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Service Change Notice 23-76 Updated
National Weather Service Headquarters Silver Spring MD
200 PM EDT Fri Aug 18 2023

To: Subscribers:
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From: Mike Farrar, Director
 National Centers for Environmental Prediction

Subject: Updated: Upgrade of National Water Model on NCEP's WCOSS System and its Post-processing Application on the Integrated Dissemination Platform (IDP): Effective September 20, 2023

Updated implementation date to September 20, 2023.

Effective on or about September 20, 2023, beginning with the 1200 Coordinated Universal Time (UTC) run, the National Centers for Environmental Prediction (NCEP) will begin operationally running Version 3.0 of the National Water Model (NWM) on the Weather and Climate Operational Supercomputing System (WCOSS), and its related output post-processing application will begin running on the Integrated Dissemination Platform (IDP).

The NWM is an hourly cycling uncoupled analysis and forecast system that provides streamflow for over 3.2 million river reaches, Total Water Level (TWL) guidance for coastal regions, and other hydrologic information on grids ranging in resolution from 100m to 1km. It also provides complementary hydrologic guidance at current NWS River Forecast Center (RFC) river forecast locations and significantly expanded guidance coverage and type in underserved locations. Further information on the observation- and model-based forcing sources used by the NWM, along with details on the NWM domain and modeling components, can be found at:

<https://water.noaa.gov/about/nwm>

The NWM post-processing application ingests raw NWM channel, land and forcing files and then creates subsetted data files and derived variables for NWS RFCs and Weather Forecast Offices (WFOs). The subsetting of data is intended to reduce system and network resource usage in obtaining critical NWM data of interest. This post-processing also supports Office of Water Prediction (OWP) web services and operations with image products and map service data for select NWM variables.

(A) Enhancements in the Model Version 3.0

Version 3.0 of the NWM contains several notable upgrades over the current operational version. These include:

- First time provision of NWM Total Water Level guidance for coastal areas of the Continental United States (CONUS), Hawaii and Puerto Rico / U.S. Virgin Island domains. This is accomplished via use of the Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM) integrated within the NWM, to couple NWM freshwater discharge estimates with oceanic forcing from the Surge and Tide Operational Forecast System (STOFS) and Probabilistic Tropical Storm Surge (P-SURGE) model. Output will be provided in both NetCDF as well as Standard Hydrometeorological Exchange Format (SHEF) format. Each NetCDF file contains full TWL domain output for one output time step, while each SHEF file contains timeseries station output for the full length of each simulation.
- NWM Domain expansion to south-central Alaska (Cook Inlet, Copper River Basin, and Prince William Sound regions), enabling provision of NWM operational hydrologic model forecast guidance to this region.
- Addition of the National Blend of Models (NBM) as a forcing source for NWM CONUS medium-range forecasts and Alaska short-range and medium-range forecasts.
- Use of Multi-Radar Multi-Sensor (MRMS) precipitation as forcing for the NWM Analysis and Assimilation configuration over the Puerto Rico / U.S. Virgin Island domain.
- Ingest of RFC-supplied reservoir outflow forecasts at 77 additional locations, bringing the total of such sites to 392.
- Enhancements to the treatment of reservoirs, land surface parameters and calibration/regionalization approach leading to improvements in model skill.
- Implementation of a new surface runoff scheme (Xinjiang) within the NWM, improving streamflow simulation performance.
- Various hydrofabric improvements for all domains, detailed in Appendix 1 at the end of this notice.

(B) Model Output Changes

Model output is available via NCEP web services here:

<https://nomads.ncep.noaa.gov/pub/data/nccf/com/nwm>
<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/nwm>

B1. Additions to existing files

None

B2. Renamed Output

None

B3. New NBM-Forced Medium-Range CONUS Forecast Configuration

New elements within the new files are detailed in Appendix 2 at the end of this notice.

- Medium Range in medium_range_blend/
nwm.tCCz.medium_range_blend.channel_rt.f###.conus.nc
nwm.tCCz.medium_range_blend.reservoir.f###.conus.nc
Where CC is cycle (00, 06, 12, 18) and ### is 001-240.

nwm.tCCz.medium_range_blend.land.f###.conus.nc
nwm.tCCz.medium_range_blend.terrain_rt.f###.conus.nc
Where CC is cycle (00, 06, 12, 18) and ### is 003-240.

- Medium Range Blend Forcing files in forcing_medium_range_blend/
nwm.tCCz.medium_range_blend.forcing.f###.conus.nc
Where CC is cycle (00, 06, 12, 18) and HHH is 001-240.

B4. New Alaska Domain Output

New elements in the new files are detailed in Appendix 3 at the end of this notice.

- Analysis and Assimilation in analysis_assim_alaska/
nwm.tCCz.analysis_assim.channel_rt.tm##.alaska.nc
nwm.tCCz.analysis_assim.reservoir.tm##.alaska.nc
nwm.tCCz.analysis_assim.land.tm##.alaska.nc
nwm.tCCz.analysis_assim.terrain_rt.tm##.alaska.nc
Where CC is cycle (00-23) and ## is 00-02.

- Analysis and Assimilation Forcing in forcing_analysis_assim_alaska/
nwm.tCCz.analysis_assim.forcing.tm##.alaska.nc
Where CC is cycle (00-23) and ## is 00-02.

- Extended Analysis and Assimilation in analysis_assim_extend_alaska/
nwm.t20z.analysis_assim_extend.channel_rt.tm##.alaska.nc
nwm.t20z.analysis_assim_extend.reservoir.tm##.alaska.nc
nwm.t20z.analysis_assim_extend.land.tm##.alaska.nc
nwm.t20z.analysis_assim_extend.terrain_rt.tm##.alaska.nc
Where ## is 00-31.

- Extended Analysis and Assimilation Forcing in
forcing_analysis_assim_extend_alaska/
nwm.t20z.analysis_assim_extend.forcing.tm##.alaska.nc
Where ## is 00-31.

- Short Range in short_range_alaska/
nwm.tCCz.short_range.channel_rt.f###.alaska.nc
nwm.tCCz.short_range.reservoir.f###.alaska.nc
nwm.tCCz.short_range.land.f###.alaska.nc
nwm.tCCz.short_range.terrain_rt.f###.alaska.nc
Where CC is cycle (00, 01...23) and ### is 001-045 for cycles 03, 09, 15, 21 and 001-015 for cycles 00, 06, 12, 18.

- Short Range Forcing files in forcing_short_range_alaska/
nwm.tCCz.short_range.forcing.f###.alaska.nc
Where CC is cycle (00, 01...23) and ### is 001-045 for cycles 03, 09, 15, 21 and 001-015 for cycles 00, 06, 12, 18.

- Medium Range in medium_range_alaska_memM/
nwm.tCCz.medium_range.channel_rt_M.f###.alaska.nc
nwm.tCCz.medium_range.reservoir_M.f###.alaska.nc
nwm.tCCz.medium_range.land_M.f###.alaska.nc
nwm.tCCz.medium_range.terrain_rt_M.f###.alaska.nc
Where CC is cycle (00, 01...23), M is ensemble member number (1 to 6) and ### is 001-045 for cycles 03, 09, 15, 21 and 001-015 for cycles 00, 06, 12, 18.

- Medium Range Forcing files in forcing_medium_range_alaska/
nwm.tCCz.medium_range.forcing.f###.alaska.nc
Where CC is cycle (00, 06, 12, 18) and ### is 001-240.

- Medium Range Blend in medium_range_blend_alaska/
nwm.tCCz.medium_range_blend.channel_rt.f###.alaska.nc
nwm.tCCz.medium_range_blend.reservoir.f###.alaska.nc
nwm.tCCz.medium_range_blend.land.f###.alaska.nc
nwm.tCCz.medium_range_blend.terrain_rt.f###.alaska.nc
Where CC is cycle (00, 01...23) and ### is 001-045 for cycles 03, 09, 15, 21 and 001-015 for cycles 00, 06, 12, 18.

- Medium Range Blend Forcing files in forcing_medium_range_blend_alaska/
nwm.tCCz.medium_range.forcing.f###.alaska.nc
Where CC is cycle (00, 06, 12, 18) and ### is 001-240.

- No-DA Analysis and Assimilation in analysis_assim_alaska_no_da/
Open Loop channel files
nwm.tCCz.analysis_assim_no_da.channel_rt.tm##.alaska.nc
Where CC is cycle (00-23) and ## is 00-02.

- No-DA Medium Range in medium_range_alaska_no_da/ Open Loop channel files
nwm.tCCz.medium_range_blend.channel_rt.f###.alaska.nc
Where CC is cycle (00, 06, 12, 18) and ### is 001-240.

B5. New Coastal Total Water Level Output
New elements in the new files are detailed in Appendix 4 at the end of this notice.

- Coastal Analysis and Assimilation in analysis_assim_coastal_RR/
nwm.tCCz.analysis_assim_coastal.total_water.tm##.RR.nc
Where RR is Region (atlgulf, pacific, hawaii or puertorico) CC is cycle (00-23) and ## is 00-02.

- Coastal Extended Analysis and Assimilation in
analysis_assim_extend_coastal_RR/
nwm.tl6z.analysis_assim_extend_coastal.total_water.tm##.RR.nc
Where RR is Region (atlgulf or pacific) and ## is 00-27.

- Coastal Short Range in short_range_coastal_RR/
nwm.tCCz.short_range_coastal.total_water.f###.RR.nc
Where RR is Region (atlgulf, pacific, hawaii or puertorico), CC is cycle (00, 01...23 for atlgulf and pacific, 00 and 12 for hawaii, and 06 and 18 for puerto rico) and ### is 001-018 for atlgulf and hawaii and 001-048 for hawaii and puertorico).

nwm.tCCz.short_range_coastal.total_water.RR.shef

Where RR is Region (atlgulf, pacific, hawaii or puertorico) and CC is cycle (00, 01...23 for atlgulf and pacific, 00 and 12 for hawaii, and 06 and 18 for puerto rico).

- Coastal Psurge Short Range in short_range_coastal_RR_psurge/

nwm.tCCz.short_range_coastal.total_water.psurge.f###.RR.nc

Where RR is Region (atlgulf), CC is cycle (00, 01...23 for atlgulf) and ### is 001-018 for atlgulf.

nwm.tCCz.short_range_coastal.total_water.psurge.RR.shef

Where RR is Region (atlgulf) and CC is cycle (00, 01...23 for atlgulf).

Note: These output files and associated output directory are only created when upstream probabilistic storm surge (P-surge) forcing data is available and this particular NWM configuration executes.

- Coastal Medium Range in medium_range_coastal_RR_mem1/

nwm.tCCz.medium_range_coastal.total_water.f###.RR.nc

Where RR is Region (atlgulf or pacific), CC is cycle (00, 06, 12, 18) and ### is 001, 002...240.

nwm.tCCz.medium_range_coastal.total_water.RR.shef

Where RR is Region (atlgulf, pacific) and CC is cycle (00, 06 12, 18).

- Coastal P-surge Medium Range in medium_range_coastal_RR_mem1_psurge/

nwm.tCCz.medium_range_coastal.total_water.psurge.f###.RR.nc

Where RR is Region (atlgulf), CC is cycle (00, 06, 12, 18) and ### is 001, 002...240.

nwm.tCCz.medium_range_coastal.total_water.psurge.RR.shef

Where RR is Region (atlgulf) and CC is cycle (00, 06 12, 18).

Note: These output files and associated output directory are only created when upstream P-surge forcing data is available and this particular NWM configuration executes.

- Coastal Medium Range Blend in medium_range_blend_coastal_RR/

nwm.tCCz.medium_range_blend_coastal.total_water.f###.RR.nc

Where RR is Region (atlgulf or pacific), CC is cycle (00, 06, 12, 18) and ### is 001, 002...240.

nwm.tCCz.medium_range_blend_coastal.total_water.RR.shef

Where RR is Region (atlgulf, pacific) and CC is cycle (00, 06, 12, 18).

- Coastal Psurge Medium Range Blend in

medium_range_blend_coastal_RR_psurge/

nwm.tCCz.medium_range_blend_coastal.total_water.psurge.f###.RR.nc

Where RR is Region (atlgulf), CC is cycle (00, 06, 12, 18) and ### is 001, 002...240.

nwm.tCCz.medium_range_blend_coastal.total_water.psurge.RR.shef

Where RR is Region (atlgulf) and CC is cycle (00, 06, 12, 18).

Note: These output files and associated output directory are only created when upstream P-surge forcing data is available and this particular NWM configuration executes.

B6. NWM Output Field Data Type Changes: The feature_ID output field now utilizes a type of int64.

(C) Post-Processing Application Output Changes

C1. NWM "channel_rt" post-processed files now use the NETCDF4 format, which allows for use of 64-bit integers for feature_id (or station_id). Land and forcing products continue to use the same format as the previous version of the NWM, which is NETCDF4_CLASSIC.

C2. Files have been added for the new Alaska domain, including:

- Analysis_assim_alaska:

nwm.tCCz.analysis_assim.[channel_rt|land|forcing].tm##.alaska.nc

Where CC is the cycle time, from 00 to 12 and ## is 00, 01 or 02.

- Short_range_alaska: nwm.tCCz.short_range.[channel_rt|land|forcing].f###.alaska.nc

Where CC is the cycle time, (00, 06, 12, 18) and ### is the forecast hour (001, 002...015).

nwm.tCCz.short_range.[channel_rt|land|forcing].f###.alaska.nc

Where CC is the cycle time, (03, 09, 15, 21) and ### is the forecast hour (001, 002...045).

- Medium_range_alaska_memX:

nwm.tCCz.medium_range.channel_rt_X.f###.alaska.nc

Where CC is the cycle time, (00, 06, 12, 18); X is 1 - 6; and ### is the forecast hour (001, 002...240).

nwm.tCCz.medium_range.land_X.f###.alaska.nc

Where CC is the cycle time, (00, 06, 12, 18); X is 1 - 6; and ### is the forecast hour (003, 006...240).

- Medium_range_blend_alaska:

nwm.tCCz.medium_range_blend.[channel_rt|forcing].f###.alaska.nc

Where CC is the cycle time, (00, 06, 12, 18) and ### is the forecast hour (001, 002...240).

nwm.tCCz.medium_range_blend.land.f###.alaska.nc

Where CC is the cycle time, (00, 06, 12, 18) and ### is the forecast hour (003, 006...240).

- Forcing_analysis_assim_extend_alaska:

nwm.t16z.analysis_assim_extend.forcing.tm##.alaska.nc

Where ## is 00, 01, 02...27.

- Forcing_medium_range_alaska:

nwm.tCCz.medium_range.forcing.f###.alaska.com

Where CC is the cycle time, (00, 06, 12, 18) and ### is the forecast hour (001, 002, 003...240).

C3. New Alaska domain Web Map Service data and image file products will be available on the NCEP Web Services here:

<https://nomads.ncep.noaa.gov/pub/data/nccf/com/nwm/post-processed/WMS>
<https://nomads.ncep.noaa.gov/pub/data/nccf/com/nwm/post-processed/IMAGES>

Filenames for Alaska contain "alaska" in the filename.

C4. New RFC NBM-Forced (Blend) RFC Products:

- Medium Range blend (CONUS region)

nwm.tCCz.medium_range_blend.channel_rt.f###.conus.nc

Where CC is the cycle time, (00, 06, 12, 18) and ### is the forecast hour (001, 002, 003...240).

nwm.tCCz.medium_range_blend.land.f###.conus.nc

Where CC is the cycle time, (00, 06, 12, 18) and ### is the forecast hour (001, 002, 003...240).

(D) Timing Changes

With the implementation of NWM V3.0, the timing of NWM output dissemination will change as follows:

D1. Hawaii Analysis Assim No DA files - 45 minutes earlier

Directory	Filename
-----	-----
analysis_assim_hawaii_no_da/	nwm.*.channel_rt.tm*.hawaii.nc

D2. Hawaii Analysis Assim files - 45 minutes earlier

Directory	Filename
-----	-----
analysis_assim_hawaii/	nwm.*.channel_rt.tm*.hawaii.nc
analysis_assim_hawaii/	nwm.*.terrain_rt.tm*.hawaii.nc
analysis_assim_hawaii/	nwm.*.land.tm*.hawaii.nc
analysis_assim_hawaii/	nwm.*.reservoir.tm*.hawaii.nc

D3. Puerto Rico Analysis Assim No DA files - 20 minutes earlier

Directory	Filename
-----	-----
analysis_assim_puertorico_no_da/	nwm.*.channel_rt.tm*.puertorico.nc

D4. Puerto Rico Analysis Assim files - 20 minutes earlier

Directory	Filename
-----	-----
analysis_assim_puertorico/	nwm.*.channel_rt.tm*.puertorico.nc
analysis_assim_puertorico/	nwm.*.terrain_rt.tm*.puertorico.nc
analysis_assim_puertorico/	nwm.*.land.tm*.puertorico.nc
analysis_assim_puertorico/	nwm.*.reservoir.tm*.puertorico.nc

D5. Hawaii Forcing Analysis Assim files - 45 minutes earlier

Directory	Filename
-----	-----
forcing_analysis_assim_hawaii/	nwm.*.forcing.tm*.hawaii.nc

D6. Puerto Rico Forcing Analysis Assim files - 20 minutes earlier

Directory	Filename
-----	-----
forcing_analysis_assim_puertorico/	nwm.*.forcing.tm*.puertorico.nc

D7. Hawaii Short Range No DA files - 15 minutes earlier

Directory	Filename
-----	-----
short_range_hawaii_no_da/	nwm.*.channel_rt.f*.hawaii.nc

D8. Hawaii Short Range files - 15 minutes earlier

Directory	Filename
-----	-----
short_range_hawaii/	nwm.*.channel_rt.f*.hawaii.nc
short_range_hawaii/	nwm.*.terrain_rt.f*.hawaii.nc
short_range_hawaii/	nwm.*.land.f*.hawaii.nc
short_range_hawaii/	nwm.*.reservoir.f*.hawaii.nc

(E) OWP Water Website visualization services

End users are able to visualize several NWM outputs via the interactive map and image viewer on the Office of Water Prediction (OWP) website:

<https://water.noaa.gov/about/nwm>

(F) Other information and contacts

As in V3.0, users will find that long-range products have enough of a lag time in creation that they may appear in the previous day's output directory. For example, long-range mem 1 products for the 18 UTC cycle will not show up until the day after their initialization time. For this reason, users are encouraged to look back in the previous dated directory for long-range product availability.

Most NWM NetCDF output files are directly viewable using standard NetCDF visualization utilities. The exception are the point-type NWM channel output files containing streamflow and other variables. In particular, due to storage space limitations, the latitude and longitude of each point are stored outside of the file, but are available at:

https://www.nohrsc.noaa.gov/pub/staff/keicher/NWM_live/web/data_tools/NWM_channel_hydrofabric.tar.gz

This archive contains an ESRI file geodatabase (gdb), which provides full geospatial information for all NWM stream reaches. The gdb file can easily be used with ESRI ArcGIS software, and other GIS software, to associate the correct geospatial data with NWM channel_rt data by feature_id. A full text description of the gdb contents and basic use instructions are available as a separate file in the archive.

A consistent parallel feed of NWM model data will be available on the NCEP servers via the following URLs:

<https://nomads.ncep.noaa.gov/pub/data/nccf/com/nwm/para>
<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/nwm/para/>

and here for the parallel post-processed data:

https://nomads.ncep.noaa.gov/pub/data/nccf/com/nwm/para_post-processed/
ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/nwm/para_post-processed/

NCEP encourages all users to ensure their decoders are flexible and are able to adequately handle changes in content order 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 implementations.

Any questions regarding this implementation should be directed below. We will evaluate any feedback and decide whether to proceed.

For questions on the science aspects of the NWM, please contact:

Brian Cosgrove
OWP/Analysis and Prediction Division
Silver Spring, MD
brian.cosgrove@noaa.gov

For questions on post-processing derived variables and general product format and processing, please contact:

Trey Flowers
OWP/Analysis and Prediction Division
Tuscaloosa, AL
205-347-1450
trey.flowers@noaa.gov

For questions regarding the data flow aspects of the post-processing application, please contact:

Joshua Huber
NCEP/NCO OnBoarding Team Lead
College Park, Maryland
idp-feedback@noaa.gov

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

Margaret Curtis
NCEP/NCO Dataflow Team Lead (acting)
ncep.pmb.dataflow@noaa.gov

APPENDICES

Appendix 1: Hydrofabric Improvements by Domain

A1.1) CONUS Domain

- Channel Segments:
 - Removal of four stream segments (Great Lakes region).
 - 12 Stream segment topology and attribute fixes.

- Streamflow Gauges:
 - Added 678 stream gauges used for assimilation routine.
 - Adjusted location of 12 gauges.
 - Replaced IDs of six existing gauges.
 - Four stream gauges removed due to tidal influence.
 - Two stream gauges removed with no replacement.

- Miscellaneous:
 - Addition of one reservoir (Santa Maria Reservoir).
 - Removal of two reservoirs.
 - New elevation and gridded channel representation.

A1.2) Hawaii Domain

No Hydrofabric changes.

A1.3) Puerto Rico / U.S. Virgin Islands Domain

- Addition of one reservoir (Portugues Reservoir).
- Adjusted location of two stream gages.

A1.4) South Central Alaska Domain

- Features 1km LSM grid with 250m terrain routing.
- 391,528 Channel segments.
- 65 U.S. Geological Survey (USGS) stream gauges.
- 237 reservoirs.
- Three glacier dammed lakes.

Appendix 2: New NBM-Forced Medium-Range CONUS Forecast Configuration

- Forcing Files: List of model output variables is a subset of that given for the CONUS NWM Medium-Range forcing files listed here:

<https://www.nco.ncep.noaa.gov/pmb/products/nwm/>

Specifically, these files only contain the RAINRATE output field.

- Model Output Files: List of model output variables is the same as for the CONUS NWM Medium-Range model output files listed here:

<https://www.nco.ncep.noaa.gov/pmb/products/nwm/>

Appendix 3: New Alaska Forecast Configuration

- Forcing Files: List of forcing output variables for the NWM Alaska Analysis and Assimilation, Extended Analysis and Assimilation, Short-Range and Medium-Range configurations is the same as for the respective CONUS forcing output files listed here:

<https://www.nco.ncep.noaa.gov/pmb/products/nwm/>

- Model Output Files: List of model output variables for the NWM Alaska Analysis and Assimilation, Extended Analysis and Assimilation, Short-Range, Medium-Range, Medium-Range Blend and No-DA configurations is the same as for the respective CONUS forcing output files listed here:

<https://www.nco.ncep.noaa.gov/pmb/products/nwm/>

Appendix 4: New NWM Coastal Total Water Level Output

- Coastal Analysis and Assimilation in analysis_assim_coastal_RR/nwm.tCCz.analysis_assim_coastal.total_water.tm##.RR.nc
Where RR is Region (atlgulf, pacific, hawaii or puertorico) CC is cycle (00-23) and ## is 00-02.

- Coastal Extended Analysis and Assimilation in analysis_assim_extend_coastal_RR/.

All coastal output files contain the same fields, defined as follows:

- time: valid output time, [minutes since 1970-01-01 00:00:00 UTC].
- "reference_time" with long_name "model initialization time" and units minutes since 1970-01-01 00:00:00 UTC
- "nSCHISM_hgrid_node" with long_name "CRS definition".
- "SCHISM_hgrid_node_x" with long_name "longitude" and units "degrees_east".
- "SCHISM_hgrid_node_y" with long_name "latitude" and units "degrees_north".
- "elevation" with long_name "sea surface elevation relative to NAVD88" (for AtlGulf and Pacific domains), "sea surface elevation relative to LMSL" for Hawaii and Puerto Rico domains), and units "m".

National Service Change Notices are online at:

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

NNNN