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Service Change Notice 22-104 Updated
National Weather Service Headquarters Silver Spring MD
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From: Mike Farrar, Director
National Centers for Environmental Prediction

Subject: Updated: Upgrade NCEP Global Forecast System to v16.3.0: Effective November 29, 2022

Updated to clarify language.

Effective November 29, 2022, beginning with the 1200 Coordinated Universal Time (UTC) run, the National Centers for Environmental Prediction (NCEP) will upgrade the Global Forecast System (GFS) from version 16.2.2 to 16.3.0.

The GFS v16.3 is upgraded with the following objectives: improving the internal flight planning and global aviation safety; ameliorating the snow depth prediction; and advancing the overall global analysis and forecast by improving the use of observations and adding newly available ones.

The GFS Unified Post Processing (UPP) system and the World Area Forecast System (WAFS), the GFS physics in the Noah land surface model, and the Grid-point Statistics Interpolation (GSI) Analysis are upgraded to meet these objectives.

The UPP and WAFS upgrades include:

- Prepare to increase vertical/temporal resolution and forecast range on 0.25-degree WAFS products to meet the 2023 International Civil Aviation Organization (ICAO) milestone.
- Minor changes in the GFS post-processing script to make a continuous bucket precipitation product for WGNE (Working Group for Numerical Experiments).
- Update synthetic satellite product generation with Community Radiative Transfer Model (crtm)/2.4.0.

GFS overestimates the accumulated snow depth for mixed precipitation events with marginal temperatures and under predicts for events with very cold temperatures. The undesired snow depth predictions are associated with Geophysical Fluid Dynamics Laboratory (GFDL) microphysics and the improper density used in the Noah land surface model for different frozen precipitation types. In this upgrade, the land surface model is addressed first by providing proper density to various frozen hydrometeors.

The upgrades in the data assimilation system are accomplished by improving the use of existing observations, adding newly available observations, enhancing Near Sea Surface temperature (NSST) analysis, and bug fixes. The upgraded data types and features include:

Feature-tracking winds from satellite:

- High-latitude winds from the combined geostationary and polar-orbiting satellite imagery (Leo-Geo) winds.
- Visible Infrared Imaging Radiometer Suite (VIIRS) winds with revised observation error.
- Advanced Very High-Resolution Radiometer (AVHRR) winds from MetOp-C.

Scatterometry Winds from satellite:

- Advanced Scatterometer (ASCAT)winds from MetOp-C; set to monitoring mode.
- Revised thinning box and observation error.

Retrieved ozone from satellite:

- Ozone profiles from NOAA-20 Ozone Mapping and Profiler Suite (OMPS) Nadir Mapper.
- Include ozone data from the top 5 layers (pressure layers less than one hPa).

GNSS Radio Occultation:

- Spanish Earth Observation Satellite (PAZ).
- Revised quality control procedures.
- Bug fixes for operational operator.
- Code optimization.

Satellite Radiances:

- Assimilate antenna-corrected instead of antenna temperature data from the Advanced Microwave Sounding Unit-A (AMSU-A), the Humidity Microwave Sounder (MHS), and the Advanced Technology Microwave Sounder (ATMS).
- Revised all-sky framework by including precipitation-affected AMSU-A and ATMS radiances and cloud fraction from the forecast model.
- Upgrade CRTM from version 2.3.0 to 2.4.0.

Near Surface Sea Temperature Analysis:

- Revised thinning box for AVHRR radiances.
- Exclusion of partly clear AVHRR radiances.
- Relaxed quality control to include in-situ observations over the mixed surface type.
- Relaxed gross check thresholds for in-situ data.
- New in-situ observations from Saildrone, Argo, and Glide.
- New correlation length based on the first baroclinic Rossby radius of deformation.

Bug Fixes:

- Variational quality control (VarQC) for winds.
- Infrared (IR) emissivity check with floating-point error.
- IR bias correction when air-mass bias terms are turned off.
- IR data thinning.

Preparation for upcoming observations:

NOAA-21: ATMS, CrIS (Cross-track Infrared Sounder), VIIRS, and OMPS
MetOp-C: Global Ozone Monitoring Experiment (GOME)
GOES-18: Advanced Baseline Imager (ABI)

Lastly, this upgrade involves moving, renaming, and removing various WAFS and precipitation forecast products produced from the GFS on the NCEP Operational Model Archive and Distribution System (NOMADS) and FTPPRD.

The first change involves renaming and removing various World Aviation Forecast System (WAFS) products currently on NOMADS/FTPPRD at:

https://nomads.ncep.noaa.gov/pub/data/nccf/com/gfs/prod/gfs.YYYYMMDD/CC/atmos/
https://ftpprd.ncep.noaa.gov/data/nccf/com/gfs/prod/gfs.YYYYMMDD/CC/atmos/
ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gfs/prod/gfs.YYYYMMDD/CC/atmos/

Rename 0.25 degree WAFS hazard data files: gfs.tCCz.wafs_0p25.fFFF.grib2 -> gfs.tCCz.awf_0p25.fFFF.grib2

Add three cumulonimbus (CB) fields (CB bottom, CB top, and CB extent) to the renamed 0.25 degree WAFS hazard data files:
gfs.tCCz.awf_0p25.fFFF.grib2

Remove the following WAFS files from NOMADS:
0.25 degree WAFS US unblended hazard data:
gfs.tCCz.wafs_0p25_unblended.fFF.grib2
1.25 degree GFS files with U/V/T/RH/H on several vertical coordinates:
gfs.tCCz.wafs_grb45fFF.grib2 and gfs.tCCz.wafs_grb45fFF.grib2.idx

The 0.25 degree WAFS US unblended hazard data will be removed from NOMADS due to a restricted access agreement. The GFS 1.25 degree files with U/V/T/RH/H on several vertical coordinates are removed from NOMADS following the ICAO schedule to retire 1.25 degree WAFS files soon after the 0.25 degree WAFS files become available.

The second change involves moving, renaming, and removing several GFS precipitation forecast products on NOMADS as follows:

Move and rename the 0.25 degree Working Group on Numerical Experimentations (WGNE) GFS accumulated precipitation forecast files on NOMADS/FTPPRD from:

https://nomads.ncep.noaa.gov/pub/data1/nccf/com/verf/prod/precip.YYYYMMDD/wgnegfs_YYYYMMDDHH_000_FFF.grb2

to:

https://nomads.ncep.noaa.gov/pub/data/nccf/com/gfs/prod/gfs.YYYYMMDD/HH/atmos/gfs.tHHz.wgne.fFFF

https://ftpprd.ncep.noaa.gov/data1/nccf/com/verf/prod/precip.YYYYMMDD/wgnegfs_YYYYMMDDHH_000_FFF.grb2

to:

https://ftpprd.ncep.noaa.gov/data/nccf/com/gfs/prod/gfs.YYYYMMDD/HH/atmos/gfs.tHHz.wgne.fFFF

ftp://ftpprd.ncep.noaa.gov/pub/data1/nccf/com/verf/prod/precip.YYYYMMDD/wgnegfs_YYYYMMDDHH_000_FFF.grb2

to:

ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gfs/prod/gfs.YYYYMMDD/HH/atmos/gfs.tHHz.wgne.fFFF

The content of the above 0.25 degree "WGNE" GFS accumulated precipitation forecast files will not change and files will continue to be made available at each GFS cycle (00, 06, 12, and 18Z) at 3-hourly forecast intervals (F003 to F180).

Remove 3-hour precipitation forecast skill score VSDB files from NOMADS/FTPPRD:

https://nomads.ncep.noaa.gov/pub/data1/nccf/com/verf/prod/precip.YYYYMMDD/vsdb3.YYYYMMDD.tar
https://ftpprd.ncep.noaa.gov/data1/nccf/com/verf/prod/precip.YYYYMMDD/vsdb3.YYYYMMDD.tar
ftp://ftpprd.ncep.noaa.gov/pub/data1/nccf/com/verf/prod/precip.YYYYMMDD/vsdb3.YYYYMMDD.tar

Remove 24-hour precipitation forecast skill score VSDB files from NOMADS/FTPPRD:

https://nomads.ncep.noaa.gov/pub/data1/nccf/com/verf/prod/precip.YYYYMMDD/vsdb24.YYYYMMDD.tar
https://ftpprd.ncep.noaa.gov/data1/nccf/com/verf/prod/precip.YYYYMMDD/vsdb24.YYYYMMDD.tar
ftp://ftpprd.ncep.noaa.gov/pub/data1/nccf/com/verf/prod/precip.YYYYMMDD/vsdb24.YYYYMMDD.tar

All changes have been tested over two four-month periods (October 2021 - February 2022 and June 2022 - October 2022) and demonstrated generally neutral impacts for most verification metrics.

Parallel data is available in the following locations:

https://nomads.ncep.noaa.gov/pub/data/nccf/com/gfs/v16.3
https://nomads.ncep.noaa.gov/pub/data/nccf/com/gfs/para
https://ftpprd.ncep.noaa.gov/data/nccf/com/gfs/v16.3
https://ftpprd.ncep.noaa.gov/data/nccf/com/gfs/para
ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gfs/v16.3
ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gfs/para

For questions regarding these model changes, please contact:

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

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