National Hurricane Center
Storm Surge Products for 2013 and Beyond

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Hurricane Season 2013

• NWS/NHC is transitioning from deterministic to probabilistic storm surge forecasts in 2013

• Deterministic SLOSH runs often conflict with official NWS storm surge forecasts….causes confusion

• Probabilistic storm surge (p-surge)

• Probabilistic Hurricane Inundation Storm Surge (PHISH)
Storm Surge

What does Surge depend on?

- **Storm Intensity and Size**
  - Stronger = Higher Surge
  - Larger = Larger impact area and higher surge

- **Storm Speed**
  - Slower storms=higher and broader storm surge inland including bays and estuaries;
  - Faster storms=more storm surge along the open coast

- **Angle to Coast at Landfall**
  - Perpendicular Maximizes Surge

- **Bathymetry** (width and slope of continental shelf + local features)
  - Shallow = worse

Slight deviations in these factors can mean large differences in storm surge!
What product can take all of this potential error into account?

Probabilistic Storm Surge (p-surge)

- Uses a collection of SLOSH runs
  - based on NHC’s official advisory
  - P-surge’s individual storms are determined by statistics of past performance of the advisories
- As an example:
  - 48-hour position off by an average of 80 n mi.
  - 48-hour intensity off by an average of 14 knots
Type 1: How Much Storm Surge Could I Get?

- This is what we call the “exceedance” product
- You pick the probability, we give you the storm surge height that has that chance of being exceeded.
- Available from 10% to 90%, every 10%
Type 1: How Much Storm Surge Could I Get?

Example:
• You pick the 10% exceedance product.
• The surge height at a location is 5 feet. There is a 10% chance that the surge at that location will be greater than 5 feet.
Type 2: What is the Chance I Get a Certain Amount of Storm Surge?

- You pick the storm surge height, we give you the chance that it will be at least that height at each location.

- Available from 2 ft. to 25 ft., every 1 ft.
Example:
• You pick 5 feet
• The probability at a location is 5%
• There is a 5% chance that the surge at that location will be greater than 5 feet.
Probabilistic Hurricane Inundation Surge Height (PHISH)

- Same as original p-surge product except above ground level
- Also takes tide into account

Available in both formats (you choose % or feet)

Available experimentally for the 2013 hurricane season: http://www.nws.noaa.govmdl/psurge2.0
Difference between PHISH and other P-Surge Maps

Above Ground

0-3 feet

Above Datum

5-7 feet
When is P-Surge Available?

http://www.weather.gov/mdl/psurge/active.php

- Beginning when the NHC issues a hurricane watch or warning for the continental US
- Available approx. 1-2 hours after the advisory release time
Changes for Hurricane Season 2013

- Definitions of TS and hurricane watches/warnings have been broaden
- New use of NHC’s Tropical Cyclone Update (TCU)
- Tropical Weather Outlook Extended
- Cone size has again been reduced.
Warning Challenge in Sandy

• The dynamical models forecast Sandy to become extratropical before landfall, although the timing varied.

• Once warnings are issued, it is difficult to switch between TC and non-TC warnings.

• During Sandy, the extratropical transition process did not reduce the threat at all!
New NHC Watch/Warning Definitions

• The National Weather Service has modified the tropical cyclone watch and warning definitions to allow them to be used after a tropical cyclone has become post-tropical.

• NHC will have the option to continue advisory products on post-tropical cyclones that pose a risk to life/property and when the transfer of responsibility to another office would result in an unacceptable discontinuity in service.

• Hurricane Warning: An announcement that sustained winds of 74 mph or higher are expected somewhere within the specified area in association with a tropical, subtropical, or post-tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the warning is issued 36 hours in advance of the anticipated onset of tropical-storm-force winds. The warning can remain in effect when dangerously high water or a combination of dangerously high water and waves continue, even though winds may be less than hurricane force.
Changes for Hurricane Season 2013

• New use of NHC’s Tropical Cyclone Update (TCU)
HURRICANE IRENE TROPICAL CYCLONE POSITION ESTIMATE
NWS NATIONAL HURRICANE CENTER MIAMI FL
AL092011
1000 PM SAT AUG 27 2011

AT 1000 PM EDT...0200 UTC...THE CENTER OF HURRICANE IRENE WAS ESTIMATED BY AN AIR
FORCE RESERVE HURRICANE HUNTER AIRCRAFT AND NOAA
DOPPLER WEATHER RADAR TO BE NEAR LATITUDE
37.1 NORTH...
LONGITUDE 75.5 WEST.

...SUMMARY OF 1000 PM EDT INFORMATION...
LOCATION...37.1N 75.5W
ABOUT 270 MI...435 KM...SSW OF NEW YORK CITY
MAXIMUM SUSTAINED WINDS...80 MPH.
PRESENT MOVEMENT...NNE OR 20 DEGREES AT 16
MPH
MINIMUM CENTRAL PRESSURE...952 MB
$$
FORECASTER BRENnan

HURRICANE ISAAC TROPICAL CYCLONE UPDATE
NWS NATIONAL HURRICANE CENTER MIAMI FL
AL092012
1100 AM CDT WED AUG 29 2012

...11 AM POSITION UPDATE...

A GUST TO 67 MPH WAS RECENTLY REPORTED AT
SHELL BEACH LOUISIANA. TROPICAL STORM
CONDITIONS ARE CONTINUING ALONG THE
MISSISSIPPI AND ALABAMA COASTS.

SUMMARY OF 1100 AM CDT...1600
UTC...INFORMATION
--------------------------------------------------
LOCATION...29.6N 90.7W
ABOUT 1 MI...2 KM W OF HOUMA LOUISIANA
ABOUT 45 MI...75 KM SW OF NEW ORLEANS
LOUISIANA
MAXIMUM SUSTAINED WINDS...75 MPH...120 KM/H
PRESENT MOVEMENT...NW OR 310 DEGREES AT 6
MPH...9 KM/H
MINIMUM CENTRAL PRESSURE...972 MB...28.70
INCHES

$$
FORECASTER STEWART
TROPICAL STORM CLAUDETTE TROPICAL CYCLONE UPDATE
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL AL042009
1215 PM EDT SUN AUG 16 2009

...DEPRESSION BECOMES TROPICAL STORM CLAUDETTE...

DATA FROM THE NOAA DOPPLER RADAR IN TALLAHASSEE FLORIDA INDICATE THAT SURFACE WINDS ASSOCIATED WITH THE DEPRESSION HAVE INCREASED TO 40 MPH...65 KM/HR...MAKING THE DEPRESSION TROPICAL STORM CLAUDETTE.

....SUMMARY OF 1215 PM AST INFORMATION...
LOCATION...28.7N 84.6W
MAXIMUM SUSTAINED WINDS...40 MPH
PRESENT MOVEMENT...NORTHWEST OR 320 DEGREES AT 14 MPH
MINIMUM CENTRAL PRESSURE...1011 MB
$$
FORECASTER ROBERTS/BRENNAN
Changes for Hurricane Season 2013

• Tropical Weather Outlook extended
The National Hurricane Center is issuing for the North Atlantic...Caribbean Sea area. The National Hurricane Center is issuing for Humberto...located a few hundred miles west-northwest of Bermuda and on Tropical Storm Gabrielle west-northwest of Bermuda.

1. The broad area of low pressure has moved over the central portion of the Yucatan Peninsula and is expected to enter the Bay of Campeche tomorrow. The shower activity associated with this low shows signs of organization and development is likely if the low moves over the Bay of Campeche far enough from land. This system has a medium chance...40 percent...of becoming a tropical cyclone during the next 48 hours and a high chance...70 percent...of becoming a tropical cyclone during the next 5 days. This system is forecast to move very slowly...producing heavy rains over eastern Mexico for the next several days.
Changes for Hurricane Season 2013

• Cone size has again been reduced.
NHC Forecast Cone

• Represents probable track of tropical cyclone center – but does not tell you anything about impacts!

• Formed by connecting circles centered on each forecast point (at 12, 24, 36 h, etc.)

• Size of the circles determined so that, for example, the actual storm position at 48 h will be within the 48-h circle 67% of the time
Future Products and Changes

- Potential Storm Surge Inundation map.
- Storm surge watches and warnings
- Map showing potential arrival times of TS and Hurricane force winds
- Graphic showing Potential for Damaging winds
Future Products and Changes

Prototype of Storm Surge Warning
Planned for Operational Implementation in 2015

Potential Storm Surge Inundation Graphic
Could be available in 2014
Prototype Graphic Showing Potential Arrival Time of TS-Force Winds

Prototype of Wind Hazard Graphic

Future Products and Changes
NHC 2013 Forecast: 12 named storms, 6 hurricanes and 3 major hurricanes.

Fall/Winter Outlook

2013 Tropical Systems So Far...
- Andrea
- Barry
- Chantal
- Dorian
- Erin
- Fernand
- Gabrielle
- TD #8
- Humberto
- Ingrid

Questions?

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