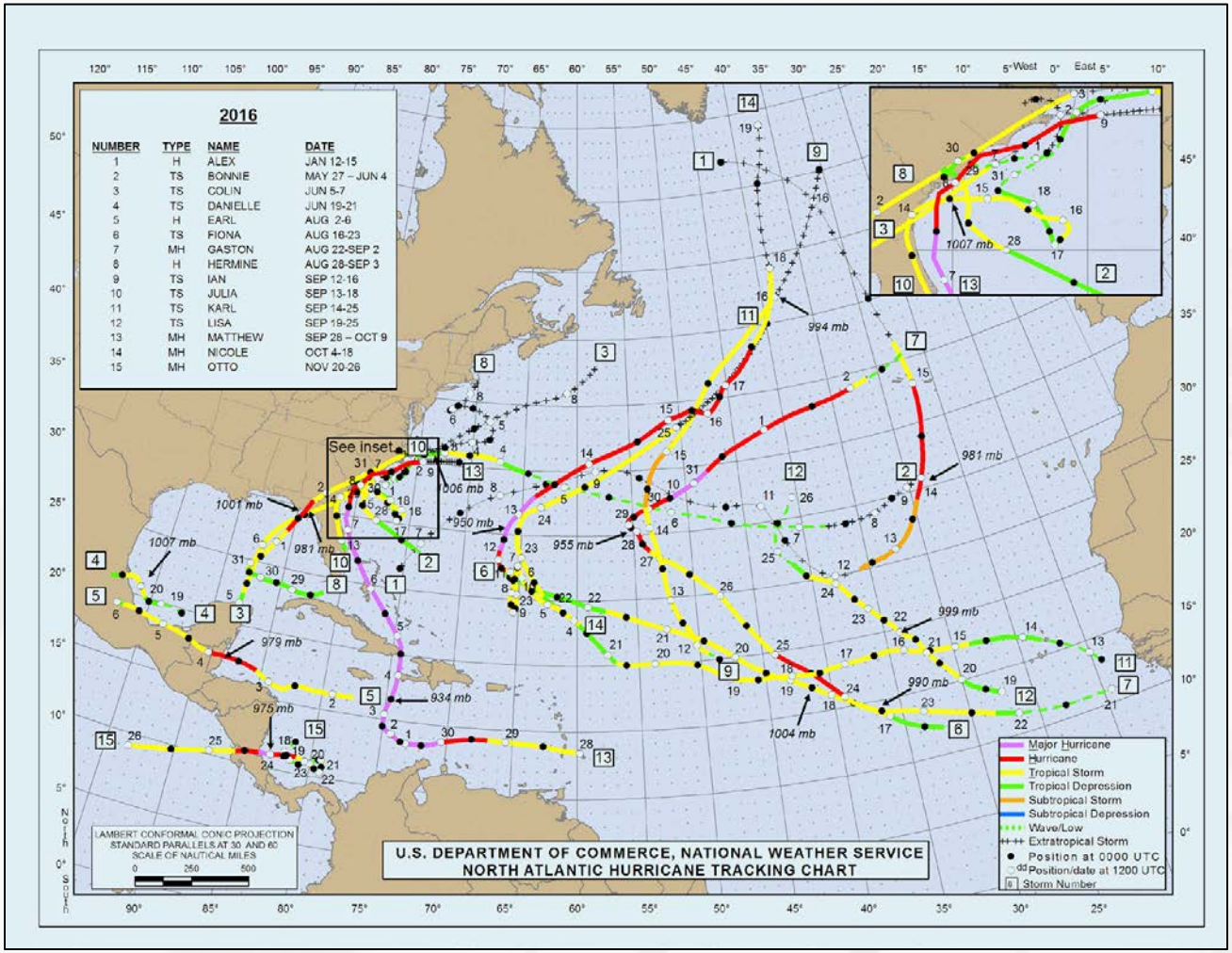
Updates to NHC Products, Services, and Warnings

Daniel Brown
National Hurricane Center
23 May 2017

#NOAAHurricaneAware

2016 Atlantic Hurricane Season

First Above Average Season Since 2012

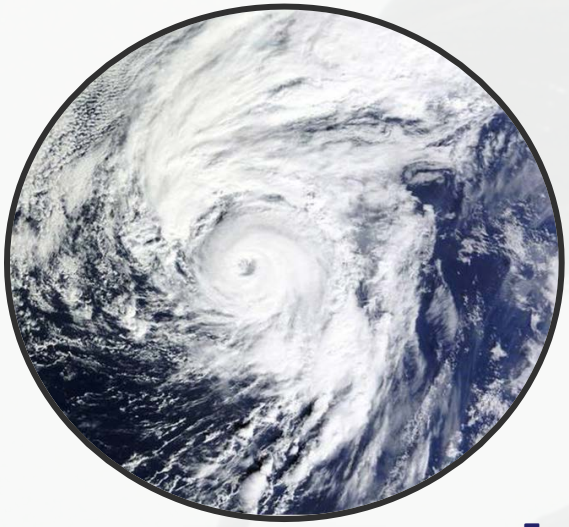


15 named storms, 7 hurricanes, and 4 major hurricanes

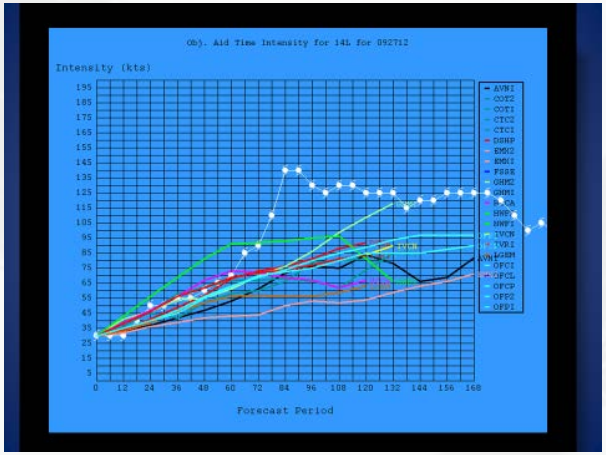
Forecast Challenges 2016

Track, Intensity, and Genesis

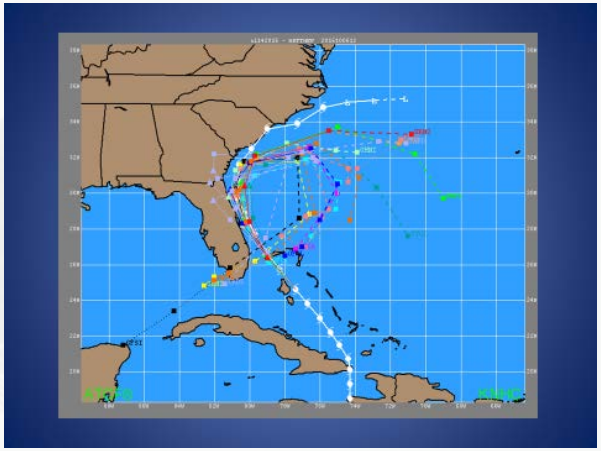
Hurricane in January (Alex)



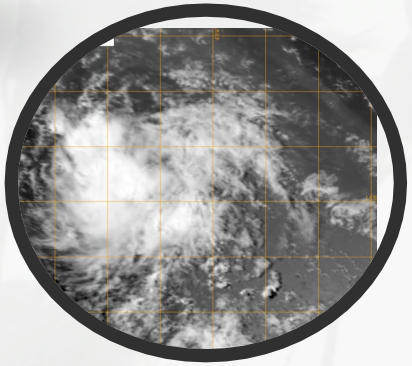
Rapid intensification



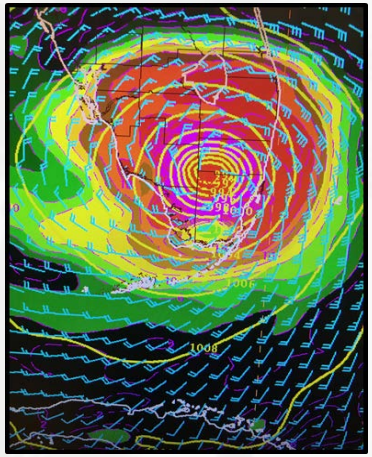
Complex Tracks



Forecasting Tropical Cyclone Development



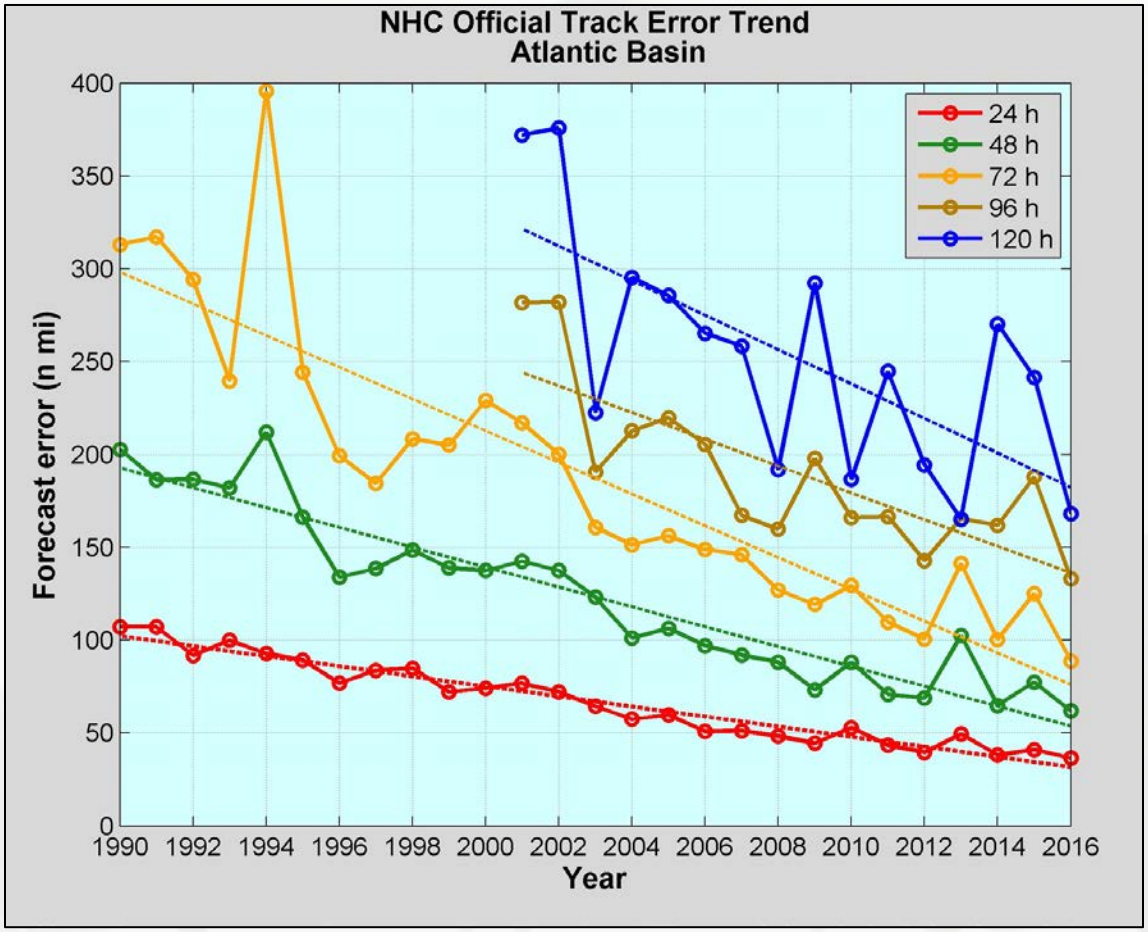
AL99 (Pre-Hermine)



False Alarms

Atlantic Track Verification 2016

Several Records Set



NHC Track Error Trend

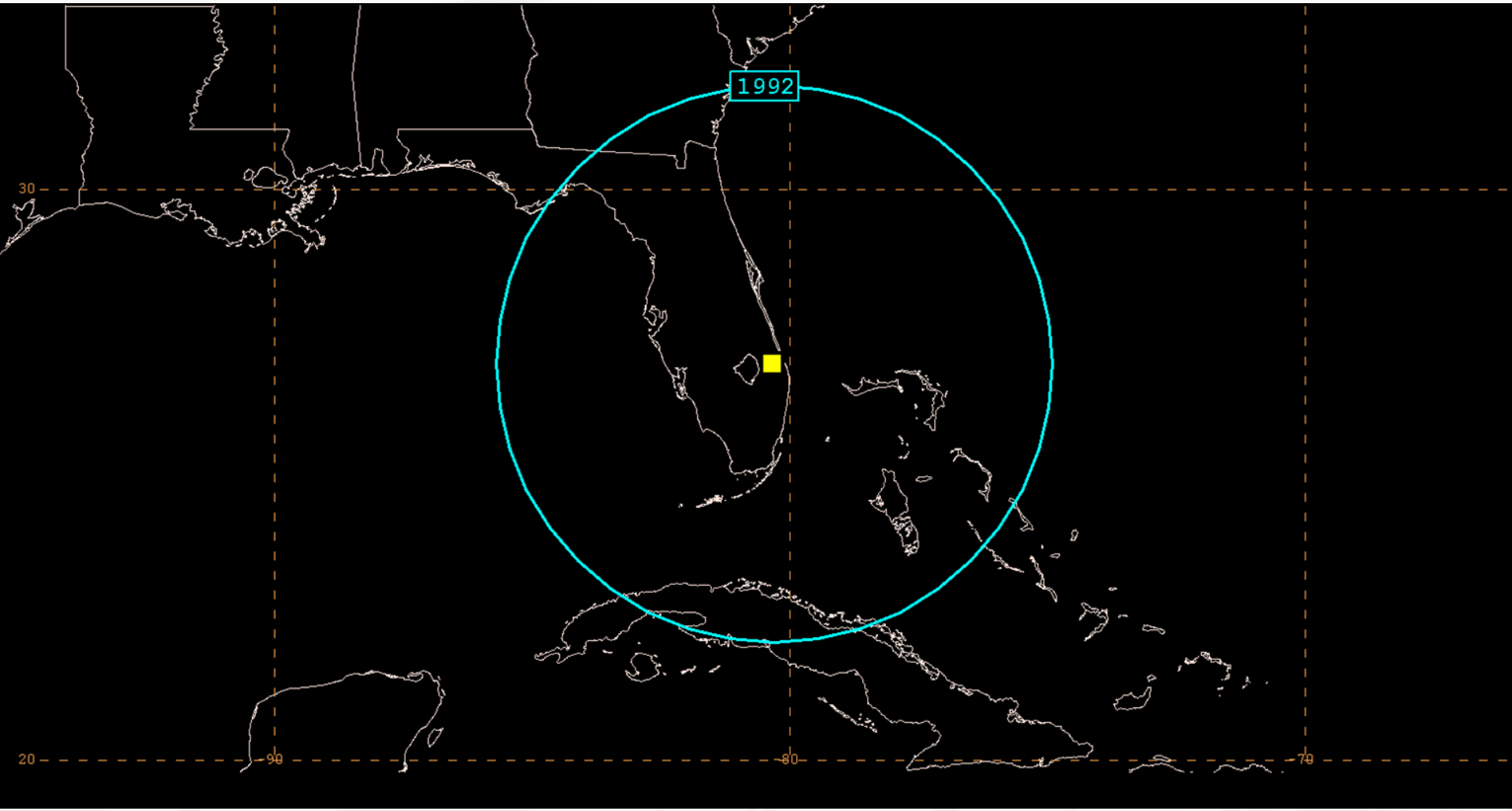
2016 NHC Forecast Errors

VT (h)	NT	TRACK (n mi)	INT (kt)
000	386	7.3	2.2
012	354	24.3	5.4
024	322	36.5	7.6
036	290	47.7	9.4
048	258	61.8	10.6
072	204	88.8	11.7
096	161	133.1	14.7
120	131	168.2	16.1

Values in blue exceed all-time records.

Track Forecast Improvements

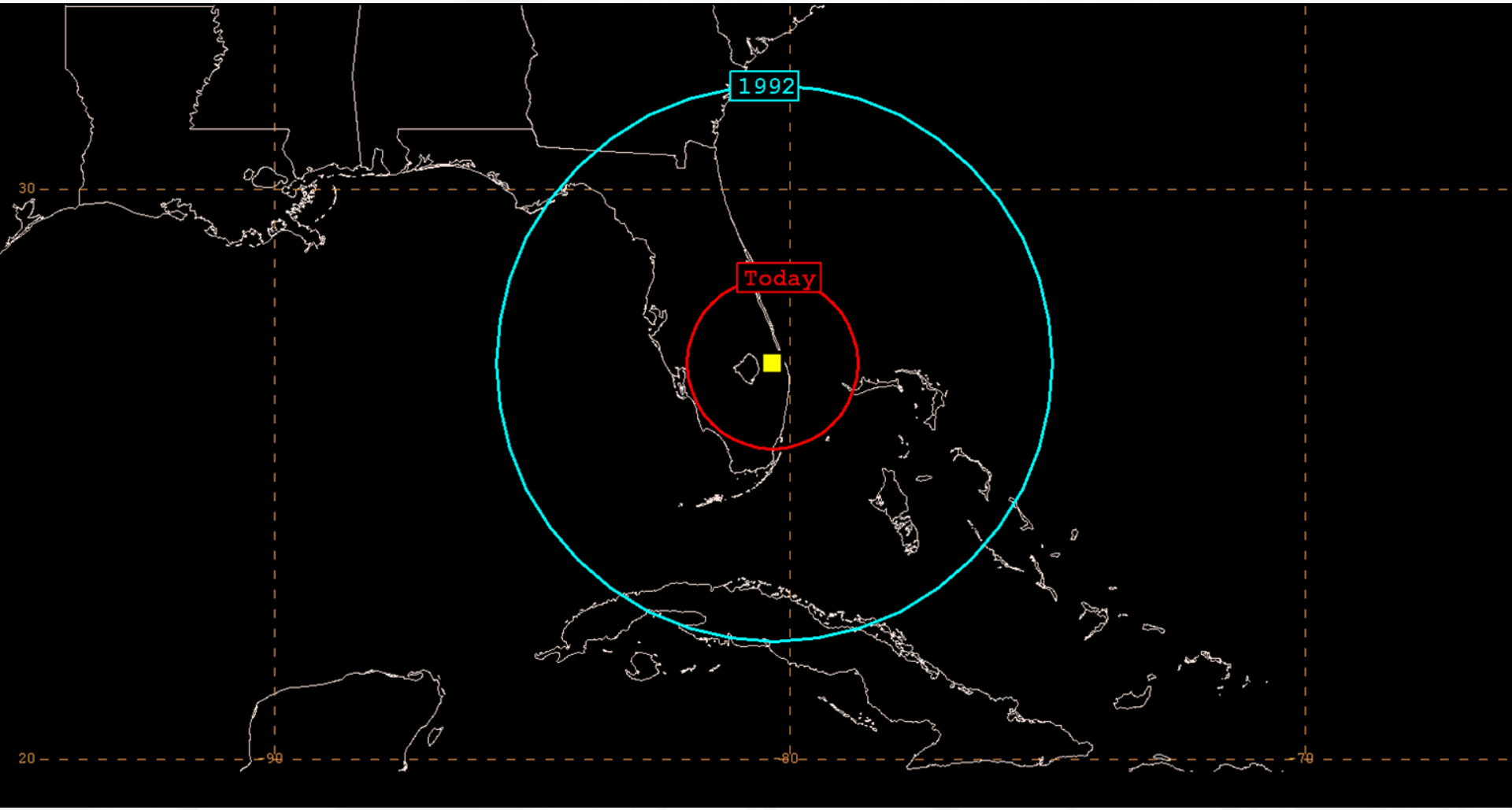
Tremendous Improvements Since 1992



Average 3-day NHC Track Error

Track Forecast Improvements

Tremendous Improvements Since 1992

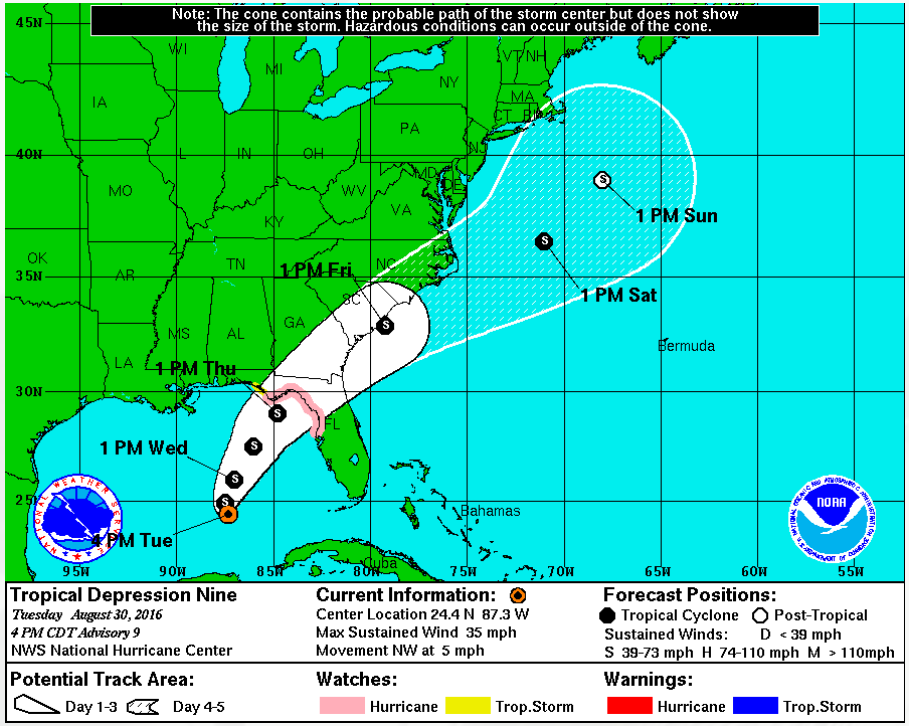


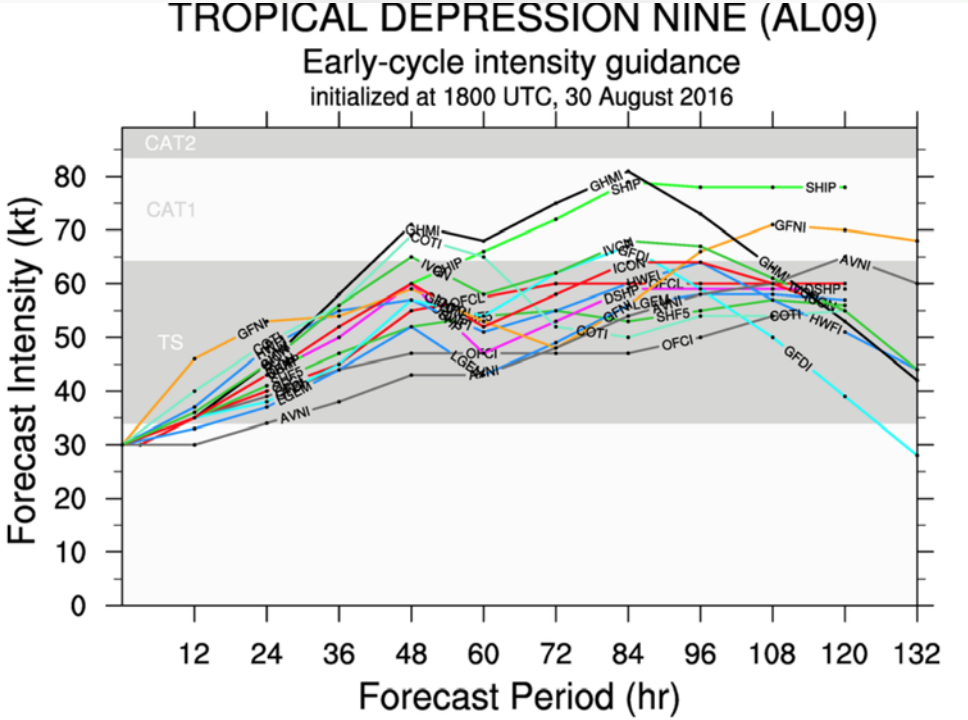
Average 3-day NHC Track Error

Intensity Forecast Success

Hermine's Intensification to a Hurricane

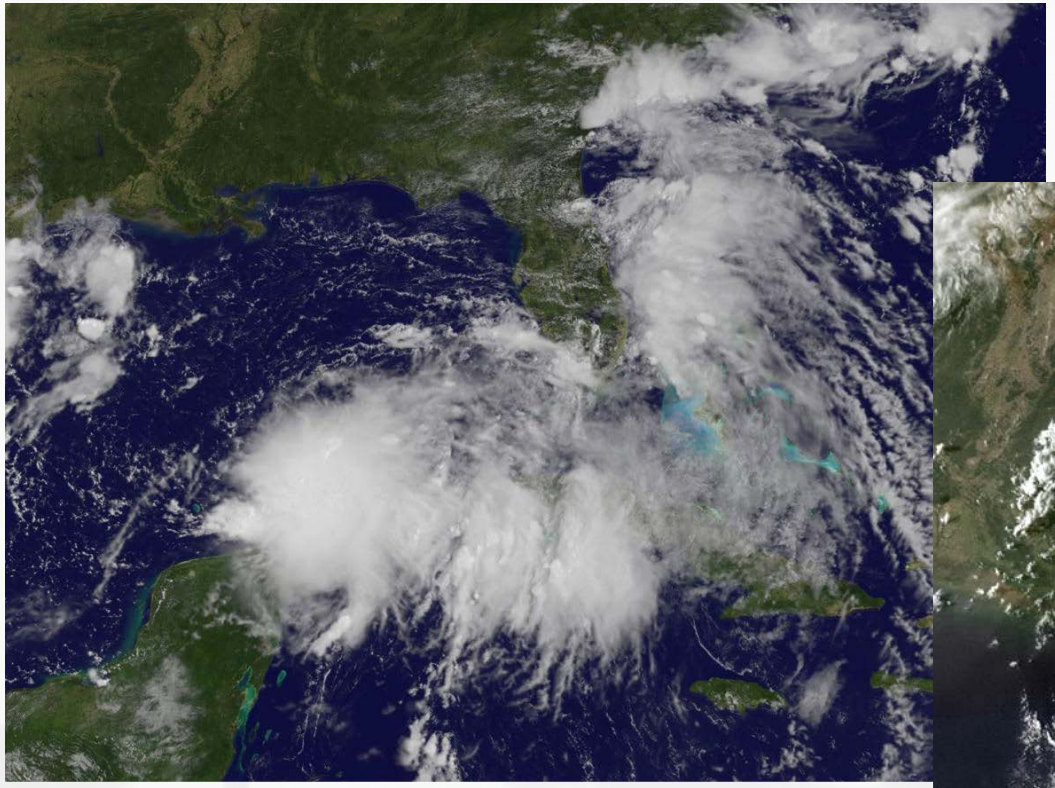
- NHC intensity forecasts were conservative during the first couple of days of the depression's existence.
- Hurricane Watch issued a little more than 48 h before the arrival of TS-force winds along the coast.
  - System was a 35-mph tropical depression at the time





Hermine's Intensification

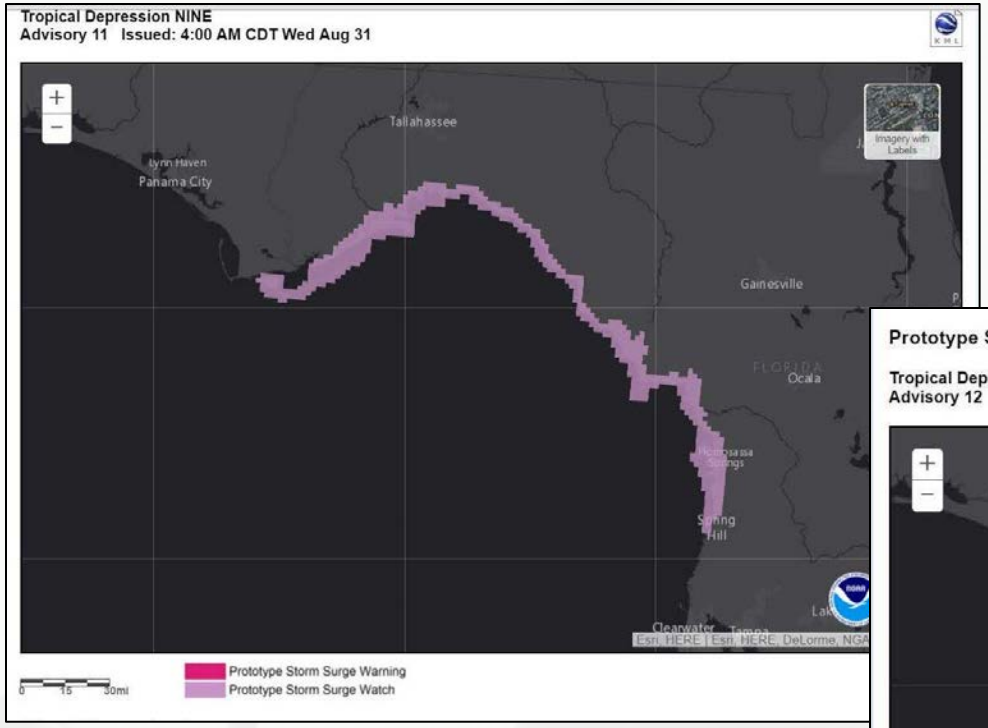
Tropical Depression to Hurricane



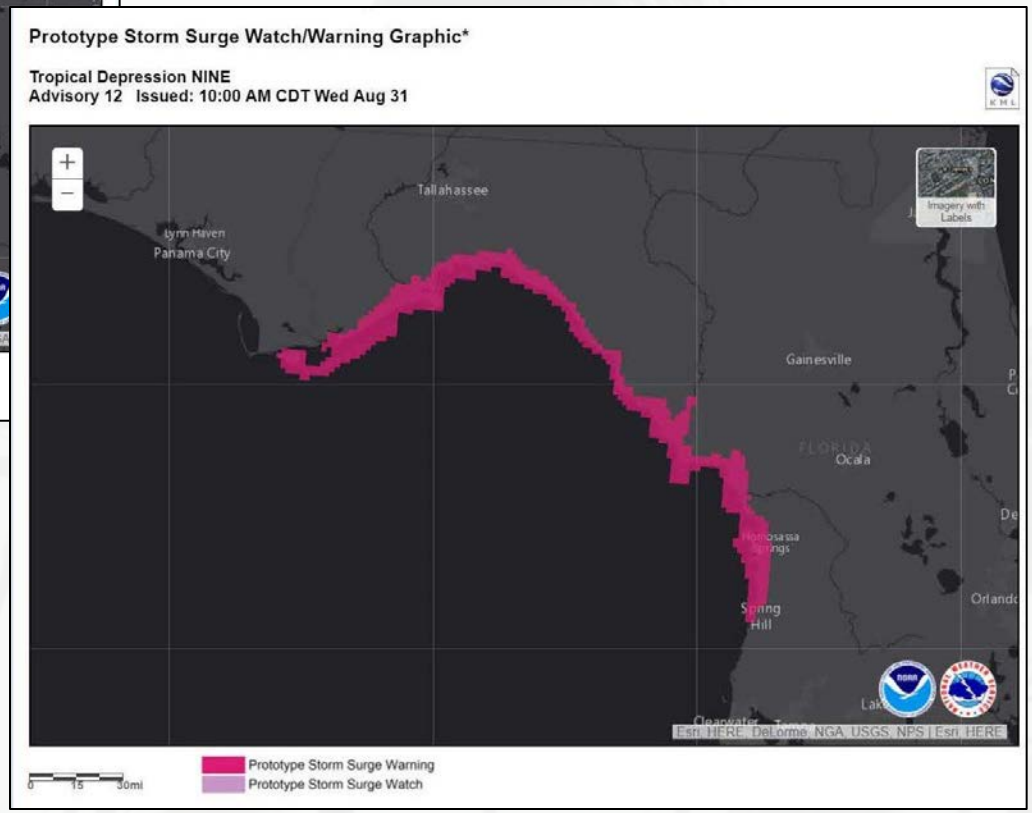
Hermine strengthened from a 35-mph tropical depression to a 80 mph hurricane in a little more than 48 hours.

Storm Surge Watches & Warnings

First Issuance of Prototype Graphics

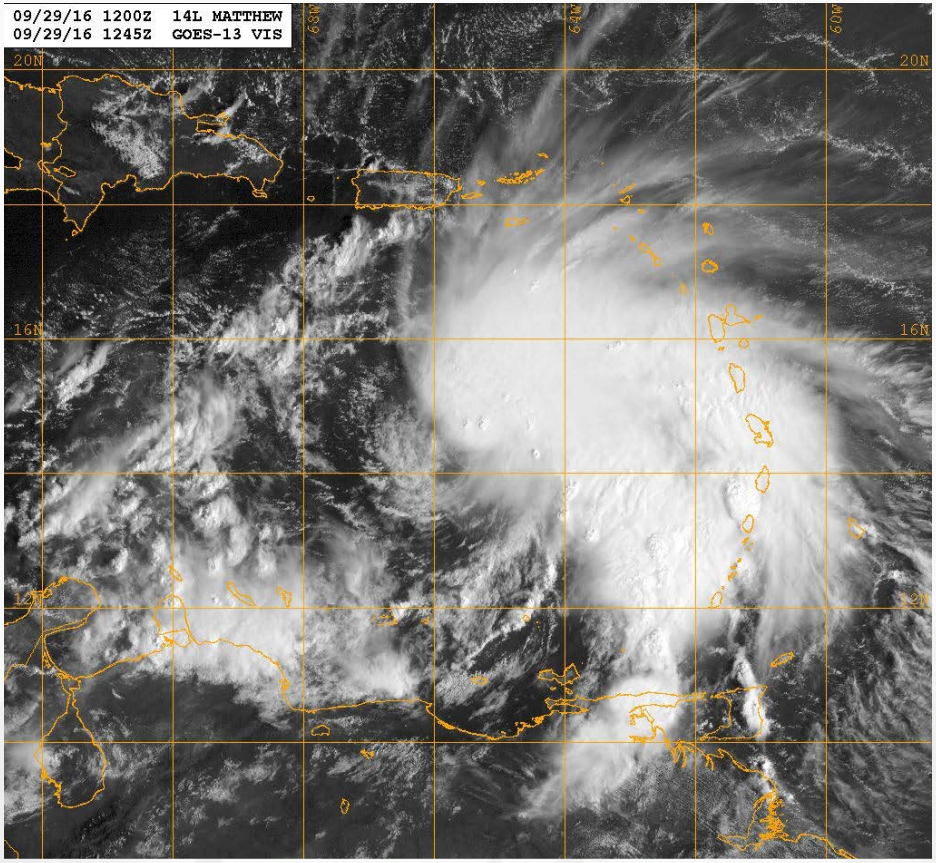


Storm Surge Watch & Warning Graphics issued for Hurricane Hermine

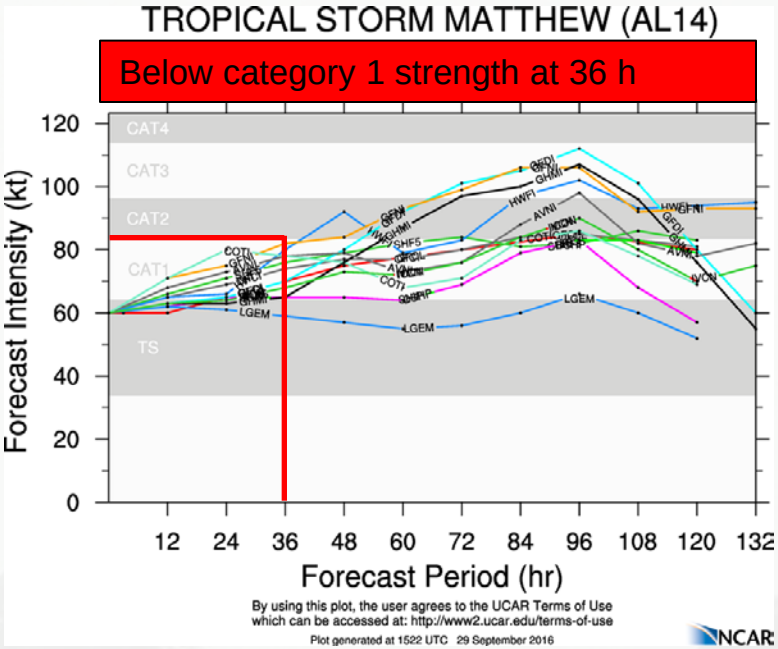


Predicting Rapid Intensification

Still a Difficult Task



Tropical Storm Matthew – 70 mph
8:00 am September 29



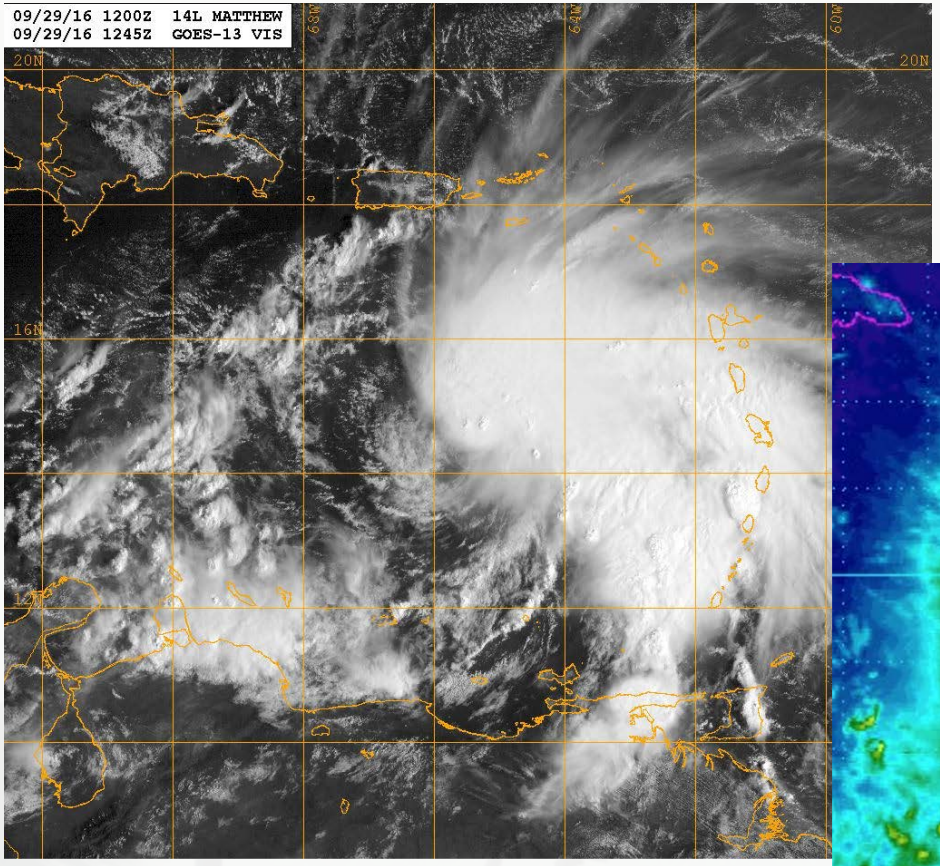
NHC Discussion 11 am Thursday, September 29, 2016

The center of Matthew is exposed to the southwest of the deep convection due to moderate southwesterly shear. Given the current shear and structure of Matthew, only slight strengthening is predicted during the next 24 hours.

Forecaster Brown

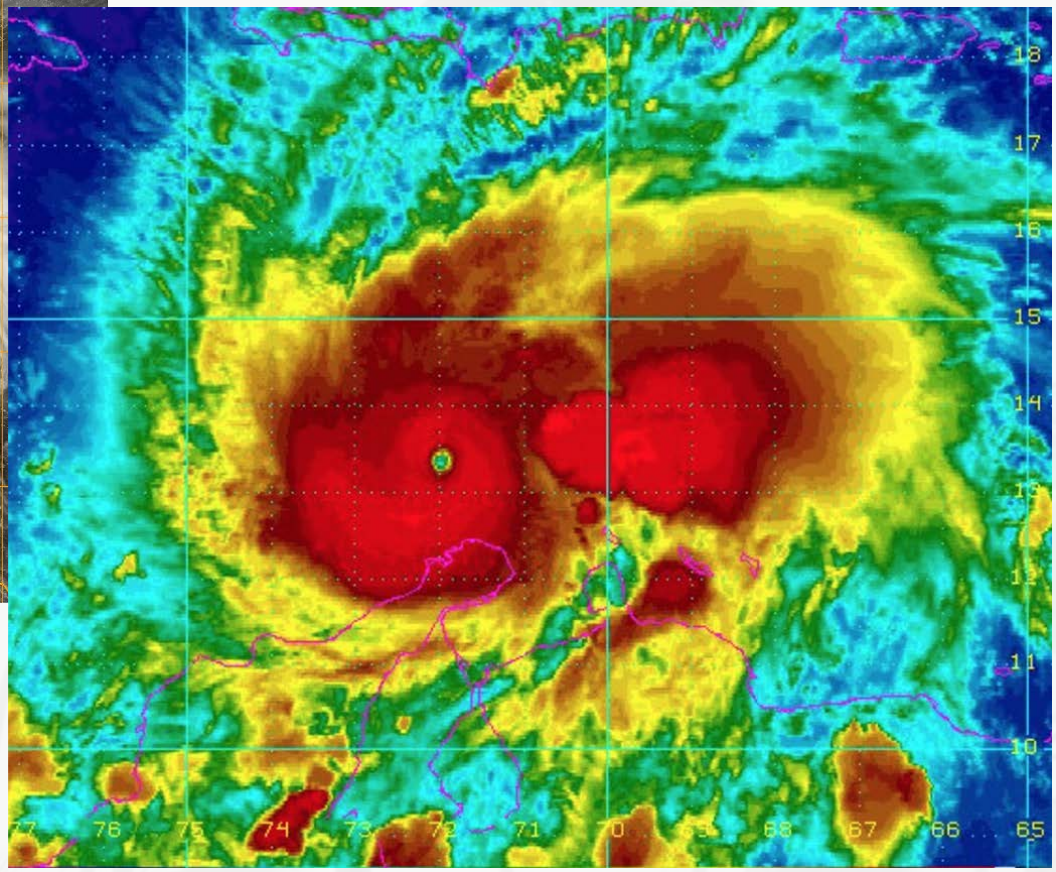
Predicting Rapid Intensification

Still a Difficult Task



Tropical Storm Matthew – 70 mph
8:00 am September 29

36 hours later
Hurricane Matthew
Category 5 – 165 mph



NATIONAL HURRICANE CENTER

2017 Product Updates

NHC Product Updates

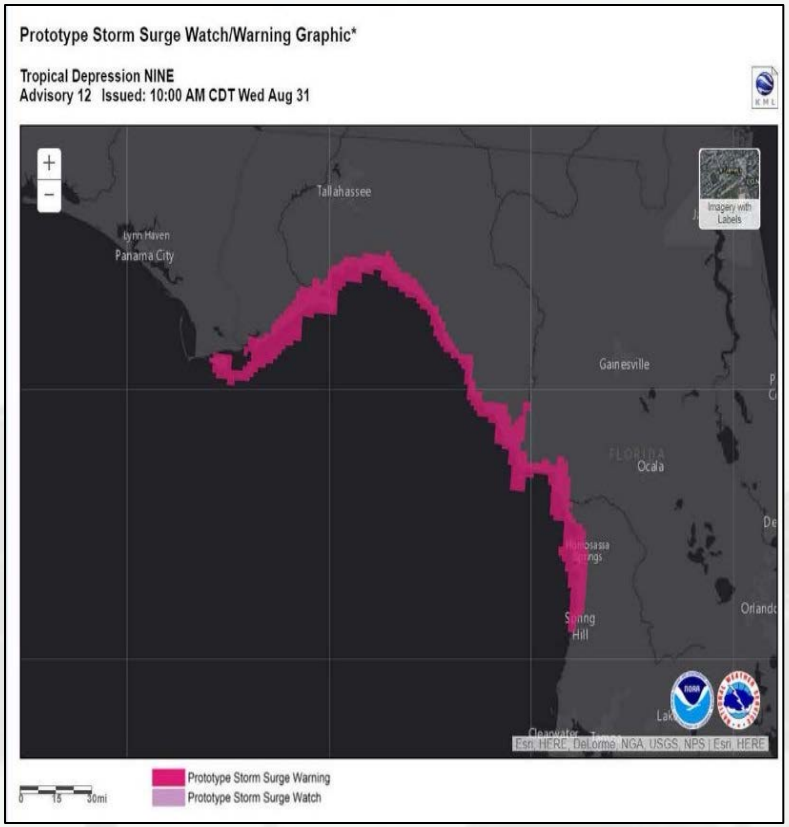
Storm Surge

STORM SURGE WATCH/WARNING

- Operational in 2017

AVAILABILITY:

- Graphic on NHC website
- Watch/Warning section of the NHC Public Advisory
- NWS WFO Hurricane Local Statements
- EAS Activation



NHC Product Updates

Storm Surge Watch/Warning Definitions

STORM SURGE WARNING

There is a **danger** of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within **36 hours**.

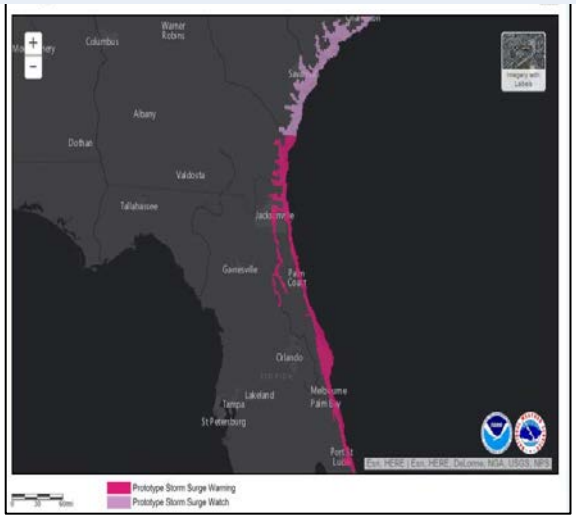
STORM SURGE WATCH

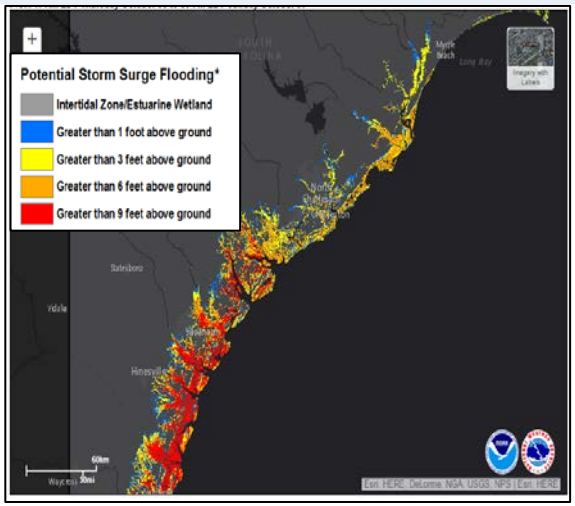
There is the **possibility** of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within **48 hours**.

Storm Surge Updates

Warning vs. Potential Flooding Map

STORM SURGE WATCH/WARNING	POTENTIAL STORM SURGE FLOODING MAP
General Public	Decision Makers





Storm Surge Updates

Warning vs. Potential Flooding Map

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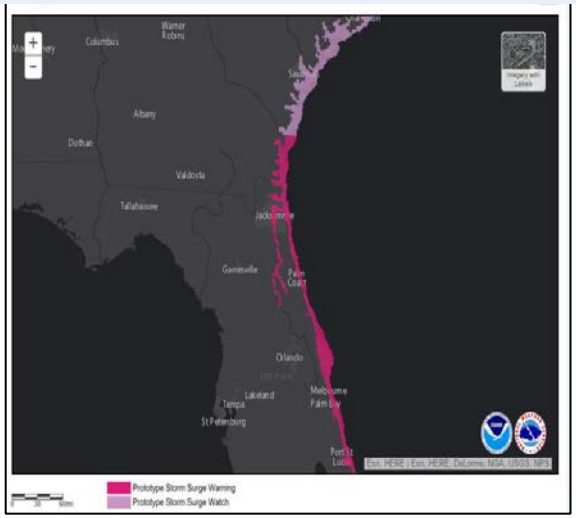
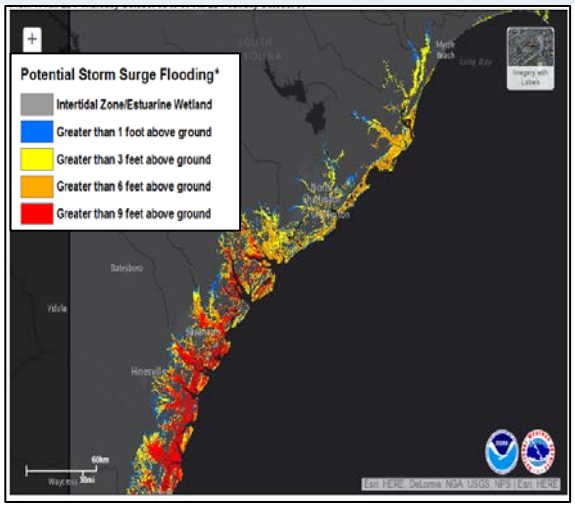
General Public	Decision Makers

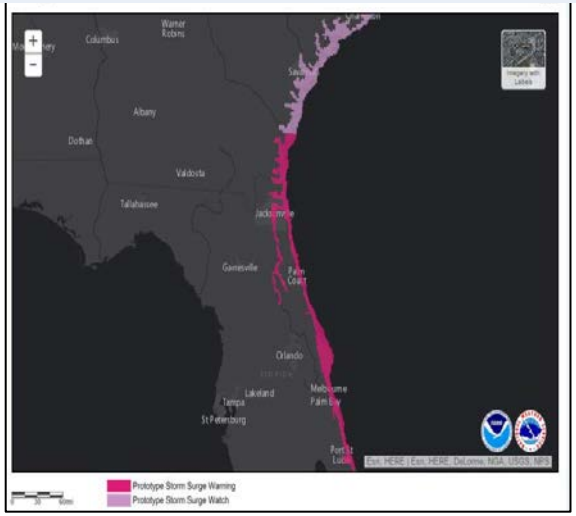


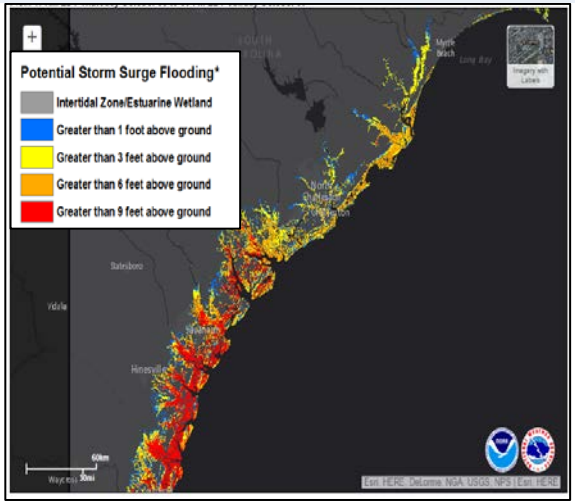


Storm Surge Updates

Warning vs. Potential Flooding Map

STORM SURGE WATCH/WARNING	POTENTIAL STORM SURGE FLOODING MAP
General Public	Decision Makers
Subjective	Objective

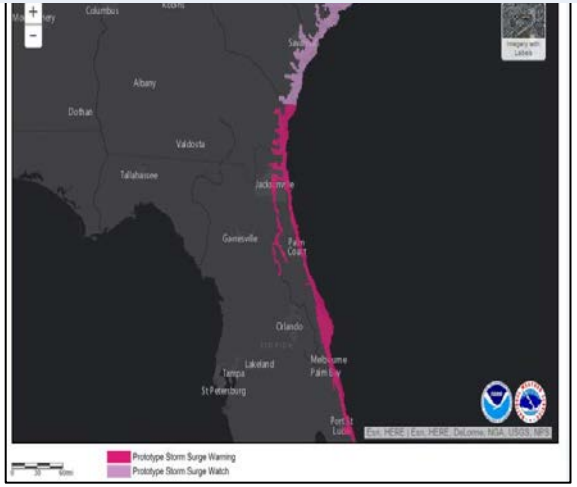


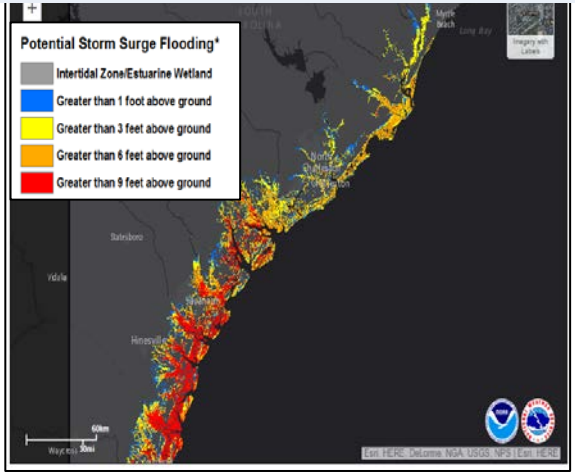


Storm Surge Updates

Warning vs. Potential Flooding Map

STORM SURGE WATCH/WARNING	POTENTIAL STORM SURGE FLOODING MAP
General Public	Decision Makers
Subjective	Objective
Categorical (life threatening inundation)	Quantitative guidance

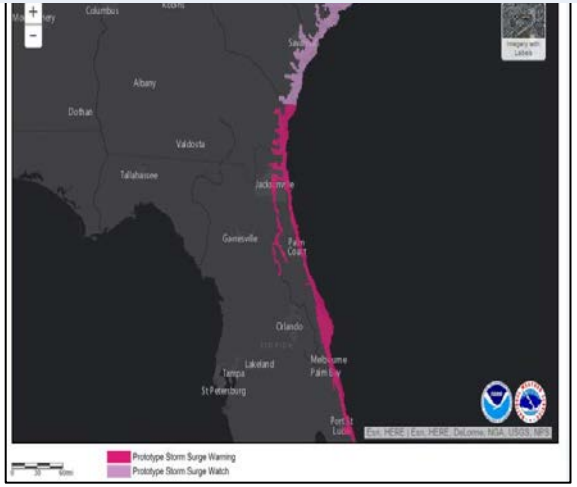


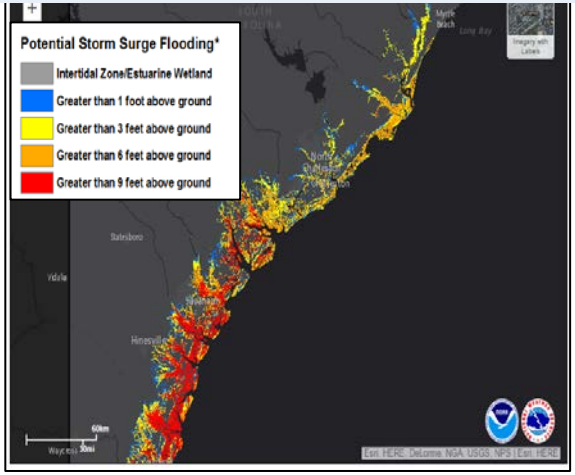


Storm Surge Updates

Warning vs. Potential Flooding Map

STORM SURGE WATCH/WARNING	POTENTIAL STORM SURGE FLOODING MAP
General Public	Decision Makers
Subjective	Objective
Categorical (life threatening inundation)	Quantitative guidance
	Reasonable worst-case scenario at a location (not expected inundation)



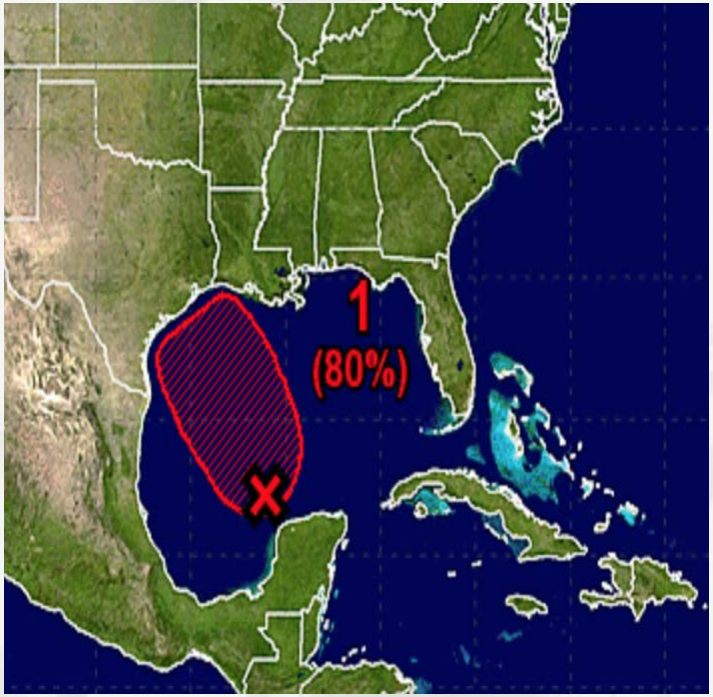


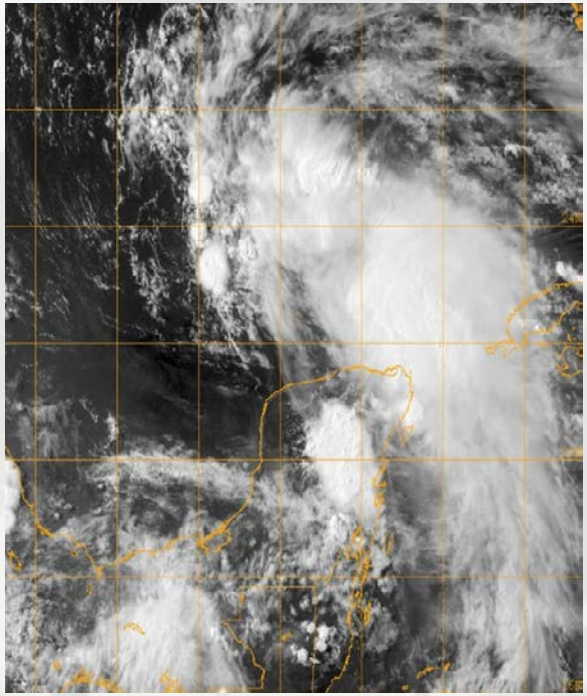
NHC Product Updates

Potential Tropical Cyclone Advisories

POTENTIAL TROPICAL CYCLONE

When there is a threat of tropical storm or hurricane conditions to land within 48 hours, NHC has the option to issue advisories, watches, and warnings for disturbances that are not yet a tropical cyclone.





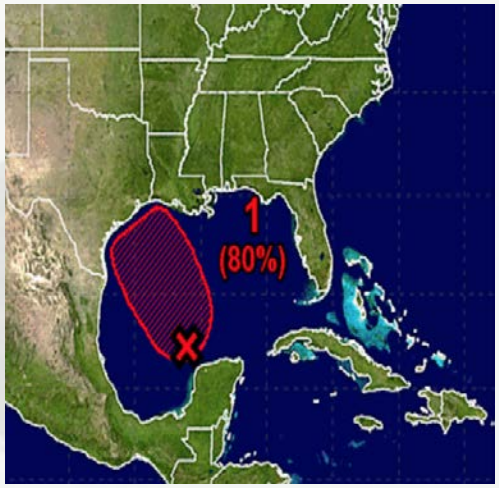
NHC Product Updates

Potential Tropical Cyclone Advisories

BEFORE A CYCLONE FORMS

The NHC can issue advisories, watches, and warnings for tropical disturbances

- **A threat of bringing tropical storm or hurricane conditions to land within 48 hours.**



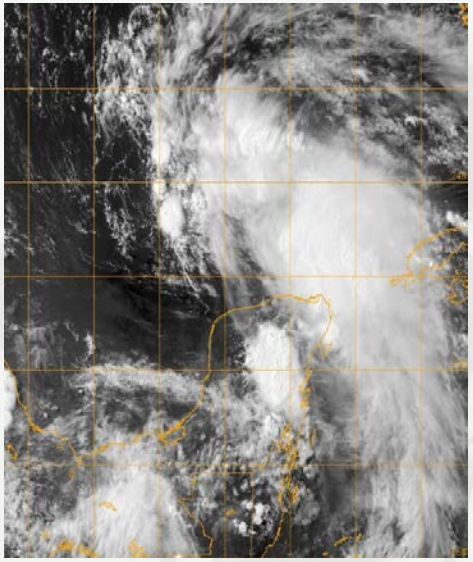
WATCH/WARNING

Regular TS/Hurricane watch and warning criteria applies

- Watch – conditions possible within 48 h
- Warning – conditions expected within 36 h

WHAT DO WE CALL IT

Systems would be identified as **Potential Tropical Cyclones** with the *same numbering system as depressions – "One", "Two", etc.*



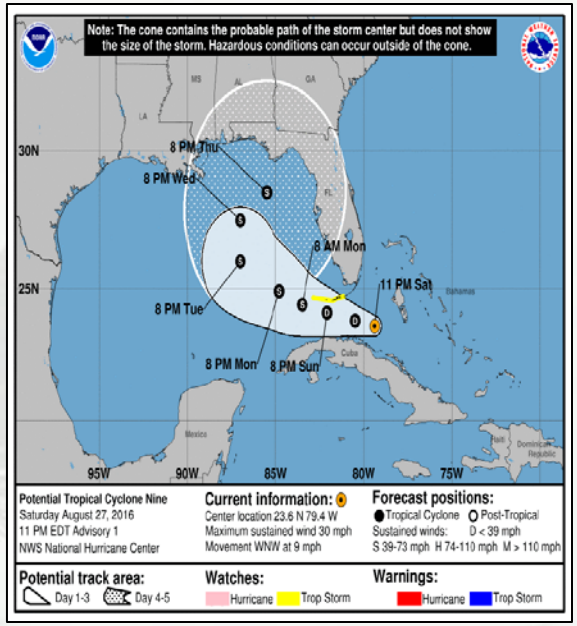
NHC Product Updates

Potential Tropical Cyclone Advisories

STANDARD NHC ADVISORY PRODUCTS

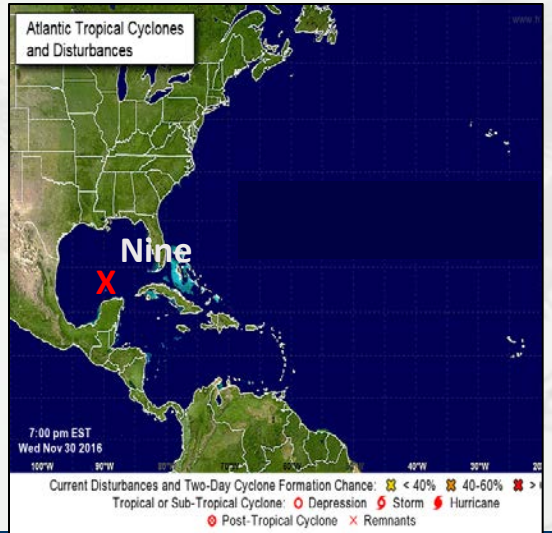
Available at standard advisory times

- Public Advisory
- Forecast Advisory
- Discussion
- Wind Speed Probabilities
- Cone graphic
- Storm Surge products, as needed



GENESIS PROBABILITIES

Genesis probabilities will appear in both the Tropical Weather Outlook and the Public Advisory



GRAPHICAL TROPICAL OUTLOOK

The Graphical Tropical Outlook will **no longer display a formation area** for these systems, to avoid confusion with the (now available) 5-day track forecast and cone graphic

NHC Product Updates

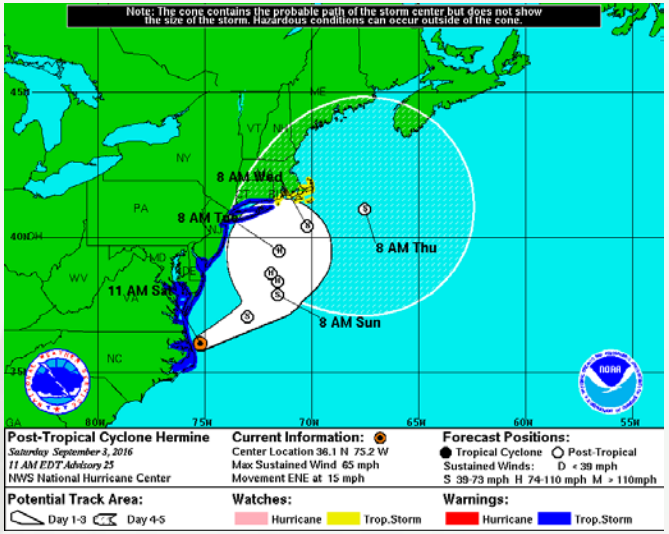
Potential Tropical Cyclone Advisories

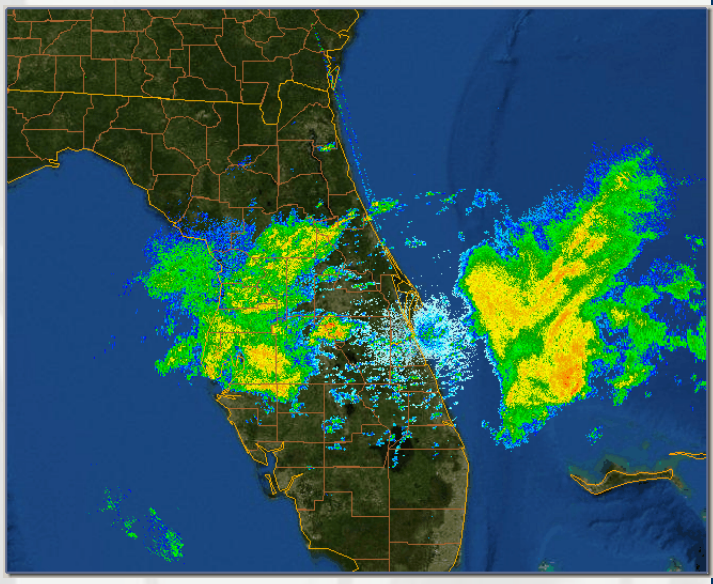
ISSUANCE CONSIDERATIONS

Not directly tied to tropical cyclone formation chance.

INITIAL ISSUANCE CRITERIA INCLUDE:

- Likely impacts
- *Need for tropical cyclone watches and warnings*
- *Desire to avoid switching warning types (tropical vs. non-tropical)*





NHC Product Updates

Potential Tropical Cyclone Advisories

MESSAGING CONSIDERATIONS:

- Issued only for systems threatening land within the watch/warning time frame.
- Advisory packages will be discontinued when watches and warnings are no longer necessary.
- When the threat is not imminent this could result in gaps in product issuance.

NATIONAL HURRICANE CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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POTENTIAL TROPICAL CYCLONE ONE PUBLIC ADVISORY NUMBER 1
NWS NATIONAL HURRICANE CENTER MIAMI FL       AL012016
400 PM CDT WED JUN 5 2016

...TROPICAL DISTURBANCE OVER THE EAST-CENTRAL GULF OF
MEXICO EXPECTED TO BECOME A TROPICAL STORM...
...TROPICAL STORM WARNING ISSUED FOR PORTIONS OF THE WEST
COAST OF FLORIDA...


SUMMARY OF 400 PM CDT...2100 UTC...INFORMATION
-----------------------------------------------
LOCATION...25.3N 86.5W
ABOUT 310 MI...500 KM SW OF TAMPA
ABOUT 320 MI...510 KM SSW OF APALACHICOLA FLORIDA
MAXIMUM SUSTAINED WINDS...35 MPH...55 KM/H
PRESENT MOVEMENT...N OR 360 DEGREES AT 3 MPH...6 KM/H
MINIMUM CENTRAL PRESSURE...1010 MB...29.92 INCHES


WATCHES AND WARNINGS
--------------------
CHANGES WITH THIS ADVISORY...

A Tropical Storm Warning has been issued fro the west
coast of Florida from Boca Grande to Ochlockonee River.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT...

A Tropical Storm Warning is in effect for...
* The west coast of Florida from Boca Grande to Ochlocknee
River

A Tropical Storm Warning means that tropical storm
conditions are expected somewhere within the warning
```

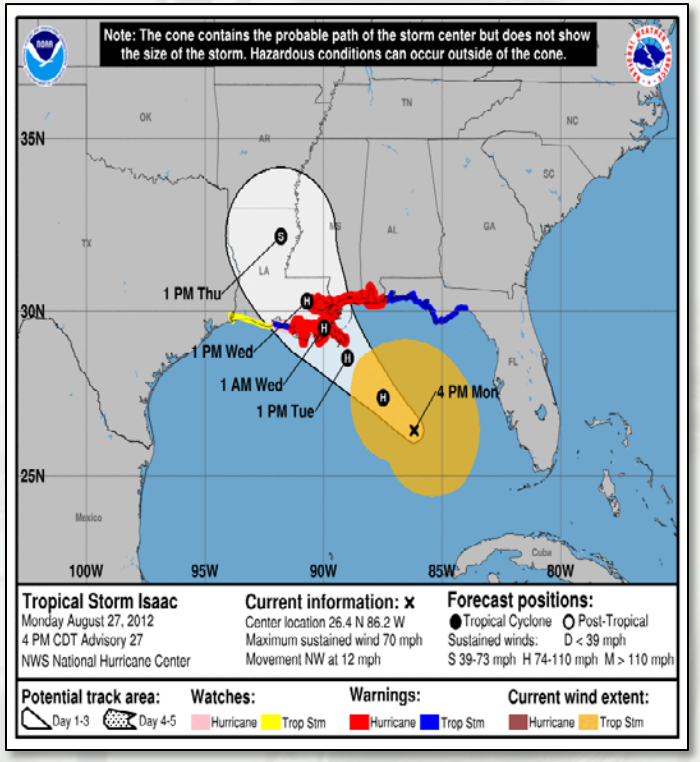
NHC Product Updates

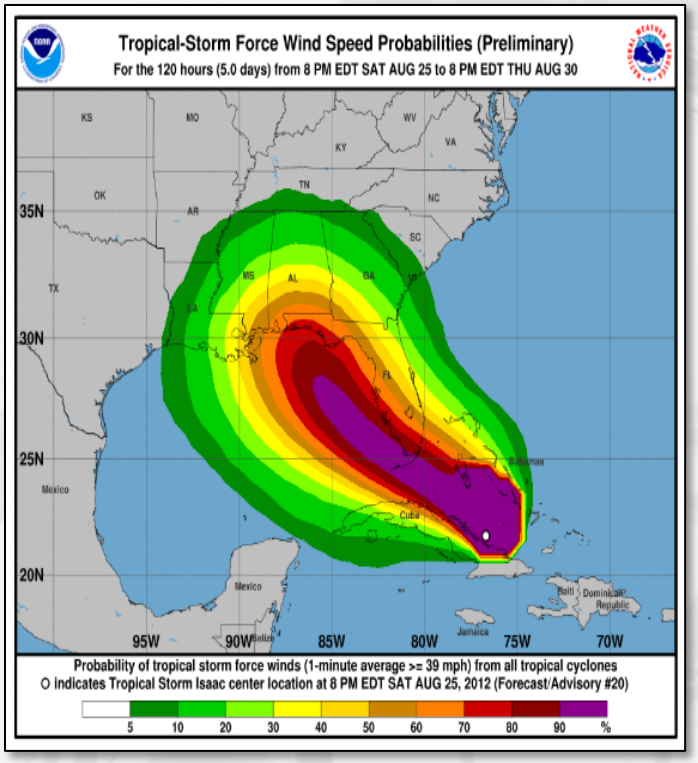
Graphics

UPDATE TO NHC GRAPHICAL PRODUCTS

Consistent background maps with a ‘cleaner’ look and feel

- Storm size (initial wind field) displayed on the error cone
  - reinforcing hazardous conditions occur outside the cone.





NHC Product Updates

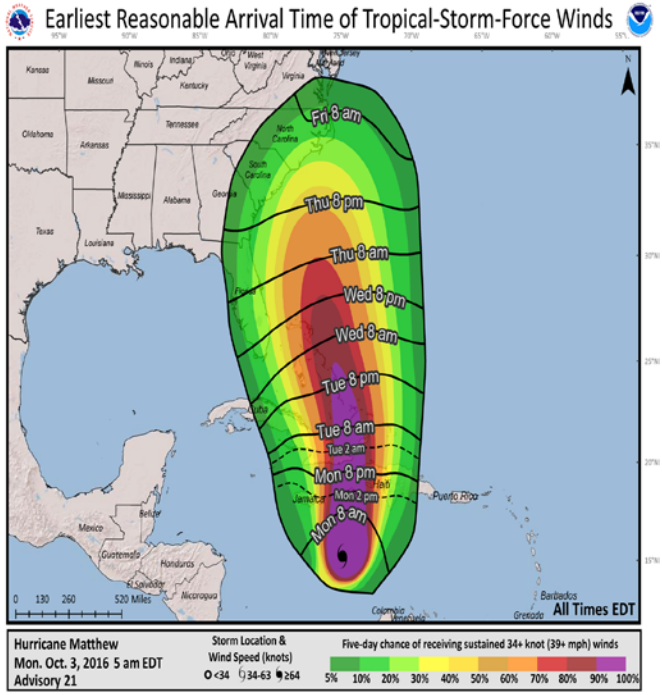
Time of Arrival

EXPERIMENTAL TIME OF ARRIVAL GRAPHIC

Accounts for forecast uncertainty (track/intensity/size)

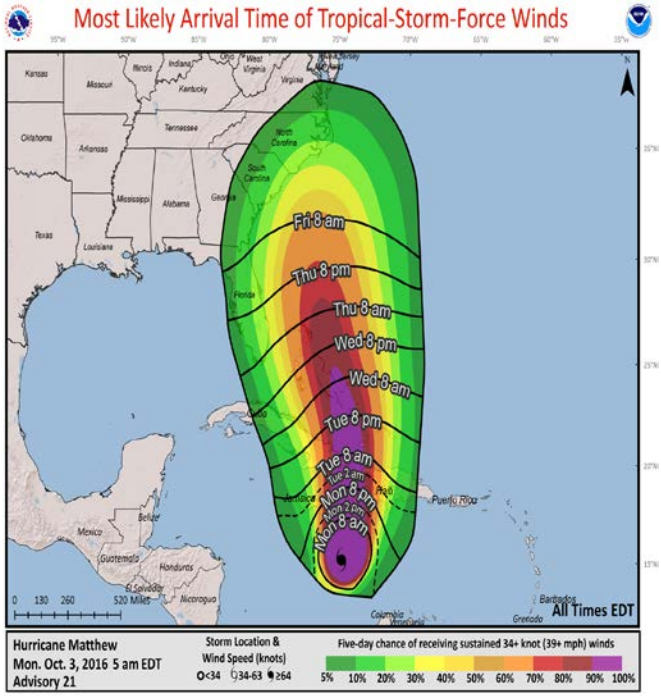
'EARLIEST REASONABLE' ARRIVAL TIME

- No more than a 10% chance of onset
- Most conservative / Risk-averse



'MOST LIKELY' ARRIVAL TIME

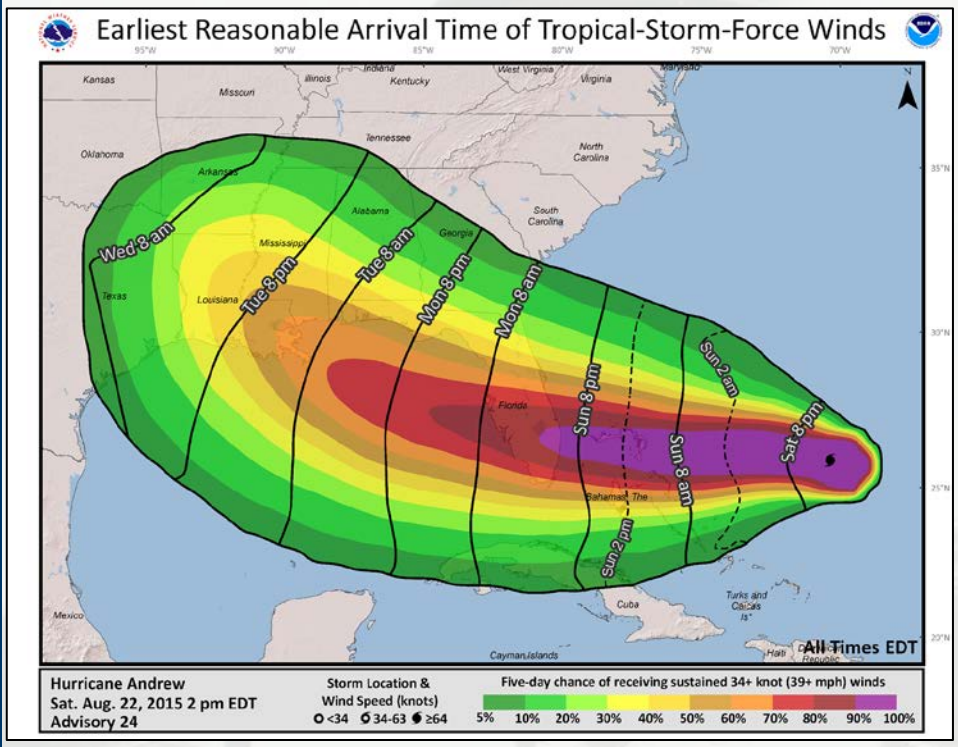
- Equally likely to occur before as after



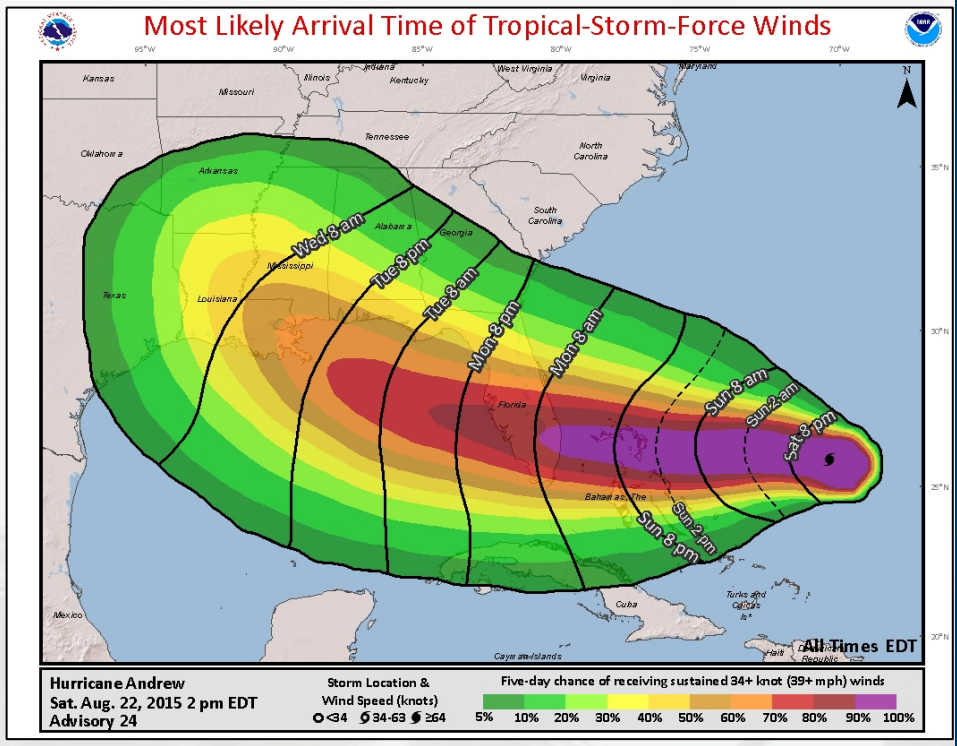
NHC Product Updates

Time of Arrival

HURRICANE ANDREW TIMING EXAMPLE



Earliest reasonable time of arrival around midnight Sunday night/Monday morning



Mostly likely time of arrival just before daybreak Monday

Enhanced Messaging

NHC Key Messages

Key Messages regarding Hurricane Matthew

October 4, 2016 – 5 p.m. EDT

1. Matthew is likely to produce devastating impacts from storm surge, extreme winds, heavy rains, flash floods, and/or mudslides in portions of the warning areas in Haiti, Cuba, and the Bahamas. Please consult statements from the meteorological services and other government officials in those countries.

2. When a hurricane is forecast to take a track roughly parallel to a coastline, as Matthew is forecast to go from Florida through South Carolina, it becomes very difficult to estimate impacts this far in advance. For example, only a small deviation of the track to the left of the NHC forecast could bring the core of a major hurricane onshore, while a small deviation to the right could keep all of the hurricane-force winds offshore. It will likely take another day or so for the potential impacts of Matthew in the United States to clarify.

3. Tropical storm or hurricane conditions could affect portions of Florida north of the current Hurricane Watch area, Georgia, South Carolina, and North Carolina later this week or this weekend, even if the center of Matthew remains offshore. It is too soon to specify what, if any, direct impacts Matthew might have on the remainder of the U.S. east coast farther to the north. At a minimum, very dangerous beach and boating conditions are likely along much of the U.S. east coast later this week and weekend.

NOAA National Hurricane Center: www.hurricanes.gov

Enhanced Messaging

Special Tweets/Messages

An example of special messages that are posted to the NHC website and Twitter simultaneously to indicate when advisories will be initiated.

Enhanced Messaging

Live Broadcasts via Facebook and Periscope

NOAA NWS National Hurricane Center was live.
May 9 at 2:17pm ·

Live from Reagan Airport in Washington DC....the Hurricane Awareness Tour

NHC Atlantic Ops @NHC_Atlantic · 5 Oct 2016

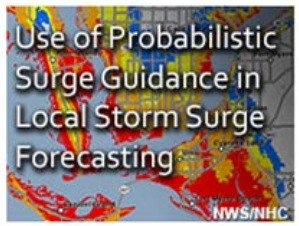
Join @NHCDirector Dr. Rick Knabb live on Periscope at 2:45 p.m. EDT this afternoon for the latest on #Matthew
periscope.tv/NWSNHC

Online Training

COMET Modules

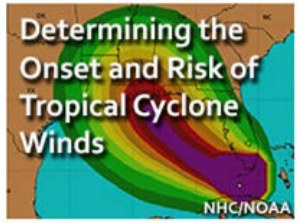
Storm surge and tropical cyclone related COMET modules online:

- Introduction to Tropical Cyclone Storm Surge
- Storm Surge and Datums
- Forecasting Tropical Cyclone Storm Surge
- Determining the Onset and Risk of Tropical Cyclone Winds
- Tropical Cyclone Forecast Uncertainty
- Real-Time Storm Surge Products
- Best Practices in Tropical Cyclone Briefings



Use of Probabilistic Surge Guidance in Local Storm Surge Forecasting

Languages: English
Publish Date: 2015-07-20
Skill Level: 2
Completion Time: .75 - 1.00 h
Topics:
Tropical/Hurricanes
(0 reviews)



Determining the Onset and Risk of Tropical Cyclone Winds

Languages: English
Publish Date: 2015-07-01
Skill Level: 1
Completion Time: .50 - .75 h
Topics:
Tropical/Hurricanes
(0 reviews)

www.meted.ucar.edu

Spanish-Language Website

FIU Partnership

huracanes.fiu.edu

Questions/Comments

Contact Information

Thanks for your attention!

#NOAAHurricaneAware

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Recording of this webinar will be available at:
www.regions.noaa.gov/secar/