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Service Change Notice 17-67 Updated
National Weather Service Headquarters Silver Spring MD
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To: Subscribers:
 -NOAA Weather Wire Service
 -Emergency Managers Weather Information Network
 -NOAAPort
 Other NWS Partners, Users and Employees

From: Dave Myrick
 NWS Office of Science and Technology Integration

Subject: Updated: Global Forecast Systems (GFS) Upgrade: Include
Information about the 0.5 degree GFS Pressure GRIB Files being Temporarily
Available on the NWS Web Services until August 22, 2017

Updated to change availability to output products on Web service, the 0.5
degree GFS datasets, which will be available from now until removed from
the NWS Web Services on August 22, 2017. Details are found in Section 4.

Effective on or about Wednesday July 19, 2017, beginning with the 1200
Coordinated Universal Time (UTC) run, the National Centers for
Environmental Prediction (NCEP) will upgrade the GFS Analysis and Forecast
System as follows:

Changes to the model components
Changes to the data assimilation and tropical storm relocation components
Changes to the post-processing
Changes to output products

Changes to the Global Forecast System Global Spectral Model (GSM)
components:

- Implement GSM source code in NOAA Environmental Modeling System (NEMS)
framework.
- Upgrade to asynchronous quilting for scalable and efficient write
component in NEMS GSM. Asynchronous quilting means that the model writes
out chunks of data to disk in a non-sequential manner. This improves
input/output (i/o) efficiency.
- Replace spectral history file output (sigma files) with new nemsio
binary files on model native grid. Documentation of nemsio format
including data structure, interface, how to open, read, write, and MPI I/O
support are at: <http://www.emc.ncep.noaa.gov/NEMS/nemsio.php> and the
nemsio library at:

<http://www.nco.ncep.noaa.gov/pmb/codes/nwprod/lib/nemsio>

- Implement Near Surface Sea Temperature (NSST) to replace Real-Time
Global SST (RTGSST) to provide more realistic ocean boundary conditions.
- Upgrade deep and shallow convection schemes with scale- and aerosol-

aware features along with convective cloudiness enhancement.

- Modify Rayleigh damping to improve temperature and wind forecasts in the upper stratosphere.
- Upgrade the land surface model to increase ground heat flux under deep snow; and unify snow cover fraction and snow albedo.
- Use new high-resolution MODIS-based snow-free albedo, maximum snow albedo, soil type and vegetation type.
- Upgrade surface layer parameterization scheme to modify the roughness-length formulation and introduce a stability parameter constraint in the Monin-Obukhov similarity theory to prevent the land-atmosphere system from decoupling.

Changes to the Global Data Assimilation System (GDAS) and Tropical Storm Relocation:

- Upgrade GDAS and Ensemble Kalman filter (EnKF) to use nemsio binary files.
- Implement Near Sea-Surface Temperature (NSST) Analysis.
- Implement CrIS full resolution data assimilation capability.
- Implement readiness for new Geostationary Operational Environmental Satellite (GOES-16), Joint Polar Satellite System.
- (JPSS-2) and Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC-2) data assimilation capability.
- Extend Regional Advanced Television Infrared Observation Satellite (TIROS) Operational Vertical Sounder (ATOVS) Retransmission Services (RARS) and Direct Broadcast Network (DBNet) capability.
- Implement bug fix to cloud water increment in Gridpoint Statistical Interpolation (GSI).
- Upgrade land surface type specification in Community Radiative Transfer Model (CRTM).
- Update data monitoring for Megha-tropiques Sounder for Probing Vertical Profiles of Humidity (SAPHIR) and Global Precipitation Measurement (GPM) Microwave Imager (GMI) radiances.
- Assimilate Visible Infrared Imaging Radiometer Suite (VIIRS) Atmospheric Motion Vectors (AMVs) and implement log-normal wind quality control for AMVs.
- Assimilate Geostationary Operational Environmental Satellite system (GOES) clear-air water vapor winds.
- Assimilate additional global navigation satellite system (GNSS) -Radio Occultation (RO) observations.
- Modify pressure and hybrid coordinates transformation during the storm relocation.
- Change relocation of the vorticity and divergence fields to the relocation of u, v wind components.
- Remove bogus Tropical Storm/Hurricane data for use in Data Assimilation.
- Assimilate Global Hawk dropsonde data when available.
- Upgrade data assimilation monitoring package.

Changes to the post-processing:

- Upgrade Post-Processing software to use new nemsio model output.
- Implement continuity equation to derive omega on grid space for new nemsio model output only.
- Modify interpolation procedure for all categorical fields including land

mask, icing severity and precipitation type products to use nearest neighbor interpolation.

- Change interpolation method for In-Cloud Turbulence Potential (CTP) and CB cover (Horizontal Extent of Cumulonimbus) from 'linear' to 'nearest neighbor' to avoid averaging their own specific negative value with normal values when doing grid conversion.

Users are advised to screen out and not use soil moisture values above 0.468 (the maximum porosity among all soil types) in GFS output files. Values above 0.468 are flag values associated with permanent deep-layer land ice. The land surface model does not predict soil moisture at land ice points.

Changes to output products on web services:

With this upgrade, the following changes occur on either the NCEP web services:

<ftp://ftp.ncep.noaa.gov/pub/data/nccf/com/gfs/prod>
<http://www.ftp.ncep.noaa.gov/data/nccf/com/gfs/prod>
<http://nomads.ncep.noaa.gov>

Or on the NWS web services:

<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/>
<http://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/>

- The 0.5 degree GFS datasets will be removed from the NWS Web Services on August 22, 2017. Users who have not migrated over to the NCEP Web Services should do so immediately. This removal does not affect any products on the NCEP Web Services; those products will continue to remain available. The following file names will be impacted:

NWS web removal: fh.0FFF_tl.press_gr.0p50deg(.idx)
NCEP web replacement: gfs.tHHz.pgrb2.0p50.fFFF(.idx)

The 2.5km resolution pressure gridded binary (GRIB) output files will be discontinued. NCEP has been providing the higher resolution products in order to provide a smooth transition period, but will no longer maintain the resources to continue creating these products. The discontinued output will be:

NWS web: fh.0FFF_tl.press_gr.2p50deg
NCEP web: gfs.tHHz.pgrb2.2p50.fFFF

The following BUFR dump and prepbufr files will be renamed as described below. There is no change to the file content:

```
gdas1.tCCz.*tm00.bufr_d.unblok > gdas.tCCz.*.tm00.bufr_d
gdas1.tCCz.*tm00.bufr_d.unblok.nr > gdas.tCCz.*.tm00.bufr_d.nr
gdas1.tCCz.sfcshp.tm00.bufr_d.unblok > gdas.tCCz.sfcshp.tm00.bufr_d.nr
gfs.tCCz.prepbufr.unblok > gfs.tCCz.prepbufr gfs.tCCz.prepbufr.unblok.nr >
gfs.tCCz.prepbufr.nr gdas1.tCCz.prepbufr.unblok > gdas.tCCz.prepbufr
gdas1.tCCz.prepbufr.unblok.nr > gdas.tCCz.prepbufr.nr
```

On the NCEP web services, the EnKF surface analysis ensemble mean file is

being discontinued. This file is simply the average of the 80 sfc anl_mem files. Thus, users may still obtain the sfc anl_ensmean content on their own.

NCEP web: `enkf.YYYYMMDD/sfc anl_YYYYMMDDCC_ensmean`

The following files will be removed from the NWS websites and the exact same product will instead be available from the NCEP websites listed above. Users are encouraged to migrate to the NCEP sites as soon as possible as all of the products are available currently. Please see below for removals, and the associated NCEP site product names:

NWS web removal: `fh.0FFF_tl.sflux(.idx)`.

NCEP web replacement: `gfs.tHHz.sfluxgrbFFFF.grib2(.idx)` NWS web removal:

`fh.0FFF_tl.press_gr.1p00deg(.idx)`.

NCEP web replacement: `gfs.tHHz.pgrb2.1p00.ffff(.idx)` NWS web removal:

`PT.sndn_DF.bufr/fh.afhr_bs.STN_ID`.

NCEP web replacement: `bufr.tHHz/bufr.STN_ID.YYYYMMDDHH`.

Where YYYY is year, MM is month, DD is day, HH is cycle, FFF is forecast hour, and STN_ID is the 6-digit station ID.

On the NCEP websites, the number of days of GFS and GDAS datasets available will be reduced from 14 to 10.

On the NWS web services, the GRIB1 211, 225, FOS 21-24, and WAFS 37-44 grids will be removed from the NWS web service

`PT.grid_DF.bb/fh.HHHH_tl.parm`

`PT.grid_DF.bb/octantX/*`

Where HHHH is the forecast hour, parm is the forecast parameter, and octantX is the WAFS grid letter.

Users can find GRIB2 replacement of the WAFS 37-44 grids available in the `PT.grid_DF.gr2/fh.HHHH_tl.press_ar.octantX` files.

Visibility field will be added to the pressure GRIB files for all resolutions:

NCEP web: `gfs.tHHz.pgrb2.DDD.ffff`

Where HH is cycle, FFF is forecast hour and DDD is for all 0.25 degree (0p25), 0.5 degree (0p50), and 1.0 degree (1p00) GRIB2 output.

On the NCEP web services, the following changes will occur to the GFS Flux files:

- Packing has been changed to complex packing to be consistent with packing method of GFS pressure GRIB files. These files will be distributed at hourly time steps instead of every three hours.
- Remove category rain (CRAIN) parameter.
- Correct GRIB2 IDs for soil temperature from "TMP...below ground" to "TSOIL...below ground".
- Correct GRIB2 IDs for total column cloud fraction from "entire atmosphere (considered as a single layer)" to "entire atmosphere".
- The time label for SUNSD will be changed to instantaneous to be

consistent with time label in GFS pressure GRIB files:

NCEP web file name: gfs.tHHz.sfluxgrbFFFF.grib2

All GDAS output on the NCEP web servers will be renamed to remove the "1", such that:

gdas.YYYYMMDD/gdas1.tCCz* -> gdas.YYYYMMDD/gdas.tCCz*

On the NCEP servers, modify the Binary Universal Form for the Representation of meteorological data (BUFR) list of stations from 1,919 to 2,021 and correct a few errors in the original station list. Land/water designations were added for those stations that do not have the designations. For the full list:

http://www.nco.ncep.noaa.gov/pmb/changes/docs/GFS_BUFR_stations.pdf

On the NCEP servers, the station BUFR files now have hourly output to forecast hour 120 and 3-hourly output to hour 180. Precipitation accumulation values are labeled as 3-hourly for all forecast steps; however, values to hour 120 are hourly and 3-hourly from 123 to 180. The files are now in unblocked format and the file names are changing:

bufr.tHHz/bufr3.STN_ID.YYYYMMDDHH > bufr.tHHz/bufr.STN_ID.YYYYMMDDHH

Where YYYY is year, MM is month, DD is day, HH is cycle, and STN_ID is station identifier.

Replace copygb2 by WGRIB2 in downstream pressure GRIB products and change the Grid definition template (octets 43-46) subdivision of basic angle used to define extreme longitude and latitude, and direction increments from 0 to 255 (missing).

NWS web: fh.0FFF_t1.press_gr.DDDdeg NCEP web: gfs.tHHz.pgrb2.DDD.fFFF

A second land mask (LAND) is added to GFS and GDAS pressure GRIB files for all resolutions. The second land mask is generated using bi-linear interpolation:

NCEP web: gfs.tCCz.pgrb2.DDD.fFFF, gdas.tCCz.pgrb2.DDD.fFFF

New GFS pressure GRIB files use a very large value of 9.99e+20 to represent the value for the variables that do not have sensible values at any given grid point. For example, soil temperature at an ocean grid point will have a value of 9.99e+20. Users may have to modify their decoding programs to handle such a large value. Files impacted:

NWS web: fh.0FFF_t1.press_gr.DDDdeg

NCEP web: gfs.tHHz.pgrb2.DDD.fFFF

With the change in nemsio output, the following link contains a list of files on the NCEP web services for the GFS, GDAS and EnKF that will be impacted. Users are highly encouraged to download sample data and test:

http://www.nco.ncep.noaa.gov/pmb/changes/docs/GFS_nemsio_filenames.pdf

Nemsio binary atmospheric files are approximately two times larger than their sigio counterparts. Nemsio atmospheric files contain data on the native model gaussian grid while sigio files project grid space data into wavenumber (spectral) space. The nemsio binary surface files are approximately the same size as their sfcio counterparts and both representations contain data on the native model Gaussian grid.

With the change in supercomputer architecture for both this upgrade and the following one, there may be some minor (less than five minutes) changes in timing of the output files. NCEP will always attempt to deliver products end to end within the expected window, but users are encouraged to re-baseline the output times once we move into operations.

On the NCEP website, the following additions will be put into the NOAA Operational Model Archive and Distribution System (NOMADS):

The surface flux GRIB2 files will be added to grib_filter.
The GDAS pressure GRIB forecast hours will be added to OpenDAP.

GFS legacy fax chart TIF images will be discontinued on the NWS web service here: <http://tgftp.nws.noaa.gov/fax/barotrop.shtml>.

The following changes will be made to NOAAPort/Satellite Broadcast Network (SBN):

Modify the lists of stations in the GFS BUFR sounding collectives disseminated on NOAAPort. For the full list, please reference this page:

http://www.nco.ncep.noaa.gov/pmb/changes/docs/GFS_BUFR_stations.pdf

Replace copygb2 by WGRIB2 and correct the resolution and component flag from 8 to 48. This change applies to the following GRIB2 output on NOAAPort:

20km CONUS grid; 20km Alaska grid; 20km Puerto Rico grid and Grid 213 (National - CONUS - Double Resolution Polar Stereographic 95km)

The 0.5 degree Puerto Rico grid 161 has been corrected to match Office Note 388 (ON-388). The latitude was changed from 102 to 103 points. ON-388 can be found here:

<http://www.nco.ncep.noaa.gov/pmb/docs/on388/>

In 2016, NCEP solicited feedback to remove all legacy GFS grids in favor for high resolution 20km and 1.0 degree grids. With this upgrade, we will be removing the Alaska Region, North Polar Stereographic - 47.5km (Grid Value #160). The full list of World Meteorological Organization (WMO) headers can be found here:

http://www.nco.ncep.noaa.gov/pmb/changes/docs/2017_gfs_160.pdf

To reference the Public Information Statement (PNS), please go to:
https://www.weather.gov/media/notification/pdfs/pns16-04gfs_removal.pdf

In 2014, NCEP solicited feedback to removal of legacy FAX charts, and at that time, we were unable to move forward. So, with this upgrade, the following will no longer be available on NOAAPort or Global Telecommunications System (GTS):
Winds and temperatures at various flight levels and surface analyses for various domains with WMO headers that match this pattern are being removed:

http://www.nco.ncep.noaa.gov/pmb/changes/docs/2017_GFS_FAXCharts.pdf

See the PNS for more details here:

https://www.weather.gov/media/notification/pdfs/pns14gfs_legacy_removal.pdf

As part of NCEP's standard 30 day parallel testing, the parallel products will be available here:

<http://para.nomads.ncep.noaa.gov/pub/data/nccf/com/gfs/para>

Users can find sample NOAAPort/SBN data in real time here:

<http://para.nomads.ncep.noaa.gov/pub/data/nccf/noaaport/>

NCEP urges all users to ensure their decoders can handle changes in content order, changes in the scaling factor component within the product definition section (PDS) of the GRIB files, and volume changes. These elements may change with future NCEP model implementations. NCEP will make every attempt to alert users to these changes before implementation.

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 changes, please contact:

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National Service Change Notices are online at:

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

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