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Service Change Notice 18-78 Updated
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To: Subscribers:
 -NOAA Weather Wire Service
 -Emergency Managers Weather Information Network
 -NOAAPort
 Other NWS Partners, Users and Employees

From: Jeffrey Craven
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 Meteorological Development Laboratory

Subject: Updated: Correction of the GRIB2 Encoding of the Probability of
Thunder in the Experimental National Blend of Models Guidance (NBM):
Effective December 5, 2018, and the Request for Comments

Updated to inform users of a gridded binary version two (GRIB2) encoding change for the NBM weather element of Probability of Thunder. Following the implementation of the NBM on October 3, 2018, it was discovered that the GRIB2 files (those with and without Header information) containing the 1-hour, 3-hour and 12-hour NBM Probability of Thunder were incorrectly encoded. Specifically, the GRIB2 generation process number in Section 4, Octet 14 was incorrectly encoded as a value of "96" (GFS) rather than "104" (National Blend of Models). This error resulted in the Advanced Weather Interactive Processing System version 2 (AWIPS2) being unable to recognize the weather element of Probability of Thunder in the GRIB2 files and properly display its contents. The Meteorological Development Laboratory (MDL) has corrected this issue and has properly reassigned the value in Section 4, Octet 14 to "104".

On or about December 5, 2018, beginning with the 1500 Coordinated Universal Time (UTC) model run, the NWS Meteorological Development Laboratory (MDL) will implement an update to the experimental National Blend of Models (NBM) guidance over the contiguous U.S. (CONUS), outside the CONUS (OCONUS; Alaska, Hawaii, Puerto Rico) National Digital Forecast Database (NDFD) domains.

In the event that the implementation date is declared a Critical Weather Day (CWD), or significant weather is occurring or is anticipated to occur, implementation of this change will occur at 1500 UTC on the next weekday not declared a CWD and when no significant weather is occurring.

1. Background:

This upgrade will incorporate additional global and mesoscale models over the CONUS, OCONUS and Oceanic domains. The upgrade will enable the NBM to fill gaps in several key weather elements for service areas such as aviation, fire weather, and marine. The location and cycle availability of all NBM products is outlined in Sections 6-8 below.

2. New NBM Elements for the CONUS and OCONUS:

A list of new weather elements that will be available at hourly time steps through 36 hours unless otherwise noted is provided in the hyperlink below (See Section 6 for data access platforms):

https://www.weather.gov/media/mdl/nbm/NewWxElem_NBM_v3.1.pdf

3. New NBM Oceanic Products (NOAAPort only):

With this implementation, NBM guidance for the Oceanic domain will now incorporate the deterministic and all ensemble members from the Navy Global Environmental Model and Global Ensemble Model (NAVGEEMD and NAVGEME) and the deterministic Global Canadian Meteorological Centre (CMC) Model (GDPS). This upgrade will include the following nine new oceanic weather elements:

1. 10-m Wind Gust (50th Percentile)
2. 80-m Wind Speed (50th Percentile)
3. 30-m Wind Speed (50th Percentile)
4. 2-m Air Temperature (50th Percentile)
5. Visibility (50th Percentile)
6. Mean Sea Level Pressure (10th Percentile)
7. Mean Sea Level Pressure (50th Percentile)
8. Mean Sea Level Pressure (90th Percentile)
9. Significant Wave Height

These new Oceanic products will continue to be produced on the current 10-km oceanic Mercator grid. With this implementation, all oceanic products will be disseminated six times daily rather than the twice, as is currently being done. Please see Section 7 for further details.

4. NBM Text Product:

For those customers who make use of Model Output Statistics (MOS)-station text bulletins, we have added a very similar product in this NBM upgrade. The data in these bulletins are the NBM's nearest grid point forecast to the corresponding station. Because these messages are not directly tuned to Meteorological Terminal Air Report (METAR) and marine sites, we are generating text messages for several additional sites not presently found in the Global Forecast System (GFS) MOS bulletins. It is important to note that while NBM forecasts are not tuned to stations, some of the input models are tuned to METARs, such as the Localized Aviation MOS Product (LAMP), Global Forecast System Model Output Statistics (GFS MOS), and Ensemble Kernel Density Model Output Statistics (EKDMOS).

We will be generating four individual NBM text bulletin products every hour, each covering different forecast horizons. They are as follows:

1. NBH (Hourly resolution to 25 hours, similar to LAMP).
2. NBS (3-hourly resolution to 66 hours, similar format to North American Model (NAM) MOS and GFS MOS short range MET and MAV).
3. NBE (12-hour resolution to 192 hours, similar format to GFS Extended range MEX).

4. NBX (same as NBE, but for Days 9-11).

Again, while the format of these four text messages is similar to the current MOS bulletins, the content and the notation in which it is conveyed are different in some instances. For a detailed explanation of these messages, please follow the hyperlink provided below:

https://www.weather.gov/mdl/nbm_textcard

5. NBM Model Inputs:

This upgrade will incorporate additional global and mesoscale models and statistically post-processed guidance over the CONUS, OCONUS and Oceanic domains:

Current inputs:

1. NAM (North American Mesoscale Forecast System)
2. NAMNest (NAM high resolution nest)
3. GFS (Global Forecast System)
4. GEFS (Global Ensemble Forecast System)
5. GDPS (CMCD - Environment Canada Global Deterministic - Probability of Precipitation (PoP)12/Quantitative Precipitation Forecast (QPF)06 only)
6. GEPS (CMCE - Environment Canada Global Ensemble)
7. EKDMOS (Ensemble Kernel Density Model Output Statistics)
8. Gridded GFS MOS (GMOS or MOSGuide)
9. HRRR (High Resolution Rapid Refresh) (CONUS only)
10. RAP (Rapid Refresh)
11. Gridded LAMP (GLMP Localized Aviation MOS Product)
12. HiResWindow ARW NCEP (High-Resolution Window Forecast System (HIRESW))
13. HiResWindow NMMB NCEP (High-Resolution Window Forecast System (HIRESW))
14. SREF (Short Range Ensemble Forecast)
15. NAVGEME (Navy FNMOC Global Ensemble)

New inputs:

1. ECMWFD (European Centre for Medium-Range Weather Forecasts, deterministic - 0.25 degree) (CONUS, OCONUS) (0000, 1200 UTC runs)
2. ECMWFE (European Centre for Medium-Range Weather Forecasts, Ensemble - 1.0 degree) (CONUS, OCONUS) (0000, 1200 UTC runs)
3. NAVGEMD (Navy FNMOC Global deterministic - 0.50 degree for most elements, 1.0 degree for significant wave heights) (CONUS, OCONUS, and Oceanic domain) (0000, 0600, 1200, 1800 UTC runs)
4. GDPS (CMCD Environment Canada Global deterministic model (25km) for weather elements other than PoP12/QPF06)
5. RDPS (Canadian Regional deterministic model - 10km) (CONUS and Alaska) (0000, 0600, 1200, 1800 UTC runs)
6. REPS (Canadian Regional ensemble model - 15km) (CONUS) (0000 and 1200 UTC runs) (Precipitation products only)
7. HRRR Alaska (High Resolution Rapid Refresh - 3km)
 - (a) 1-18 hours (0300, 0900, 1500, 2100 UTC runs)
 - (b) 1-36 hours (0000, 0600, 1200, 1800 UTC runs)

8. HiResWindow ARW Mem2(3-km High-Resolution Window Forecast System (configured like NSSL WRF) (CONUS and OCONUS)
9. WW3 (0.5 degree WaveWatchIII global deterministic model)
10. WW3 (0.5 degree WaveWatchIII global ensemble model)
11. WW3 (0.16 and 0.06 degree WaveWatchIII high resolution regional models) (CONUS and OCONUS)
12. GLW (2.5km Great Lakes Wave model)

Model Resolution Changes:

1. GFS to 0.117 degree (was 0.25 degree)
2. GDPS (CMCD) to 0.25 degree (was 0.50)
3. GEPS (CMCE) to 0.50 degree (was 1.00)
4. GDAS (Global Data Assimilation System) to 0.117 degree (was 0.25 degree) (like URMA [Unrestricted Mesoscale Analysis] for tuning/bias correction but only used for Oceanic Domain)

Model Expansion Changes:

The grid specifications for both the GMOS and EKDMOS covering the CONUS and Alaska domains will now exactly match that of the National Blend of Models.

Model Projection Changes:

1. HRRR CONUS: 1-36 hours
(0000, 0600, 1200, 1800 UTC)
2. RAP CONUS and OCONUS: 1-39 hours
(0300, 0900, 1500, 2100 UTC)
3. NAM CONUS and Alaska: 1-36 hours, 3-hourly to 84
(0000, 0600, 1200, 1800 UTC)
4. NAMNest CONUS and OCONUS: 1-60 hours
(0000, 0600, 1200, 1800 UTC)

The NBM products will be produced on the following grids:

Region	Grid Type	Dimensions
-----	-----	-----
CONUS	Lambert Conformal	NX=2345, NY=1597
Alaska	3km Polar Stereographic	NX=1649, NY=1105
Hawaii	2.5km Mercator	NX=625, NY=561
Puerto Rico	1.25km Mercator	NX=353, NY=257

6. Satellite Broadcast Network (SBN)/NOAAPort Dissemination:

While the NBM will run every hour and produce output to 264 hours with each run, only a subset will be sent across the Satellite Broadcast Network (SBN) and NOAAPort due to bandwidth limitations. Products will be disseminated in gridded binary version two (GRIB2) format and will contain individual World Meteorological Organization (WMO) headers. The schedule for SBN/NOAAPort dissemination is as follows:

NBM Window -----	Disseminated Cycles (UTC) -----
Short-term: 1-18 hours	0100, 0200, 0400, 0800, 1000, 1100, 1300, 1400, 1600, 2000, 2200, 2300
Short-term: 1-36 hours	0300, 0600, 0900, 1500, 1800, 2100
Short-term and medium-range: 1-187 hours	0500, 1700
Short-term and extended-range:	1900 1-204 hours
Short-term and extended-range: 1-264 hours	0000, 0700, 1200
Oceanic Products: Short-term and extended-range 3-264 hours (sans 1900 UTC, which contains projections 3-204 hours)	0000, 0500, 0700, 1200, 1700, 1900

SBN Additions:

(a) Adding several Fire Weather elements for CONUS, Alaska, Hawaii, and Puerto Rico through 204 hours: Mixing Height, Transport Wind Speed, Transport Wind Direction, Ventilation Rate, 6-hour maximum Haines Index, and 6-hour maximum Fosberg Fire Weather Index. Projections through 264 hours will be available on TGFTP/NDGD (sans 1900 UTC, which contains projections 1-204h) and FTPPRD/NOAA Operational Model Archive and Distribution System (NOMADS).

(b) Adding several Aviation elements for CONUS, Alaska, Hawaii, and Puerto Rico through 36 hours: Low-level Wind Shear (LLWS) Speed, LLWS Direction, LLWS Height, Simulated Maximum Reflectivity, Vertically Integrated Liquid, and Echo Tops.

(c) Adding several elements for the Oceanic domain for projections 3-264 hours (0000, 0500, 0700, 1200, 1700 UTC cycles) and 3-204 hours for 1900 UTC cycle: 10-m Wind Gust, 30-m Wind Speed, 80-m Wind Speed, Visibility, Air Temperature, 10th, 50th, 90th percentile Mean Sea Level Pressure. For the 1900 UTC cycle, projections 3-264 hours will be available on FTPPRD/NOMADS.

(d) Adding Significant Wave Height through 192 hours for CONUS, Alaska, Hawaii, Puerto Rico, and Oceanic domains.

(e) Adding NBM American Standard Code for Information Interchange (ASCII) text bulletins for each NBM cycle containing approximately 3,100 CONUS and OCONUS stations. These NBM bulletins will be available on the SBN. Following are the four types of NBM text bulletins:

1. 1-hourly NBM guidance from 1-25 hours (NBH)
2. 3-hourly NBM guidance from 6-66 hours (NBS)

3. 12-hourly NBM guidance from 24-192 hours (NBE)
4. 12-hourly NBM guidance from 204-372 hours (Data currently to 264 hours) (NBX)

SBN Removals:

(a) At 1900 UTC, all existing elements beyond the 204-hour projection will no longer be sent on the SBN and TGFTP/NDGD, but will still be available on FTPPRD/NOMADS.

(b) Existing 6-hour Probability of a Thunderstorm for CONUS will no longer be produced for any cycle (GMOS is only available input - already disseminated on SBN). CONUS Precipitation Potential Index (6-hourly) for projections 42 through 240 will no longer be disseminated on the SBN and TGFTP/National Digital Guidance Database.

(c) The following existing elements for CONUS will no longer be sent on the SBN and TGFTP/NDGD through 18 hours for 0400 UTC, 0800 UTC, 1600 UTC and 2000 UTC cycles (but will still be available on FTPPRD/NOMADS): Max Wet-bulb Temperature Aloft, Positive Energy Aloft, Negative Energy Low-level, Probability Cloud Ice Present, Probability Refreeze Sleet, Conditional Probability Snow/Sleet/Rain/Freezing Rain, Snow-Liquid Ratio and Snow Level.

(d) For the Oceanic domain, 10th and 25th percentile Wind Speed will no longer be sent on the SBN and TGFTP/NDGD (but will still be available on FTPPRD/NOMADS).

7. TGFTP/NDGD Dissemination:

On implementation day, NBM output for the 0000, 0700, 1200 and 1900 UTC cycles will be placed in the experimental area of the NDGD in GRIB2 format at the following locations listed below. Alternatively, one may substitute "http" for "ftp" and obtain the data in that manner.

<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.expr/DF.gr2/DC.ndgd/GT.blend/AR.conus/> (CONUS)

<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.expr/DF.gr2/DC.ndgd/GT.blend/AR.alaska/> (Alaska)

<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.expr/DF.gr2/DC.ndgd/GT.blend/AR.hawaii/> (Hawaii)

<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.expr/DF.gr2/DC.ndgd/GT.blend/AR.puertorico/> (Puerto Rico)

<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.expr/DF.gr2/DC.ndgd/GT.blend/AR.oceanic/> (Oceanic)

Each domain directory will contain subdirectories for each valid period as follows:

VP.001/	Day 1
VP.002/	Day 2
VP.003/	Day 3
VP.004/	Day 4
VP.005-007/	Days 5-7
VP.008-450/	Days 8 and beyond

Each element-specific GRIB2 file will reside in the appropriate valid period subdirectory and contain individual WMO headers. A listing of GRIB2 file names for both new and updated existing NBM elements is provided in Tables 1 through 5 in the following document:

https://www.weather.gov/media/mdl/nbm/TGFTP_NDGD_Data_NBM2018.pdf

8. NCEP Web Dissemination:

On implementation day, NBM GRIB2 output and NBM text messages for all cycles, elements, and projections will now be made available on NCEP web services sites by following any one of the four hyperlinks below:

<http://nomads.ncep.noaa.gov/pub/data/nccf/com/blend/prod/>
<http://ftp.ncep.noaa.gov/data/nccf/com/blend/prod/>
<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/blend/prod/>
<ftp://ftp.ncep.noaa.gov/pub/data/nccf/com/blend/prod/>

The file names of the four types of NBM text messages discussed in Section 4 are the following:

- (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]

Grid Analysis and Display System (GRaDS) users can find additional NOMADS OpenDap datasets at:

<http://nomads.ncep.noaa.gov:9090/dods/blend/>

9. WMO Headers:

A document outlining the WMO header scheme for NBM GRIB2 products can be found here:

https://www.weather.gov/media/mdl/nbm/NBM_V3_1_Header_Scheme.pdf

Unique originating center IDs have been assigned to each geographic region. A listing of the originating center IDs is provided below.

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

Three IDs are assigned to each geographic region to accommodate all weather elements:

Geographic Region	Originating Center (CCCC)
-----	-----
CONUS and Oceanic	KWEA, KWEB, KWEI
Alaska	KWEC, KWED, KWEJ
Hawaii	KWEE, KWEF, KWEK
Puerto Rico	KWEG, KWEH, KWEL

A detailed list of WMO headers for new NBM products to be disseminated over the SBN/NOAAPort and placed on TGFTP/NDGD can be found in Table 7 here:

<https://www.weather.gov/media/mdl/nbm/FTPFRD NOMADS NBM2018.pdf>

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

WMO header information for NBM text products:

WMO Header	NBM Text Bulletin Description
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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)

For those existing NBM weather elements that will no longer be disseminated with header information, please see the bottom of the following supplemental document:

<https://www.weather.gov/media/mdl/nbm/WMO Headers Remove 2018.pdf>

Approximately one month prior to implementation, users may find parallel NBM data for download:

<http://para.nomads.ncep.noaa.gov/pub/data/nccf/noaaort/blend/>
<http://para.nomads.ncep.noaa.gov/pub/data/nccf/com/blend/para/>
<https://www.weather.gov/mdl/nbm text>

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, please contact:

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For questions regarding the data flow, please contact:

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A webpage describing the NBM can be found at:

[http://w2.weather.gov/mdl/nbm home](http://w2.weather.gov/mdl/nbm_home)

National Service Change Notices are online at:

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

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