HFIP Post Processing and Verification Update 2019

HFIP Annual Review
Co-leads: David Zelinsky, Mark DeMaria
November 4, 2019
Contributing Partners

• HRD
  • Andy Hazleton, Paul Reasor, Jun Zhang, Rob Rogers, Gus Alaka, Lew Gramer, Russel St. Fleur, Gopal Sundararaman, Heather Holboch

• DTC
  • Paula McCaslin

• NCAR
  • Paul Kucera, Tatiana Burek, Jonathan Vigh, Christopher Williams

• CIRA/Colorado State/NHC
  • Kate Musgrave, Christopher Slocum, John Knaff, Alan Brammer, Jeri Schwietert Livingston, Joseph Valancy

• SUNY Albany
  • Ryan Torn
SFMR Recalibration (Holbach)

• SFMR observations from recent major hurricanes are showing an apparent high bias.

• Goal of this HS project is to re-examine the calibration in view of more recent intercomparison data as well as re-examination of the data co-location and adjustment algorithms.
3D Model Visualization (Valancy)

- To improve real-time assessment of model reliability by forecasters.
- Facilitate post-storm analysis of poor forecasts.
- Effort is focusing on a software package called VAPOR.
• Extend statistical-dynamical models SHIPS and LGEM to seven days.
• Modernize WSP model and extend it to seven days. Update its representation of forecast uncertainty
HAFSV0.B consistently showed the highly asymmetric precipitation structure observed by the P-3 Tail Doppler Radar (TDR).

Moderate-to-high shear (~20+ kt) and dry air prevented symmetrization.

The broad and asymmetric wind field was also captured well (maybe a little too weak?)
• Two forecasts initialized 6 hours apart
• Near the time of center relocation
• Very different wind structures
• Second one correctly predicted the small wind core that developed
• Track/intensity very different
• Before the bifurcation point, low-Km forecast with smaller vertical mixing produces more bursts inside the radius of the maximum wind speed (RMW) than the high-Km forecast.

• The bursts are more symmetrically distributed near RMW in the low-Km forecast than in the high-Km forecast, with more bursts located in the upshear-left quadrant in low-Km forecast. The burst distribution in the low-Km forecast is closer to observations (Rogers et al. 2015).
Boundary-layer recovery and hurricane intensity change

- The entropy ($\Theta e$) in the boundary layer is lower in the high-Km forecast than in the low-Km forecast before the onset of rapid intensification.
- Surface enthalpy fluxes are enough to recover the low-entropy air from the upshear-left quadrant to the downshear-right quadrant in the low-Km forecast, but they are not enough for boundary layer recovery in the high-Km forecast.
AOML Hurricane Model Viewer
Visualization for Experimental & Operational Models

https://storm.aoml.noaa.gov/basin
New Diagnostic Products

HFIP ensemble rapid Intensification (RI) diagnostic products
• NCAR developed new diagnostic products to improve understanding of ensemble rapid intensification (RI) forecasts
• Focused on several new prototype visualization products colored by a selected diagnostic parameter:
  • Environmental conditions (wind shear, maximum potential intensity, sea surface temperature, etc.)
  • Inner core storm structure (precipitation symmetry, radius of maximum winds, inertial stability, etc.).
• Prototype visualizations use parameters available from the ATCF a-decks (intensity, minimum sea level pressure, forecast lead time)

Examples of new diagnostic products (shown on the right)
• Top Panel: The trajectory of each forecast model colored by forecast lead time.
• Bottom Panel: The trajectory of each forecast model colored by its predicted intensity converted to the Saffir-Simpson Hurricane Scale
The NHC-Display system is built upon modern and flexible technology that is platform independent (web-based)

New Features:

• Advanced editing tool for editing for fix-position (F-deck) and best-track (B-deck) databases
  • Fixed-position input from aircraft analysis, radar, satellite, microwave, and scatterometer observations
• Wind radii plotting
• Improved functionality (pan zoom, configurable labeling, meta data information pop-up windows)
• New products
  • SST contours
  • Gridded diagnostic fields: wind shear, precipitable water, moisture

Public Version: [http://www.hfip.org/nhc-display](http://www.hfip.org/nhc-display)
HFIP Products Website

• HFIP website and products pages continue to be a priority
  • Increased visibility and recognition for HFIP and now HAFS
  • Popular resource for long range outlook by the HFIP community and senior executives (especially during high impact events)
  • Showcase for models run via real-time reservations
  • Pages constantly updated and maintained. Occasional data interruption is noted and corrected, reasons can very but all are solved
  • Places operational and experimental models in the same framework – a key feature
  • A lot is offered!

"We use hfip.org to provide experimental hybrid wind speed probabilities, as well as model diagnostic text files and more." – CSU CIRA
New additions to the HFIP Webpage

• HFIP product spotlight page on hfip.org homepage
• Reorganized events and documents pages
• Improved documentation for new participants on Jet
• HAFS website related links added and emphasized
• Google Maps TC Tracks page
  • Added GFLD SHEILD and ESRL FV3-GSD plus others granted 2019 real-time reservations
  • Updated GUI
HFIP Website Usage

• Product pages: 45 K views
• Google Storm Track page: 115K views, average visit lasts 5 minutes
CIRA updates

• SHIPS/LGEM Developmental Database updated to include 2018 season in all global basins
• GOES-R series data, including GLM, collected in real-time for 2019 season
• SPICE, SPICE-RII, and RIPA run in real-time for 2019 season
• Environmental diagnostics produced in real-time for 2019 season and evaluated post-season for 2018 season
• Continued delivery of real-time products to NHC, NCAR, TC Real-Time website and HFIP Products page
Rapid Intensification Prediction Aid

- RIPA was run in all global basins in real-time starting July 2019
  - [http://rammb.cira.colostate.edu/research/tropical_cyclones/ripa/](http://rammb.cira.colostate.edu/research/tropical_cyclones/ripa/)
- Text and graphics files posted to TC Real-Time
  - [http://rammb.cira.colostate.edu/products/tc_realtime/](http://rammb.cira.colostate.edu/products/tc_realtime/)
- RIPA is a consensus of linear discriminant analysis and logistic regression techniques; deterministic version is triggered when probabilities exceed 40% for any threshold; highest threshold of over 40% is designated

![Graph showing intensity over time with thresholds]
HWRF and HMON from the 2017-2018 Atlantic, East Pacific, and Central Pacific basins were examined against the GFS analysis valid at that forecast time.

Initial location and intensity is determined from the CARQ.

Intensity (VMAX), 200 mb temperature (T200), and 700-500 mb relative humidity (RHMD) displayed below.
SHIPS and LGEM produced from ECMWF

- SHIPS and LGEM were run from ECMWF fields starting August 2015
- Comparison of the input predictors for the 2018 Atlantic season is shown to the left
  - Cool colors represent GFS having the larger value, warm colors represent ECMWF having larger values
- Differences in mid-level relative humidity average less than 10% out through 120 hours; some cases up to 30% difference in RHMD at 120 hours (below)
Questions?