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PNSWSH

Service Change Notice 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 Experimental 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
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),
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/pdf2/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) Addition of 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) 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) Improvement in the deterministic aviation guidance routinely used in daily airport operational planning through 84 hours for Terminal Aerodrome Forecasts (TAFs).

e) 6-hour 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) Addition of several new elements to the Guam domain including MaxT and MinT through Day-11.

g) Addition of new weather elements in the NBM text product along with improvements to the probabilistic text message product.

h) Addition of 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

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

2.  NBM Model Modifications

New NBM Model Inputs:
This upgrade will incorporate several of the NWS's 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) Local Area MOS Product (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 inputs 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-hour 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-hour interpolation only)

f) NAM (North American Mesoscale Forecast System: Required a 1-hour interpolation only)

g) SREF (Short Range Ensemble Forecast - Required a 1-hour interpolation only)

h) RDPS (Canadian Regional deterministic model: Required a 1-hour 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) Improved NBM guidance for those 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-hour projection.

e) Calibrating Radar reflectivity, Echo tops, and Vertically Integrated Liquid (VIL) to Multi Radar-Multi Sensor (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 customers 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 9,000 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
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 < 3,000 feet
IFC = Probability of Ceiling IFR conditions < 1,000 feet
LIC = Probability of Ceiling LIFR conditions < 500 feet
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-hour Precipitation Duration (DUR) was removed from the
hourly text message.

Short-Range Text Messages (NBS):
TXN = (Formally X/N or N/X) = 18-hour Maximum and Minimum temperatures
XND = 18-hour 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-hour thunderstorm probability
IFC = Probability of Ceiling Instrument Flight Rules (IFR) conditions <
1,000 feet
IFV = Probability of Visibility IFR conditions < 3 miles

Extended-Range Text Messages (NBE/X):
TXN = (Formally X/N or N/X) = 18-hour Maximum and Minimum temperatures
XND = 18-hour 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 filenames 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 Gridded Binary version two (GRIB2) format and will contain
grouped World Meteorological Organization (WMO) headers as they do in NBM
v3.2.

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

a) The inclusion of select percentiles for daytime maximum temperature and
nighttime minimum temperatures for the 0100- and 1300-UTC cycles through
Day-10.

b) The 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) The addition of select QMD QPF24 percentiles for the 0100-, 0700-,
1300-, 1900-UTC NBM cycles.

d) The 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).

e) 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
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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)
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-hour 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 (1-18 hour) 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 American Standard Code for Informatio
Interchange (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%20
Header%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 six 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 five 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-hour projection while the 0000/0600/1200/1800-UTC cycles contain hourly QMD QPF01 data through the 276-hour 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/

Please note that 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 the NOAA Operational Model Archive and Distribution System (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 one 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, MD
301-427-9456
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or

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

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

A webpage describing the NBM can be found at:

http://www.weather.gov/mdl/nbm_home

National Service Change Notices are online at:

http://www.weather.gov/notification

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