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Service Change Notice 23-60
National Weather Service Headquarters Silver Spring MD
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From: Mike Farrar, Director
 National Centers for Environmental Prediction

Subject: Go-Live of New NCEP Hurricane Model, HAFS, and Future
Decommissioning of Legacy Hurricane Systems: Effective June 27, 2023

Effective on or about Tuesday, June 27, 2023 with the 1200 Coordinated Universal Time (UTC) cycle, the National Centers for Environmental Prediction (NCEP) Central Operations (NCO) will be implementing a new hurricane modeling system, Hurricane Analysis and Forecast System version 1 (HAFSv1), and beginning the process to decommission the legacy hurricane modeling systems at the end of the hurricane season.

A new hurricane modeling system, HAFS, will be added to the production suite. Two configurations of HAFSv1 will run operationally to produce similar tropical cyclone (TC) track and intensity forecast model guidance as the legacy hurricane systems.

The two current operational hurricane systems, the Hurricane Weather Research and Forecast (HWRF) and Hurricanes in a Multi-scale Ocean-coupled Non-hydrostatic (HMON) models, will continue running operationally for the 2023 hurricane season and are currently scheduled to be decommissioned on or about November 30, 2023. The legacy models will run a maximum of three storms at one time and the output will be delayed an average of 30 minutes compared to HAFS.

Output products from the HWRF and HMON will no longer be available on the NCEP web services (NOAA Operational Model Archive and Distribution System (NOMADS), FTPPRD, and the Model Analyses and Guidance webpage (MAG)) after decommissioning. Users should use this hurricane season to transition data retrievals to the HAFS model output.

The HAFSv1 scientific and technical enhancements include the following:

System and Infrastructure Upgrades
Finite-Volume Cubed-Sphere Dynamical Core (FV3)
Common Community Physics Package (CCPP) based physics suites tailored for hurricanes
Single convection-allowing, high-resolution (~2 km) storm-following nest with Extended Schmidt Gnomonic (ESG) grid
Earth System Modeling Framework (ESMF)/Community Mediator for Earth Prediction System (CMEPS) based coupling.

Vortex Initialization Improvement:
Vortex initialization modernized, leveraged from operational HWRF,

cycling storm region only.

Data Assimilation Improvement:

Four-dimensional ensemble-variational (4DEnVar) with background error covariances from Global Data Assimilation System (GDAS)
Data Assimilation (DA) is turned on for all National Weather Service basins, including North Atlantic, eastern North Pacific, and central North Pacific storms
Leverage observations used in Global Forecast System (GFS)
Adding new meso-scale observations including NEXRAD.

Post-processing and Products:

Uses the latest version of Unified Post Processor (UPP)
Upgraded Geophysical Fluid Dynamics Laboratory (GFDL) tropical cyclone tracker
HFSA and HFSB will be the new model identifiers in the Automated Tropical Cyclone Forecasting System (ATCF) tracker output.

Model Physics Advancements:

Use of advanced Microphysics (MP) schemes, GFDL MP for HAFS-A and Thompson MP for HAFS-B
Upgraded Turbulent Kinetic Energy-Eddy-Diffusivity Mass-Flux (TKE-EDMF) GFS Planetary Boundary Layer (PBL) with TC-specific mixing length scale adjustment
GFS surface layer scheme with HWRF-type air-sea exchange coefficients suitable for hurricane prediction
Upgraded scale-aware Simplified Arakawa-Schubert (saSAS) convection parameterization with TC-specific deep convection entrainment parameter
Unified Gravity Wave Physics (UGWPv1).

Coupling to Wave and Ocean Models:

One-way coupling to WaveWatch III wave model for North Atlantic, eastern North Pacific, and central North Pacific basins
Two-way Coupled to HYbrid Coordinate Ocean Model (HYCOM) for all global basins
Extended HYCOM domain to cover both North Atlantic and North Eastern Pacific basins, initial and boundary conditions from the Real- Time Ocean Forecast System (RTOFS) model.

The HAFS system has been fully tested and compared with the forecast skill of 2021 operational HWRF v13.2.5 and HMONv3.2.3. Overall, it has shown improved skill by about 5-10% in both track and intensity forecasts for both North Atlantic (NATL) and Eastern Pacific (EPAC) basins.

New Output Products:

The following new directories will be available on the NCEP Web Services with the HAFS go-live:

<https://nomads.ncep.noaa.gov/pub/data/nccf/com/hafs/prod/hfsa.YYYYMMDD/>
<https://nomads.ncep.noaa.gov/pub/data/nccf/com/hafs/prod/hfsb.YYYYMMDD/>
<https://ftpprd.ncep.noaa.gov/data/nccf/com/hafs/prod/hfsa.YYYYMMDD/>
<https://ftpprd.ncep.noaa.gov/data/nccf/com/hafs/prod/hfsb.YYYYMMDD/>

Where YYYYMMDD is Year, Month and Day.

The Model Analyses and Guidance (MAG) Website will be updated to reflect the HAFS output.

Sample HAFS products will be available at:

<https://nomads.ncep.noaa.gov/pub/data/nccf/com/hafs/para/hfsa.YYYYMMDD/>
<https://nomads.ncep.noaa.gov/pub/data/nccf/com/hafs/para/hfsb.YYYYMMDD/>
<https://magpara.ncep.noaa.gov/tropical-guidance-model-storm.php>

The graphic products of the HAFS system from three-year retrospectives (2020-2022) for NATL and EPAC hurricanes are available at:

<https://www.emc.ncep.noaa.gov/HAFS/HFSAv1>
<https://www.emc.ncep.noaa.gov/HAFS/HFSBv1>

NCEP encourages users to ensure their decoders are flexible and are able to adequately handle changes in content order, changes in the scaling factor component within the product definition section (PDS) of the gridded binary (GRIB) files and any volume changes which may be forthcoming. These elements may change with future NCEP model implementations. NCEP will make every attempt to alert users to these changes prior to any implementations.

Any questions, comments or requests regarding this implementation should be directed to the contacts below. We will review any feedback and decide whether to proceed.

For questions regarding these model changes, please contact:

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For questions regarding the data flow aspects of these datasets, contact:

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National Service Change Notices are online at:

<https://www.weather.gov/notification>

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