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PNSWSH

Service Change Notice 20-105
National Weather Service Headquarters Silver Spring MD
200 PM EST Fri Nov 6 2020

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From: Brian Gross
 Acting Director
 National Centers for Environmental Prediction

Subject: Upgrade to Real-Time Ocean Forecasting System (RTOFS):
Effective December 8, 2020

Effective on or about Tuesday, December 8, 2020 with the 0000 Coordinated Universal Time (UTC) cycle, the National Centers for Environmental Prediction (NCEP) Central Operations (NCO) will be implementing an upgrade to the Real Time Ocean Forecasting System (RTOFS) model to version 2.0.

The scientific and technical enhancements include the following:

- The daily ocean and ice analysis, which for RTOFS v1 is done through Navy Coupled Ocean Data Assimilation (NCODA) at the Naval Oceanographic Office (NAVOCEANO), will be done instead at the Environmental Modeling Center (EMC) with a similar but upgraded data assimilation system, RTOFS-DA.

- The coupled ocean-sea ice model, `hycom_cice`, will be upgraded with the following major changes:

- * A difference archive will read for incrementally updating the `hycom` state according to the RTOFS-DA increments for temperature, salinity, layer pressure and velocity (`u,v`). The RTOFS-DA incremental update procedure would start three hours prior to the RTOFS-DA analysis time and end with the increments fully incorporated at the analysis time. The new source includes improvements in incremental update time stepping.

- * A "RELO" (relocation) option will be included in `hycom` to allow using the same executable for different domains. Land masks are used to skip land.

- The source includes several upgrades for future use:
 - a. In addition to ice coverage, ice thickness can be inserted in `cice`.
 - b. Atmospheric pressure can be used as atmospheric forcings.
 - c. Wind stress can be modified during the run, from (`U10m - Uocean`).
 - d. Activate Tidal body forcings.

Note: The above options remain inactive in the current configuration.

- Evaluation results from RTOFS v2 are available at:

<https://www.emc.ncep.noaa.gov/users/meg/rtofsv2/>

The RTOFS v2.0.0 system has been fully tested and qualitatively and quantitatively (statistics for BIAS, RMSE, correlation coefficient) compared with independent observations from the National Environmental Satellite, Data and Information Service (NESDIS) - Office of Satellite and Product Operations (OSPO) Satellite Ocean Heat Content Suite (SOHCS) products and the current operational RTOFS (RTOFS v1.1.4) for the 2019 hurricane season and also for the May-July, 2020 period. The forecast skill of the 2019 hurricanes has also been compared with the operational Hurricane Weather Research and Forecasting (HWRF) v12.4.4. Overall, RTOFS v2.0.0 results show better statistical and forecast skill in comparison to the current operational RTOFS v1.1.4.

New Products:

- Addition:

With this upgrade, the following products will be added to NCEP Web Services, including OpenDap and ftpprd:

NetCDF:

-rtofs_glo_2ds_nNNN_ice.nc
-rtofs_glo_2ds_fFFF_ice.nc

These files contain Global Ice data in netCDF format in 1-hourly intervals (Nowcast hours: NNN: 000 to 024 in 1-hour increments. Forecast Hours: FFF: 000 to 072 (in 1-hour intervals) and 75 to 192 in 3-hourly intervals).

Fields available are ice_coverage, ice_thickness, ice_temperature, ice_uvelocity and ice_vvelocity

Gridded binary version two (GRIB2):

- rtofs_glo.t00z.nNNN_alaska_std.grb2
- rtofs_glo.t00z.nNNN_arctic_std.grb2
- rtofs_glo.t00z.nNNN_bering_std.grb2

- rtofs_glo.t00z.fFFF_alaska_std.grb2
- rtofs_glo.t00z.fFFF_arctic_std.grb2
- rtofs_glo.t00z.fFFF_bering_std.grb2

(Nowcast hour NNN: 024. Forecast hours FFF: 024, 048, 072 and 144). The above regional files will have ice_coverage and ice_thickness in addition to the products currently available in GRIB2 format.

World Meteorological Organization (WMO) GRIB data will be added to the Satellite Broadcast Network (SBN)/NOAAPort: Nowcast hour (024) and Forecast hours (024, 048, 072 and 144) for products ice_coverage and ice_thickness will be added to three regions: Alaska, Arctic and Bering in the header files.

Please see the list of headers here:

https://www.nco.ncep.noaa.gov/pmb/changes/RTOFS_48hr_nowcast_headers.txt

Product Removals:

With this upgrade, the following products will be removed from NCEP Web Services, including NOAA Operational Model Archive and Distribution System (NOMADS) OpenDap and ftpprd.

```
-rtofs_glo.t00z.n-NN.archs.a  
-rtofs_glo.t00z.n-NN.archs.b  
  
-rtofs_glo.t00z.n-NN.archv.a  
-rtofs_glo.t00z.n-NN.archv.b
```

Where NN = 25-48 Nowcast in the new upgrade is run for one day (n-24 to n00) and hence, the above files are removed. For n-48 to n-24, users can use the previous day nowcast files from n-24 to n00.

```
-rtofs_glo_2ds_nNNN_3hrly [diag/prog].nc  
-rtofs_glo_2ds_nNNN_daily [diag/prog].nc  
  
-rtofs_glo_2ds_fNNN_3hrly_[diag/prog].nc  
-rtofs_glo_2ds_fNNN_daily_[diag/prog].nc
```

The reason for removing the above files (*prog* and *diag*) is that they are redundant. In current production, *1hrly* files get copied to *3hrly* and *daily* files. So, we have three copies of the same file which causes redundancy. Hence, we plan to have one copy of the files with *hrly* and *daily* removed from the filenames (more on that below).

```
-rtofs_glo_3dz_nNNN_6hrly_hvr_REGION.nc  
-rtofs_glo.t00z.n048_REGION_std.grb2  
-rtofs_glo_3dz_n048_daily_3zsio.nc
```

Nowcast in the new upgrade is run for one day (n-24 to n00) and hence the above files are removed. (where NNN = 30, 36, 42, 48). For n-48 to n-24, users can use the previous day nowcast files from n-24 to n00.

WMO GRIB data to be removed from the SBN/NOAAPort:

48-hour nowcast output for the following regions will be removed:
alaska, arctic, bering, guam, gulf_alaska, honolulu, hudson_baffin,
samoa, trop_paci_lowres, west_atl, west_conus.

Please see the list of headers here:

https://www.nco.ncep.noaa.gov/pmb/changes/RTOFS_48hr_nowcast_headers.txt

Product Changes:

With this upgrade, the following products will change on NCEP Web Services, including NOMADS OpenDap and ftpprd.

All the Global Surface 1-hourly files:
rtofs_glo_[2ds]_[f/n]NNN_1hrly_[diag/prog].nc will be renamed as:
rtofs_glo_[2ds]_[f/n]NNN_[diag/prog].nc

Where f/n: forecast/nowcast

Nowcast hours: NNN: 000 to 024 for nowcast
Forecast Hours: NNN: 000 to 192 for forecast

- rtofs_glo_[2ds]_[f/n]NNN_1hrly_[diag].nc

Ice coverage and Ice thickness will be removed from the "diag" files and added on to Global Surface ice data files in netCDF format in 1-hourly intervals for both nowcast and forecast.

Further, all nc files will be converted to NetCDF4 with compression.

The above-mentioned list of changed products has been approved. A Public Information Statement with more details can be found here:

https://www.weather.gov/media/notification/pdf2/pns20-41rtofs_product_removal.pdf

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 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, please contact:

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National Service Change Notices are online at:

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

NNNN