3-km hfvGFS Forecasts From the 2018 Atlantic Season

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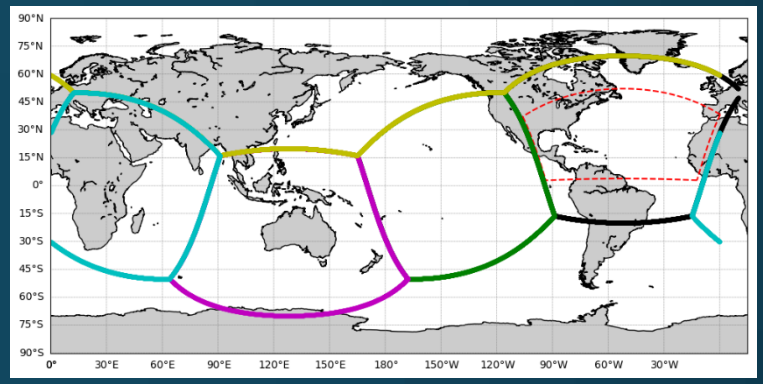
Overview

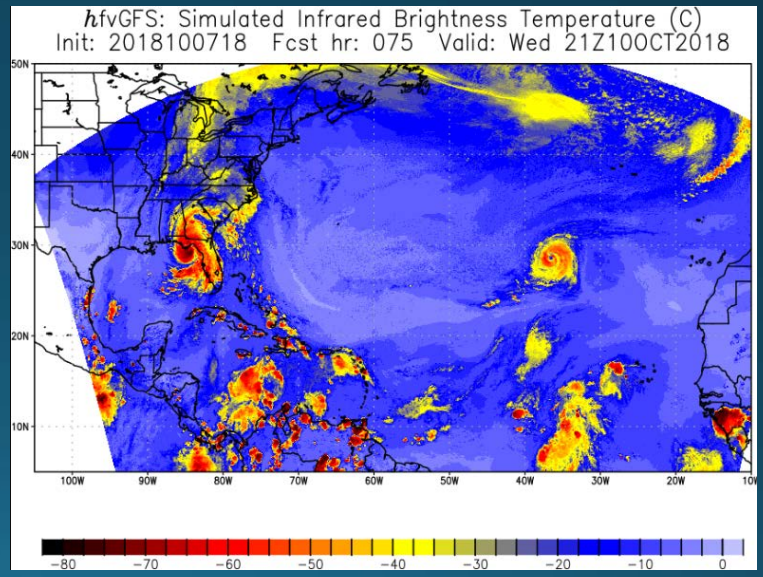
- Nested FV3 with 3-km nest inside a 13-km global run (hfvGFS)

- Similar to 2017 layout described in Hazelton et al. (2018, WAF)

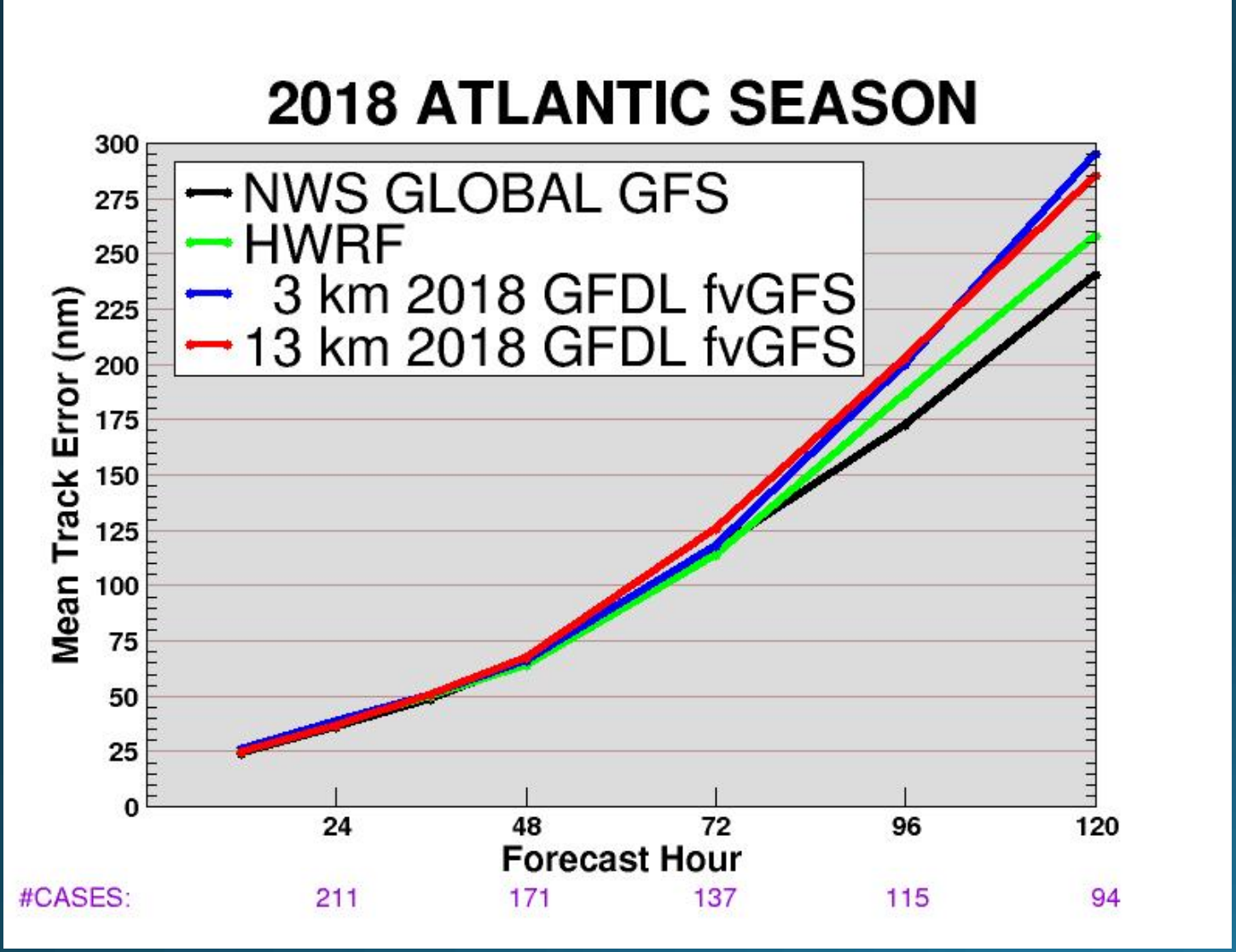
- Important changes from 2017 version:

1. YSU PBL scheme
2. Less diffusive tracer advection
3. 1-d mixed-layer ocean





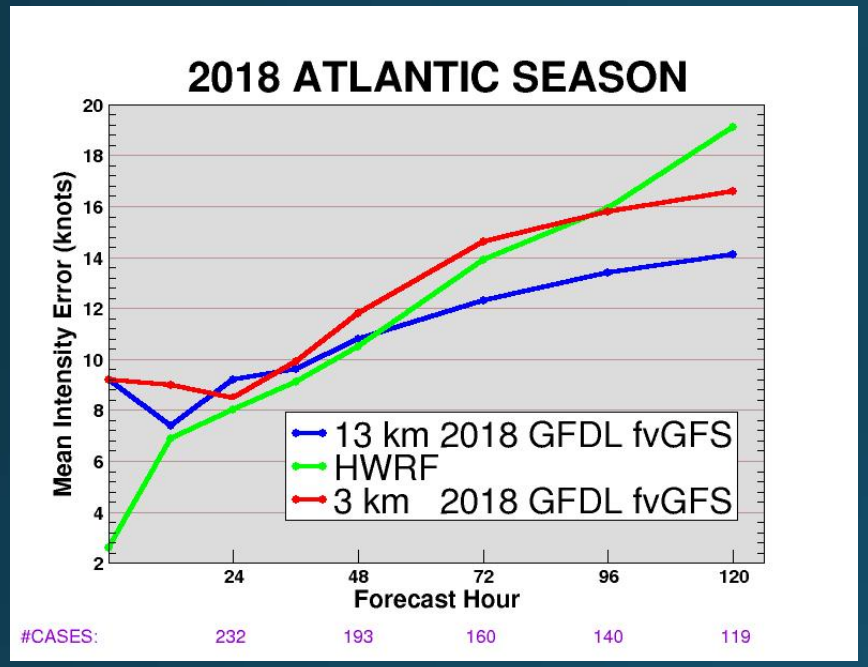
Track Skill



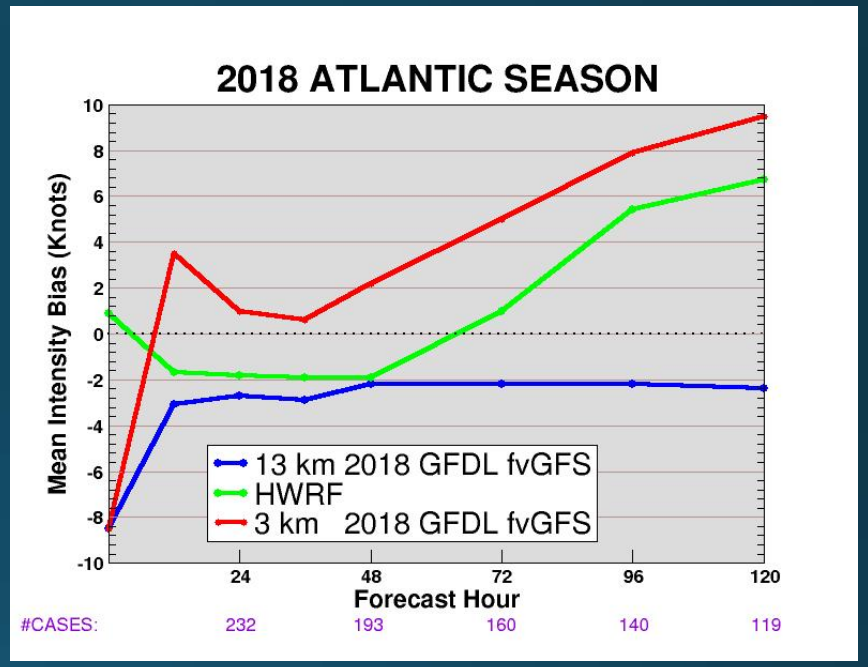
-Generally comparable track skill to global GFDL fvGFS

-Not as good at Day 4/5 as HWRF or GFS

Intensity Skill

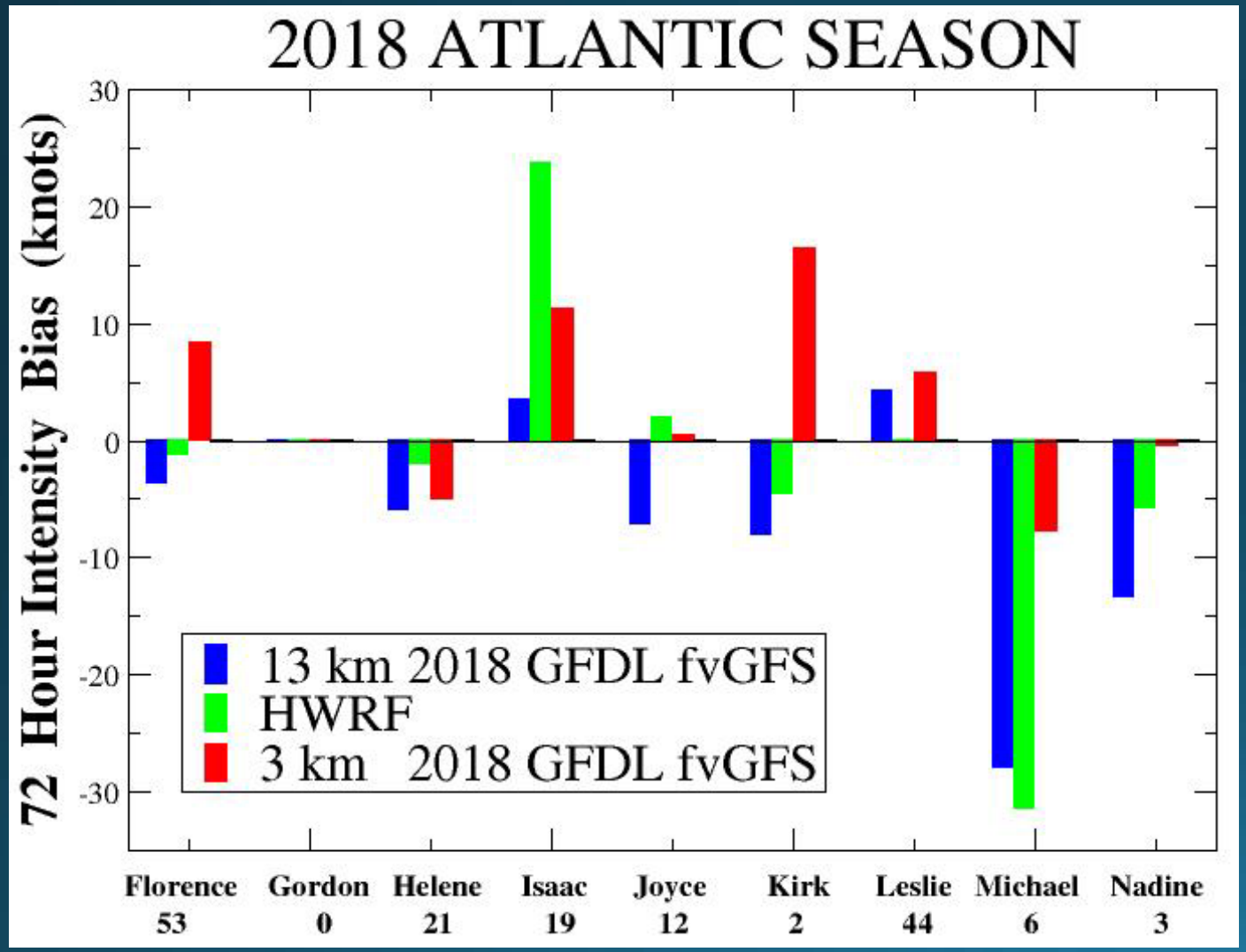


-Global 13-km GFDL FV3 has lowest intensity errors



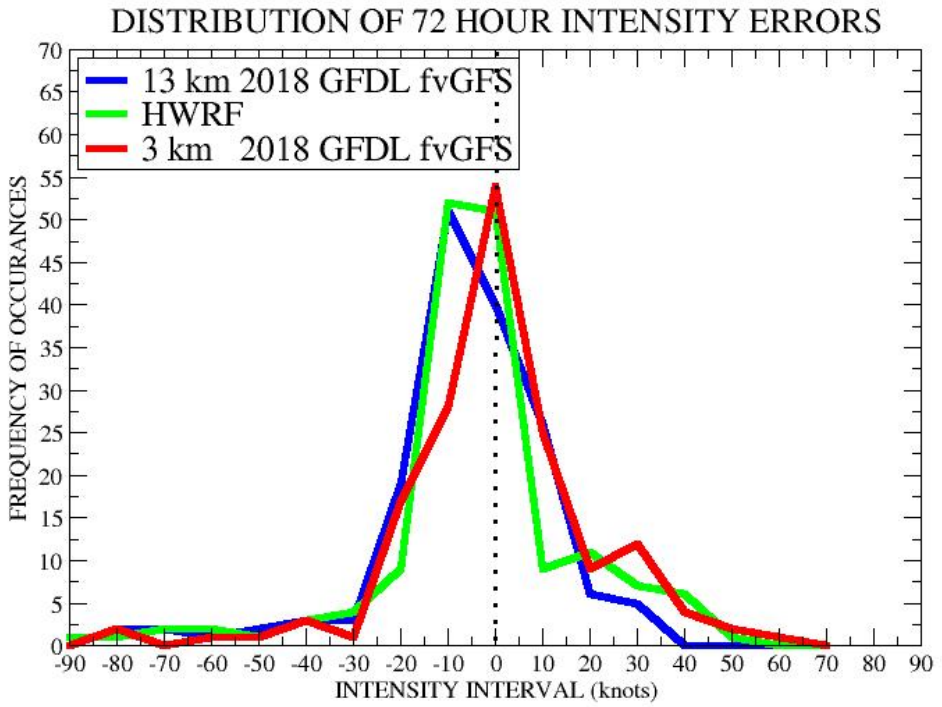
-Both HWRF and hfvGFS had a high bias, particularly at longer lead times

Intensity Bias by Storm



- hfvGFS high bias was dominated by Florence, Isaac, Kirk (smaller sample), Leslie
- High bias in Isaac not as bad as HWRF

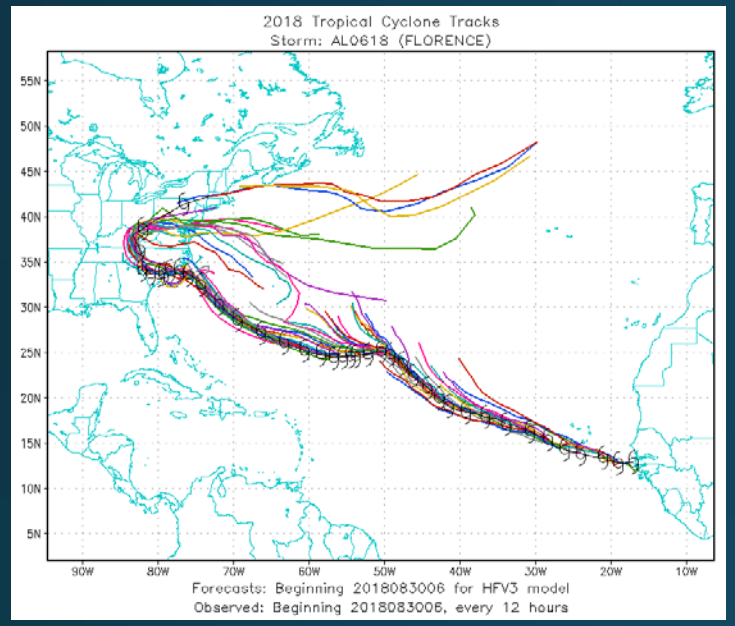
Intensity Errors Distribution



- Histogram of intensity errors
- hfvGFS distribution mostly centered around 0
- Fewer low-bias cases than HWRF/global FV3
- Higher tail of high-bias cases, especially around +25-30 kt

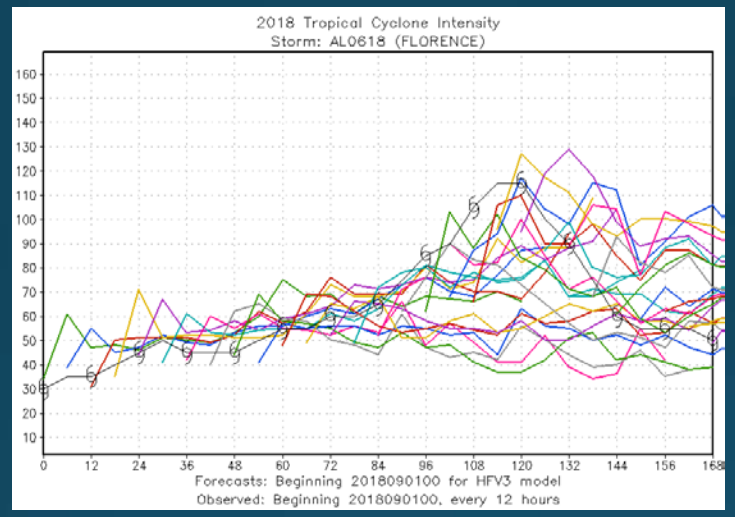
Hurricane Florence: Overview

All Florence Tracks



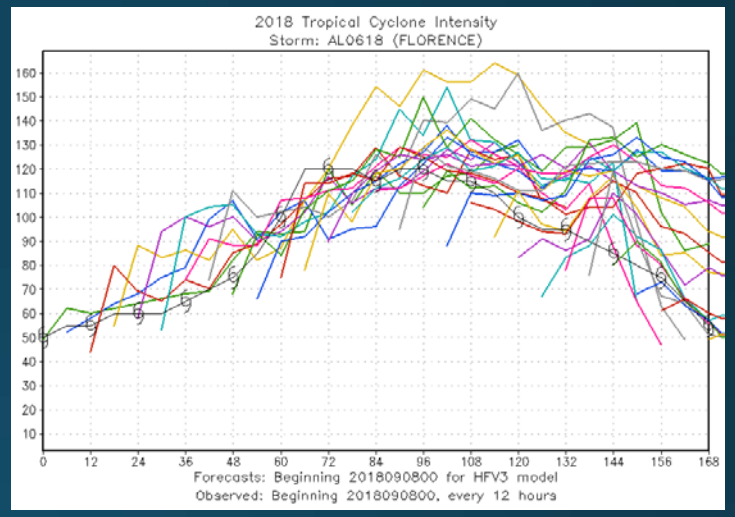
- Early tracks had slight right bias
- 4-5 took "wrong turn" at ~50W
- After bifurcation, most correctly honed in on landfall

Vmax Sep 01-08



- Early RI in shear was tricky
- Some runs missed completely
- Others captured RI, but not subsequent RW

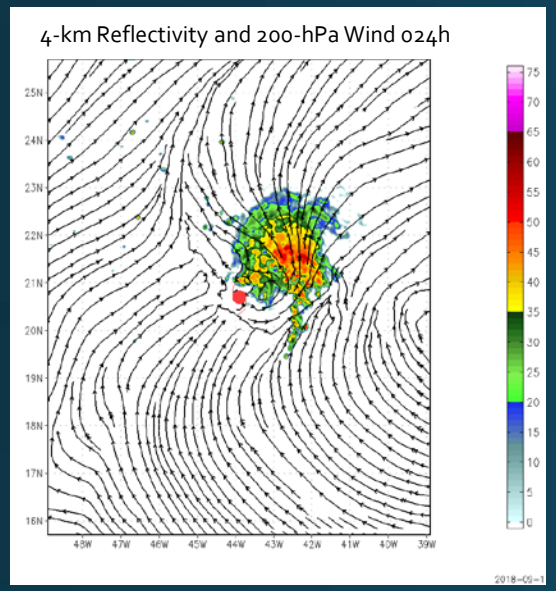
Vmax Sep 08-15

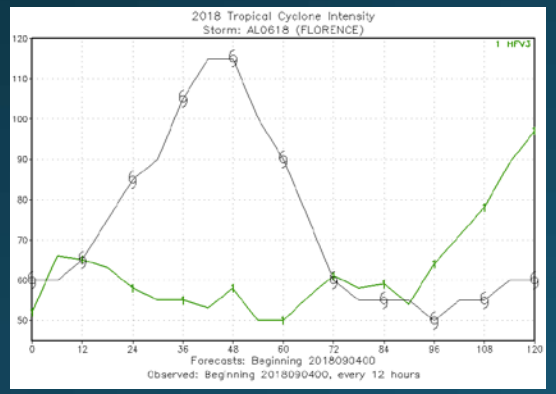


- Late-period RI was well-forecast
- Persistent high bias after peak
- Role of shear, ERCs needs to be examined

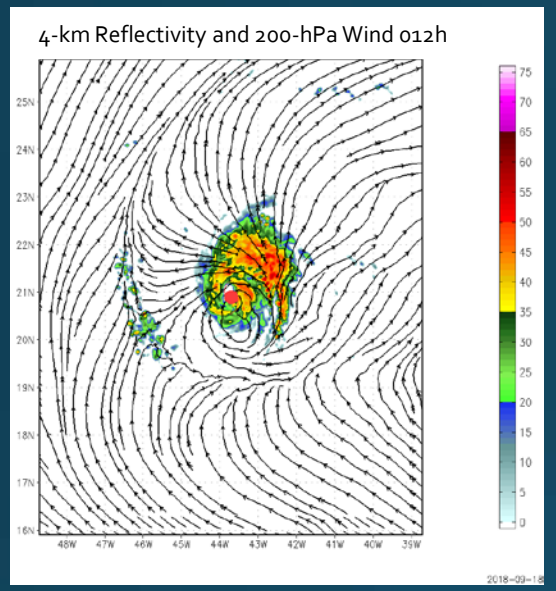
Florence: Structure Differences

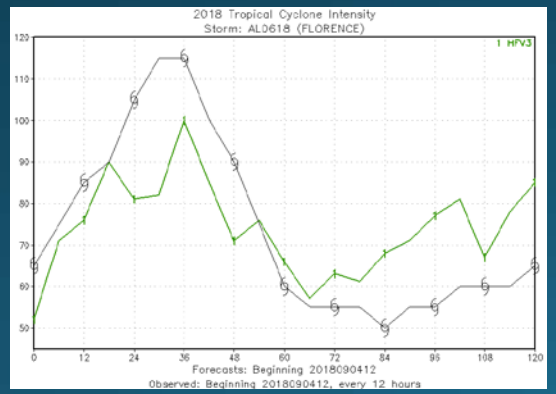
Non-RI: 2018090400



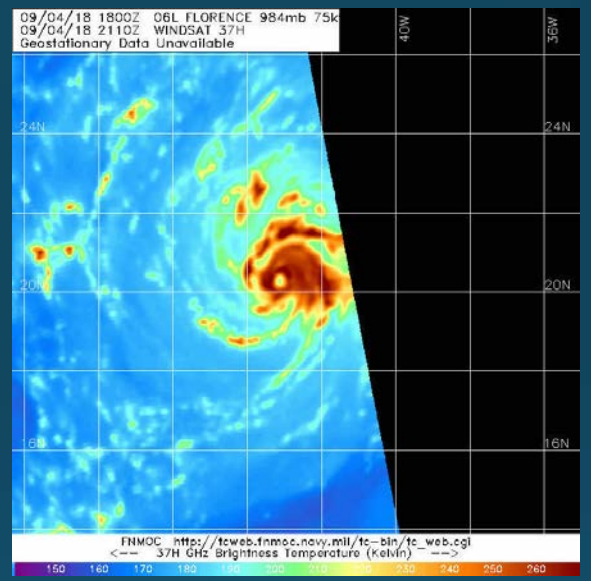


RI: 2018090412





Observed 37 GHZ MW



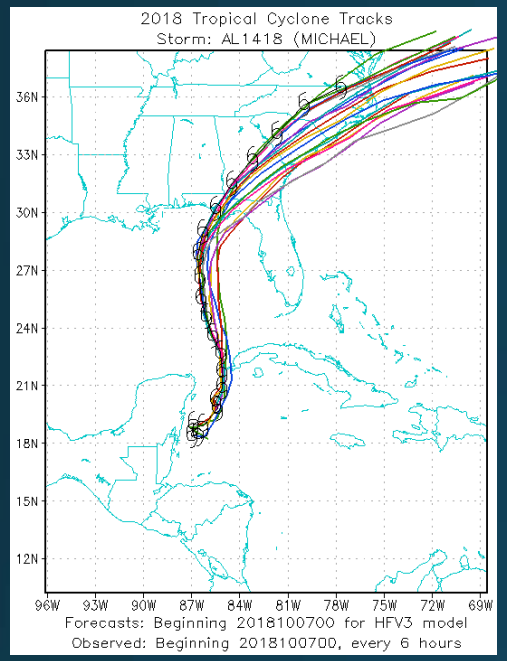
- Outflow severely limited by SW shear in both forecasts
- In "bad" forecast, shear penetrates core
- Core develops and outflow pushes back in "good" forecast
- Observations show a small core did develop
- What is the predictability of this core?

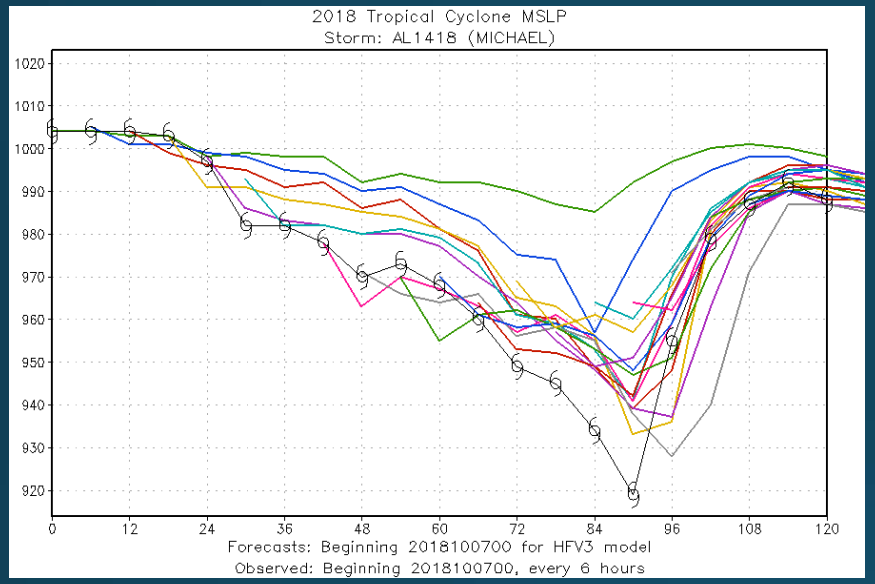
Conclusions

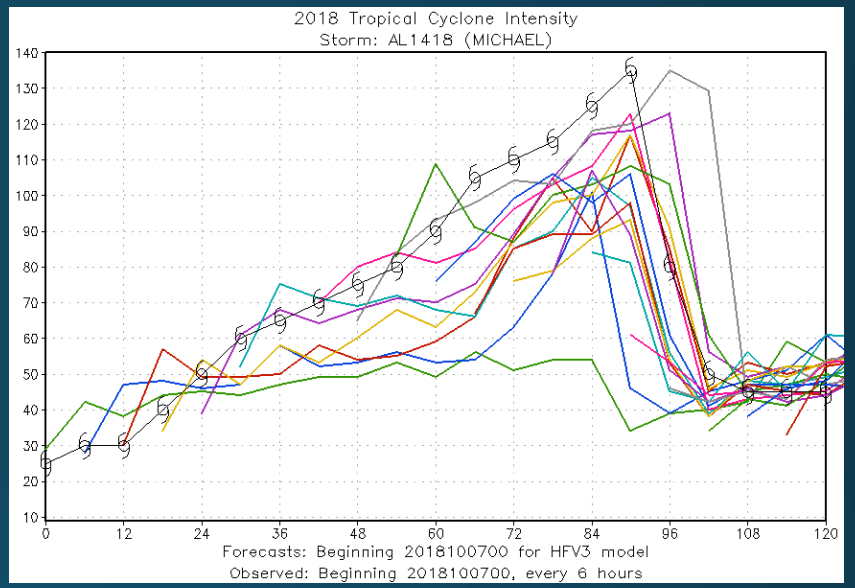
- Track skill comparable to global GFDL FV3
- Intensity skill comparable to HWRF; high bias in a few cases
- Error distribution mostly symmetric around zero with a slight skew towards high bias
- For Florence, early RI was inconsistent in the model
- For Hurricane Michael, some early forecasts missed deepening, most captured
- Need to examine RI in these moderate-high shear cases
- Real-time forecasts: http://data1.gfdl.noaa.gov/fvGFS/fvGFS_products.php

Extra Slides

Hurricane Michael: Overview



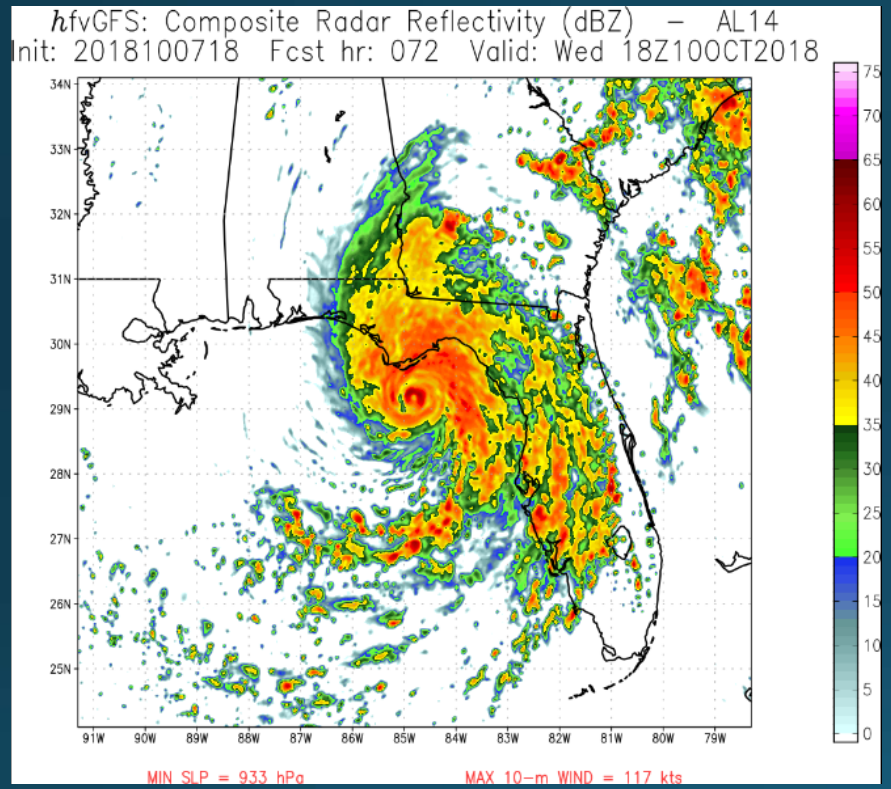




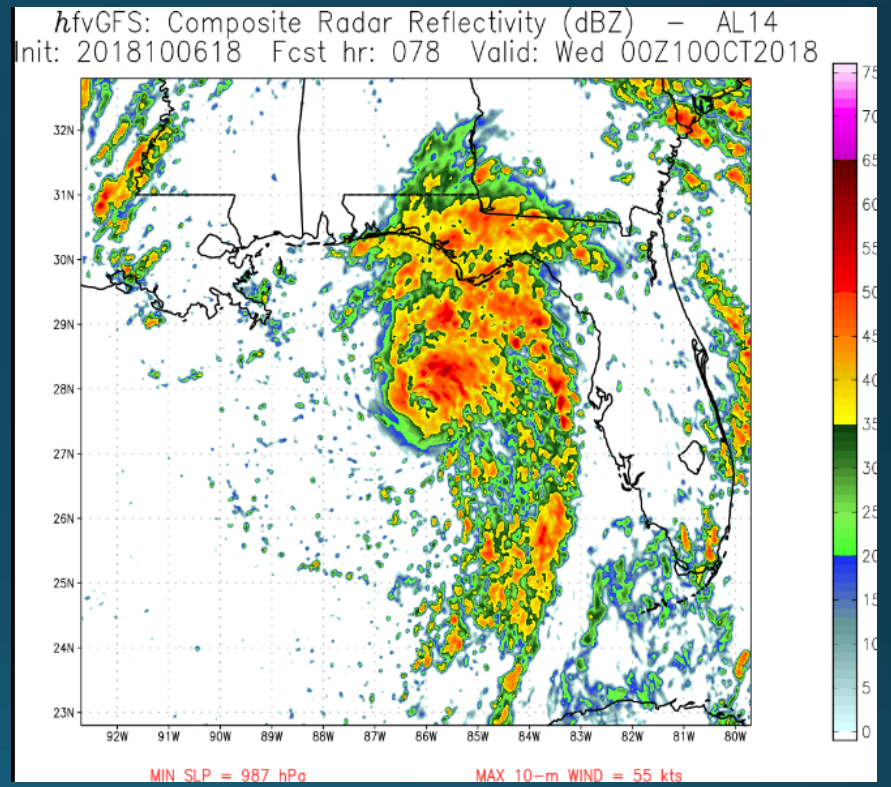
- Tracks generally consistent with observed (slight right bias)
- First 2 forecasts too weak
- Others generally showed deepening, although perhaps not as much as observed

Hurricane Michael: Structure Differences

Later Forecast: RI



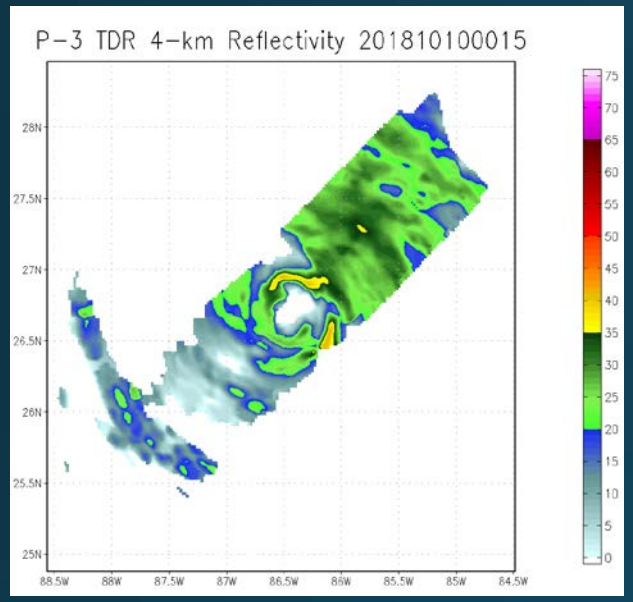
Early Forecast: No RI



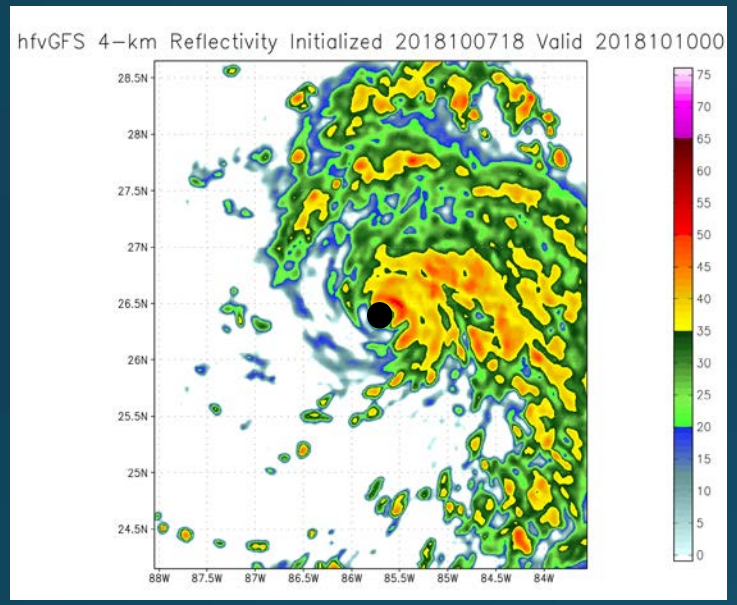
- Runs that predicted intensity more closely showed better upshear wrapping of precipitation
- Some runs seemed to show too much shear-relative asymmetry

Comparison With Radar Structure

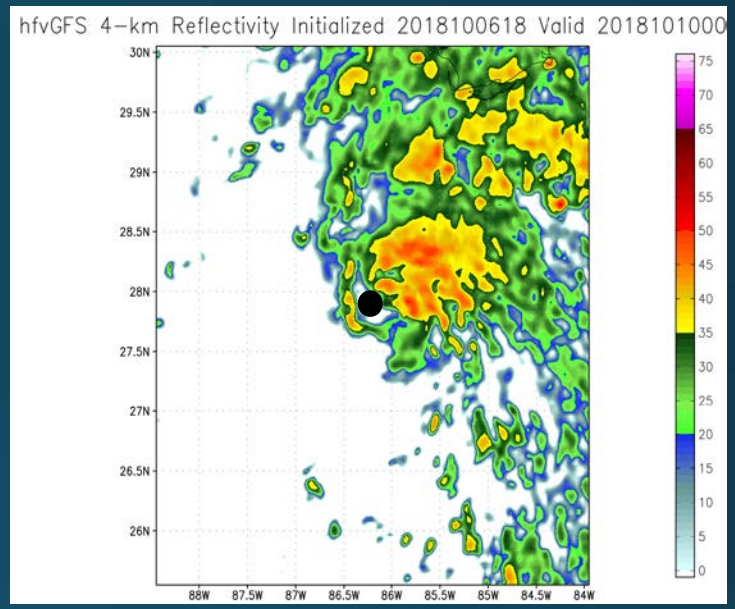
Observed



RI Forecast



Non-RI Forecast



- Both "good" and "bad" forecasts showed similar precip asymmetry
- More defined eyewall curvature in the "good" forecast
- Need to look at storm structure in more detail (local shear, vortex tilt)