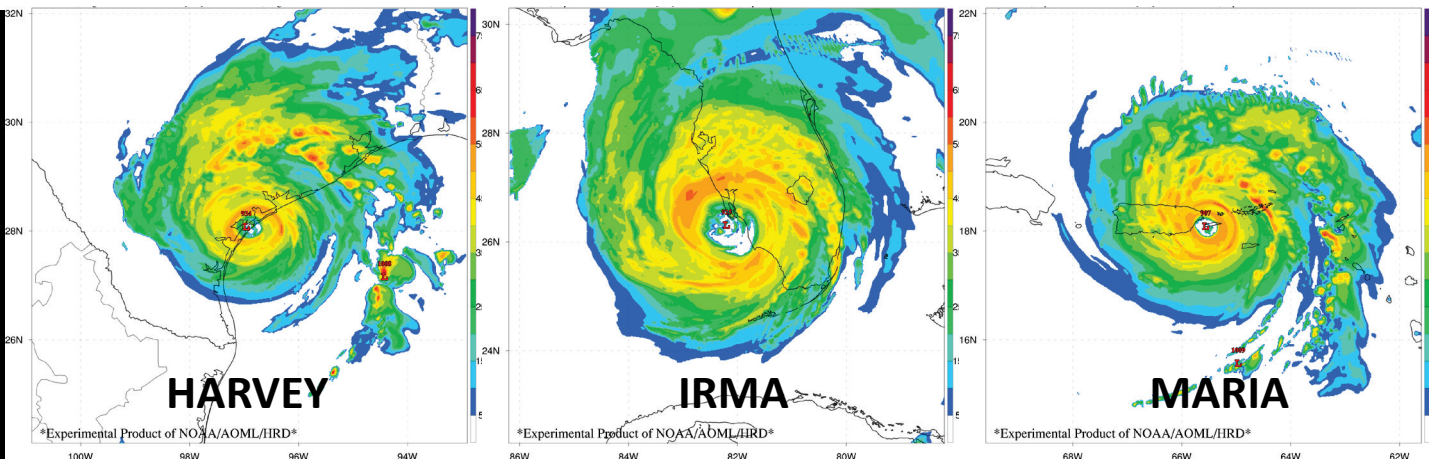




BASIN-SCALE HWRF:

Evaluation of 2017 Real-Time Forecasts



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Acknowledgements: NOAA/NWS/EMC, Developmental Testbed Center

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What is Basin-Scale HWRF?

An experimental version of the community HWRF developed at NOAA/AOML/HRD in collaboration with NOAA/NWS/EMC and DTC, uniquely configured to serve as a testbed for the Real Time Product

Two key papers:

- X. Zhang et al. (WAF, 2016) of H
- Alaka et al. (WAF, 2017)

Primary Objectives:

The 2017 version is

1. To improve TC guidance available for referred to as HB17.

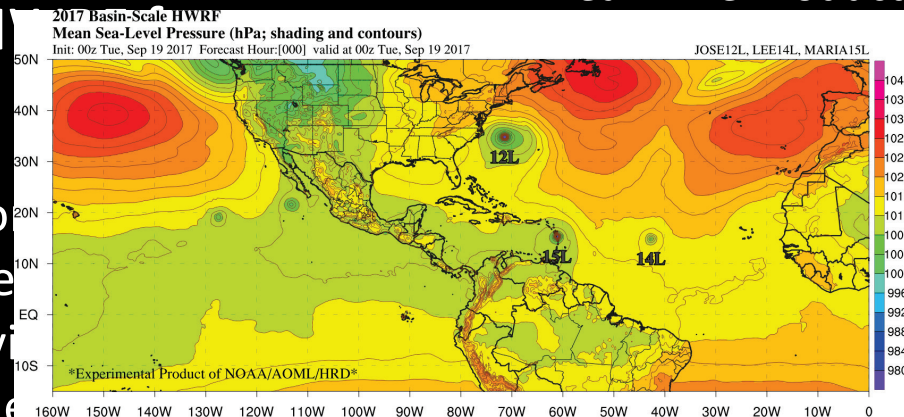
2. To study TC-TC, TC-land, and TC-envi

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4. To explore new data assimilation & ens

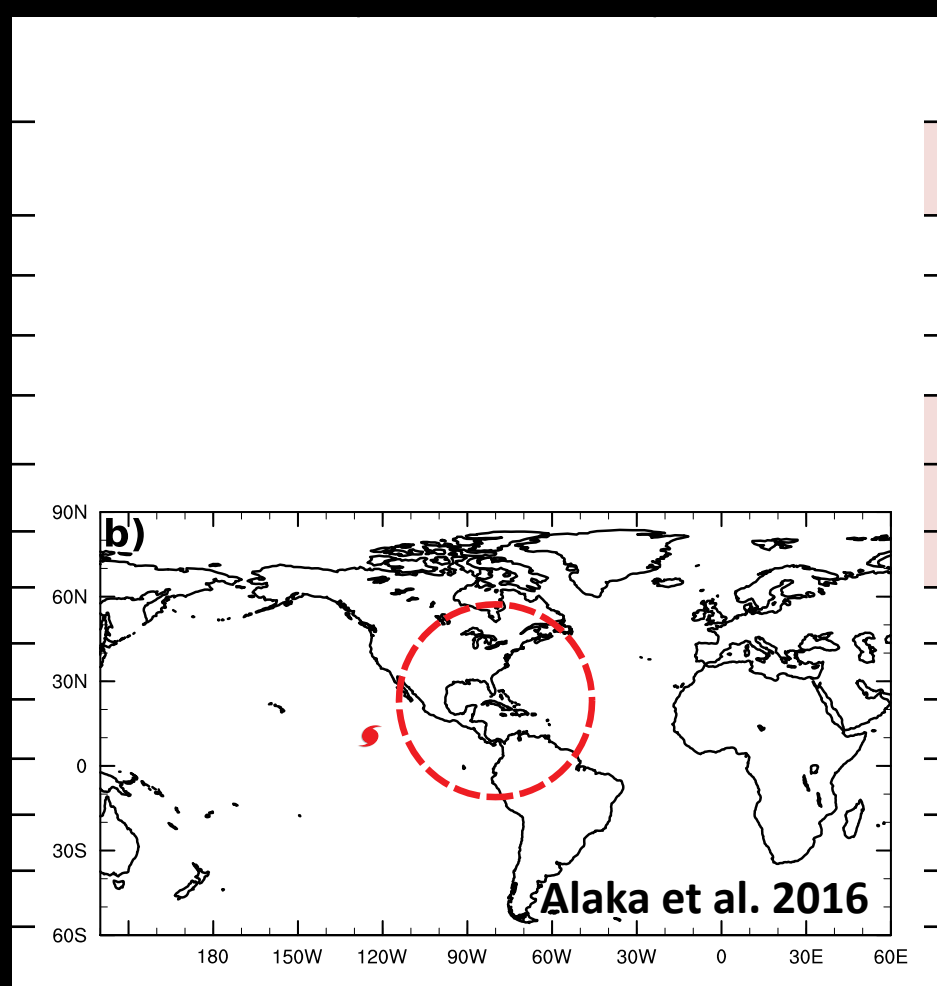
<http://external.gov/bsin>

6. To improve TC genesis guidance



HB17 Configuration

- Dynamical core is identical to the 2017 operational HWRF (**H217**)
- Most configuration options are identical
 - All physics, vertical resolution, 18-06-02km horizontal resolution
- Key configuration differences
 1. **Outermost domain size**
 - Spans Atlantic & E. Pacific basins
 2. **Multi-storm**
 - Up to 3 this year
 3. **Data assimilation**
 - No TDR ensemble
 4. **Ocean coupling**
 - Work in progress



Major Findings & Milestones

Scientific Findings

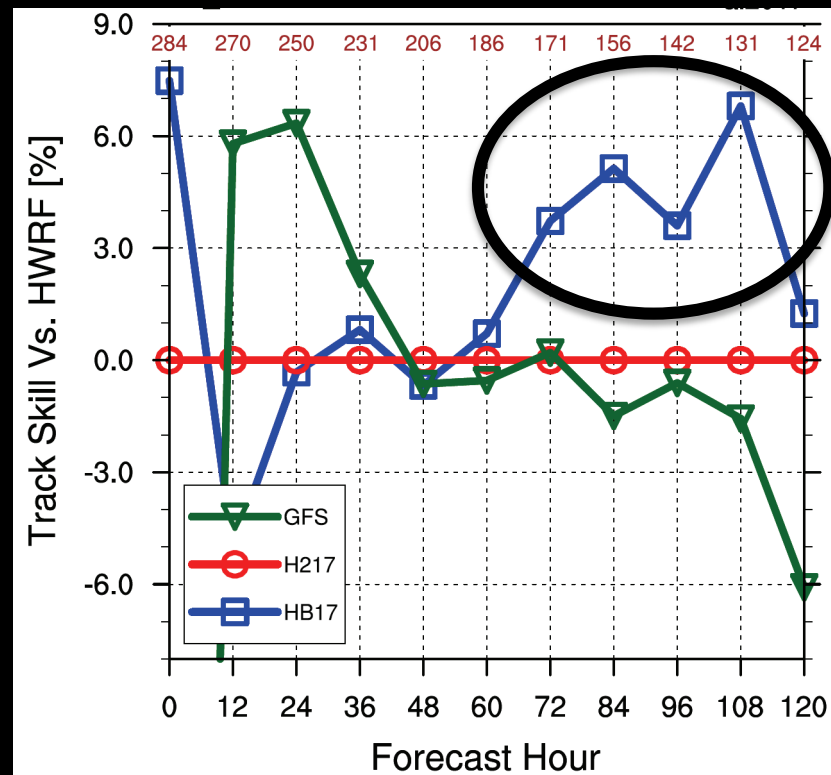
1. Better track forecasts than **H217** & **GFS** at longer lead times (> 72h)
2. Improved track forecasts when “far-field TCs” were present
3. Excellent track forecasts for high-impact TCs (Harvey, Irma, Maria)
4. Excellent rapid intensification forecasts for Harvey
5. Irma forecasts shifted west near FL before **H217/GFS**

Project-Oriented Milestones

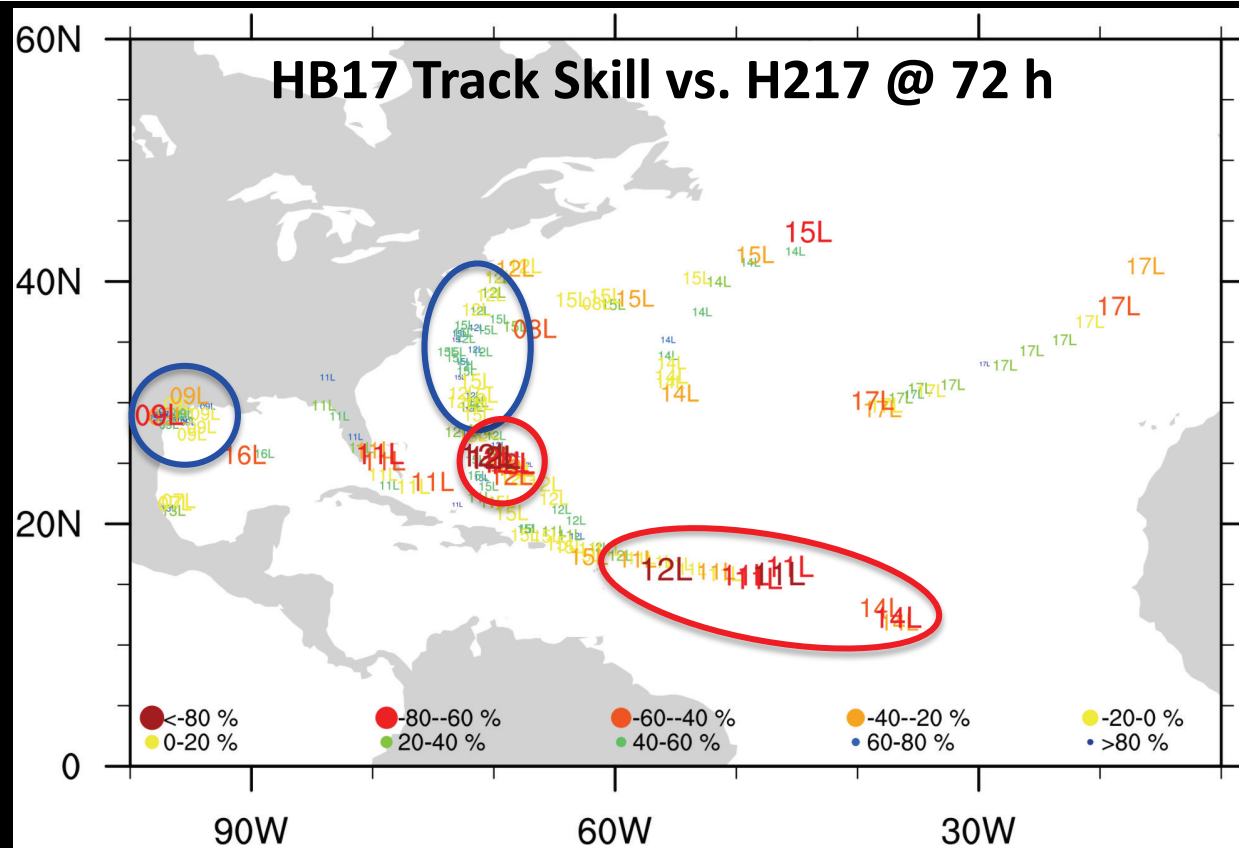
6. Ran 4x daily in real-time under the HFIP demo on Jet
7. Provided guidance in near-real-time for the NOAA Hurricane Field Program
8. Assimilated TDR & HDOB data in real-time starting with Harvey
9. All Basin-Scale HWRF options were committed to the DTC trunk (thx to Evan & Jim)
10. Created interpolated (early) forecasts in real-time
11. Cycled data assimilation system developed for the outermost domain

Verification: Atlantic 2017

- **HB17** excels at long lead times
 - Best improvement at 108 h (7%)
 - Better than **H217** & **GFS** at 60+ h lead times
 - Improvements amplified for 06z/18z cycles → **Why? Restricted data?**
 - Note actual errors are small at short lead times
- Track was the primary focus with Basin-Scale HWRF this year
 - TC-TC interactions
 - TC-land interactions
 - TC-environment interactions



Verification: Finding Outliers



Overall, **HB17** track forecasts are more skillful than **H217**

Mean = 3.7% Median = 16.2%

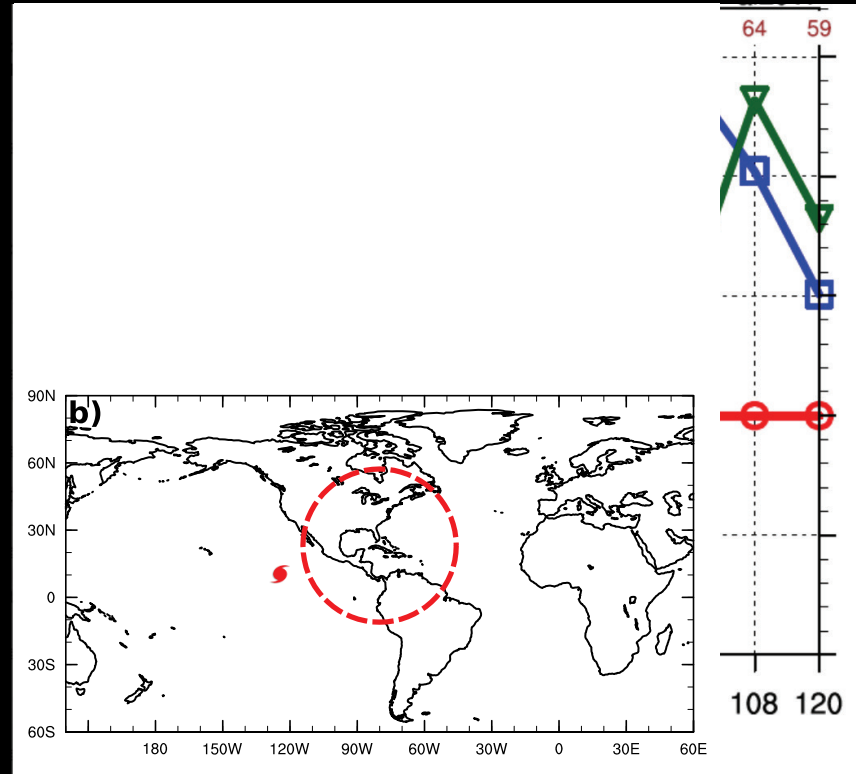
Where and for what TCs did HB17 improve/degrade H217 forecasts?

- **Positive** track skill:
 - 1) NW Atlantic (Jose/Maria)
 - 2) NW Gulf of Mexico (Harvey)
- **Negative** track skill:
 - 1) western MDR (Irma)
 - 2) NE of Bahamas (Jose)

Verification: Multiple Storms

- **For 2 extra TC/invest anywhere**
 - 96/124 cases at 120 h
 - **HB17** track skill increases to 8% at 96 h, 108 h
 - **GFS** track skill too
- **Far-field Storms** are TCs/invests that are >3500 km away from the verified TC.
- See Alaka et al. 2016
- **For 1+ extra Far-Field Storm**
 - 59/124 cases retained at 120 h
 - **HB17** track skill increases to over 14% at 96 h
 - **GFS** track skill also increases

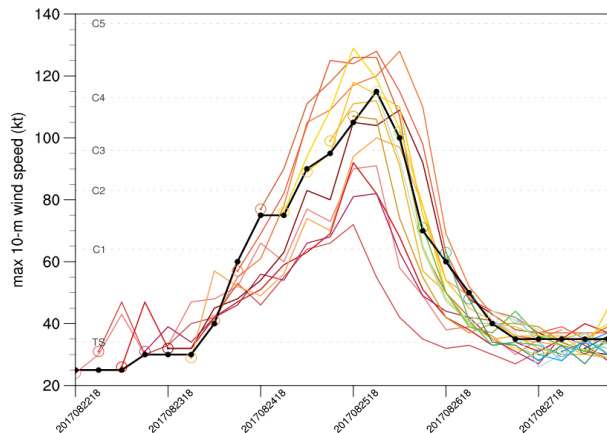
RECOMMENDATION
HWRF should adopt D01, at least



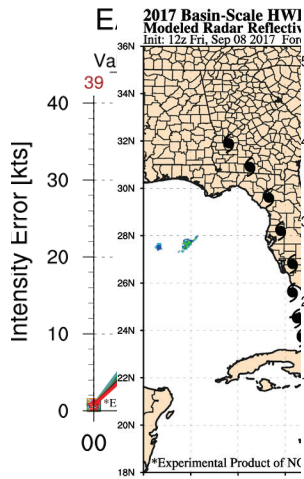
Verification: Harvey/Irma/Maria

HARVEY (09L)

09L Harvey

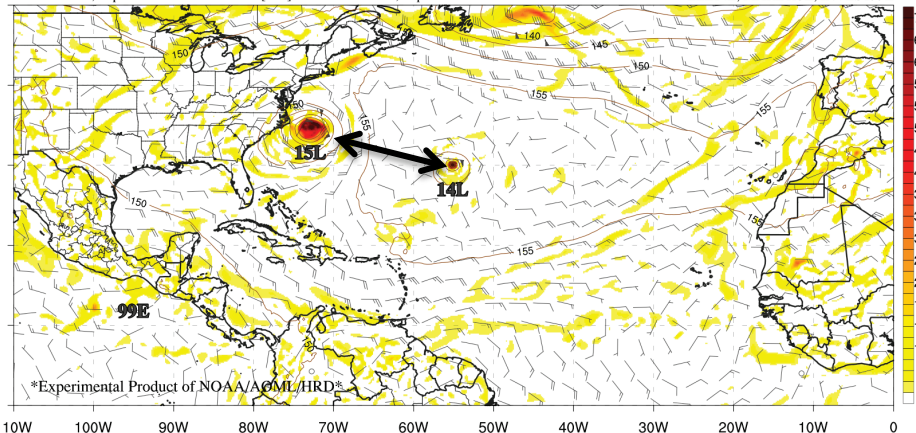


IRMA (11L)



2017 Basin-Scale HWRF Modeled Radar Reflectivity Init: 12z Fri, Sep 08 2017 Fon

2017 Basin-Scale HWRF 850mb Rel. Vorticity (10^{-5} s^{-1} , shaded), GPH (dam; lines), and Wind (kt; barbs) Init: 00z Wed, Sep 27 2017 Forecast Hour:[000] valid at 00z Wed, Sep 27 2017



- Track & Intensity forecasts from HB17 and its interpolated early forecasts (**HB7I**) were generally good for these high-impact TCs.
- Good rapid intensification forecasts for Harvey.
- Irma's westward shift was detected earlier than **H217** & **GFS**
- Several TC-TC interactions this year, e.g., Maria & Lee

What's Next For Basin-Scale HWRF?

1. Ocean coupling
 - Currently being tested for multi-storm implementation by NOAA/NWS/EMC & NOAA/AOML/HRD
2. Ensemble Prediction System
 - Building a workflow to initialize 10-20 ensemble members from J. Poterjoy's cycled DA system (more on that later)
3. TC Genesis
 - Run GFDL tracker on HB17 forecasts from this past season

Is this sufficient for an R2O transition?

The Milestones Sum It Up...

1. Better track forecasts than **H217** & **GFS** at longer lead times (> 72h)
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