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PNSWSH

Service Change Notification 20-78 Updated
National Weather Service Headquarters Silver Spring MD
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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
            NWS Office of Science and Technology Integration
            Meteorological Development Laboratory

Subject:    Updated: Upgrade of National Blend of Models guidance
            effective September 29, 2020

Updated to correct subject header which incorrectly referred to
the National Blend of Models (NBM) as an experimental rather
than an operational product. NBM has been an operational product
since v3.2 when it first met Initial Operating Capability (IOC)
requirements.


On or about Tuesday, September 29, 2020, beginning with the 1200
Universal Time Coordinated (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), OCONUS (Alaska, Hawaii, Puerto
Rico, Guam), and Oceanic 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 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 April 20 through May 22, 2020:

https://www.weather.gov/media/notification/pns20-16nbm-v4.0.pdf

NBM Version 4.0, which is scheduled to be implemented on Tuesday, September 29, 2020, will continue to fill existing product gaps and expand slightly into probabilistic and uncertainty forecast guidance.

The highlights associated with this upcoming release include:

a) Continued infusion of cutting edge science advancements in the area of probabilistic quantitative precipitation forecasting (PQPF) and the addition of calibrated PQPF guidance for the Oceanic domain (see details: https://www.weather.gov/media/mdl/nbm/docs_v40/QMD_Oceanic_Summary.pdf

b) Adding probabilistic daytime maximum (MaxT) and nighttime minimum (MinT) temperatures in the form of percentiles, standard deviation, and exceedance values for particular thresholds for the CONUS domain
c) Including standard deviations for temperature, dew point temperature, percentage of sky cover, convective available potential energy (CAPE), and significant wave height for the CONUS, Alaska, Hawaii, and Puerto Rico domains
d) Improving the deterministic aviation guidance routinely used in daily airport operational planning through 84 hours for Terminal Aerodrome forecasts (TAFs)
e) Including 6-h Probability of Thunder for the CONUS, Alaska, Hawaii, Puerto Rico, and Oceanic domains (see details for all NBM Probability of Thunder products here: https://www.weather.gov/media/mdl/nbm/docs_v40/Thunder_changes_for_NBM_v40.pdf)
f) Adding several new elements to the Guam domain including MaxT and MinT through Day-11
g) Adding new weather elements in the NBM text product along with improvements to the probabilistic text message product.
h) Adding climatology information for MaxT, MinT, and weekly average rainfall; there will be over 2,000 new station text locations added (bringing the total to about 9,000), including most of the CONUS public airports
i) Providing NBM dynamical weights at stations for various NBM input models for the weather elements of MaxT, MinT, Temperature, Dew point, Wind Speed, Wind Gust, and Sky Cover.

A comprehensive list of new weather elements added to NBM v4.0 can be found by following this hyperlink:

https://www.weather.gov/media/mdl/nbm/docs_v40/All_NBM_v40_Wx_Elements.pdf

These upgrades should help NWS provide better Impact-Based Decision Support Services (IDSS).

2. NBM Model Modifications

New NBM Model Inputs:

This upgrade will incorporate several of the NWS's Meteorological Development Laboratory (MDL) station-based NWS Model Output Statistical (MOS) guidance and include:

a) GFS-MOS (0000-, 0600-, 1200-, and 1800-UTC cycles)
b) Deterministic ECMWF-MOS (0000- and 1200-UTC cycles)
c) Ensemble ECMWF-MOS (0000- and 1200-UTC cycles)
d) EKDMOS (0600- and 1800-UTC cycles)
e) NAM-MOS (0000- and 1200-UTC cycles)
f) LAMP (hourly)

These statistical models will be used to improve NBM guidance for the weather elements of wind speed, wind gust, daytime maximum temperature, nighttime minimum temperature, temperature, and dew point temperature at METAR sites over the CONUS, Alaska, Hawaii, and Puerto Rico domains. A list of these stations can be found here:
https://www.weather.gov/media/mdl/nbm/docs_v40/STATIONS_FINAL_ALL_2020.pdf

Removed NBM Model Inputs:

The Australian Bureau of Meteorology's regional ACCESS-R model (11km resolution) is no longer running operationally because its global parent model, the ACCESS-G, has been upgraded with a similar horizontal resolution (12km). This change, however, is not expected to cause any degradation in the NBM Guam product.

NBM Input Model horizontal resolution changes:

a) ACCESS-G (BOM) horizontal resolution changes from 35km to 12km
b) NAVGEME (FNMOC) wave resolution changes from 100km to 50km
New NBM Model Input Model Projections:

For this upgrade, the NBM will be configured to leverage additional forecast projections from the extended Rapid Refresh (RAPX) and extended Hourly Rapid Refresh (HRRRX) guidance once implemented. These include:

a) Hourly projections from 37-48 hours for the HRRRX 0000-UTC, 0600-UTC, 1200-UTC, and 1800-UTC cycles
b) Hourly projections from 39-51 hours for the RAPX cycles of 0300-UTC, 0900-UTC, 1500-UTC, and 2100-UTC cycles

NBM Input Models with increased temporal projection resolution:

To improve upon the temporal consistency of the NBM weather grid product, many of the native global and regional model input's have been temporally interpolated to a finer resolution. All model inputs cited below have been temporally interpolated to an hourly resolution for the NBM projections between 1-36 hours. For NBM projections beyond 36 hours, the following input models have been interpolated to a 3-h resolution unless otherwise noted.

a) ECMWFD (European Centre for Medium-Range Weather Forecasts, deterministic)
b) ECMWFE (European Centre for Medium-Range Weather Forecasts, Ensemble)(CONUS, OCONUS)
c) NAVGEMD (Navy FNMOC Global deterministic)
d) NAVGEME (Navy FNMOC Global Ensemble)
e) GDPS (CMCD Environment Canada Global deterministic model: Required a 1-h interpolation only)
f) NAM (North American Mesoscale Forecast System: Required a 1-h interpolation only)
g) SREF (Short Range Ensemble Forecast - Required a 1-h interpolation only)
h) RDPS (Canadian Regional deterministic model: Required a 1-h interpolation for CAPE only)
i) REPS (Canadian Regional ensemble model)

Change to the NBM Tropical Product:

To provide NWS forecasters with the most recent NHC updates, NBM v4.0 will now include refreshed tropical guidance 1-hour earlier than NBM v3.2. Specifically, NBM v4.0 tropical guidance will be updated for the 0100-, 0700-, 1300-, and 1900-UTC cycles. Please also note that the NBM v4.0 Tropical Product will now include the Guam domain.

New and Improved Techniques for Various NBM Weather Elements
Include:

a) Improving NBM guidance for METAR reporting sites by
substituting the URMA observation value with the METAR value.
This replacement allows all available input models for the
weather elements of MaxT, MinT, Temperature, Dew point
temperature, Wind speed, Wind gust to be calibrated to METAR
observations rather than the URMA analysis
b) Substituting NBM v3.2 ceiling height and visibility guidance
with the Localized Aviation MOS Program (LAMP) guidance for NBM
projections of 1-36 hours: For projections 37-84, the NBM will
leverage probabilistic Global Forecast System-based MOS (GFS-
MOS) and North American Model based MOS (NAM-MOS) ceiling height
and visibility guidance as input to generate both deterministic
and calibrated probabilistic gridded ceiling height and
visibility guidance.
c) Improving NBM Sky cover guidance over the CONUS by
calibrating to the URMA (sky cover) analysis
d) Removing the anomalous high bias of NBM Precipitation
Duration beyond the 36-h projection
e) Calibrating Radar reflectivity, Echo tops, and Vertically
integrated Liquid (VIL) to MRMS in the CONUS
f) Using the square of the MAE in the dynamic weighting of
temperature, dew point temperature, MaxT, MinT, Wind speed, Wind
gust, and Sky cover (CO)
g) Delineating water points from land points when bias
correcting wind speed and wind gusts for the CONUS, AK, HI, and
PR domains

3. NBM Text Product Changes and Additions

For those users who use the deterministic-based NBH, NBS, NBE,
NBX, and NBP station text bulletins, you will find several new
weather elements (see below) and stations in these text products
(for over 9000 stations
https://www.weather.gov/mdl/nbm_stationtable_v40)
A comprehensive description of all NBM text file products can be
found here: https://www.weather.gov/mdl/nbm_textcard_v40.

Hourly Text Messages (NBH):

TSD = Temperature standard deviation

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DSD = Dew point temperature standard deviation
SSD = Sky cover standard deviation
WSD = Wind speed standard deviation
GSD = Wind gust standard deviation
MVC = Probability of Ceiling MVFR conditions < 3000 ft
IFC = Probability of Ceiling IFR conditions < 1000 ft
LIC = Probability of Ceiling LIFR conditions < 500 ft
MVV = Probability of Visibility MVFR conditions < 5 miles
IFV = Probability of Visibility IFR conditions < 3 miles
LIV = Probability of Visibility LIFR conditions < 1 mile
```

Please note that 12-h Precipitation Duration (DUR) was removed from the hourly text message.

   Short-Range Text Messages (NBS):

```
TXN = (Formally X/N or N/X)=18-h Maximum and Minimum
temperatures
XND = 18-h Maximum and Minimum temperature standard deviation
TSD = Temperature standard deviation
DSD = Dew point temperature standard deviation
SSD = Sky cover standard deviation
WSD = Wind speed standard deviation
GSD = Wind gust standard deviation
T06 = 6-h thunderstorm probability
IFC = Probability of Ceiling IFR conditions < 1000 ft
IFV = Probability of Visibility IFR conditions < 3 miles
```

   Extended-Range Text Messages (NBE/X):

```
TXN = (Formally X/N or N/X)=18-h Maximum and Minimum
temperatures
XND = 18-h Maximum and Minimum temperature standard deviation
TSD = Temperature standard deviation
DSD = Dew point temperature standard deviation
SSD = Sky cover standard deviation
WSD = Wind speed standard deviation
GSD = Wind gust standard deviation
SOL = 12-hour mean solar radiation (for hours in period with
sunlight present)
```

With NBM v4.0 moving more towards probabilistic guidance, we have added several new probabilistic station-based text weather elements (NBP) for the same set of stations noted above.  Two new notable weather elements that have been added to the NBP at 0100-, 0700-, 1300-, and 1900-UTC are various percentiles for probabilistic MaxT/MinT and QPF.  Additional percentiles have

been added to previously existing weather elements that include snow and ice accumulation, wind speed, and mean sea-level pressure. Details can be found in the NBM text file link noted above.

The file names of the five types of NBM text messages are:

```
1. blend_nbhtx.t[hh]z      [where hh=00,01,02,...,23]
2. blend_nbstx.t[hh]z      [where hh=00,01,02,...,23]
3. blend_nbetx.t[hh]z      [where hh=00,01,02,...,23]
4. blend_nbxtx.t[hh]z      [where hh=00,01,02,...,23]
5. blend_nbptx.t[hh]z      [where hh=00,01,02,...,23]
```

4. NBM Runtime Changes


Upon implementation of v4.0, several timing and cycle changes should be noted. All runtime changes noted below apply to all NBM cycle times and domains except where indicated.
a) NBH, NBS, NBE, and NBX text messages will be disseminated approximately 15 minutes earlier.
b) NBP text messages will be disseminated 60-75 minutes earlier.
c) Significant wave height products will have an approximate 7-minute dissemination delay due to the addition of significant wave height standard deviation guidance.
d) Several precipitation related variables will shift from the 0100/0700/1300/1900-UTC cycles to the 0000/0600/1200/1800-UTC cycles.


5. Changes to SBN/NOAAPORT Dissemination

While the NBM runs hourly and produces output to 264 hours with each run, as with NBM v3.2 only a subset will be sent across the Satellite Broadcast Network (SBN) and NOAAPORT due to bandwidth limitations. Products will be disseminated in GRIB2 format and will contain grouped WMO headers as they do in NBM v3.2.

With the implementation of of NBM v4.0, the notable dissemination changes to the SBN/NOAAPORT can be summarized as follows:

a) Inclusion of select percentiles for daytime maximum temperature and nighttime minimum temperatures for the 0100- and 1300-UTC cycles through Day-10
b) Addition of several weather elements to the 0200-, 0008-, 1100-, 1400-, 2000-, and 2300-UTC cycles for the NBM CONUS domain for the 1-18 hour projections

c) Addition of select QMD QPF24 percentiles for the 0100-, 0700-, 1300-, 1900-UTC NBM cycles
d) Addition of probabilistic information for CONUS ceiling height and visibility for the 0300-, 0900-, 1500-, and 2100-UTC cycles for projections 26-78 hours (26-36 hourly and 3-hourly for projections 39-78 hours)

Due to the changes in timing for tropical output as noted above in section 2, NBM v4.0 tropical guidance will be produced for the 0100-, 0700-, 1300-, and 1900-UTC cycles instead of the current 0200-, 0800-, 1400-, and 2000-UTC cycles

A detailed listing of NBM v4.0 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://www.weather.gov/media/mdl/nbm/docs_v40/NBM_v40_Elements_on_SBN_by_Cycle_ALL.pdf

Unique originating center IDs have been assigned to each geographic region.  Please note that with the implementation of NBM v4.0, the originating center IDs of KWEO, KWEP, and KWEQ have been added to the CONUS and Oceanic, Alaska, and Guam domains, respectively.

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 |

The NBM text bulletin WMO header information for each of the five bulletins to be disseminated every hour on the SBN are 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 v4.0 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:

https://www.weather.gov/media/mdl/nbm/docs_v40/headers_added_co.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_added_ak.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_added_hi.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_added_pr.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_added_gu.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_added_oc.pdf

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

https://www.weather.gov/media/mdl/nbm/docs_v40/headers_removed_co.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_removed_ak.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_removed_pr.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_removed_hi.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_removed_gu.pdf
https://www.weather.gov/media/mdl/nbm/docs_v40/headers_removed_oc.pdf

A. GRIB2 SBN/NOAAPORT output additions and removals:
New products that will be added to the SBN with this implementation include:
1) Uncertainty information in the form of standard deviations for Daytime Max Temperature, Nighttime Min Temperature, 2-m Temperature, 2-m Dewpoint, 10-m Wind Speed, 10-m Wind Gust, and Sky Cover for CONUS
2) Probability of exceedance values for 24-Snowfall for CONUS
3) Probability of exceedance values for Daytime Max Temperature and Nighttime Min Temperature for CONUS
4) 6-h Thunderstorm Probability for CONUS, Alaska, Hawaii, Puerto Rico, and Oceanic

The following products will be removed from the SBN with this implementation:
1) Bourgouin Positive Energy aloft and Negative Energy Low-Level for CONUS and Alaska
2) Predominant Weather for CONUS and Alaska
3) 30-m and 80-m Wind Speed and Direction for CONUS, Alaska, Hawaii, Puerto Rico, and Guam

The following short-range (1-18h) cycles will be added back to the SBN for CONUS domain only:

0200-, 0500-, 0800-, 1100-, 1400-, 1700-, 2000-, and 2300-UTC

NBM v4.0 GRIB2 header identifiers delineated by weather element and domain can be found here:
https://www.weather.gov/media/mdl/nbm/docs_v40/NBM_v40_WMO_Headings.pdf

B. Text Bulletins on SBN/NOAAPORT:

NBH, NBS, NBE, NBX, and NBP will continue to be hosted on the SBN/NOAAPORT as in v3.2.  This station-based guidance covers 12-hour periods for projections 24-192 hours and has a very similar format to the NBM v3.2 deterministic NBM extended ASCII text bulletins.

Header information for the probabilistic and deterministic text bulletin files are identical to that of NBM v3.2.  For reference, that header information can be found here:
https://www.weather.gov/media/mdl/nbm/NBM%20V3.2%20Text%20Product%20WMO%20Header%20Scheme.pdf

C. Timing Changes to Oceanic Precipitation Products

Because the QMD calibrated precipitation system will now replace v3.2 uncalibrated precipitation products in the Oceanic Domain, QPF06 percentiles and PoP12 data will arrive with a different timing cadence.  Upon implementation, these two elements in the Oceanic Domain will arrive 6 hours later for the 0000- and 1200-UTC cycles. Data from the 0700- and 1900-UTC cycles will now be disseminated with the 0600- and 1800-UTC cycles and arrive 5 hours later than the current timing in operations.

6. Changes to NCEP/MDL Web Dissemination

On implementation day, all GRIB2 master (Core and QMD) files, index files, and NBM text messages will be hosted on NCEP web

services.  Please note that the 0100/0700/1300/1900-UTC cycles
for the Core CONUS files contain hourly data through the 264-h
projection while the 0000/0600/1200/1800-UTC cycles contain
hourly QMD QPF01 data through the 276-h projection.  Please
follow any one of the four subsequent hyperlinks to access this
data:

https://nomads.ncep.noaa.gov/pub/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/
https://blend.mdl.nws.noaa.gov/downloads/

The naming convention and directory structure for the Master
GRIB2 files will now delineate between the core NBM products and
those derived from the QMD process. The old file naming
convention and new file naming convention are the following:

Old File Naming Convention:
grib2/blend.tCCz.master.fHHH.rg.grib2

New 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, pr, or oc.

The Master GRIB2 files that are labeled qmd exclusively contain
QMD derived QPF, PQPF, and Probabilistic MaxT and MinT products
through f276. The remaining Master GRIB2 core files contain all
other NBM v4.0 data.  Please also note that we will be removing
all Oceanic domain files that do not contain "master" in their
filename as that data is already contained in the "master""
Oceanic domain file.  With this upgrade, NCO will be adding a
GRIB filter option for some of the NBM GRIB2 datasets hosted on
NOMADS as well as index files for all domains.  This will allow
users to more readily isolate and then download the data of
interest.

Operational NBM GRIB2 data can also be found on Amazon Web
Services at the following hyperlink:
https://noaa-nbm-grib2-pds.s3.amazonaws.com/index.html

Approximately 1 month prior to implementation, users may find
parallel NBM data for download:
https://para.nomads.ncep.noaa.gov/pub/data/nccf/noaaport/blend/
https://para.nomads.ncep.noaa.gov/pub/data/nccf/com/blend/para/
https://blend.mdl.nws.noaa.gov/nbm-text/

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:


  David Rudack
  MDL/Silver Spring, Maryland
  301-427-9456
  David.Rudack@noaa.gov
or
  Jeff Craven
  MDL/Silver Spring, Maryland
  301-427-9475
  Jeffrey.Craven@noaa.gov

For questions regarding the dataflow for NWS/NCEP services, please contact:

  Anne Myckow
  NCEP Central Operations Dataflow Team Lead
  301-683-3825
  ncep.pmb.dataflow@noaa.gov

A web page describing the NBM can be found at:
    http://www.weather.gov/mdl/nbm_home

NWS National Service Change Notices are online at:
    http://www.weather.gov/notification

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