



National Hurricane Center Forecast Verification

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National Hurricane Center



Accuracy of NHC Forecasts

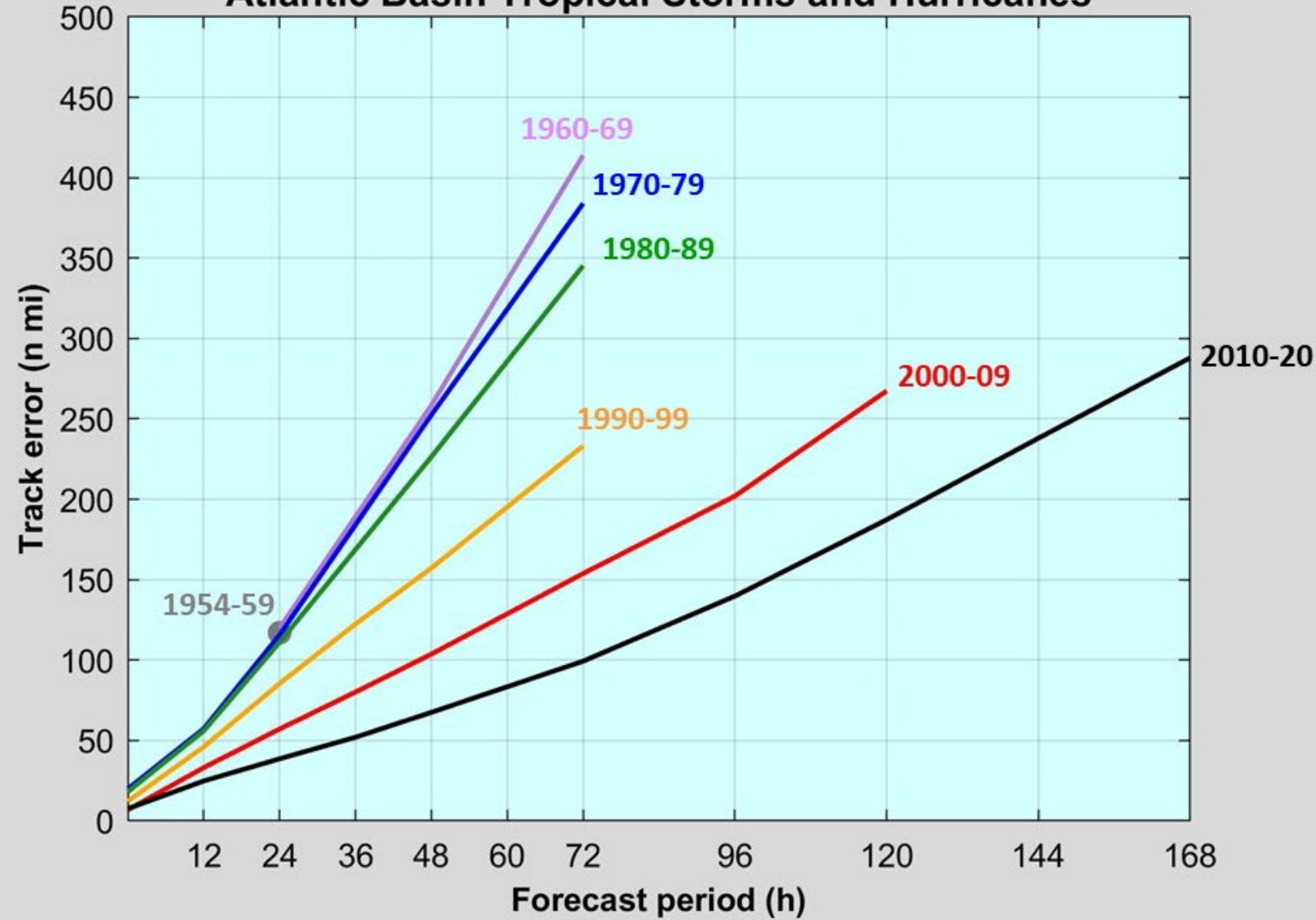
- * Track (how far off - east/west, north/south)
- * Intensity (was the prediction too strong or too weak)
- * Compare NHC forecasts against the models and look at long-term trends.



Atlantic Track Error Trends

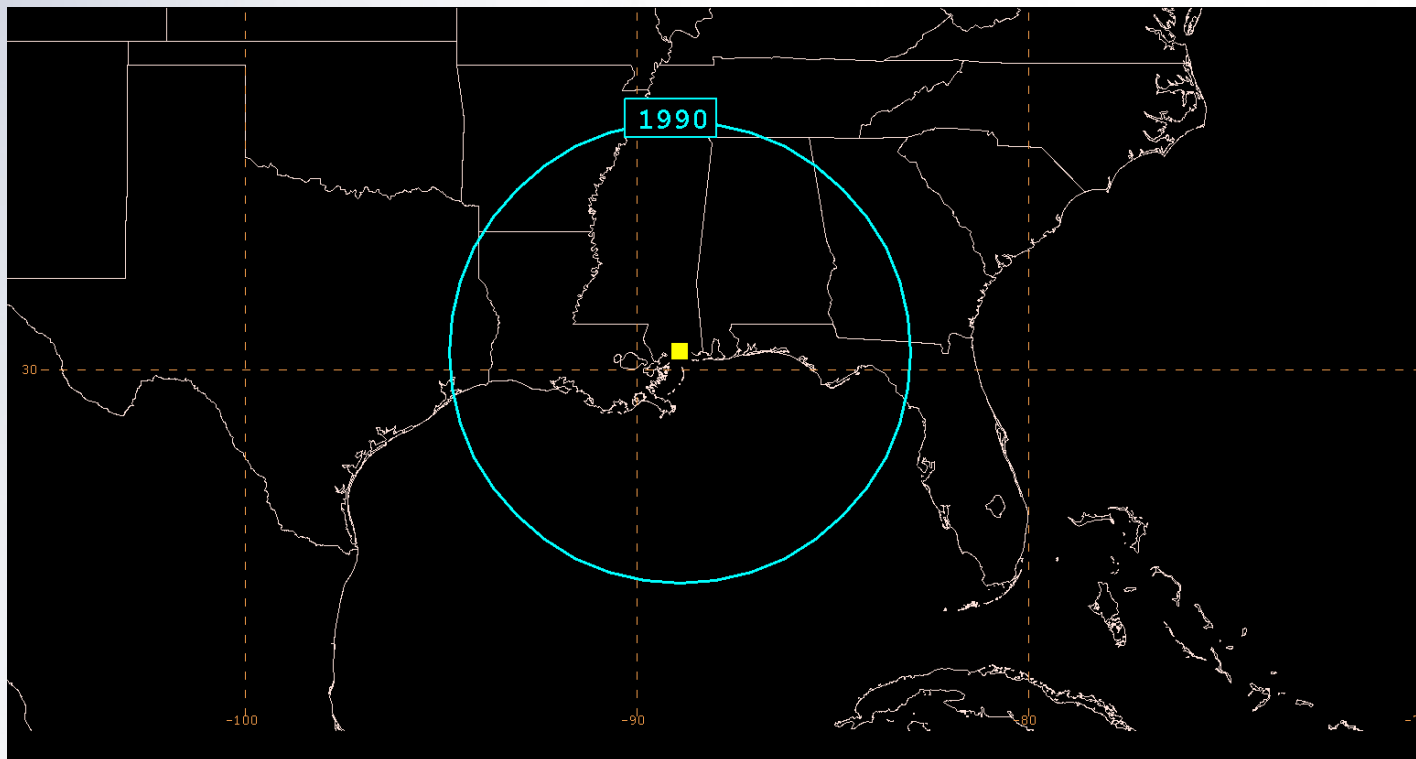


NHC Official Average Track Errors
Atlantic Basin Tropical Storms and Hurricanes



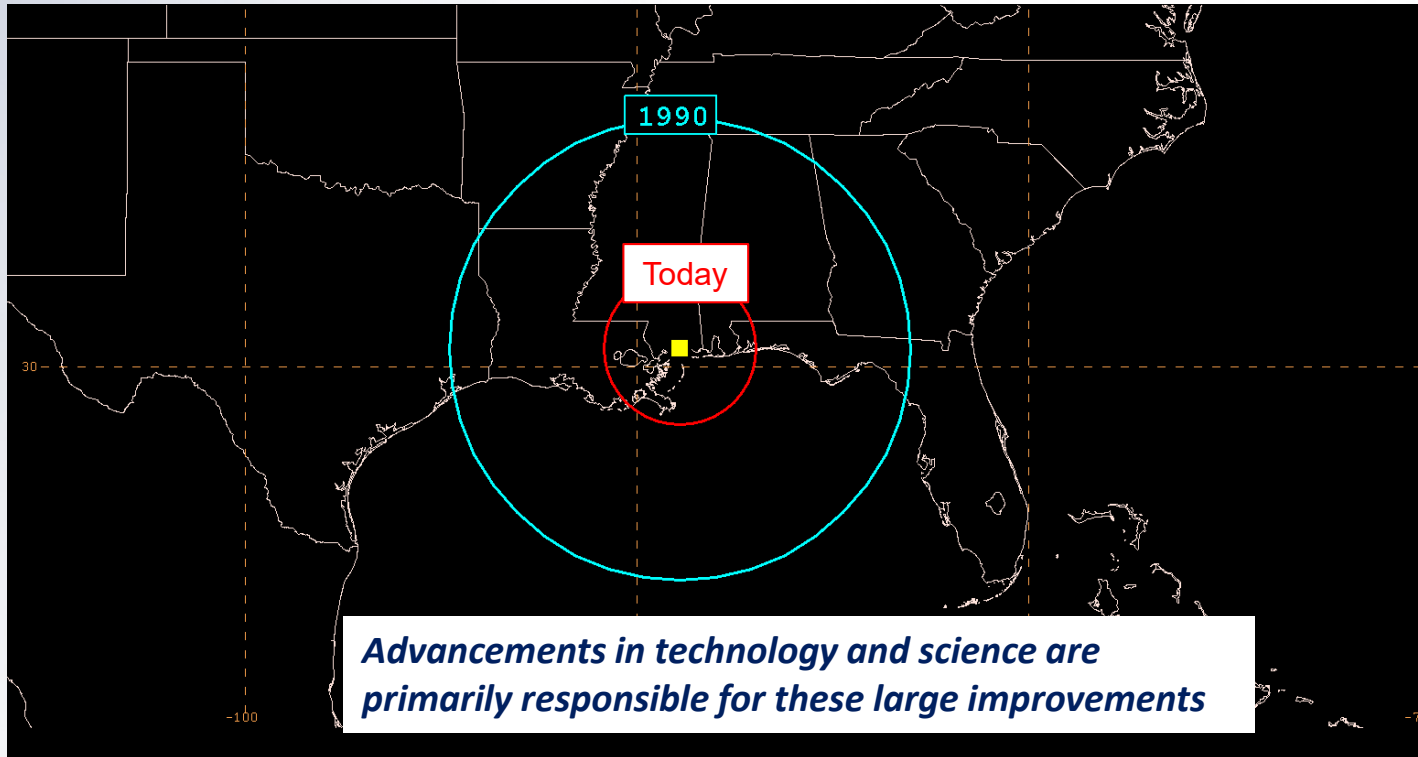


3-day NHC Average Track Error





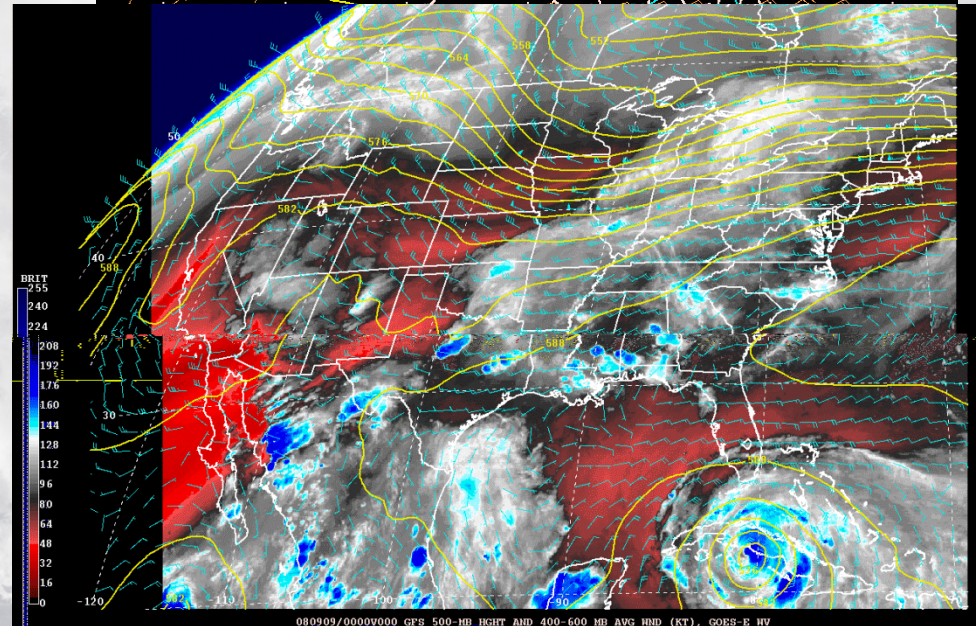
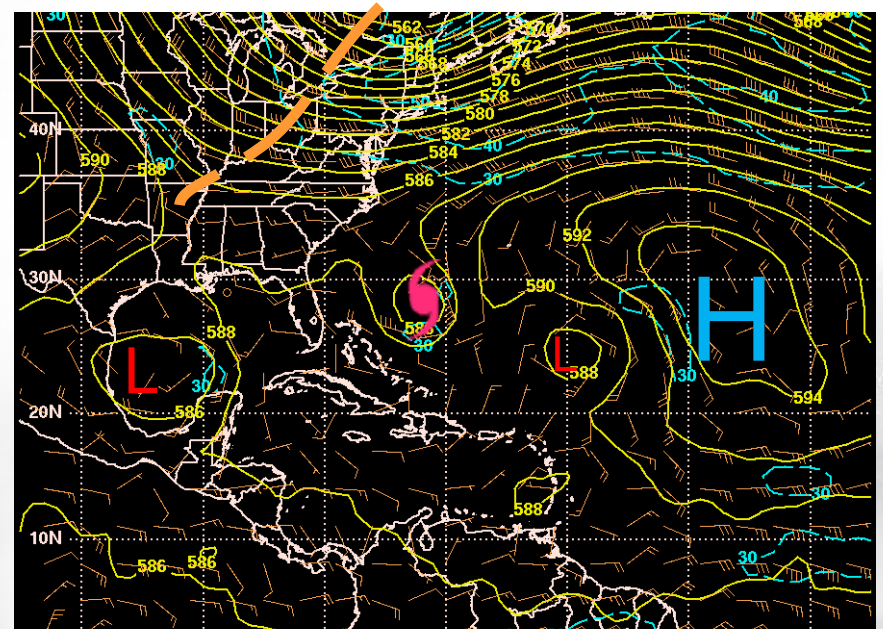
3-day NHC Average Track Error



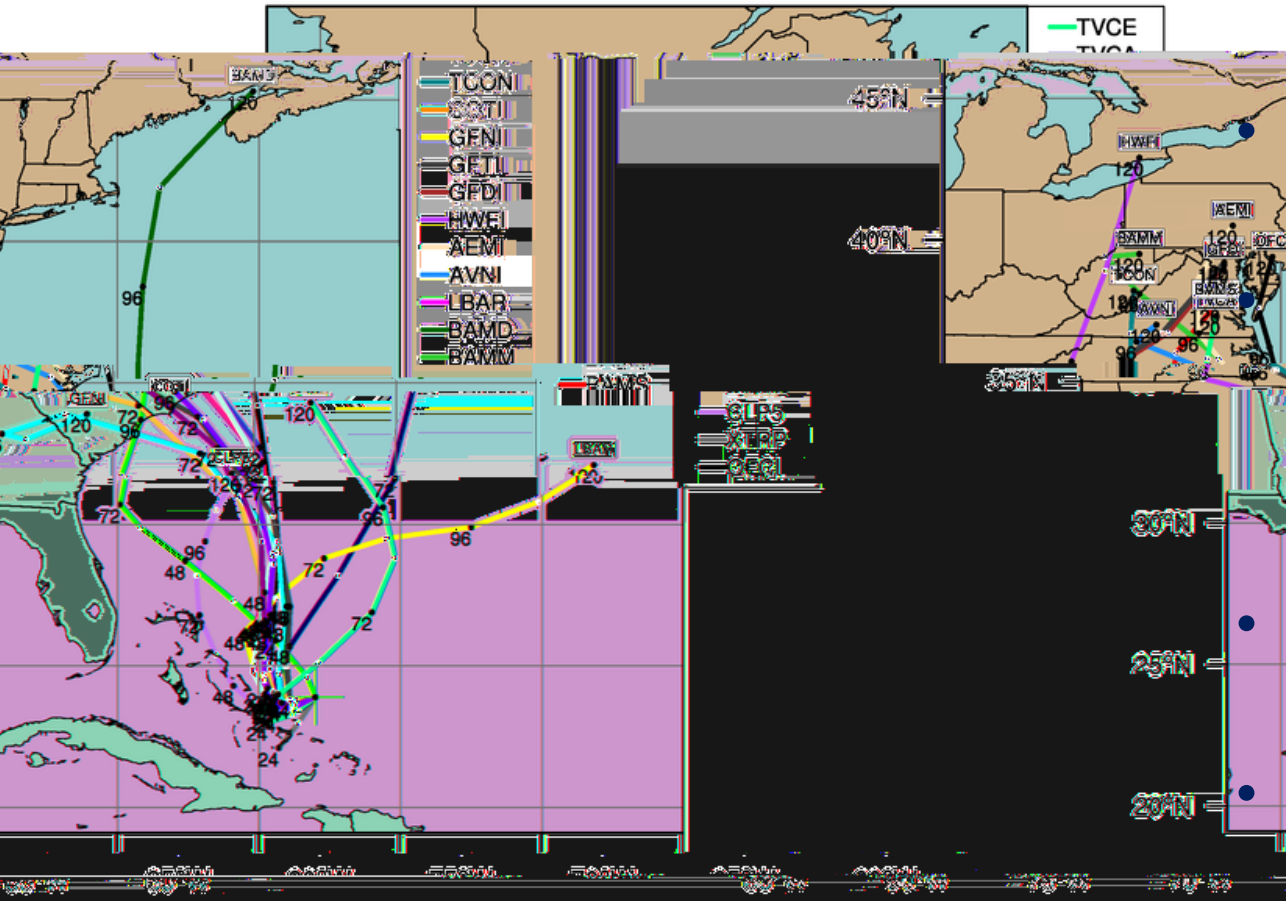
Tropical Cyclone Motion



- Track forecasting is a relatively simple problem with well-understood physics
 - Cork in stream analogy
- Important atmospheric features are relatively large and easy to measure
- Numerical computer models forecast track quite well
 - Constantly improving with upgrades to model physics and resolution
 - Long ago surpassed statistical models in accuracy



Track Models



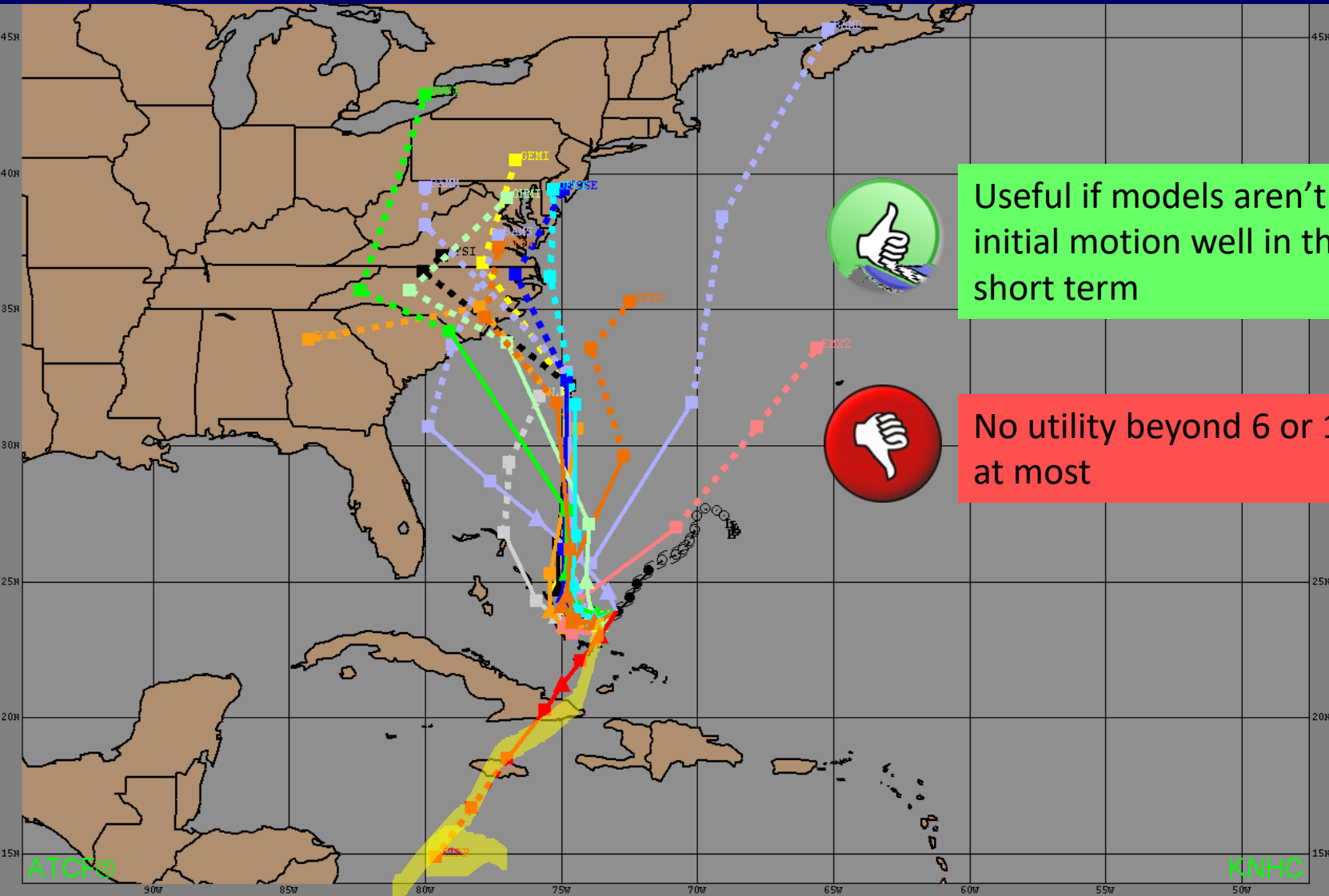
*What does this set of lines represent?
Do they accurately convey the uncertainty in the track forecast?*

- Are they all created equal?*
- What's missing?*

MAJOR HURRICANE JOAQUIN (AL11)

Tropical Cyclone Models

Extrapolated Motion



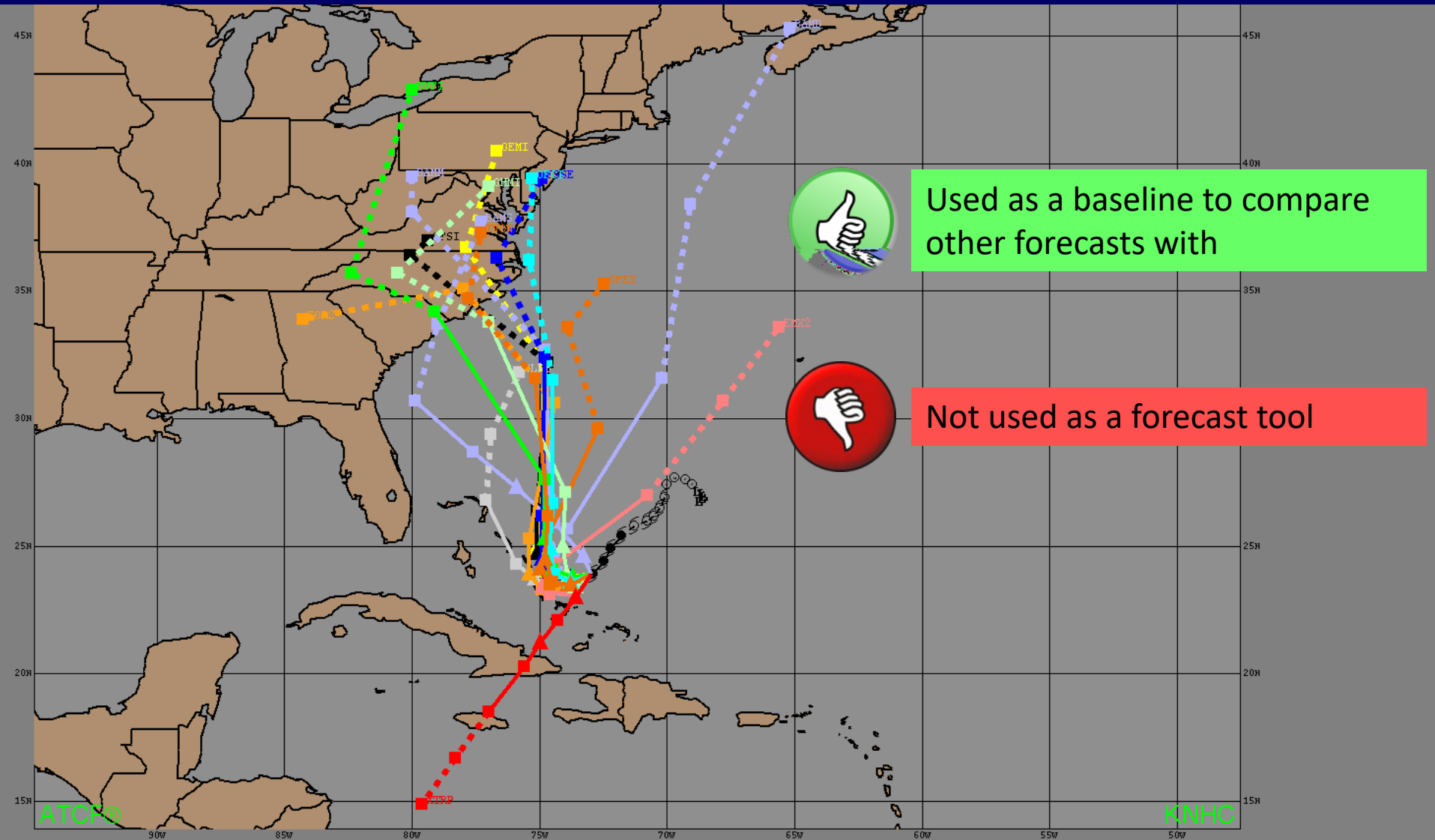
Useful if models aren't handling initial motion well in the very short term



No utility beyond 6 or 12 hours at most

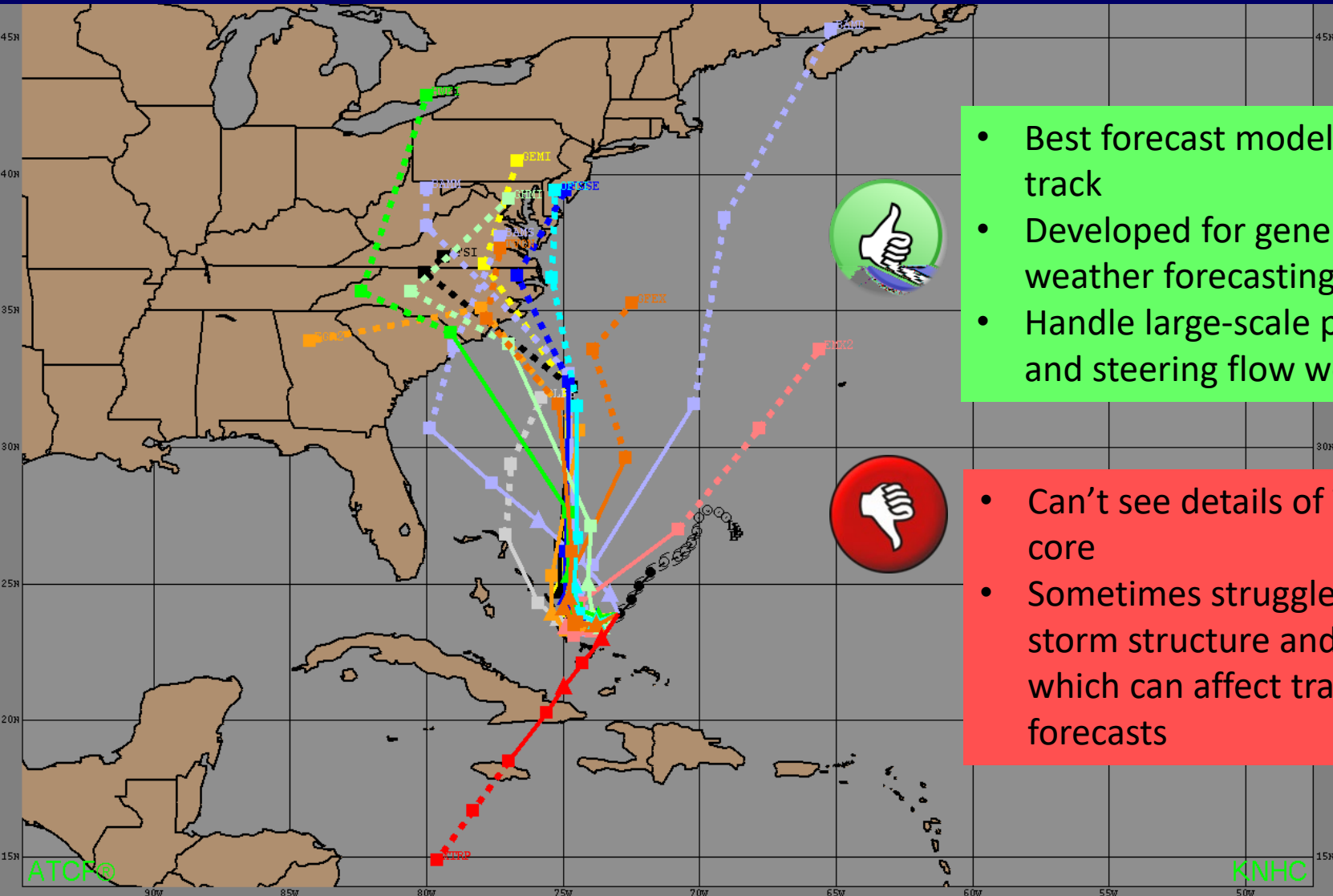
Tropical Cyclone Models

Climatology and Persistence



Tropical Cyclone Models

Global Models

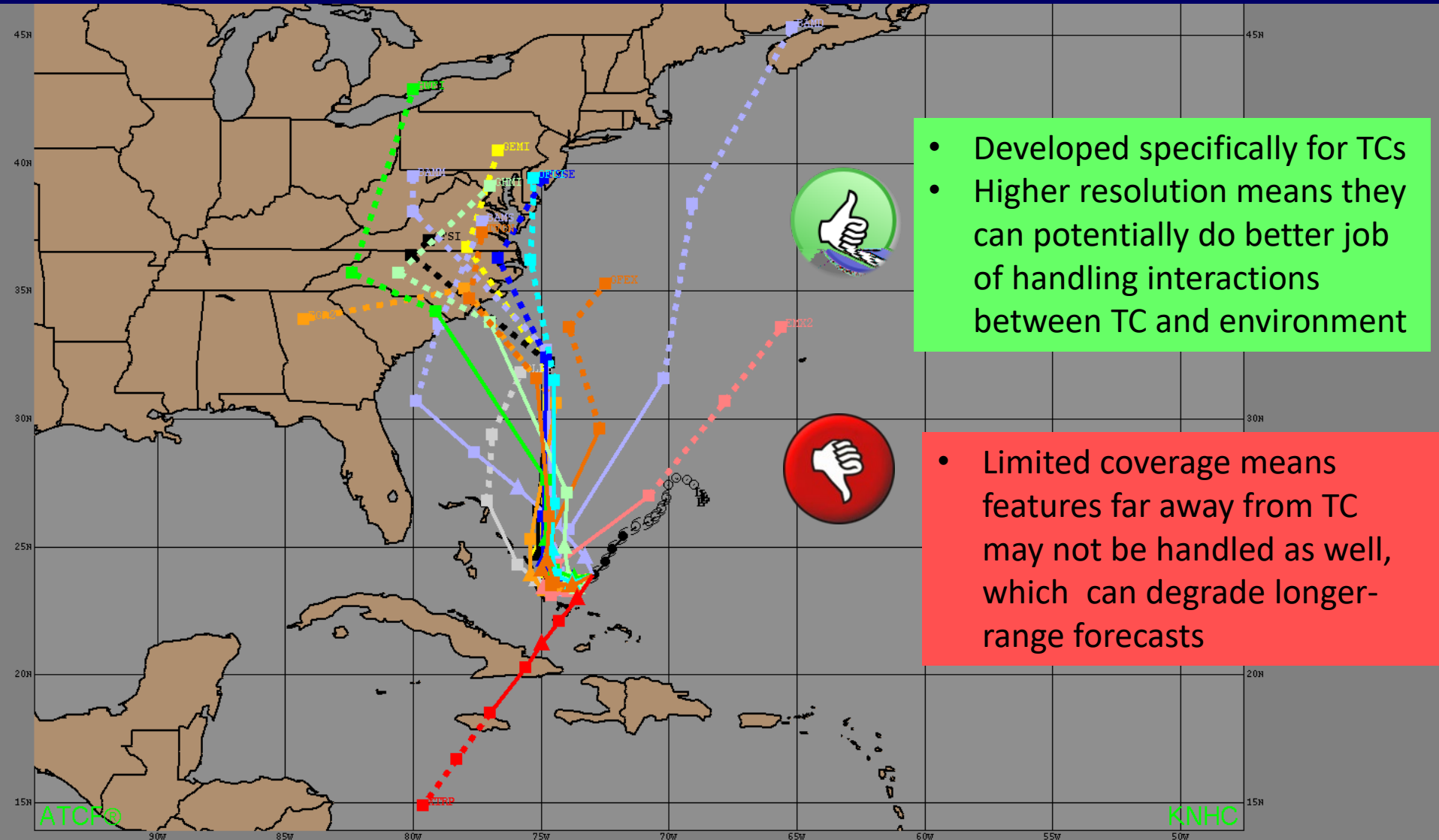


- Best forecast models for TC track
- Developed for general weather forecasting
- Handle large-scale pattern and steering flow well

- Can't see details of TC inner core
- Sometimes struggle with storm structure and intensity, which can affect track forecasts

Tropical Cyclone Models

Regional Hurricane Models

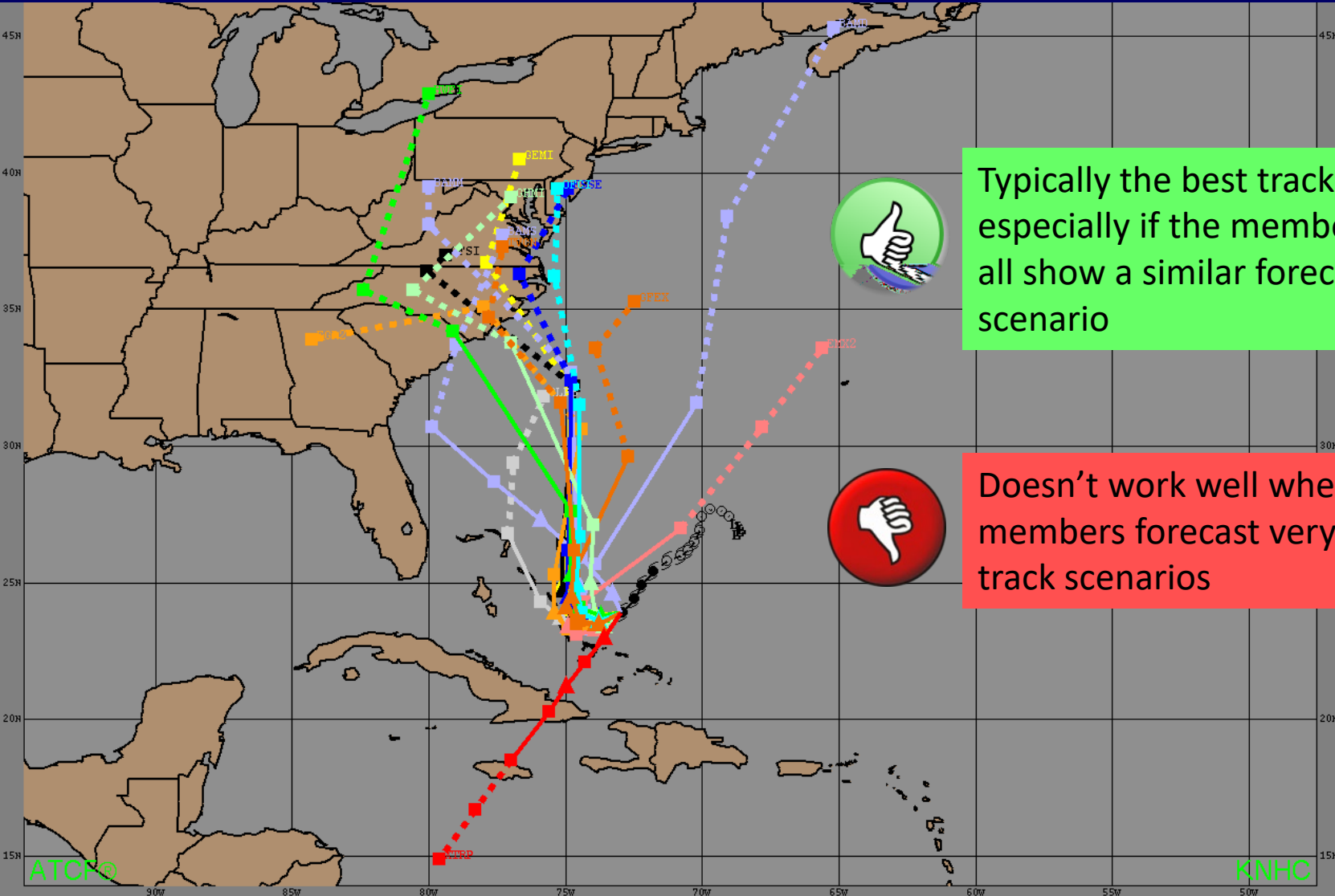


- Developed specifically for TCs
- Higher resolution means they can potentially do better job of handling interactions between TC and environment

- Limited coverage means features far away from TC may not be handled as well, which can degrade longer-range forecasts

Tropical Cyclone Models

Consensus Models



Typically the best track guidance, especially if the member models all show a similar forecast scenario



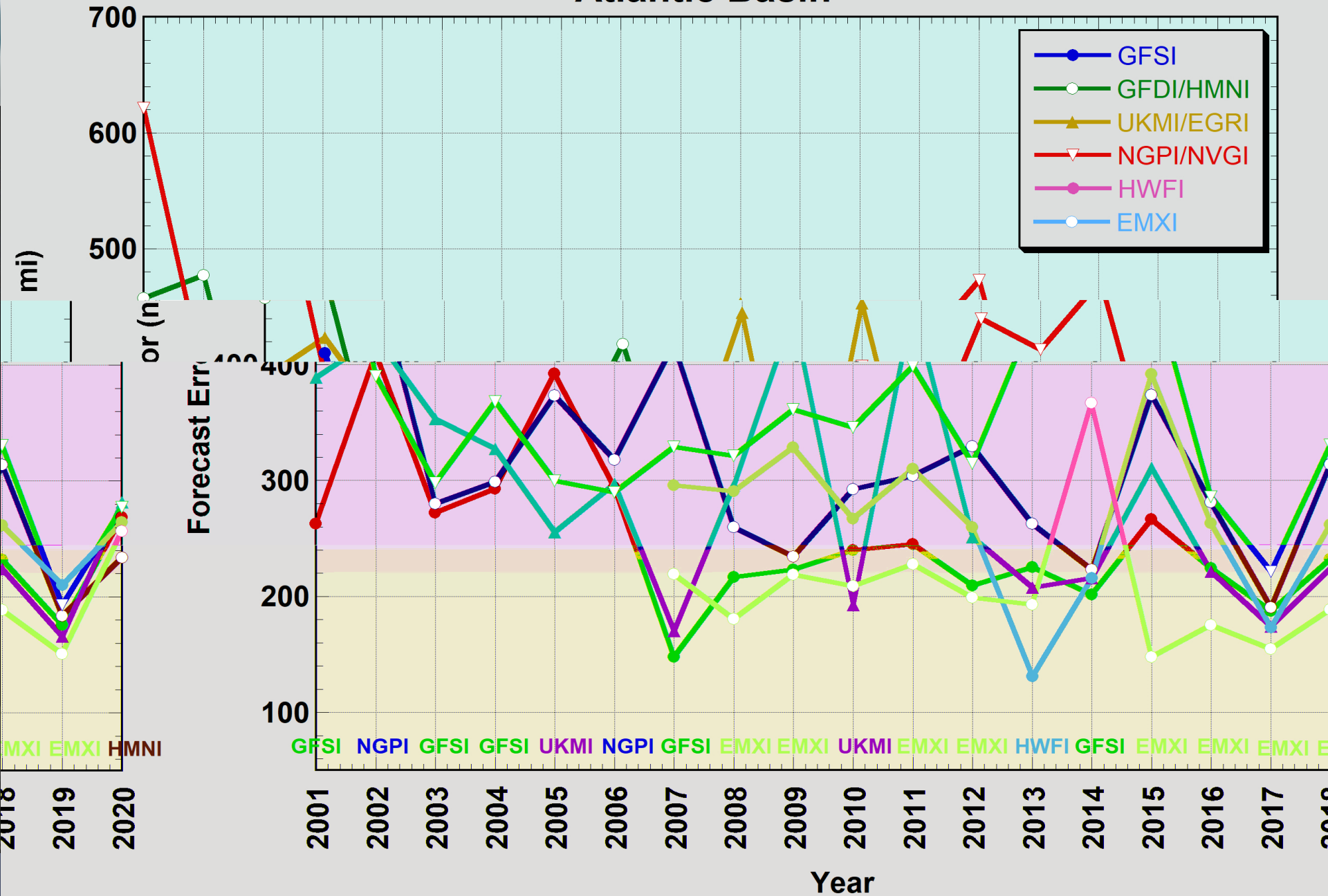
Doesn't work well when members forecast very different track scenarios

Questions



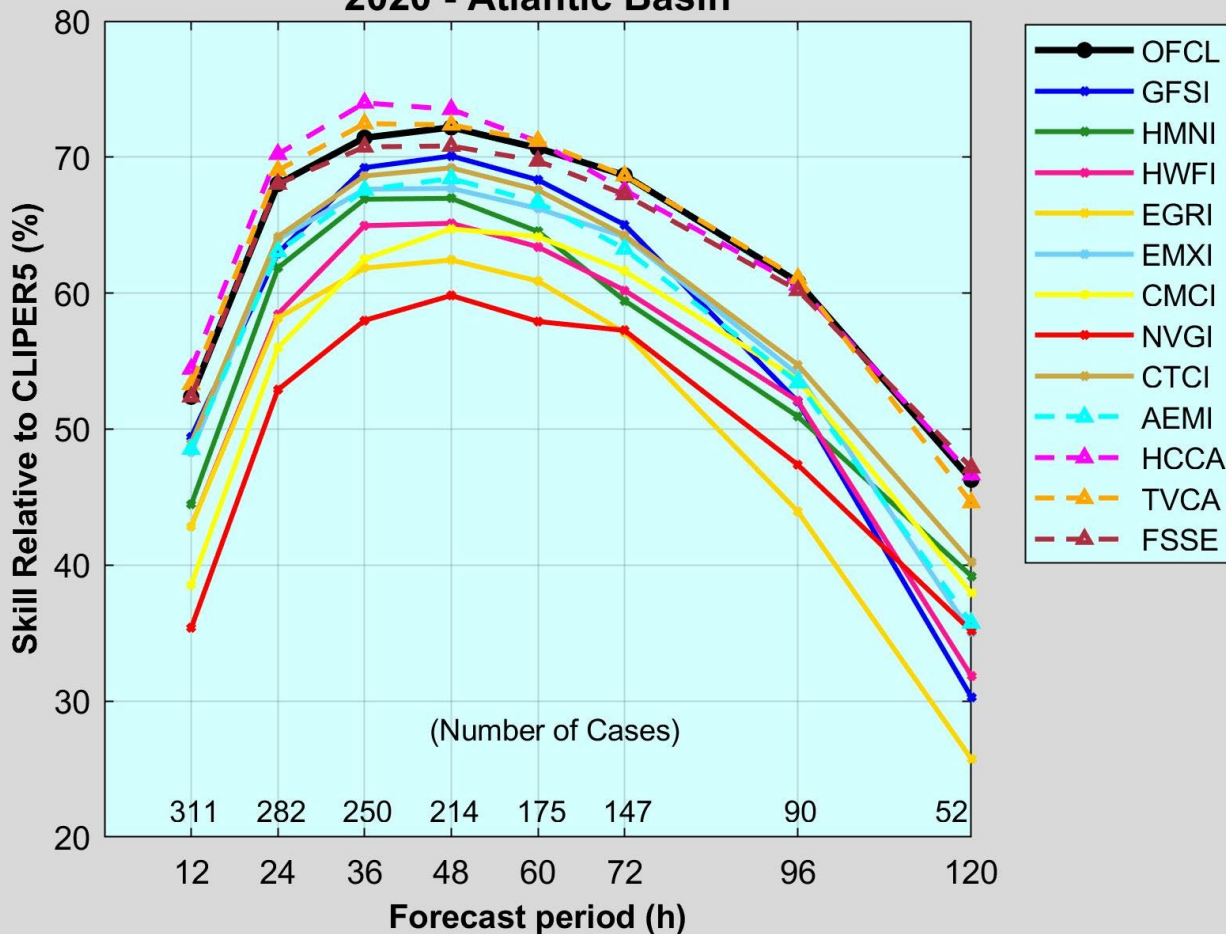
**Which model is the best one?
Which one should you use?**

120-h Track Forecast Guidance Trends Atlantic Basin



2020 Track Guidance

**Track Forecast Skill (Early Models)
2020 - Atlantic Basin**



Official forecasts were very skillful and were near best performing models, the consensus aids (FSSE, HCCA, TVCA).

GFSI best individual model, from 36 – 72 h.

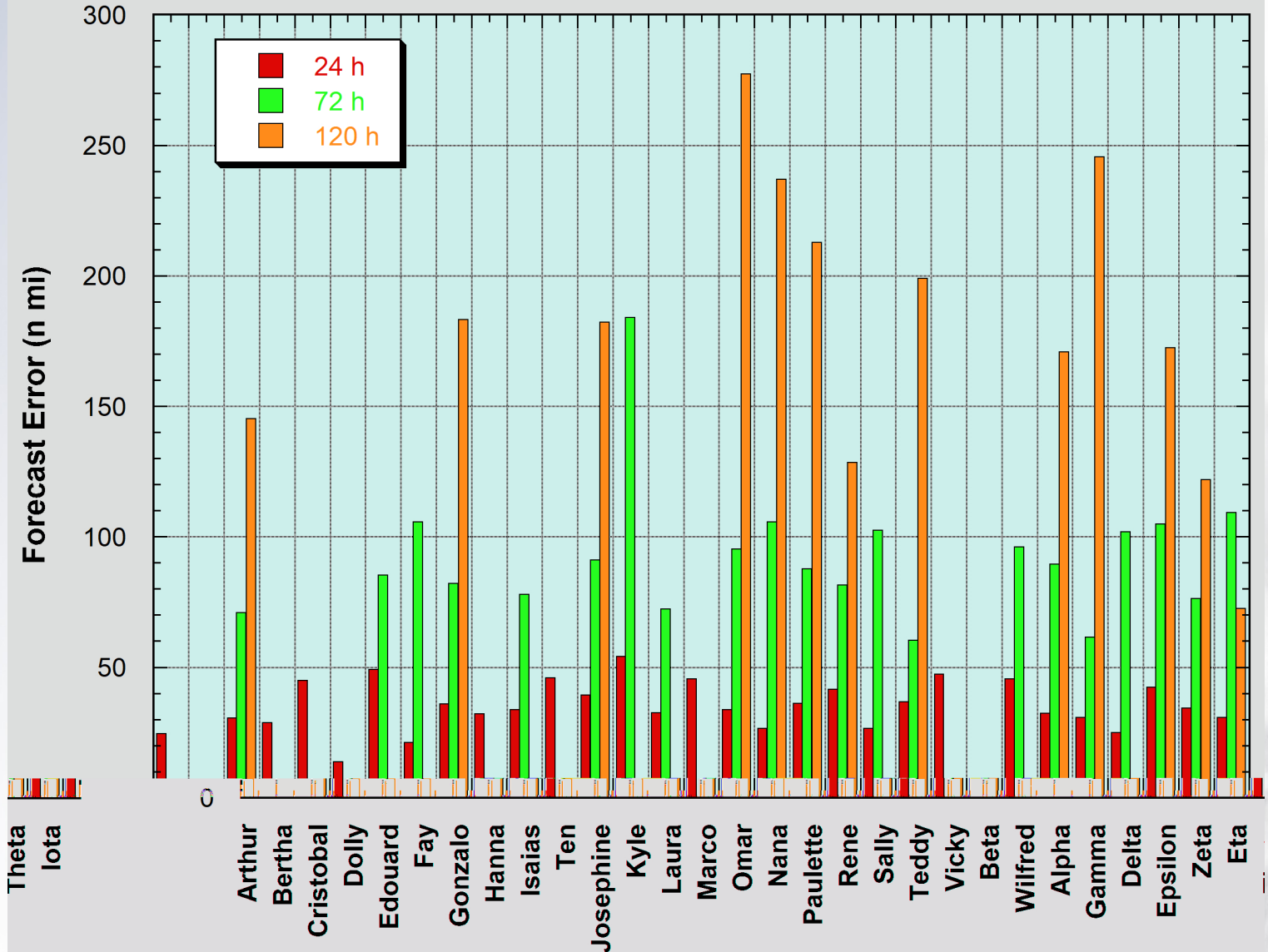
AEMI, EMXI, HMNI, CTCI, close to one another.

HWFI and **CMCI** were next best models.

NVGI, EGRI trailed

2020 NHC Track Errors by Storm

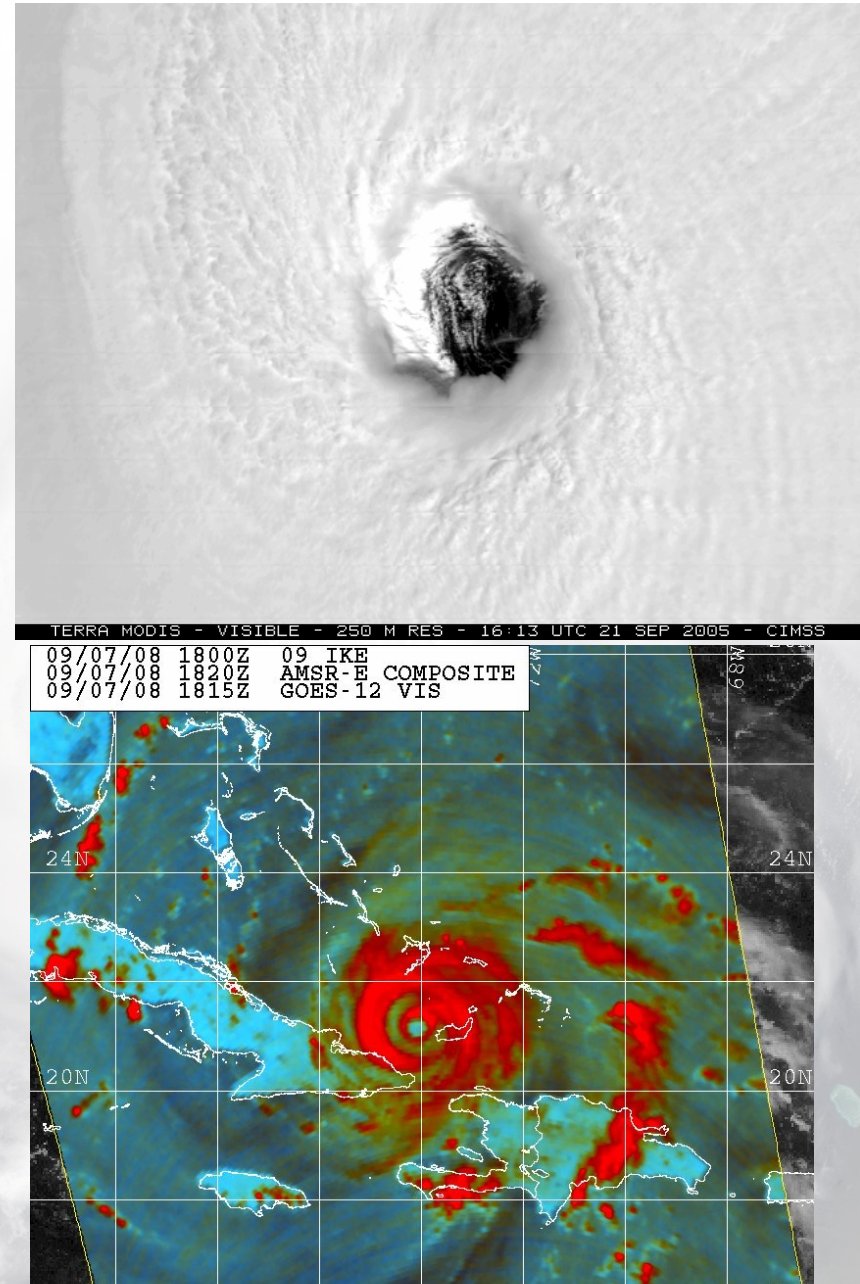
NHC Track Errors by Storm
2020 - Atlantic Basin



Tropical Cyclone Intensity

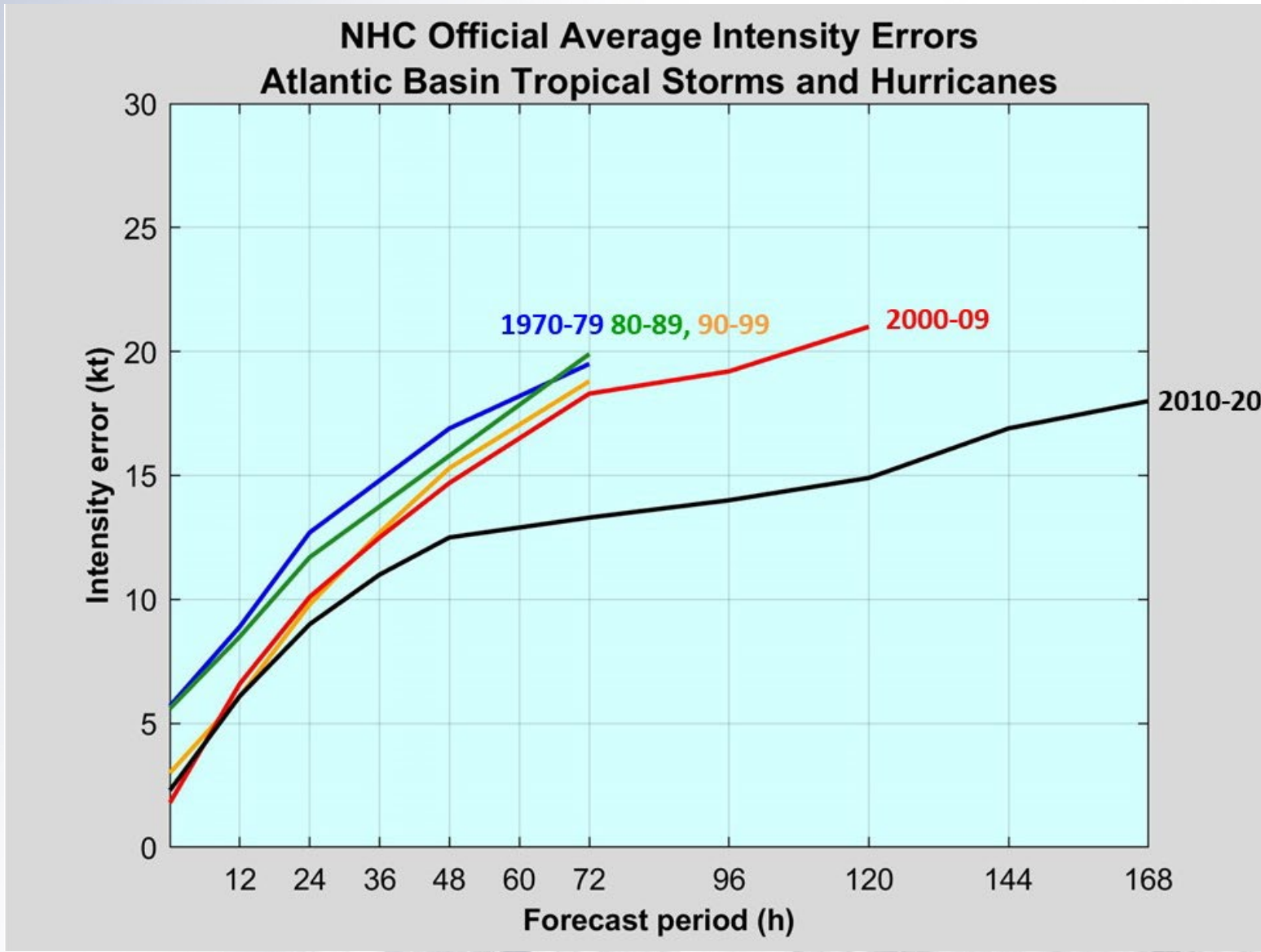


- Multi-scale problem that involves complex interactions between thunderstorms in the core and the environment, as well as atmosphere-ocean interactions
- Depends strongly on track
- Depends critically on wind, temperature, and moisture patterns over the core and near environment
- Depends on internal processes, such as eyewall replacement cycles, that are poorly understood



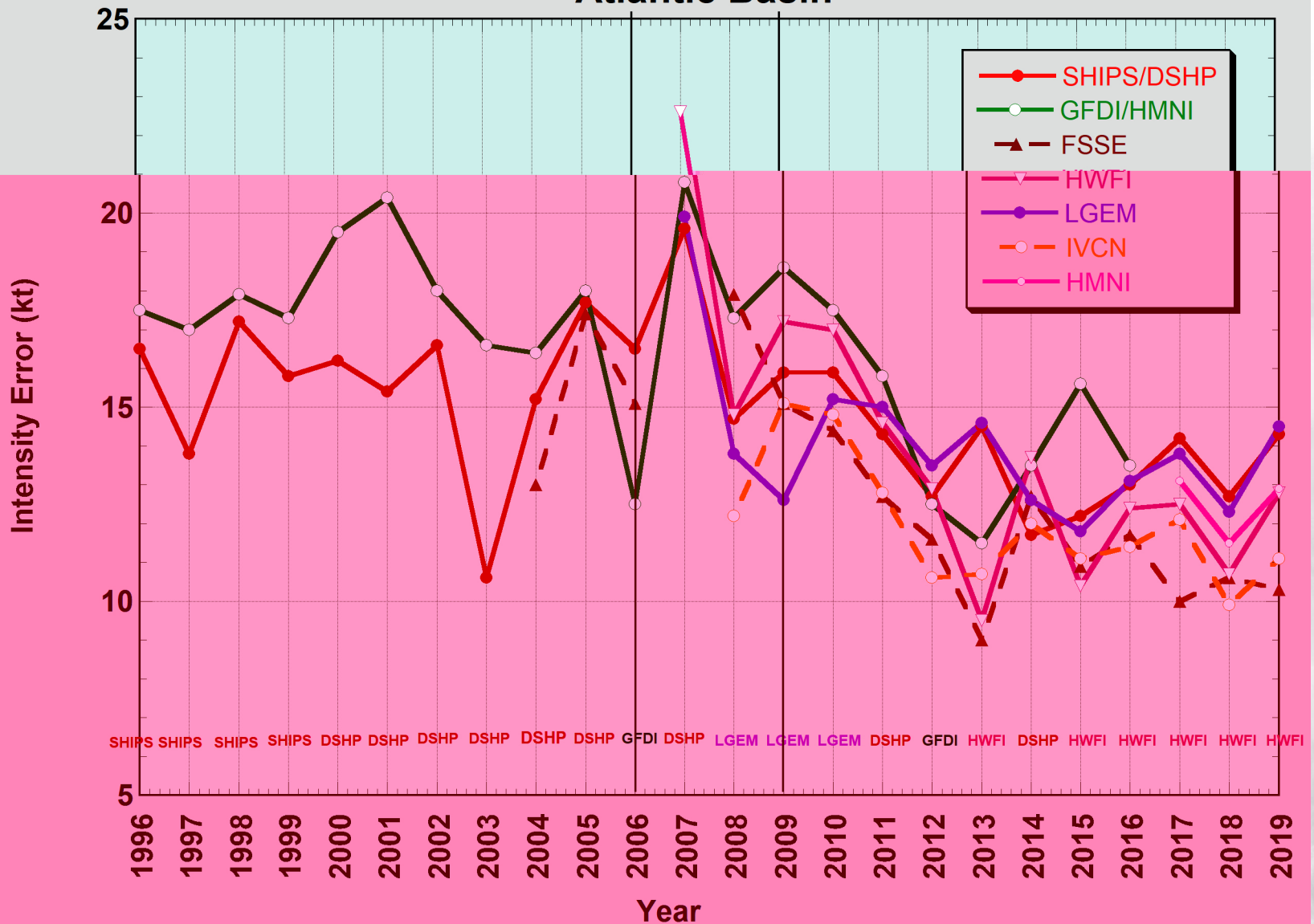


Atlantic Intensity Error Trends



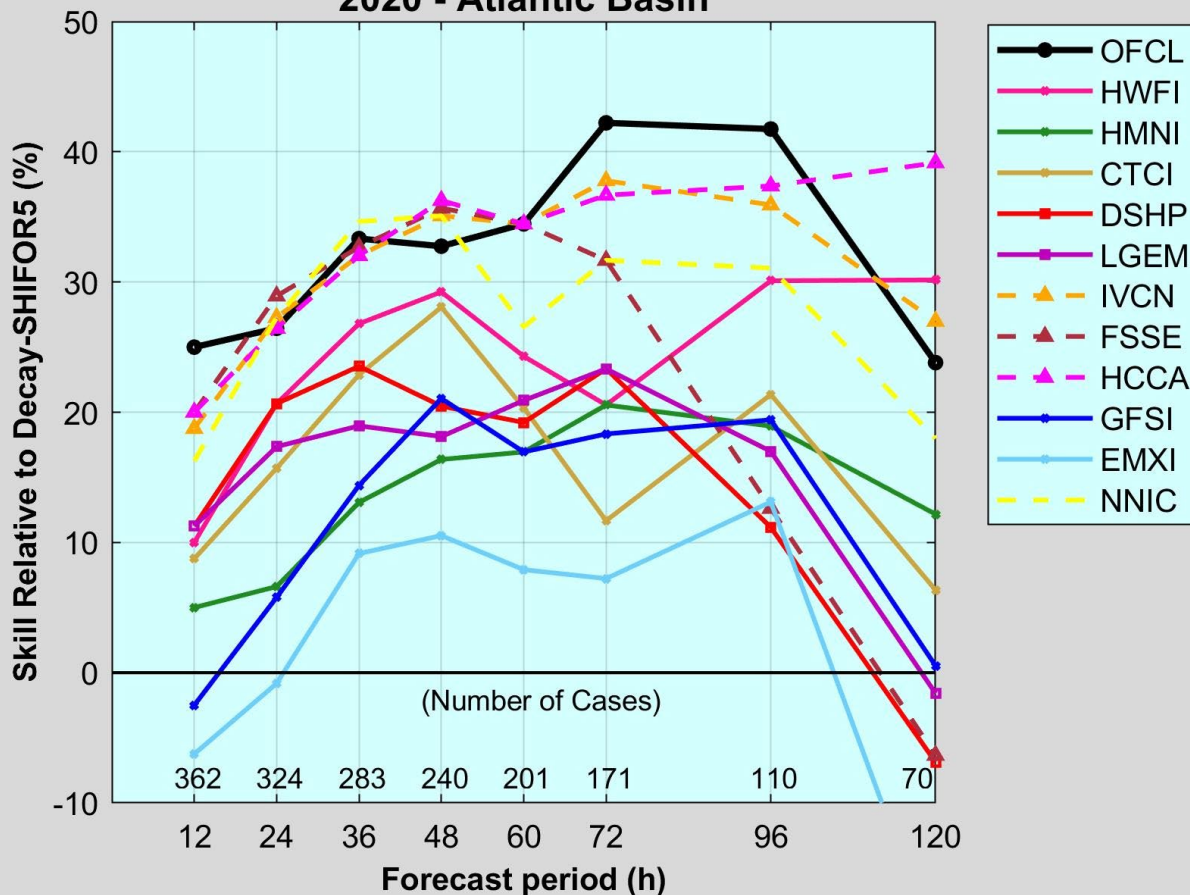
48 h Model Trends

48-h Intensity Forecast Guidance Trends Atlantic Basin



2020 Intensity Guidance

**Intensity Forecast Skill (Early Models)
2020 - Atlantic Basin**



Official forecasts very skillful, as good as or better than the consensus aids.

FSSE trailed with time.

HWFI was a strong performer, best individual model.

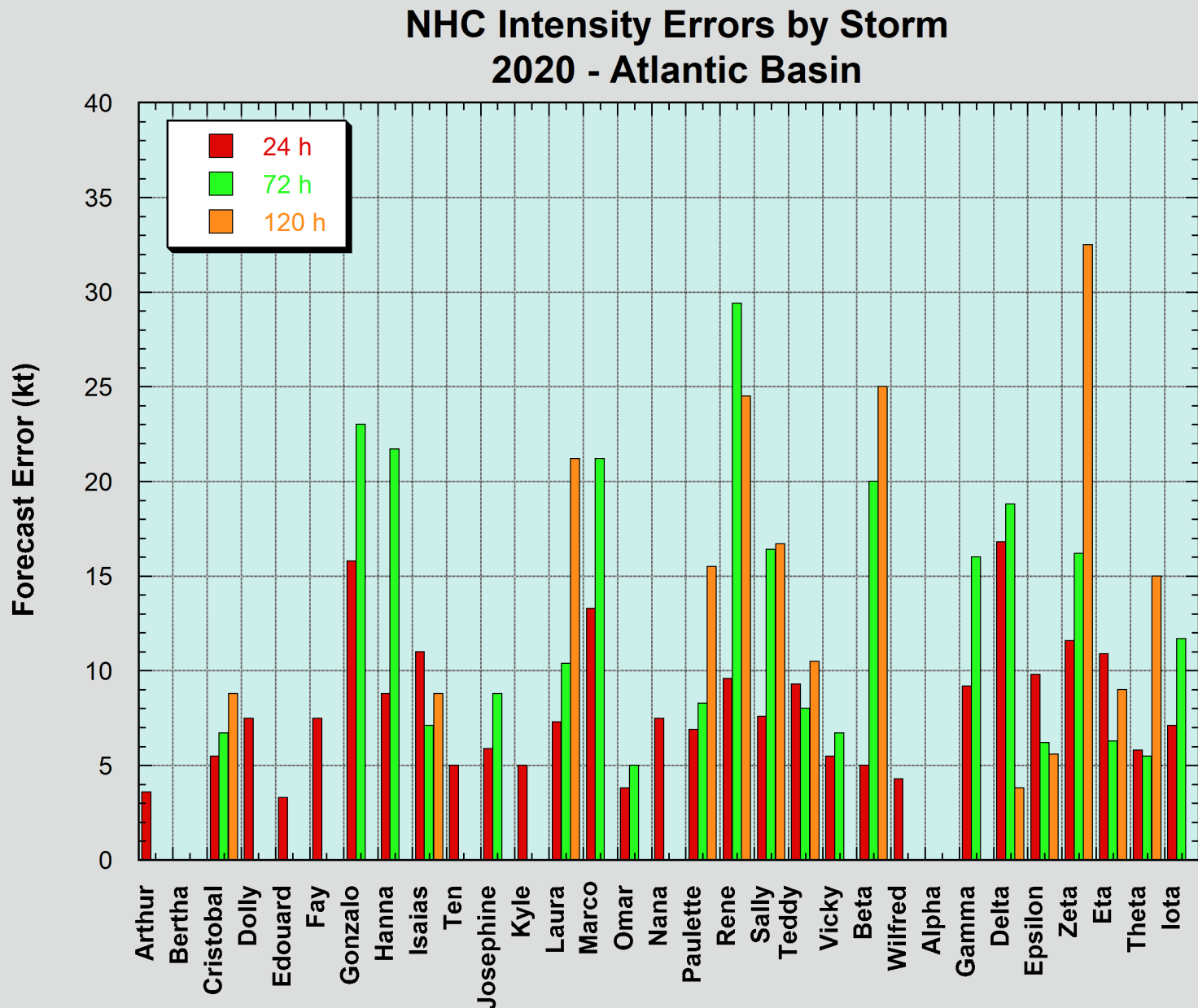
CTCI and HMNI not as good as HWFI.

DSHP and LGEM were fair performers, but not as good as HWFI and consensus models.

GFSI somewhat competitive.

EMXI barely skillful.

2020 NHC Intensity Errors by Storm



RAPID INTENSIFICATION

Rapid intensification remains a forecast challenge and often results in very large errors

- Our ability to recognize conditions that favor rapid intensification has improved, however forecasting the extent and timing of that intensification remains difficult.

Example: Iota Advisory 7 (2020)

Initial Intensity: 65 mph
24h Forecast: 105 mph
Actual Intensity: 105 mph
24 h Error: 0 mph

Initial Intensity: 65 mph
36h Forecast: 120 mph
Actual Intensity: 155 mph
36 h Error: 35 mph

