

# Product Description Document

## Experimental Guidance for the National Blend of Models (NBM)

### Part 1 – Mission Connection

#### 1. Product Description:

The National Weather Service (NWS) is developing the National Blend of Models (NBM) to provide a nationally consistent and skillful suite of calibrated forecast guidance based on a blend of NWS and non-NWS deterministic, ensemble, and statistically post-processed model output. The NBM was motivated by recent efforts to blend numerical model guidance to provide a better starting point for NWS gridded forecasts at the NWS Regions and the National Centers for Environmental Prediction's (NCEP's) Weather Prediction Center (WPC). The Disaster Relief Appropriations Act of 2013 (Sandy Supplemental) provided support for the NWS to leverage these ideas to implement a national-scale, centrally-produced, model blending approach. The NBM will be developed and released in a series of versions through Summer 2018.

#### Version 1:

NBM Version One (V1.0) was released on January 6, 2016, with the 1200 Coordinated Universal Time (UTC) model run. The NWS Meteorological Development Laboratory (MDL) implemented experimental NBM guidance for the Contiguous United States (CONUS). Guidance included blends of deterministic and ensemble mean-based model grids for the following weather elements:

1. Sky cover (3-hourly)
2. 10-m wind direction (3-hourly)
3. 10-m wind speed (3-hourly)
4. 2-m temperature (3-hourly)
5. 2-m dewpoint temperature (3-hourly)
6. Daytime maximum temperature
7. Nighttime minimum temperature
8. 2-m relative humidity (3-hourly)
9. 2-m apparent temperature (3-hourly)
10. 10-m wind gust (3-hourly)

#### Version 2:

On or about Tuesday, September 21, 2016, beginning with the 1200 UTC model run, MDL will implement an update to the experimental NBM guidance for the CONUS. As a part of this upgrade, experimental NBM guidance will be added for the Alaska, Hawaii, Puerto Rico and Oceanic National Digital Forecast Database (NDFD) domains.

Experimental NBM guidance over the CONUS will be updated with additional model inputs and extended to 264 hours for the following weather elements:

1. Sky cover
2. 10-m wind direction
3. 10-m wind speed
4. 2-m temperature
5. 2-m dewpoint temperature
6. Daytime maximum temperature
7. Nighttime minimum temperature
8. 2-m relative humidity
9. 2-m apparent temperature
10. 10-m wind gust

Experimental NBM guidance will be added for the following weather elements over the CONUS:

1. Quantitative precipitation amount (6-hour)
2. Probability of Precipitation (12-hour)

Experimental NBM guidance will be added for the following weather elements over the Alaska, Hawaii and Puerto Rico NDFD domains:

1. Sky cover
2. 10-m wind direction
3. 10-m wind speed
4. 2-m temperature
5. 2-m dewpoint temperature
6. Daytime maximum temperature
7. Nighttime minimum temperature
8. 2-m relative humidity
9. 2-m apparent temperature
10. 10-m wind gust

Experimental NBM guidance will be added for the following weather elements over the Oceanic NDFD domain:

1. 10-m wind speed exceedance value for the 50th percentile

### Future Upgrades

Future NBM versions will add forecast information to the short term, and that NBM content will mirror the NDFD in terms of resolution, grids, etc.

## **2. Purpose/Intended Use:**

The goal of the NBM is to create a skillful, nationally consistent starting point for NWS digital forecasts that is useful for traditional forecast production as well as delivery of effective Impact-based Decision Support Services (IDSS) at the national centers, local field offices and national and regional operations centers. This development will leverage common data assimilation analyses for calibration and verification, and ensemble guidance, which enables the estimation of uncertainty in the forecast. It will also leverage emerging statistical post processing techniques to calibrate and blend model output and make the forecast guidance more useful.

NBM data may also be used by external users for additional model guidance provided by the NWS.

## **3. Audience/Users:**

The primary users of the NBM will be the NWS forecasters; however, since the data are provided publicly, it will be possible for external users to use the guidance for private and commercial needs.

## **4. Presentation Format:**

Forecasters at the NWS Weather Forecast Offices (WFOs) will be able to view the NBM guidance in the Graphical Forecast Editor (GFE). WPC will be able to view NBM data in the Advanced Weather Interactive Processing System 2 (AWIPS2) National Center Perspective. Versions 1.0 and 2.0 of the NBM (based on global model inputs) will initially run twice a day on the Weather and Climate Operational Supercomputing System (WCOSS). There are also Web-based graphic images, accessible only by NWS employees, at <https://veritas.nws.noaa.gov/blend/>. This website requires logging in with individual NWS credentials.

Data for external use are presented as downloadable files only, as documented in Part 2, Section 3 below.

## **5. Feedback Method:**

Internal user comments:

NWS employees are encouraged to use NOAA's [Virtual Lab \(VLab\)](#) to provide their comments, questions and suggestions on the NBM. All NOAA employees already have an account with VLab that can be easily activated by following these [VLab instructions](#).

NBM feedback received directly through VLab will be time-stamped to include the name and email address of the submitter so moderators can respond directly in the forum. An additional means of anonymous feedback may be provided by emailing [national.blend.feedback@noaa.gov](mailto:national.blend.feedback@noaa.gov). An automated system will forward anonymous feedback to the VLab forum. It does not display the name or email address of the submitter.

External user comments:

The external review and comment period for NBM V1.0 and V2.0 will begin in September, 2016 and continue through December 31, 2016. Feedback can be submitted through the following link: [www.nws.noaa.gov/survey/nws-survey.php?code=EXPNBM](http://www.nws.noaa.gov/survey/nws-survey.php?code=EXPNBM).

## **Part 2 – Technical Description**

### **1. Format and Science Basis:**

The NBM will run centrally on WCOSS in the production job stream. The NBM will be disseminated to WFOs via the Satellite Broadcast Network (SBN) and to the National Centers via NCEP's Central Operations (NCO) Data Server (NCOSRV).

CONUS products are produced on a 2.5-kilometer (km) Lambert Conformal grid over the CONUS with dimensions NX=2145 and NY=1597. This represents an expansion to the north by 220 grid lengths compared to the current NDFD CONUS grid, in order to provide coverage for the entire Northwest River Forecast Center (NWRFC) basin. Guidance is available for the 0000 and 1200 UTC model cycles for projections from 6 hours to 264 hours in advance.

The Alaska NBM products will be produced on a 3-km Polar Stereographic grid with dimensions NX=1649 and NY=1105. The Hawaii NBM products will be produced on a 2.5-km Mercator grid with dimensions NX=625 and NY=561. The Puerto Rico NBM products will be produced on a 1.25-km Mercator grid with dimensions NX=353 and NY=257. Alaska, Hawaii and Puerto Rico NBM guidance will be available for the 0000 and 1200 UTC model cycles for projections from 6 hours to 264 hours in advance.

The Oceanic NBM products will be produced on a 10-km Mercator grid with dimensions NX=2517 and NY=1817. The Oceanic NBM guidance will be available for the 0000 and 1200 UTC model cycles for projections from 6 hours to 264 hours in advance.

## **2. Training:**

Four (4) modules have been created by the Cooperative Program for Operational Meteorology, Education and Training (COMET<sup>®</sup>) that provide information and training for the NBM.

1. [Introduction to the NWS National Blend of Global Models](#)
2. [Gridded Products in the NWS National Blend of Global Models](#)
3. [Statistical Methods in the NWS National Blend of Global Models](#)
4. [Verification Methods in the NWS National Blend of Global Models](#)

These modules are available on the public-facing Meteorology, Education and Training (MetEd) website: <https://www.meted.ucar.edu/>.

Additionally, NWS forecasters and staff can access these COMET<sup>®</sup> modules through the Commerce Learning Center (CLC) (<https://doc.csod.com/client/doc/default.aspx>) and have them recorded on his/her personal NWS training transcript. This is the preferred method of access for NWS employees.

## **3. Availability:**

All experimental NBM products will be disseminated on the SBN, NOAAPORT, and the NWS File transfer protocol (ftp) server in GRIdded Binary or General Regularly-distributed Information in Binary form (GRIB)2 format.

All NBM products are available in GRIB2 format in the experimental area of the National Digital Guidance Database (NDGD) on the NWS ftp server at the following locations:

CONUS:

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

Alaska

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

Hawaii

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

Puerto Rico

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

Oceanic

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

This 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 a World Meteorological Organization (WMO) superheader and individual headers. A listing of the GRIB2 file names for each element is given in Table 1 below. WMO superheaders for the NBM products are given in Table 2.

Table 1. GRIB2 file names for the NBM elements. These files will reside in the appropriate valid period subdirectory on tgftp.

<b>GRIB2 FILE NAME</b>	<b>ELEMENT</b>
ds.skymean.bin	Sky cover
ds.wdirmean.bin	Wind direction
ds.wspdmean.bin	Wind speed
ds.pop12.bin	12-h probability of precipitation
ds.tempmean.bin	2-m temperature
ds.tdmean.bin	2-m dewpoint temperature
ds.maxtmean.bin	Daytime maximum temperature
ds.mintmean.bin	Nighttime minimum temperature

ds.rhmean.bin	2-m relative humidity
ds.qpf06.bin	6-h quantitative precipitation amount
ds.apptmean.bin	2-m apparent temperature
ds.wgustmean.bin	Wind gust

Table 2. WMO superheaders for each CONUS NBM element. Listed below are representations of the superheaders where ii=98 for day 1, ii=97 for day 2, ii=96 for day 3, ii=95 for day 4, ii=94 for days 5-7, and ii=93 for days 8 and beyond.

WMO SUPERHEADER	ELEMENT
LAAZii KWEA	Sky cover
LCAZii KWEA	Wind speed
LDAZii KWEA	12-h probability of precipitation
LEAZii KWEA	2-m temperature
LFAZii KWEA	2-m dewpoint temperature
LGAZii KWEA	Daytime maximum temperature
LHAZii KWEA	Nighttime minimum temperature
LIAZii KWEA	6-h quantitative precipitation amount
LRAZii KWEA	2-m relative humidity
LTAZii KWEA	2-m apparent temperature
LWAZii KWEA	Wind gust

Table 3. WMO superheaders for each Alaska NBM element. Listed below are representations of the superheaders where ii=98 for day 1, ii=97 for day 2, ii=96 for day 3, ii=95 for day 4, ii=94 for days 5-7, and ii=93 for days 8 and beyond.

WMO SUPERHEADER	ELEMENT
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MAAZii KWEA	Sky cover
MBAZii KWEA	Wind direction
MCAZii KWEA	Wind speed
MEAZii KWEA	2-m temperature
MFAZii KWEA	2-m dewpoint temperature
MGAZii KWEA	Daytime maximum temperature
MHAZii KWEA	Nighttime minimum temperature
MRAZii KWEA	2-m relative humidity
MTAZii KWEA	2-m apparent temperature
MWAZii KWEA	Wind gust

Table 4. WMO superheaders for each Hawaii NBM element. Listed below are representations of the superheaders where ii=98 for day 1, ii=97 for day 2, ii=96 for day 3, ii=95 for day 4, ii=94 for days 5-7, and ii=93 for days 8 and beyond.

WMO SUPERHEADER	ELEMENT
ZAAZii KWEA	Sky cover
ZBAZii KWEA	Wind direction
ZCAZii KWEA	Wind speed
ZEAZii KWEA	2-m temperature
ZFAZii KWEA	2-m dewpoint temperature
ZGAZii KWEA	Daytime maximum temperature
ZHAZii KWEA	Nighttime minimum temperature
ZRAZii KWEA	2-m relative humidity
ZTAZii KWEA	2-m apparent temperature

ZWAZii KWEA	Wind gust
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Table 5. WMO superheaders for each Puerto Rico NBM element. Listed below are representations of the superheaders where ii=98 for day 1, ii=97 for day 2, ii=96 for day 3, ii=95 for day 4, ii=94 for days 5-7, and ii=93 for days 8 and beyond.

WMO SUPERHEADER	ELEMENT
YAAZii KWEA	Sky cover
YBAZii KWEA	Wind direction
YCAZii KWEA	Wind speed
YEAZii KWEA	2-m temperature
YFAZii KWEA	2-m dewpoint temperature
YGAZii KWEA	Daytime maximum temperature
YHAZii KWEA	Nighttime minimum temperature
YRAZii KWEA	2-m relative humidity
YTAZii KWEA	2-m apparent temperature
YWAZii KWEA	Wind gust

Table 6. WMO superheaders for each Oceanic NBM element. Listed below are representations of the superheaders where ii=98 for day 1, ii=97 for day 2, ii=96 for day 3, ii=95 for day 4, ii=94 for days 5-7, and ii=93 for days 8 and beyond.

WMO SUPERHEADER	ELEMENT
HCAZii KWEA	Wind speed (50th percentile exceedance)

Beginning approximately one month prior to each version release, users may find parallel data for download on NOAA's Operational Model Archive and Distribution System (NOMADS) at the following link:

<http://para.nomads.ncep.noaa.gov/pub/data/nccf/noaaport/blend/>