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Service Change Notice 24-41
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To: Subscribers:
           -NOAA Weather Wire Service
           -Emergency Managers Weather Information Network
           -NOAAPort
           Other NWS Partners, Users and Employees

From: Geoff Manikin
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           Meteorological Development Laboratory

Subject: Upgrade of National Blend of Models Guidance: Effective May 15, 2024

On or about Wednesday, May 15, 2024, beginning with the 1200 Coordinated Universal Time (UTC) model run, the NWS Meteorological Development Laboratory (MDL) will implement an update to the National Blend of Models (NBM) guidance over the Contiguous United States (CONUS) and outside the OCONUS (Alaska (AK), Hawaii (HI), Puerto Rico (PR), Guam (GU), and Oceanic (OC)) National Digital Forecast Database (NDFD) domains.

In the event that the implementation date is declared a Critical Weather Day (CWD), an Enhanced Caution Event, or other significant weather is occurring or is anticipated to occur, implementation of this change will take place at 1200 UTC on the next weekday not declared a CWD and when no significant weather is occurring.

1. Background

Comments/feedback on this upgrade were previously solicited publicly from November 20, 2023 through January 19, 2024:

https://www.weather.gov/media/notification/pdf_2023_24/pns23-45_nbm_v4.2.pdf

NBM Version 4.2 will continue to fill existing product gaps requested by the Aviation, Water Resources, Marine, Winter, and Tropical NWS Service Programs. A listing of the new NBM v4.2 weather elements includes:

- 10m instantaneous quantile mapped wind speed and wind gust guidance in the form of percentiles (1-99) and exceedance values (Wind speed: 7 kts, 11 kts, 17 kts, 22 kts, 30 kts, 34 kts, 48 kts, and 64 kts; Wind gust: 17 kts, 22 kts, 30 kts, 34 kts, 41 kts, 48 kts, 56 kts, and 64 kts) for the CONUS domain.

- 10m instantaneous wind speed and wind gust mean and standard deviation derived from the quantile mapped forecasts.

It is anticipated that these upgrades will benefit the NWS in its goal toward providing better Impact-Based Decision Support Services (IDSS).

2. Summary of Product Enhancements

Several highlights associated with this upcoming release include the following:

- New probabilistic Quantile Mapping-based (QM) 10m instantaneous wind speed and wind gust percentiles and exceedance values (CONUS). Varying time windows of the analyzed cumulative distribution function are used to assist in removing daytime and nighttime biases.

- Mixing Height calculation is now dependent upon UnRestricted Mesoscale Analysis (URMA) surface terrain height rather than the Rapid Refresh (RAP) model surface height (CONUS).

- For QM Quantitative Precipitation Forecasts (QPF), smoothing is introduced to the QM precipitation amount Cumulative Distribution Functions (CDFs) to reduce the "lattice-like" features in the NBM blended snow amount for these inputs: European Centre for Medium-Range Weather Forecasts Ensemble (ECMWFE), Global Ensemble Forecast System (GEFS), Global Forecast System (GFS), and Short-Range Ensemble Forecast System (SREF). Note that this modification was made for all regions where QM QPF is made (CONUS, Alaska, Hawaii, Puerto Rico, Oceanic).

- The Snow Liquid Ratio (SLR) calculation is modified by taking into account the melting of snow where temperatures are at or above freezing at the surface, and the 25% reduction factor to each model input SLR value is removed (CONUS, Alaska).

- Usage of a downscaled wet bulb temperature for ECMWFE, GEFS, GFS, and SREF models for improvement in ice accumulations (CONUS, Alaska).

- Reduction of blocky precipitation type features in the winter weather suite by (1) omitting the parent 12km NAM as an input; (2) modifying the weights of the HiRes Window FV3, NAMNest, GFS, GEFS, and ECMWFE inputs; and (3) leveraging the downscaled the GFS (QPF) input.

- Modified usage of the HiRes Windows ARW and ARW2 in computation of probability of precipitation types to remove inflated probabilities driven by a precipitation type computed in the output of those two models at a much lower precipitation rate threshold than used by other models. Precipitation type information for those two inputs is now only used in the NBM when a minimum of 0.01" of precipitation falls during the previous hour.

- Removal of the consistency check between sky cover and ceiling height for CONUS and Alaska - Sky Cover percentage values can now be less than 57% when a ceiling height is present.

- Gridded LAMP (GLMP) ceiling height is used as NBM ceiling height over coastal waters through hour 16 in the operational NBM, with the Rapid Refresh (RAP) ceiling height used thereafter. In this upgrade, the GLMP

is used through forecast hour 24 with the usage of the RAP ceiling height
starting at forecast hour 25.

- Runtime of the tropical cyclone feature matching technique is optimized
to preserve the National Hurricane Center's Gridded Tropical Cyclone
forecast advisory Message (wTCM) wind field while also ensuring a
meteorologically consistent wind field along the periphery and outside
edges of the wTCM (CONUS, Hawaii, Puerto Rico, Guam, Oceanic).

3. NBM Product Changes

With NBM v4.2 continuing to move towards probabilistic guidance, we have
replaced the current methodology employed to generate deterministic wind
speed and wind gust guidance with the mean of the distribution calculated
from the QM technique. As noted above in Section 2, the new wind product
will be updated four times daily with no changes to the number of
available projections and hourly issuance cadence. We do note however
that the wind direction is calculated from a separate but similar set of
model inputs and remains unchanged from the methodology calculated in NBM
v4.1. The following hyperlink provides a comprehensive listing of all the
multi-model inputs used to generate the new 10m probabilistic wind speed
and wind gust product.

NBM v4.2 10m probabilistic wind speed and wind gust multi-model inputs:

https://www.weather.gov/media/mdl/nbm/docs_v42/NBM_v4.2_Quantile_Mapped_Mo
del_Inputs_for_Probabilistic_10m_Wind_Speeds_and_Wind_Gusts.pdf

NBM v4.2 10m probabilistic wind speed and wind gust multi-model inputs as
a function of NBM cycle issuance:

https://www.weather.gov/media/mdl/nbm/docs_v42/QMD_Run_Availability_in_NBM
_Model_Availability_V4.2.pdf

4. NBM Text Product Changes

A comprehensive list of stations for which deterministic-based Hourly
(NBH), Short-term (NBS), Extended (NBE), Super Extended (NBX), and
probabilistic Extended (NBP) station text bulletin guidance can be found
at:

https://vlab.noaa.gov/web/mdl/nbm-stations-v4.2

A description of all NBM text file products can be found here:

https://vlab.noaa.gov/web/mdl/nbm-textcard-v4.2

Changes to the deterministic wind speed and wind gust product:

Please note that the values in the deterministic wind speed and wind gust
text messages are the mean of the distribution of the QM solution noted in
section 2. The associated standard deviation values are also derived from
the QM solution space. No changes have been made to the probabilistic

text message to incorporate the new QM 10m wind speed and wind gust guidance. That update will be made with the next upgrade to NBM v5.0.

As a reminder, the file names of the five types of NBM text messages are:

a. blend_nbhtx.t[hh]z   [where hh = 00,01,02,...,23]
b. blend_nbstx.t[hh]z   [where hh = 00,01,02,...,23]
c. blend_nbetx.t[hh]z   [where hh = 00,01,02,...,23]
d. blend_nbxtx.t[hh]z   [where hh = 00,01,02,...,23]
e. blend_nbptx.t[hh]z   [where hh = 00,01,02,...,23]

For a comprehensive document fully describing changes to the text products, please refer to Section 7 - "NCEP Web Services (NOMADS/FTPPRD) Dissemination".

5.   NBM Runtime Changes

With the implementation of v4.2, dissemination delays can be expected for many of the quantile mapped products with shorter delays for a majority of the NBM core products. In some instances, however, users can expect earlier arrival times of the data. For specific timing information please see the following link:

https://www.weather.gov/media/mdl/nbm/docs_v42/Dissemination_Timing_Differences.pdf

6. Changes to Satellite Broadcast Network (SBN)/NOAAPort Dissemination

While the NBM runs hourly and produces output to 264 hours for each cycle, as with NBM v4.1, only a subset will be disseminated across the SBN and NOAAPort due to bandwidth limitations. NBM v4.2 data will be disseminated in GRIB2 format and will contain grouped World Meteorological Organization (WMO) headers, as is done in NBM v4.1.

With the implementation of NBM v4.2, the notable SBN/NOAAPort dissemination time changes can be summarized as follows:

- Fixed headers not matching the header scheme for the following elements (no net change in SBN bandwidth):

* 6-hour Probability of Thunder
* Daytime Maximum and Nighttime Minimum Temperature Probabilities and Percentiles
* 24-hour, 48-hour, and 72-hour Ice and Snow Amounts
* Solar Radiation
* Maximum Hourly Reflectivity
* Probability of Tornado, Severe Hail, and Severe Wind
* Some elements at 2200 UTC and 2300 UTC not shifting day 1 to day 0 (i.e., ended in "Bxx" instead of "Axx")
* All Global Domain Headers.

New weather elements added:

- Wind Speed and Wind Gust Percentiles (10th, 50th, and 90th) and Wind Gust Standard Deviation in the CONUS domain
- 6-hour Probability of Precipitation in the Guam domain
- Tropical Wind Speed in the Oceanic domain.

Changes to SBN data as requested by various regions:

- 12-hour Probability of Precipitation now extends to 263 hours in the Alaska, Hawaii, and Guam domains
- 2m Temperature, daily Maximum and Minimum Temperature, 6-hour QPF, Snow Level now extends to 263 hours in the CONUS and Alaska domains
- 6-hour and 12-hour Probability of Thunder now extends to 191 hours in the Alaska domain
- Removal of "off-hour" Wind Speed, Direction, and Gust in CONUS to avoid duplication of data.

A detailed listing of NBM v4.2 weather elements to be disseminated on the SBN/NOAAPort as a function of cycle time and domains can be found in the following hyperlink:

https://vlab.noaa.gov/web/mdl/nbm-data-availability-v4.2

Unique originating center IDs have been assigned to each geographic region.

List of originating center IDs (CCCC) for NBM products:

Geographic Region	Originating Center (CCCC)
CONUS and Oceanic	KWEA, KWEB, KWEI, KWEO
Alaska	KWEC, KWED, KWEJ, KWEP
Hawaii	KWEE, KWEF, KWEK
Puerto Rico	KWEG, KWEH, KWEL
Guam	KWEM, KWEN, KWEQ
Global	KWER

The NBM text bulletin WMO header information for each of the five bulletins to be disseminated every hour on the SBN is listed below.

WMO header information for NBM text products:

WMO Header	NBM Text Bulletin Description
FOUS15 KWNO	Hourly bulletin (1-24 hours)
FOUS16 KWNO	Short-range bulletin (6-66 hours)
FEUS16 KWNO	Extended bulletin (12-192 hours)
FEUS17 KWNO	Extra-extended bulletin (204-264 hours)
FEUS18 KWNO	Probabilistic extended bulletin (12-192 hours)

NBM v4.2 SBN/NOAAPORT Header Additions and Removals:

A detailed listing of NBM WMO headers (by NBM domain) to be added over the SBN/NOAAPort can be found below:

CONUS Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_additions_co.pdf

Alaska Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_additions_ak.pdf

Hawaii Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_additions_hi.pdf

Puerto Rico Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_additions_pr.pdf

Guam Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_additions_gu.pdf

Oceanic Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_additions_oc.pdf

Global Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_additions_global.pdf

A detailed listing of NBM WMO headers (by NBM domain) to be removed from the SBN/NOAAPort can be found below:

CONUS Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_removed_co.pdf

Alaska Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_removed_ak.pdf

Hawaii Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_removed_hi.pdf

Puerto Rico Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_removed_pr.pdf

Guam Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_removed_gu.pdf

Oceanic Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_removed_oc.pdf

Global Domain:
https://www.weather.gov/media/mdl/nbm/docs_v42/headers_removed_global.pdf

A. GRIB2 SBN/NOAAPort output additions and removals:

https://www.weather.gov/media/mdl/nbm/docs_v42/NBM_v4.2_SBN_Product_Additions_and_Removals.pdf

NBM v4.2 GRIB2 header identifiers delineated by weather element and domain can be found here:

https://www.weather.gov/media/mdl/nbm/docs_v42/NBM_v4.2_Header_Scheme.pdf

B. Text Bulletins on SBN/NOAAPort:

NBH, NBS, NBE, NBX, and NBP will continue to be hosted on the SBN/NOAAPort as in NBM v4.1. This station-based guidance covers 12-hour periods for projections 24-192 hours and has an identical format to the NBM v4.1 deterministic NBM extended ASCII text bulletins. Note that wind speed percentile information found for all stations in the text bulletins are from the forecasts made in the Oceanic Domain, and not the Quantile Mapping system. This is unchanged from the previous version.

Header information for the probabilistic and deterministic text bulletin files are identical to that of NBM v4.1. For reference, that header information can be found here:

https://www.weather.gov/media/mdl/nbm/docs_v42/NBM_V4.2_Text_Product_WMO_Header_Scheme.pdf

7. NCEP Web Services (NOMADS/FTPPRD) Dissemination

On implementation day, all GRIB2 master (Core and QMD) files, index files, and NBM text messages will continue to be hosted on NCEP web services. Please follow any one of the three subsequent hyperlinks to access this data:

https://nomads.ncep.noaa.gov/pub/data/nccf/com/blend/prod/
https://ftpprd.ncep.noaa.gov/data/nccf/com/blend/prod/
ftp://ftp.ncep.noaa.gov/pub/data/nccf/com/blend/prod/

Please note that the naming convention and directory structure for the Master GRIB2 files remain unchanged and delineate between the core NBM products and those derived from the QMD process.

File Naming Convention:
core/blend.tCCz.core.fHHH.rg.grib2 and qmd/blend.tCCz.qmd.fHHH.rg.grib2, where CC = NBM cycle time, HHH = forecast projection, and rg = NBM domain that includes: co, ak, hi, pr, oc, gu, global (core only).

On implementation day, forecasts from the "global" domain will begin to populate NCEP Web Services at the locations listed above at the 0000 UTC and 1200 UTC cycles only. The "global" domain is on a 50 kilometer resolution grid, covering 85 degrees South to 85 degrees North latitude and 180 degrees West to 180 degrees East longitude. Elements include Geopotential Height, Relative Humidity, Temperature, Wind Speed, and Wind

Direction at the following pressure levels: 250, 500, 700, 850, and 925 millibars.

Changes to existing files on NOMADS/FTPPRD:

These links detail the elements added to or removed from output that is hosted on NOMADS/FTPPRD:

https://www.weather.gov/media/mdl/nbm/docs_v42/NBM_v4.2_NOMADS_Changes-Text.pdf
https://www.weather.gov/media/mdl/nbm/docs_v42/NBM_v4.2_NOMADS_Changes-Core.pdf
https://www.weather.gov/media/mdl/nbm/docs_v42/NBM_v4.2_NOMADS_Changes-QMD.pdf

Prior to implementation, users may find parallel NBM data for download here:

https://nomads.ncep.noaa.gov/pub/data/nccf/com/blend/para/
https://para.nomads.ncep.noaa.gov/pub/data/nccf/noaaport/blend/
https://vlab.noaa.gov/web/mdl/nbm-text-products

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 that 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 the implementation of NBM guidance or data available on Amazon Web Services, please contact:

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or

David Rudack
NBM Team Lead
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For questions regarding the data flow for NWS/NCEP services, please contact:

Tony Salemi
NCEP Central Operations Acting Dataflow Team Lead
ncep.pmb.dataflow@noaa.gov

A webpage describing the NBM can be found at:

https://vlab.noaa.gov/web/mdl/nbm

National Service Change Notices are online at:

https://www.weather.gov/notification

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