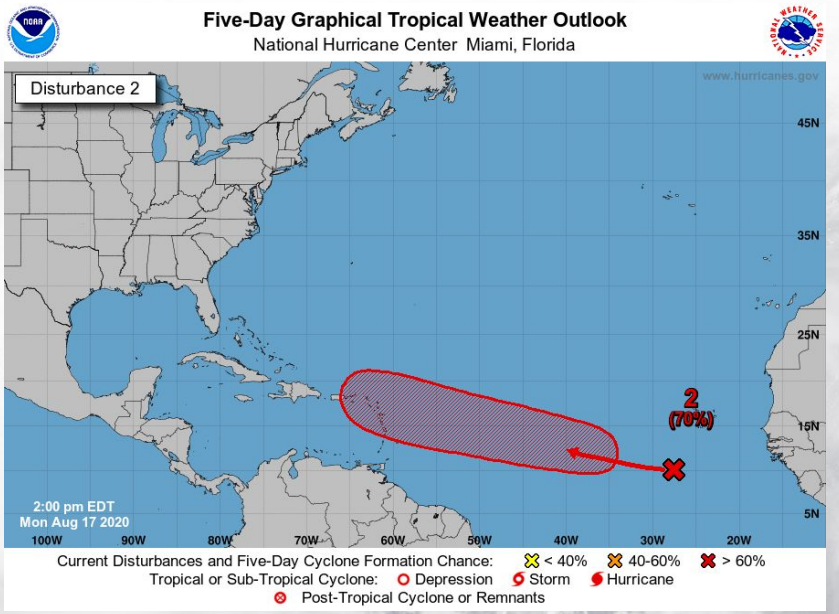
NHC Genesis Forecasts



Eric Blake
National Hurricane Center
May 17, 2022

History of Lead Time of NHC Forecasts

Miami Beach 1926

Miami Beach Today

Significant increase in coastal population has necessitated need for longer lead times

1954: One-day forecasts were issued

1961: Forecasts extended to 2 days

1964: Forecasts extended to 3 days

2003: 4-day and 5-day forecasts began

2010: Tropical cyclone warning and watch lead times increased to 36 and 48 hours, respectively

2013: NHC Tropical Weather Outlook extended to 5 days, accompanying graphic introduced in 2014

2017: Potential Tropical Cyclone advisories introduced giving NHC/NWS the ability to issue watches and warning before tropical cyclone formation

Increased Messaging, Earlier Public Readiness, Compressed Preparedness Timelines

- Strongly worded Tropical Weather Outlooks emphasizing hazards
  - Storm Surge
  - Tropical storm or hurricane-force winds
  - Potential for heavy rainfall
- Mention that watches or warnings could be required
- Public messaging encouraging readiness and preparedness actions
- Overall focus on potential impacts – not specific track or intensity

Key Messages for disturbance in the southern Caribbean Sea

02:00 PM EDT Wed Aug 25, 2021

1. A tropical depression is likely to form late this week or this weekend over the northwestern Caribbean Sea, and move near or across the Yucatan Peninsula of Mexico and into the Gulf of Mexico this weekend where conditions are expected to be favorable for additional development.

2. Heavy rainfall and flooding will be possible through the weekend in portions of Nicaragua, Honduras, Guatemala, Belize, and the Yucatan Peninsula.

3. This system could bring dangerous impacts from storm surge, wind, and heavy rainfall to portions of the coasts of Louisiana, Texas, and the Mexican state of Tamaulipas late this weekend and early next week. However, uncertainty remains large since the system has yet to form. Interests in these areas should closely monitor the progress of this system and ensure they have their hurricane plan in place.

For more information go to hurricanes.gov and weather.gov

*Pre-Ida Key Messages that highlighted potential for **dangerous storm surge, wind, and heavy rainfall** impacts for Louisiana, Texas, and northern Mexico late in the weekend*

NOAA Genesis Forecasts

- **NHC forecasts genesis out to 5 days publicly, 4 times per day from 15 May- 30 November.**
- **WPC collaborates with NHC once per day for their 7-day maps, issued every afternoon during hurricane season.**
- **CPC collaborates with NHC twice per week for their week 1 and week 2 tropical cyclone formation maps. These maps are issued on Tuesday and Friday afternoons around 3 pm EDT.**
- **NHC testing 7-day outlooks in house, results promising.**

FEMA

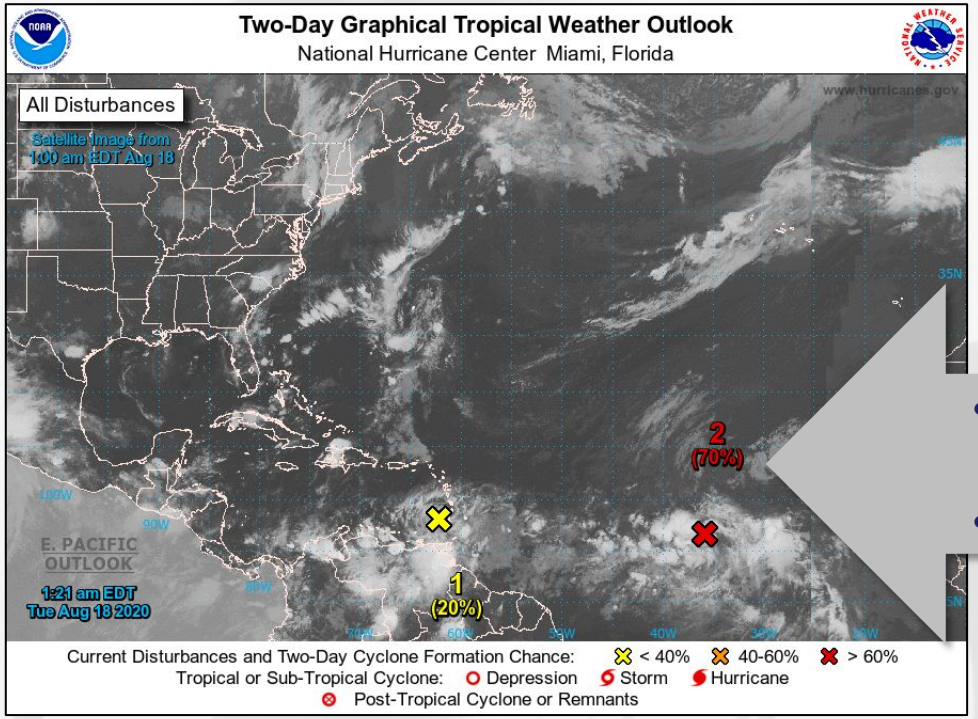
OUTLOOK SCHEDULE

- Issued May 15 through November 30
- A *Special Tropical Outlook* can be issued at anytime for significant or unexpected changes

- 2 am – **Tropical Outlook**
- 8 am – **Tropical Outlook**
- 2 pm – **Tropical Outlook**
- 8 pm – **Tropical Outlook**

TIMES IN EDT

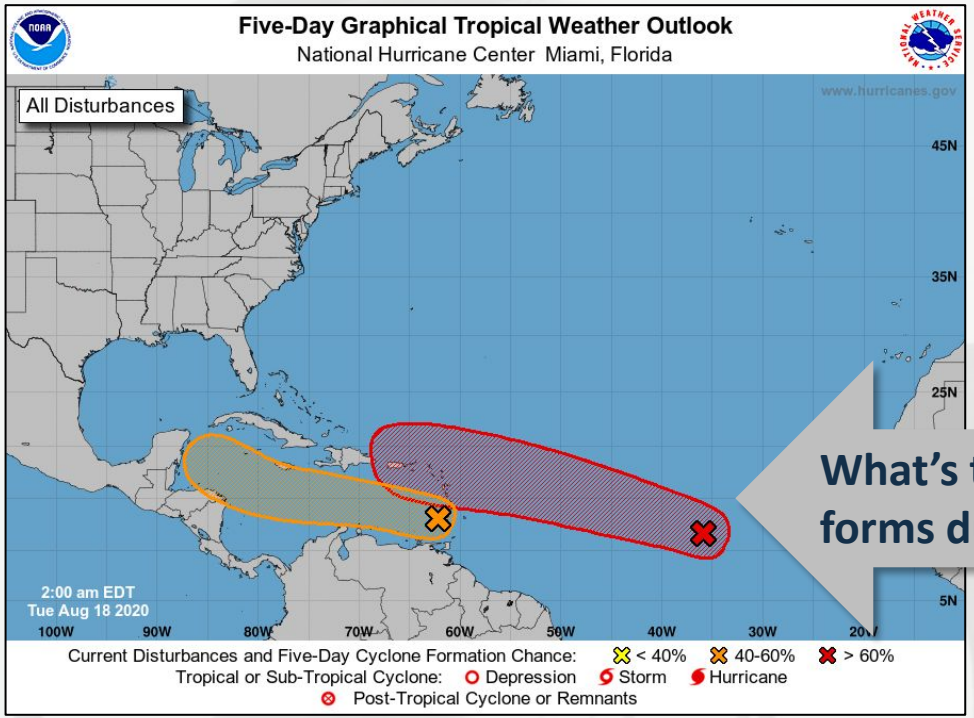
TROPICAL OUTLOOK
2-Day Formation Potential



- Current location of disturbances
- Formation chance during the next 48 hrs

- **CATEGORICAL** (Low, Medium, and High)
- **PROBABILITIES**

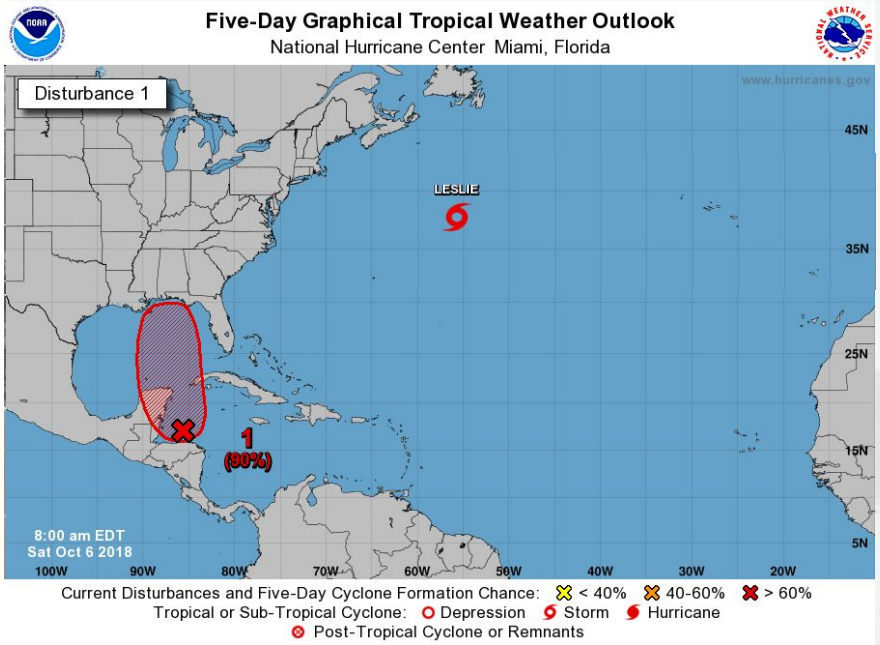
TROPICAL OUTLOOK
5-Day Formation Potential



- **Initial location of disturbance (x) indicated**
- **Formation potential during the next 5 days**
  - Shading represents formation area

What's the chance this area forms during the next 5 days?

TROPICAL OUTLOOK
5-Day Formation Potential



HURRICANE LIFECYCLE
Ingredients for Formation

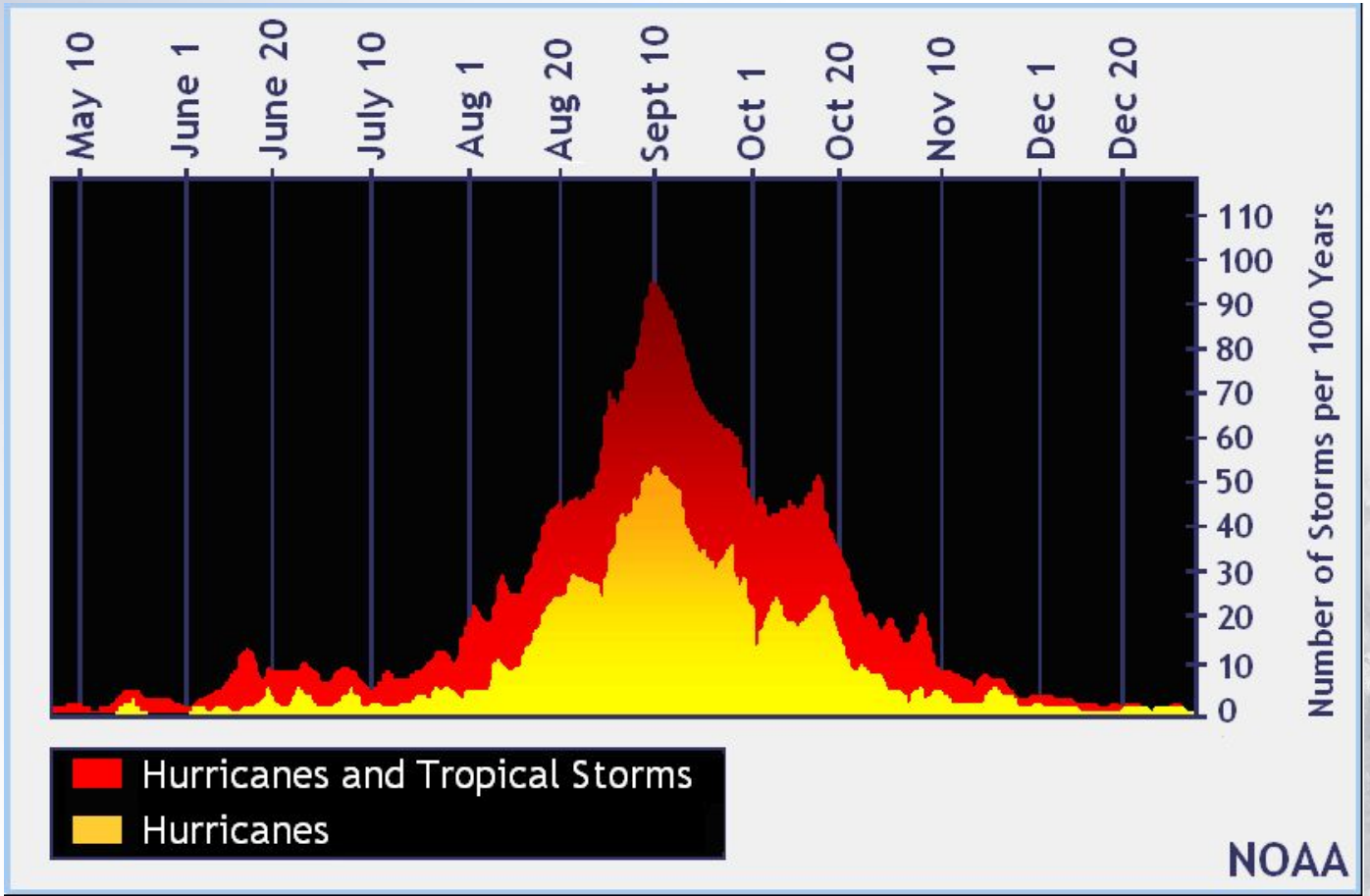
FEMA

BUILDING BLOCKS	FUEL
1) A pre-existing disturbance (vorticity or spin) 	4) Warm sea-surface temperatures (usually at least 80°F) 
2) Location several degrees north of the equator 	5) Unstable atmosphere (temperature goes down as you go up) 
3) Little change in wind speed and/or direction with height (vertical wind shear) 	6) High atmospheric moisture content (relative humidity) 

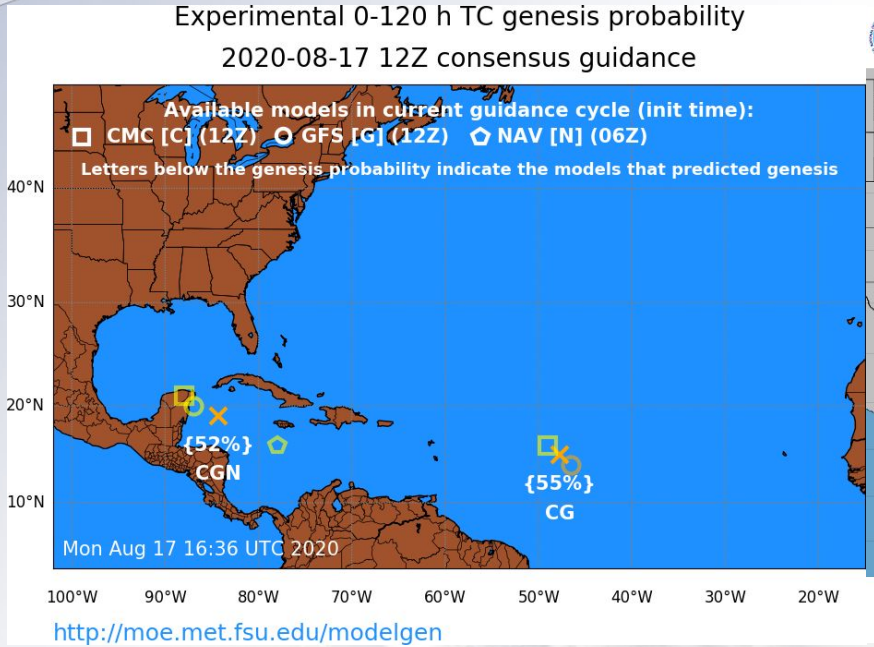
Genesis Forecasting at NHC

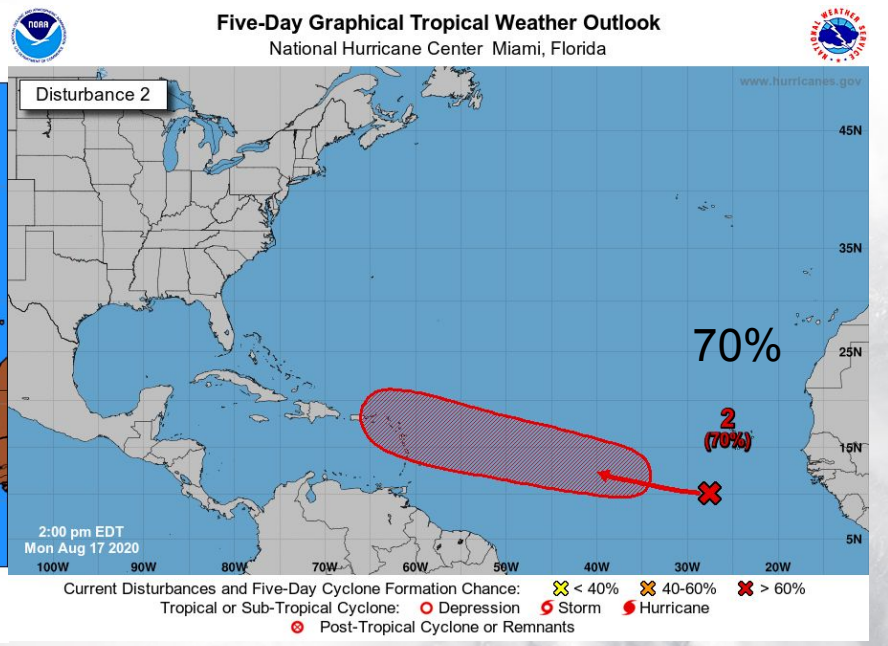
- **Global models, especially the ECMWF, GFS, and UKMET (along with their ensembles) are our primary tools for predicting TC genesis.**
- **We look for consistency among the different models, as well as run-to-run consistency, to assess the likelihood of genesis.**
- **Generally the GFS spins up more cyclones than the ECMWF (higher probability of detection) but also has a higher false alarm rate.**
- **The UKMET model has has more erratic performance in recent years.**
- **The Canadian global model typically shows the highest number of false alarms, but not nearly as many as several years ago.**
- **Just like track and intensity forecasting, the consensus is a powerful tool (but subject to large errors like intensity).**

Climatology matters!



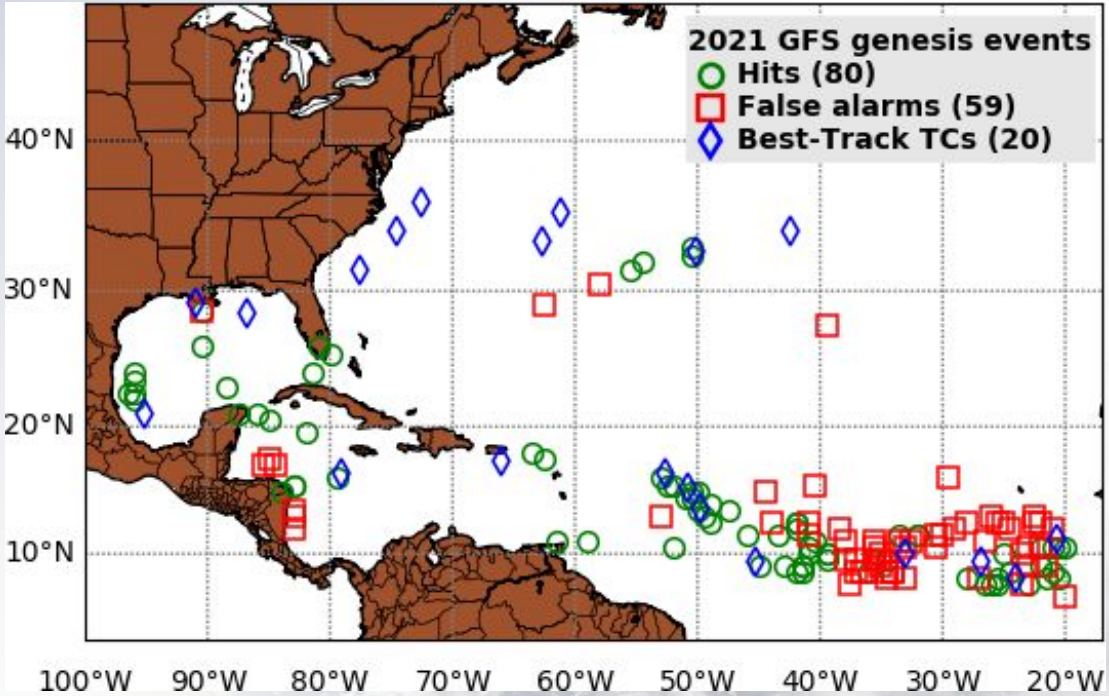
FSU Guidance





- **Best objective genesis guidance**
- **Uses past statistics on dynamical model forecasts**
- **Multi-model consensus gives the most reliable forecasts**
- **Public site: http://moe.met.fsu.edu/modelgen**

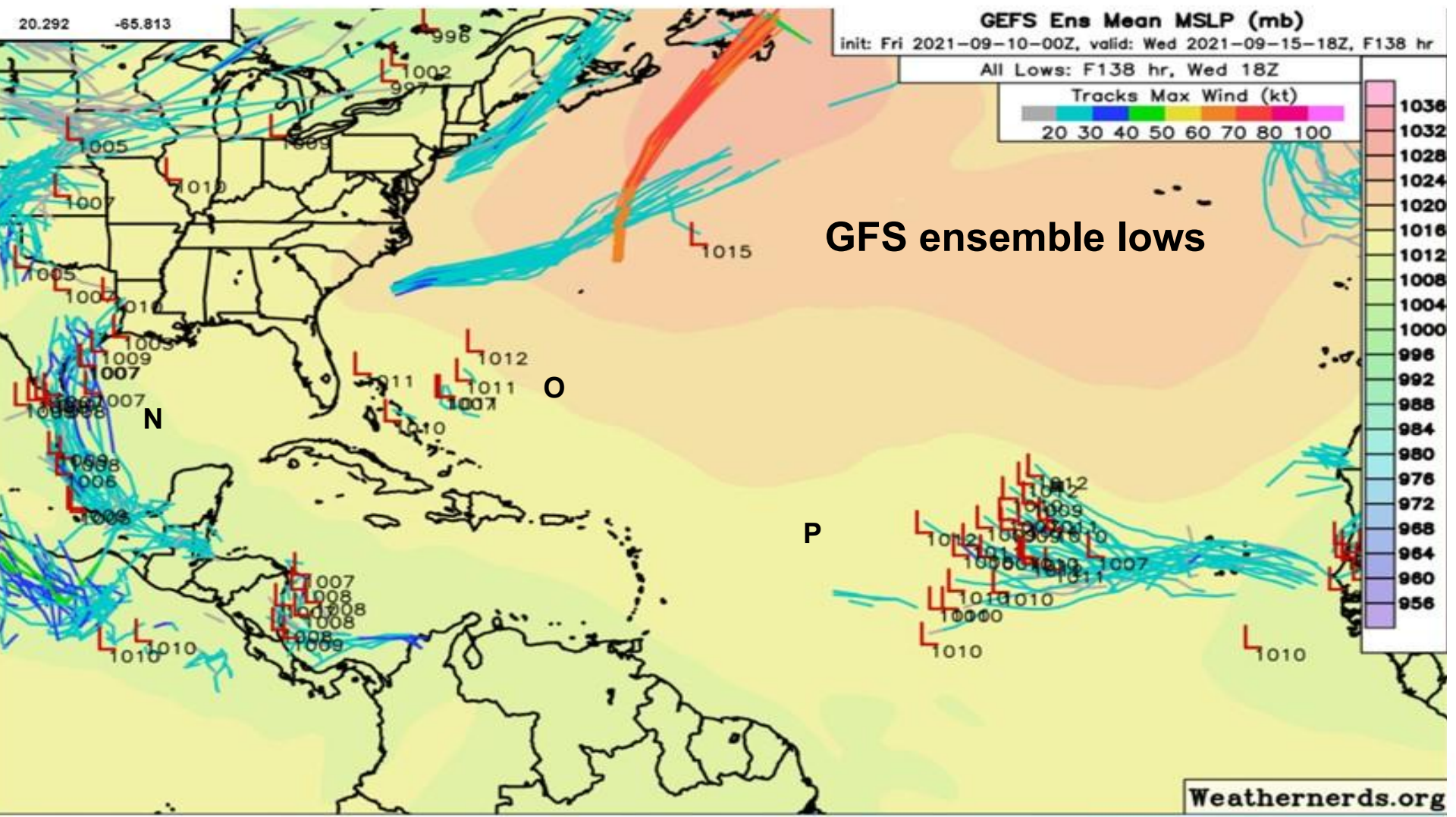
GFS Genesis Verification



Figures and data provided by Dan Halperin and Bob Hart

GFS Genesis Forecasts Summary

- **Correctly forecast genesis on several occasions over the eastern Atlantic, however the false alarm rate there was rather high**
- **Performed very well in tropical Central Atlantic, Caribbean, and Gulf of Mexico.**
- **Did not perform as well in the subtropical Atlantic, with several systems not anticipated.**
- **Generally, the larger the system, the better performance. Small systems, especially at higher latitudes, are difficult for any global model, and sometimes the HRRR/NAM can be useful (be wary of false alarms though!)**


20.292 -65.813
GEFS Ens Mean MSLP (mb)
init: Fri 2021-09-10-00Z, valid: Wed 2021-09-15-18Z, F138 hr
All Lows: F138 hr, Wed 18Z
Tracks Max Wind (kt)
20 30 40 50 60 70 80 100
1036
1032
1028
1024
1020
1016
1012
1008
1004
1000
996
992
988
984
980
976
972
968
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956
GFS ensemble lows
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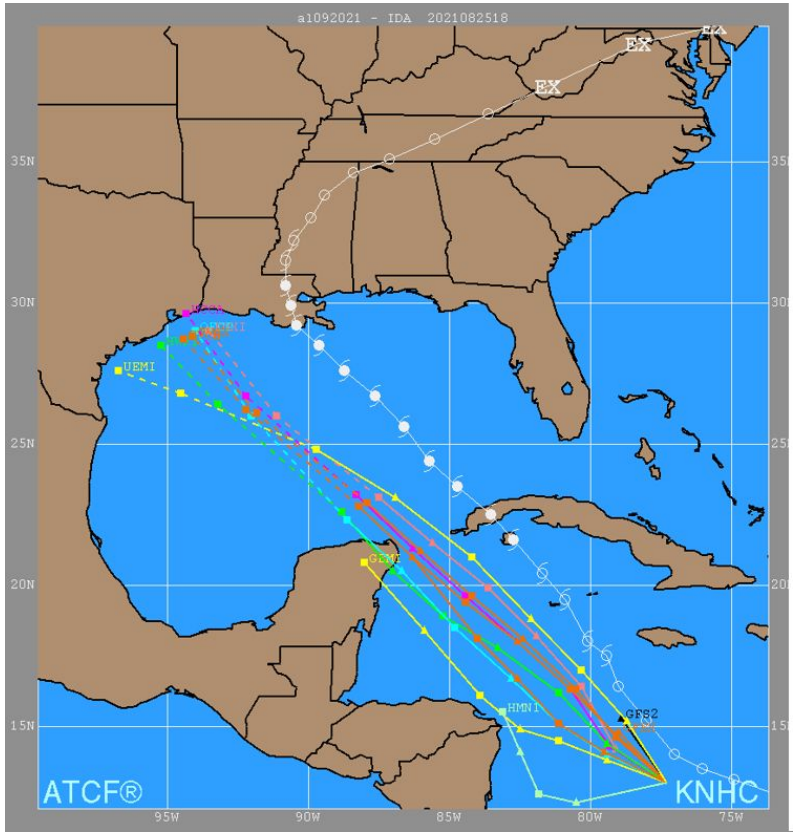
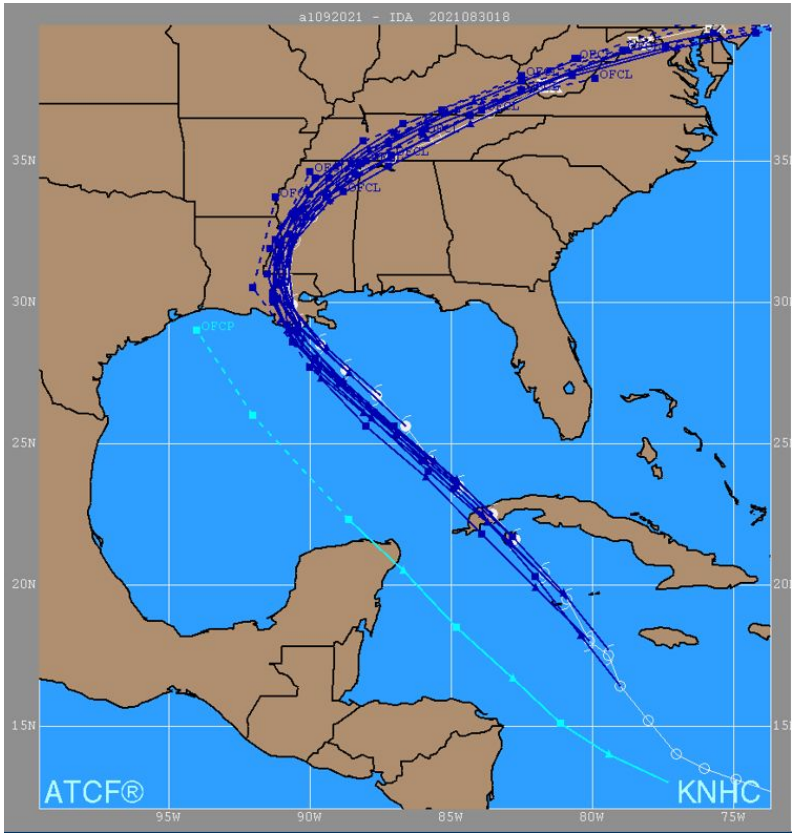
Weathernerds.org

Forecast Challenges - Pre-Genesis Ida Track Guidance

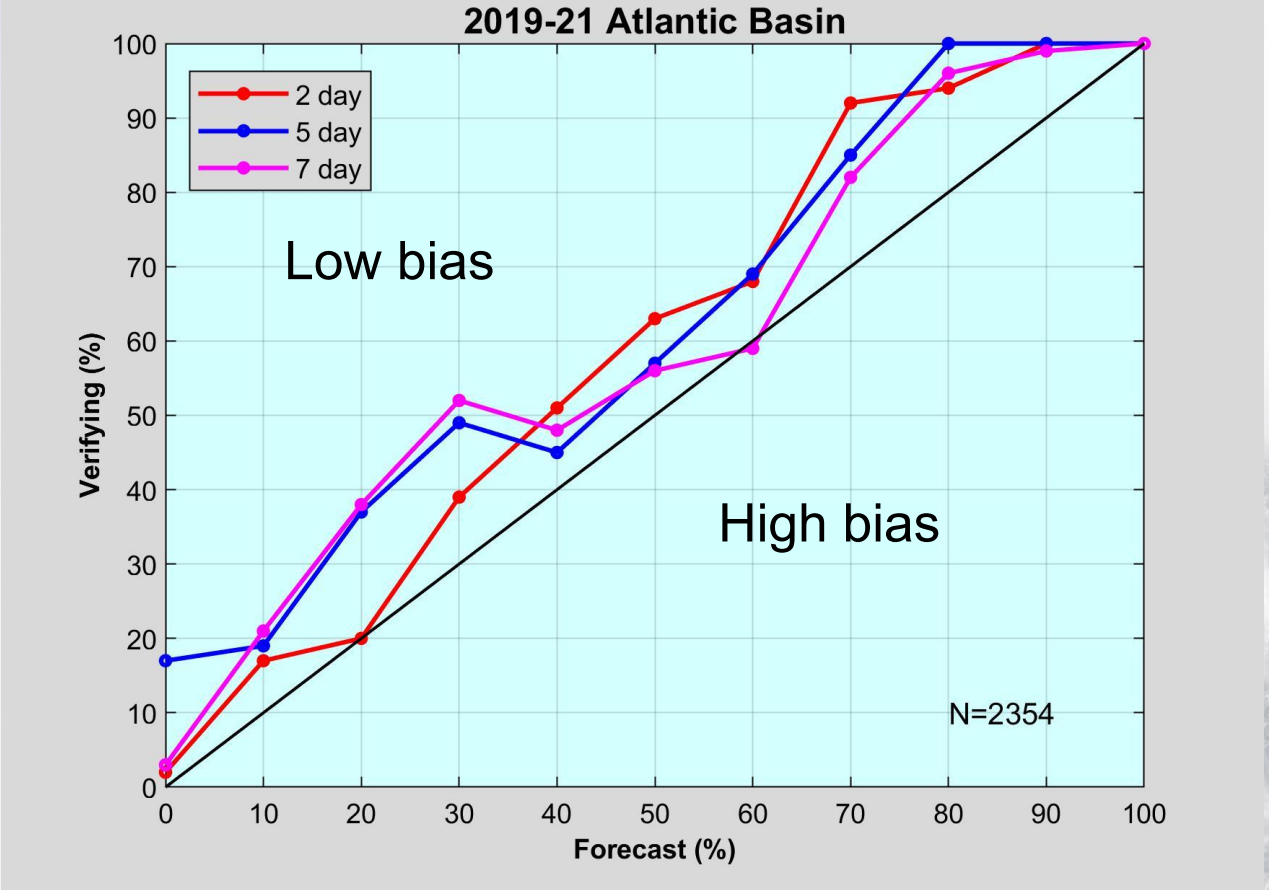


Pre-Genesis Ida Track Guidance 18Z 8/25



Pre-Genesis Ida Provisional Forecast and subsequent NHC Official Forecasts

Atlantic Genesis Forecast Verification



Questions?

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