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PNSWSH

Technical Implementation Notice 15-43 Amended
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From: Timothy McClung, Portfolio Manager
Office of Science and Technology Integration

Subject: Amended: Global Ensemble Forecast System (GEFS) Changes: Effective December 2, 2015

Amended to change the implementation date from to be determined (TBD) to December 2, 2015.

On or about Wednesday, December 2, 2015, beginning with the 1200 Coordinated Universal Time (UTC) run, the National Centers for Environmental Protection's (NCEP's) Global Ensemble Forecast System (GEFS) will be updated.

The upgrade in the GEFS production suite includes:

- Running the latest Global Forecast System (GFS) model with Semi-Lagrangian dynamic scheme and improved physics scheme, GSM v12.1.0 replacing GFS v9.1.0.

- Increasing the horizontal resolution from T254 (about 55 km) to TL574 (about 33 km) for the first 192 hours (8 days) of model integration and from T190 (about 70 km) to TL382 (about 55 km) between 192 hours and 384 hours of model integration.

- Increasing vertical resolution from 42 levels to 64 levels for 0-384 hours (0-16 days) forecasts.

- Modifying the ensemble initialization method by replacing the Bred Vector with Ensemble Transform and Rescaling (BV-ETR) scheme with Ensemble Kalman Filter (EnKF) scheme. The 6-hour forecasts of the 80 EnKF ensemble members of the Hybrid Data Assimilation system, from the previous cycle, are used to initialize the ensemble perturbations.

- Improving the Stochastic Total Tendency Perturbation (STTP) scheme by (1) turning off perturbations in the surface pressure; increasing the perturbation amplitude of other model state variables around the time of model truncation (192 hours), and adjusting its parameters to match the Semi-Lagrangian scheme, the increased model resolution and improved model physics.

There will be several changes in the 1-degree GEFS product data files, affects files with names pgrb2a/pgrb2b. The GEFS products disseminated over NOAAPort will not change in format or content. The GEFS products disseminated via the NWS and NCEP servers will have some changes in content. A significant increase in the gridded binary (GRIB) product data volumes is expected due to these changes. These products are available at the following locations:

NCEP/NOAA Operational Model Archive and Distribution System (NOMADS) server:

http://nomads.ncep.noaa.gov/pub/data/nccf/com/gens/prod/gefs.YYYYMMDD/CC

NWS server:

ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/MT.ensg_CY.CC/RD.YYYYMMDD

Note that all YYYYMMDD strings represent the Year, Month, Day value and CC is the model cycle.

Specific sub-directories and file names on these servers will be given for each product change below.

Replacing GRIB Products:

To make best use of resources, the 2.5-degree grids will be replaced by the 0.5-degree grids. The 1-degree grids will continue to be available.

The 2.5-degree GRIB2 datasets on the NCEP file transfer protocol (FTP), NOMADS and tgftp servers will not be available after this upgrade. Below are the affected servers and directories:

http://www.ftp.ncep.noaa.gov/data/nccf/com/gens/prod/gefs.YYYYMMDD/CC/pgrb2alr and pgrb2blr

http://nomads.ncep.noaa.gov/pub/data/nccf/com/gens/prod/gefs.YYYYMMDD/CC/pgrb2alr and pgrb2blr

ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/MT.ensg_CY.CC/RD.YYYYMMDD/PT.grid_DF.gr2_RE.high/fh.HHHH_pa.membr???_tl.press_gr.2p 5deg

ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/MT.ensg_CY.CC/RD.YYYYMMDD/PT.grid_DF.gr2_RE.low/fh.HHHH_pa.membr???_tl.press_gr.2p5 deg

Note that HHHH is the forecast hour and ??? is the ensemble member.

The new 0.5-degree product files will be written to the new sub-directories pgrb2ap5 and pgrb2bp5. The file names will be:

ge???.tHHz.pgrb2a.0p50.anl, ge???.tHHz.pgrb2a.0p50.fhhh, ge???.tHHz.pgrb2b.0p50.anl, and ge???.tHHz.pgrb2b.0p50.fhhh.

When these two (pgrb2ap5 and pgrb2bp5) sub-directories are combined, these files will have the same content as the 1-degree products but at higher

frequency (every three hours) for the first 192 hours (eight days) of model integration. However, the division of variables between the two sub-directories is different from that between pgrb2a/pgrb2alr and pgrb2b/pgrb2blr. While most of the variables are in the pgrb2bp5 files, the pgrb2ap5 files include the following 43 variables:

HGT: 1000, 925, 850, 700 mb, surface (000h and 204h only) (5)
TMP: 1000, 925, 850 mb and 2m above the surface (4)
RH: 1000, 925, 850 mb and 2m above the surface (4)
UGRD: 1000, 925, 850, 700, 500 400 300 mb and 10m above surface (8)
VGRD: 1000, 925, 850, 700, 500 400 300 mb and 10m above surface (8)
PRES: surface, mean sea level (2) APCP, CSNOW, CICEP, CFRZR, CRAIN (5)
PWAT, TCDC, CAPE, CIN (4) TMAX, TMIN (2) VVEL, 850 mb (1)

Product Additions:

- In pgrb2b and pgrb2blr, 166 new variables will be added. A list of these new products is available online:

http://www.nco.ncep.noaa.gov/pmb/changes/gefs_2015_changes.shtml

Product Removals:

- The following three variables in pgrb2b/pgrb2blr will be removed:

GPA: 500 mb, 1000 mb (anomaly)
5WAVA: 500 mb (HGT filtered, anomaly)

- The following four variables will be moved from pgrb2b/pgrb2blr to pgrb2a/pgrb2alr:

UGRD: 300, 400mb
VGRD: 300, 400mb

Product Changes:

- The four products of soil temperature (for 0-0.1, 0.1-0.4, 0.4- 1, 1-2 m below ground) will be re-named TSOIL (currently TMP). The corresponding Product Definition Section (PDS) for this parameter will also change to accurately represent the product as TSOIL.

GRIB2 Packing Changes:

- The packing for GRIB2 will be switched to second order complex packing. The benefits for users will be much faster input/output (IO) time compared with the existing JPEG packing. The second order packing provides good accuracy, although files will be slightly larger than JPEG packing.

With this upgrade, output files are being written directly to GRIB2 instead of first being written out to GRIB1 and converted to GRIB2. Users may see some differences with the encoding, including UGRD and VGRD wind components being packed into two different records instead of one. Users are encouraged to test with the parallel datasets and upgrade their software to handle the encoding changes. Please see the links below for

upgraded code:

http://www.nco.ncep.noaa.gov/pmb/codes/GRIB2
http://www.cpc.ncep.noaa.gov/products/wesley/wgrib2
ftp://ftp.cpc.ncep.noaa.gov/wd51we/wgrib

Changes in the ensstat directory:

- The bias corrected 24-hour accumulated precipitation, in the file enspost.t00z.prcp_24hbc.grib2, will be changed: Perturbed members of ENS=+15, +16, +17, +18, +19, +20 will be added, resulting in an increase of 6x31=186 records in the file. Meanwhile, the 16 records for the intervals from 180-204h to 15-16 day (360-384-hour) from the hi-resolution control forecast will be removed to be consistent with the original design.

New tropical cyclone track and genesis forecast products:

- For the first time, tropical cyclone track forecasts and genesis probability forecasts will be disseminated as text files in the sub-directories tctrack and genesis, respectively.

tctrack: storm positions for individual perturbed members (ap01- 20), low resolution control member (ac00) and high resolution control member (gfsx), and the ensemble mean (aemn) are available in the following files:

ac00.tHHz.cyclone.trackatcfunixaemn.tHHz.cyclone.trackatcfunixap
??.tHHz.cyclone.trackatcfunixgfsx.tHHz.cyclone.trackatcfunix

genesis: probability for each potential storm XX in each Northern Hemisphere Basin, HC, AL, EP and WP, is presented in the following files:

aemn.trkprob.HCXX.65nm.YYYYMMDDHH.indiv.data
aemn.trkprob.ALXX.65nm.YYYYMMDDHH.indiv.data
aemn.trkprob.EPXX.65nm.YYYYMMDDHH.indiv.data
aemn.trkprob.WPXX.65nm.YYYYMMDDHH.indiv.data

Similar tropical storm track and genesis forecasts, from Environmental Canada Global Ensemble (CMC) and Fleet Numerical Global Ensemble (FNMOC) systems will also be available at the following locations:

NCEP NOMADS Server:

CMC:
http://nomads.ncep.noaa.gov/pub/data/nccf/com/gens/prod/cmce.YYYYMMDD/xx/genesis or tctrack

FNMOC:
http://nomads.ncep.noaa.gov/pub/data/nccf/com/gens/prod/fens.YYYYMMDD/xx/genesis or tctrack

GEFS:
http://nomads.ncep.noaa.gov/pub/data/nccf/com/gens/prod/gefs.YYYYMMDD/xx/genesis or tctrack

The ensemble identifier in the tctrack file names for the perturbed members, low and high resolution control, and the ensemble mean for the cmce (CMC) directories are cp??, c00, cmc and cemn, respectively. For the fens directory (FNMOC), they are fp??, fc00, ngx and femn. The identifiers cemn and femn are also used to name the corresponding genesis files.

Retrospective forecasts for the period of May 2013 to April 2015 (00Z only) were conducted using the GEFS upgrade package. The dataset is available at:

http://para.nomads.ncep.noaa.gov/pub/data/nccf/retrospective/gefs/gefs.YYYYMMDD

The retrospective data are the pgrb2a files at 1.0-degree resolution.

Certain components of the current GEFS production package will continue to run for a limited time, with a name GEFS_LEGACY, so that users can transition to the new GEFS. It will run the BV-ETR based ensemble initialization cycling every six hours and provide the 00Z cycle forecast. A limited set of output products will be accessible at:

http://nomads.ncep.noaa.gov/pub/data/nccf/com/gefs_legacy/prod

A consistent parallel feed of data from the new GEFS will become available on the NCEP server once the model is running in parallel on the NCEP Weather and Climate Operational Supercomputing System (WCOSS) by late August. The parallel data will be available via the following URL:

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

Test data are also available at: ftp://ftp.emc.ncep.noaa.gov/gc_wmb/. Specific information regarding the scientific implementation can be found at:

http://www.emc.ncep.noaa.gov/gmb/yzhu/html/imp/201412_imp.html

NCEP encourages all users to ensure their decoders are flexible and are able to adequately handle changes in content order, parameter fields changing order, changes in the scaling factor component within the PDS of the GRIB files and also 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 implementation.

For questions regarding these changes, please contact:

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National Technical Implementation Notices are online at:

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

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