Hurricane Supplemental Framework to Accelerate the Hurricane Analysis and Forecast System (HAFS)

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Weather Act Sec.104: HFIP

Develop an updated plan, detailing the specific research, development, and technology transfer activities necessary to sustain HFIP and achieve the 3 focus areas in **Section 104 of the Weather Research and Forecasting Innovation Act**:

1. improving the prediction of rapid intensification and track of hurricanes

2. improving the forecast and communication of storm surges from hurricanes

3. incorporating risk communication research to create more effective watch and warning products

The plan details long-term HFIP goals, priorities, and approaches.

HFIP Goals aligned with Weather Act

1. Reduce numerical forecast guidance errors, including during rapid intensification, by 50 percent from 2017;

2. Produce 7-day forecast guidance that is similar to the 2017 5-day forecast guidance;

3. Improve guidance on pre-formation disturbances, including genesis timing, track and intensity forecasts, by 20 percent from 2017; and

4. Improve hazard guidance and risk communication, based on social and behavioral science, to modernize the TC product suite (i.e., products, information, and services) for actionable lead times for storm surge and all other threats.

NOAA Hurricane Forecast Improvement Project

Meeting the Nation's Needs

Key Strategies:

1. Advance an operational Hurricane Analysis and Forecast System (HAFS)

2. Improve probabilistic guidance

3. Enhance communication of risk and uncertainty

4. Support dedicated high performance computing allocation

5. R2O Enhancement

6. Broaden expertise and expand interaction with external community
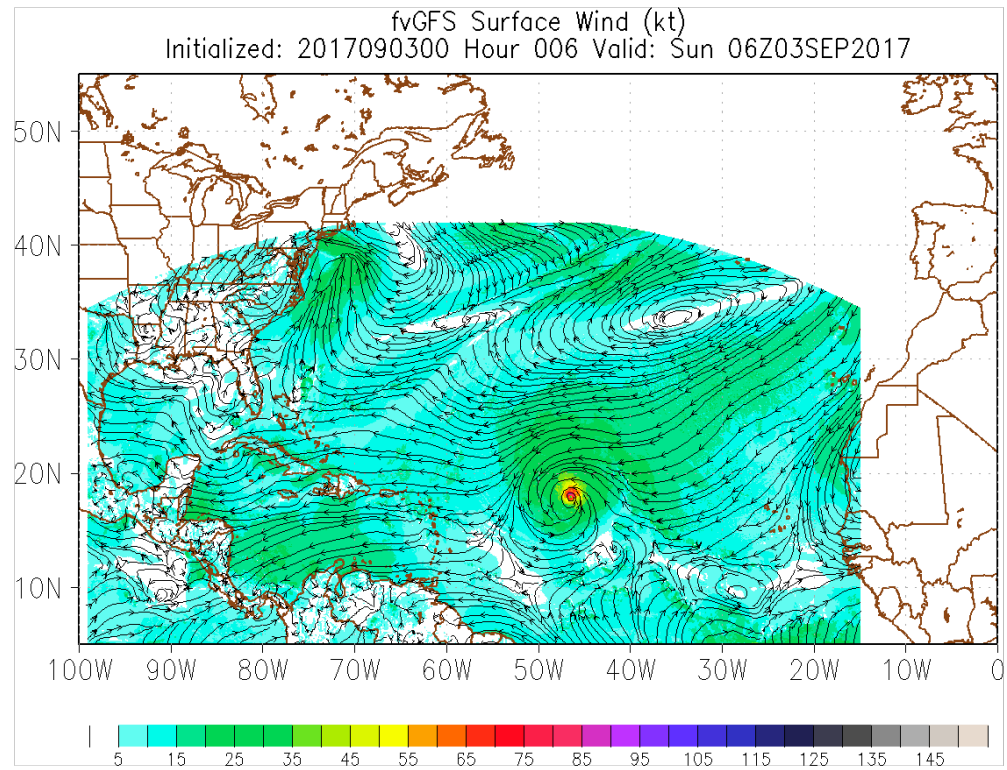
Key Strategies: HAFS

1. Advance operational HAFS

- R&D for HAFS to advance deterministic and ensemble prediction capabilities
- R&D for fusion of modeling, data assimilation and observations to produce an Analysis of Record
- R&D for ensemble post-processing to extract guidance and uncertainty information

fvGFS Surface Wind (kt)
Initialized: 2017090300 Hour 006 Valid: Sun 06Z03SEP2017

Key Strategies: HAFS

1. **Coordinated 6 Hurricane Supplemental Plans to Accelerate Improvements in Hurricane Intensity Forecasting**
    - **1A.4:** Accelerate NGGPS elements related to severe weather prediction, especially landfalling tropical storms and hurricanes (Gopal)
    - **3A.1:** Accelerate implementation of the Updated HFIP Plan (Marks)
    - **3A.2:** Accelerate re-Engineering of Hurricane Analysis and Forecasting System (HAFS) (Mehra)
    - **3B:** Sustained Ocean Observations - Train for, prepare, deploy "picket fence" gliders; deliver, assess data (Goni)
    - **4A.1:** Optimize current observing system to improve prediction of extreme weather (Cucurull)
    - **4A.2:** Data Impact Studies (OSE/OSSE) (Cucurull)

Key Strategies: HAFS

3 possible versions of HAFS:

1. Storm following nest like HWRF/HMON,
2. Regional nest embedded in global model like Basin-Scale HWRF,
3. Multiple moving nests in global model

2 strategies to test in 1st year:

1. Global uniform model with high-resolution nests (hfvGFS AOML, GFDL)
2. Stand Alone Regional model (FV3 CAM EMC, GSD)

Discussion on test plan:

1. Observations and DA options
2. Nesting issues
3. Physics options
4. Testing and evaluation

Key Strategies: HAFS

1. Observations and DA (team-Sippel, Winterbottom, Wang, Alexander):
   - IC/BC from FVGFS or FVGFS + HWRF analysis
   - NHC recommend cases for retrospective
   - Run semin real-time in 2019
2. Nesting strategy (team-Gopal, Mehra, Alexander)
   - CAM configuration like small basin 3 km res
   - Nest in global FVGFS like hfvGFS with 3 km res
3. Physics options (team-Grell, Tallapragada, Mehra, Gopal, and JW Bao)
   - Use same suite of physics available through CCPP following test plan by Jack Cain
   - One-way ocean coupling IC/BC form FVGFS
4. Testing and evaluation plan (team-HFIP, NHC, CAM)
   - Standard metrics developed fo HFIP
   - Enhanced metrics
   - Develop common workflow

The Grand vision: HWRF-B to UFS