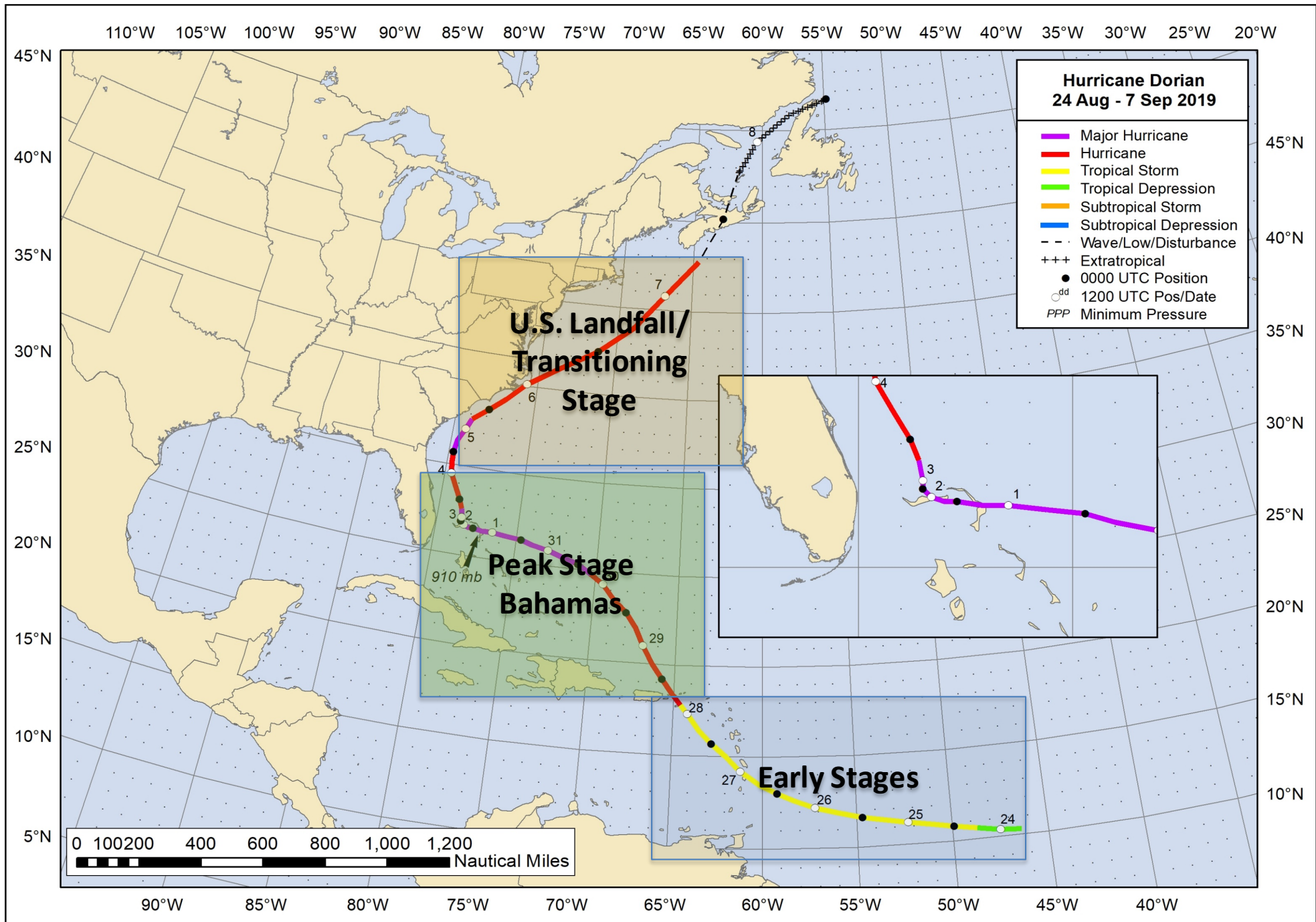


A satellite image of Hurricane Dorian, showing a well-defined eye and a dense, swirling cloud structure over the Atlantic Ocean. The hurricane is positioned to the east of the Florida peninsula. A semi-transparent dark grey box is overlaid on the top portion of the image, containing the title text in yellow. The text is bold and has a slight drop shadow.

# **Hurricane Dorian: NHC Successes and Challenges**

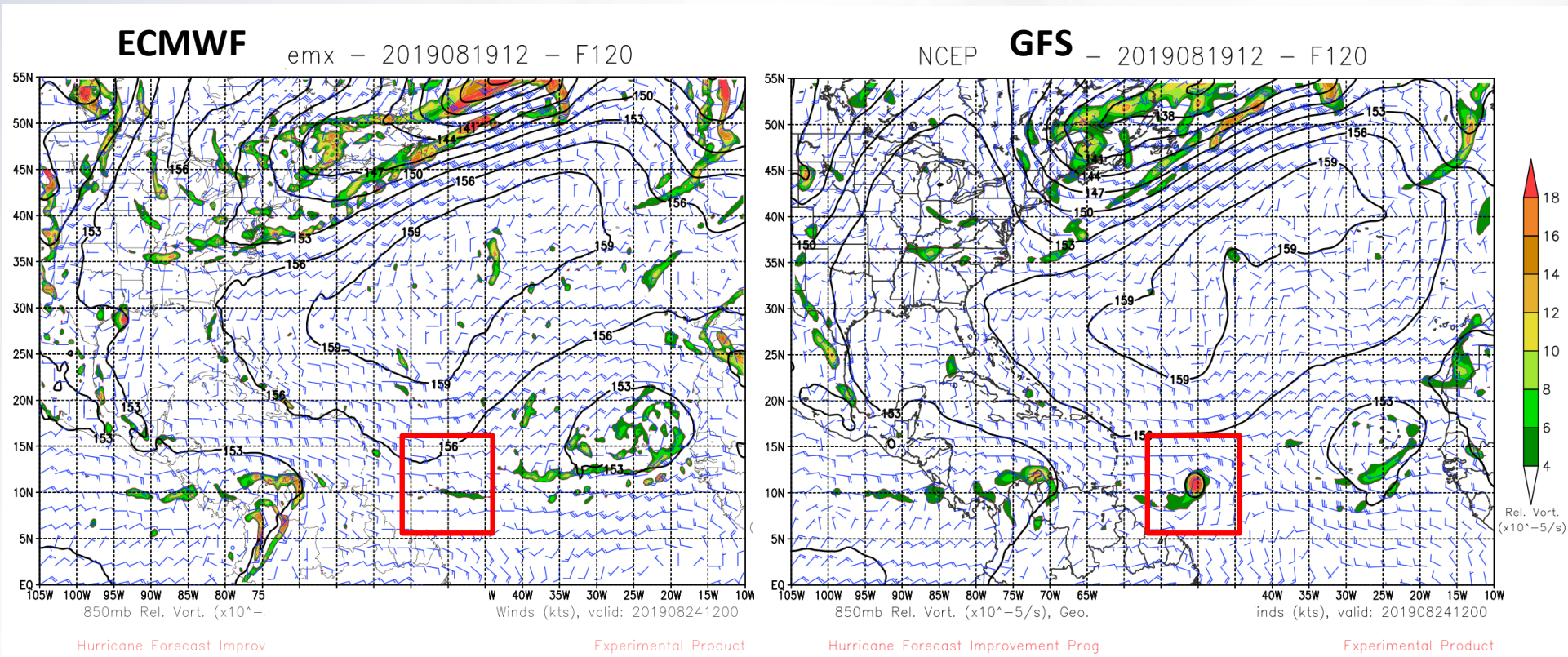
**John Cangialosi  
National Hurricane Center**





# 5 days before genesis

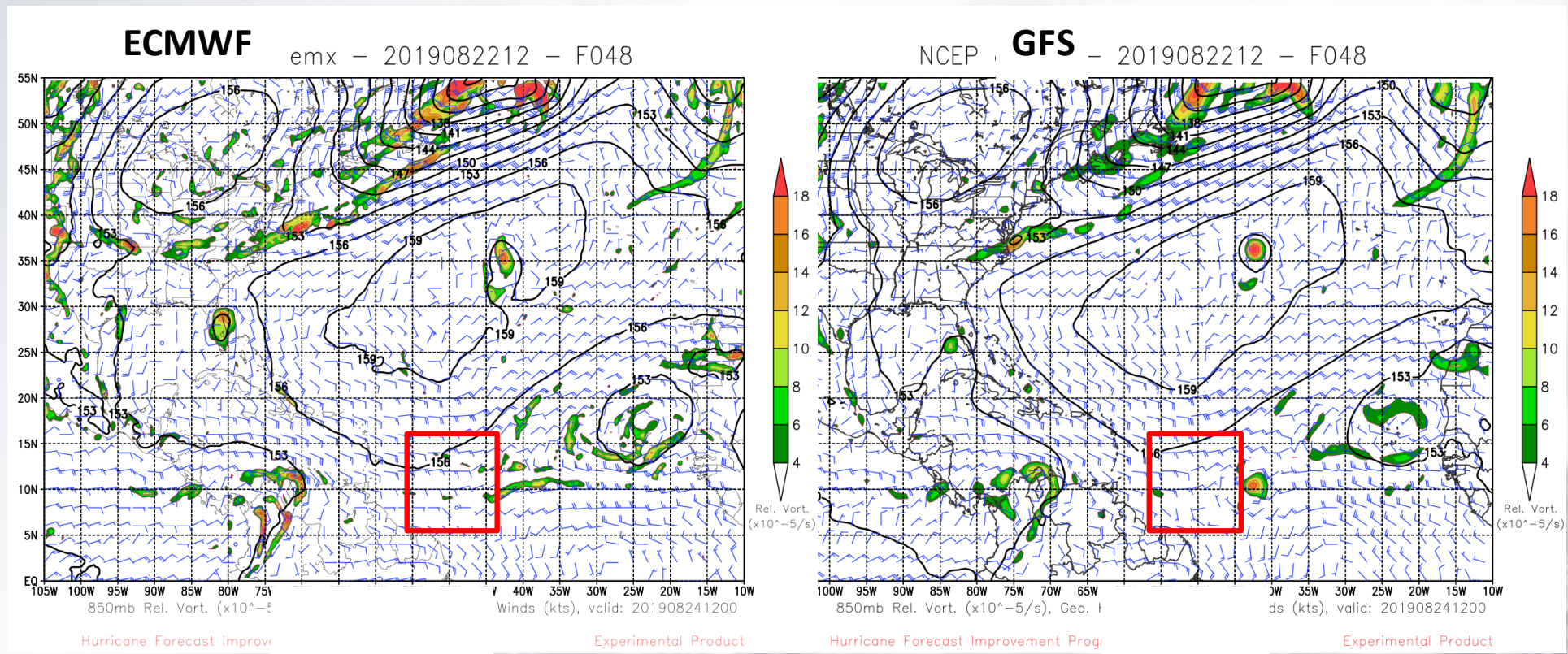
ECMWF had no clue while the GFS was spot on 5 days out





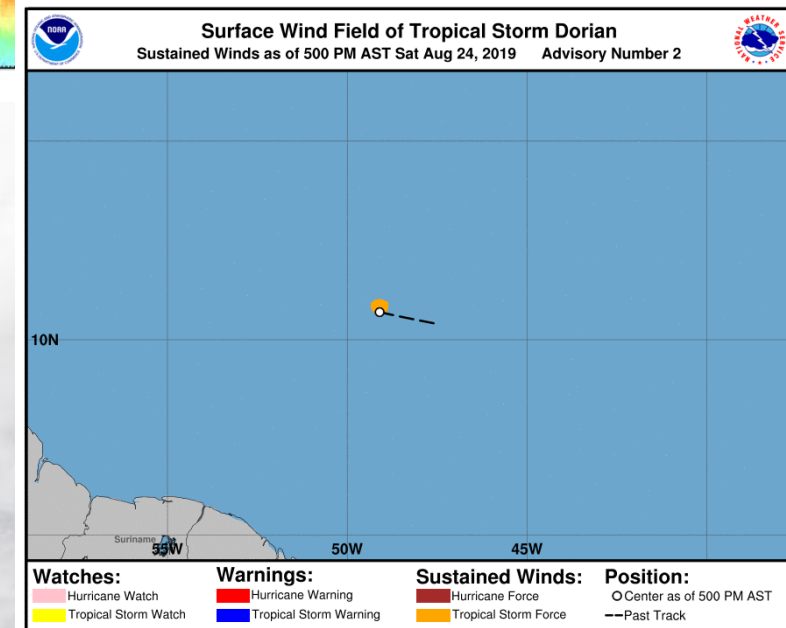
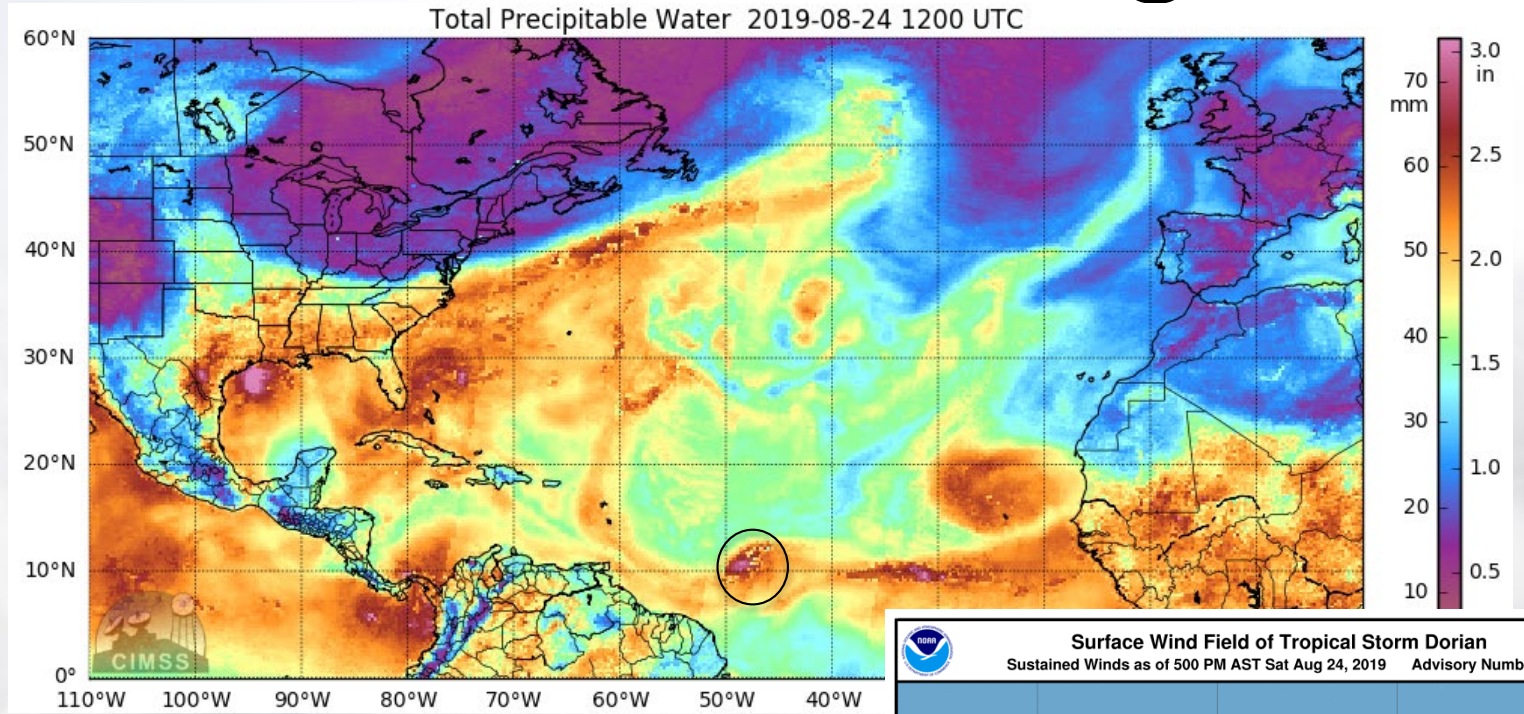
# 2 days before genesis

ECMWF still had no clue while the GFS weaker/too far east 2 days out



# NHC Genesis Prediction - Not great

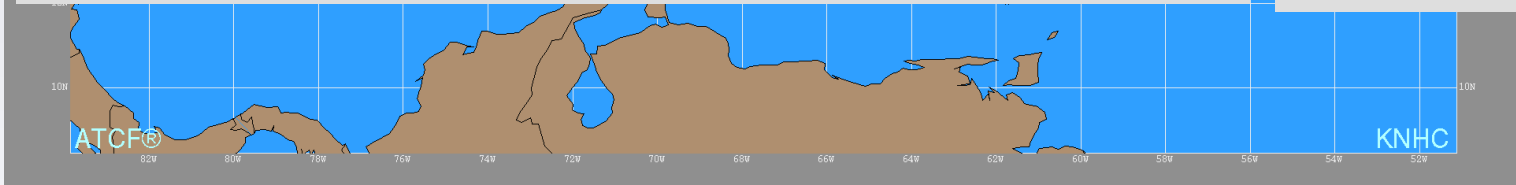
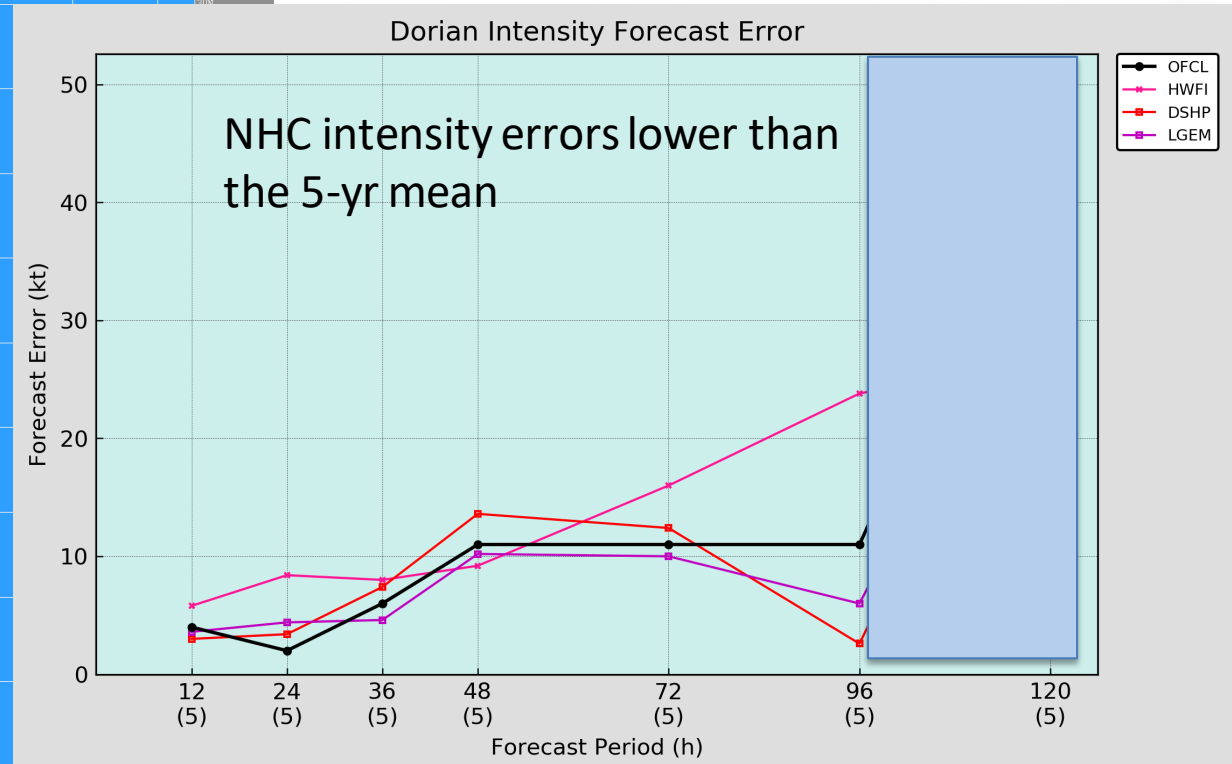
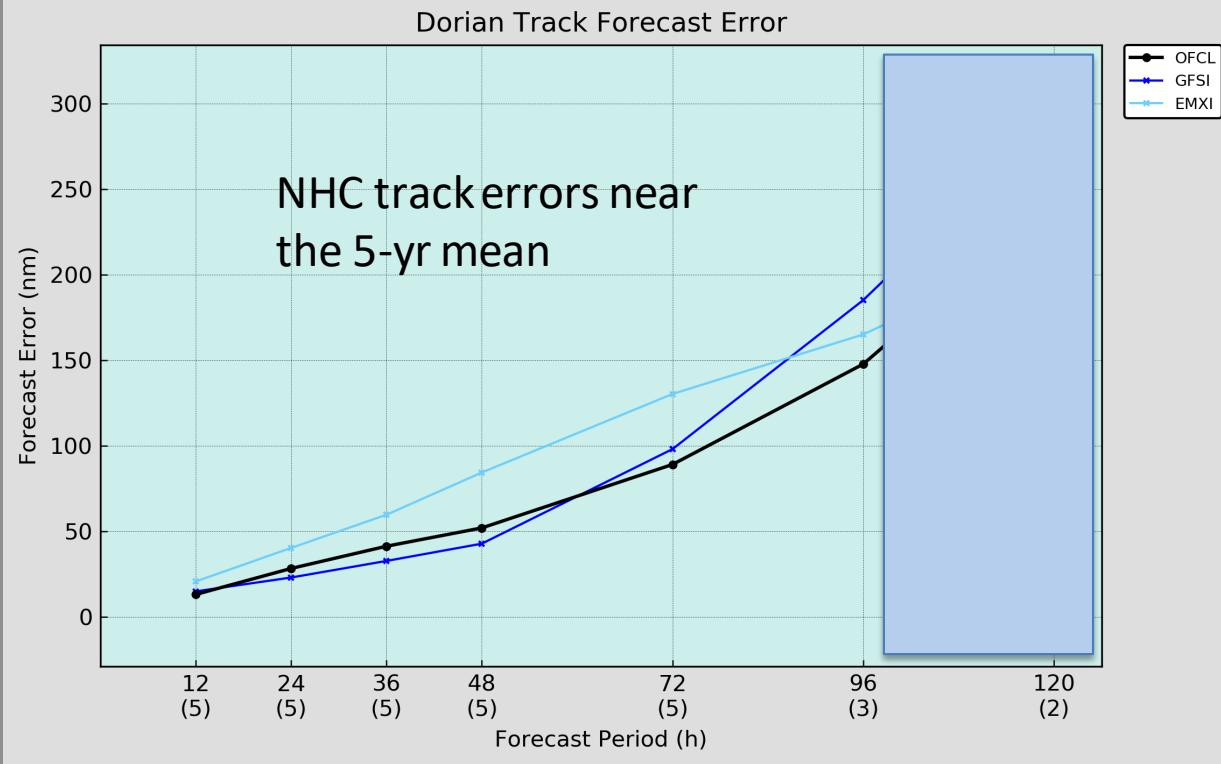
| Probability | 5-day genesis lead time |
|-------------|-------------------------|
| Low         | 24 hours                |
| Medium      | 18 hours                |
| High        | 12 hours                |



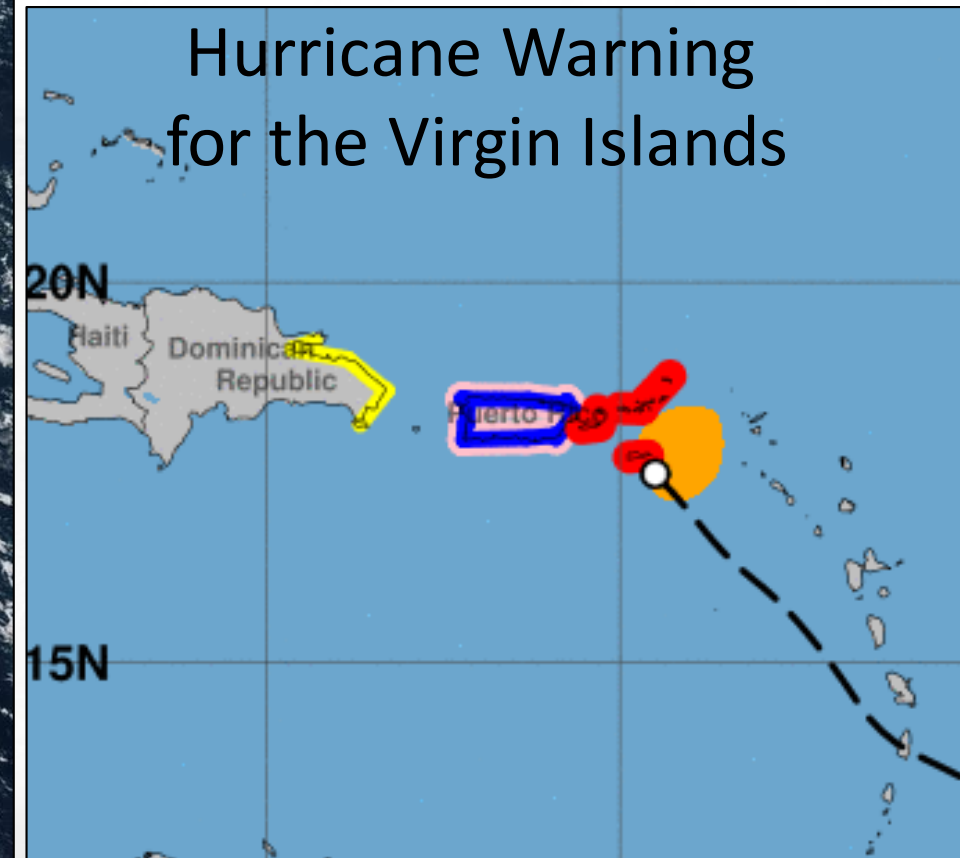
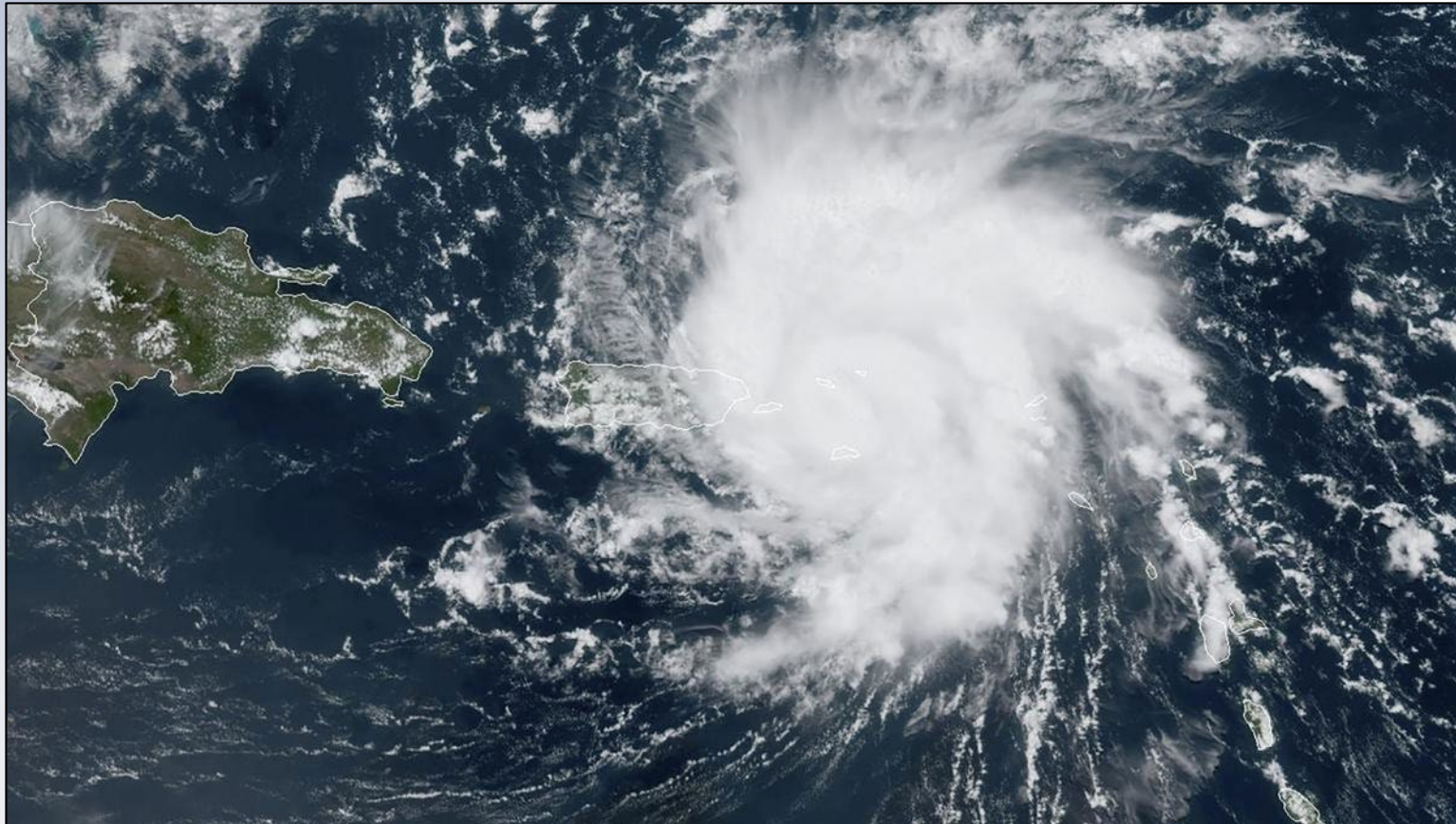
NHC's lead times before genesis were quite short. This was likely due to the mixed guidance, small size of Dorian at the time of genesis, and very dry surrounding environment.



# Track and Intensity Forecasts - Caribbean



# Dorian's Landfall on the Virgin Islands



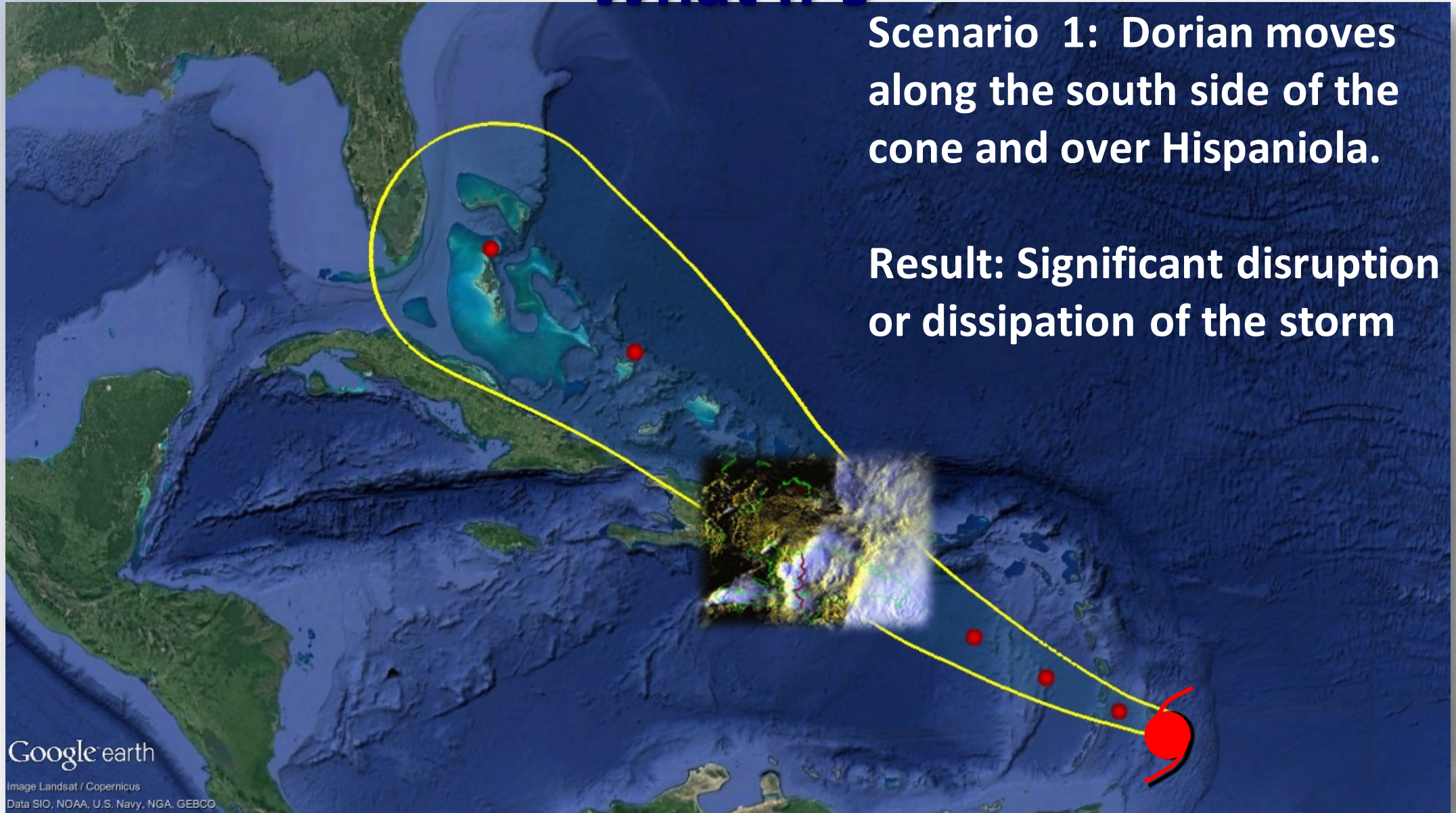
**Wind gust to 111 mph in St. Thomas, U.S. Virgin Islands**



# Forecasts for the Bahamas and Florida: What If's

**Scenario 1: Dorian moves along the south side of the cone and over Hispaniola.**

**Result: Significant disruption or dissipation of the storm**

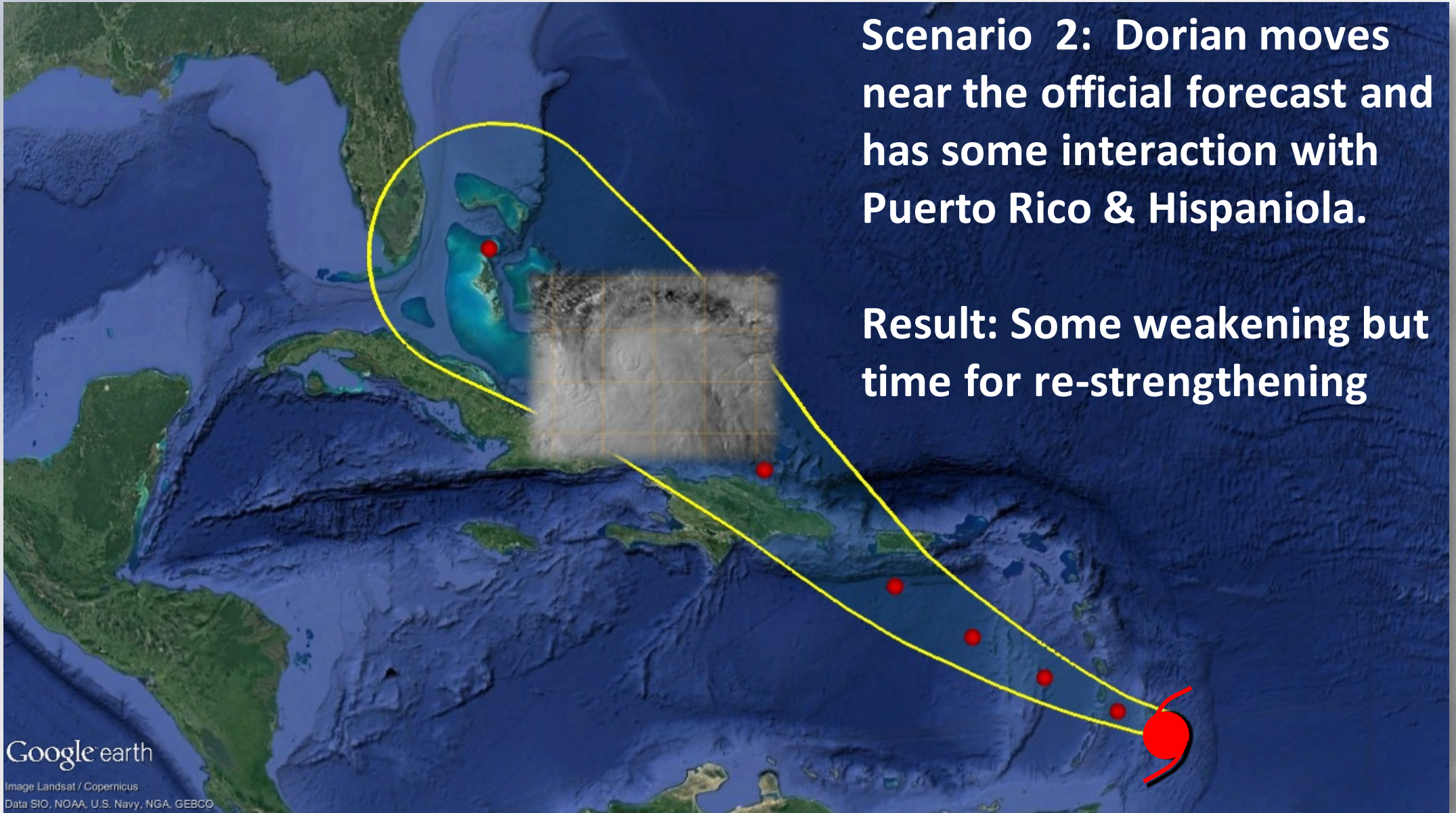




# Dorian What If's

**Scenario 2: Dorian moves near the official forecast and has some interaction with Puerto Rico & Hispaniola.**

**Result: Some weakening but time for re-strengthening**

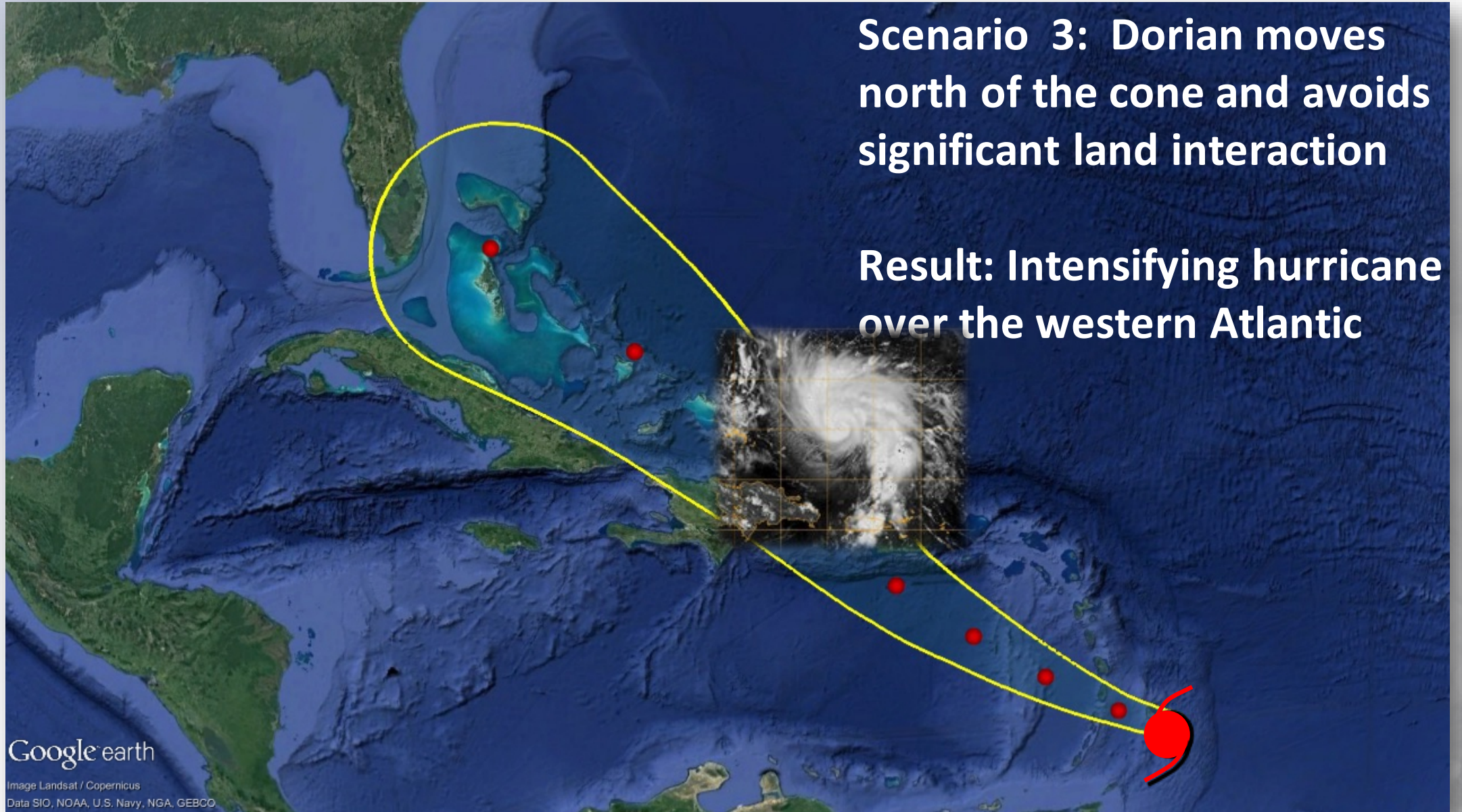




# Dorian What If's

**Scenario 3: Dorian moves north of the cone and avoids significant land interaction**

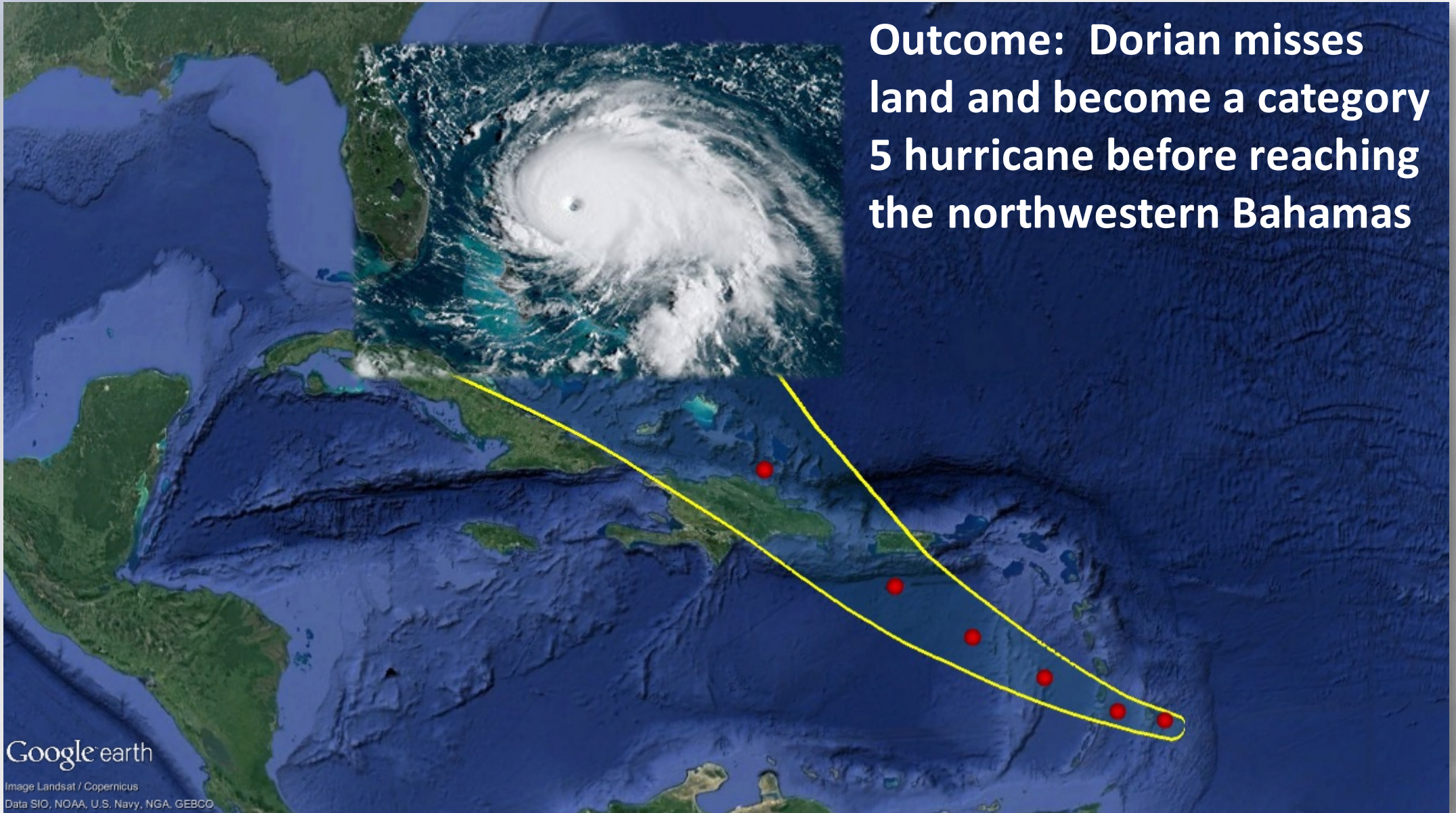
**Result: Intensifying hurricane over the western Atlantic**





# Dorian What If's

**Outcome: Dorian misses land and become a category 5 hurricane before reaching the northwestern Bahamas**



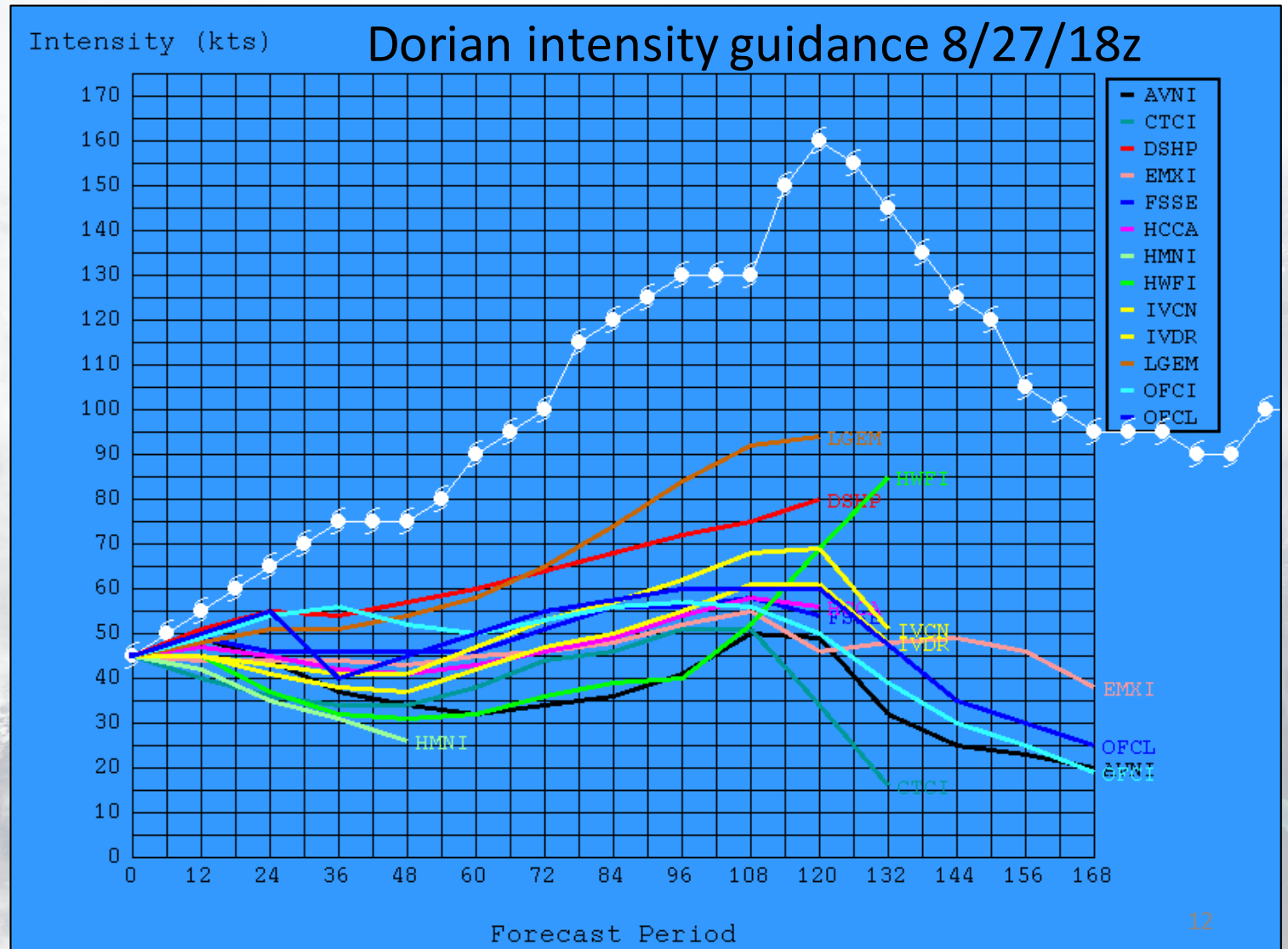
Google earth

Image Landsat / Copernicus  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO



# Dorian's Track and Intensity Challenges

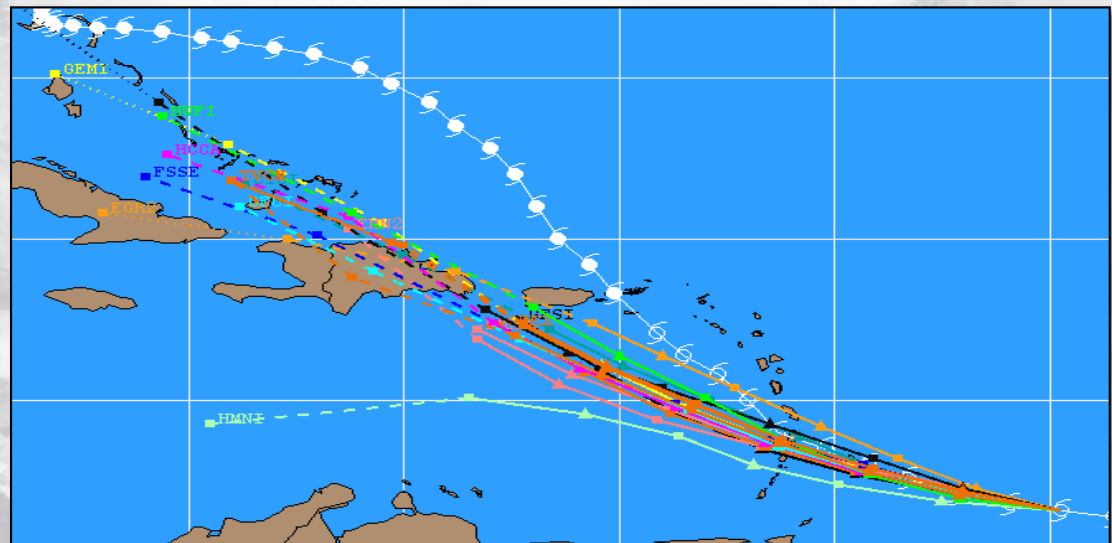
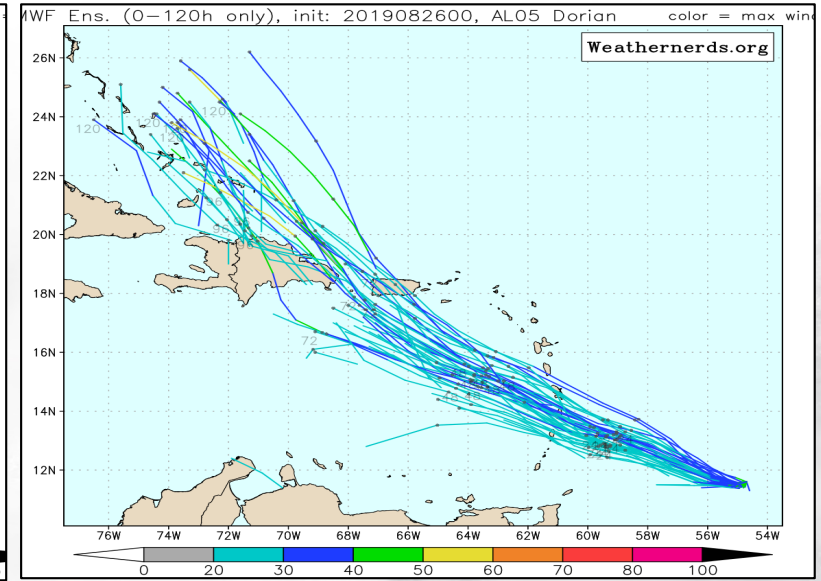
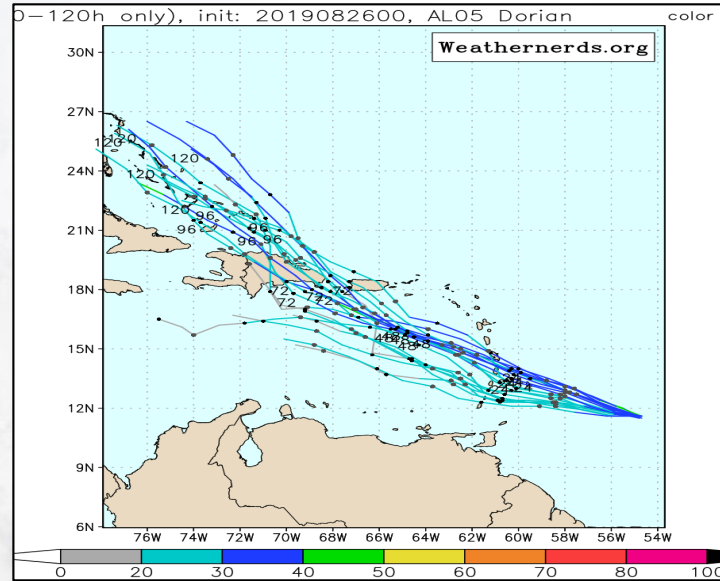
- Difficulty in Dorian's intensity forecast:
  - 100-kt error in 5 day intensity forecast
  - No model even a had major hurricane





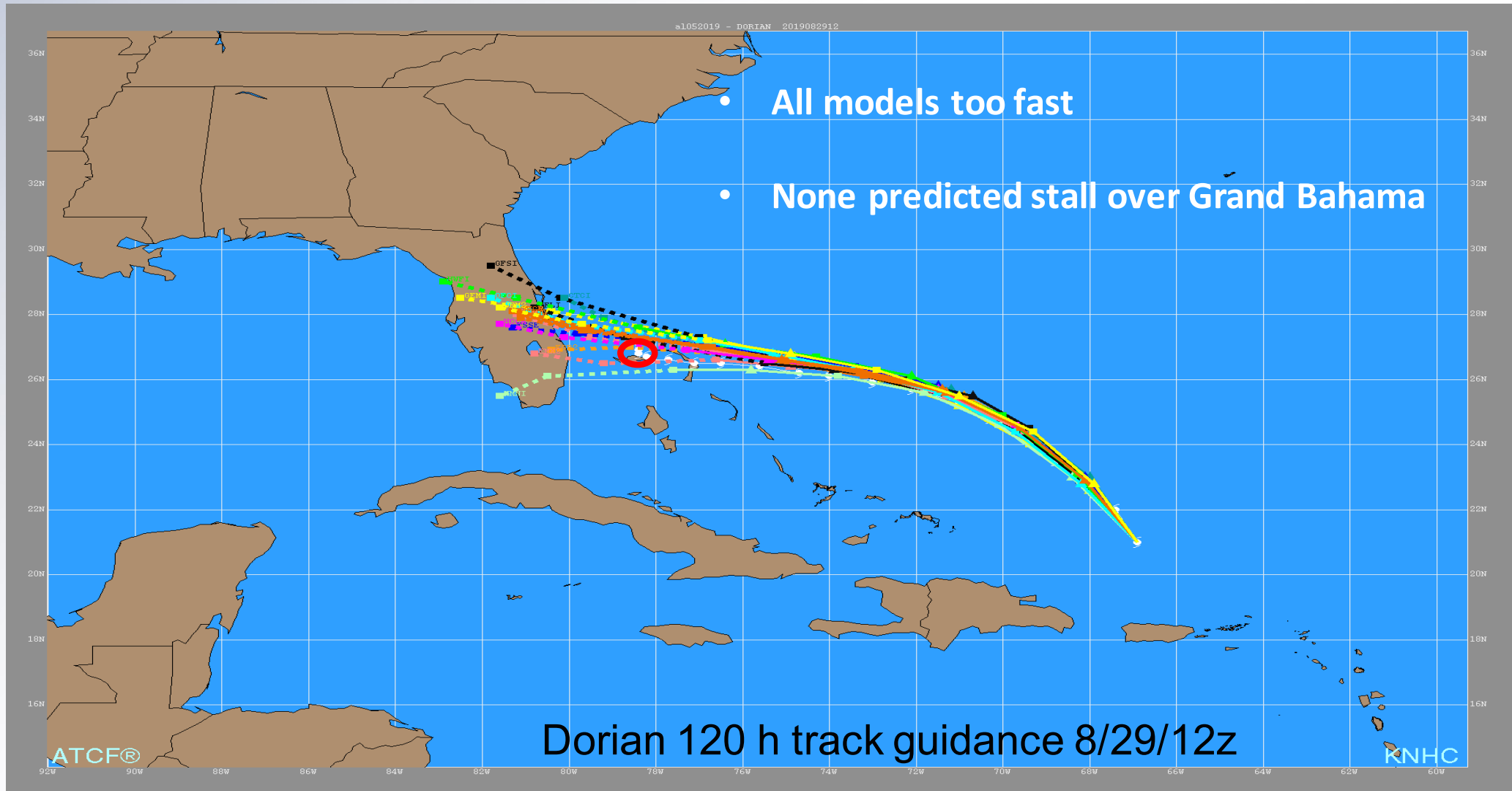
# Dorian's Track and Intensity Challenges

- Why such large intensity errors?
- Most of the track guidance initially predicted significant land interaction



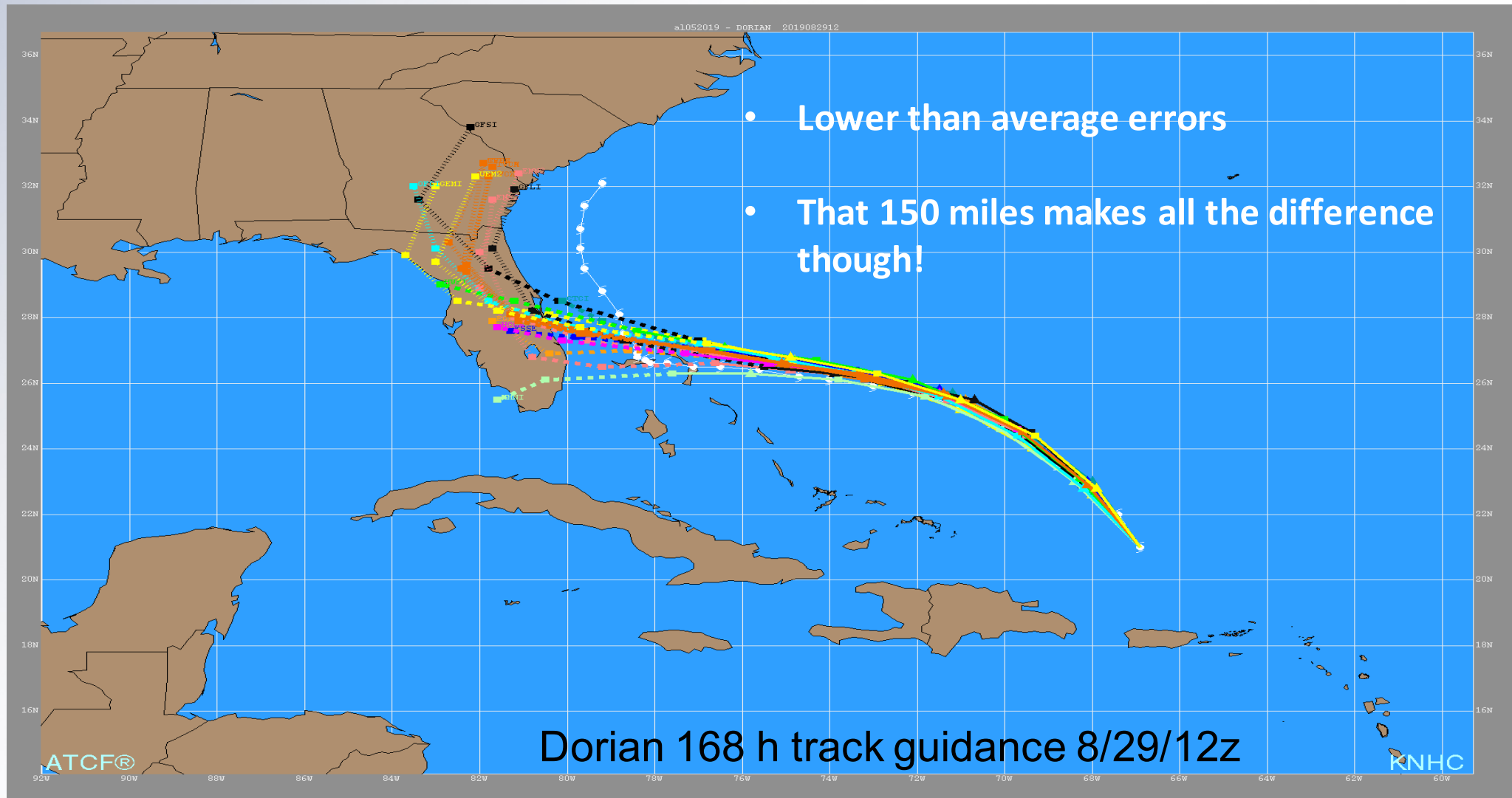


# Dorian's Track Failure





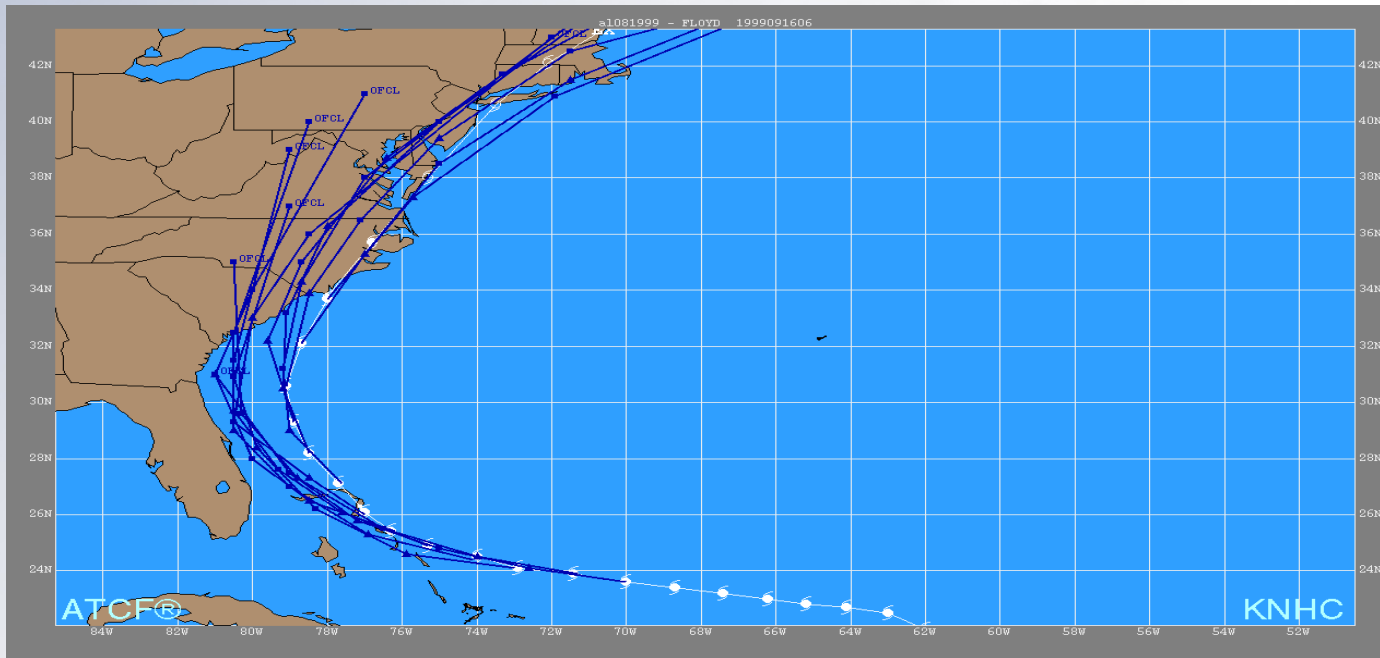
# The Models Did Pick up on a Turn Eventually





# North Carolina Landfall – Floyd (1999)

## How Far Have We Come Since Floyd?

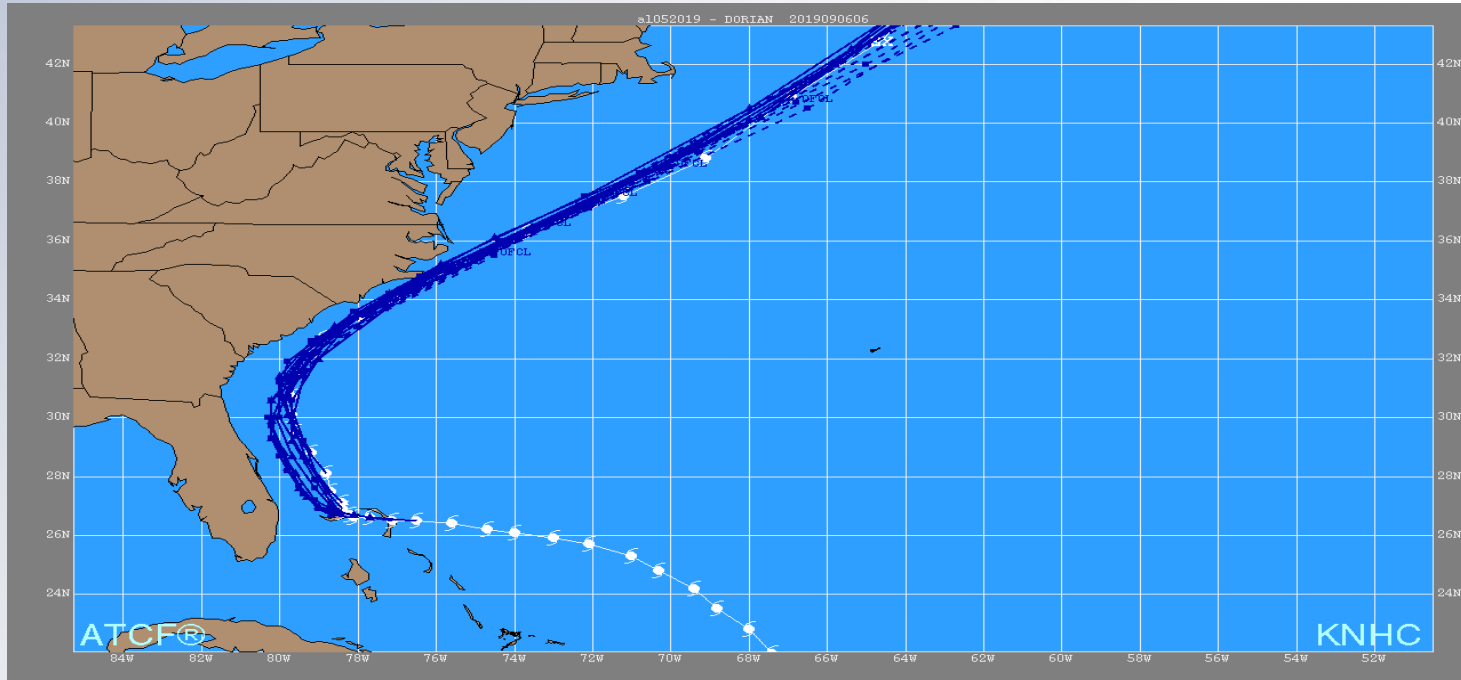


**NHC Track Forecasts for Floyd from  
06Z 13 Sep - 06Z 16 Sep 1999**

- **Average 3-day NHC track forecast error of 236 n mi for forecasts issued within 3 days of landfall in North Carolina**
- **Triggered the largest evacuation in U.S. history at the time – 2.6 million coastal residents from 5 states**

# North Carolina Landfall - Dorian

## How Far Have We Come Since Floyd?



NHC Track Forecasts for Dorian from  
06Z 1 Sep - 06Z 6 Sep 2019

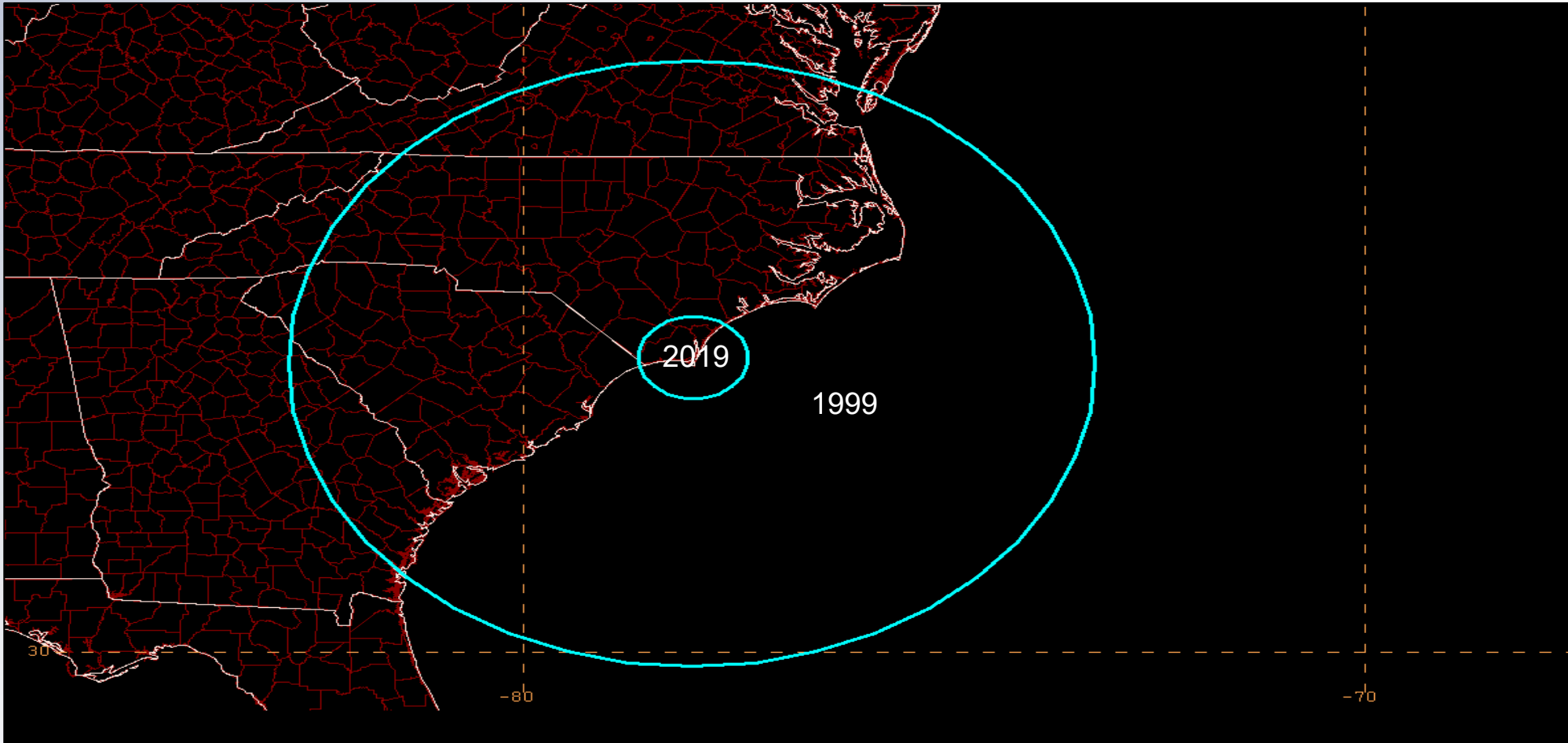
Average 3-day NHC track forecast error (preliminary) of 35 n mi for forecasts issued during the 5 days prior to landfall in NC

No watches/warning for Miami-Dade County, and no Hurricane Warning for Broward County

As many as 3 million did NOT have to evacuate



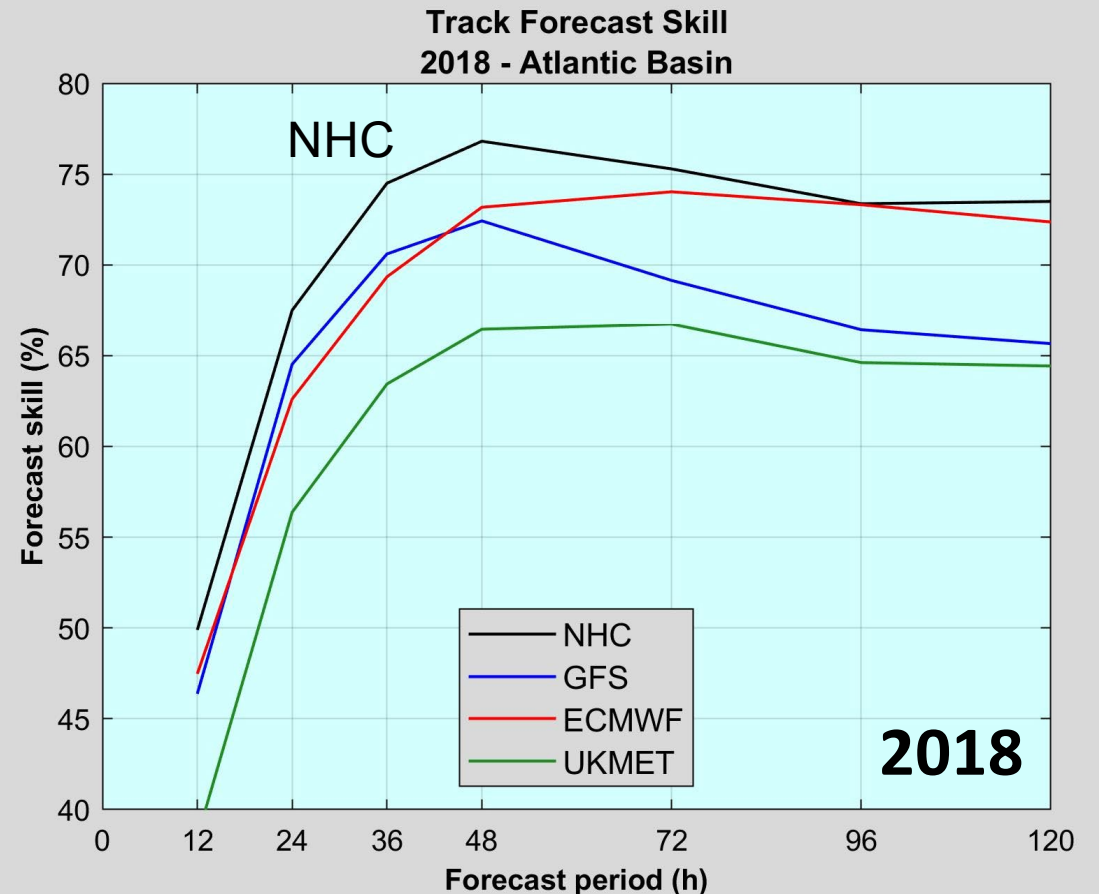
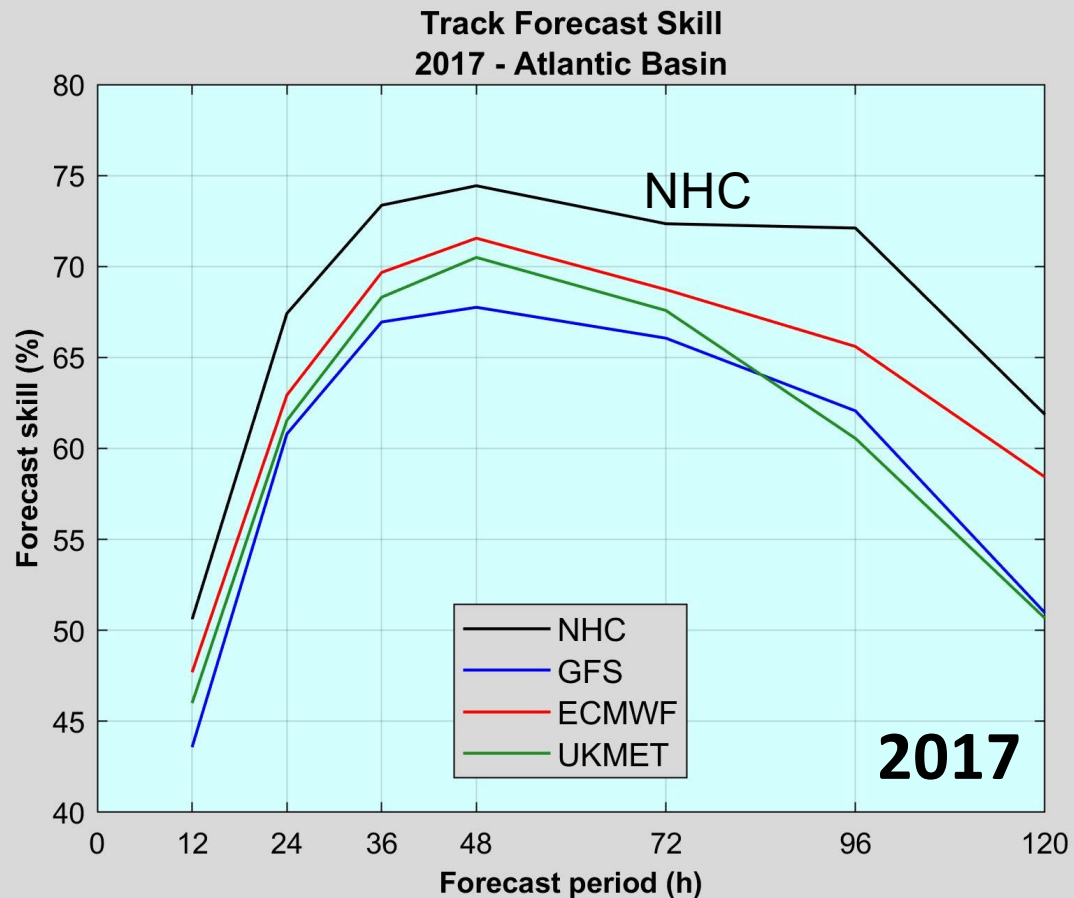
# How Far Have We Come in 20 years?



**Difference in  
average 3-  
day track  
forecasts for  
Floyd (1999)  
and Dorian  
(2019)**

# NHC vs. Global Models in 2017 & 2018

## NHC more skillful than the GFS, ECMWF, and UKMET

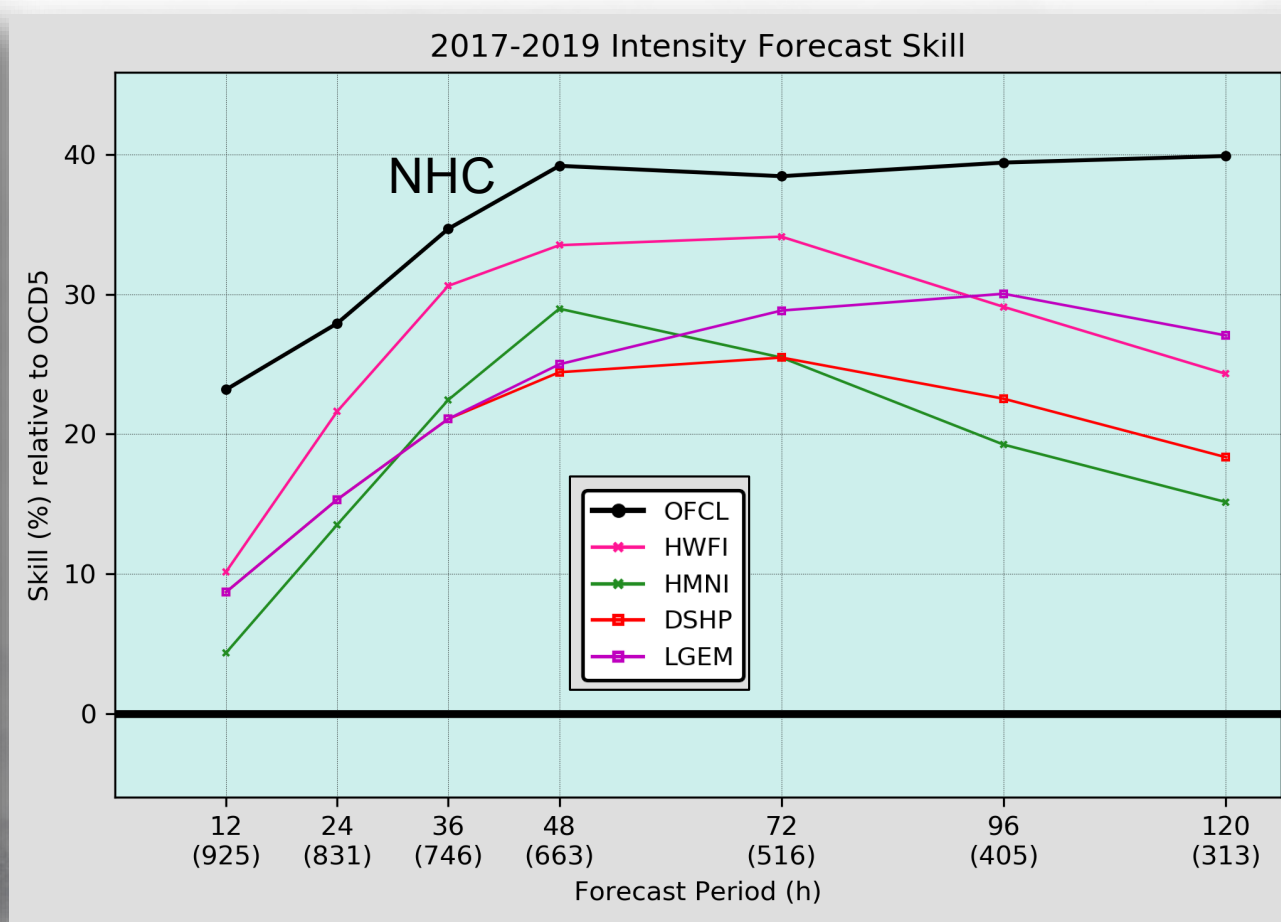
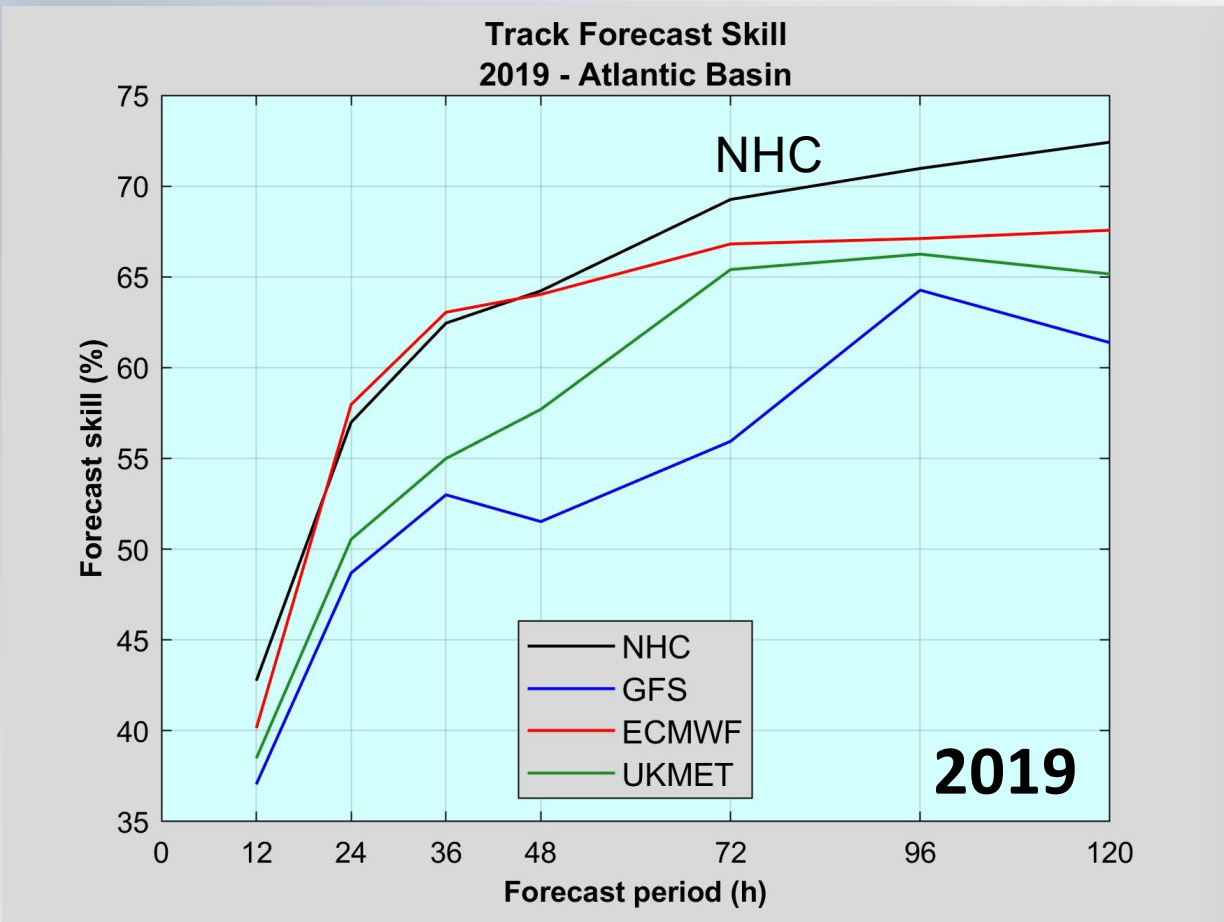


\*Skill vs Climatology and Persistence (OCD5)



# NHC vs. Global Models in 2019

## NHC neck and neck with ECMWF through 48 h, but NHC more skillful at days 3, 4, and 5



\*Skill vs Climatology and Persistence (OCD5)

# NHC is not only more accurate, but also more consistent

