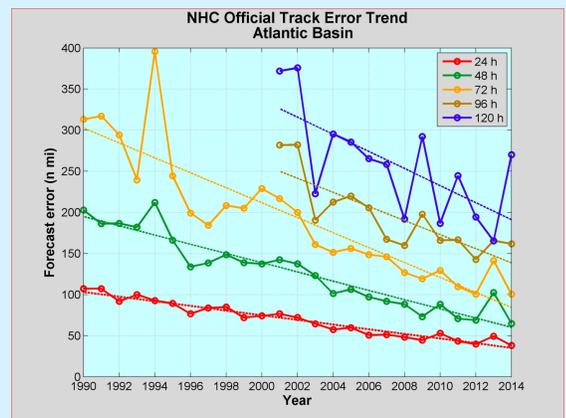
The 2005 Atlantic hurricane season was a record-breaker.

- Most hurricanes in a season: **15**
- Highest number of major hurricanes making landfall in the U.S.: **4**
- Latest end to a hurricane season: **Jan. 6**
- Strongest storm in recorded history based on storm central pressure: **Wilma**
- Most damaging storm: **Katrina**

Since 2005, new seasonal forecast tools, research, improved monitoring capabilities, and **the development of improved climate models within NOAA have led to more confident seasonal hurricane predictions.** Much of improvement has occurred since 2008, coinciding with the implementation of NOAA's Climate Forecast System (CFS). A hurricane prediction model derived from the CFS was first used by seasonal hurricane forecasters in 2008. Since 2009, a high-resolution (24 mile grid spacing) version of CFS has been providing direct predictions of the statistics of named storms and hurricanes for the seasonal hurricane outlook. CFS also forecasts critical atmospheric and oceanic conditions, including ENSO, that contribute to hurricane forecasting capabilities.

Higher Resolutions: In 2014-2015, NOAA's Geophysical Fluid Dynamics Laboratory (GFDL) developed the world's highest-resolution (15 mile grid spacing) modeling system used for prediction weeks to months in advance. **The system has demonstrated an ability to correctly simulate global hurricane patterns and the most powerful hurricanes, category 4 and 5 storms, and is currently being used to help inform NOAA's seasonal hurricane outlooks.**

Additional work at GFDL, in collaboration with the external community, is exploring the possibility of forecasting the location at which hurricanes tend to form and make landfall weeks to months in advance. This promising research avenue could open up a wide array of new, advanced products and warnings at lead times longer than a typical weather forecast.



The official forecasts of hurricane track have improved steadily over the past two decades. Since 2005, hurricane track forecast two days in advance has improved by over 50% while four day forecasts have improved by over 25%.
Credit: NHC



2005 version

2015 version

These graphics show the forecast path and estimated uncertainty for Hurricane Katrina with a three-day lead. The forecast done in 2005 is shown on the LEFT. On the RIGHT is the same forecast run in 2015 to include the last 10 years of modeling and forecast improvement. The smaller size of the potential path (shown in the white area) in the 2015 version is a testament to the significant improvement of modeling and forecast capabilities since Katrina made landfall. *Figures from NHC.*