

2019 Basin-scale HWRF (HWRF-B)

An HFIP Real-Time Demonstration Project on WCOSS

PRELIMINARY RESULTS FOR HURRICANE DORIAN (AL052019)

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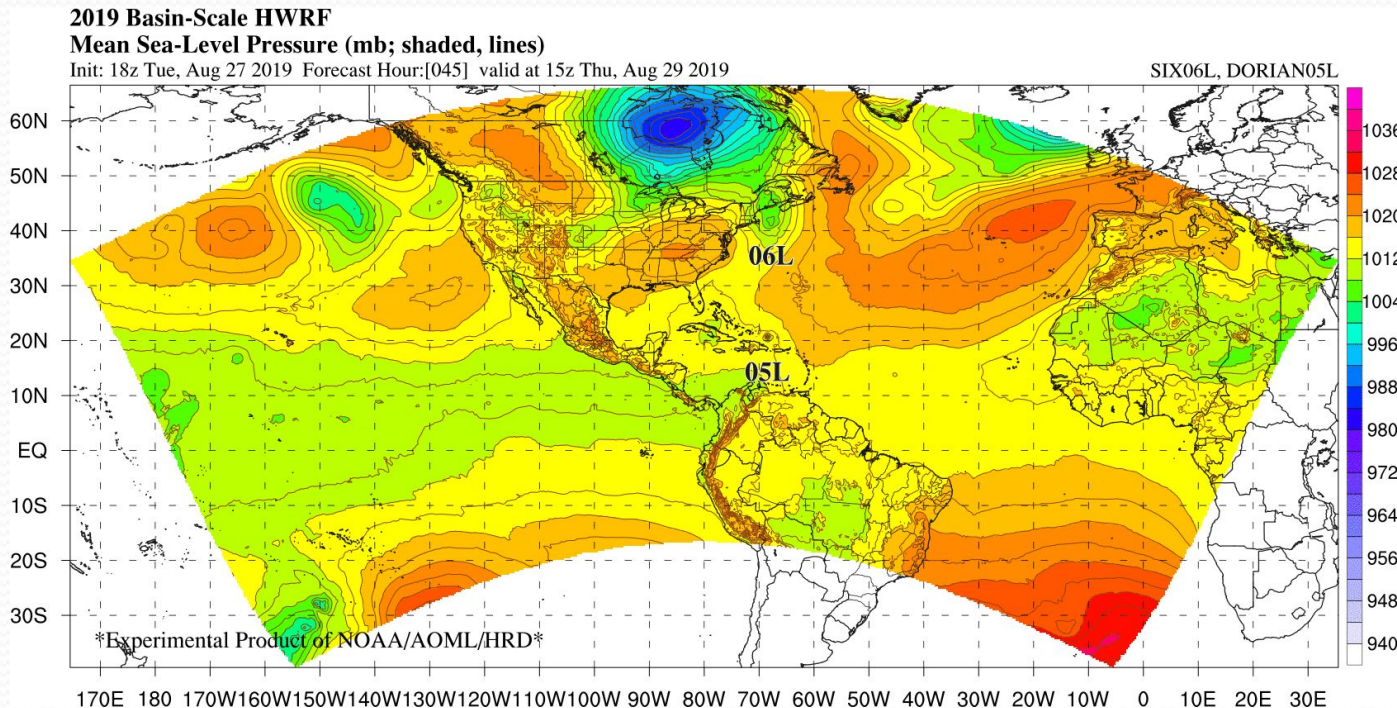
⁴UM Cooperative Institute for Marine and Atmospheric Studies



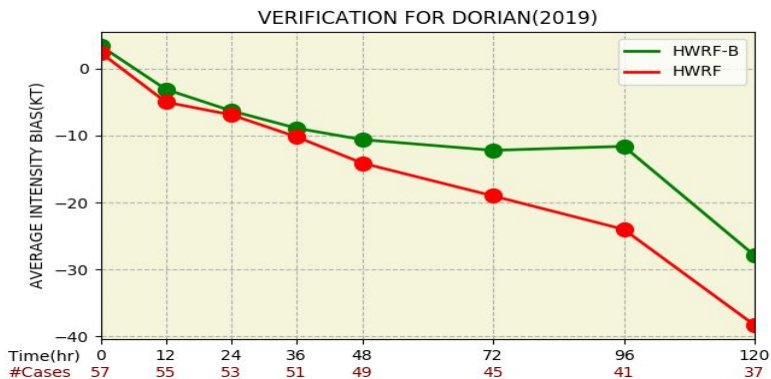
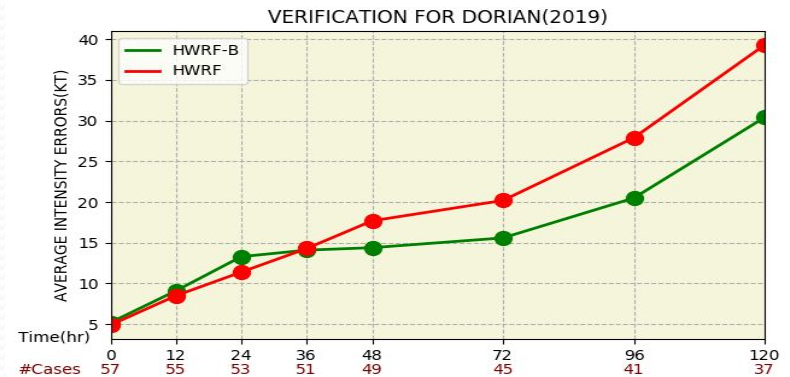
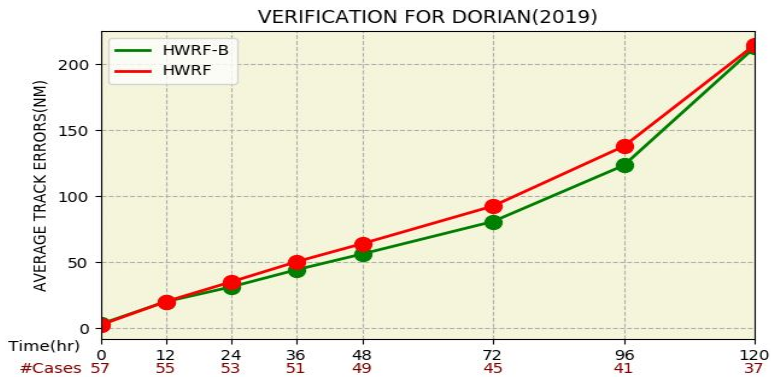
HWRF-B Configuration

HWRF-B configuration is identical to HWRF, except for:

1. Large, static outermost domain that covers NATL, EPAC, and CPAC
2. Multiple sets of movable multi-level nests
3. RTOFS initialization for POM
4. No TDR-based hybrid data assimilation



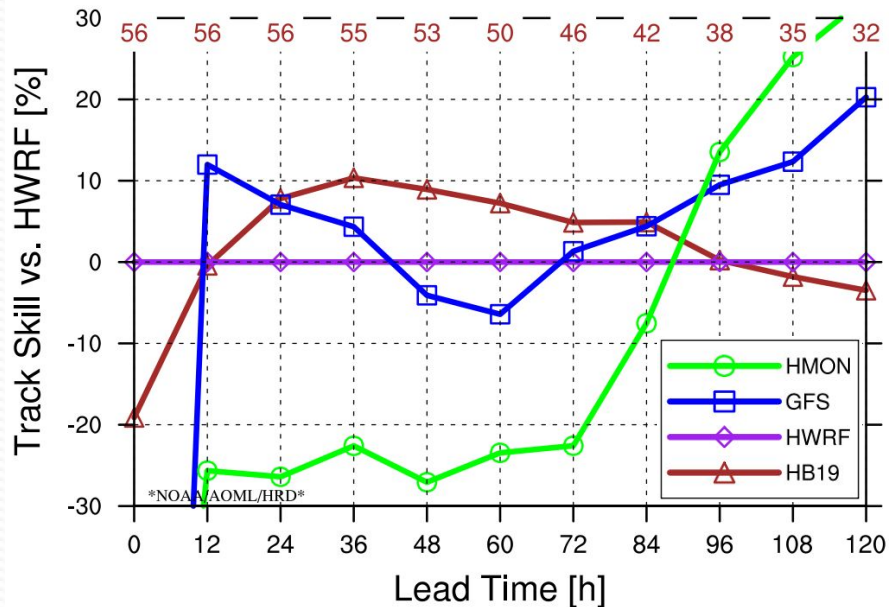
Track and Intensity Verification for DORIAN (HWRF-B vs. HWRF)



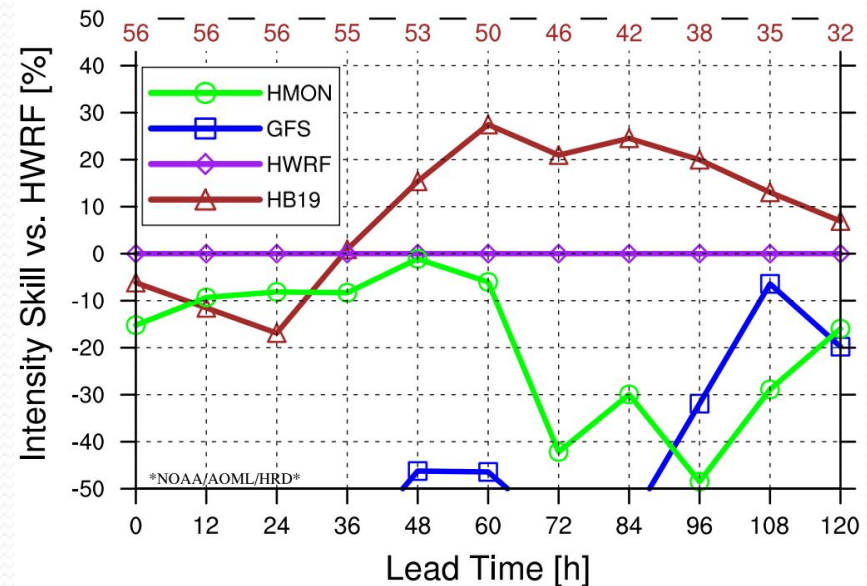
- HWRF-B has **lower track errors** than HWRF at 24-96 h
- HWRF-B has **lower absolute intensity errors** at 48-120 h
- HWRF-B **intensity bias is improved** at 12-120 h

Track and Intensity Skill Verification for DORIAN (HWRF-B vs. HWRF)

Track Skill vs. HWRF



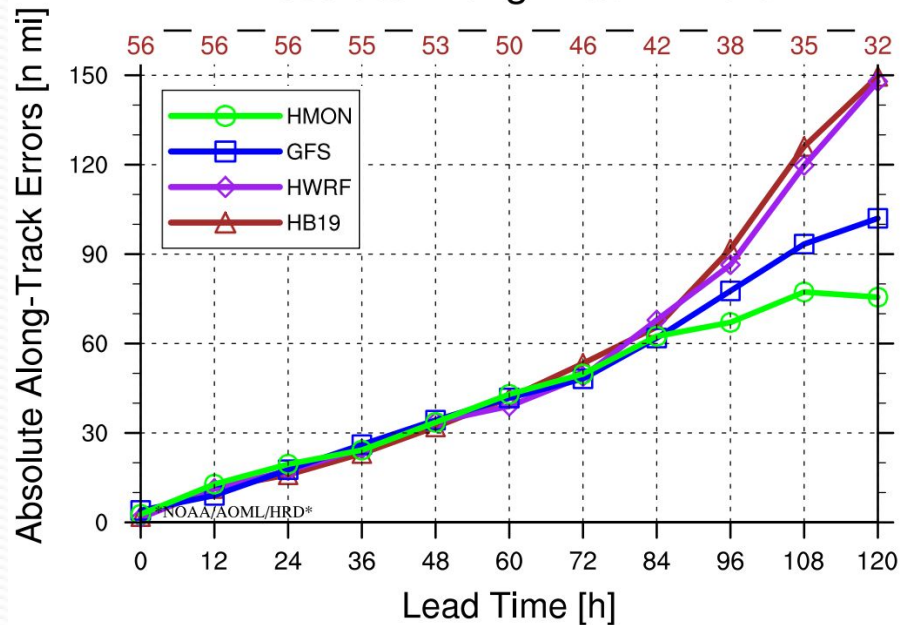
Intensity Skill vs. HWRF



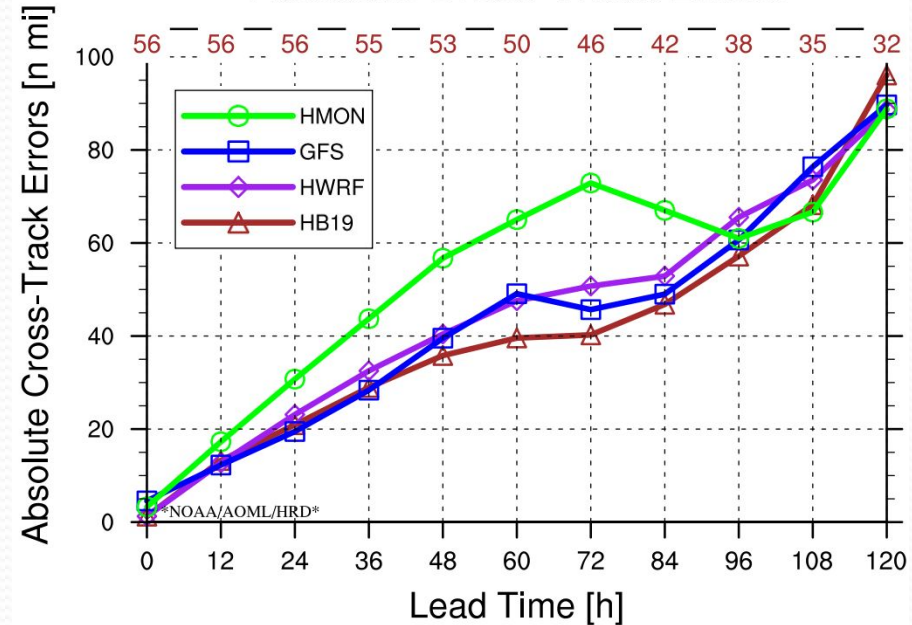
- Ignore skills at 0-h
- HWRF-B track is **more skillful** than HWRF from 24-84 h
- HWRF-B intensity is **more skillful** than HWRF from 48-120 h
 - Degradation at earlier lead times may be related to the lack of hybrid DA in HWRF-B

Along-Track and Cross-Track Verification for DORIAN (HWRF-B vs. HWRF)

Absolute Along-Track Errors

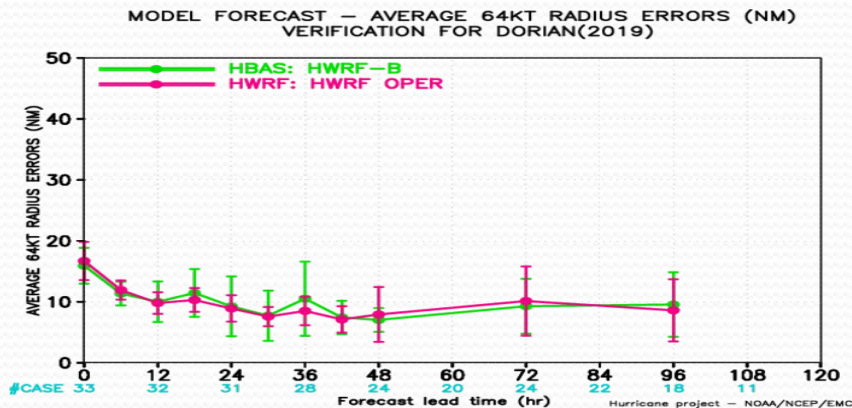
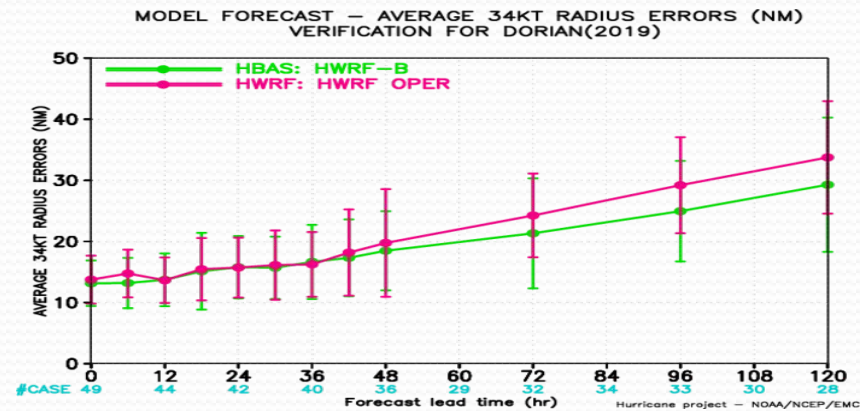
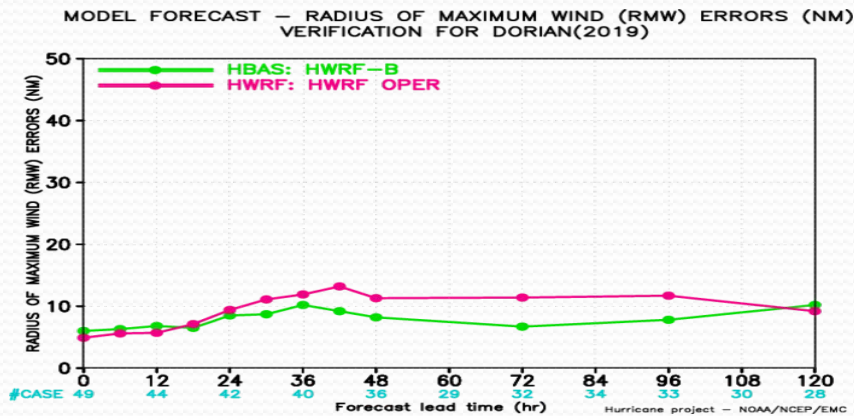


Absolute Cross-Track Errors



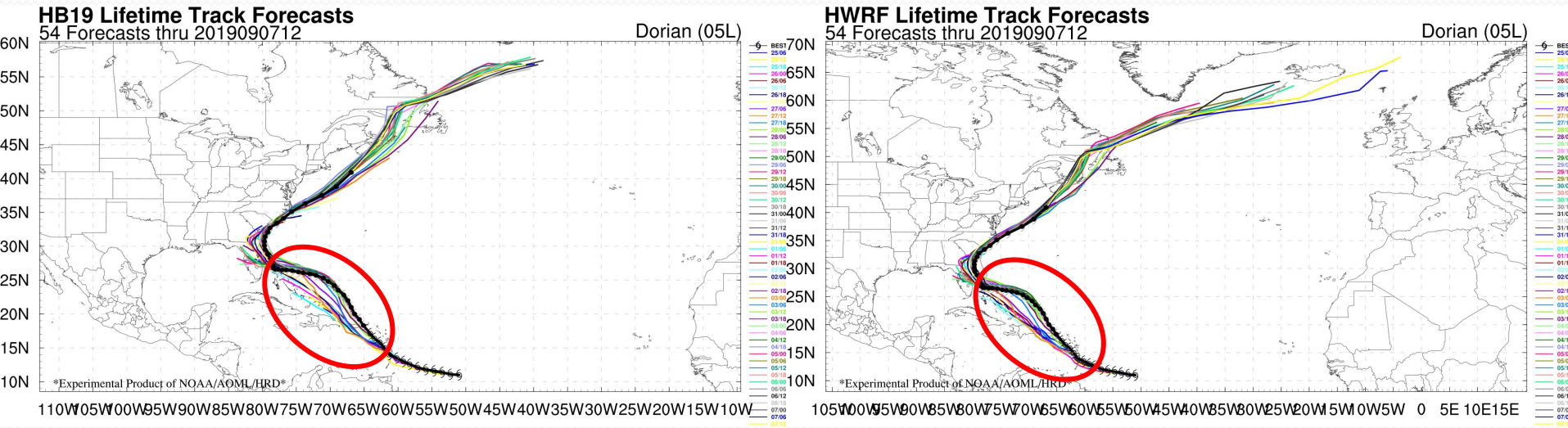
- Along-track errors are **very similar** for HWRF-B and HWRF.
- HWRF-B cross-track errors are **lower** than HWRF at most lead times.

Wind Radii Verification for DORIAN (HWRF-B vs HWRF)



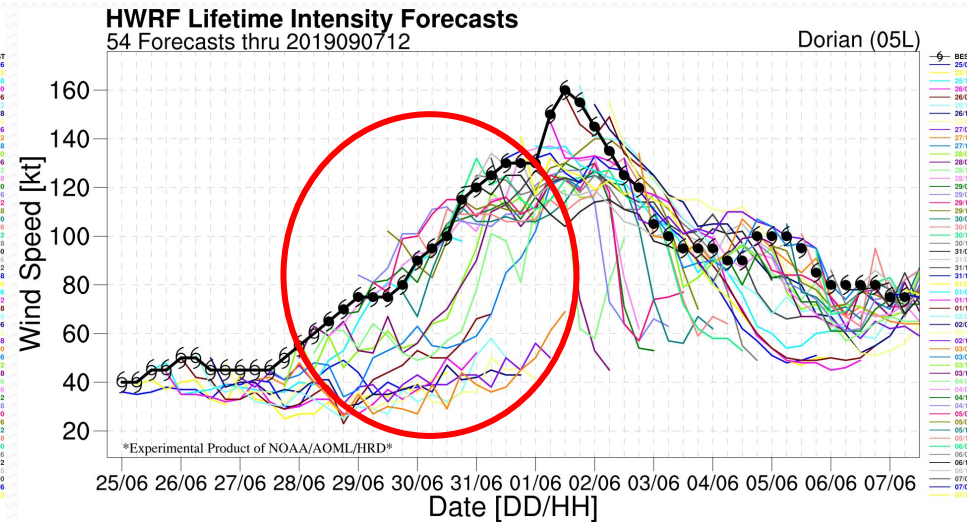
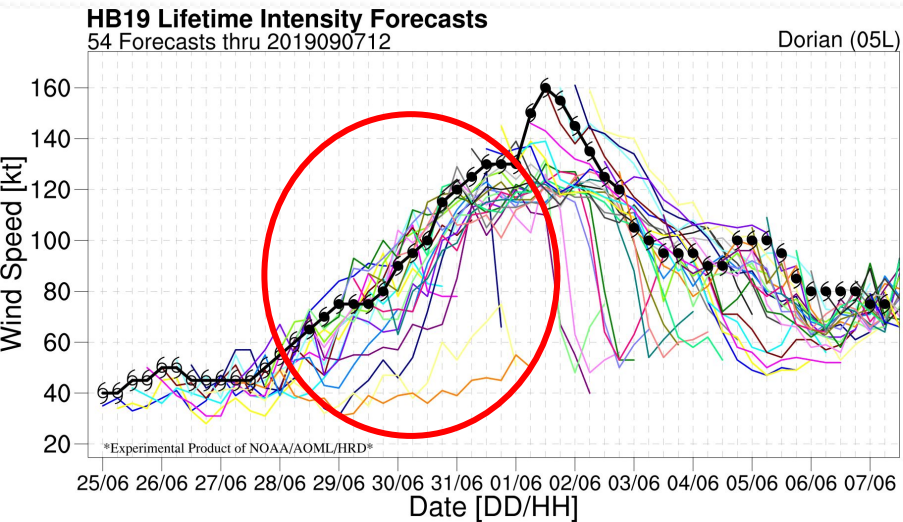
- Radius of maximum wind and 34KT radius errors for HWRF-B **are better** than HWRF, especially at later lead times.
- 64KT radius errors **are comparable** for HWRF-B and HWRF

Lifetime Track Forecasts for DORIAN (HWRF-B vs. HWRF)



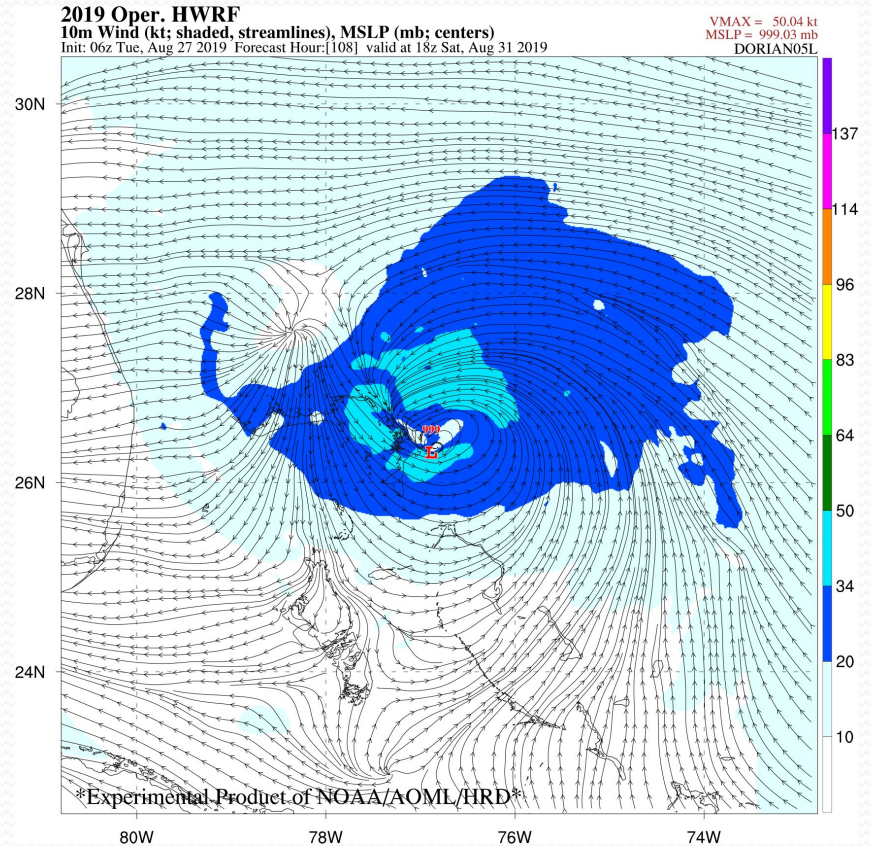
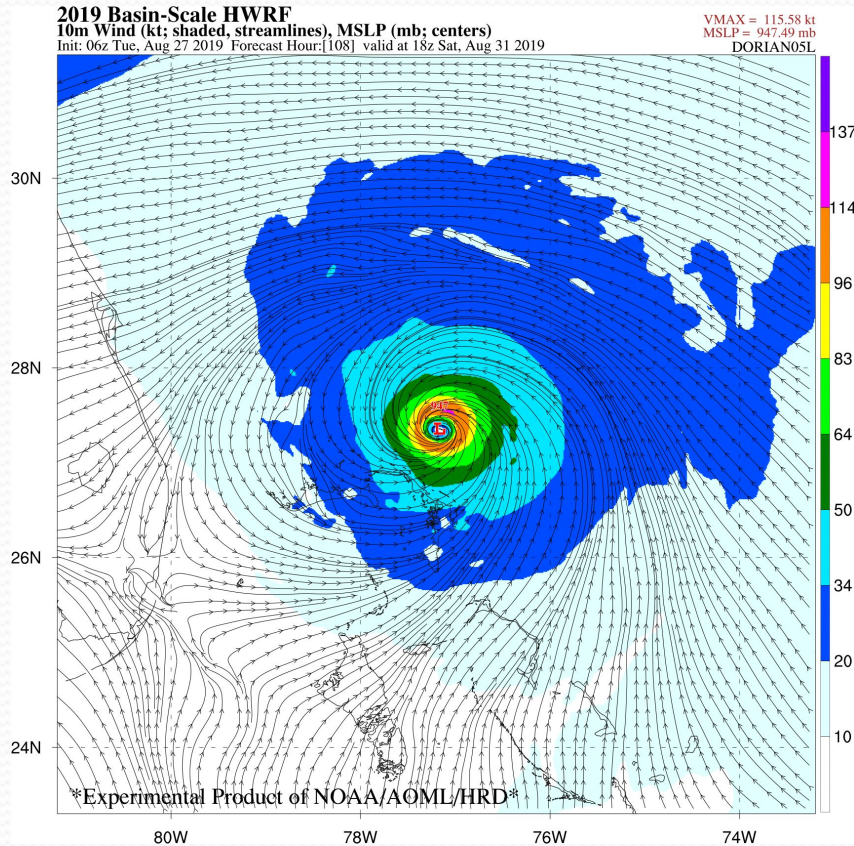
- HWRF-B was **better** than HWRF near the Greater Antilles
 - Fewer forecasts with Hispaniola landfall
 - Implications for intensity forecasts
- HWRF-B and HWRF both had a **left bias** near FL
 - Resulted in more FL landfall forecasts for both models
 - More forecasts were offshore for HWRF-B

Lifetime Intensity Forecasts for DORIAN (HWRF-B vs. HWRF)



- HWRF-B was **better** than HWRF during the critical intensification period
- HWRF had **more weaker systems** due to interaction with the Greater Antilles
- Both HWRF-B and HWRF topped out near 125 kt
 - Both missed the maximum intensity

DORIAN Case Study: 2019082706 (HWRF-B vs. HWRF)



- HWRF-B intensity and 10m wind structure is **more realistic** than HWRF
 - BEST: VMAX = 130 kt, PMIN = 941 mb
 - HWRF-B: VMAX = 115 kt, PMIN = 947 mb
 - HWRF: VMAX = 50 kt, PMIN = 999 mb

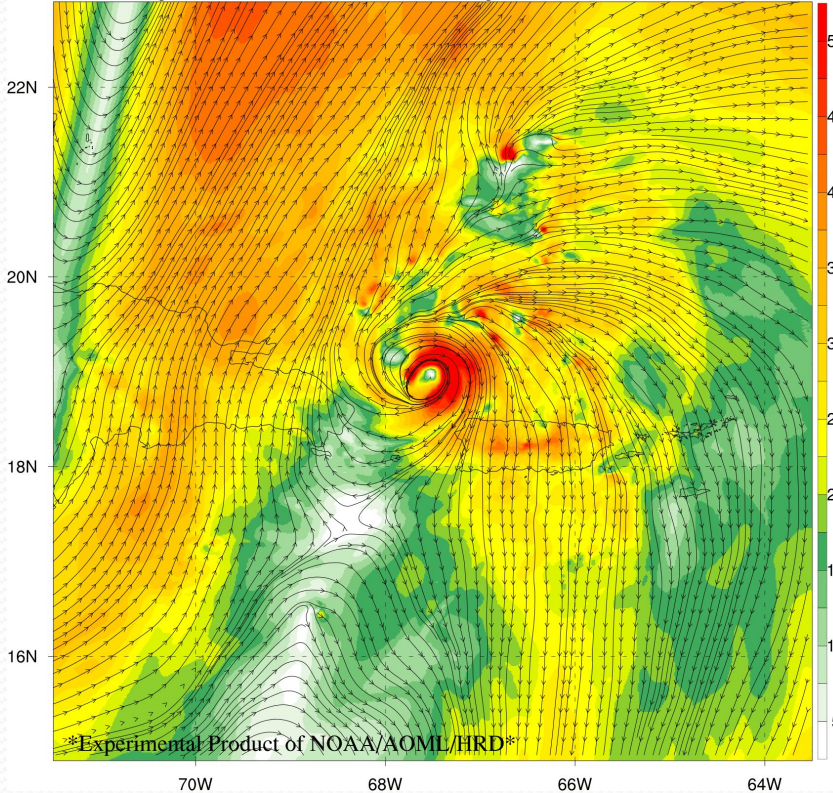
DORIAN Case Study: 2019082706 (Near-Storm Environment @ 48 h)

2019 Basin-Scale HWRP

Deep-Layer (200-850mb) Wind Shear (kt; shaded, lines)

Init: 06z Tue, Aug 27 2019 Forecast Hour:[048] valid at 06z Thu, Aug 29 2019

VMAX = 52.73 kt
MSLP = 997.75 mb
DORIAN05L

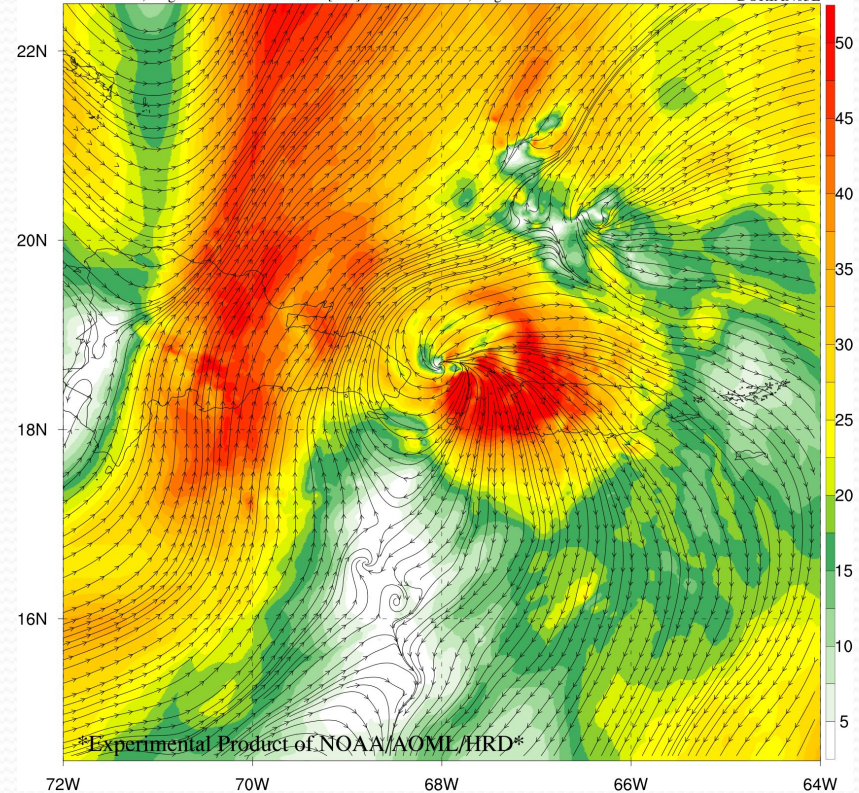


2019 Oper. HWRP

Deep-Layer (200-850mb) Wind Shear (kt; shaded, lines)

Init: 06z Tue, Aug 27 2019 Forecast Hour:[048] valid at 06z Thu, Aug 29 2019

VMAX = 38.30 kt
MSLP = 1004.57 mb
DORIAN05L



- **Deep-layer shear** is 10-15 kt weaker associated with the ULL to the west of Dorian.
- Dorian location differences may be associated with subtle **steering flow** differences as well.

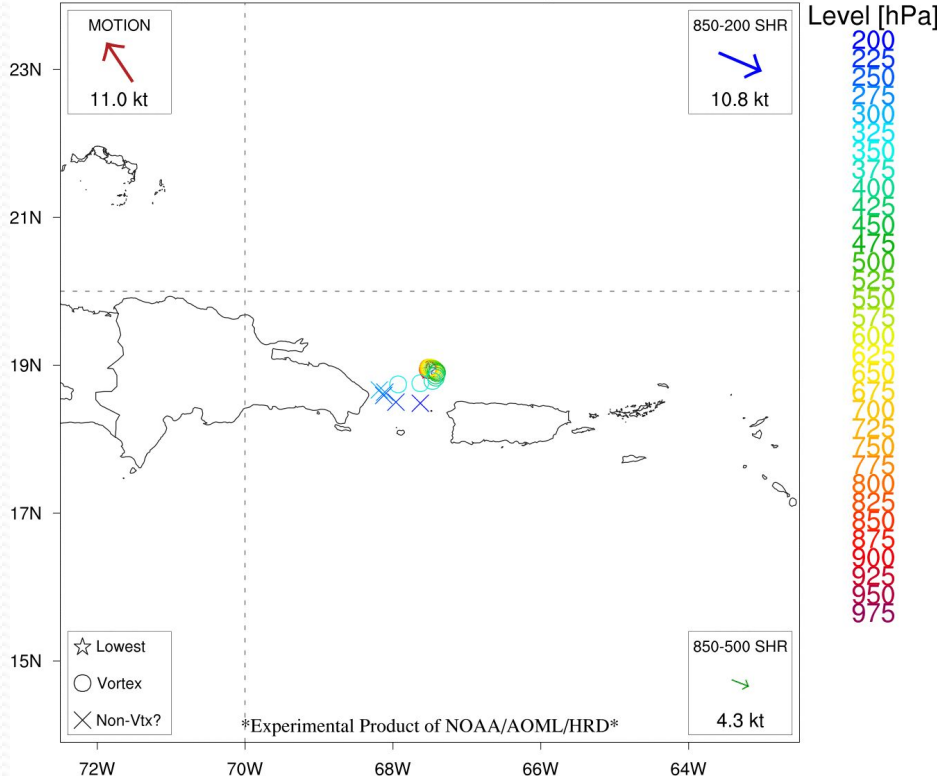
DORIAN Case Study: 2019082706 (Vortex Structure @ 48 h)

2019 Basin-Scale HWRF

Center Fixes [geopotential height centroid]

Init: 06z Tue, Aug 27 2019 Forecast Hour:[048] valid at 06z Thu, Aug 29 2019

DORIAN05L

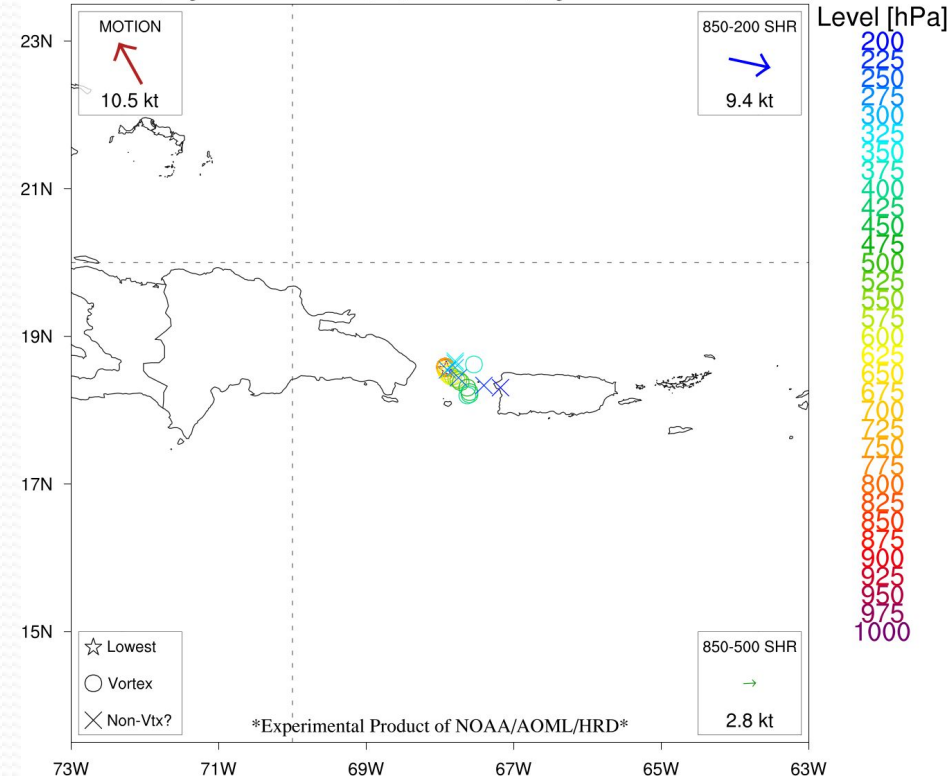


2019 Oper. HWRF

Center Fixes [geopotential height centroid]

Init: 06z Tue, Aug 27 2019 Forecast Hour:[048] valid at 06z Thu, Aug 29 2019

DORIAN05L



- HWRF-B is **more aligned up to 400 mb** than HWRF.
- HWRF has a **more distinct tilt to the SE** up to 400 mb.

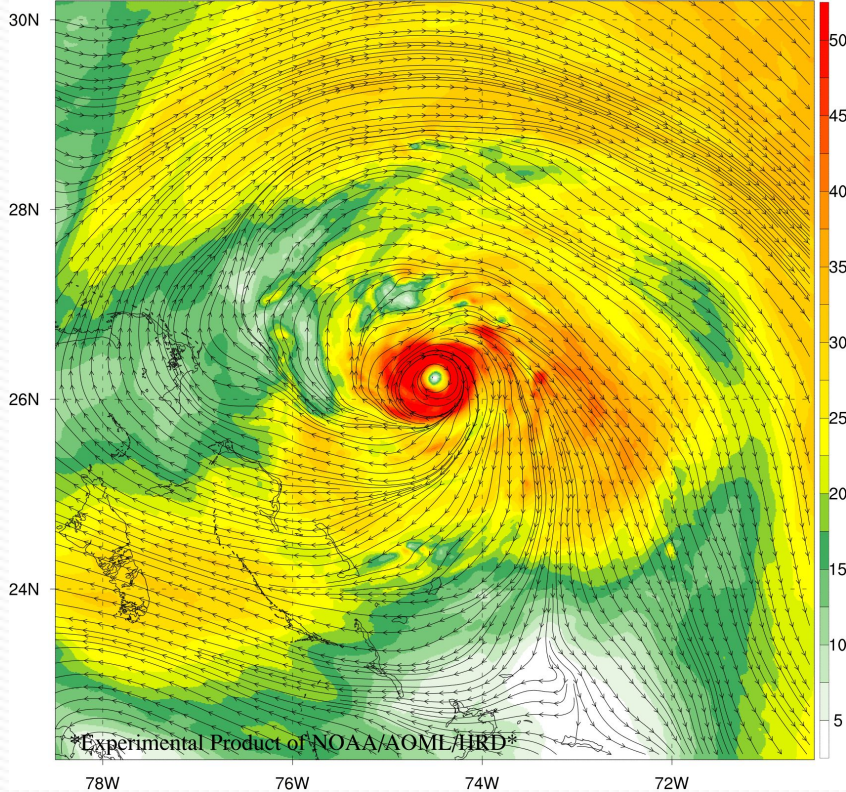
DORIAN Case Study: 2019082706 (Near-Storm Environment @ 96 h)

2019 Basin-Scale HWRF

Deep-Layer (200-850mb) Wind Shear (kt; shaded, lines)

Init: 06z Tue, Aug 27 2019 Forecast Hour:[096] valid at 06z Sat, Aug 31 2019

VMAX = 102.77 kt
MSLP = 963.74 mb
DORIAN05L

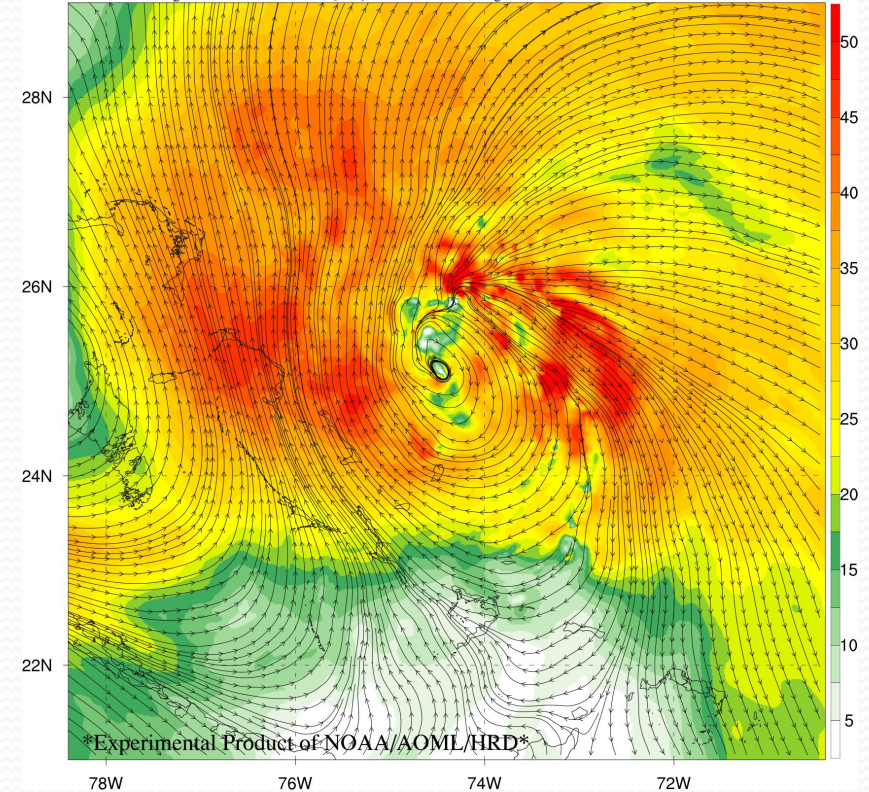


2019 Oper. HWRF

Deep-Layer (200-850mb) Wind Shear (kt; shaded, lines)

Init: 06z Tue, Aug 27 2019 Forecast Hour:[096] valid at 06z Sat, Aug 31 2019

VMAX = 43.22 kt
MSLP = 1006.32 mb
DORIAN05L



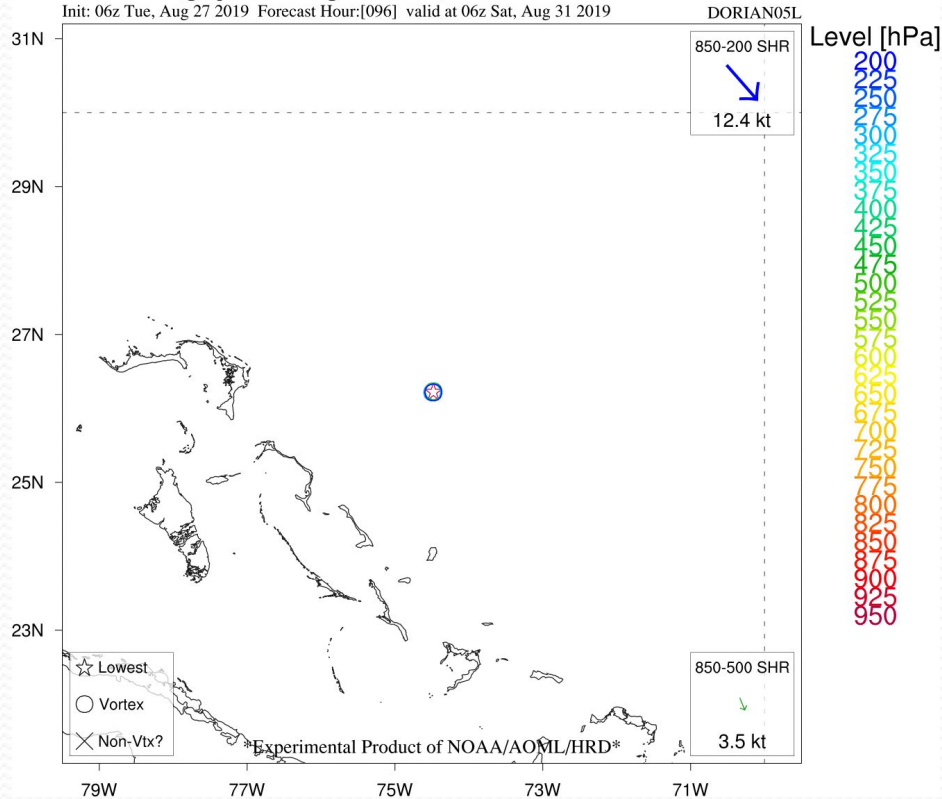
- HWRF-B has an anticyclone over Dorian and overall weaker shear than HWRF.
- HWRF is still contending with shear associated with the ULL to the west.

DORIAN Case Study: 2019082706 (Vortex Structure @ 96 h)

2019 Basin-Scale HWRFB

Center Fixes [geopotential height centroid]

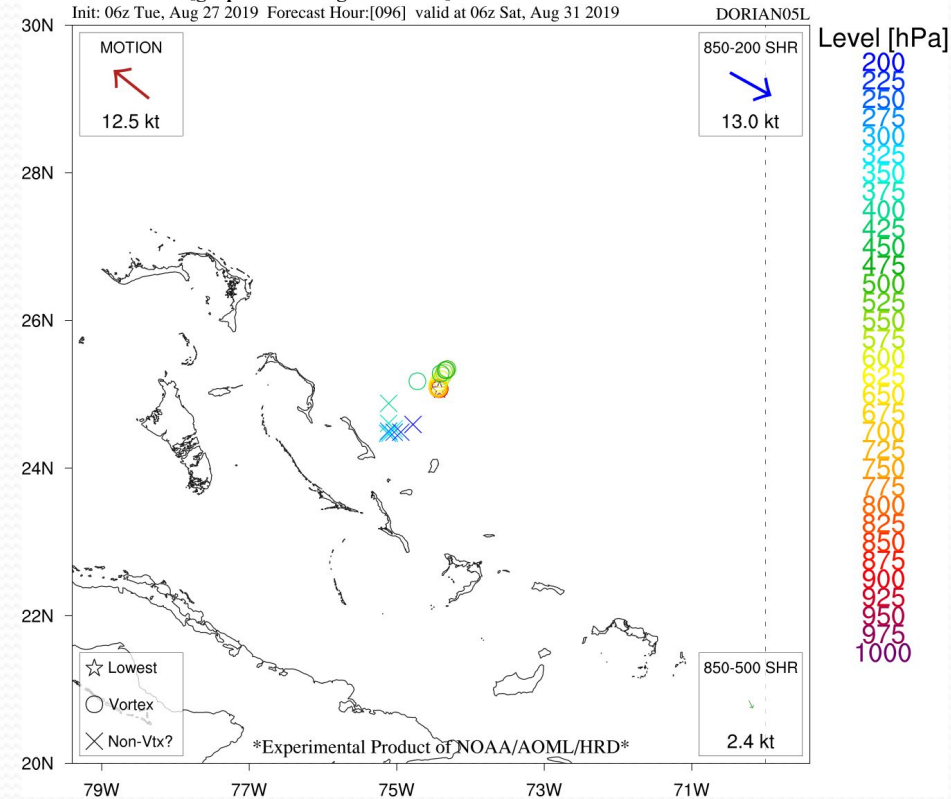
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2019 Oper. HWRFB

Center Fixes [geopotential height centroid]

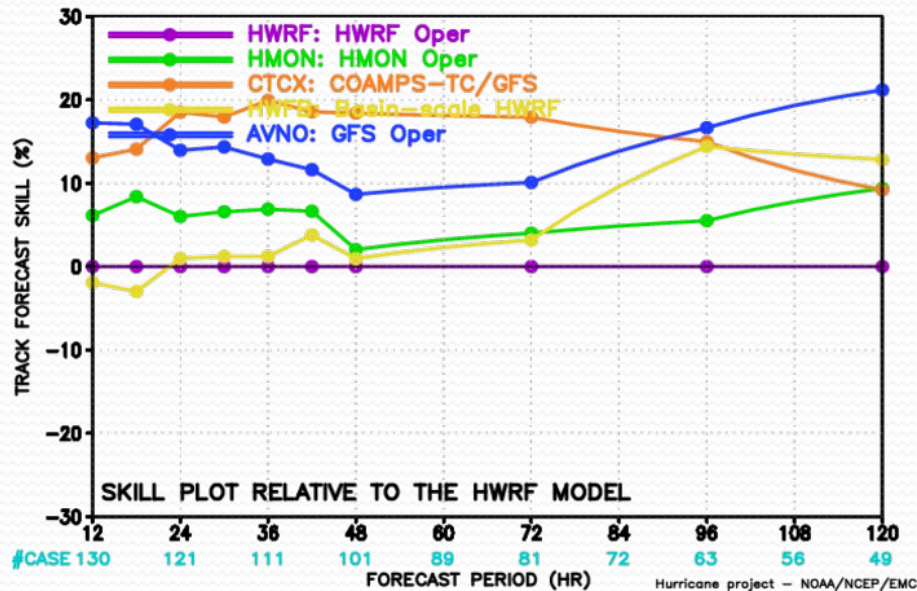
Init: 06z Tue, Aug 27 2019 Forecast Hour:[096] valid at 06z Sat, Aug 31 2019



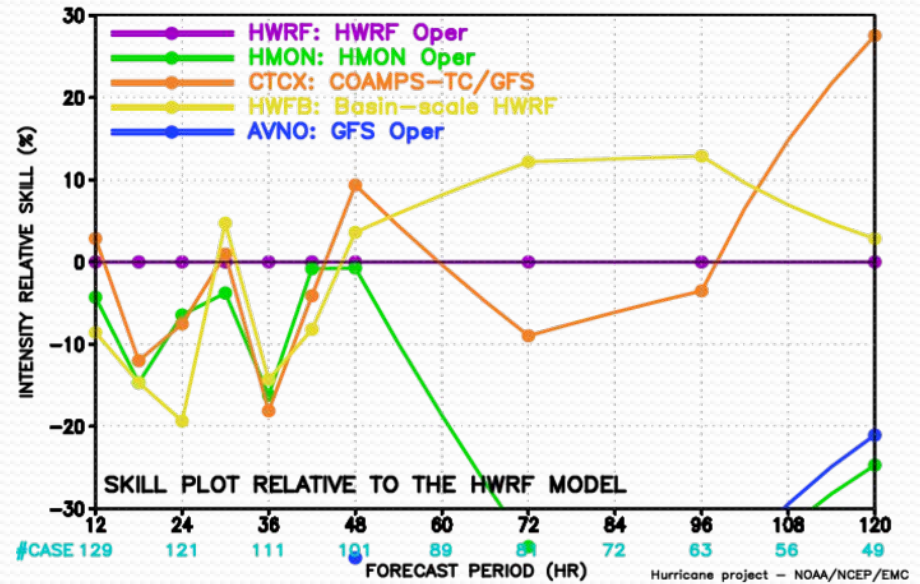
- HWRFB is **vertically aligned**.
- HWRFB still exhibits a **tilted** vortex structure.

Track and Intensity Skill Verification for 2019 NATL (HWRF-B vs. HWRF)

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



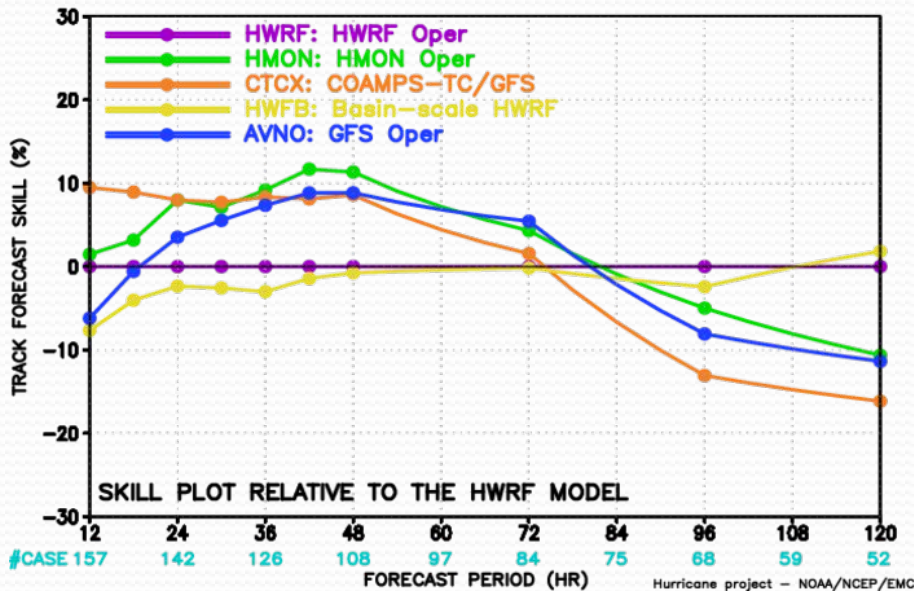
MODEL FORECAST – INTENSITY RELATIVE SKILL (%)
VERIFICATION FOR NATL BASIN



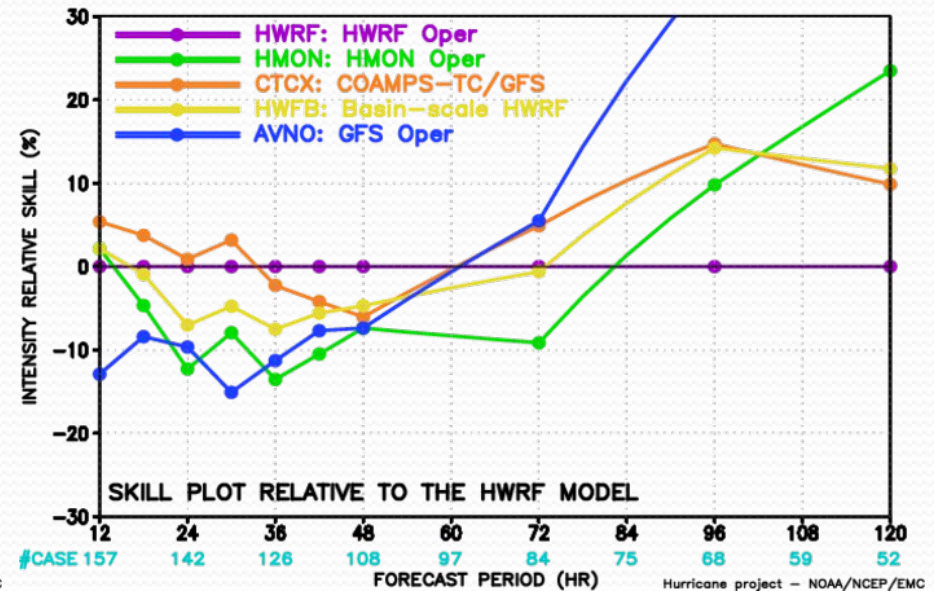
- HWRF-B track is **more skillful** than HWRF from 24-120 h
 - > 10% improvement on Days 4-5
- HWRF-B intensity is **more skillful** than HWRF from 48-120 h
 - > 10% improvement on Days 3-4
 - Degradation at earlier lead times may be related to the lack of hybrid DA in HWRF-B

Track and Intensity Skill Verification for 2019 EPAC (HWRF-B vs. HWRF)

MODEL FORECAST – TRACK FORECAST SKILL (%)
VERIFICATION FOR EPAC BASIN



MODEL FORECAST – INTENSITY RELATIVE SKILL (%)
VERIFICATION FOR EPAC BASIN



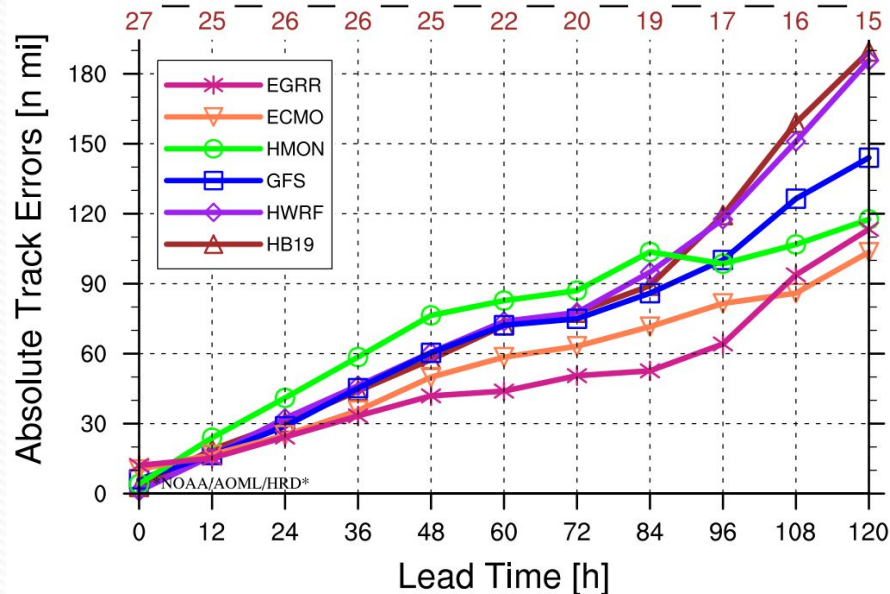
- HWRF-B track is **comparable** to HWRF at most lead times.
- HWRF-B intensity is **less skillful** than HWRF from 0-48 h (< 10%).
- HWRF-B intensity is **more skillful** than HWRF at 96 h and 120 h (> 10%).



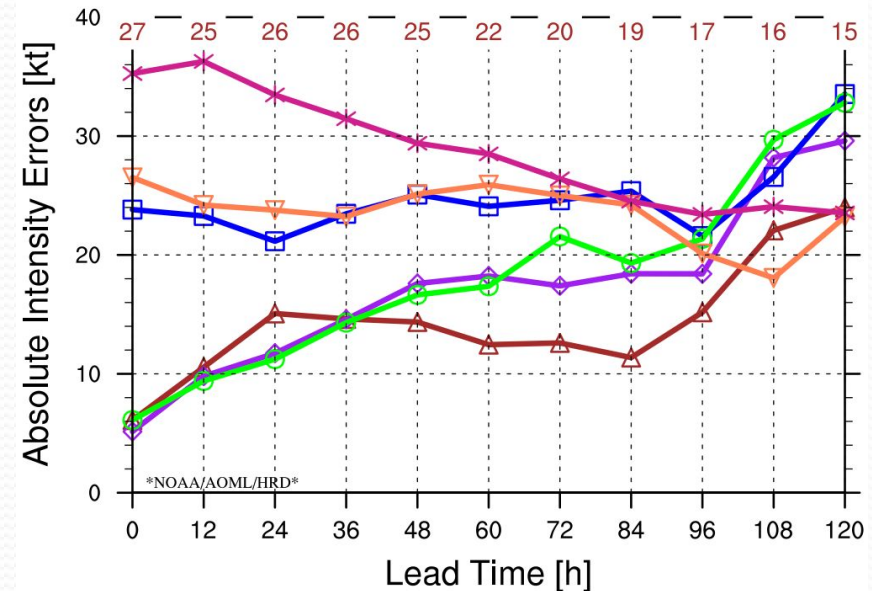
EXTRA MATERIAL

Track and Intensity Verification for DORIAN (HWRF-B vs. HWRF)

Absolute Track Errors



Absolute Intensity Errors

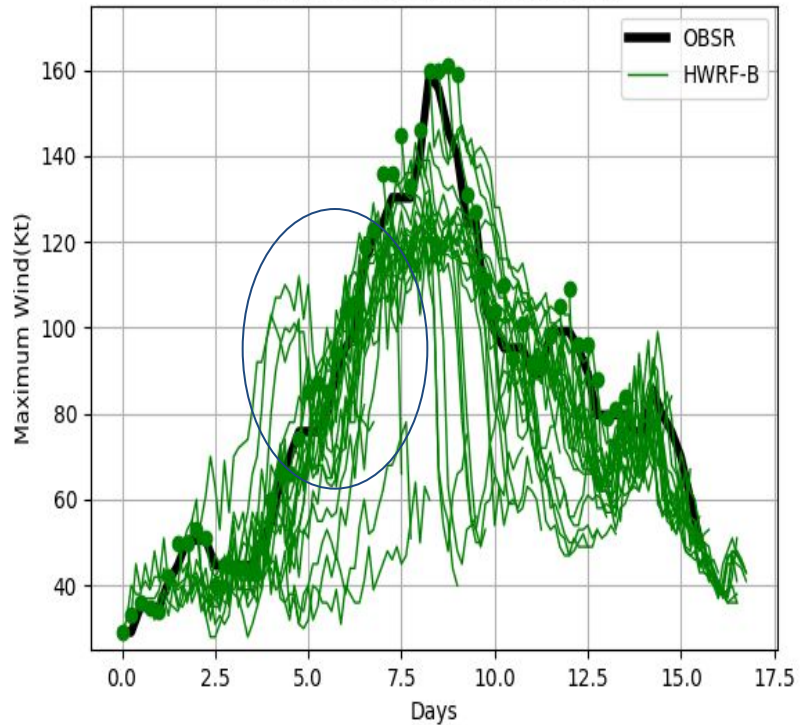


- EGRR was the best track model over most lead times
- HWRF-B was the best intensity model over most lead times

These results do not include HAFA or HAFB

HWRF-B versus HWRF composite intensity

Tropical Cyclone DORIAN(2019)



Tropical Cyclone DORIAN(2019)

