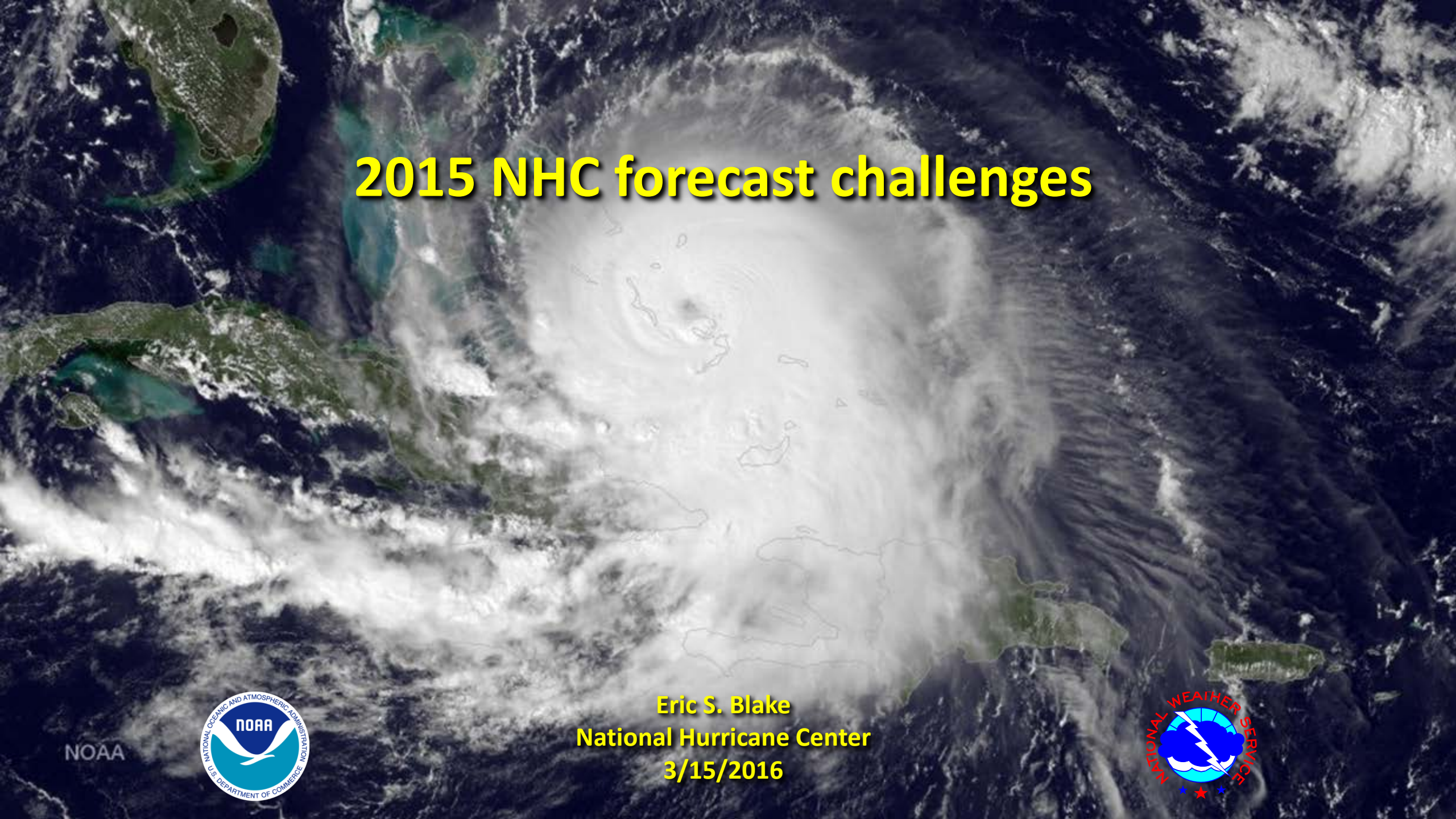
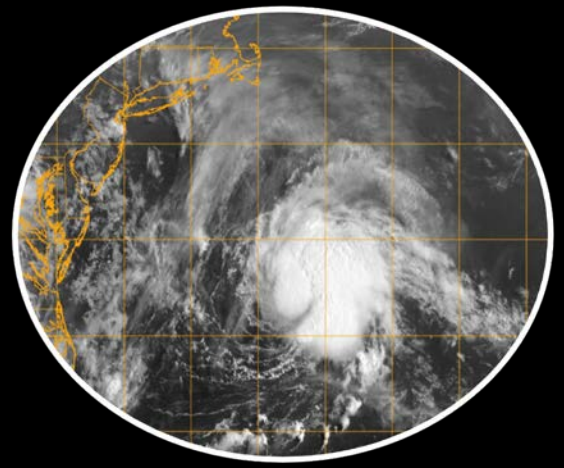



# 2015 NHC forecast challenges

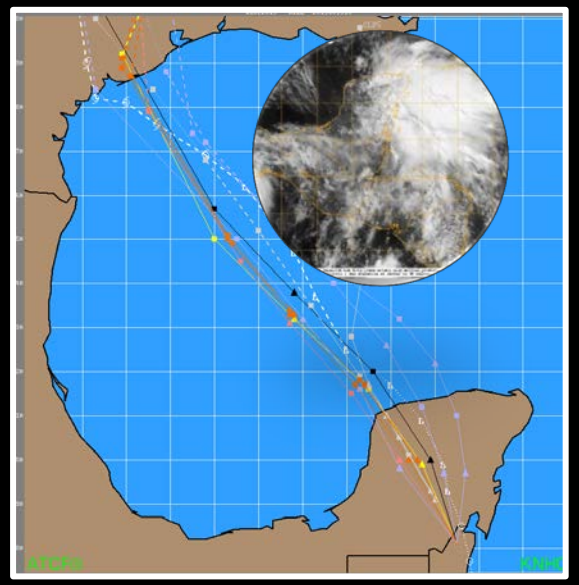
Eric S. Blake
National Hurricane Center
3/15/2016

# 2015 Summary

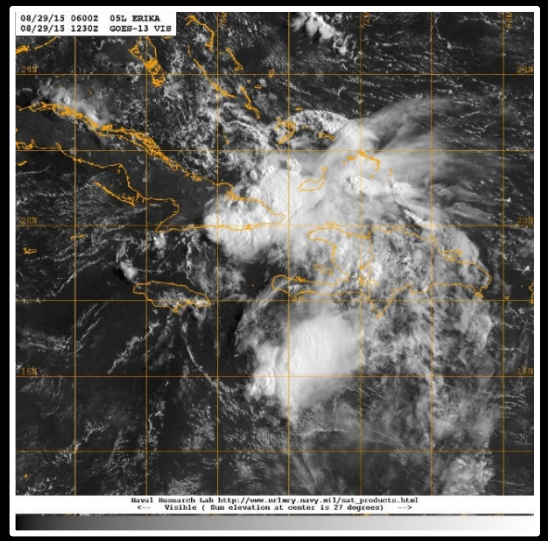
**Unexpected genesis**
**Claudette**



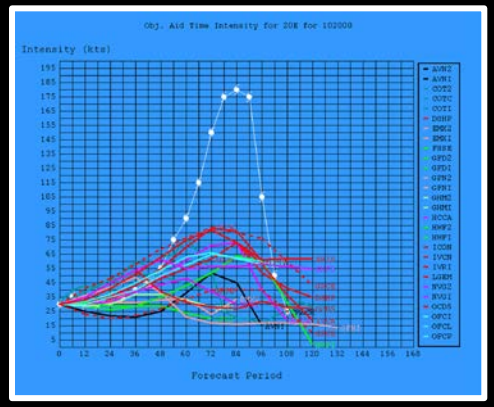
**Genesis near the coast**



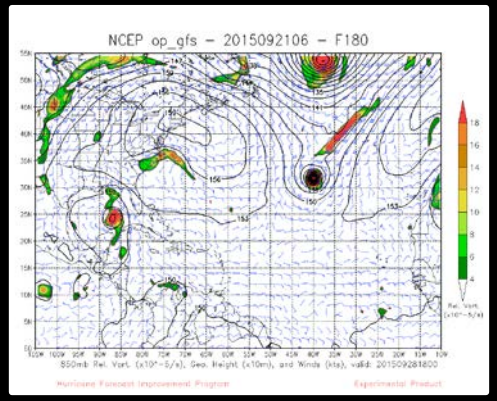
**Dissipation near landfall**



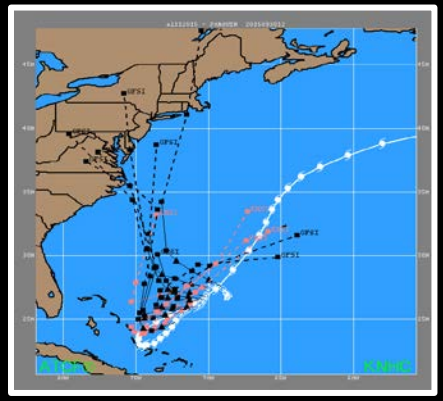

**Rapid intensification**



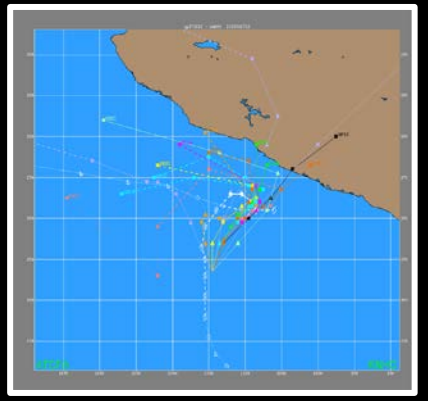

**False Alarms**

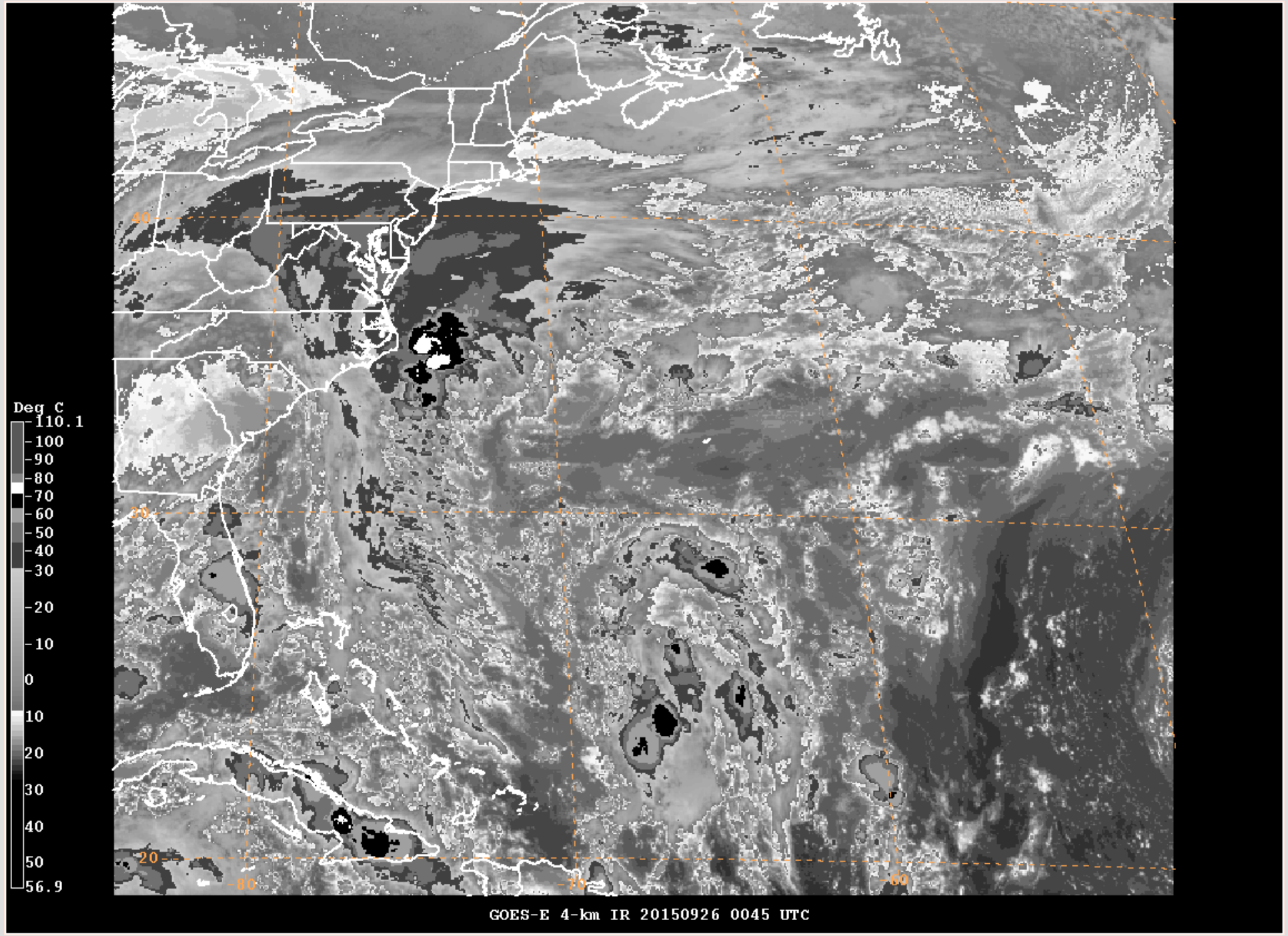



**Guidance disagreement**



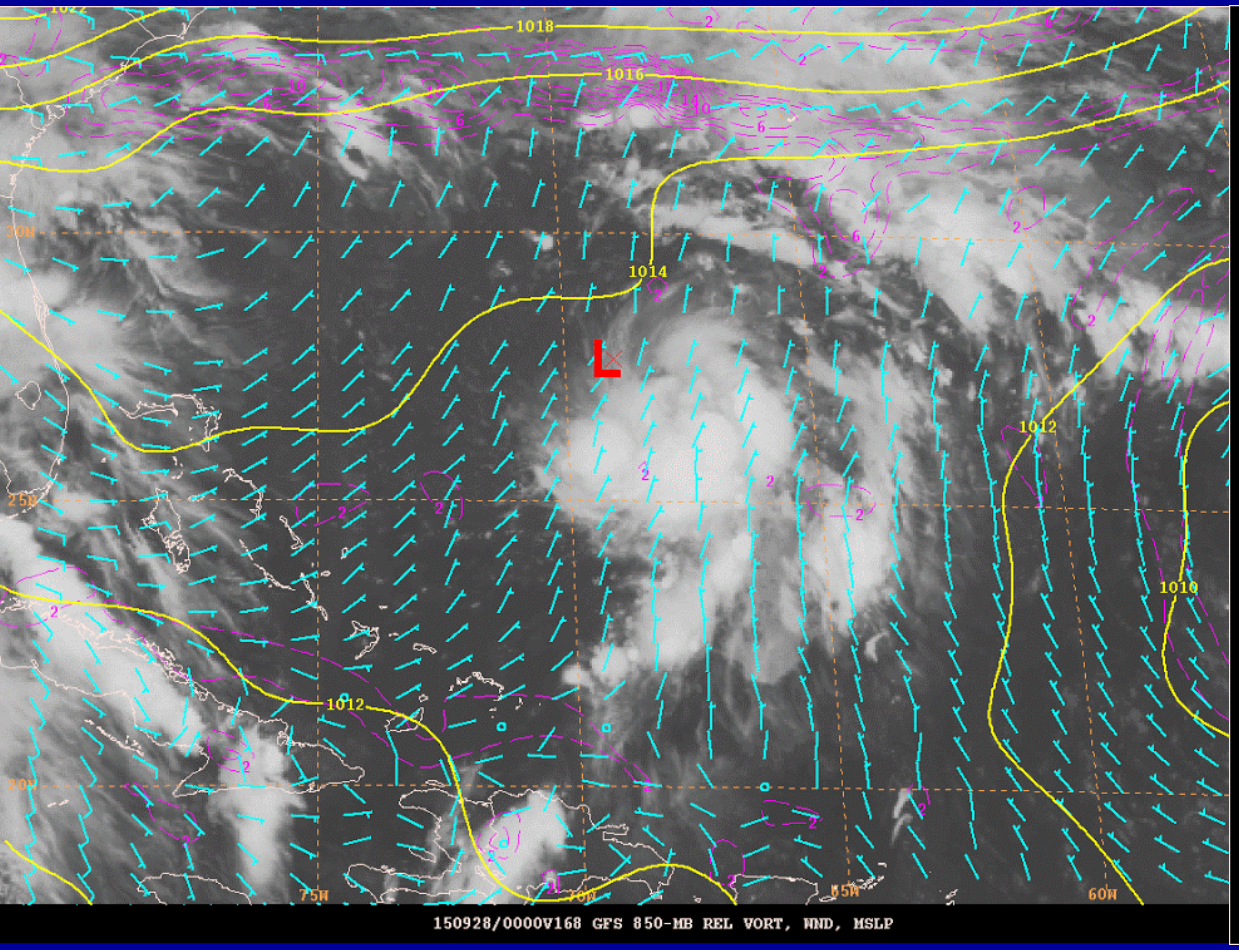
**Track change before landfall**



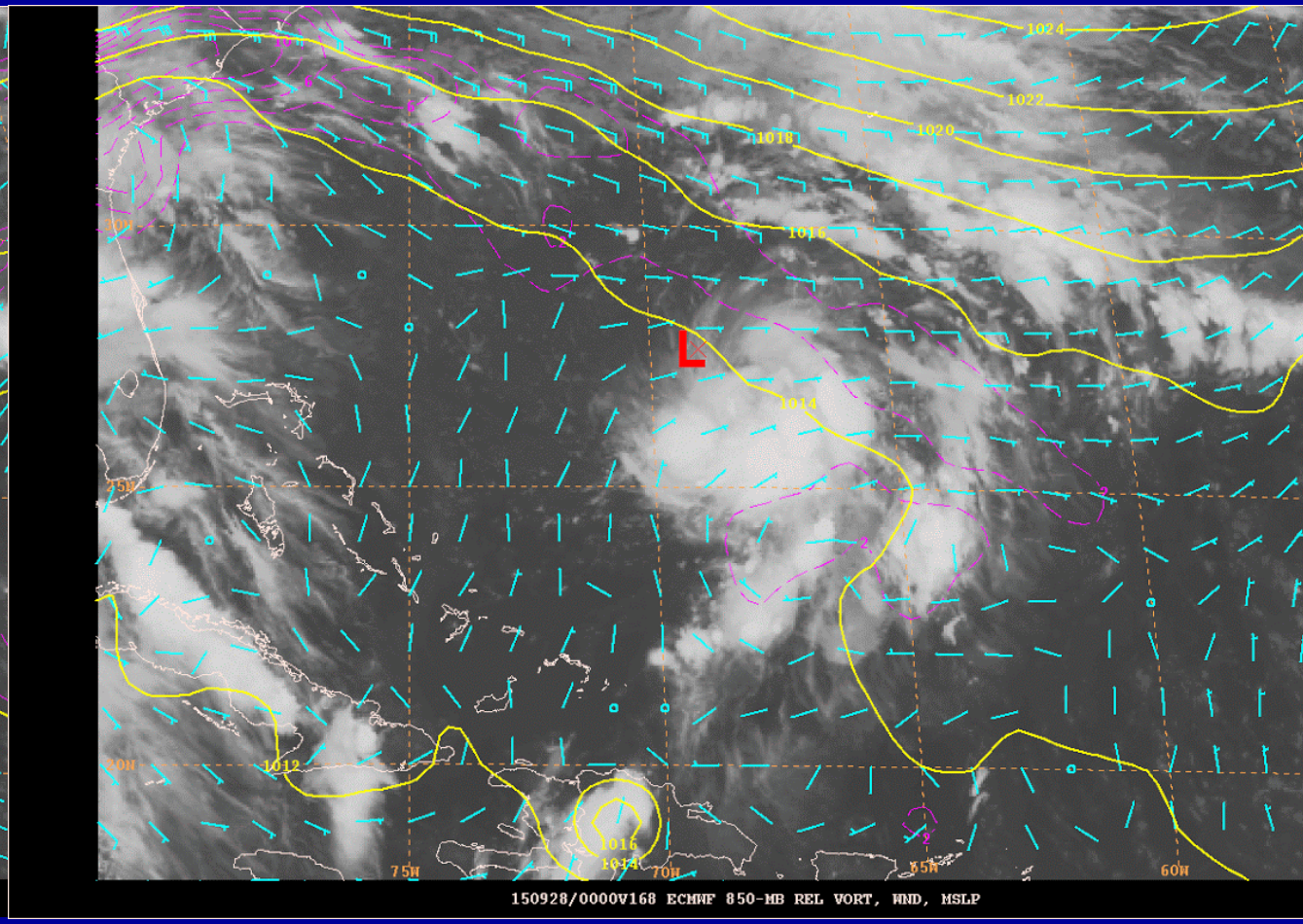

Deg C
-110.1
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
56.9
40
30
20
-80
-70
-60
GOES-E 4-km IR 20150926 0045 UTC

# Genesis forecasts for Joaquin

GFS

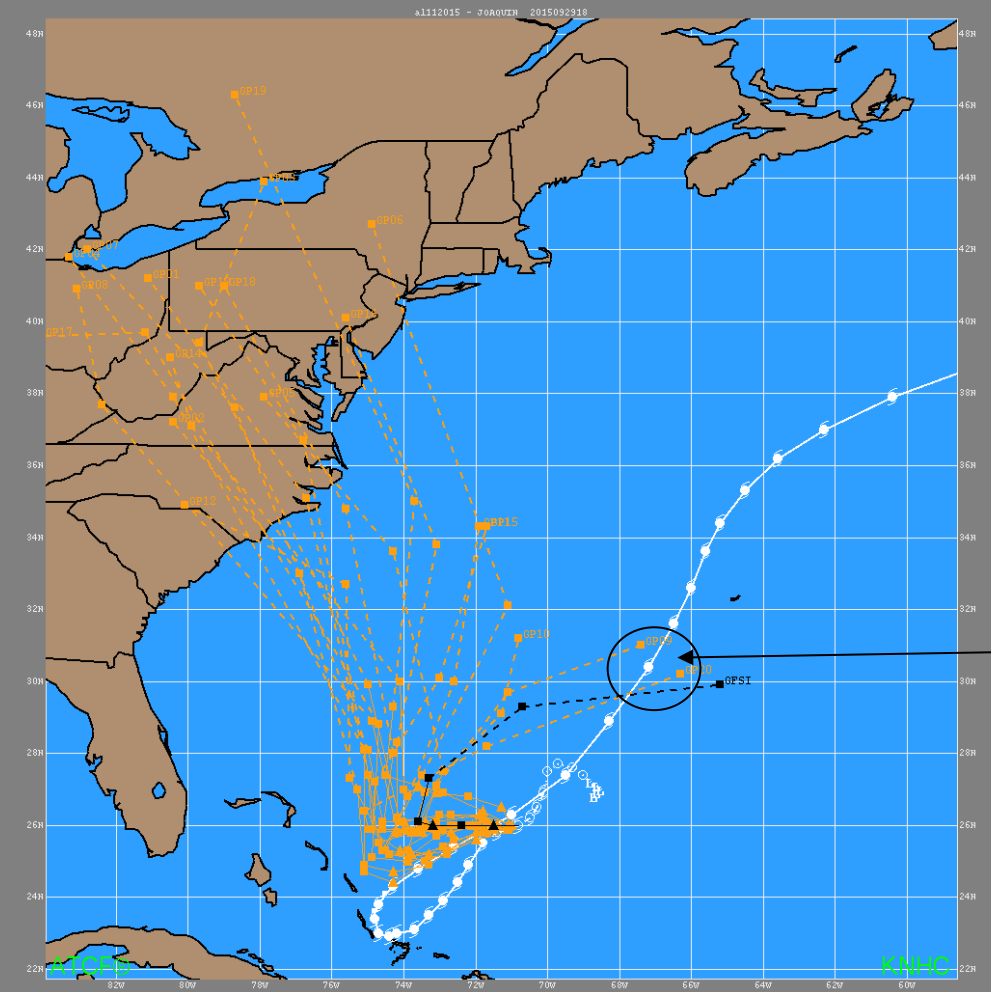



ECMWF



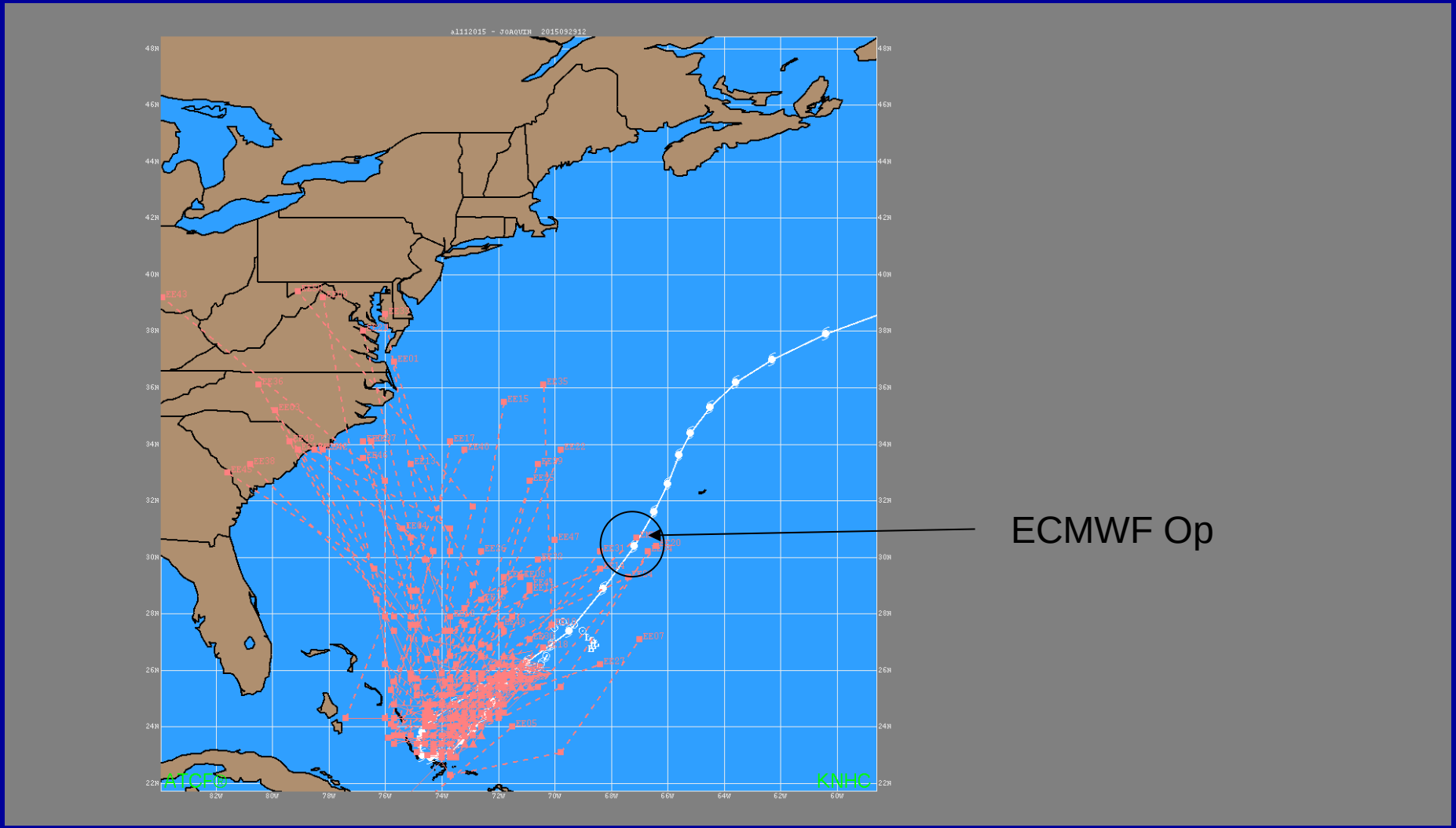

- Little signal at long-range in GFS, broad low/trough in ECMWF
- ECMWF detected genesis about a day earlier than the GFS

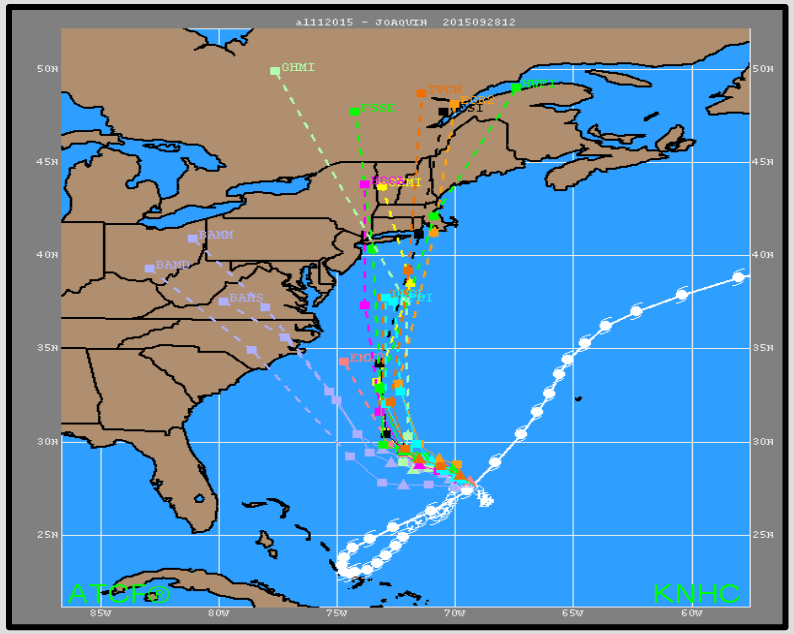
# GFS Joaquin ensembles 29 Sep 1200 UTC

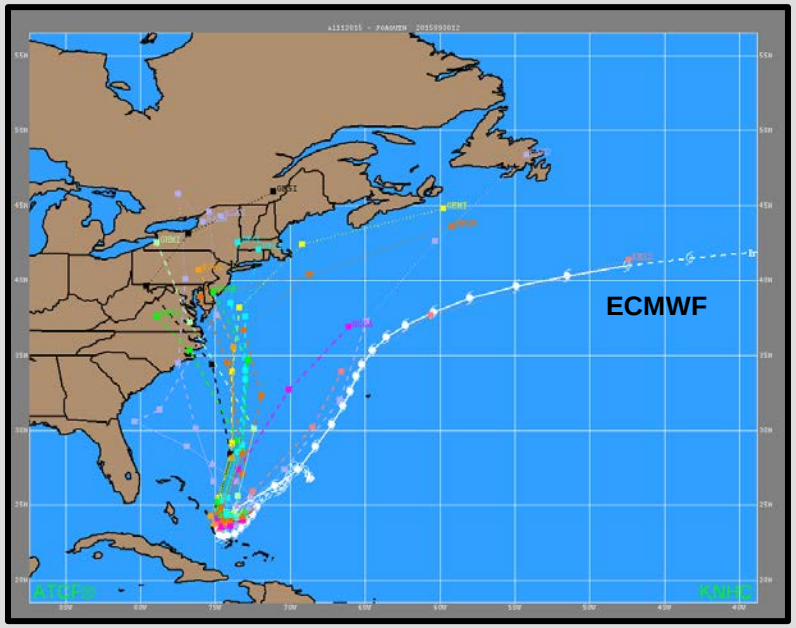


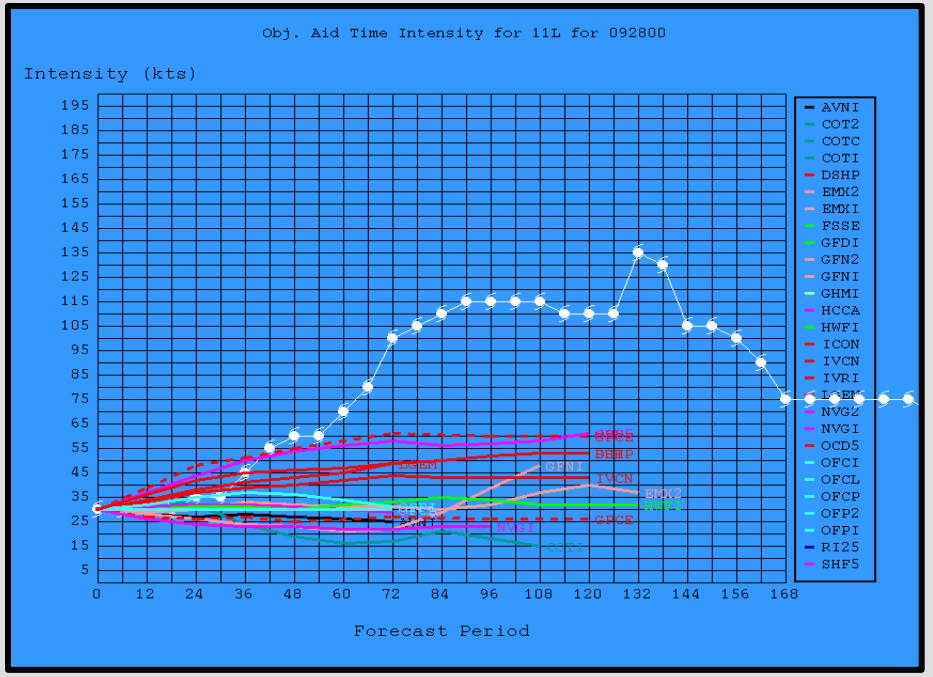

Verifying position

# ECMWF Joaquin ensembles 29 Sep 1200 UTC

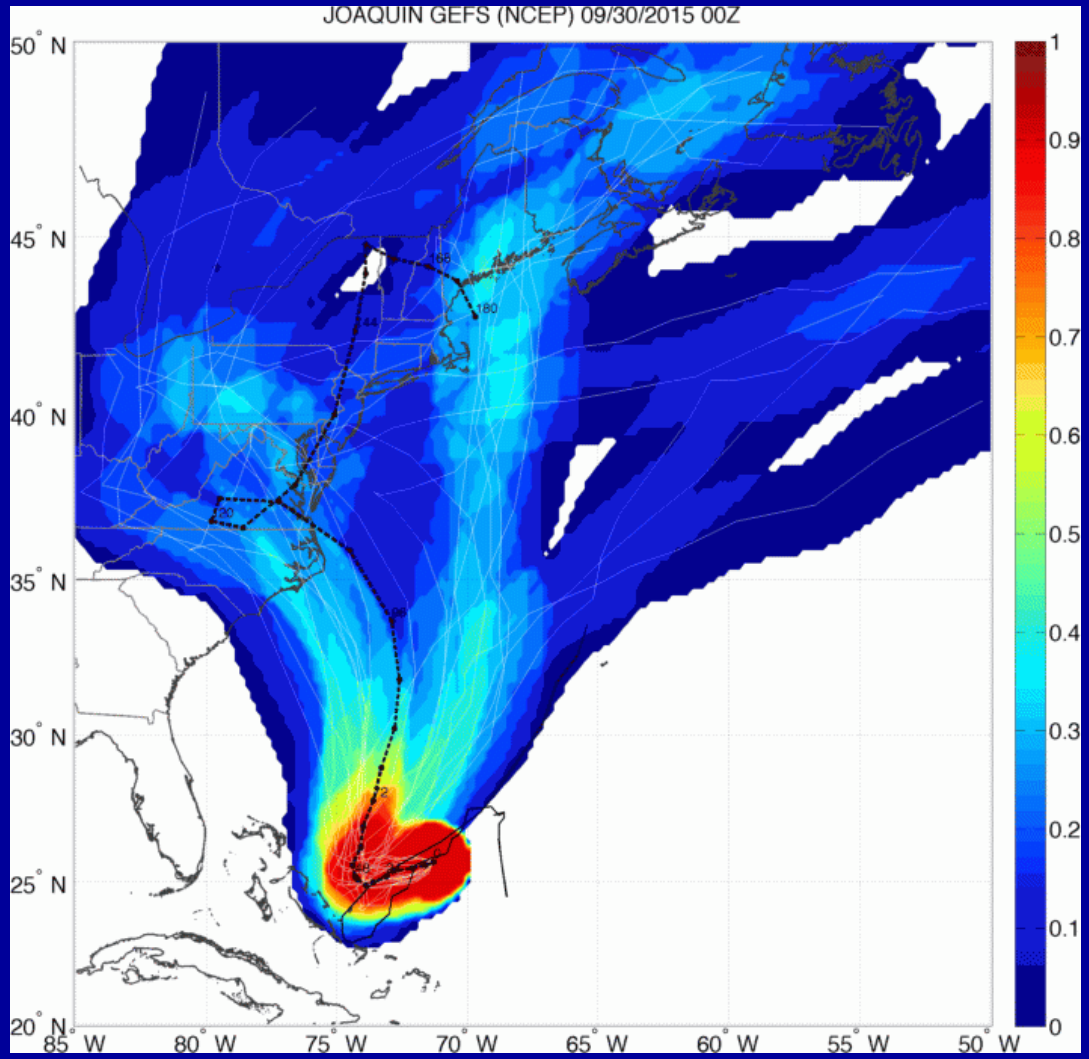



al112015 - JOAQUIN 2015092812
GHMI
FSSE
IVCN
HWFI
BAMM
BAMD
BAMS
AVNI
ATCF®
KNHC

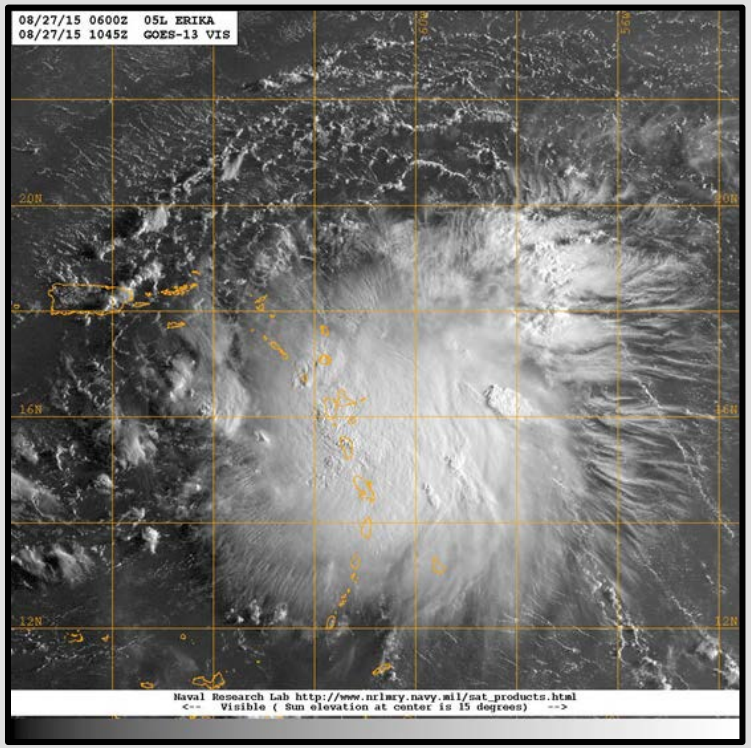

ECMWF
ATCF®
KNHC

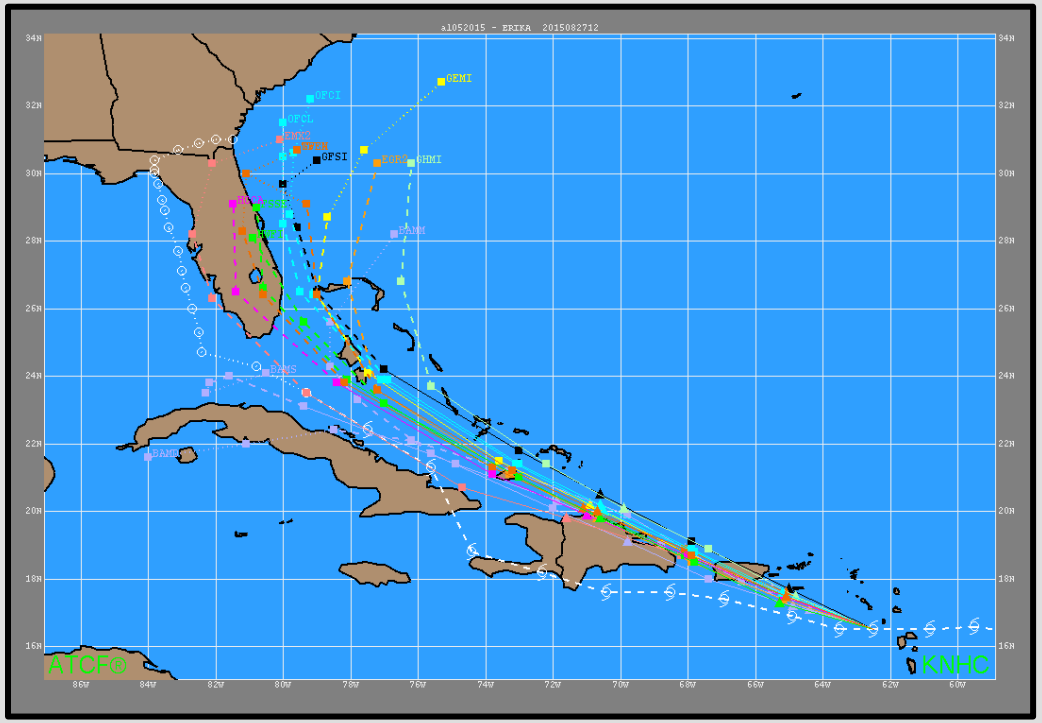

Obj. Aid Time Intensity for 11L for 092800
Intensity (kts)
Forecast Period
AVNI
COT2
COTC
COTI
DSHP
EMX2
EMXI
FSSE
GFDI
GFN2
GFNI
GHMI
HCCA
HWFI
ICON
IVCN
IVRI
LGEM
NVG2
NVGI
OCD5
OFCI
OFCL
OFCP
OFP2
OFPI
RI25
SHF5

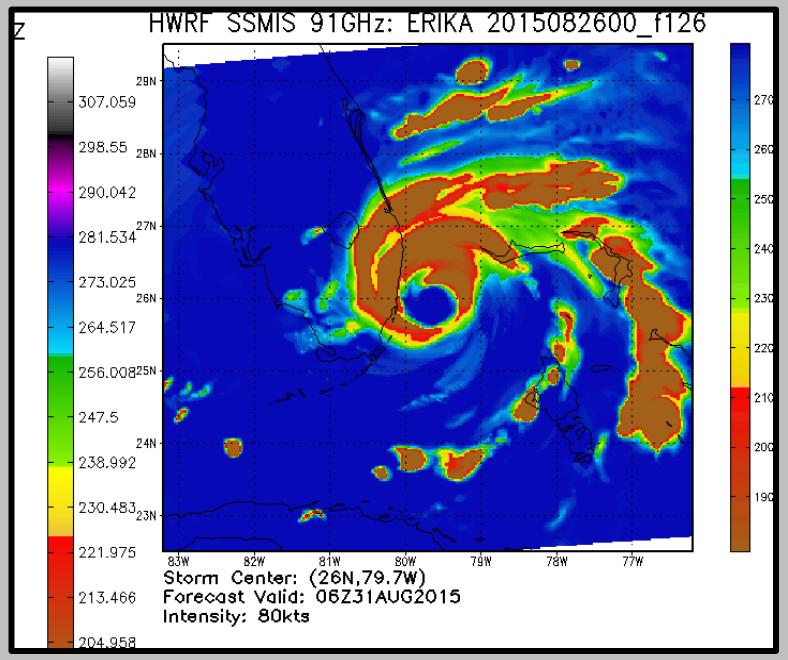
# GEFS vs EC Ensemble 30 Sep 0000 UTC

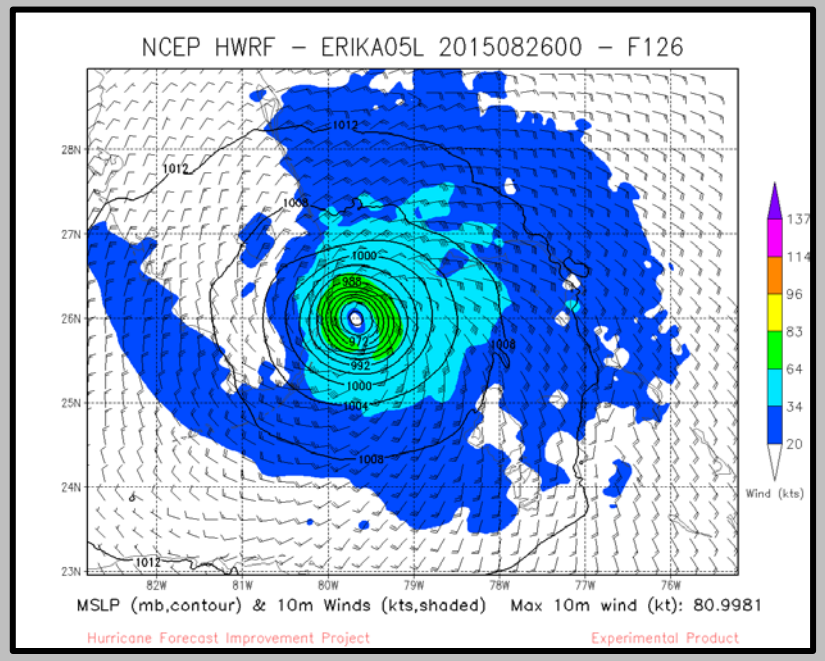


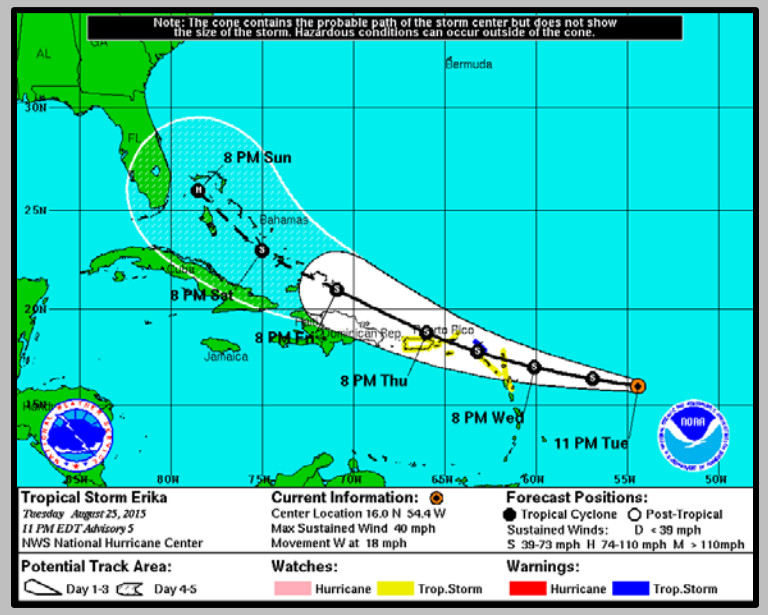
# Erika

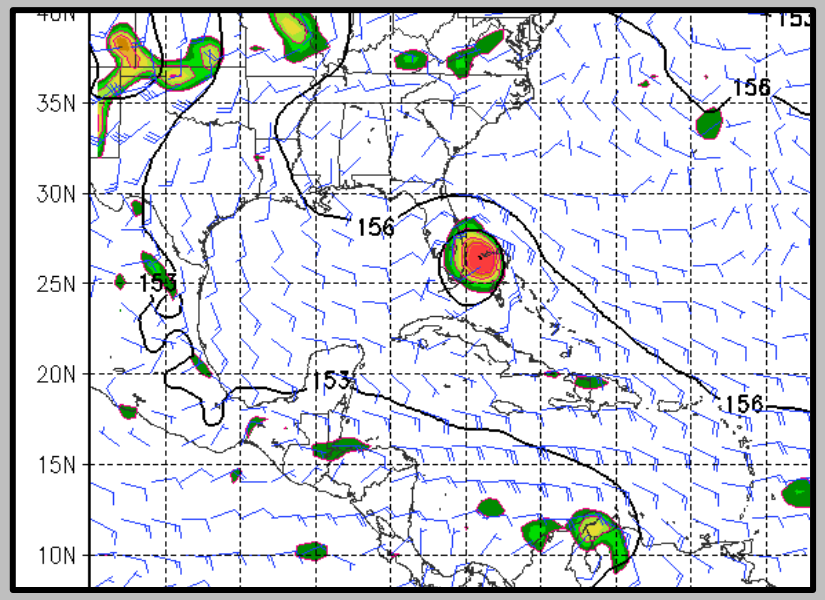

08/27/15 0600Z 05L ERIKA
08/27/15 1045Z GOES-13 VIS
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- Visible ( Sun elevation at center is 15 degrees) -->

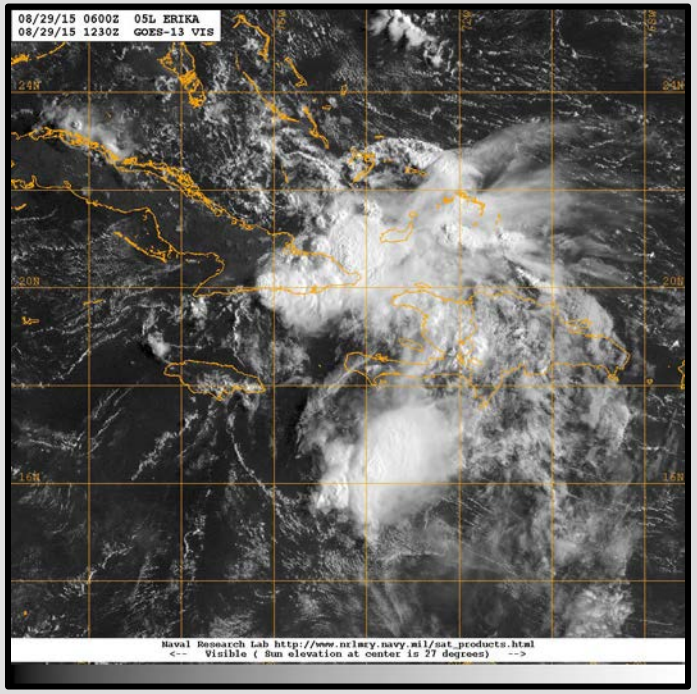

al052015 - ERIKA 2015082712
GEMI
OFCI
OFCL
OFSI
VHMI
BAMM
BAMS
ATCF©
KNHC

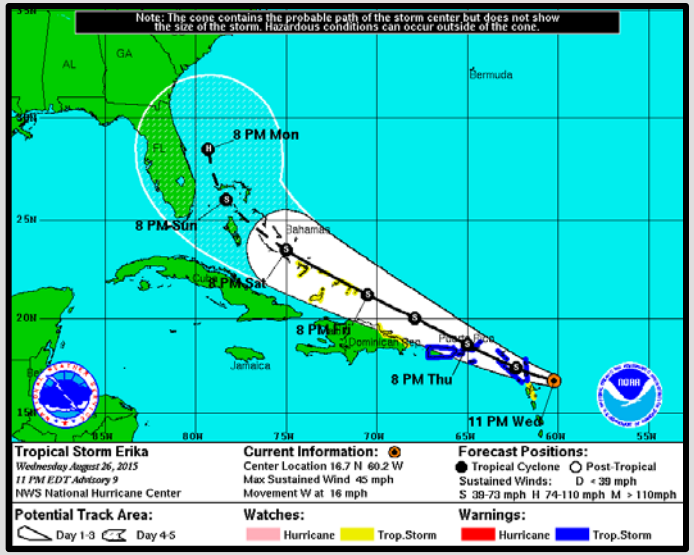

HWRF SSMIS 91GHz: ERIKA 2015082600_f126
307.059
298.55
290.042
281.534
273.025
264.517
256.008
247.5
238.992
230.483
221.975
213.466
204.958
Storm Center: (26N,79.7W)
Forecast Valid: 06Z31AUG2015
Intensity: 80kts


NCEP HWRF – ERIKA05L 2015082600 – F126
MSLP (mb,contour) & 10m Winds (kts,shaded) Max 10m wind (kt): 80.9981
Hurricane Forecast Improvement Project
Experimental Product
Wind (kts)

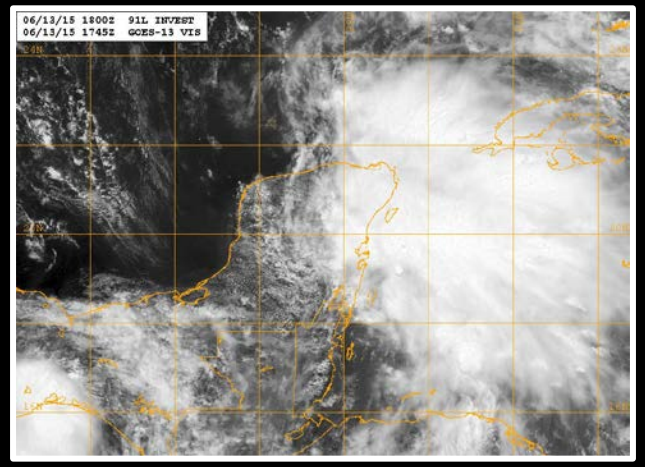

Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.
Bermuda
8 PM Sun
Bahamas
8 PM Sat
8 PM Fri
Jamaica
8 PM Thu
8 PM Wed
11 PM Tue
Tropical Storm Erika
Tuesday August 25, 2015
11 PM EDT Advisory 5
NWS National Hurricane Center
Current Information:
Center Location 16.0 N 54.4 W
Max Sustained Wind 40 mph
Movement W at 18 mph
Forecast Positions:
Tropical Cyclone
Post-Tropical
Sustained Winds: D <39 mph
S 39-73 mph H 74-110 mph M >110mph
Potential Track Area:
Day 1-3
Day 4-5
Watches:
Hurricane
Trop.Storm
Warnings:
Hurricane
Trop.Storm


35N
30N
25N
20N
15N
10N
156
153


08/29/15 0600Z 05L ERIKA
08/29/15 1230Z GOES-13 VIS
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- Visible ( Sun elevation at center is 27 degrees) -->

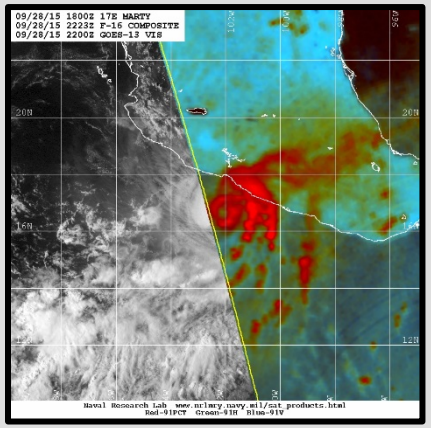

Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.
AL
GA
Bermuda
8 PM Mon
8 PM Sun
Bahamas
8 PM Sat
8 PM Fri
Dominican Rep.
Puerto Rico
Jamaica
8 PM Thu
11 PM Wed
Tropical Storm Erika
Wednesday August 26, 2015
11 PM EDT Advisory 9
NWS National Hurricane Center
Current Information:
Center Location 16.7 N 60.2 W
Max Sustained Wind 45 mph
Movement W at 16 mph
Forecast Positions:
Tropical Cyclone
Post-Tropical
Sustained Winds: D < 39 mph
S 39-73 mph H 74-110 mph M > 110mph
Potential Track Area:
Day 1-3
Day 4-5
Watches:
Hurricane
Trop.Storm
Warnings:
Hurricane
Trop.Storm

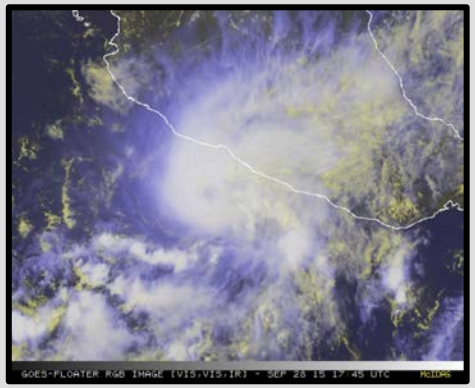
# Genesis near the coast

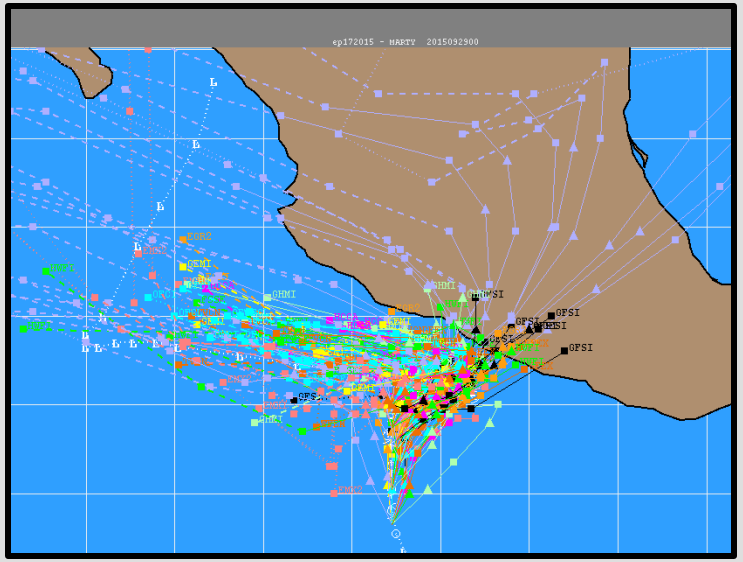


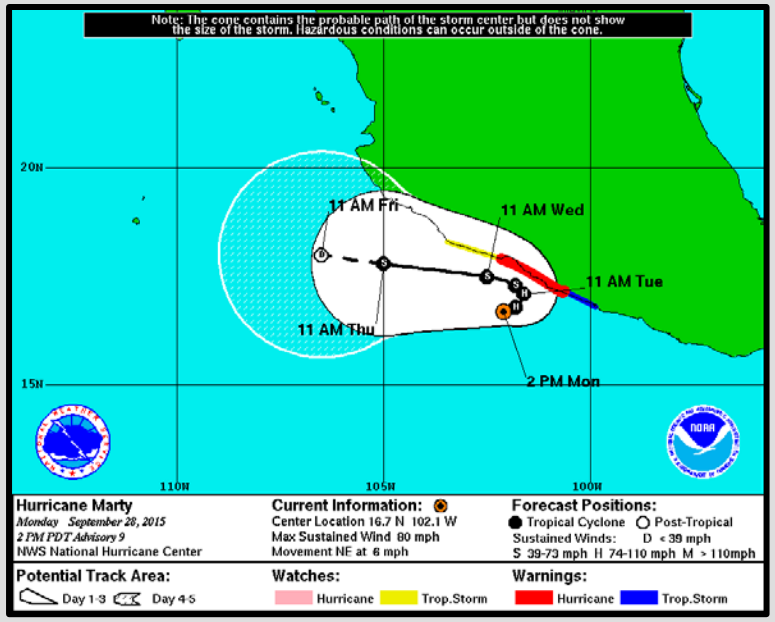


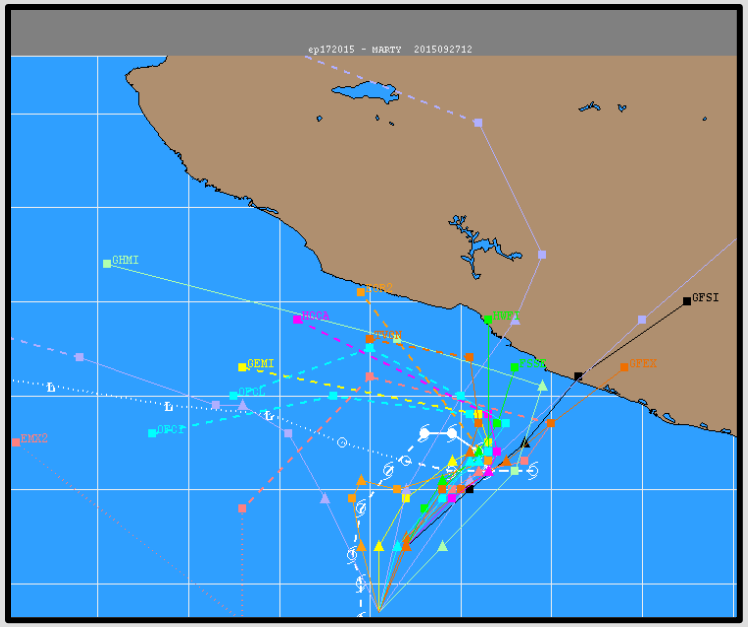
# Marty: Change in track before landfall

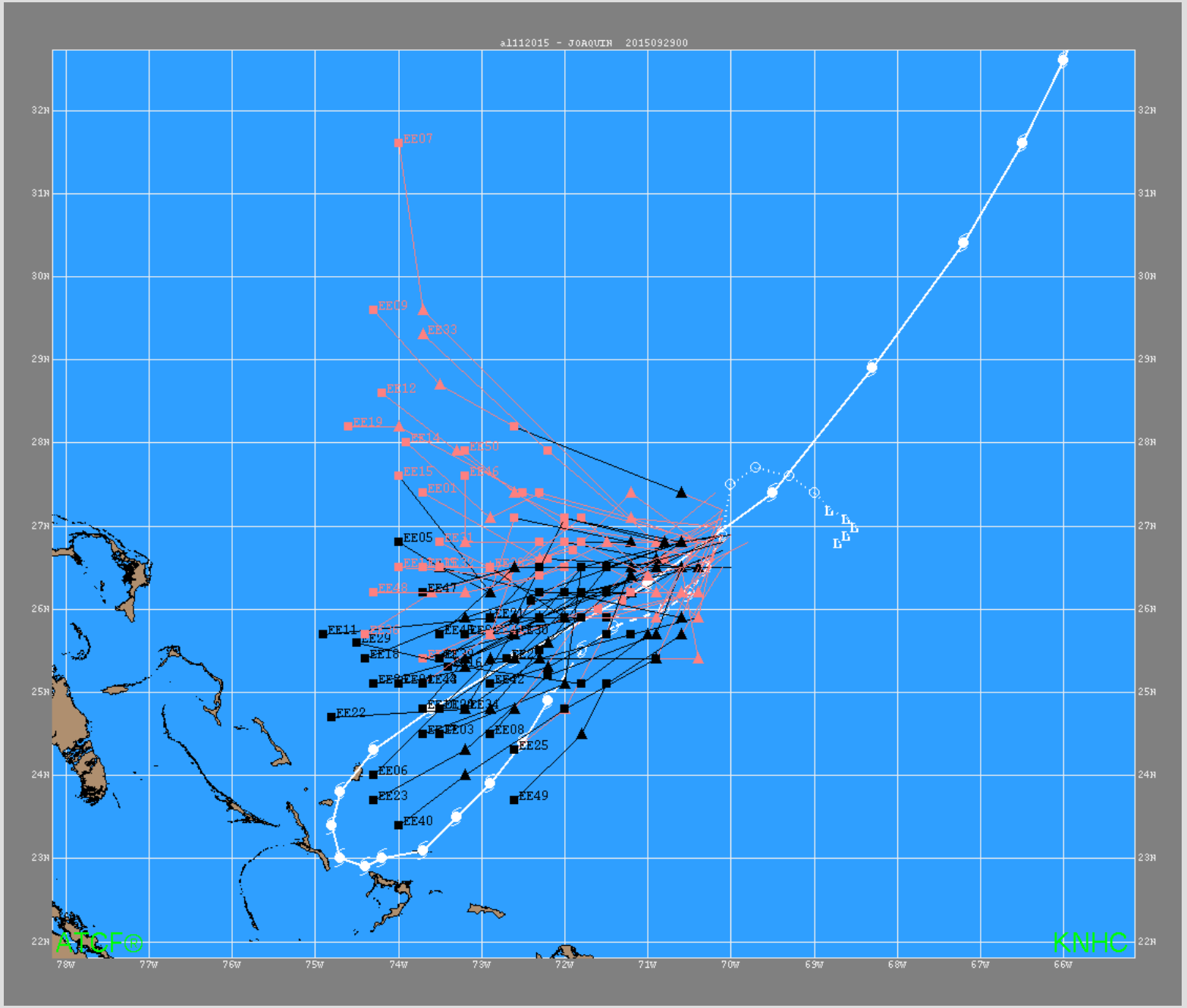


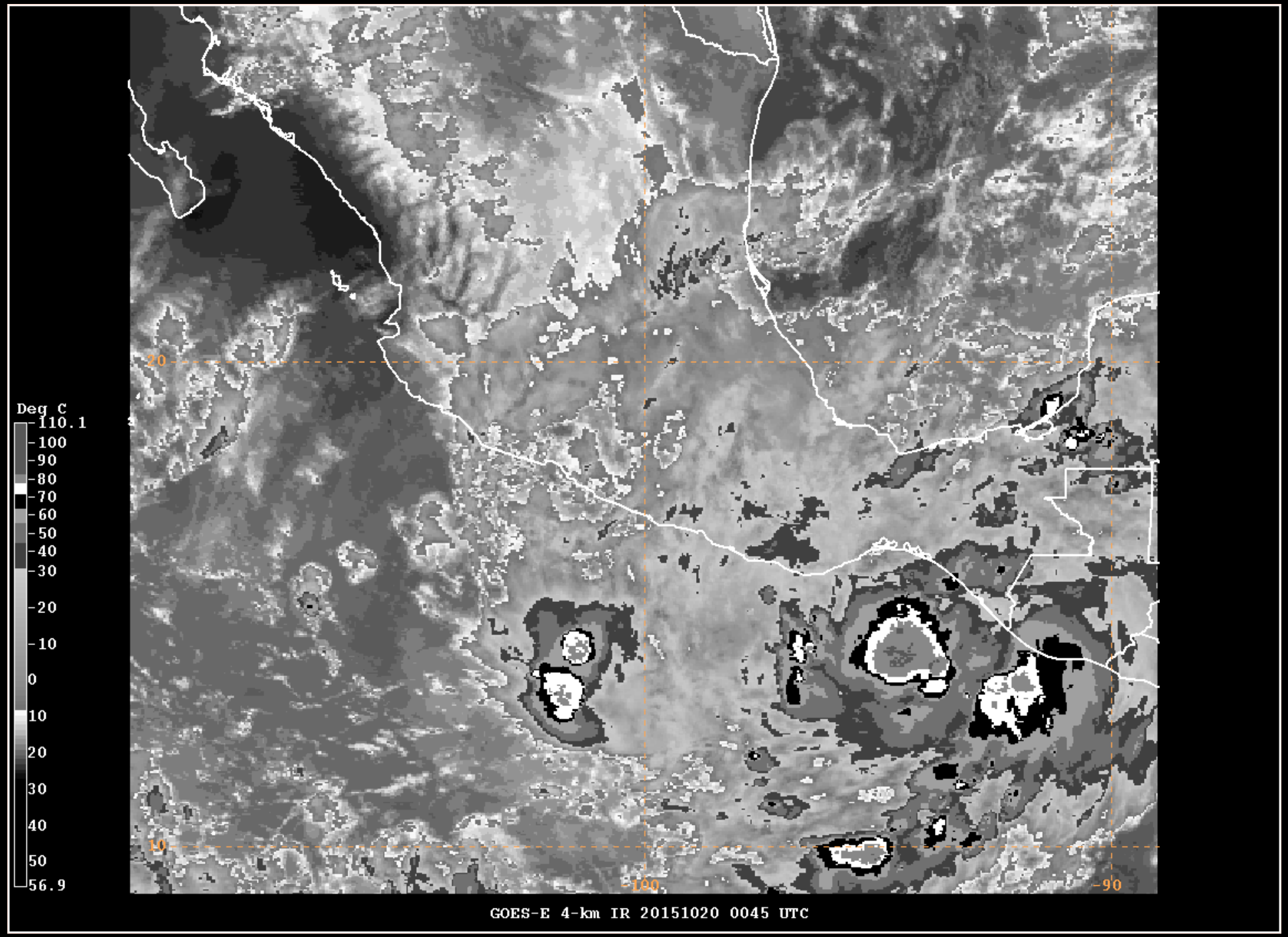



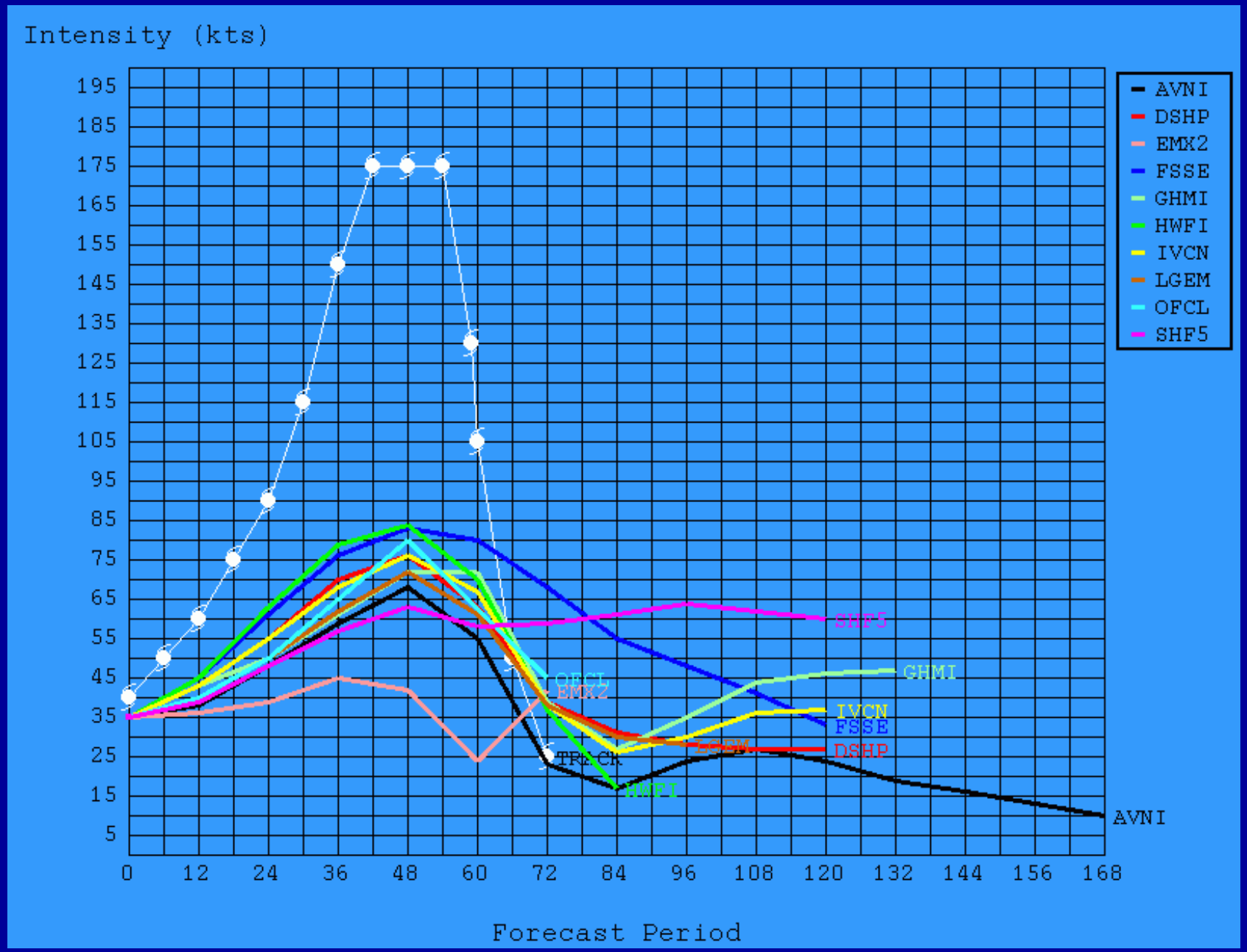




al112015 - JOAQUIN 2015092900
32N
31N
30N
29N
28N
27N
26N
25N
24N
23N
22N
78W
77W
76W
75W
74W
73W
72W
71W
70W
69W
68W
67W
66W
EE07
EE09
EE03
EE12
EE19
EE14
EE50
EE15
EE46
EE01
EE05
EE48
EE47
EE11
EE29
EE18
EE44
EE42
EE22
EE03
EE08
EE25
EE06
EE23
EE49
EE40
ATCF
KNHC


Deg C
110.1
100
90
80
70
60
50
40
30
20
10
0
10
20
30
40
50
56.9
20
10
-100
-90
GOES-E 4-km IR 20151020 0045 UTC

# Patricia guidance before rapid intensification




- Woefully underdone
- Good timing of peak
- Statistical models outperformed the dynamical models

# National Hurricane Center Update 2016


Daniel Brown
Warning Coordination Meteorologist

# Enhanced Messaging

## Key messages added to Discussion and shared on Social Media

### Key Messages on Hurricane Joaquin

**Wednesday Evening, September 30, 2015**

1. **Preparations to protect life and property within the warning areas in the Bahamas should be rushed to completion.**

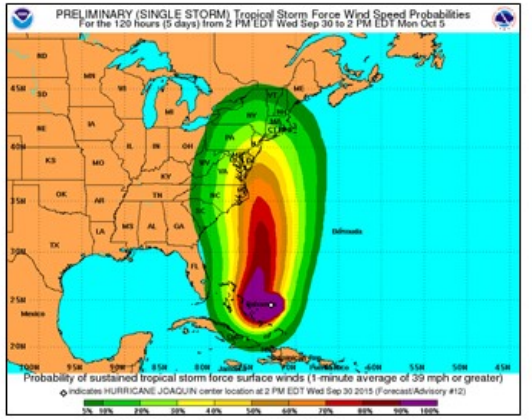
2. **A significant adjustment to the forecast has been made this afternoon to reflect an increased threat to the mid-Atlantic states and the Carolinas.** However, confidence in the details of the forecast after 72 hours remains low, since we have one normally excellent model that keeps Joaquin far away from the United States east coast. The range of possible outcomes is still large, and includes the possibility of a major hurricane landfall in the Carolinas.

3. **Every effort is being made to provide the forecast models with as much data as possible.** The NOAA G-IV jet has begun a series of missions in the storm environment, and the National Weather Service has begun launching extra balloon soundings.

4. **Because landfall, if it occurs, is still more than three days away, it's too early to talk about specific wind, rain, or surge impacts from Joaquin in the United States.** Regardless of Joaquin's track, strong onshore winds will create minor to moderate coastal flooding along the coasts of the mid-Atlantic and northeastern states through the weekend.

5. **A hurricane watch for a portion of the U.S. coast could be required as early as Thursday evening.**

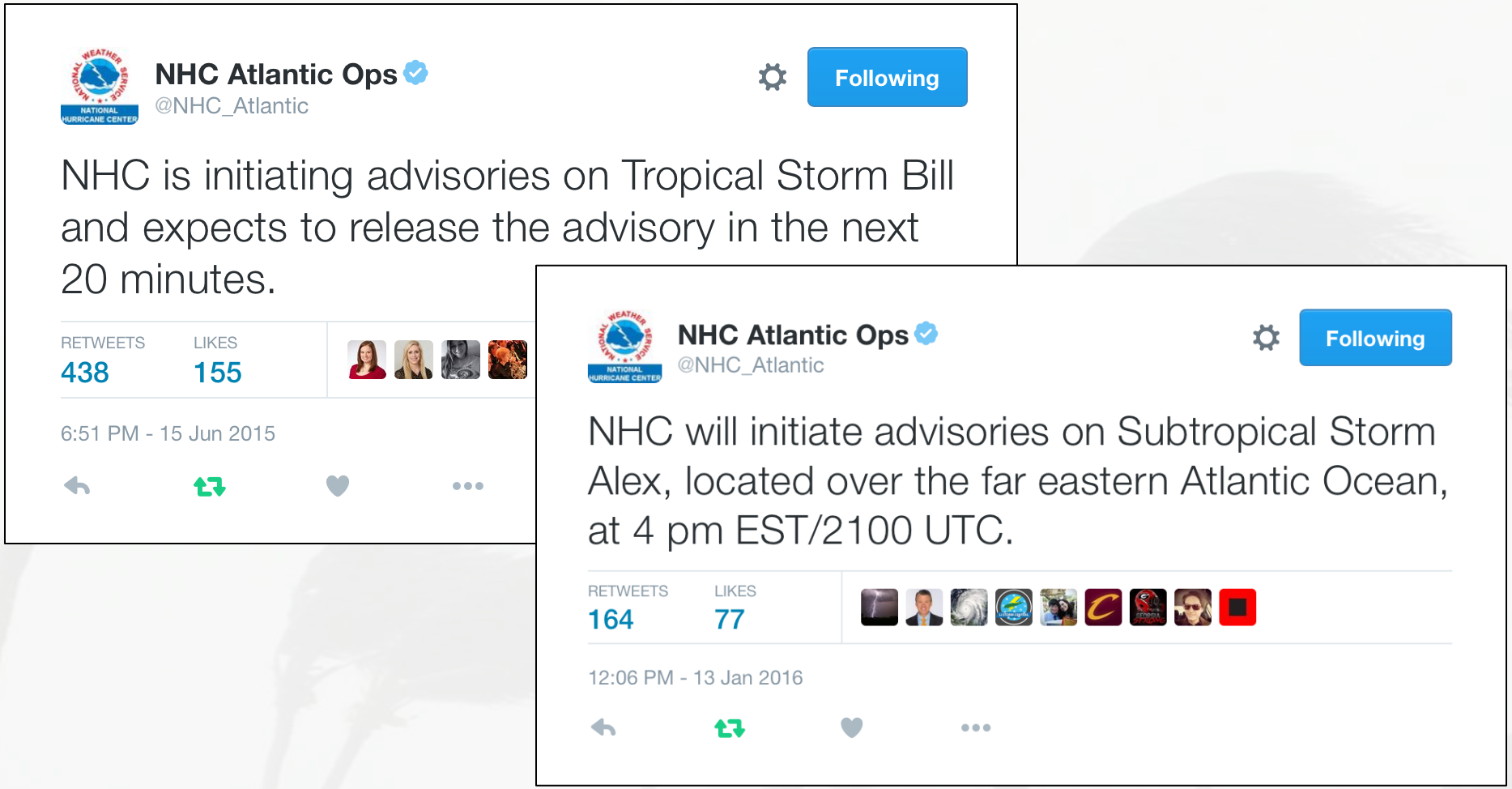
6. **Many areas of the eastern U.S. are currently experiencing heavy rains and gusty winds associated with a frontal system.** This inclement weather is expected to continue over the next few days, which could complicate preparations for Joaquin should it head toward the coast, and greatly exacerbate the impacts from the hurricane.


**National Hurricane Center: www.hurricanes.gov**

# Enhanced Messaging

## NHC Special Messages

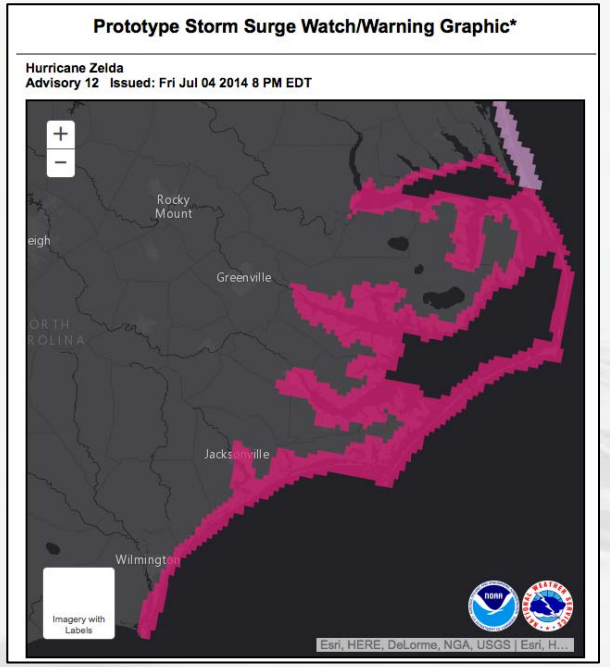



An example of special messages that are posted to the NHC website and Twitter simultaneously to indicate when advisories will be initiated.

# Real-time NHC Storm Surge Products

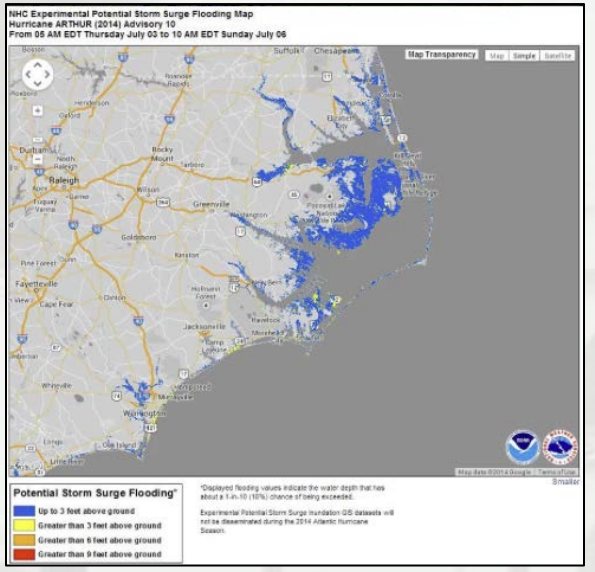
## Watch/Warning Graphic

- Primary audience is the general public.
- Highlights areas that have a significant risk of life-threatening surge, but does not provide any quantitative inundation levels.
- Although driven by objective guidance, *W/W areas also based on subjective factors such as forecaster confidence, continuity with previous issuances, wind trigger, smoothing, isolated areas, etc.*




## Potential Storm Surge Flooding Map

- Intended for decision makers.
- Objective guidance on where inundation from surge could occur and height above ground the water could reach.
- Based solely on the latest NHC forecast and historical error characteristics. No guaranteed continuity from cycle to cycle, or consistency with W/W graphic.



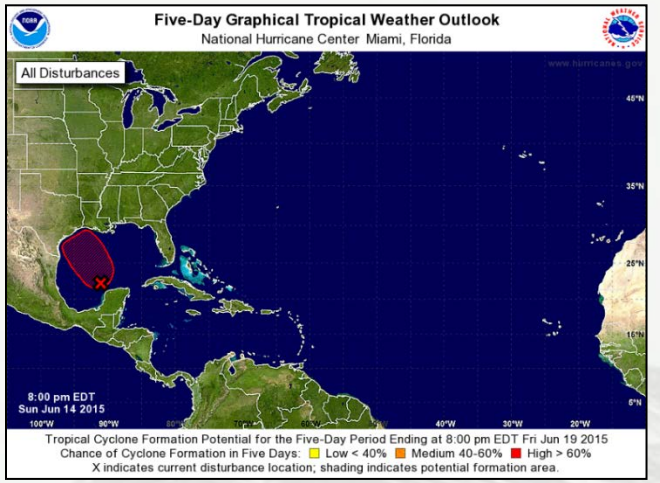
# Watches/Warnings/Forecasts for Potential Tropical Cyclones

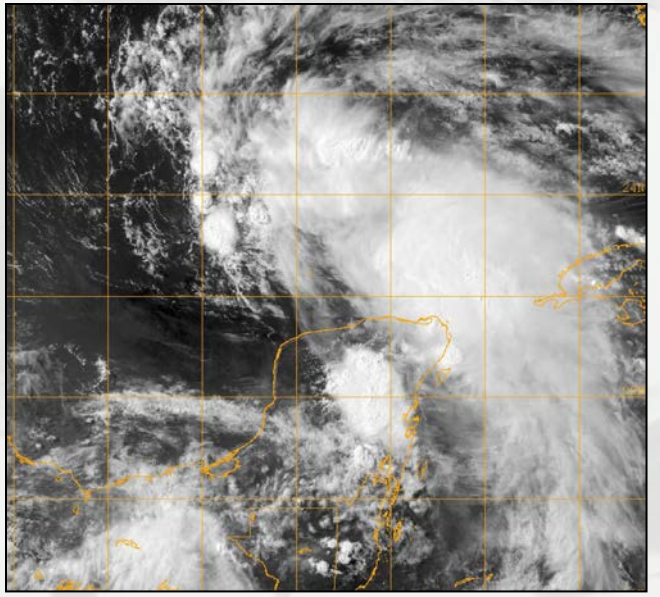
- NHC would have the ability to initiate advisories for disturbances that have a significant risk of becoming a tropical cyclone and producing tropical-storm-force winds over land.

- Regular tropical storm and hurricane watch/warning criteria would apply
  - Watch – possible within 48 h
  - Warning – expected within 36 h

- Issued through the standard suite of NHC advisory products
  - *Potential Tropical Cyclone*

- <u>Possible implementation in 2017</u>

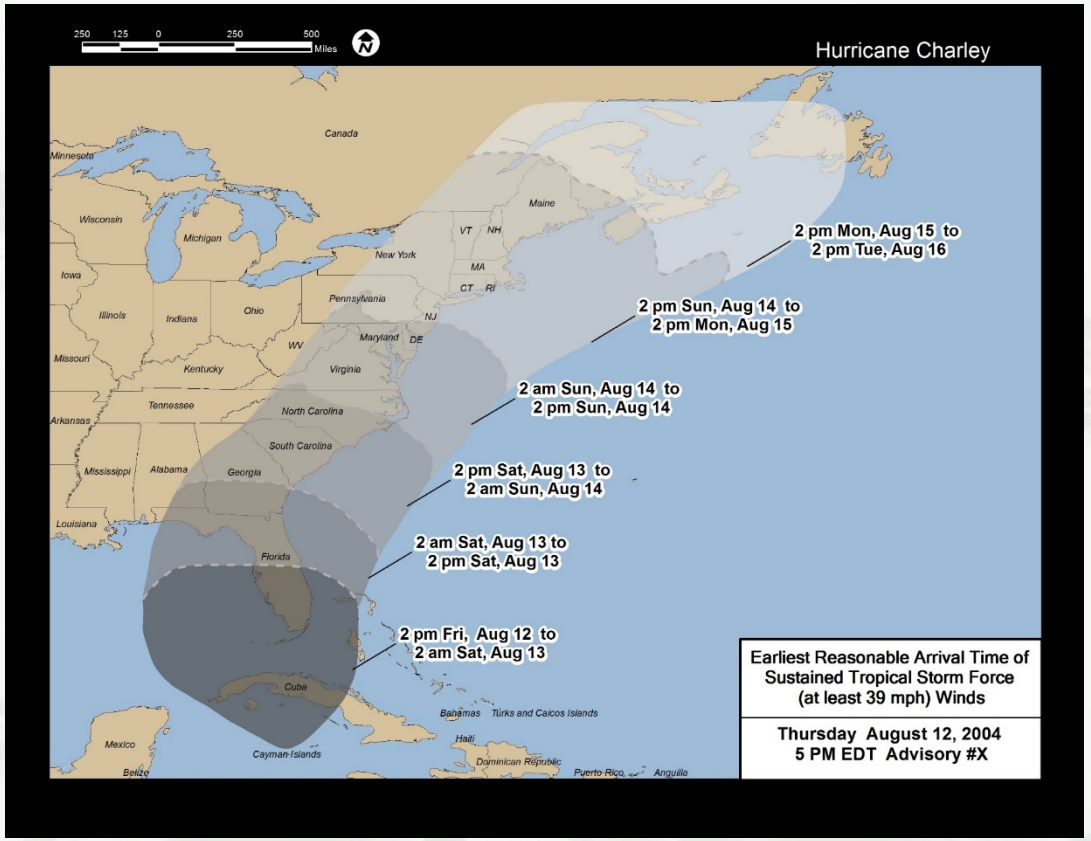


**Pre-Bill (2015) disturbance over the Gulf of Mexico**

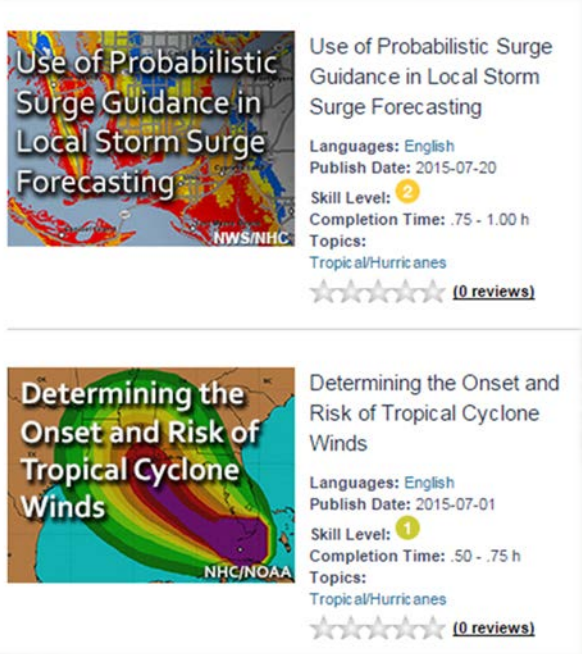
# Prototype Time of Arrival Graphic

- Uses timing information from the same realizations used to create the NHC wind speed probability products
- Accounts for forecast uncertainty
- Provides graphical depiction of potential arrival times of tropical-storm-force winds



# Online Webinars & Training

- New 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 (Spring 2016)




- Webinar's sponsored by NOAA's Southeast & Caribbean Regional Team
  - Planned for May/early June
  - Geared toward emergency managers and broadcast meteorologists

# Questions/Comments