# HWRF Ensemble Prediction System Performance
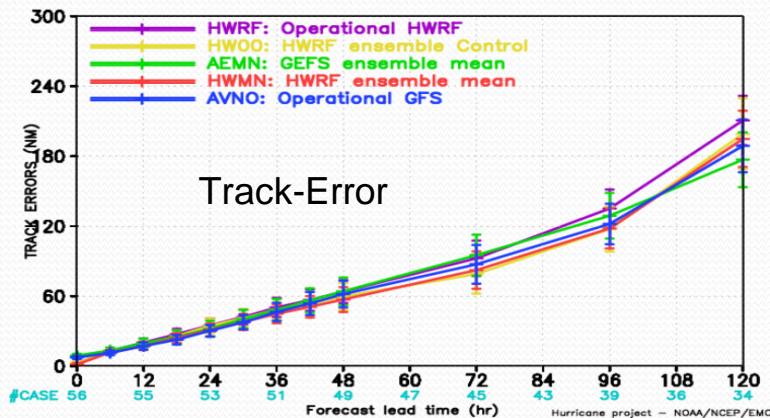# Hurricane Dorian (2019)

2019 HWRF ensemble Configuration

- ➢ Use then operational deterministic HWRF model except for
  - Reduced horizontal resolution: 14.5/4.5/1.5km vs. 18/6/2km
  - Reduced vertical resolution: L75 vs. L61 (L43 before 2018)
  - No GSI due to lack of GDAS data;

- ➢ IC/BC Perturbations (large scale): 20 member GEFS, 0.5x0.5 degree GRIB2

- ➢ Model Physics Perturbations (vortex scale):
  - Stochastic Convective Trigger Perturbations in SAS: -50hPa to + 50hPa white noise ;
  - Stochastic boundary layer height perturbations in PBL scheme, -20% to +20%;
  - Stochastic Cd perturbation;

- ➢ Situation-appropriate perturbations to the initial time position and intensity in TCVital.

- ➢ Initial ocean SST perturbations (Xiao Hui & Ryan Torn, added in 2017)
  - Climatological (2012-2016), GFS surface analysis
  - Remove climatological mean, scale to 0.5K standard deviation.
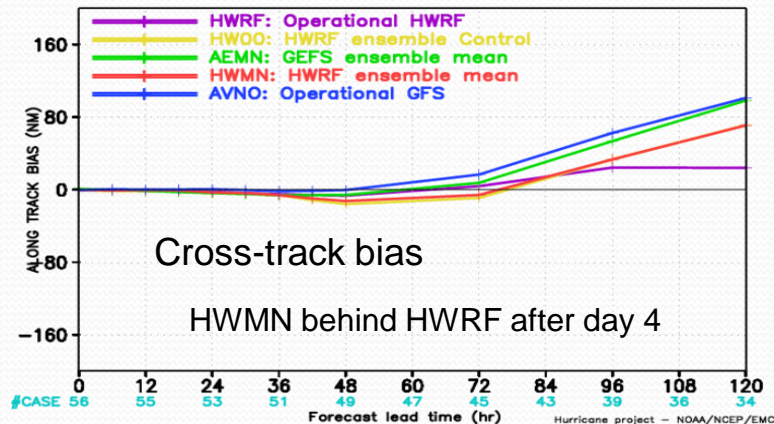 - Mix the initial SST perturbation downward into upper ocean (150 m).

Atlantic best track 2001-2013
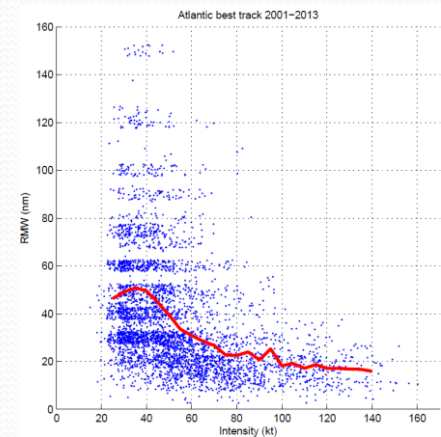
HWRF Based Ensemble Track Verification| Dorian 05L, 2019

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HWRF Based Ensemble Intensity Verification, Dorian 05L, 2019
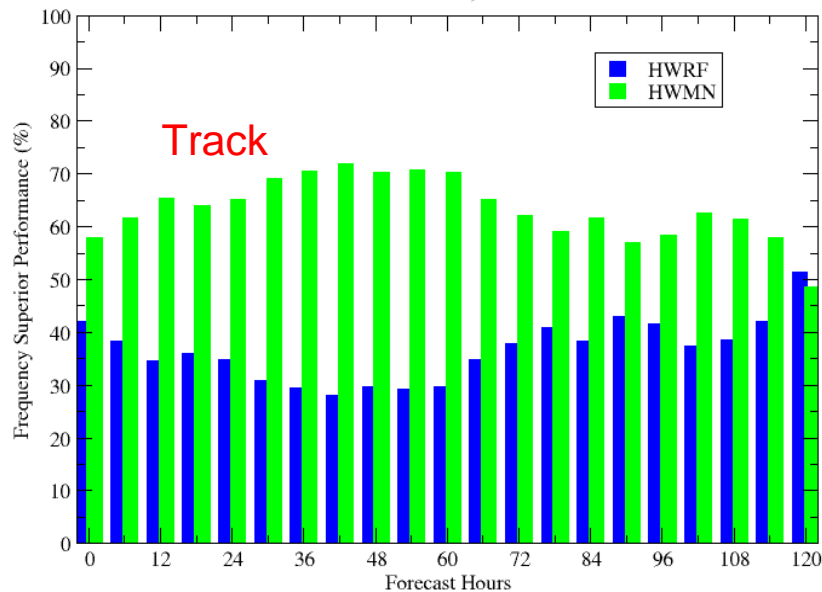

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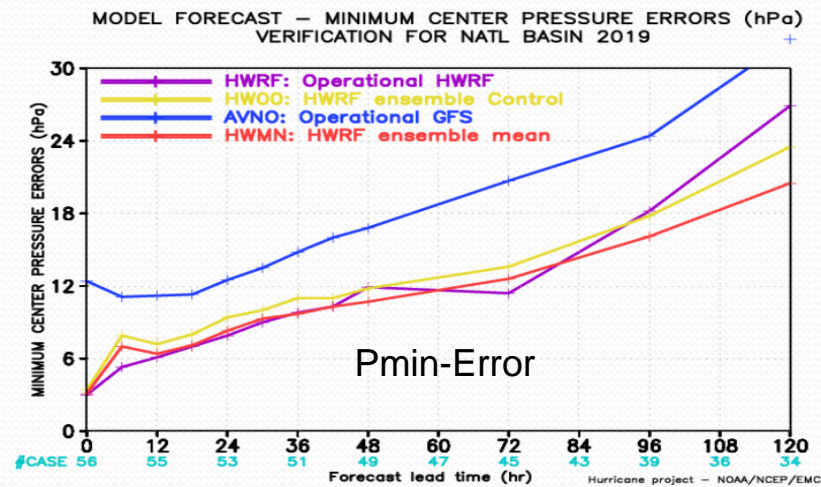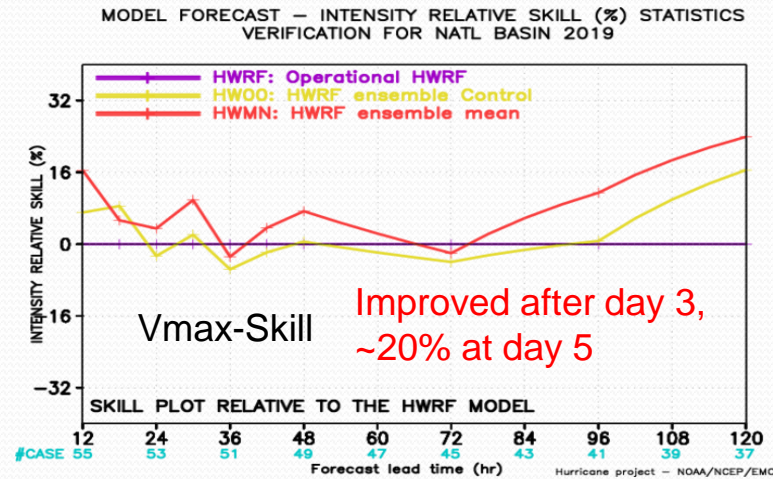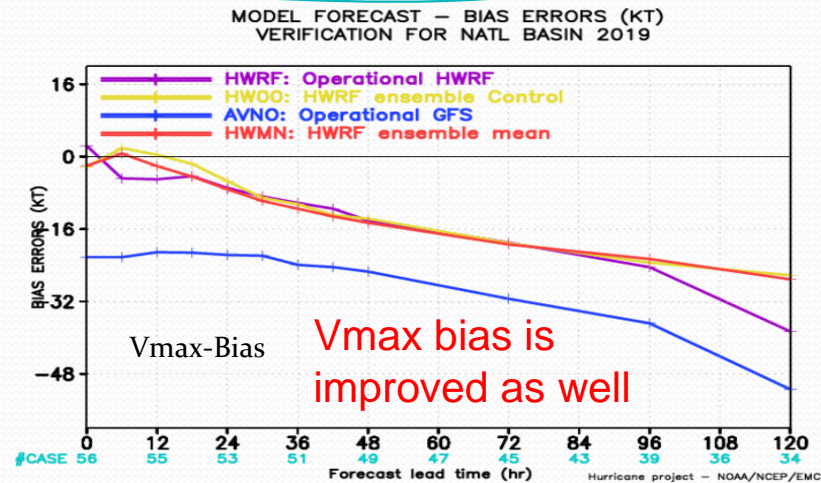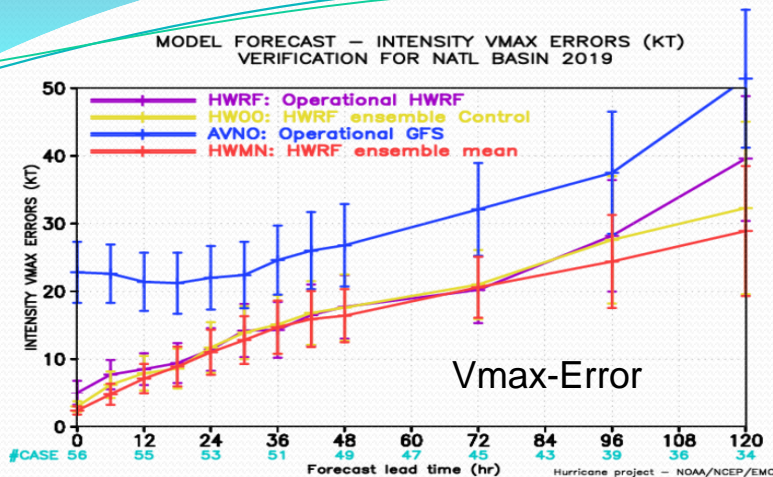
FSP for Track and Intensity
Dorian 05L 2019

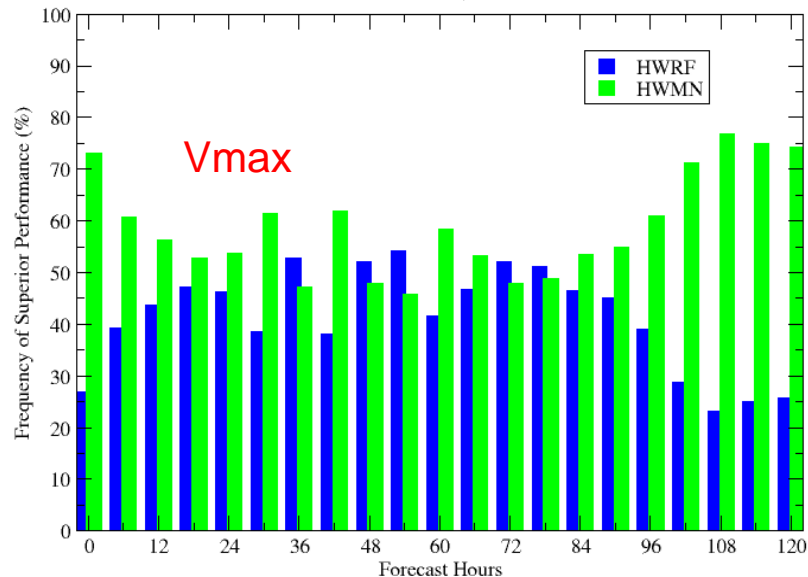Frequency of Superior Performace for Track Forecast
Dorian 05L, 2019

Track

HWRF
HWMN

Frequency Superior Performance (%)

Forecast Hours

Frequency of Superior Performance for Intensity Forecasts
Dorian 05L, 2019

Vmax

HWRF
HWMN

Frequency of Superior Performance (%)

Forecast Hours

HWRF ensemble mean outperformed the operational deterministic HWRF at most of forecast lead hours in terms of both track and intensity
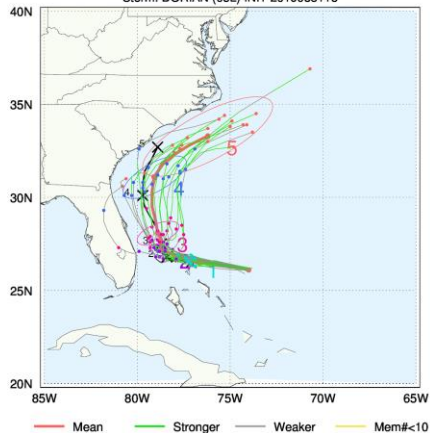
Ensemble Track and Intensity Spread
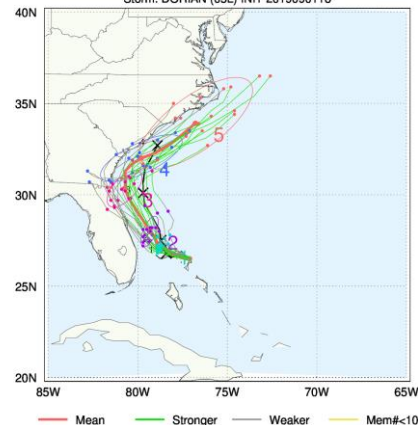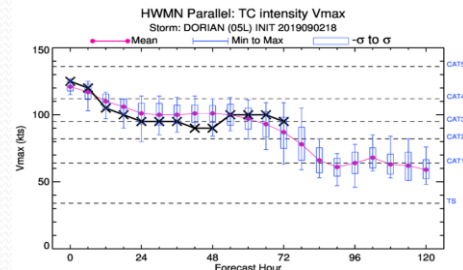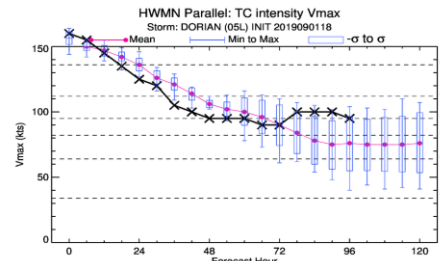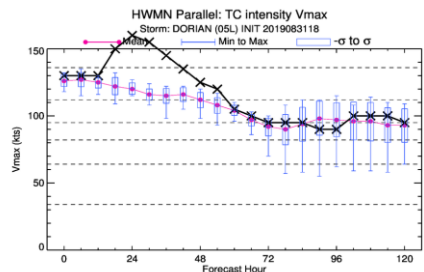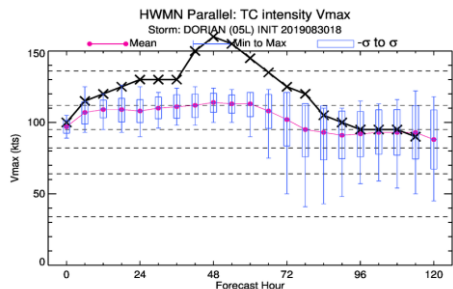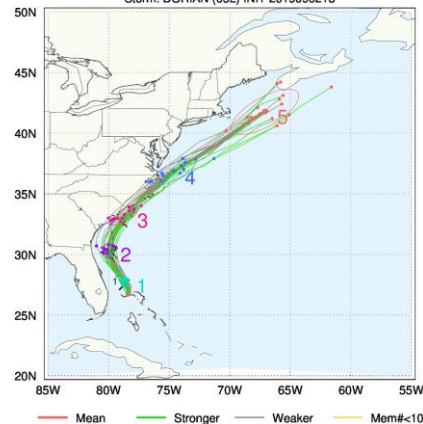
Ensemble track spread well indicated uncertainty and reliability of the track and intensity forecasts from dynamic models
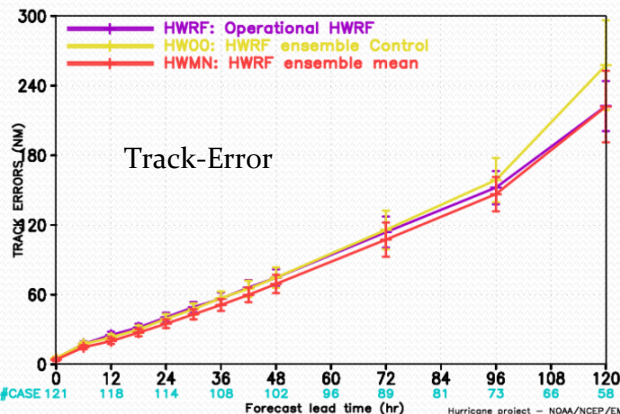Ensemble intensity is still under dispersed
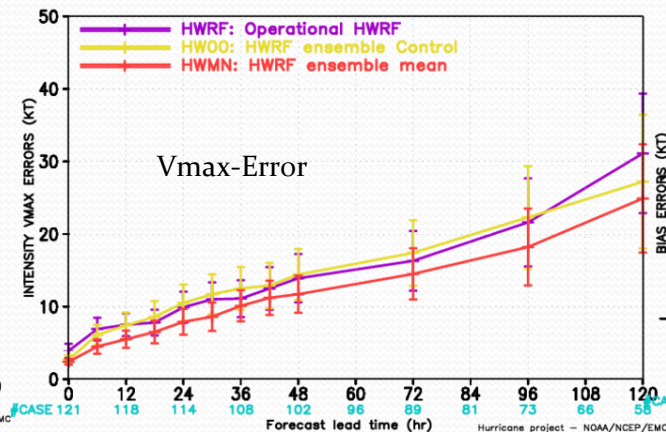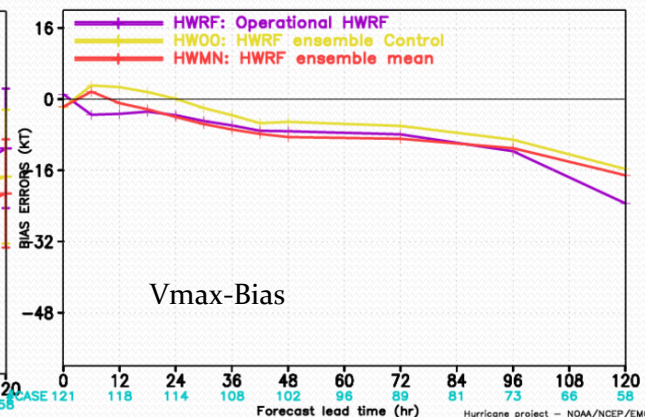Stronger ensemble members tended to recurring earlier than weaker members

MODEL FORECAST – TRACK ERRORS (NM)
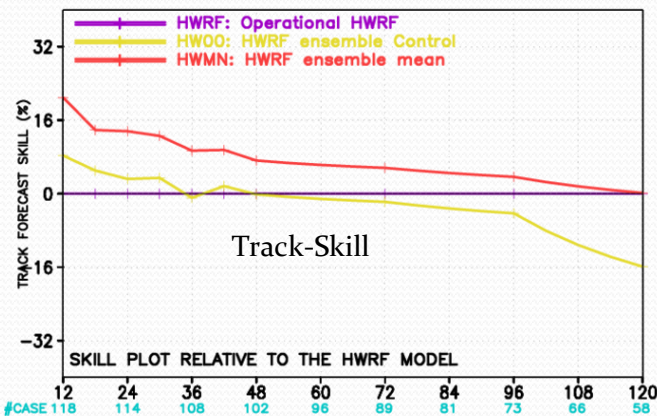VERIFICATION FOR NATL BASIN 2019

Track-Error

MODEL FORECAST – INTENSITY VMAX ERRORS (KT)
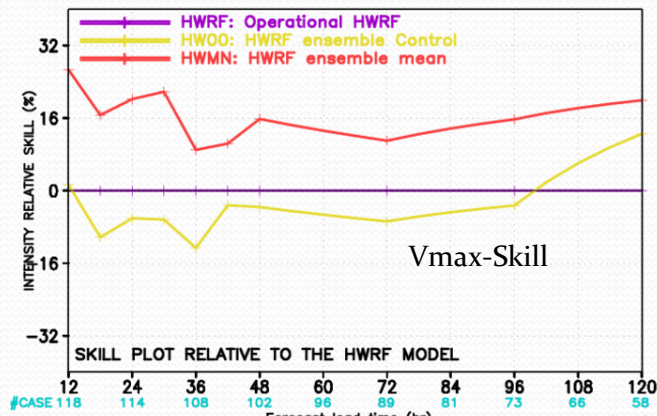VERIFICATION FOR NATL BASIN 2019

Vmax-Error

MODEL FORECAST – BIAS ERRORS (KT)
VERIFICATION FOR NATL BASIN 2019

Vmax-Bias

MODEL FORECAST – TRACK FORECAST SKILL (%) STATISTICS
VERIFICATION FOR NATL BASIN 2019

Track-Skill

MODEL FORECAST – INTENSITY RELATIVE SKILL (%) STATISTICS
VERIFICATION FOR NATL BASIN 2019

Vmax-Skill

Improved track
forecasts from
HWRF ensemble,
and ~16% intensity
improvement over
deterministic HWRF
at all lead time

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