

Hurricane Irene Impacts Storm Surge Forecasting Ties to Resiliency



NOAA in the Carolinas Meeting

March 15, 2012

Richard Bandy

National Weather Service

Newport/Morehead City, NC



Outline



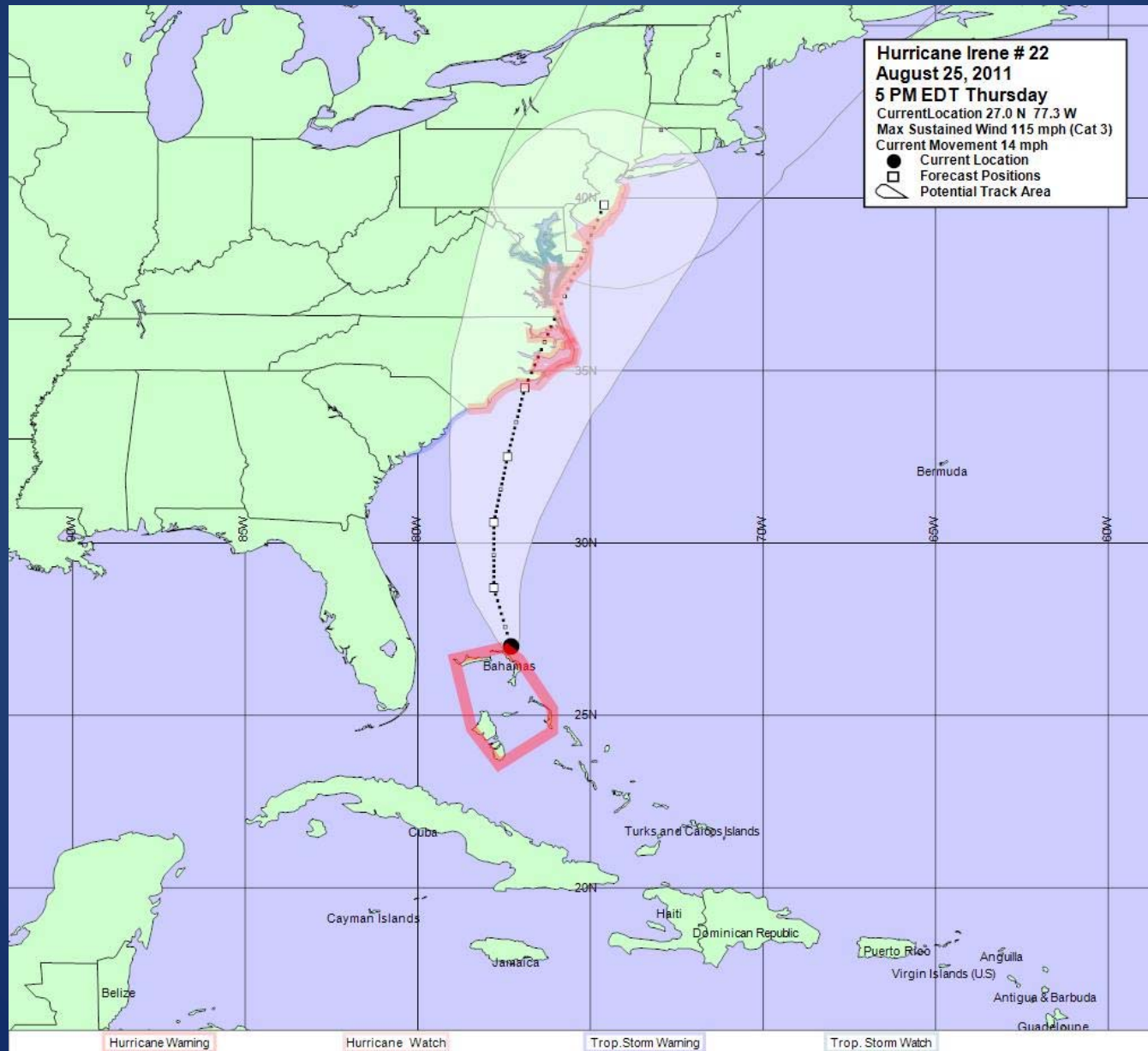
- Irene Track Tornado, Heavy Rain and Winds in Eastern NC
- Understanding Storm Surge Impacts and Forecasts Using Irene
- Experimental and Prototype Products
- NWS Operational Products and Services
- Using Hurricanes to Inform on Sea Level Rise Impacts and Promote Resiliency



Irene's Track Tornado, Heavy Rain, and Wind Impacts

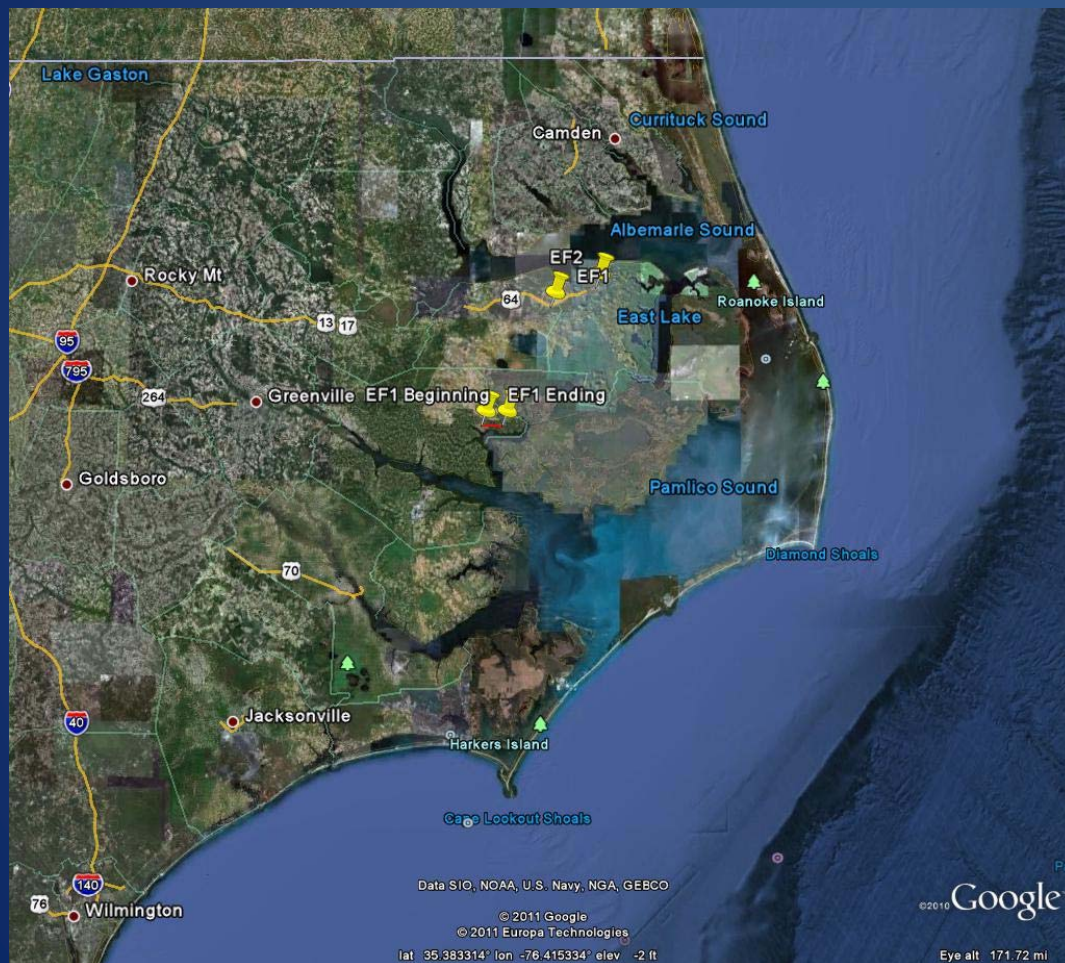


Hurricane Irene Track Forecast





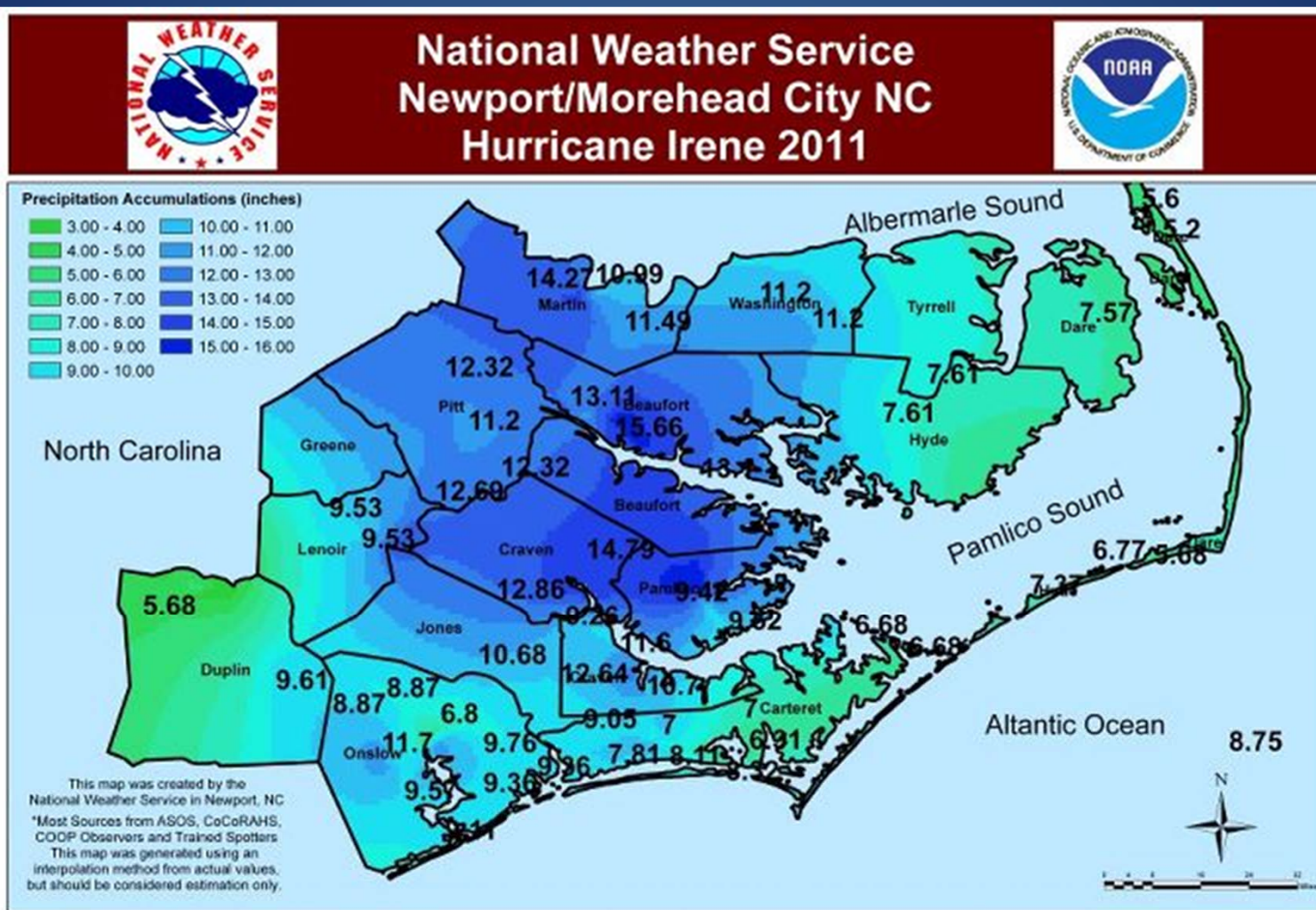
Tornado Impacts



- Columbia, NC
 - EF Scale Rating - EF2
 - Estimated Max Winds – 130 mph
 - Maximum Width – 50 yards
 - Path Length – 0.5 miles
- Cresswell, NC
 - EF Scale Rating – EF1
 - Estimated Max Winds – 110 mph
 - Maximum Width – 50 yards
 - Path Length – 0.5 miles
- Belhaven, NC
 - EF Scale Rating – EF1
 - Estimated Max Winds – 105 mph
 - Maximum Width – 75 yards
 - Path Length – 4.40 miles



Heavy Rainfall Impacts





Wind Observations



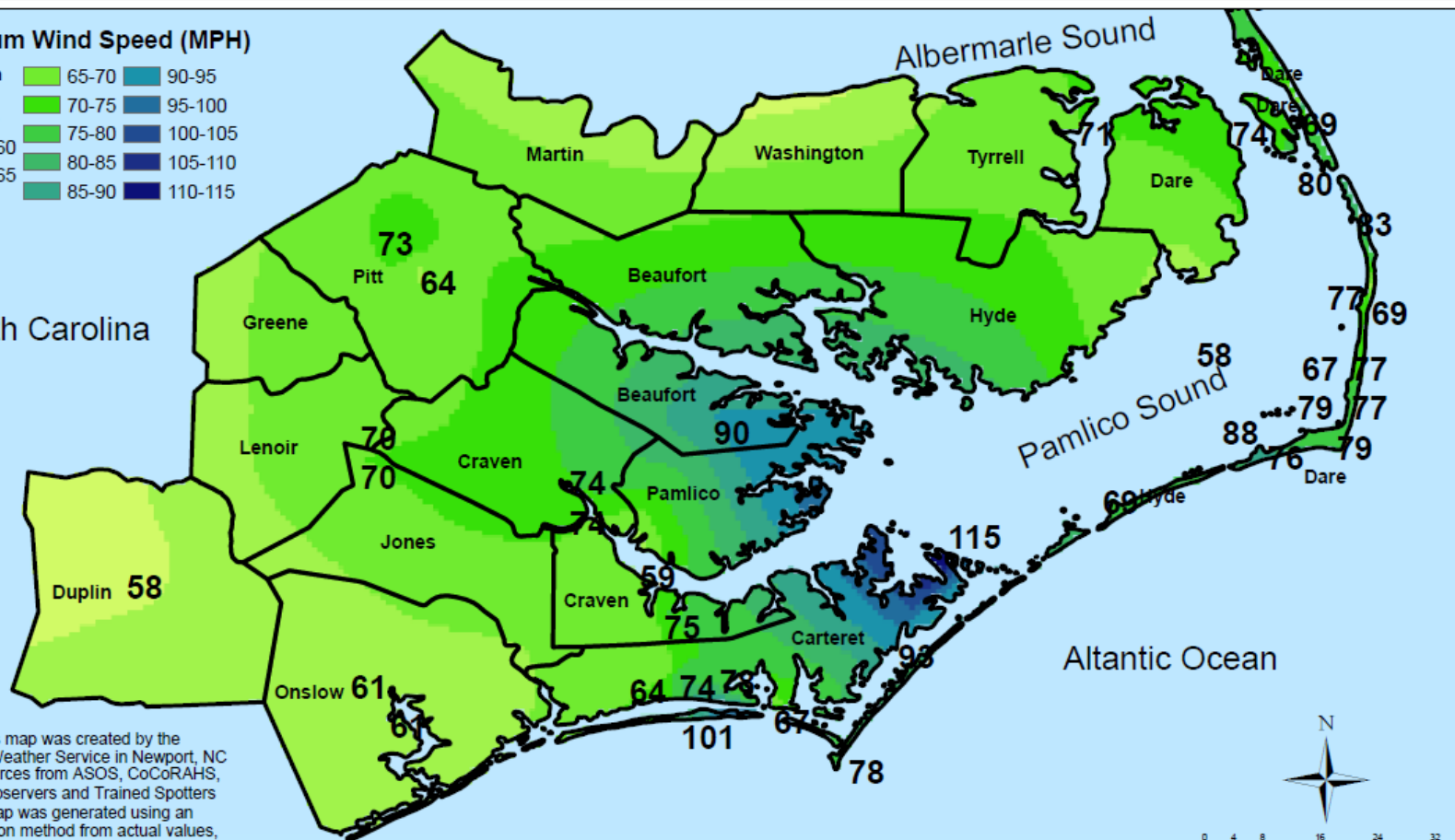
National Weather Service Newport/Morehead City NC Hurricane Irene 2011



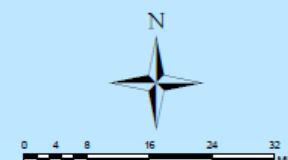
Maximum Wind Speed (MPH)

irene_rain	65-70	90-95
<VALUE>	70-75	95-100
<55	75-80	100-105
55-60	80-85	105-110
60-65	85-90	110-115

North Carolina



This map was created by the National Weather Service in Newport, NC
*Most Sources from ASOS, CoCoRAHS, COOP Observers and Trained Spotters
This map was generated using an interpolation method from actual values, but should be considered estimation only.





Understanding Storm Surge Impacts and Forecasts Using Irene



Storm Surge Survey



19. When Hurricane Irene was downgraded to a Category 1 storm, did this change your perceptions of the potential impacts associated with storm surge?

#	Answer		Response	%
1	Yes	<div><div></div></div>	14	61%
2	No	<div><div></div></div>	9	39%
	Total		23	100%

20. How much did it change your perceptions of what the impacts from storm surge might be?

#	Answer		Response	%
1	Very much	<div><div></div></div>	1	7%
2	Somewhat	<div><div></div></div>	13	93%
3	A little	<div><div></div></div>	0	0%
4	Very little	<div><div></div></div>	0	0%
	Total		14	100%



Storm Surge Survey



21. How different did you think storm surge would be?

#	Answer		Response	%
1	Much lower	<div></div>	2	14%
2	Somewhat lower	<div></div>	11	79%
3	Not very different at all	<div></div>	1	7%
	Total		14	100%

22. Were you surprised by the magnitude of the storm surge that Hurricane Irene caused?



#	Answer		Response	%
1	Yes	<div></div>	18	78%
2	No	<div></div>	5	22%
	Total		23	100%



Storm Surge Survey



23. Why were you surprised? (Click all that apply)

#	Answer		Response	%
1	In my experience, a Category 1 storm does not usually cause storm surges of that magnitude		9	50%
2	From what I knew, a Category 1 storm does not usually cause storm surges of that magnitude		8	44%

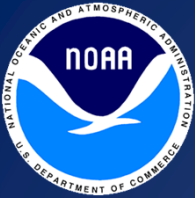


Storm Surge Survey

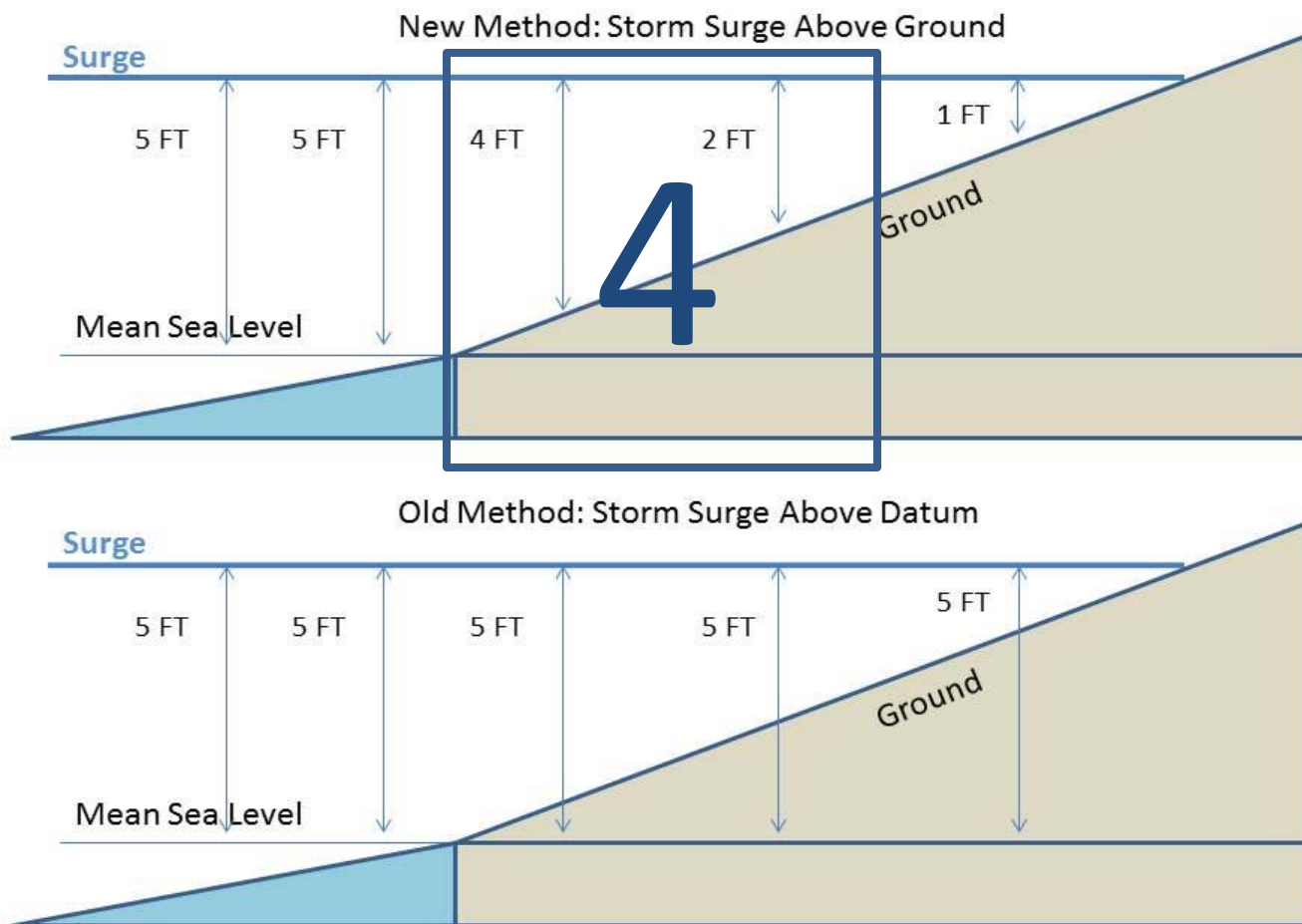


Storm surge forecasts from the National Weather Service provide height above ground level

How long have you lived in this county?			Frequency	Percent	Valid Percent	Cumulative Percent
Less than 15 years	Valid	True	1	9.1	9.1	9.1
		False	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
Over 15 years	Valid	True	7	38.9	43.8	43.8
		False	9	50.0	56.3	100.0
		Total	16	88.9	100.0	
	Missing	System	2	11.1		
	Total		18	100.0		



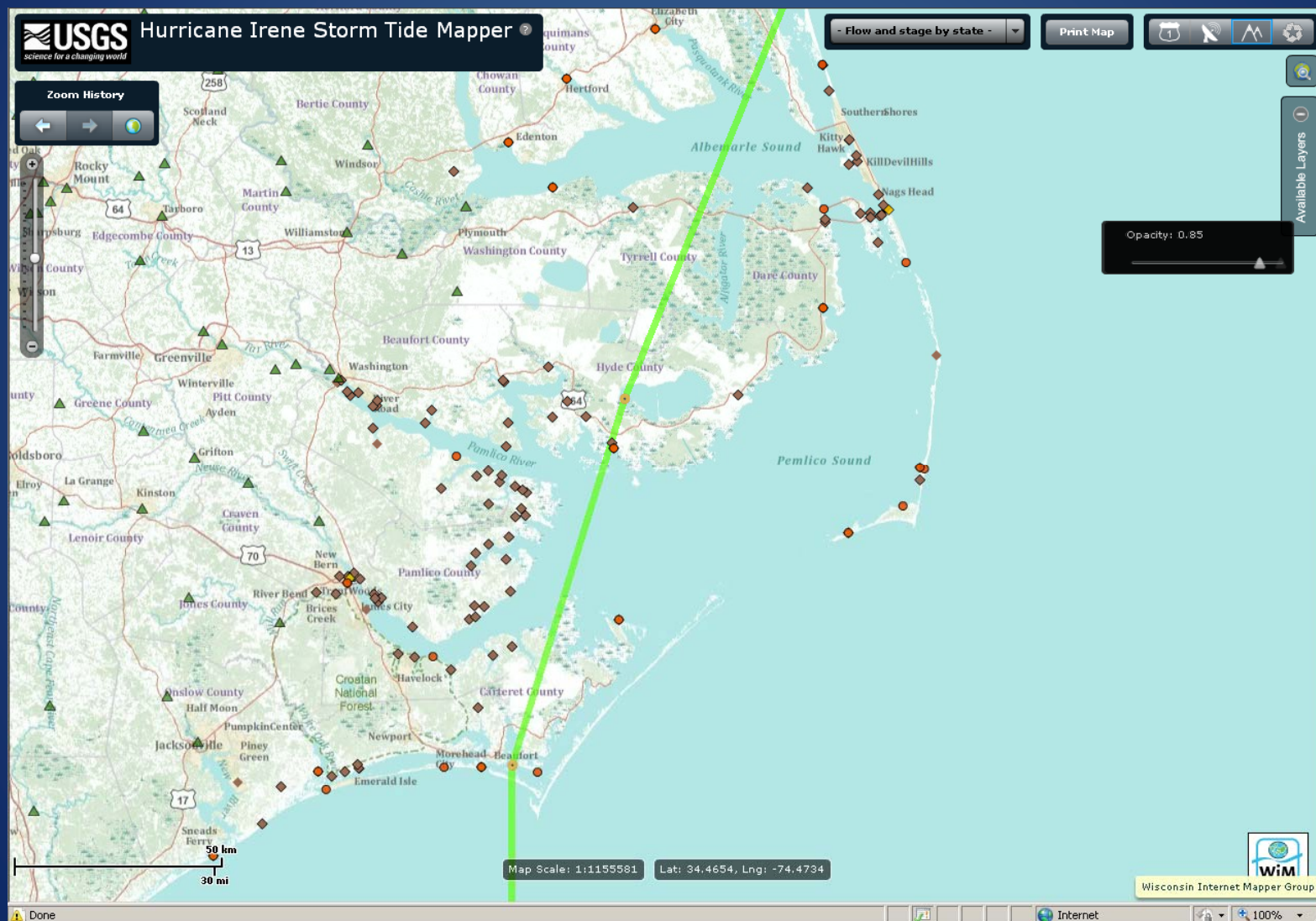
Surge Referenced Above Ground







USGS Storm Surge Surveys

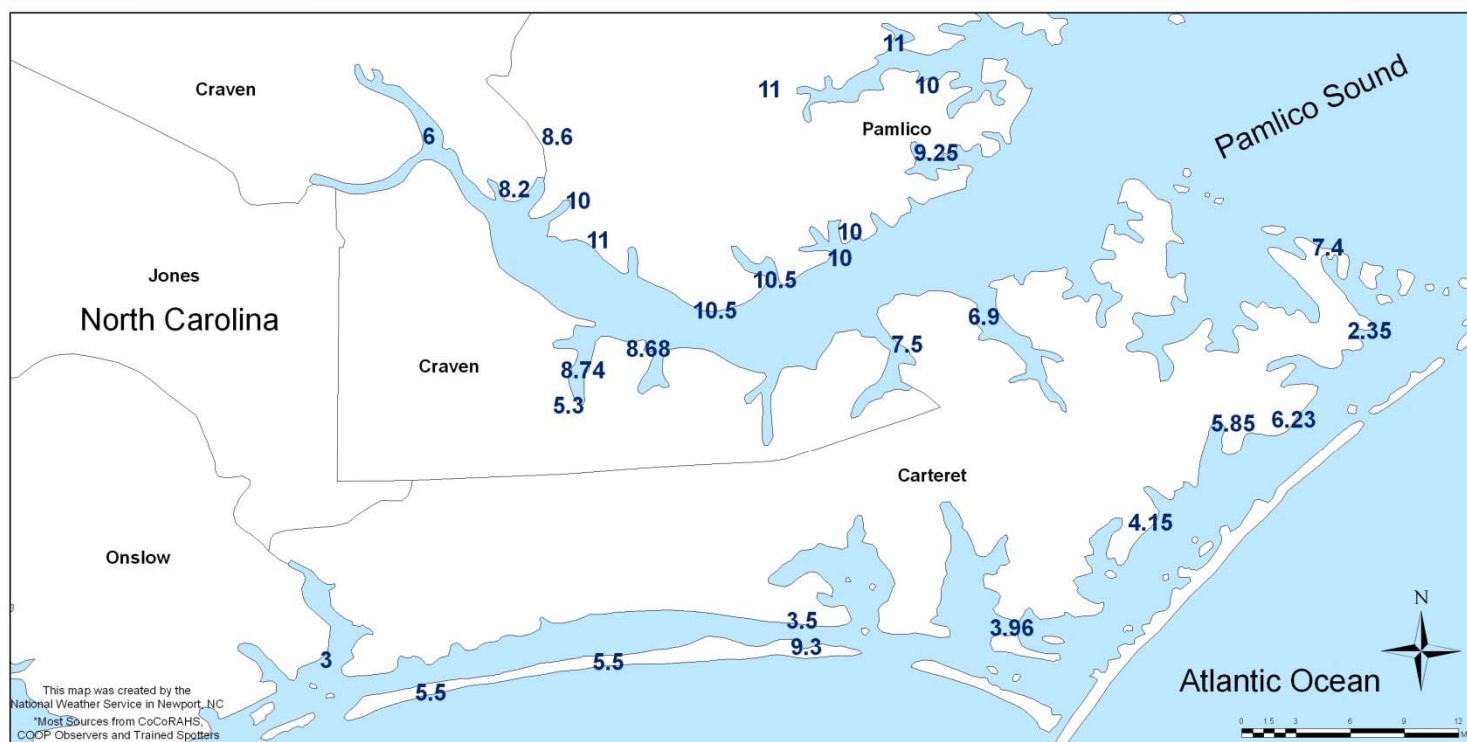




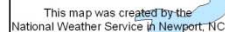
Storm Surge Observations (Above Normal High Tide)

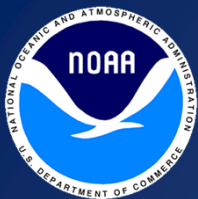


National Weather Service Newport/Morehead City NC



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COOP Observers and Trained Spotters

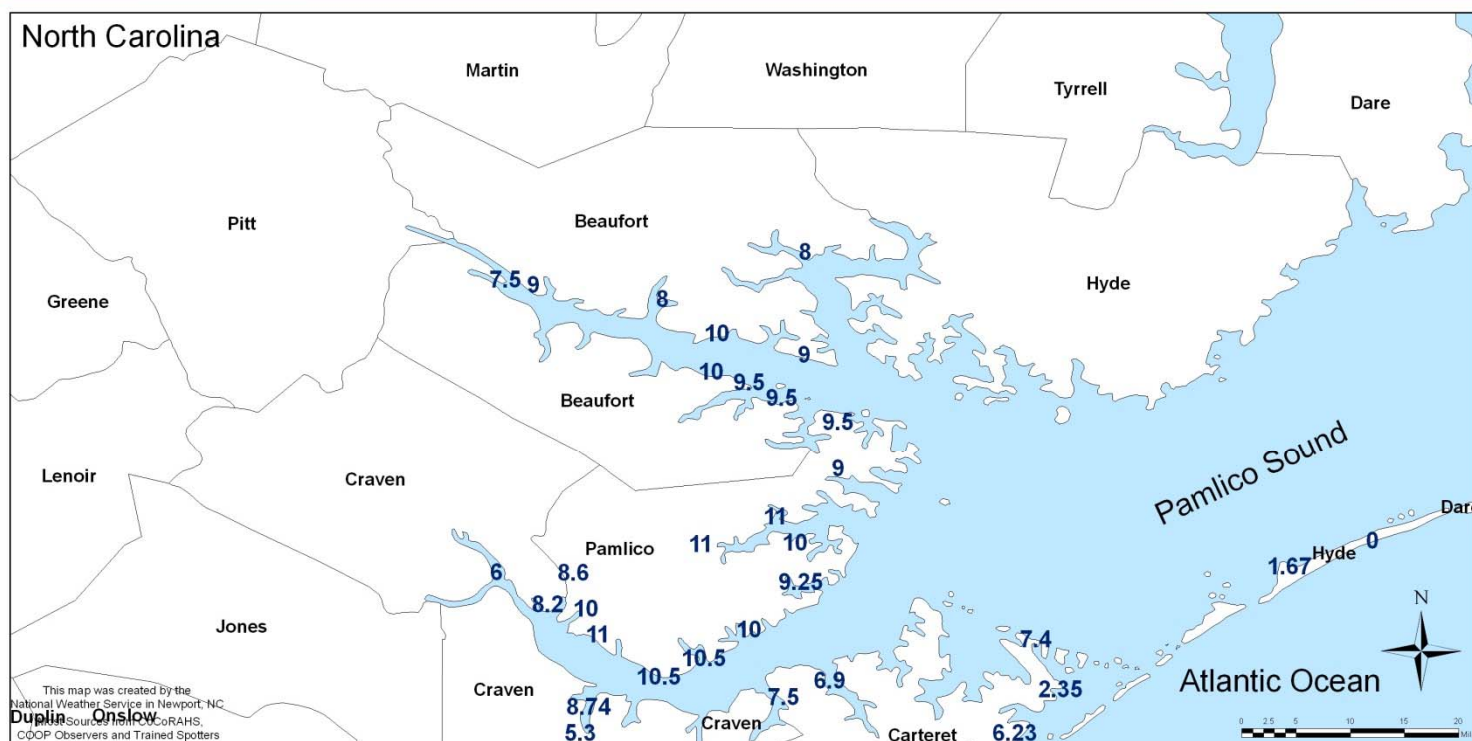




Storm Surge Observations (Above Normal High Tide)



National Weather Service Newport/Morehead City NC

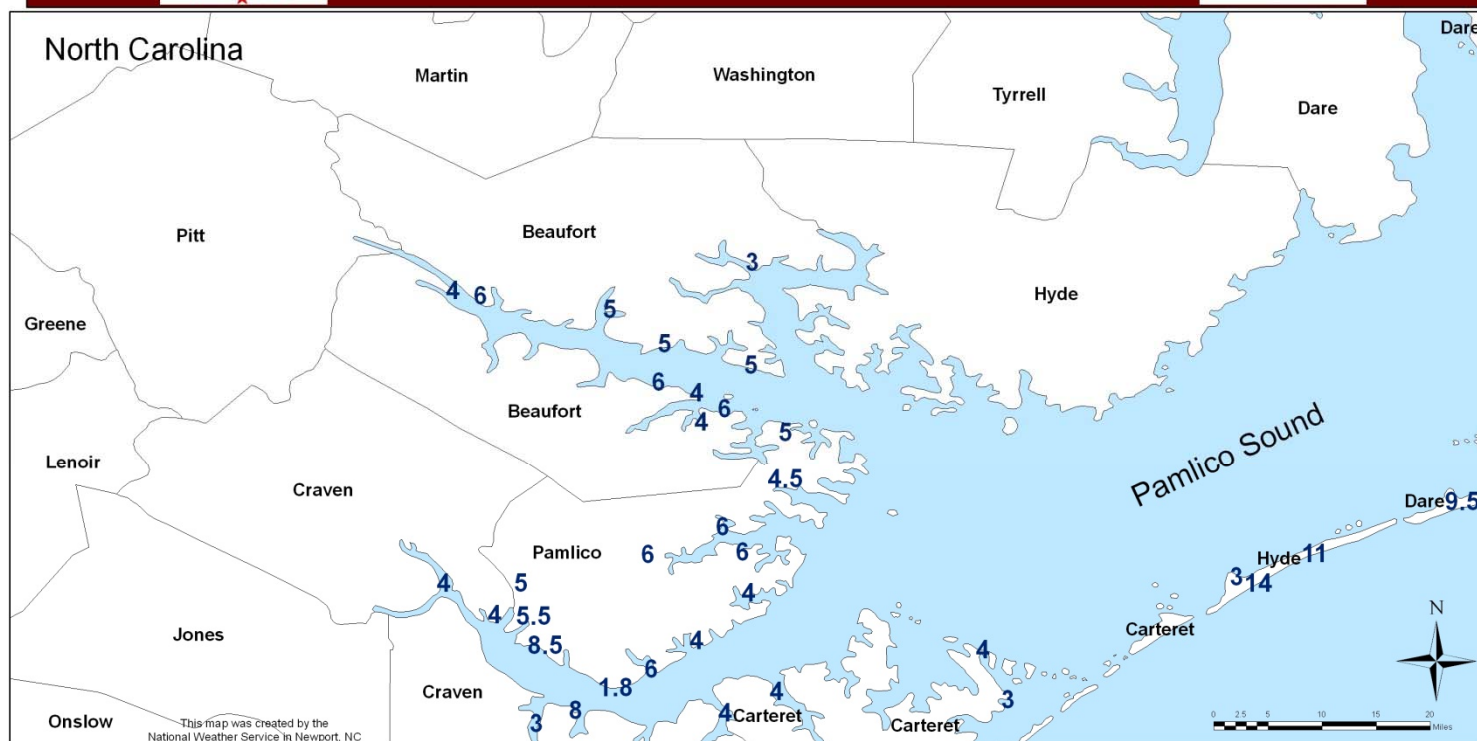
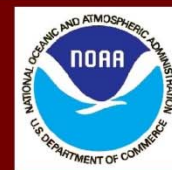




Storm Surge Observations (Above Ground Level)

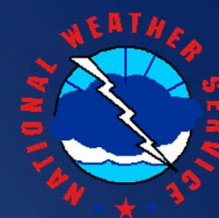


National Weather Service Newport/Morehead City NC





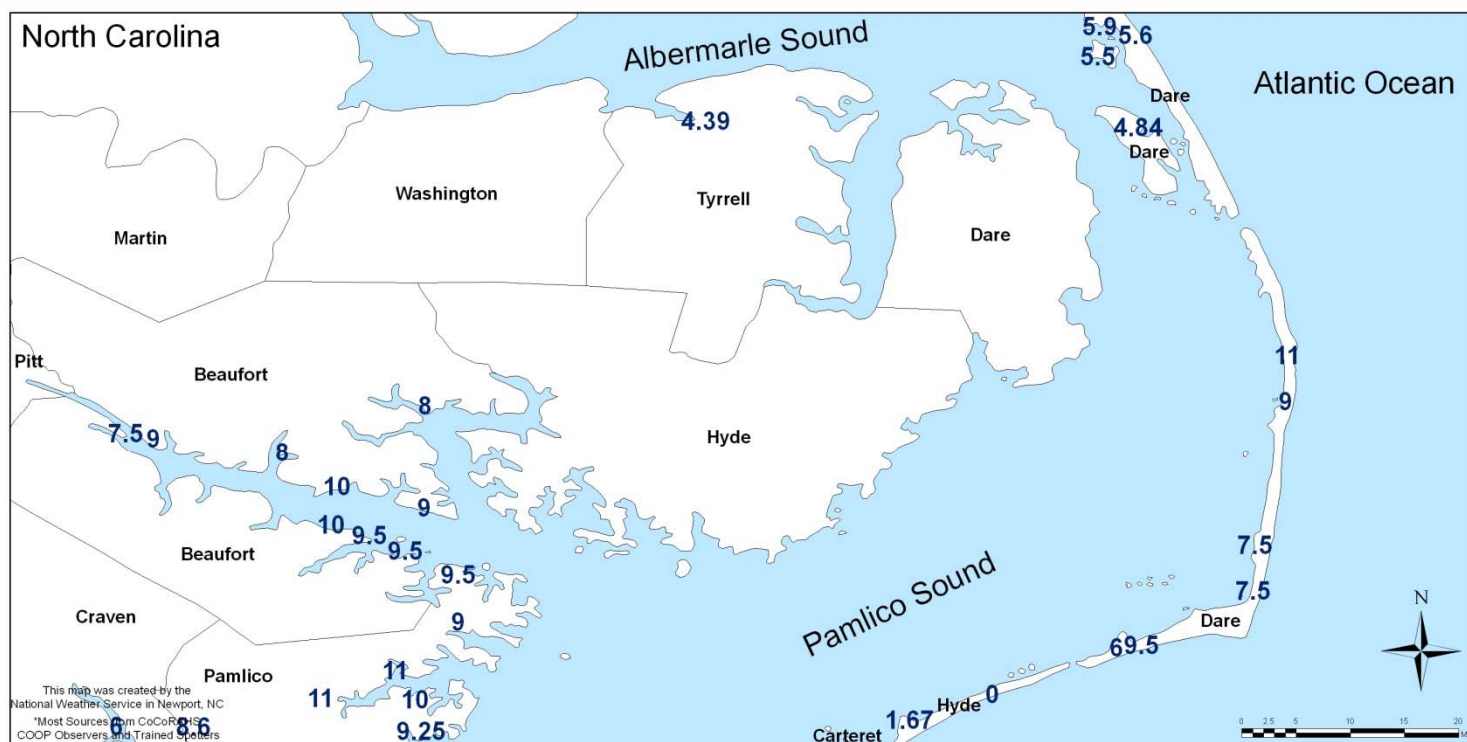
Storm Surge Observations (Above Normal High Tide)





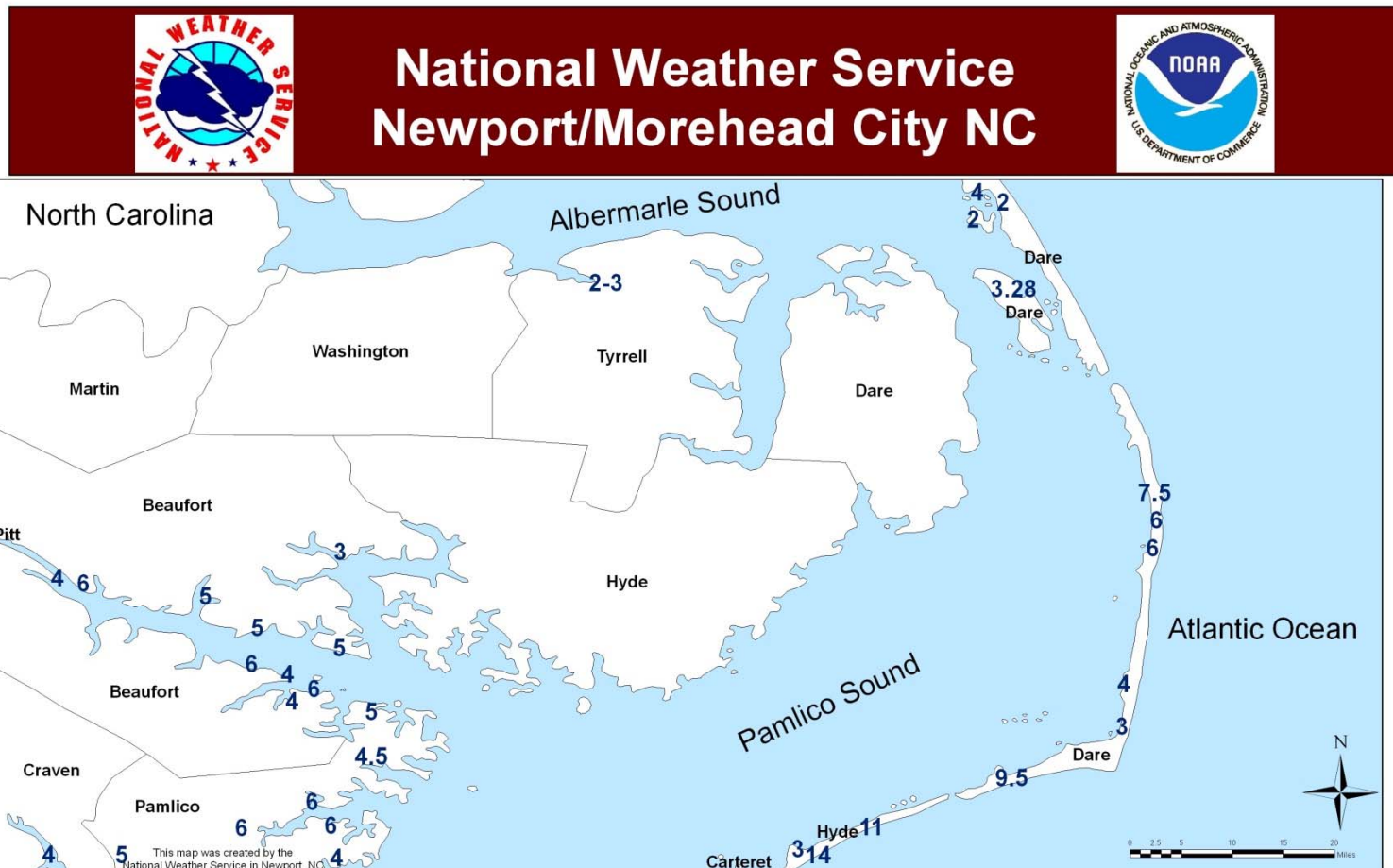
National Weather Service Newport/Morehead City NC







Storm Surge Observations (Above Ground Level)





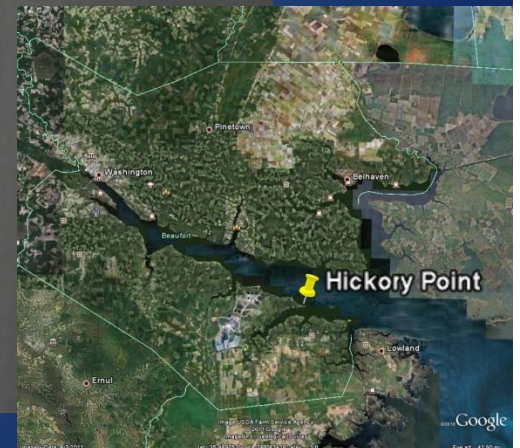
Hickory Point



On the Pamlico River, Beaufort County, at the height of Irene.



Courtesy Williamson Family





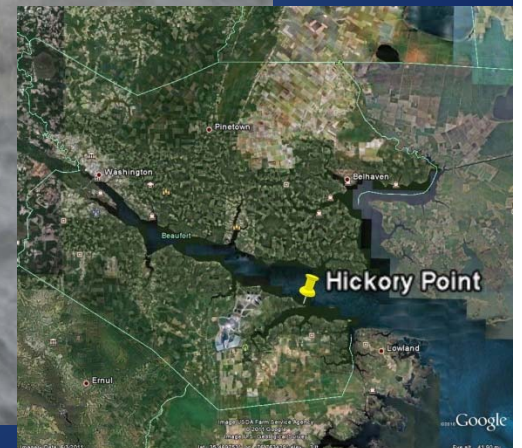
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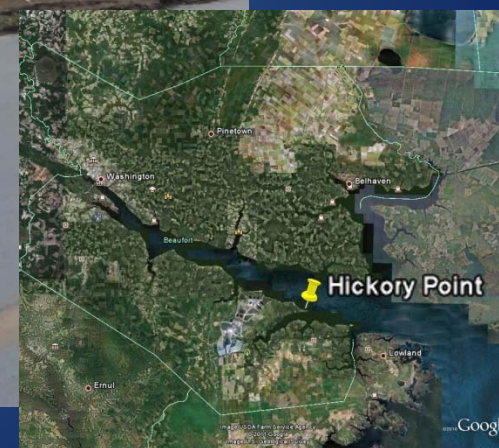


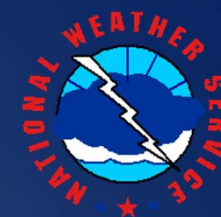


Hickory Point



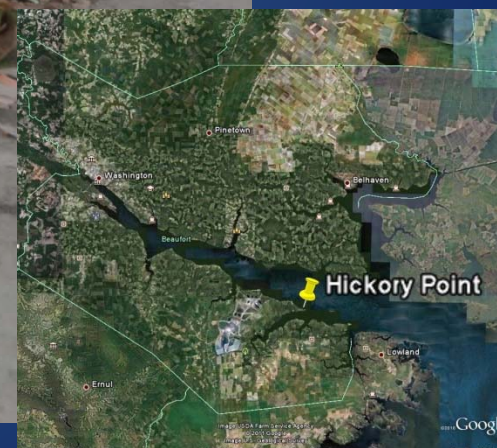
Older homes wiped clean off the foundation and off the peninsula entirely.





Hickory Point

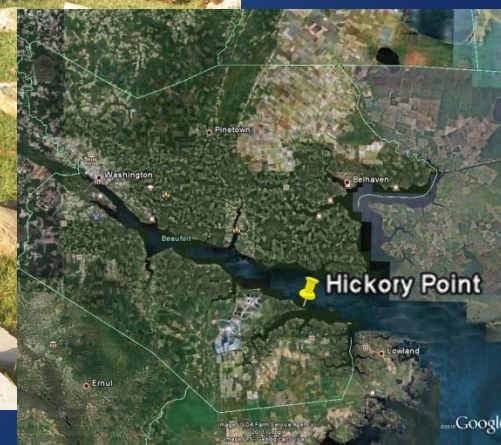
Many homes pushed off their foundation.

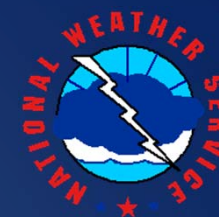




Hickory Point

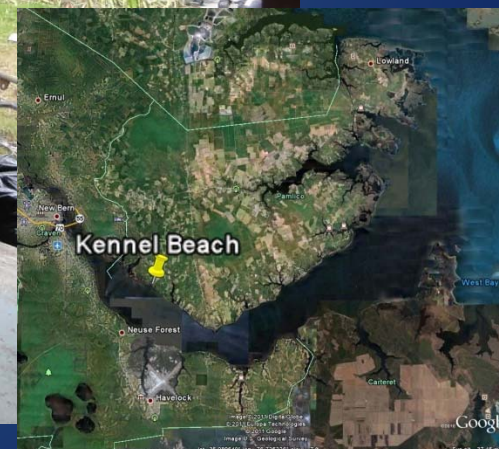
Rip-rap from seawall carried inland/home damage.





Kennel Beach

Watermark just below top hinge of door.





Oneal's Drug Store in Belhaven



Watermarks compared to other storms.



Irene

Floyd

Fran

Bonnie

Dennis

Bertha

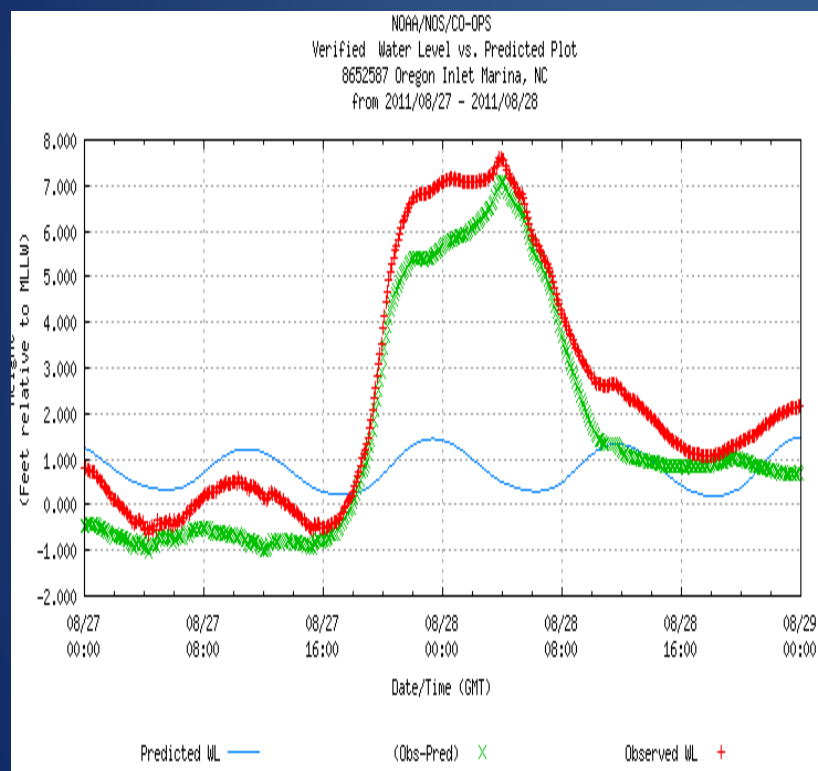
Ernesto



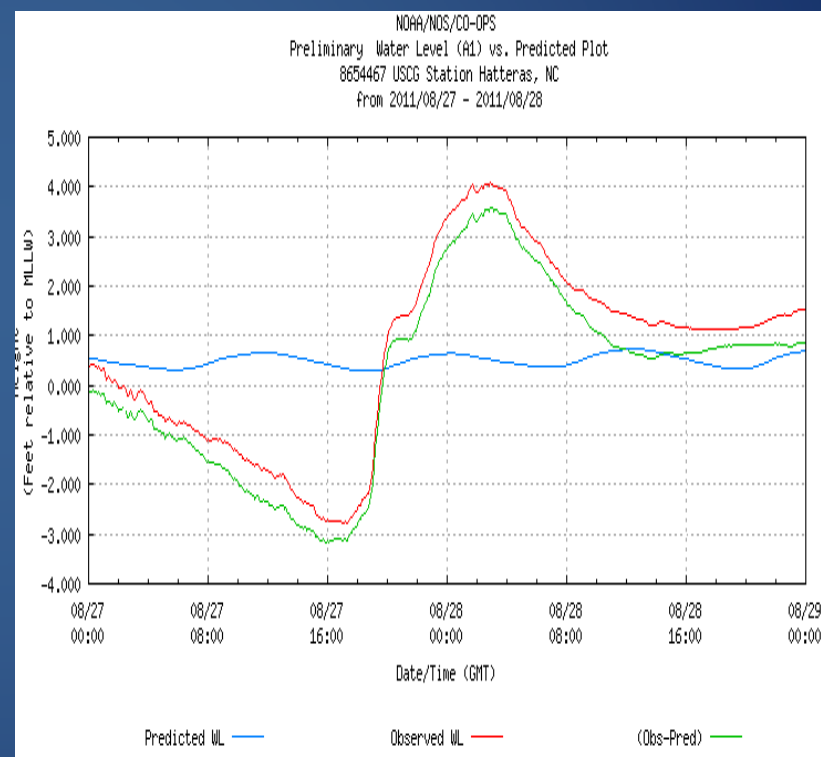


Irene Outer Banks Sound Side Surge

Oregon Inlet



USCG Cape Hatteras

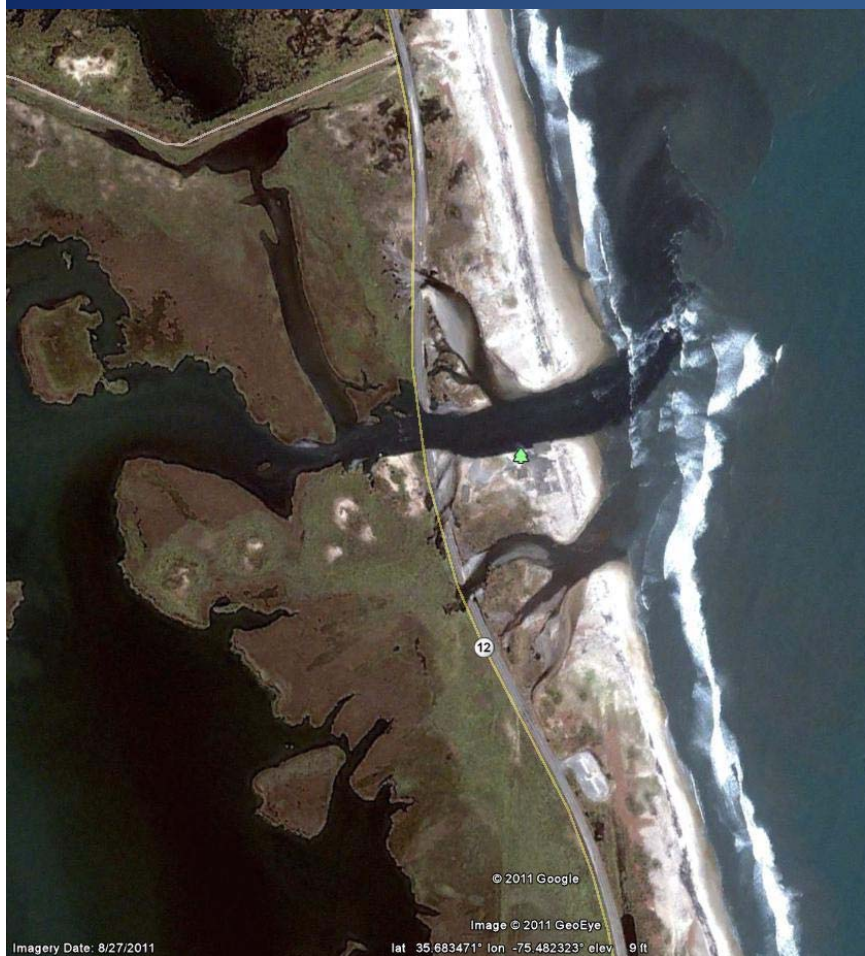




Pea Island Cut

Left: 2011 after Irene/Right: 1993

Note: Highway 12 was on the coast side of the maintenance buildings in 1993.

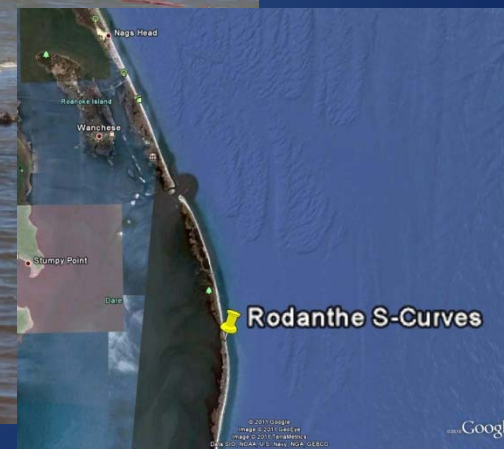
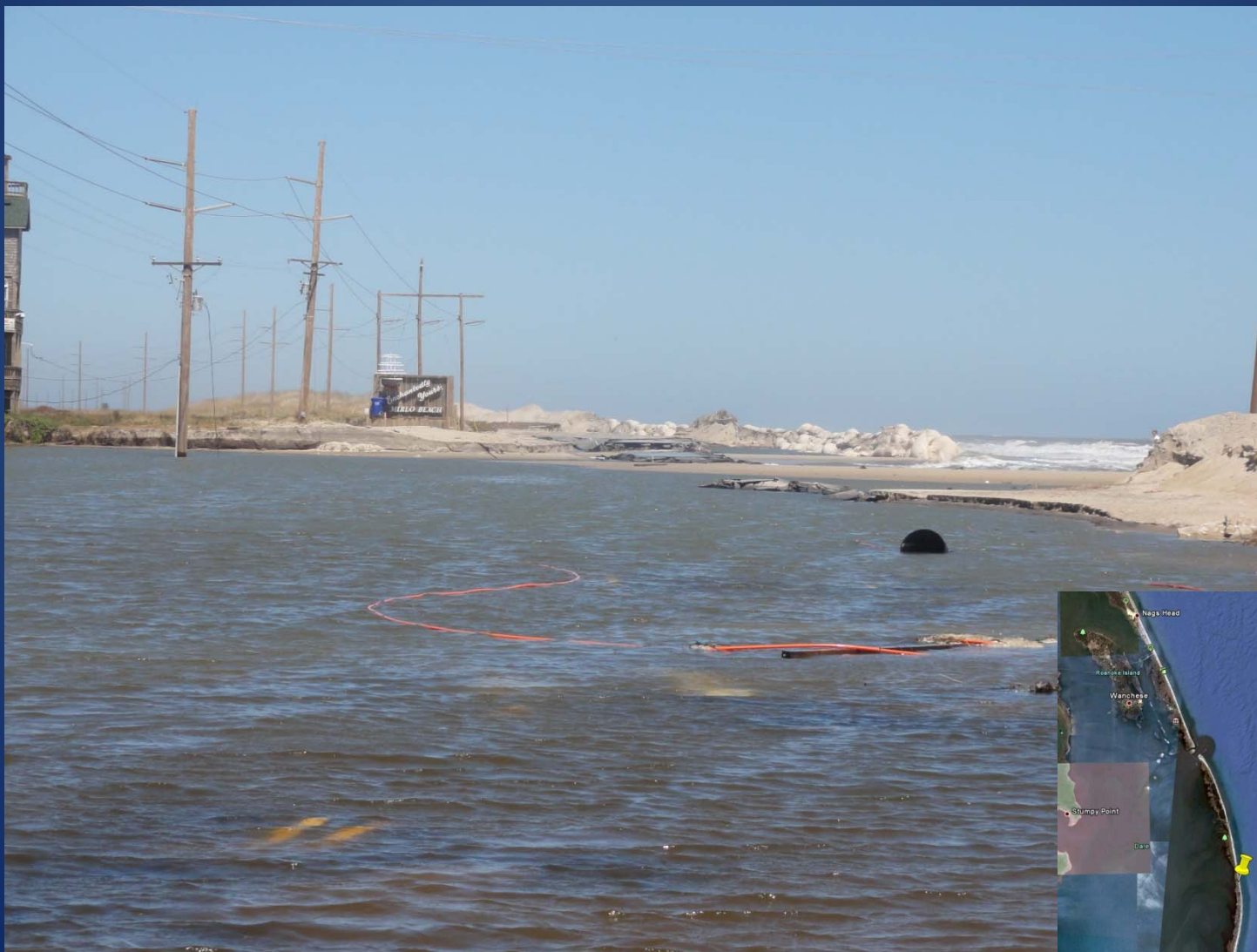


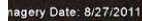




Rodanthe S-Curves

Dune breach/Inlet cut at Mirlo Beach.







Rodanthe



Mirlo Beach/S-Curves

Serendipity:
Nights in Rodanthe house
– Moved in May 2010



Soundside Buxton

Watermark compared to Earl in 2010.

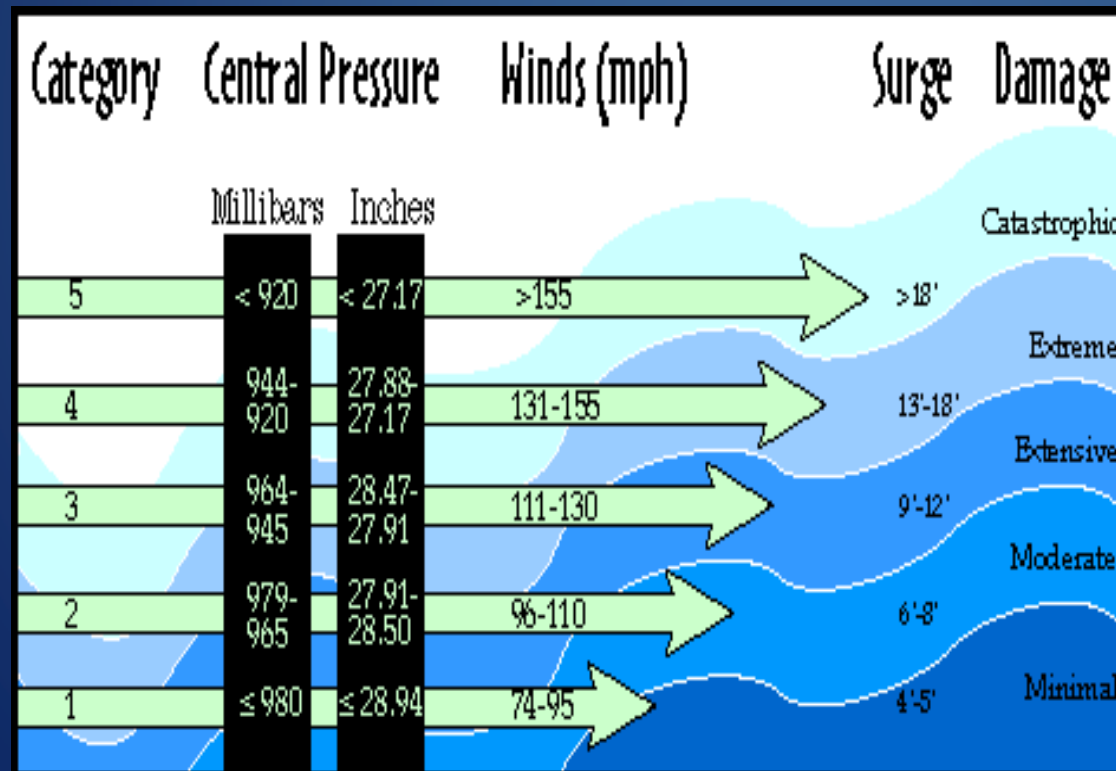




Storm Surge Not Dependent on Hurricane Category!



- Storm surge is dependent on more than just the peak wind!!!



KATRINA (3)

IKE (2)

CHARLEY (4)

Saffir-Simpson Hurricane Scale

1

MINIMAL DAMAGE

Winds 74–95 mph

2

MODERATE DAMAGE

Winds 96–110 mph

Small trees down
roof damage

3

EXTENSIVE DAMAGE

Winds 111–130 mph

Moderate to heavy
damage to homes.
Many trees down.

4

EXTREME DAMAGE

Winds 131–155 mph

Major damage to all
structures.

5

CATASTROPHIC DAMAGE

Winds >155 mph

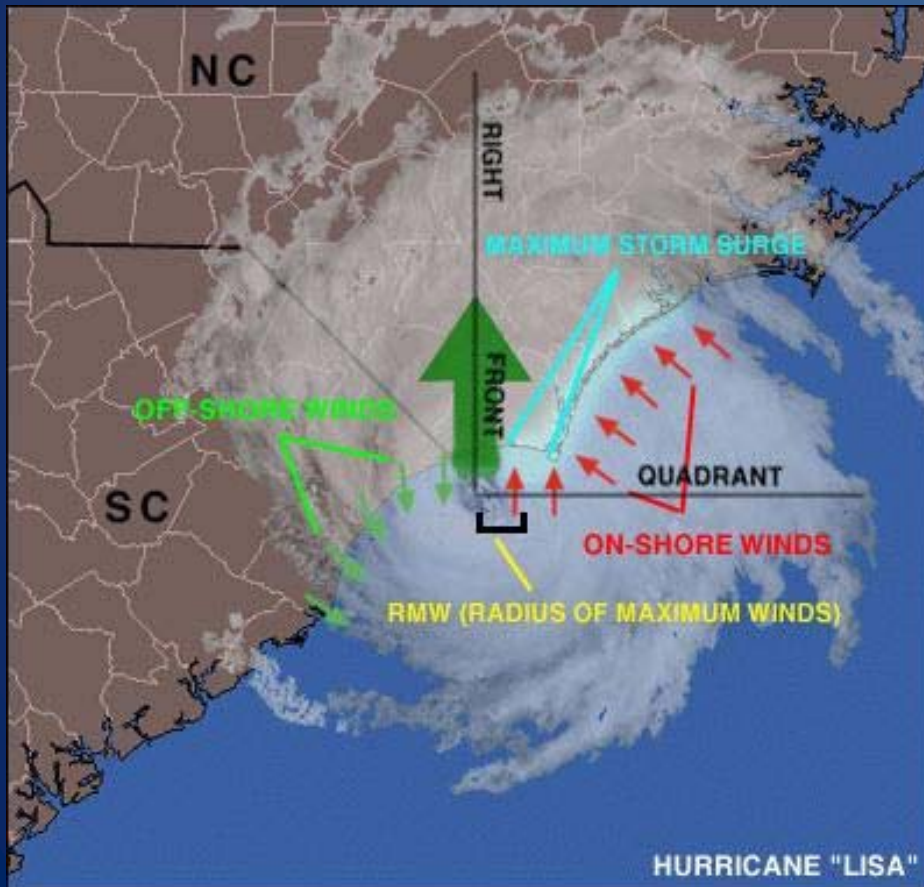
Severe damage to all structures.



Storm Surge Forecasting



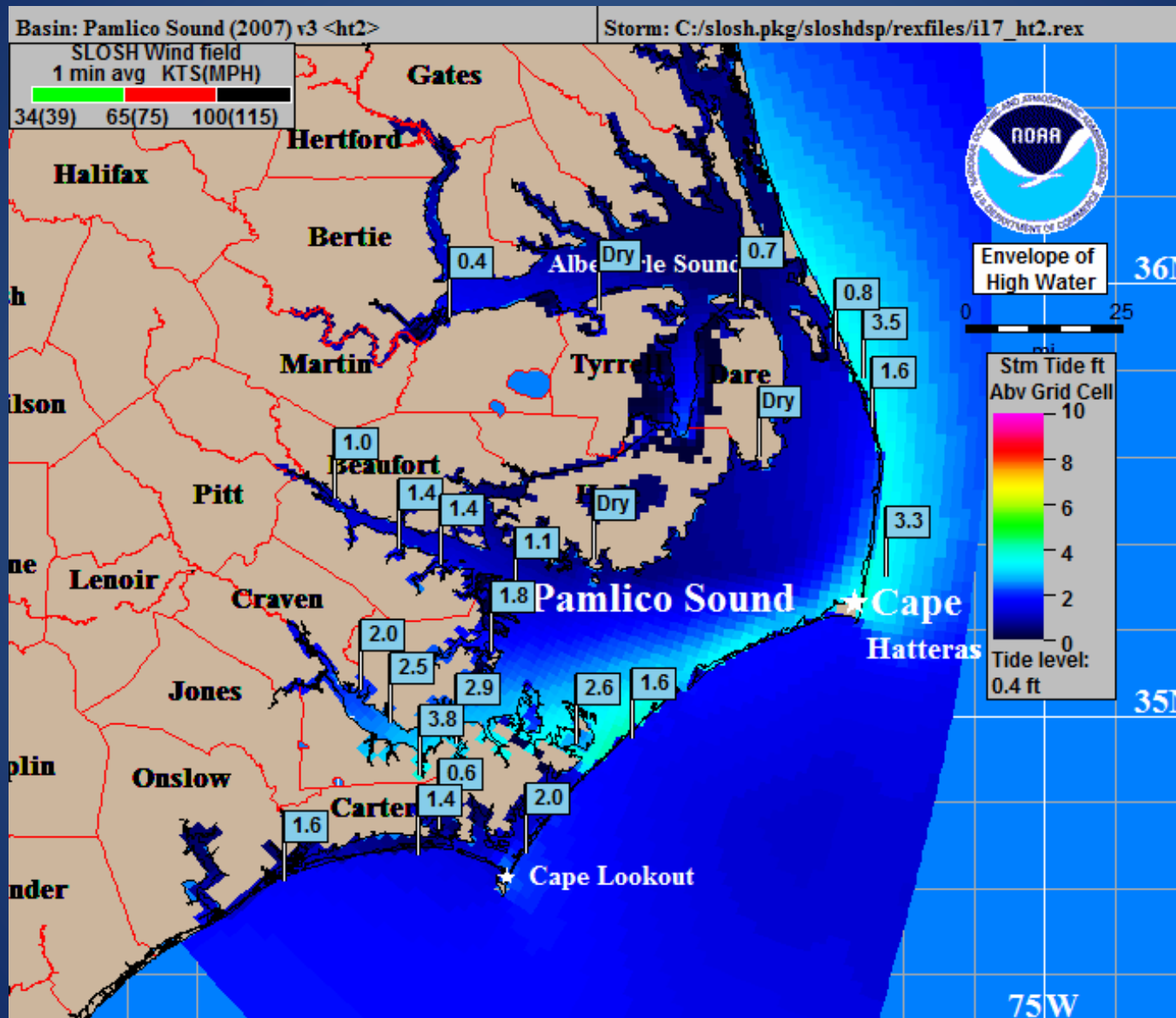
What factors does it depend on?



- Storm Intensity and Size
 - Stronger = Higher Surge
 - Larger = Larger impact area and higher surge
- Storm Speed
 - Faster Often Means Higher Surge Oceanside
 - Slower Often Means Higher Surge Sound Side
- Angle to Coast at Landfall
 - Perpendicular Maximizes Surge (Katrina)
- Bathymetry of Coastline
 - Shallow Slope Builds Higher Surge
 - Steep Slope Lessens Surge Height
- Wind Direction and Duration on Sounds
 - Can pile water into narrow rivers and streams
 - A rapid change in wind direction can result in a seiche effect



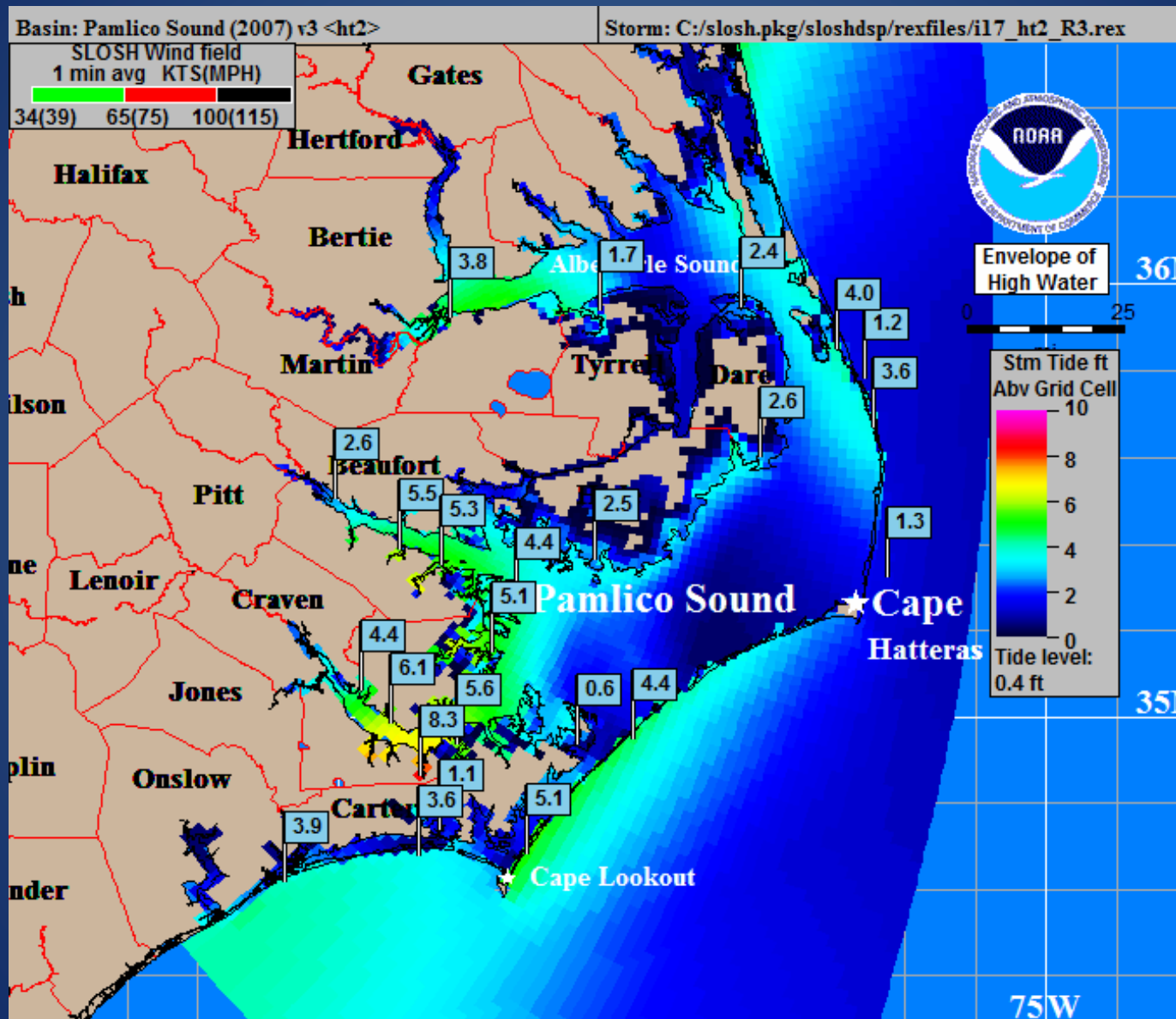
Storm Surge Guidance



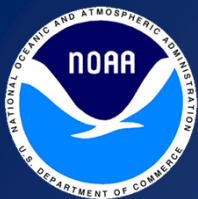
SLOSH Along Forecast Track Run



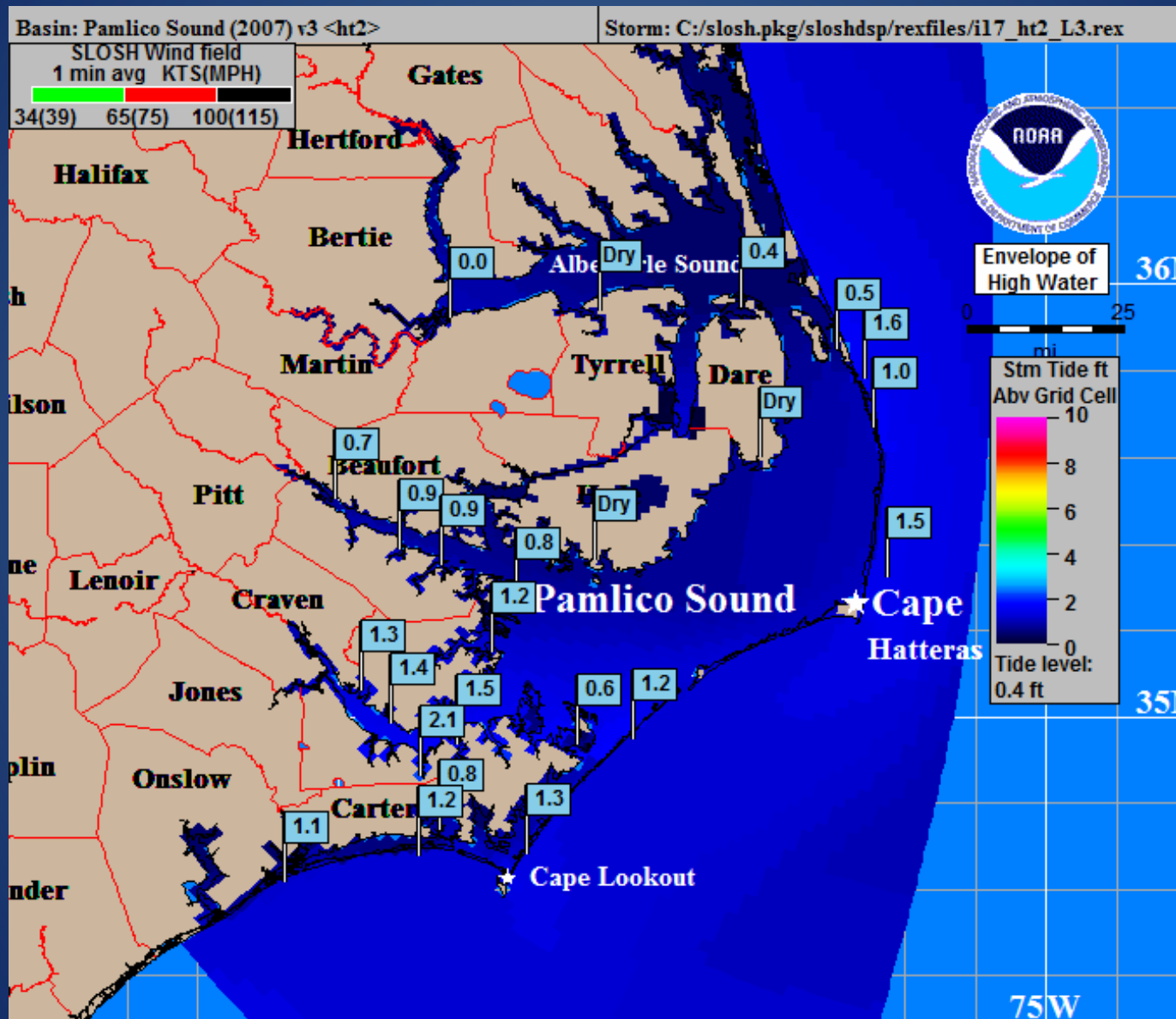
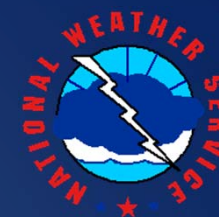
Storm Surge Guidance



SLOSH Left of Forecast Track Run



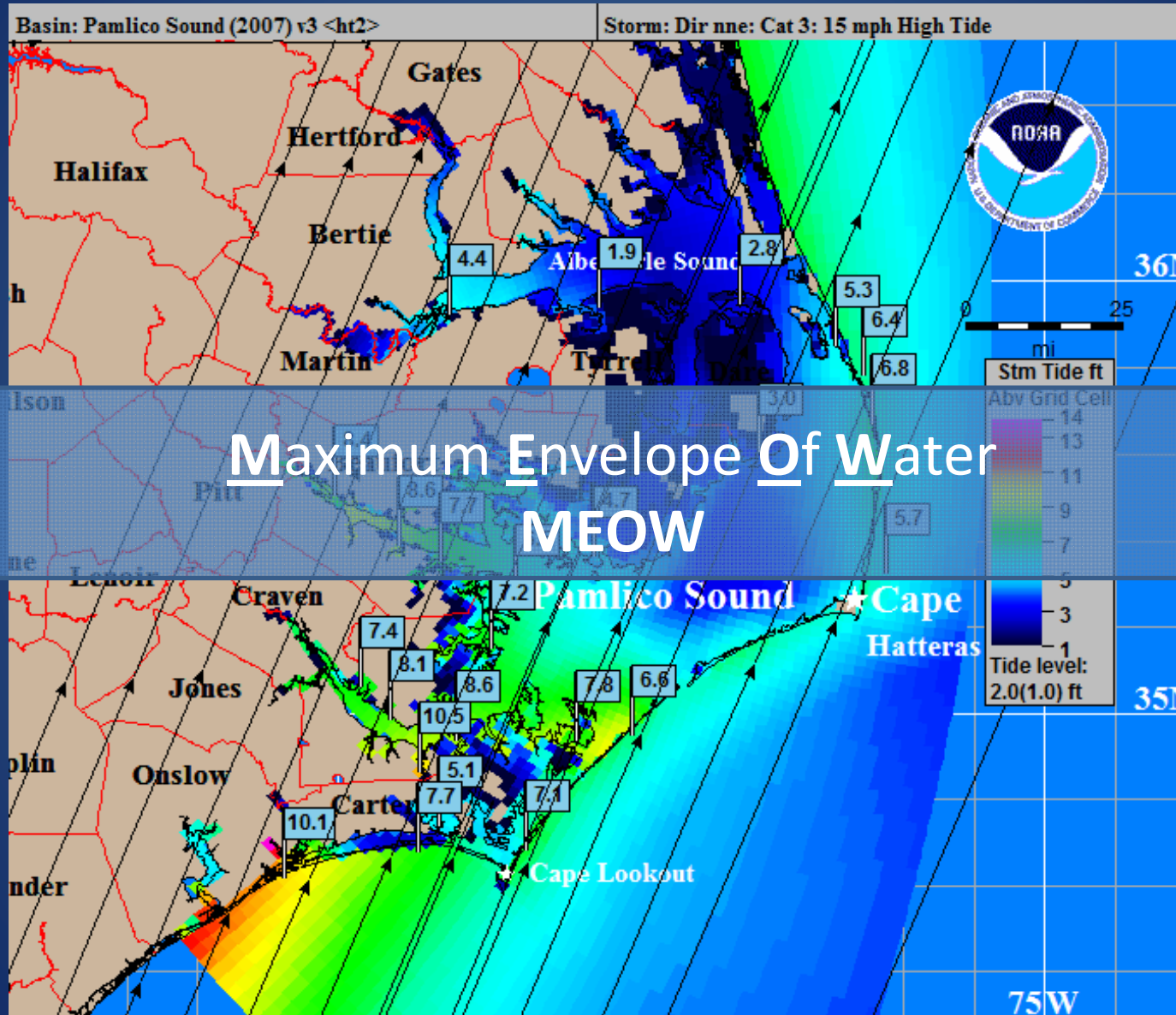
Storm Surge Guidance



SLOSH Right of Forecast Track Run



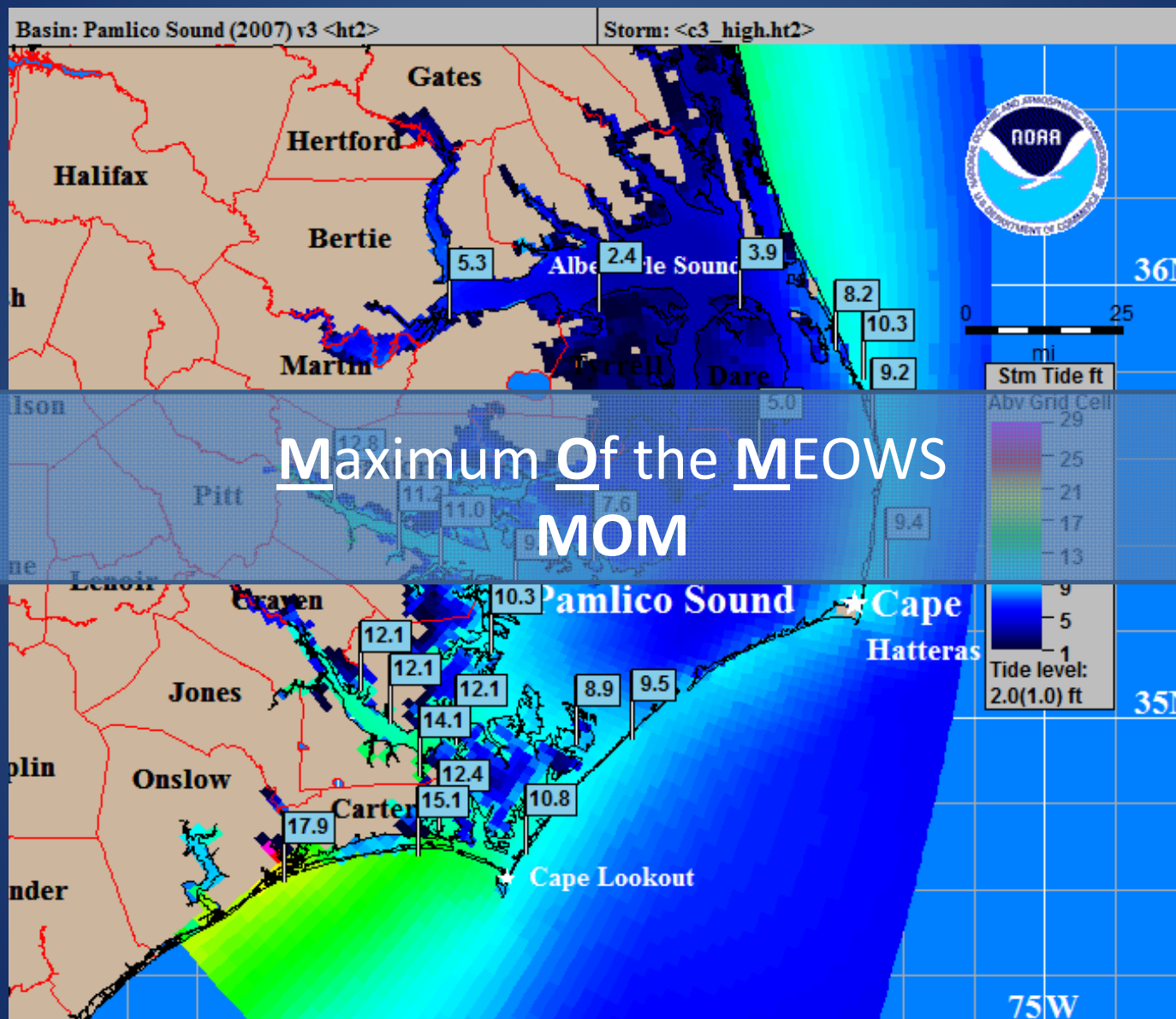
Storm Surge Guidance



Aggregate of Tracks for a CAT 3 Moving NNE at 15 mph at High Tide



Storm Surge Guidance



Aggregate of Tracks for a CAT 3 of All Directions and Speed at High Tide



Probabilistic Storm Surge Guidance



- Takes into account actual NHC Track Forecast and statistics of NHC error including: timing, location, intensity, and size of storm.
- Uses an ensemble of SLOSH runs to create probabilistic storm surge (p-surge)
 - Different directions of motion
 - Different landfall locations
 - Different intensities
 - Different storm sizes
 - Different forward speeds



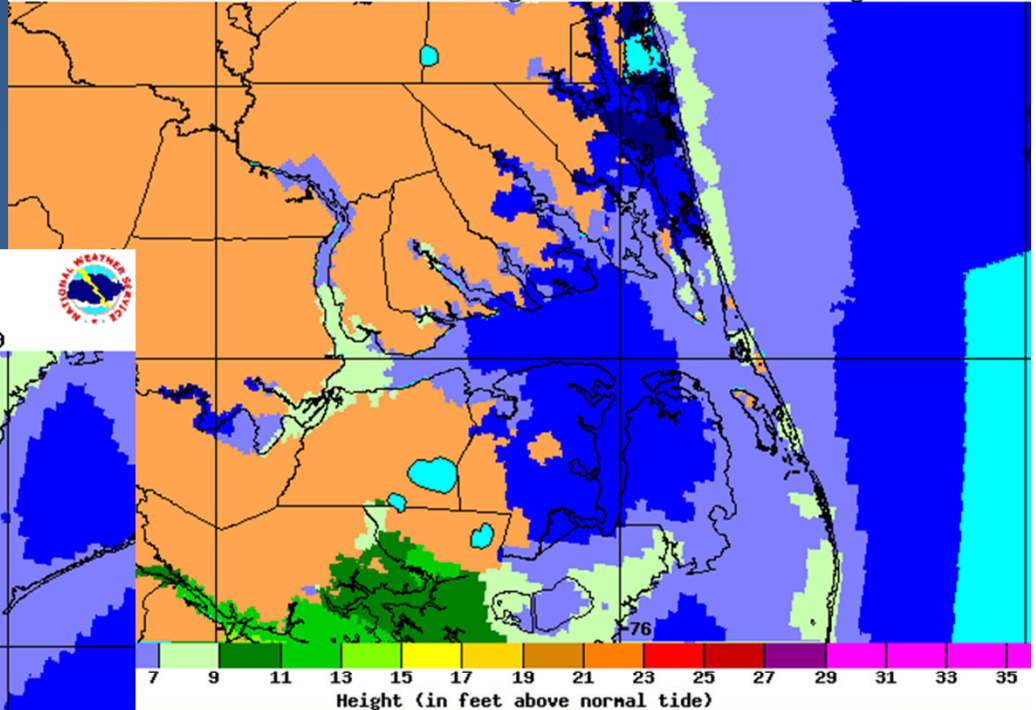
Probabilistic Storm Surge Guidance



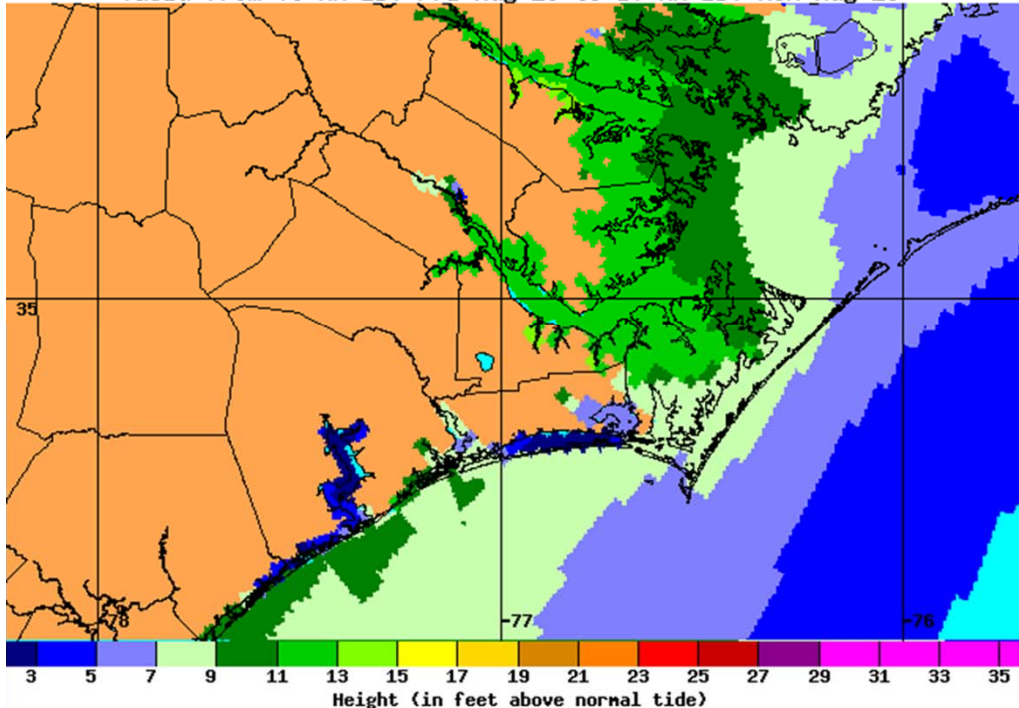
- Available when the NHC issues a hurricane watch or warning for the continental US.
- Can be utilized to assess potential surge based on uncertainties in forecast.



Tropical Cyclone Storm Surge Exceedance
Heights Which Have a 10% Chance of Being Exceeded
Hurricane Irene (2011) Advisory 24
Valid from 05 AM EDT Fri Aug 26 to 10 AM EDT Mon Aug 29



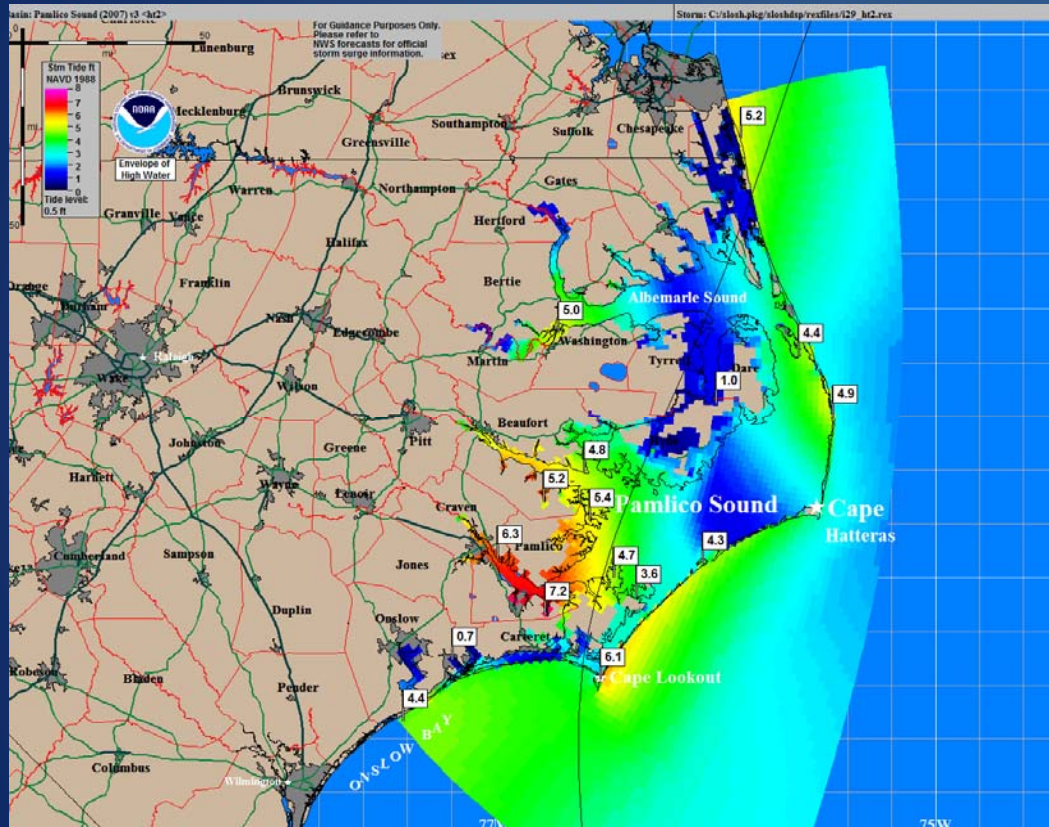
Tropical Cyclone Storm Surge Exceedance
Heights Which Have a 10% Chance of Being Exceeded
Hurricane Irene (2011) Advisory 24
Valid from 05 AM EDT Fri Aug 26 to 10 AM EDT Mon Aug 29



- Used to assist in generating coastal flooding impact graphics and surge forecasts in NHC and local NWS office text products.



Deterministic Storm Surge Guidance

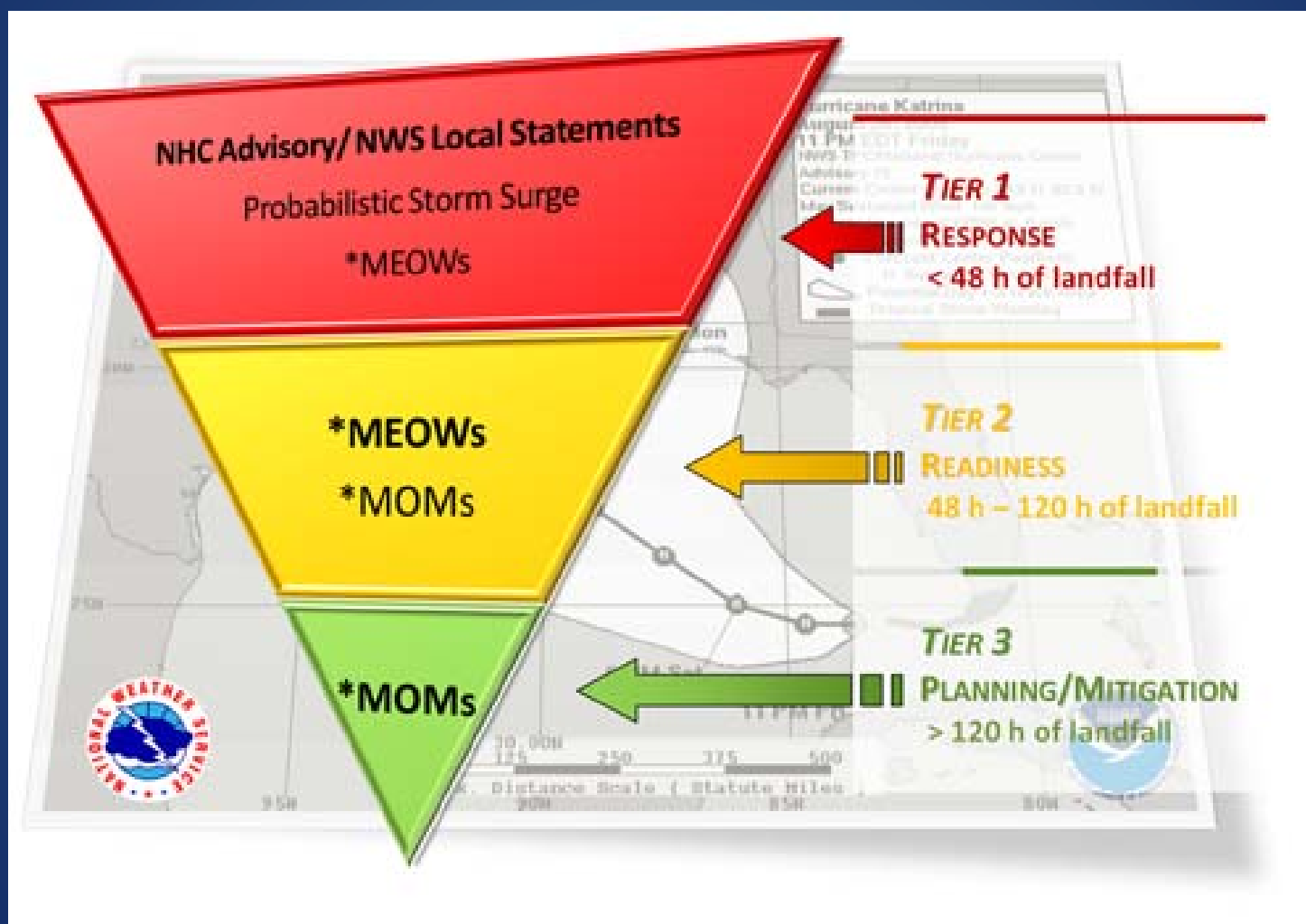


11 AM Saturday August 27

- Single Track SLOSH will be run approximately 36 hours prior to arrival of TS winds
 - Why only 36 hours?
 - NHC track/intensity errors
- Run every 6 hours coinciding with full NHC advisory package
- Shows surge animated in time.
- Includes one storm total inundation image.
- Only useful very close to landfall for search and rescue and other recovery planning.



Storm Surge Decision Guide





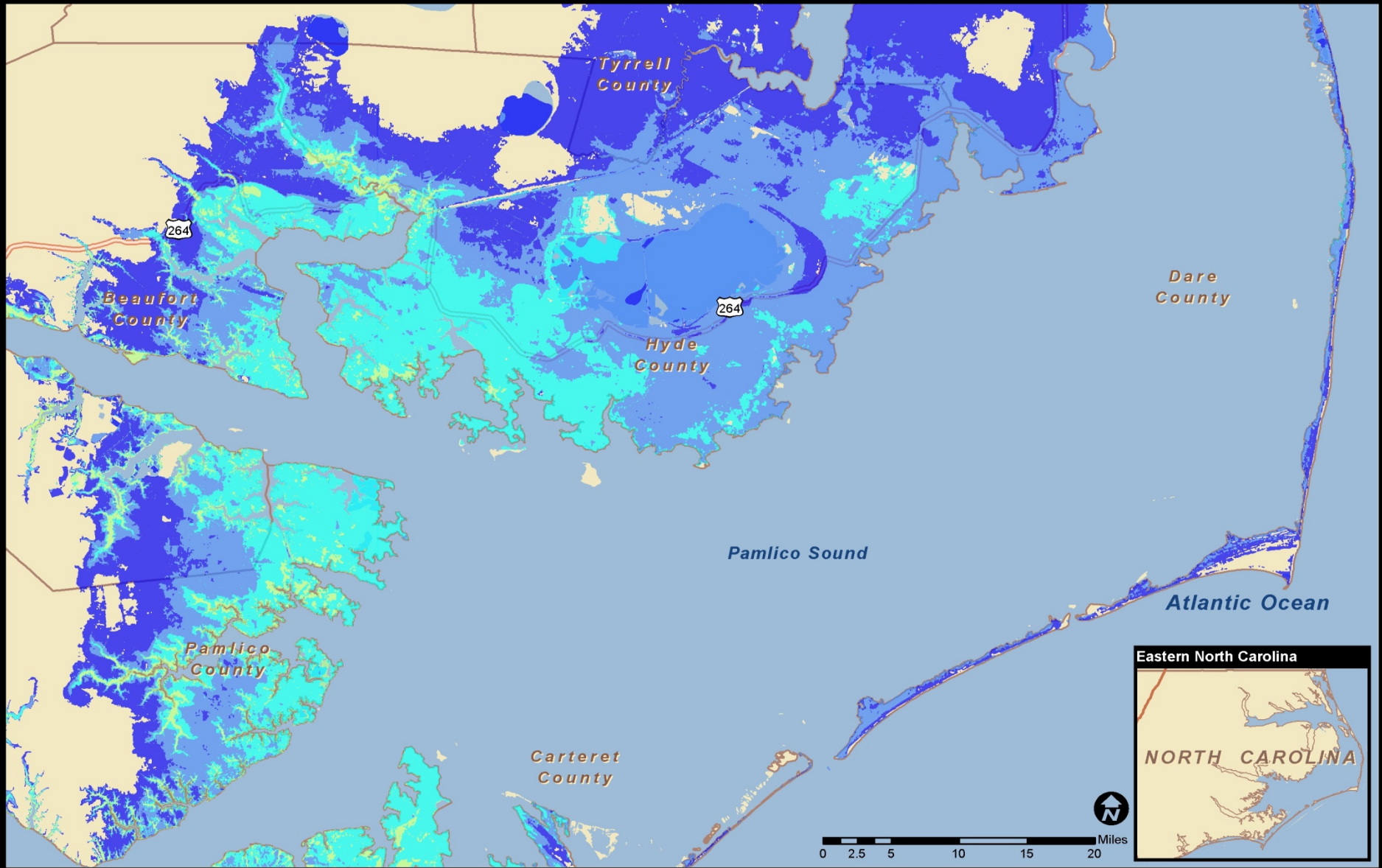
Experimental and Prototype Products



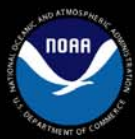
Hurricane Irene

Potential Inundation (10% exceedence)
Advisory #24
Thursday August 26, 2011
5 AM EDT

Feet Above Ground Level

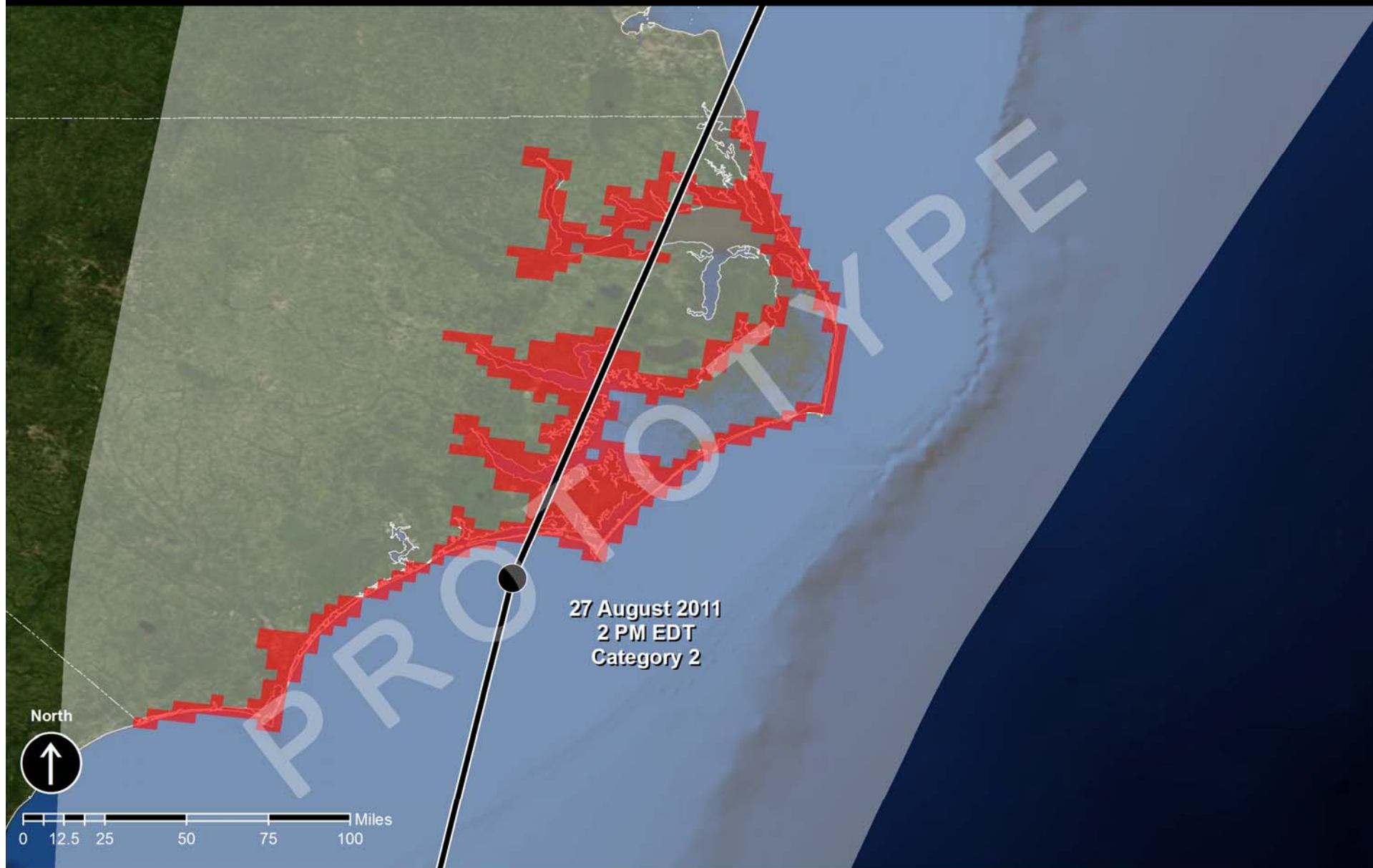


National Hurricane Center
Storm Surge Unit



Hurricane Irene, Advisory #22

Storm Surge Warning PROTOTYPE



National Hurricane Center
Storm Surge Unit



Hurricane Irene Adv #22 Forecast Track

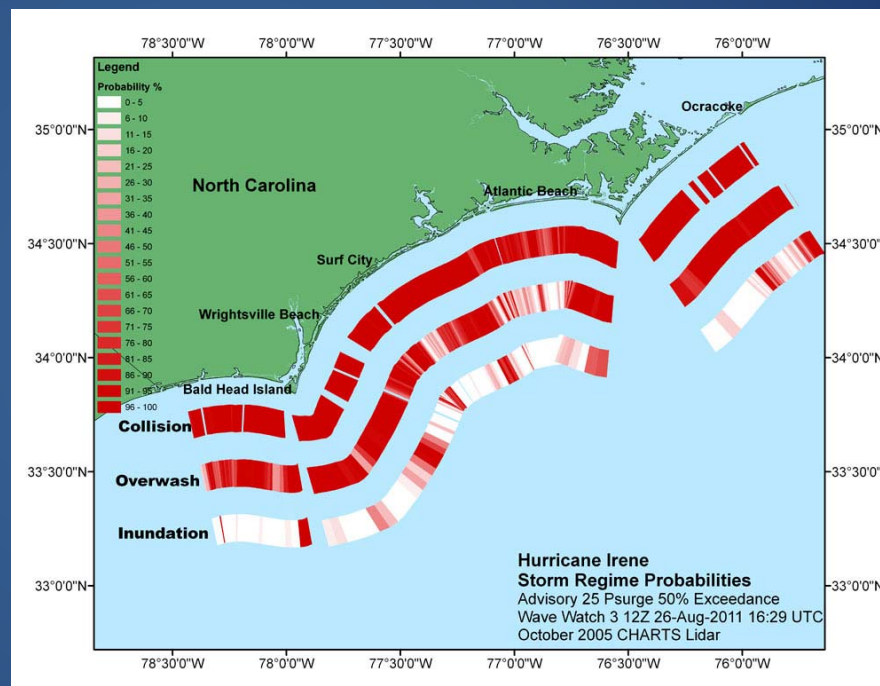
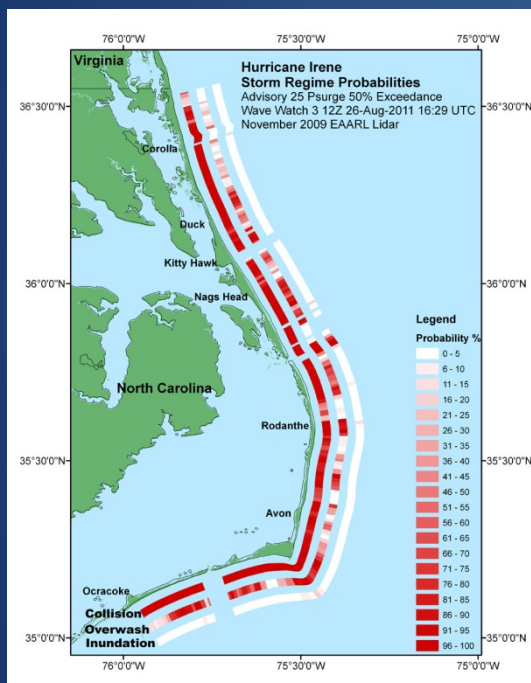


NWS/NHC Storm Surge Warning



Experimental USGS

Erosion, Overwash, and Inundation Guidance



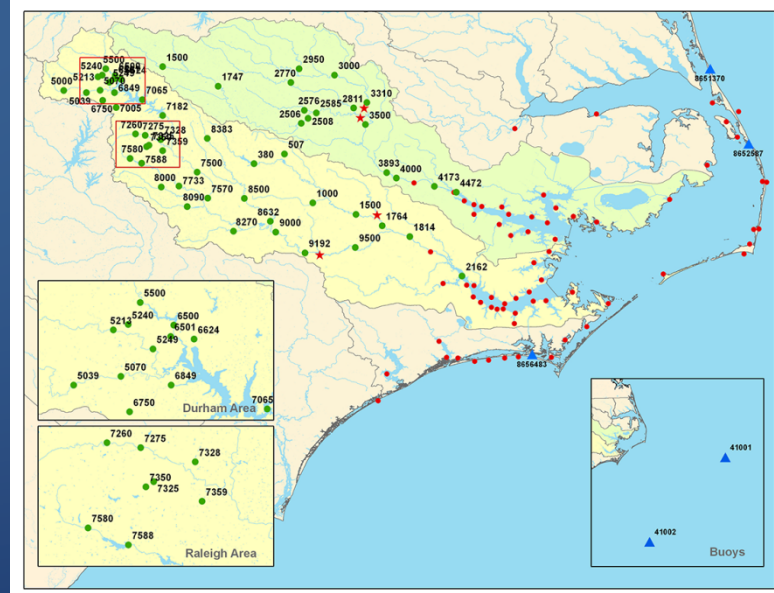
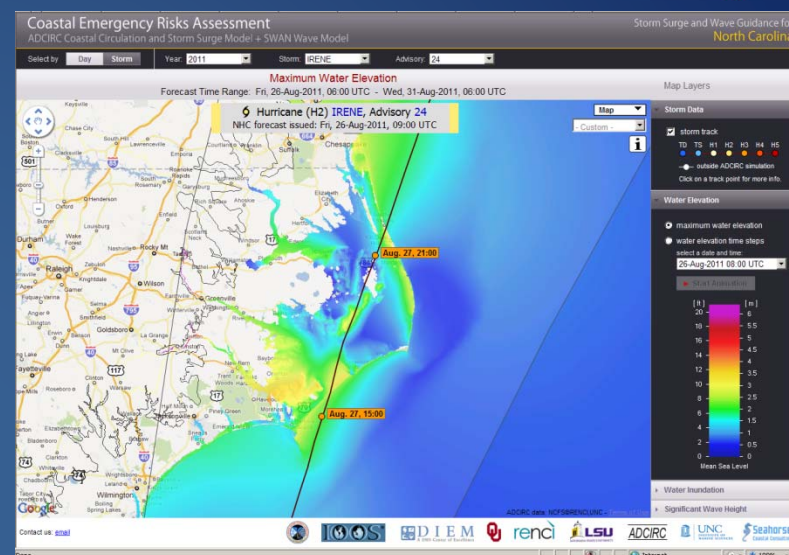
Collaborative effort underway between NWS and USGS to evaluate and bring into an operational setting.



CI-FLOW



- Project with NSSL, Sea Grant, and other NOAA partners born out of our NOAA in the Carolinas involvement.
- Created a coupled river and storm surge model for the Neuse and Pamlico Rivers and Pamlico Sound.
- Preliminary website and data available during Hurricane Earl in 2010, but very rudimentary and little operational use.
- Two web site interfaces developed for this season had much more usability. Very good interfaces and could be used and understood relatively easily.
- Still significantly limited due to computing resources that only allow for a single forecast hurricane track to be used.
- Would need an ensemble approach to better cover uncertainty in strength and uncertainty in track and size of storm.
- Water levels, inundation, significant wave heights, etc http://nc-cera.renci.org/cgi-cera_nc/cera_nc.cgi
- Water levels at particular points <https://secure.nssl.noaa.gov/projects/ciflow/>
Just click on a red dot and you can see the real-time ADCIRC simulations. When the NHC issues its track forecast, the ADCIRC results will be based on the NHC best track.





CI-FLOW

Coastal and Inland Flooding Observation and Warning Project

[CI-FLOW](#)

[C](#)

[CI-FLOW o](#)

[CI-FLOW on Coastal Emergency Risks](#)

Real-time
Station Map

Total Water
Level Simulation

Regional ADCIRC
Products
(disabled)

Precipitation-QPE

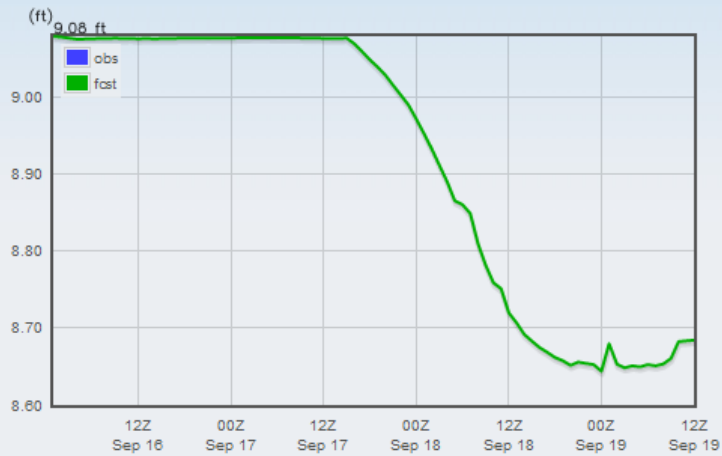
Data Downloads

Additional
Information
(disabled)

Case Study
Home
(disabled)

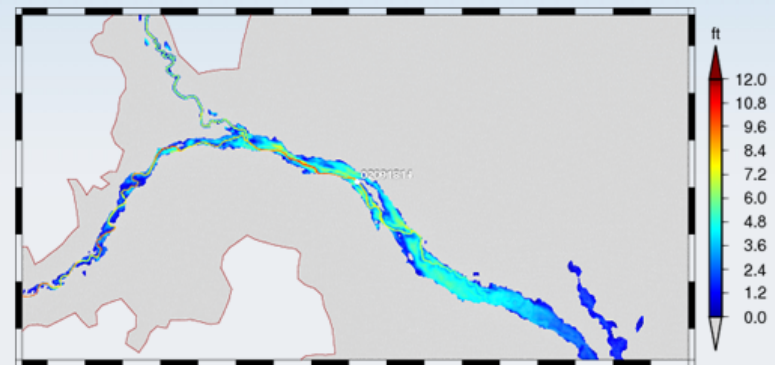
Simulation for NEUSE RIVER NEAR FORT BARNWELL, NC — USGS Station 02091814

ADCIRC HYDROGRAPH (NAVD88)



NAVD88 Stage

MAXIMUM INUNDATION MAP



Graphical representation of flood inundation for NWS flood categories are based on steady state hydrologic modeling water surface elevations for incremented discharges. Map shows approximate inundation areas for given water surface elevations and should not be used for navigation or permitting or other legal purposes, but strictly as a planning reference tool.

FLOOD CATEGORIES

(in feet)

Moderate Flood Stage	14
Flood Stage	12.5
Action Stage	12

FLOOD IMPACTS

- | | |
|------|---|
| 14 | River begins to threaten homes along north bank of the river up to River Road. Many acres of farmland flooded. |
| 13 | Minor lowland flooding of many acres along the river. Water begins to flood boat ramps along the north bank of the river downstream to Streets Ferry. |
| 12.5 | Minor flooding begins as river overflows the north bank into lowlands along the river. |



CI-FLOW

Coastal and Inland Flooding Observation and Warning Project

[CI-FLOW](#)

[C](#)

[CI-FLOW 0](#)

[CI-FLOW on Coastal Emergency Risks](#)

Real-time
Station Map

Total Water
Level Simulation

Regional ADCIRC
Products
(disabled)

Precipitation-QPE

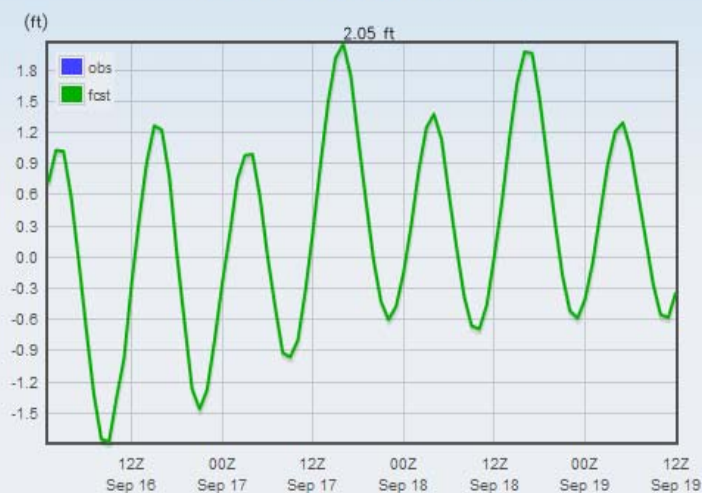
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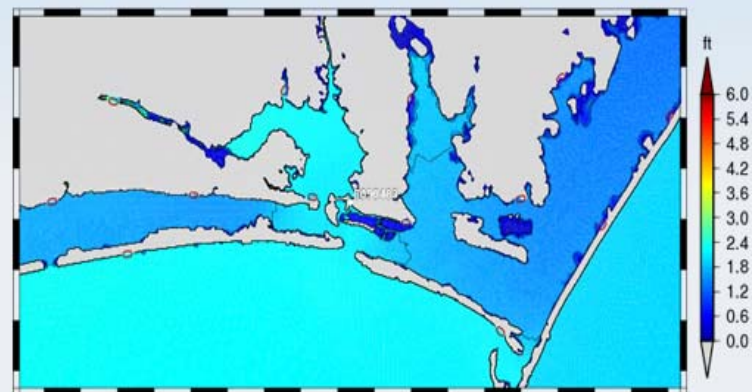
Simulation for BEAUFORT, NC — NOS Station 8656483

ADCIRC HYDROGRAPH (NAVD88)



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NAVD88 Stage



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FLOOD CATEGORIES

(in feet)

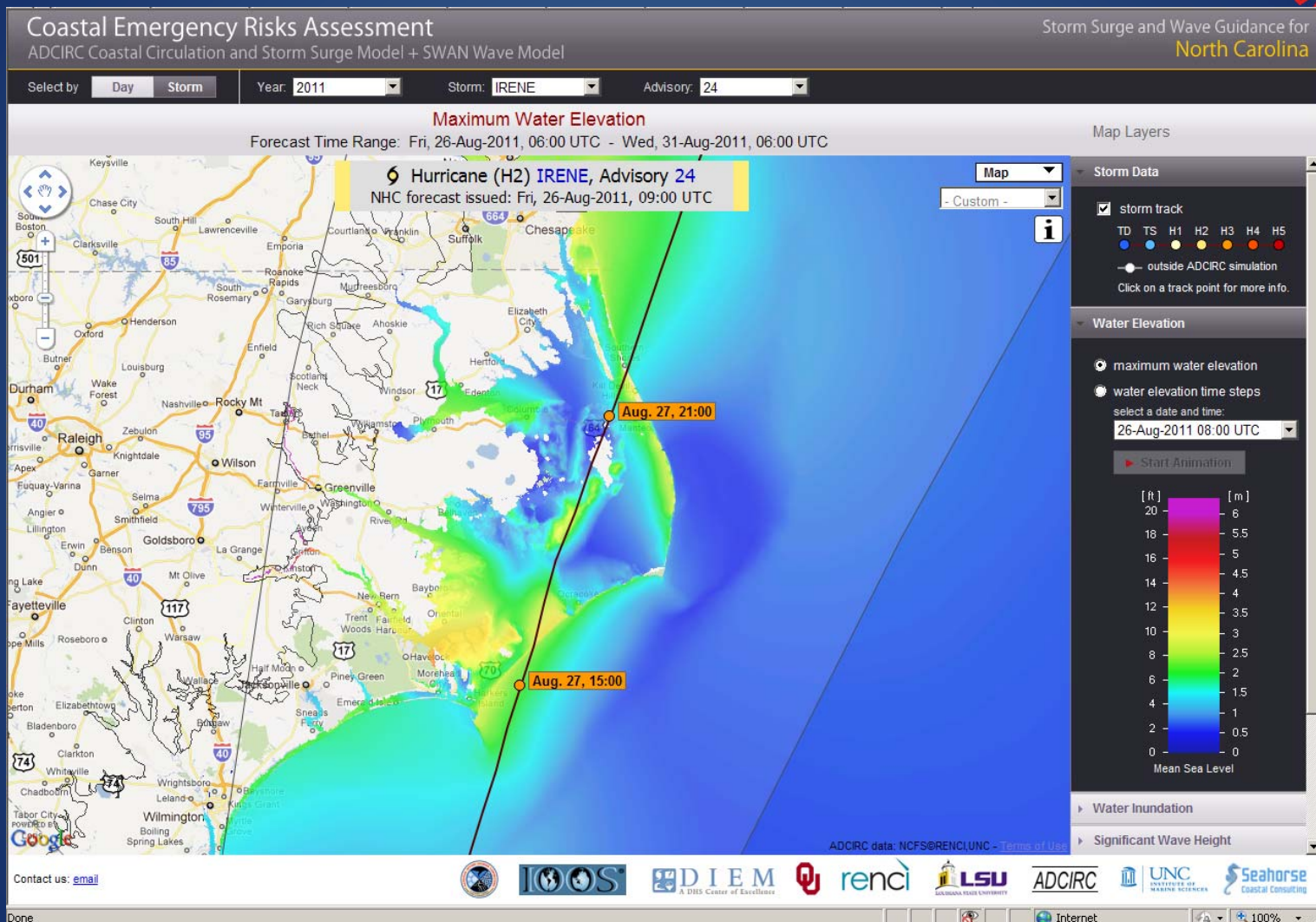
Undefined.

FLOOD IMPACTS

Undefined.



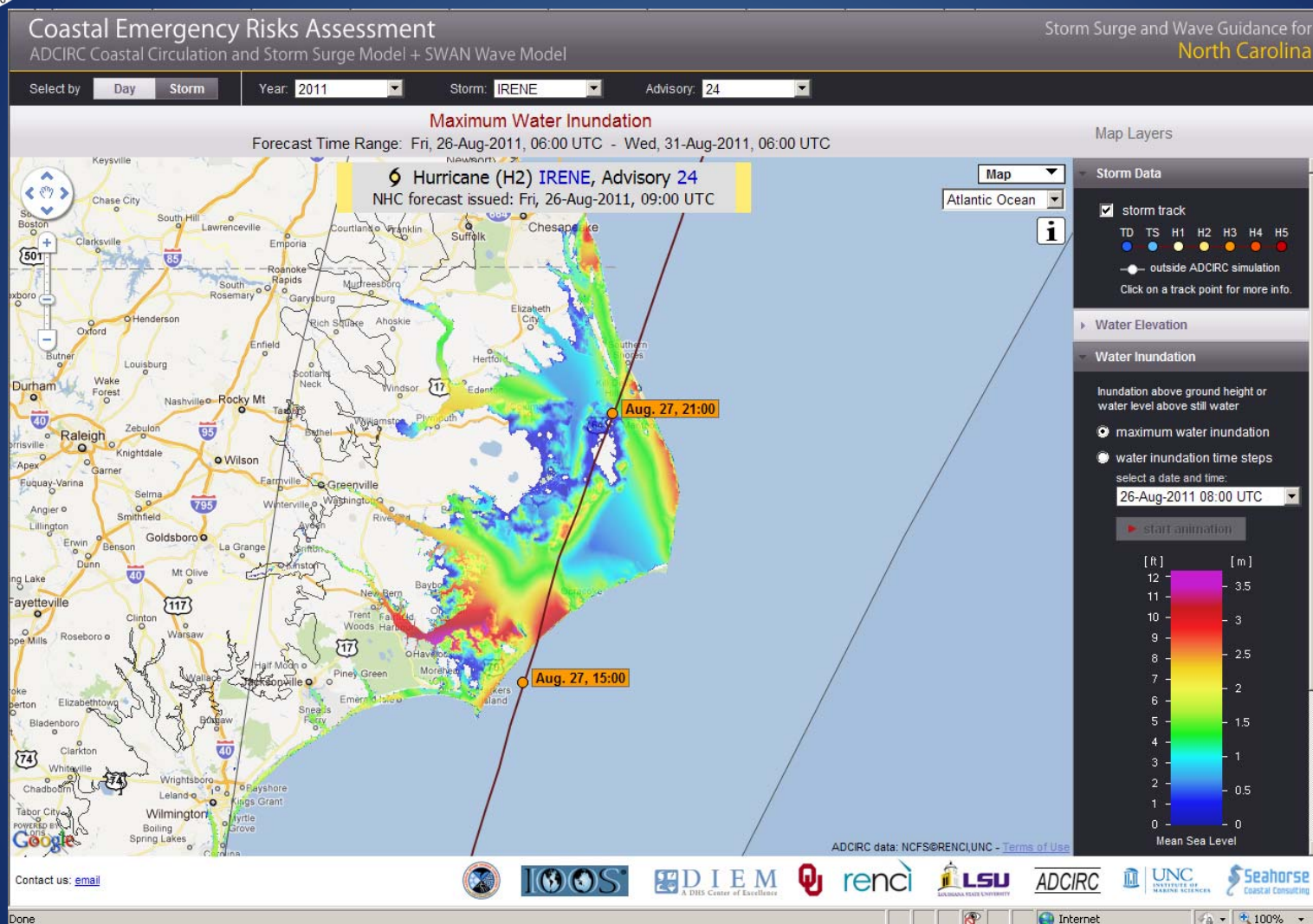
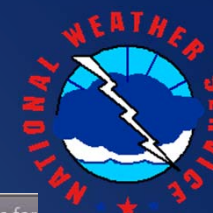
CI-FLOW



Maximum Water Elevation
(Surge + Tide + Wave)



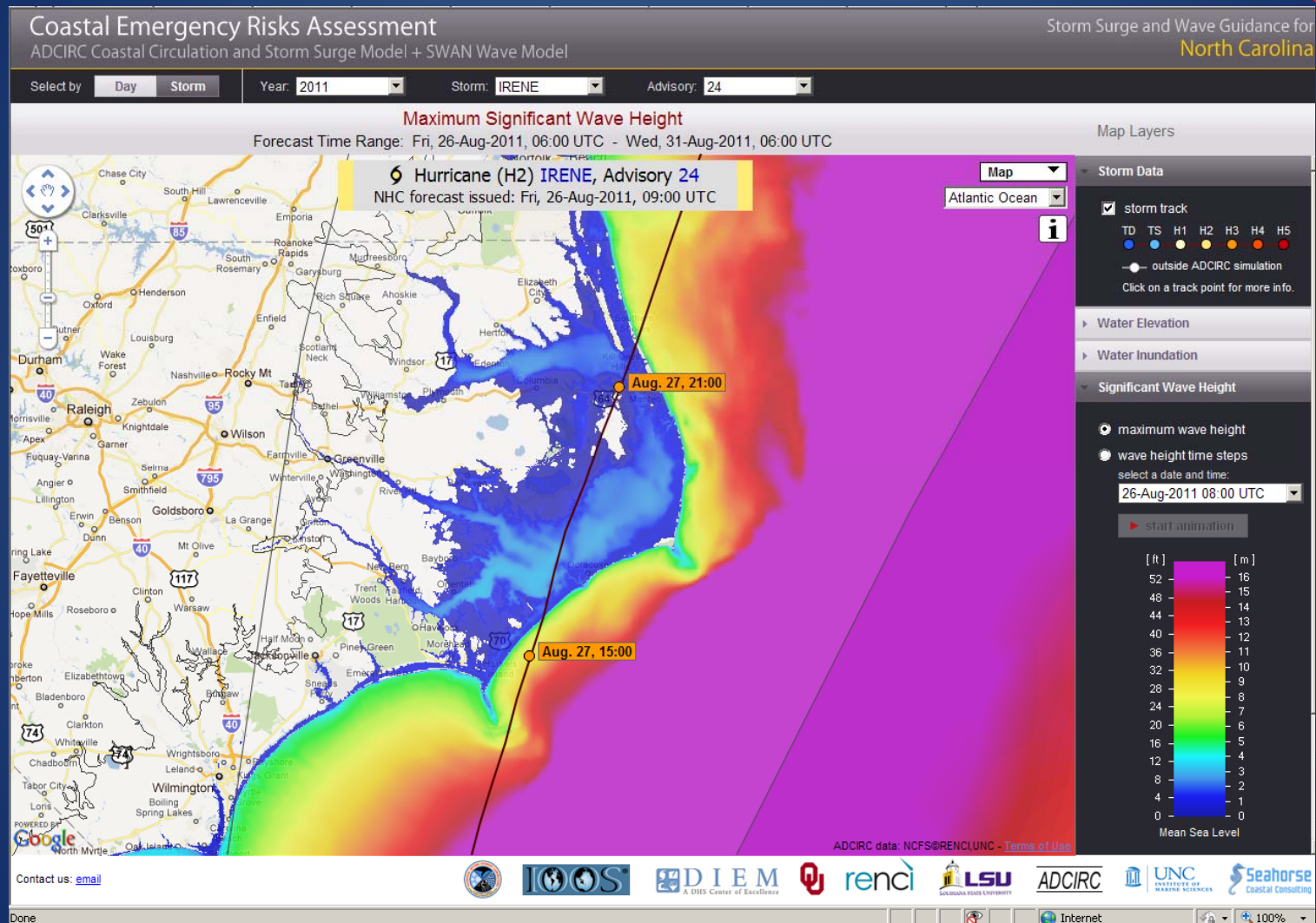
CI-FLOW



Maximum Water Inundation Above Ground
(Surge + Tide + Waves)



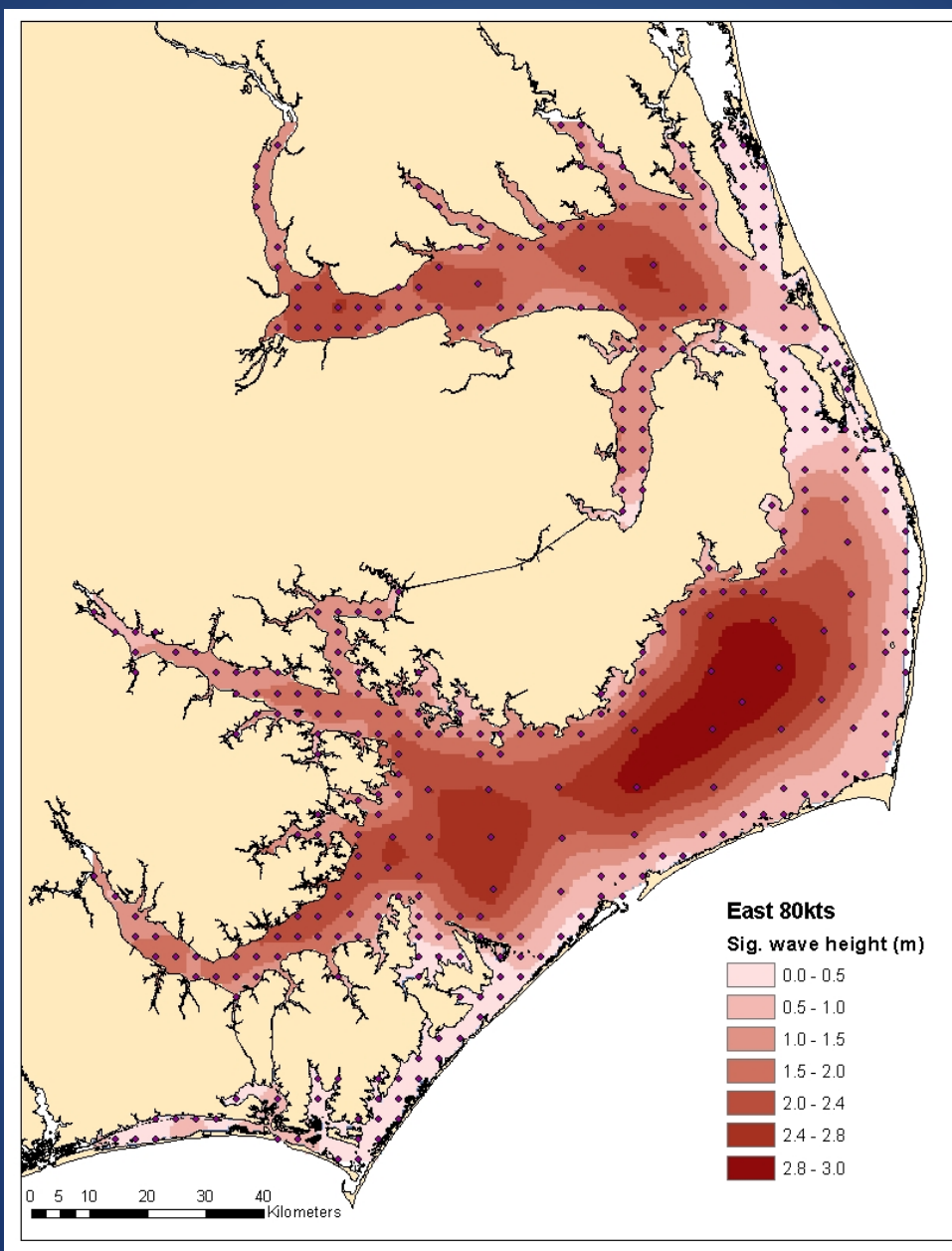
CI-FLOW



Maximum Wave Height



WEMo





National Weather Service Products and Services



When a Storm Threatens



The screenshot shows the National Hurricane Center (NHC) website. The header includes the NHC logo and navigation links: Home, News, Organization, Search, and a Go button. Below the header, there's a section for 'Top News of the Day' with a link to 'view past news' and a timestamp 'Last update Mon, 20 Jun 2011 03:49:36 UTC'. The main content area features a map titled 'Atlantic Tropical Cyclone Activity' showing the Atlantic Ocean and surrounding landmasses. The map is labeled 'No tropical cyclones at this time'. A legend at the bottom indicates '48-hour formation potential' with three categories: Low <30% (yellow), Medium 30-50% (orange), and High >50% (red). The map also shows the date and time '7:29 PM EDT Jun 19, 2011'. On the left side of the website, there's a sidebar with various links including 'Local forecast by City, St or ZIP', 'Alternate versions', 'Get Storm Info', 'Marine Forecasts', 'Hurricane Awareness', and 'Hurricane History'.

www.nhc.noaa.gov

- Look to the National Hurricane Center for information about broad scale tropical impacts.
- They provide information including tropical weather outlooks detailing the probability that a storm will form
- Once formed, they provide track graphics, wind and storm surge probabilities, and public advisory statements



When a Storm Threatens



National Weather Service Forecast Office
Newport/Morehead City, NC

Home News Organization Search

Local forecast by "City, St" or zip code
City, St Go

Weather Hazards
Graphical Hazardous
Weather Outlook
Rip Currents
National Hazards
National Hurricane
Center
Storm Prediction
Center
Storm Reports
E-Mail Alerts

Submit Local
Storm Reports

Current Conditions
NC Observations
Buoy Observations
Other Marine
Reports
Marine Portal
Satellite Images
Rivers & Lakes
AHPS
nowCOAST
IIV Index

Top News of the Day [Subscribe](#)

The NWS Has Declared June 19-25 as Lightning Awareness Week
Summer is the peak season for one of the nation's deadliest weather phenomena: lightning. In the United States, an average of 55 people are killed each year by lightning.

[Point and Click Forecast Map\(Description\)](#)

Quick Glimpse at the Weather **Newport/Morehead City, NC**

Click on the map below for the latest forecast.

Read watches, warnings & advisories [Zoom Out](#)

Severe Thunderstorm Warning
Severe Weather Statement
Small Craft Advisory
Air Quality Alert
Special Weather Statement
Hazardous Weather Outlook

Last map update: Mon, Jun. 20, 2011 at 12:07:38 am EDT

Synopsis for Eastern North Carolina

www.weather.gov/mhx

- Look to your local weather service forecast office for detailed information specific to your location. There are 8 Weather Forecast Offices that serve the Carolinas
- Land and Coastal Text and Graphical Forecasts
- Watches and Warnings in Effect
- Live Radar Images
- Satellite Images
- Current Conditions and Climate Data
- Preparedness and Weather Safety Information



What is a Hurricane Local Statement?



- The Hurricane Local Statement (HLS) is the primary tropical cyclone product issued by the NWS Weather Forecast Office for the media and general public.
- They contain essential, detailed hurricane or tropical storm information, expanding on the storm's potential effects on the local area and on any actions declared by local emergency managers.

URGENT - IMMEDIATE BROADCAST REQUESTED
HURRICANE IRENE LOCAL STATEMENT
NATIONAL WEATHER SERVICE NEWPORT/MOREHEAD CITY NC
1158 PM EDT FRI AUG 26 2011

Overview of HLS for entire region

**...IRENE MOVING NORTH-NORTHEASTWARD TOWARD
CAROLINA...TROPICAL STORM CONDITIONS LASHING**

.NEW INFORMATION...

TORNADO WATCH HAS BEEN ISSUED FOR MUCH OF E

.AREAS AFFECTED...

THIS LOCAL STATEMENT PROVIDES IMPORTANT INFORMATION
RECOMMENDED ACTIONS FOR PEOPLE AND MARINE IN
LOCATIONS AND COASTAL WATER LEGS OF EASTERN NC
ADJACENT COASTAL WATERS.

.WATCHES/WARNINGS...

A HURRICANE WARNING CONTINUES FOR THE FOLLOWING
MARTIN...PITT...WASHINGTON...TYRRELL...MAINLAND
BEAUFORT...MAINLAND HYDE...DUPLIN...LENOIR...JON
PAMLICO...CARTERET...ONslow...OUTER BANKS DARE
HYDE.

FOR MARINE INTERESTS...A HURRICANE WARNING CO
ATLANTIC COASTAL WATERS INCLUDING ALBEMARLE A

A **FLOOD WATCH** IS IN EFFECT FOR ALL OF EASTERN NC
PLEASE LISTEN CLOSELY FOR ANY FLOOD WARNINGS THAT
EFFECT FOR YOUR AREA.

A **TORNADO WATCH** IS IN EFFECT FOR PORTIONS OF E
CAROLINA AND ADJACENT COASTAL WATERS. PLEASE
ANY TORNADO WARNINGS THAT MIGHT BE IN EFFECT

.STORM INFORMATION...

AT 11 PM EDT...THE CENTER OF HURRICANE IRENE WAS
LATITUDE 32.6N...LONGITUDE 76.9W. THIS WAS ABOUT
SOUTH-SOUTHWEST OF BUXTON NC...OR ABOUT 150
MOREHEAD CITY NC. STORM MOTION WAS NNE OR 20
STORM INTENSITY WAS 100 MPH.

.SITUATION OVERVIEW...

WHEN MAKING DECISIONS...**DO NOT FOCUS ON THE EXACT FORECAST TRACK.**

DUE TO THE SIZE
IMPACTS WILL OF
STORM SURGE...

AS IRENE AFFECT
INTO SOUTHERN
THE NIGHT. **HUR**
SOUTHERN PORT
HURRICANE WAR
HURRICANE IRENE
SATURDAY.

A **FLOOD WATCH**
RAINFALL WILL IN
THROUGH THE A
WITH LOCALLY H
DURING THIS EVE
OF HIGHWAY 17.
IN EFFECT FOR YOUR AREA

.PRECAUTIONARY/PREPAREDNESS ACTIONS...
PRECAUTIONARY/PREPAREDNESS ACTIONS...

PREPARATIONS FOR THE PROTECTION OF LIFE AND PROPERTY SHOULD BE
COMPLETED AT THIS TIME. **EVACUATE IF DIRECTED TO DO SO BY LOCAL
OFFICIALS...OR IF YOUR HOME IS VULNERABLE TO HIGH WINDS OR
FLOODING.**

SMALL CRAFT SHOULD REMAIN IN PORT AND WELL SECURED.

FOR ADDITIONAL PRECAUTIONARY AND PREPAREDNESS INFORMATION...
PLEASE REFER TO THE DETAILED RECOMMENDATIONS RELATIVE TO YOUR
LOCATION AS FURTHER DESCRIBED BY YOUR LOCAL NATIONAL WEATHER
SERVICE OFFICE AND LOCAL EMERGENCY MANAGEMENT.

&&

A **5 TO 9 FEET OF SURGE IS EXPECTED ACROSS THE WARNED AREA.** AREAS
THAT WILL BE HARDEST HIT WILL BE ADJACENT TO THE PAMLICO SOUND
INCLUDING THE LOWER REACHES OF THE NEUSE AND PAMLICO
RIVERS...OCEANSIDE AREAS SOUTH OF CAPE HATTERAS...AND SOUNDSIDE
OUTER BANKS DARE AND HYDE COUNTIES. THESE WATER LEVELS WILL
PRODUCE MODERATE TO MAJOR FLOODING OF HOMES...ROADS...AND
PROPERTIES.

10 TO 15 FOOT BREAKERS WILL PRODUCE SEVERE BEACH EROSION...OCEAN
OVERWASH...AND LIFE THREATENING RIP CURRENTS.

A **TORNADO WATCH** IS IN EFFECT FOR MUCH OF THE AREA. ISOLATED
TORNADOES ARE LIKELY TONIGHT AND DURING THE DAY SATURDAY MAINLY
ALONG THE IMMEDIATE COAST. ANY TORNADOES THAT OCCUR WILL BE BRIEF
AND VERY DIFFICULT TO SEE. PLEASE LISTEN FOR ANY TORNADO WARNINGS
THAT MIGHT BE ISSUED FOR YOUR AREA.

NCZ045>047-080-081-093>095-098-103-104-280400-
/O.CON.KMHX.HU.W.1009.000000T0000Z-000000T0000Z/

WASHINGTON...TYPICAL MAINLAND BASE BEAUFORT MAINLAND UNDE

CRAVEN-
HYDE-
1158 PM

...HURRIC

...PRECAU
PRECAUT

FOR DAR
VISITORS
THROUGH
VIRGINIA
COUNTY.
DAVIS RE
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FOR ON
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9 AM SU
MIDDLE S
MIDDLE..

FOR CAR
RESIDENT
BEACH B
BOGUE B
FOLLOW
HIGH...AT
SMITHFIE

FOR HYDE COUNTY...THERE ARE MANDATORY EVACUATION
OCRACOKE ISLAND AND MAINLAND
OPEN AT INGLEWOOD BAPTIST CHU
SHELTER IS OPEN AT RALEIGH ROAD
MORE INFORMATION PLEASE CALL
252 926 4368.

FOR BEAUFORT COUNTY...THERE ARE
LIVING IN LOW LYING AREAS.

FOR TYRRELL COUNTY...THERE ARE
LIVING IN LOW LYING AREAS AND M

&&

...PROBABILITY OF TROPICAL STORM
THE CHANCE FOR **HURRICANE CON**
ALSO...THE CHANCE FOR TROPICAL S
TO 100 PERCENT.

...STORM SURGE AND STORM TIDE..
AN EXTREMELY DANGEROUS STORM
MUCH AS **6 TO 11 FEET ABOVE GRO**
AREA IN NORTH CAROLINA...**INCLUD**
SOUNDS. NEAR THE COAST...**THE SU**
LARGE...DESTRUCTIVE...AND LIFE- T

AS HURRICANE IRENE APPROACHES
CHANCE FOR COMBINED STORM SU
TO **9 FEET ABOVE MEAN SEA LEVEL**
RESULTING **IN WORST CASE FLOOD**
GROUND LEVEL SOMEWHERE WITH

THE LOCATIONS MOST LIKELY TO RE
INCLUDE THE OUTER BANKS....DOWNEAST CARTERET COUN
ADJACENT TO THE PAMLICO AND ALBEMARLE SOUNDS...THI

PAMLICO RIVERS...AND
FORECAST...THERE IS A
ASTRONOMICAL TIDE
AREAS CLOSER TO THE
INUNDATION OF 6 TO
SURGE ZONE. **MAXIMI**
CARTERET COUNTY AL
NEUSE AND PAMLICO
SURGE IS LIKELY WITH
POTENTIAL DUNE BRE
AT TOPSAIL BEACH. AL
MOST LIKELY PERIOD C
EVENING.

THERE IS A SIGNIFICAN
FLOODING...POTENTIAL
THE CHANCE OF MAJO
SURGE ZONE...**RESULT**
INUNDATION. IF REAL
FAILED TO HEED OFFIC
PLACED THEIR LIVES IN
STAYING BEHIND IN V
BUSINESSES NEAR THE
PRONE AREAS.

SEVERAL COASTAL CO
STRUCTURES NOT RAIS
SIGNIFICANT FLOODIN
AND POUNDING SURF
LOCATIONS. FLOOD W
CARS WILL LIKELY BE S

HLS for Coastal Counties

SUBSTANTIAL BEACH EROSION WILL OCCUR. **MANY ROADS WILL LIKELY BE
DAMAGED OR WASHED OUT BY THE FLOOD WATERS...LEAVING SECTIONS OF
COASTAL COMMUNITIES IN FLOOD PRONE AREAS TEMPORARILY CUT OFF.**
ROADWAY TRAVEL MAY BE DANGEROUS WITH SEVERAL ROADS CLOSED.

...INLAND FLOODING...

A **FLOOD WATCH** IS IN EFFECT FOR ALL OF EASTERN NORTH CAROLINA.
RAINFALL WILL INCREASE IN INTENSITY AS HURRICANE IRENE MOVES
TOWARD THE COAST EARLY SATURDAY. **RAINFALL AMOUNTS OF 6 TO
10 INCHES WITH LOCALLY HIGHER AMOUNTS AS MUCH AS 12 INCHES COULD
OCCUR DURING THIS EVENT.** THE HEAVIEST RAINFALL IS EXPECTED TO
OCCUR EAST OF HIGHWAY 17. PLEASE LISTEN FOR ANY FLOOD WARNINGS
THAT MIGHT BE IN EFFECT FOR YOUR AREA.

...WINDS...

AS HURRICANE IRENE MOVES THROUGH THE AREA...**MAXIMUM WINDS ARE
FORECAST TO BE IN THE 45 TO 65 MPH RANGE WITH GUSTS TO 100 MPH.**

DAMAGING WINDS ARE EXPECTED. POORLY ANCHORED MOBILE HOMES MAY BE
DESTROYED...ALONG WITH THOSE OF OLD OR POOR CONSTRUCTION. SOME
WELL ANCHORED MOBILE HOMES WILL HAVE SUBSTANTIAL DAMAGE TO
ROOFS...WALLS...AND WINDOWS...AND COULD BECOME UNINHABITABLE.
SOME HOMES OF FRAME CONSTRUCTION WILL SUSTAIN PARTIAL WALL AND
ROOF FAILURE...AND POSSIBLY BLOWN OUT WINDOWS. LOOSE OUTDOOR
ITEMS WILL BECOME PROJECTILES...CAUSING ADDITIONAL DAMAGE AND
POSSIBLE INJURY. MANY AREAS WILL EXPERIENCE POWER OUTAGES WITH
SOME DOWNED POWER POLES. NUMEROUS LARGE BRANCHES OF HEALTHY TREES
WILL SNAP. SOME TREES WILL BE UPROOTED...ESPECIALLY WHERE THE
GROUND IS SATURATED.

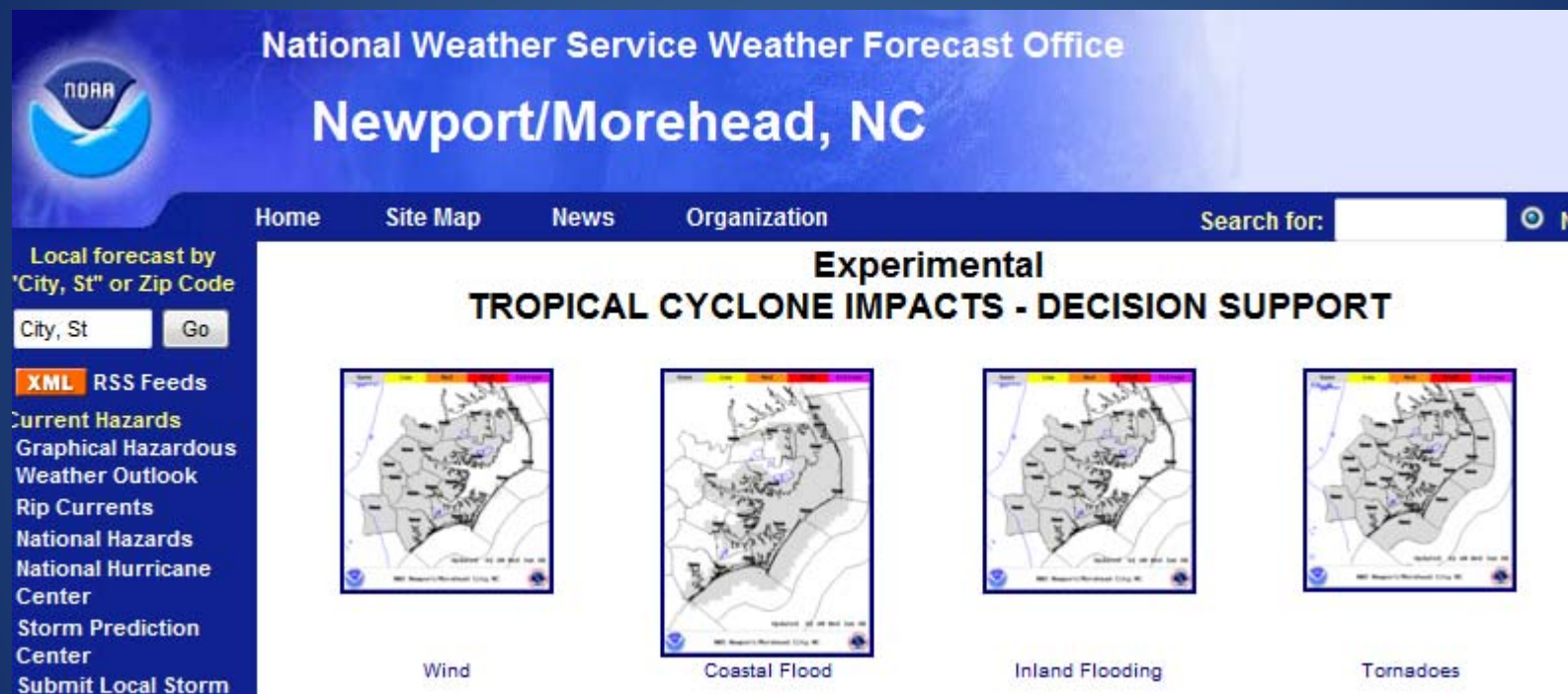
...COASTAL HAZARDS...

THERE WILL BE A HIGH RISK OF RIP CURRENTS ALONG AREA BEACHES
TODAY. LARGE BREAKING WAVES AND ROUGH SURF WILL ALSO BE A THREAT.
DUE TO RIP CURRENTS AND VERY ROUGH SURF...BEACH GOERS ARE URGED
TO STAY OUT OF THE WATER.

\$\$



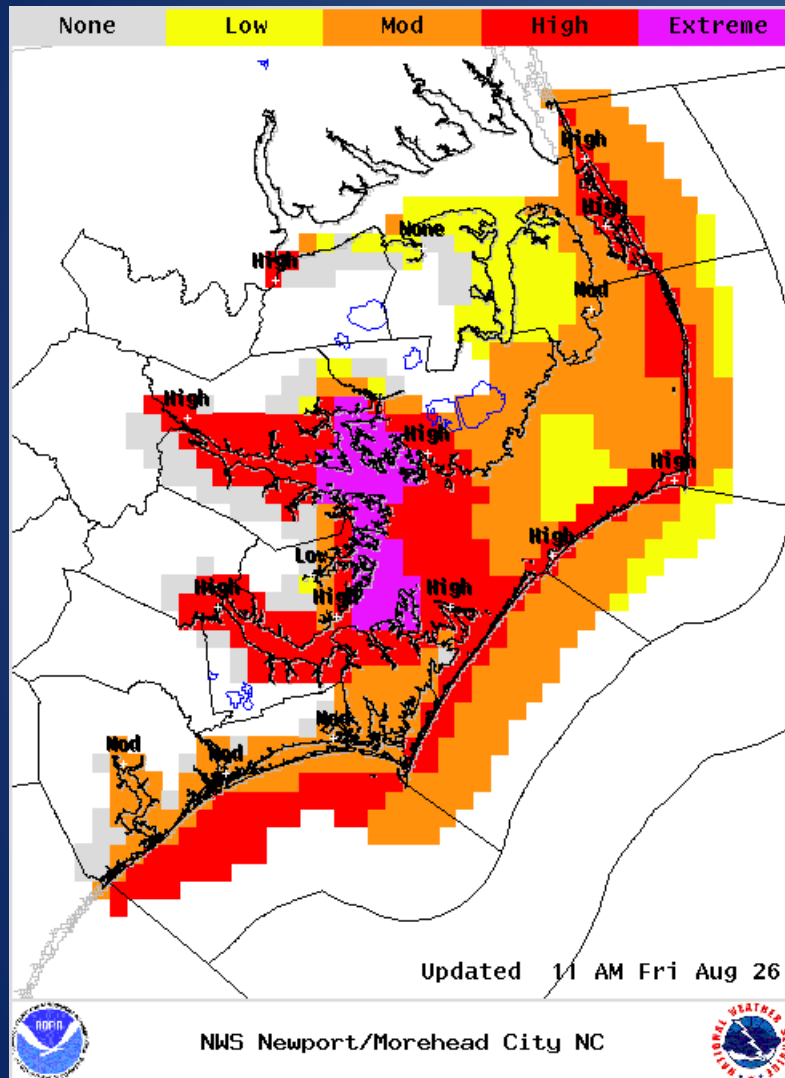
Tropical Impact Graphics



- For more detailed information when a storm threatens consult your local NWS Weather Forecast Office
- These graphical impact graphics become available when an area is placed under a tropical storm or hurricane watch or warning (typically 36 to 48 hours in advance of landfall.)



Coastal Flooding Impact Graphics



None	Low	Mod	High	Extreme
Low				
Threat - An elevated threat to life and property; the reasonable chance for combined storm surge and tide resulting in sea water inundation of 2 to 3 feet.				
Minimum Action - Prepare for the possibility of minor to locally moderate coastal flood damage.				
Potential Impact - If realized, expect a low but notable impact to communities in the specified area. Coastal flood waters capable of causing partial inundation within the surge zone, especially for low-lying areas. Moderate to locally major beach erosion. Very heavy surf breaching dunes in isolated locations, mainly in historically vulnerable spots.				
Moderate				
Threat - A significant threat to life and property; the reasonable chance for combined storm surge and tide resulting in sea water inundation of 4 to 5 feet.				
Minimum Action - Prepare for the possibility of moderate coastal flood damage.				
Potential Impact - If realized, expect a moderate impact to communities in the specified area. Coastal flood waters capable of causing large areas of inundation within the surge zone. Severe beach erosion. Several sections of near-shore roads washed out and/or low-lying escape routes flooded. Scouring surge and tide waters accentuated by battering wind waves breaching dunes and seawalls in scattered locations to result in structural damage to shoreline buildings, with a few washing into the sea. Damage accentuated by floating debris. Moderate to major damage to marinas, docks, and piers. Many small craft broken away from moorings, especially in unprotected anchorages.				
High				
Threat - A critical threat to life and property; the reasonable chance for combined storm surge and tide resulting in sea water inundation of 6 to 7 feet.				
Minimum Action - Prepare for the possibility of major coastal flood damage.				
Potential Impact - If realized, expect a high impact to communities in the specified area. Coastal flood waters capable of causing large areas of inundation within the surge zone. Severe beach erosion. Several sections of near-shore roads washed out and/or low-lying escape routes flooded. Scouring surge and tide waters accentuated by battering wind waves breaching dunes and seawalls in scattered locations to result in structural damage to shoreline buildings, with a few washing into the sea. Damage accentuated by floating debris. Moderate to major damage to marinas, docks, and piers. Many small craft broken away from moorings, especially in unprotected anchorages.				
Extreme				
Threat - An extreme threat to life and property; the reasonable chance for combined storm surge and tide resulting in sea water inundation of 8 feet or more.				
Minimum Action - Prepare for the possibility of extreme to catastrophic coastal flood damage.				
Potential Impact - If realized, expect an extreme impact to communities in the specified area. Coastal flooding capable of causing widespread inundation within the surge zone, possibly reaching several miles inland. Extreme beach erosion with several new inland cuts likely created. Many large sections of near-shore roads washed out and/or low-lying escape routes flooded. Powerful scouring surge and tide waters greatly accentuated by intense battering wind waves breaching dunes and seawalls in widespread locations to result in structural damage to shoreline buildings, with several washing into the sea. Damage greatly accentuated from considerable floating debris. Extensive damage to marinas, docks, and piers. Numerous small craft broken away from moorings.				

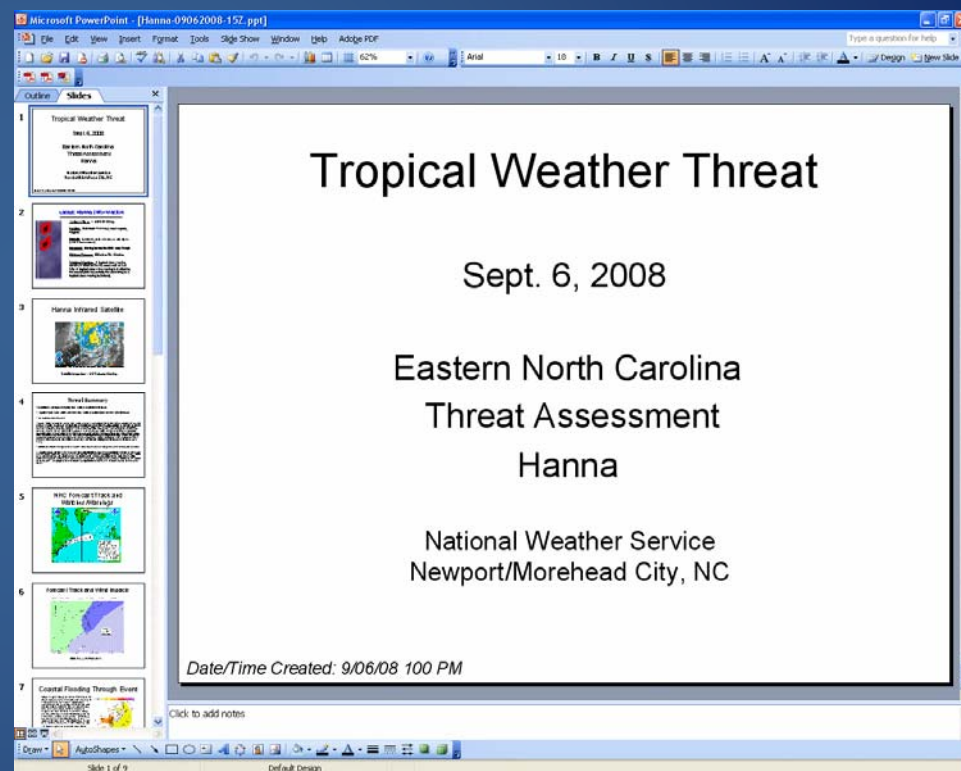
18 hours prior to landfall



Threat Assessment Briefings



- Free form presentations containing graphics and explanations of threats associated with potential significant weather events that will affect life and property.
- The presentations are posted on our main website under the Top News of the Day section and on Facebook.

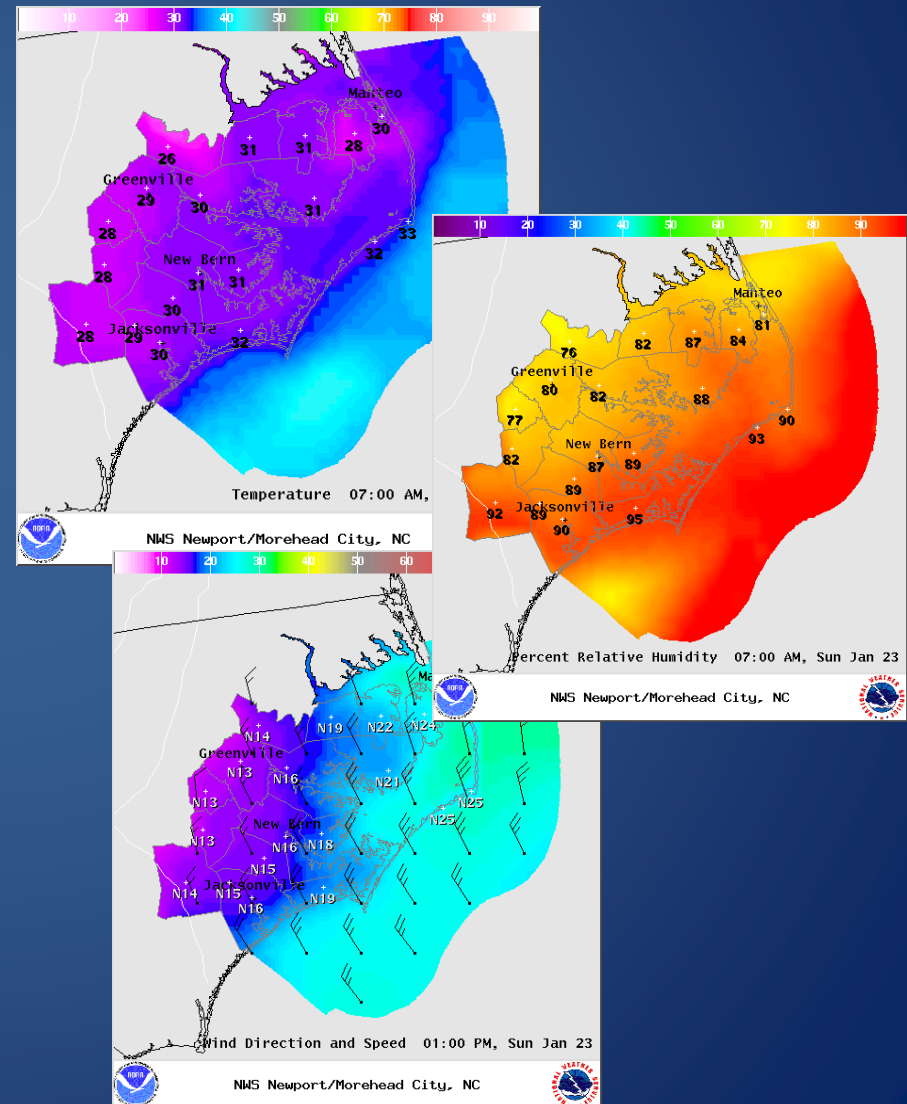




National Digital Forecast Database (NDFD)



- On our website under “Gridded Images”
- 7-Day public, marine & fire weather forecasts
- Dozens of elements shown in graphic format: temperature, weather, sky cover, relative humidity, wind speed/direction, seas and many more!





Hourly Weather Graph

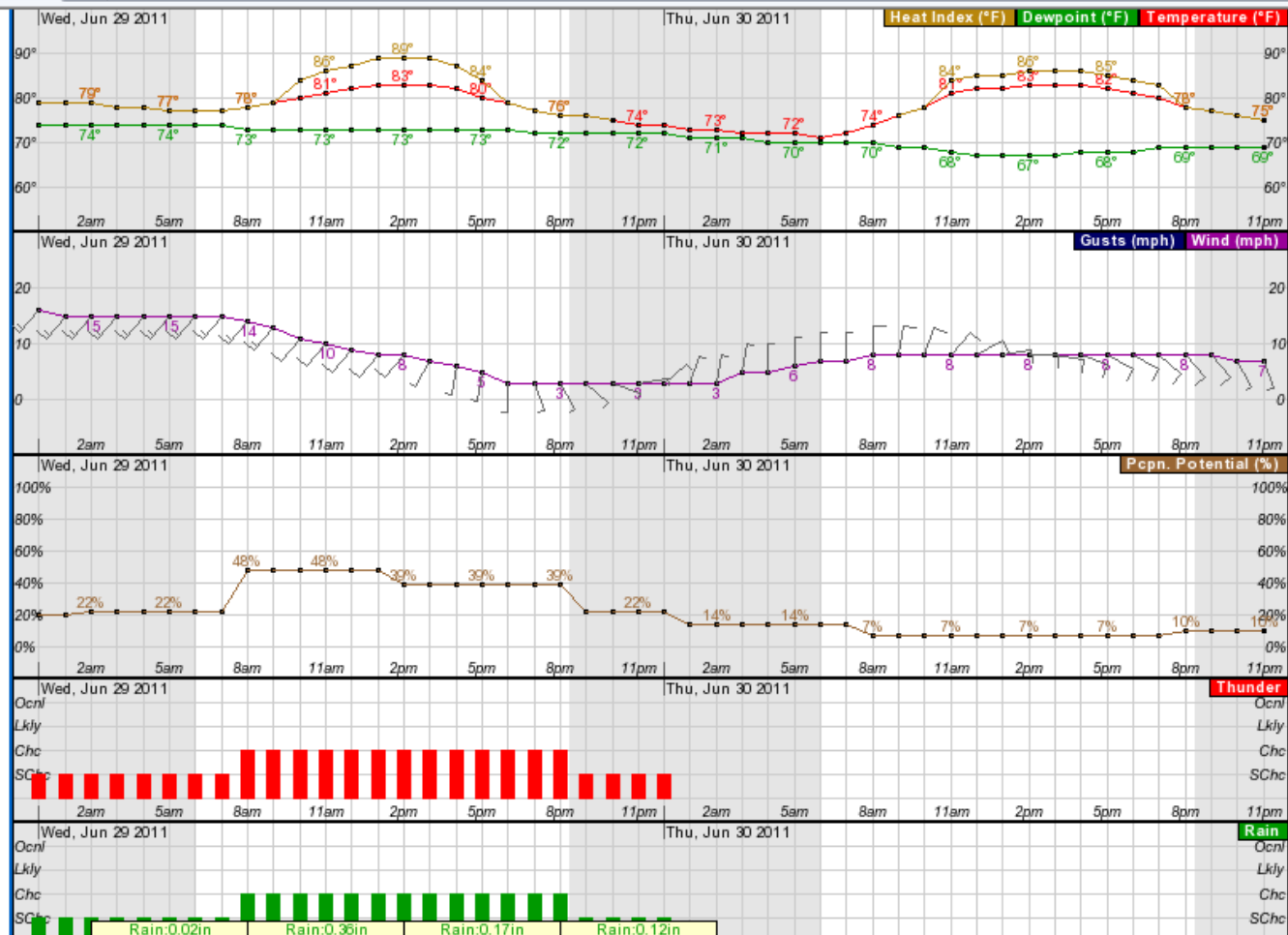


Weather Forecast for 34.71N 76.77W - Windows Internet Explorer

http://forecast.weather.gov/MapClick.php?w0=t&w1=td&w2=hi&w3=sfcwind&w3u=1&w5=pop&w7=thunder&w8=rain&AheadHour=0&Submit=Submit&Fcst=

es Suggested Sites Web Slice Gallery

Weather Forecast for 34.71N 76.77W





Social Media



Find us on Facebook

Click on the above image to "Like" us on Facebook!!

We now have a local Facebook page to stay connected with users via social media. This page will have all Threat Assessment Briefings, and short text status updates. This is a great tool for the public to stay informed, especially through mobile technology. It is also a great way to submit reports to the NWS. Search for National Weather Service Newport to "Like" us!



Using Hurricanes to Inform on Sea Level Rise Impacts and Promote Resiliency



Town Hall Meeting Results

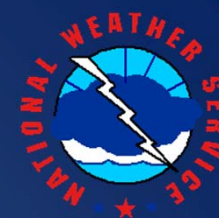


How much did the presentation help you to better evaluate the risks from storm surge associated with a hurricane?

How long have you lived in this county?			Frequency	Percent	Valid Percent	Cumulative Percent
Less than 15 years	Valid	Very much	7	63.6	63.6	63.6
		Somewhat	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
Over 15 years	Valid	Very much	6	33.3	42.9	42.9
		Somewhat	3	16.7	21.4	64.3
		A little	3	16.7	21.4	85.7
		Not at all	2	11.1	14.3	100.0
		Total	14	77.8	100.0	
	Missing	System	4	22.2		
	Total		18	100.0		



Commemorating High Water Marks



- Placed commemorating Irene:
 - Downtown Manteo, NC
 - Downtown Columbia, NC
- Placed commemorating Floyd:
 - Trenton, NC
 - Kinston, NC
 - Greenville, NC
 - Belhaven, NC
- Educational reminders to all of the need to be prepared and resilient.



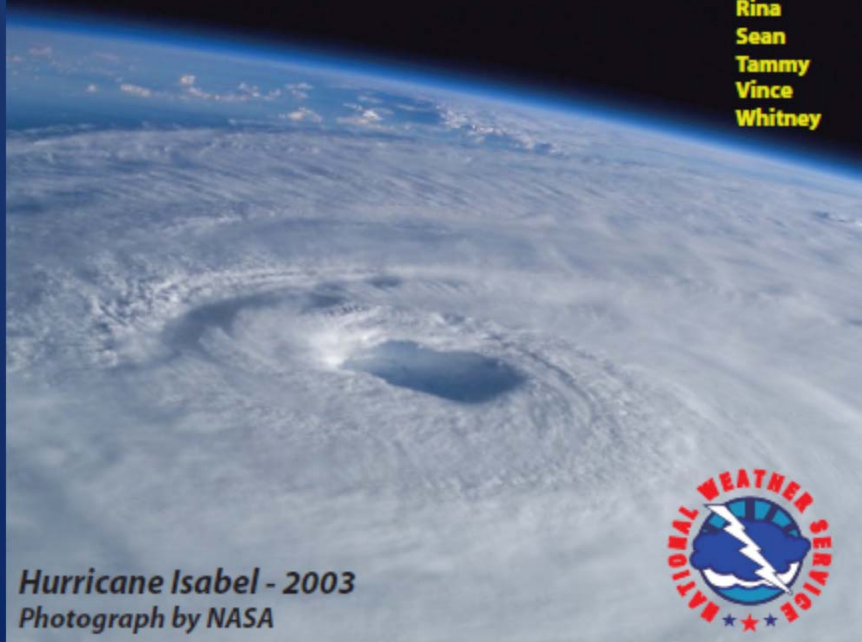
Hurricane Survival Guide



The National Weather Service

North Carolina
 **Hurricane**
Survival Guide
2011 Season

Arlene
Bret
Cindy
Don
Emily
Franklin
Gert
Harvey
Irene
Jose
Katia
Lee
Maria
Nate
Ophelia
Phillipe
Rina
Sean
Tammy
Vince
Whitney



Hurricane Isabel - 2003
Photograph by NASA



- Contains Information on:
 - Hurricane Definitions and Climatology
 - Hurricane Hazards
 - Local National Weather Service Products and Services
 - Preparing Before a Storm Threatens
 - Evacuation Routes
 - After the Storm
- Available for Download on our Tropical Weather Web Page



Work with Sea Grant to Educate



IF CAUGHT IN A RIP CURRENT

- Don't fight the current
- Swim out of the current, then to shore
- If you can't escape, float or tread water
- If you need help, call or wave for assistance

SAFETY

- Know how to swim
- Never swim alone
- If in doubt, don't go out

More information about rip currents can be found at the following web sites:

www.ripcurrents.noaa.gov
www.noaa.gov



- Develop an educational campaign similar to the collaboration on rip current awareness to build an awareness and understanding of storm surge impacts
- Sea Level Rise and Resiliency could be incorporated.



Thanks for Attending!

