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From: Brian Gross, Acting Director
 NCEP/Environmental Modeling Center

Subject: Soliciting Comments on the Proposed Upgrade of the GFS through
July 15, 2018

NOAA/NWS selected the Geophysical Fluid Dynamics Laboratory (GFDL) finite-volume cubed-sphere (FV3) dynamical core as the NWS Next Generation Global Prediction System (NGGPS). The Environmental Modeling Center (EMC) is seeking comments on the proposed changes to the Global Forecast System (GFS) running with FV3 through July 15, 2018.

The current operational GFS, which has a spectral dynamical core, will be replaced by the proposed GFS with FV3 dynamical core and improved physics parameterizations in Quarter two of Fiscal Year 2019 (Q2FY19). We are seeking feedback on the performance of the GFS with FV3 and the proposed product changes.

The proposed GFS version maintains a horizontal resolution of 13km and has 64 levels in the vertical extending up to 0.2 hPa. It uses the same physics package as the current operational GFS except for:

- Replacing Zhao-Carr microphysics with the more advanced GFDL microphysics.
- Updating parameterization of ozone photochemistry with additional production and loss terms.
- Introducing parameterization of middle atmospheric water vapor photochemistry.
- Revising bare soil evaporation scheme.

The data assimilation system will be updated to include:

- Infrared Atmospheric Sounding Interferometer (IASI) moisture channels.
- Advanced Technology Microwave Sounder (ATMS) all-sky radiances.
- Fix for an issue with the Near Sea Surface Temperature (NSST) in the Florida Strait.
- Upgrade to the use of Cross-track Infrared Sounder (CrIS) radiances.
- NOAA-20 CrIS and ATMS data.
- Megha-Tropiques SAPHIR data.
- Advanced Scatterometer (ASCAT) data from MetOp-B.

The ensemble part of the hybrid data assimilation will also increase in resolution from 35 km to 25 km.

The proposed changes in model forecast output, post-processed fields and downstream products are as follows:

- Adding Numerous variables to the pressure gridded binary (GRIB) output.
- Increasing data volume for almost all output. This includes a 30-60 percent increase in the 'pgrb2' files and up to a 200 percent increase in the 'nemsio' files, but file names will remain unchanged.
- Adding precipitation product with continuous accumulation. The traditional precipitation product with 6-hour bucket is also provided.
- Removing legacy products on NOAAPort/Satellite Broadcast Network (SBN).
- Including more cloud hydrometers predicted by the advanced microphysics scheme in the products.
- Adding radar reflectivity derived using these new cloud hydrometers to GFS products.
- Computing the height, pressure, and vertical velocity (w) will be non-hydrostatic in model instead of deriving it hydrostatically in Unified Post Processor (UPP). Hydrostatic vertical velocity (ω) computed in the UPP is also provided. Only the non-hydrostatic vertical velocity (w) will be included in the station time series BUFR output.
- Switching the Guam Real-Time Mesoscale Analysis (RTMA) product to use High-Resolution Window (HiResW) Guam as its initial guess.

The National Centers for Environmental Prediction (NCEP) wants to highlight two potentially impactful changes to vertical velocity and accumulated precipitation variables and encourage users to migrate to the new variables described below. In the future, the legacy output will be removed to keep in line with the direction of the NCEP modeling suite unification:

1. A second vertical velocity field will be included in the output files and written out by the model as DZDT (m/s). This is because FV3 GFS treats DZDT as a prognostic variable. The vertical velocity VVEL (pascal/s) found in the current operational product is now derived from DZDT using the hydrostatic approximation.

2. A new precipitation product (both total and convective) with continuous accumulation will be included in the output. Products on NOAAPort/SBN will also get the additional variables of vertical velocity and continuous precipitation, as mentioned above. The World Meteorological Organization (WMO) headers will be the same respective to the current variables, but will have different Product Definition Template (PDT) values. NCEP plans to remove the legacy variables as soon as the 2019 upgrade, so users should plan to migrate to the new variables with this implementation.

With this upgrade, NCEP is proposing to remove some legacy products off the SBN/NOAAPort only:

Grid	Resolution	Area	Map Projection
#211	80 km	CONUS	Lambert Conformal
#225	80 km	Hawaii	Mercator
#37-44	1.25 degree	WAFS thinned	Latitude/Longitude
#160	47 km	Alaska	North Polar Stereographic
#161	0.5 degree	Puerto Rico	Latitude/Longitude
#213	95 km	Alaska	Polar Stereographic
#254	40 km	Pacific Region	Mercator

WMO headers for these grids slated for removal are listed at:

http://www.nco.ncep.noaa.gov/pmb/changes/gfs_AWIPS_grids.shtml

In the future, NCEP will be terminating the lower resolution products from its Web Services and encourages users to take this opportunity to migrate to higher resolution output.

In preparation for the official release of the Q2FY19 GFS version, NCEP-EMC is running a real-time parallel with fully cycled data assimilation. A real-time output of the both NOAAPORT and NCEP Web Services data can be found at:

<http://para.nomads.ncep.noaa.gov>

The real-time data will be available at best effort and with variable timing output.

EMC is also conducting retrospective experiments covering the past three years for a comprehensive evaluation of the Q2FY19 GFS implementation.

Evaluation of both the real-time and retrospective parallels can be found at:

<http://www.emc.ncep.noaa.gov/users/Alicia.Bentley/fv3gfs>

Which includes relevant links to various evaluation and verification websites.

Send any comments on the science aspects of this upgrade to:

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The NWS will evaluate all comments to determine whether to proceed with this upgrade. If approved, a Service Change Notice (SCN) will be issued giving a minimum of 30-day notice of the implementation date.

National Public Information Statements are online at:

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

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