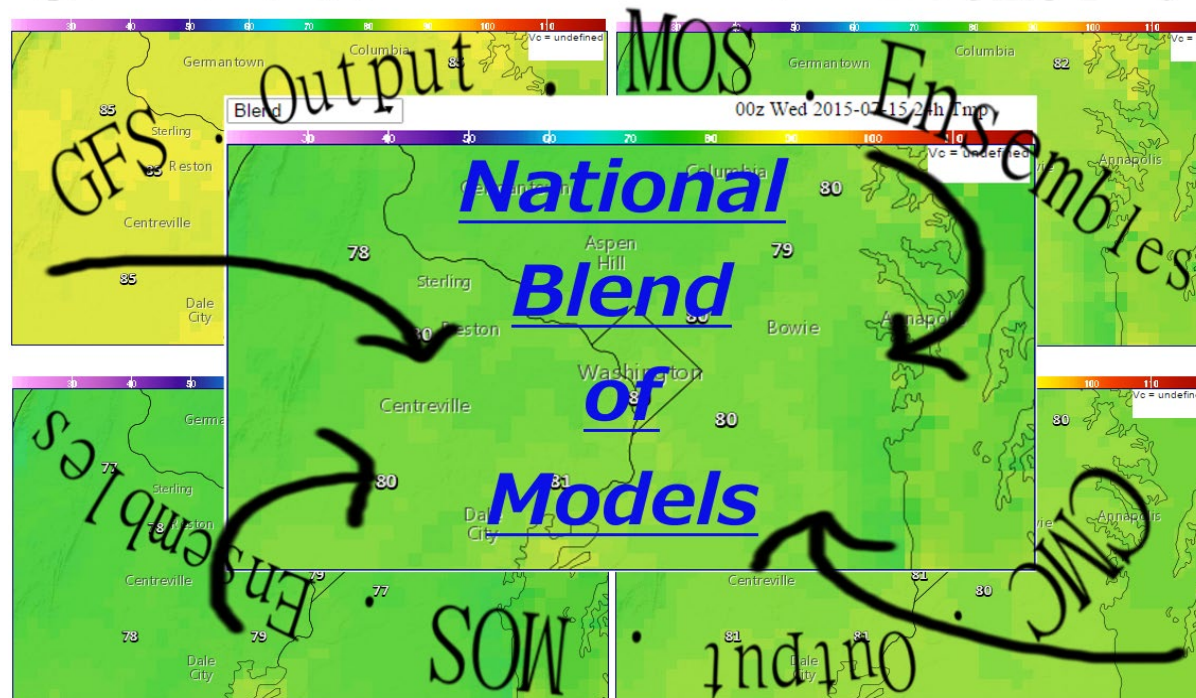


# What's new in NBM v3.2 in Oct 2019?: NSPR Dec 2018

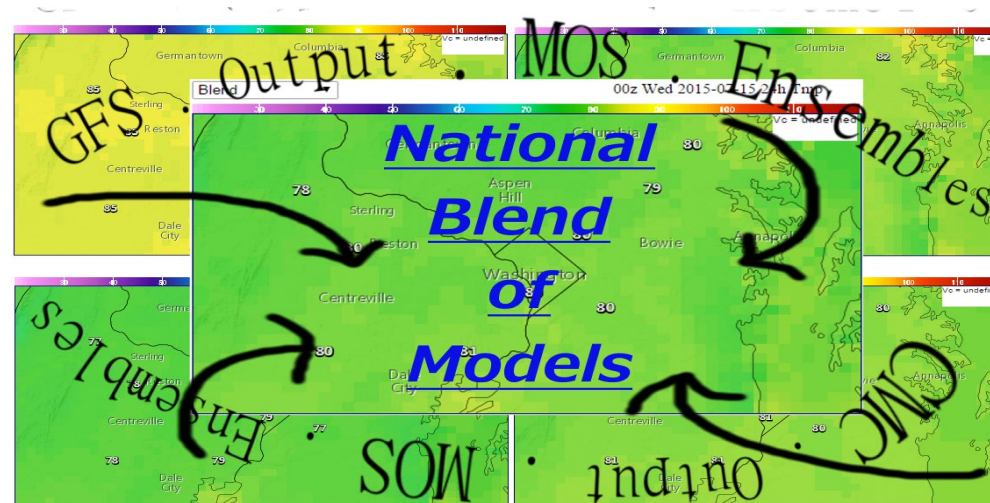
Jeff Craven, Chief SMB

NOAA/NWS/OSTI/MDL Silver Spring, MD



# Outline

- New Guam NBM sector
- New NWP
- Changes to NWP resolution for existing models
- Changes to techniques on existing parameters
- New parameters



# New Guam sector

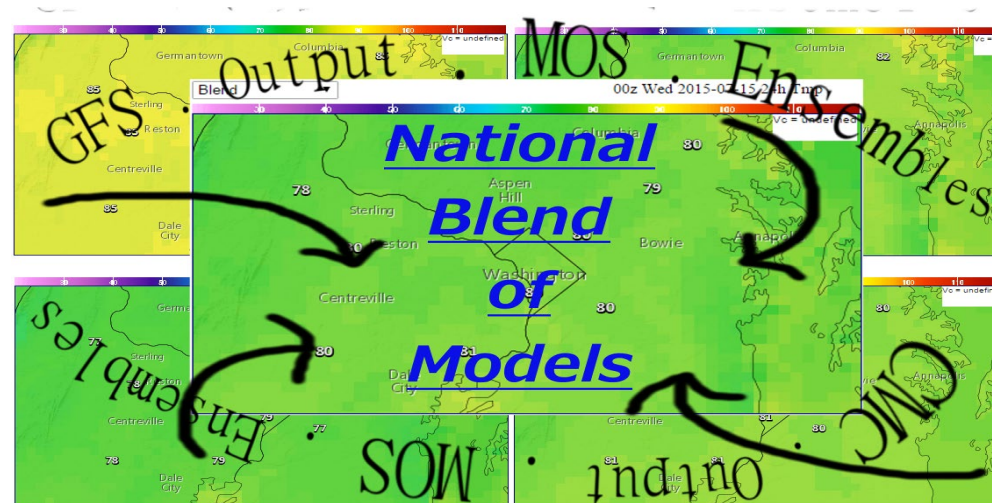
- 2.5km resolution
- Will have similar NWP composition to Hawaii sector
- Will include 11km BoM ACCESS-R (UKMET regional model covering Australia)
- 2.5km RTMA v2.7 will run hourly and use HiRes sectors as first guess (was 3 hourly using GFS as first guess)

# New Guam sector

- Temperature (no MaxT/MinT in Guam RTMA)
- Dew Point
- Wind Direction
- Wind Speed 10 m
- Wind Gust 10 m
- Wind Speed 30 m
- Wind Speed 80 m
- Sky Cover
- PoP12
- QPF06
- MaxRH
- MinRH

# Outline

- New Guam NBM sector
- **New NWP**
- Changes to NWP resolution for existing models
- Changes to techniques on existing parameters
- New parameters

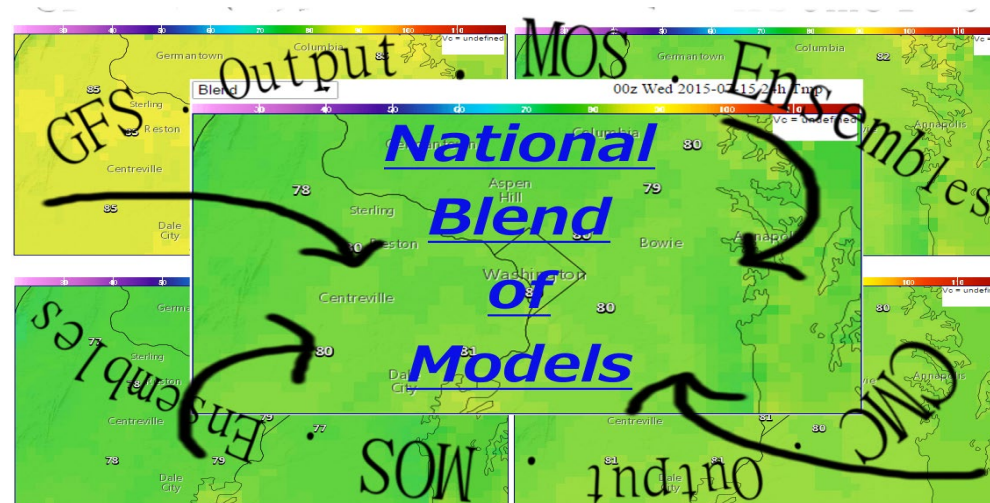


# New NWP

- 0.35 deg BoM ACCESS-G (UKMET from Australia)
  - 2x a day, updating in NBM at 0700 and 1900 UTC
- REPS (CONUS and Alaska) – CMC SREF at 15km
  - 2x a day, updating in NBM at 0700 and 1900 UTC
  - Most core elements (already used in v3.1 for PoP/QPF QMD)
- Add ECWMFD and ECMWFE to Oceanic Domain and Significant Wave Heights, and Fire Weather elements
- Adding HRRR, RAP, and HREF to CONUS QMD for PoP/QPF
- Adding NAM MOS/GFS MOS to ceiling and visibility out to 72 hours<sup>6</sup>

# Outline

- New Guam NBM sector
- New NWP
- Changes to NWP resolution for existing models
- Changes to techniques on existing parameters
- New parameters



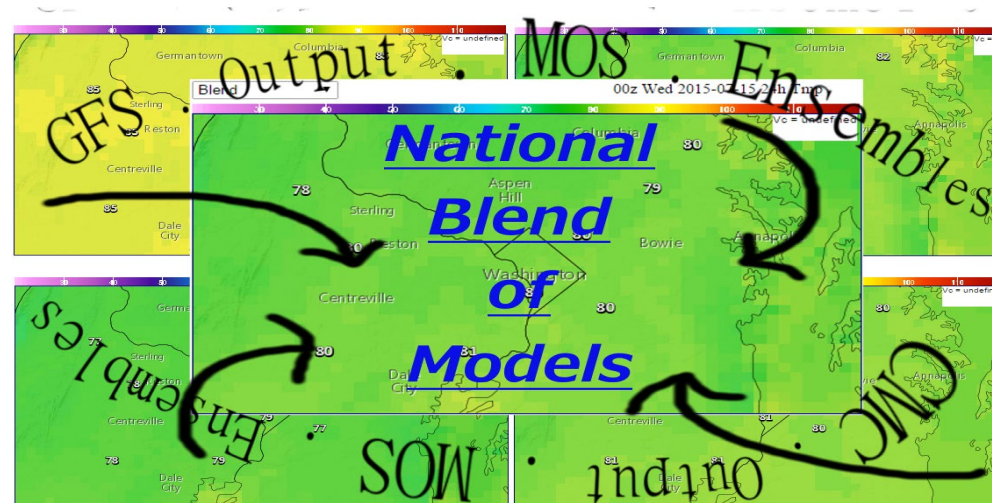
# NWP resolution changes

- For PoP and QPF Quantile Mapping and Dressing (QMD), GFS goes from 0.25 deg to 0.117 deg
- For PoP and QPF QMD, ECMWFE and NAVGEME go from 1.0 deg to 0.5 deg



# Outline

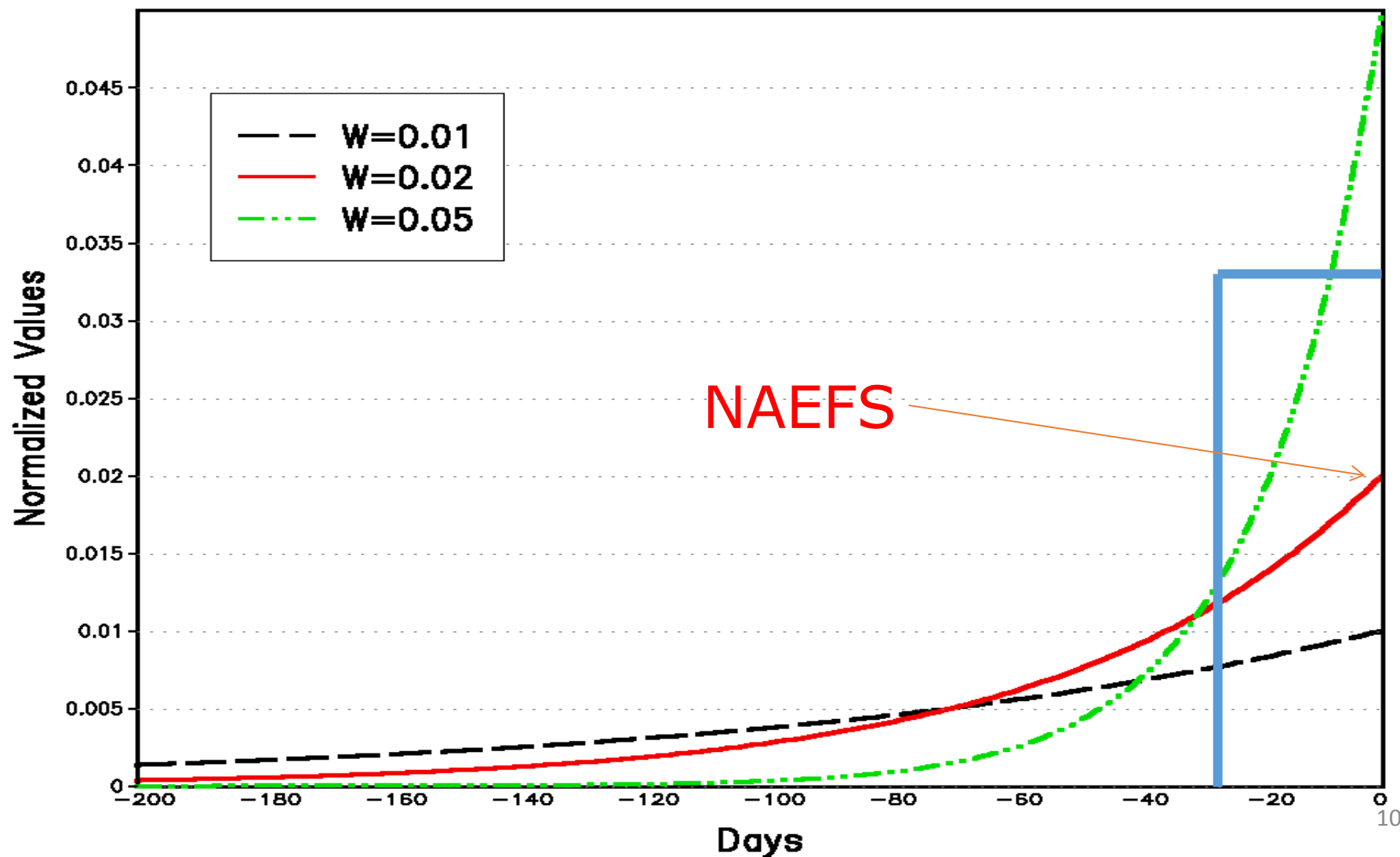
- New Guam NBM sector
- New NWP
- Changes to NWP resolution for existing models
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- New parameters



# Comparing Linear Regression to Decaying Average Weighting

DECAYING AVERAGE WEIGHTING

NBM v3.1



BOIVerify

30 day linear regression, common for BOIVerify and field BC grids has equal weighting for past 30 days.

No influence prior to 30 days ago

Month	NBM v3.1 Alpha	NBM v3.2 Alpha
January	0.05	0.025
February	0.05	0.025
March	0.05	0.030
April	0.05	0.035
May	0.05	0.040
June	0.05	0.045
July (same)	0.05	0.050
August (same)	0.05	0.050
September	0.05	0.045
October	0.05	0.040
November	0.05	0.035
December	0.05	0.030

# Influence of recent obs on bias correction

Alpha setting	Past 10 days	Past 20 days	Past 30 Days
0.050	41%	68%	85%
0.045	37%	63%	79%
0.040	34%	57%	73%
0.035	30%	52%	67%
0.030	26%	46%	60%
0.025	23%	41%	54%
0.020 (EMC)	19%	35%	48% <sub>12</sub>

# QMD

- Changing from Empirical to Gamma based CDF creation
- Supplemental stations go from 13km to 2.5km resolution
- Using combination of CCPA (EMC) and CAPA (CMC) precipitation analyses to create supplemental stations
- Ground Truth using 2.5km URMA goes to full NBM domain and includes MRMS and CMORPH to cover Canada, Mexico, Pacific, Gulf, and Atlantic
- Expand QMD to Alaska and Puerto Rico
  - Alaska harnesses both URMA and CAPA (CMC) QPE

# Wind

- Direction changed from clustering to U & V components (to more closely replicate technique used in SuperBlend)
- Experimenting with removal of terrain inflation in coordination with WR SOOs
- Experimenting with doing wind and wind gust bias correction based on impact bins rather than all speeds (ie light winds, SCA, Gale, Storm, and Hurricane force)

# PoWT (lots of input from NBM SAG\*)

- Change from Top Down to Bourgouin method
- Expert weights for models, giving more weight to higher resolution short range guidance
- Rather than using a mean sounding, calculate PoWT individually from each sounding, then use relative frequencies to create probabilities
- Add in LAMP and MOS derived probabilities
- Zero out snow accumulations based on surface  $T > 35F$  to surface  $T_w > 33.5F$

*\*NBM SAG (Science Advisory Group)*

# MaxT/MinT

- NBM v3.1 uses NWP that has 6 hour MaxT or MinT calculations straight from the model
- Many of the high resolution NWP does not have this parameter, so it was omitted
- For NBM v3.2, we look at the highest hourly temp (MaxT), or lowest hourly temp (MinT) over the relevant 18 hour periods to calculate a MaxT or MinT



# MaxT/MinT/Temp

- Using BCDG, downscaling to 2.5km the raw direct model mean output of GEFS, GEPS, NAVGEME, and ECMWFE (all starting out at 0.50 deg)
- This will not be bias corrected to URMA, and will be in addition to the bias corrected elements
- For CONUS, using Hamill/Engle Quantile Mapping technique to produce ProbMaxT, ProbMinT, and ProbTemp. Will produce 10<sup>th</sup>, 50<sup>th</sup>, 90<sup>th</sup> percentiles, along with mean and spread parameters. Full distribution for a few select METAR sites

# Ceiling, Visibility, Lowest Cloud Base

- Working with WFO GGW MT and CRGMAT, calculating Lowest Cloud Base (CloudBasePrimary) using RH technique as a new input with a number of inputs
- This is in addition to those high resolution models that produce LCB directly
- Also, improved Sky Cover in short term by using all guidance rather than just the high resolution models

# Significant Wave Height

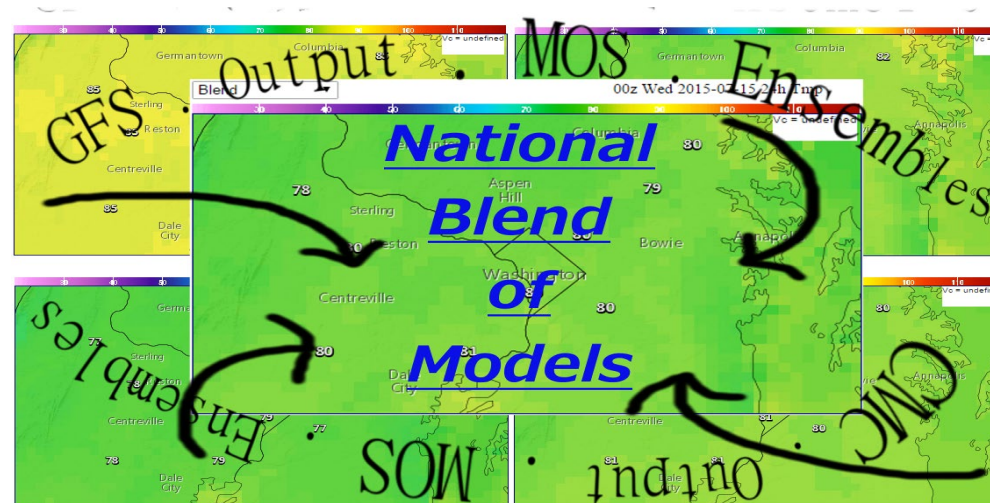
- Use ECMWFD and ECMWFE sig wave heights
- Use URMA for Bias Correction in AK, HI, PR

# PPI and PoP12

- Use calibrated LAMP PoP01 to drive PPI 1-36 hours
- Include LAMP PoP12 in first 36 hours

# Outline

- New Guam NBM sector
- New NWP
- Changes to NWP resolution for existing models
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- New parameters



# New parameters/elements

- 30m wind (CONUS, AK, HI, PR)
- 80m wind (CONUS, AK, HI, PR)
- Prob Blowing Snow (Baggaley) for CONUS, AK via CRGMAT
- Freezing spray (CONUS, AK, Oceanic) via AK and OPC
- Water Temperature (Oceanic, CONUS, AK)
- Incoming solar radiation (CONUS, AK, HI, PR)
- Precipitation Duration (CONUS, AK, HI, PR)
- Turbulence (Clear Air {CAT} and Mountain Wave) via AWC
- Ceiling, Visibility, and Lowest Cloud Base OCONUS
- Probabilistic MaxT, MinT, Temp (CONUS)

# New parameters/elements

- PoP12 Oceanic
- QPF06 Oceanic
- Sea Ice Concentration Oceanic
- Ceiling Height and Visibility 39-72 hour (CONUS, AK, HI, PR)
- MUCAPE (all domains)
- Tropical Wind (Oceanic, CONUS, HI, PR)
  - 35% HWRF, 35% HMON, 30% rest of NBM
  - gTCM (Official NHC forecast) inserted on top (34+ knots)

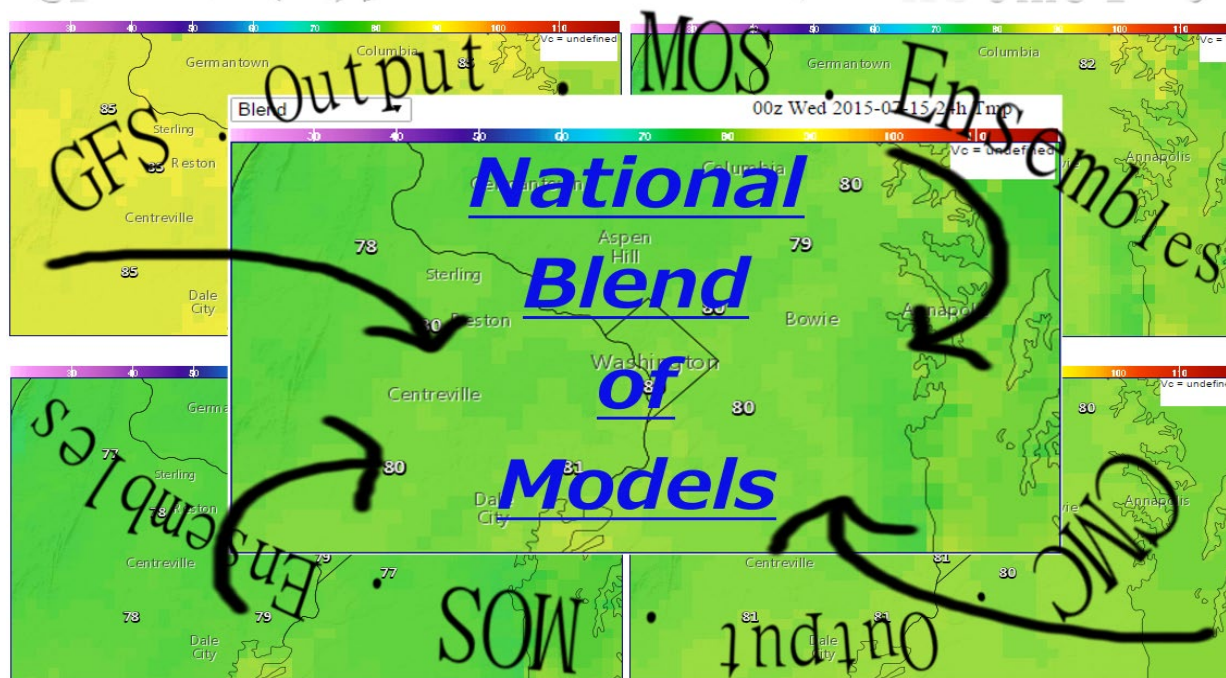
# New parameters/elements

- QPF01 to 264 hours (CONUS) for NWM
- PQPF24 (rolling 6 hour totals 00z and 12z only CONUS 24-96 hours)
- PWPF24 to support Prob Snow/Ice per above
- QPF06, PoP06, PoP12 Using Hamill/Engle QMD (AK,PR)



# Thanks for your attention

- Schedule: Code freeze April 2019
- Science Brief and NCO code handoff June 2019
- Implementation of NBM v3.2 October 2019



**BACKUP**

# NBM Home Page

- [https://www.weather.gov/mdl/nbm\\_home](https://www.weather.gov/mdl/nbm_home)

The screenshot displays the NOAA National Blend of Models (NBM) home page. At the top, a navigation bar includes links for Statistical Postprocessing, Digital Forecasts, Verification, Storm Surge, Decision Support Tools, Web Services, NOAA VLab, and About MDL.

The main content area is titled "The National Blend of Models (NBM)" and contains a descriptive paragraph: "The National Blend of Models (NBM) is a nationally consistent and skillful suite of calibrated forecast guidance based on a blend of both NWS and non-NWS numerical weather prediction model data and post-processed model guidance. The goal of the NBM is to create a highly accurate, skillful and consistent starting point for the gridded forecast. This new way to produce NDFD grids will be helpful providing forecasters with a suite of information to use for their forecasts. The NBM is considered an important part of the efforts to evolve NWS capabilities to achieve a Weather-Ready Nation."

Below the main text is the "NBM Product Pages" section, which features three interactive components: "NBM Text Bulletins" showing a data table, "NBM Quick-look Images" displaying a temperature map of the United States, and "NBM Image Viewer\* (NOAA login required)" showing a multi-panel view of forecast data.

On the left side of the page, there are several vertical navigation menus: "Page Navigation" with links to Statistical Modeling Branch Home, National Blend of Models Home, and NBM Vlab Page\* (NOAA login required); "Product Pages Text Products" with a link to NBM Text Bulletins; "Graphical Products" with a link to NBM Images; "Documentation" with links to About, Weather Element Descriptions, Grib2 Specifications, Technical Notices, Presentations, Publications, and Training Modules; and "Verification" with a partially visible link.

# NBM v3.1 QPF06 weights

QPF06 Projections 6, 12		QPF06 Projection 18		QPF06 Projection 24, 30, 36		QPF06 Projections 42, 48	
Model	Weight	Model	Weight	Model	Weight	Model	Weight
QMD	12	QMD	15	QMD	<b>20</b>	QMD	<b>50</b>
HRRR	<b>40</b>	HRRR		HRRR		HRRR	
HRRRX	10	HRRRX	<b>27</b>	HRRRX	<b>20</b>	HRRRX	
RAP	5	RAP	5	RAP		RAP	
RAPX	3	RAPX	3	RAPX	5	RAPX	
HiResW NMMB	5	HiResW NMMB	10	HiResW NMMB	10	HiResW NMMB	
HiResW ARW	5	HiResW ARW	10	HiResW ARW	10	HiResW ARW	
HiResW ARW2	5	HiResW ARW2	10	HiResW ARW2	10	HiResW ARW2	
GMOS	0	GMOS	0	GMOS	0	GMOS	0
NAM	5	NAM	5	NAM	5	NAM	5
NAMNest	10	NAMNest	15	NAMNest	<b>20</b>	NAMNest	45
Total	100	Total	100	Total	100	Total	<sup>28</sup> 100

# NBM v3.1 PoP06 and PoP12 weights

PoP06 PoP12 Projection 6, 12		PoP06 PoP12 Projection 18		PoP06 PoP12 Projection 24-36		PoP06 PoP12 Projection 42, 48	
Model	Weight	Model	Weight	Model	Weight	Model	Weight
QMD	<b>55</b>	QMD	<b>60</b>	QMD	<b>65</b>	QMD	<b>85</b>
HRRR	5	HRRR		HRRR		HRRR	
HRRRX	5	HRRRX	5	HRRRX	5	HRRRX	
RAP	5	RAP	5	RAP		RAP	
RAPX	5	RAPX	5	RAPX	5	RAPX	
HiResW NMMB	5	HiResW NMMB	5	HiResW NMMB	5	HiResW NMMB	
HiResW ARW	5	HiResW ARW	5	HiResW ARW	5	HiResW ARW	
HiResW ARW2	5	HiResW ARW2	5	HiResW ARW2	5	HiResW ARW2	
GMOS	5	GMOS	5	GMOS	5	GMOS	5
NAM	5	NAM	5	NAM	5	NAM	10
Total	100	Total	100	Total	100	Total	<sup>29</sup> 100

# NBM v3.1 QMD PoP06 PoP12 QPF06 Ensemble membership #/%

	6 to 54	60 to 78	84+	#		6 to 54	60 to 78	84+	%
GFS	1	1	1		GFS	1%	1%	1%	
GEFS	20	20	20		GEFS	12%	14%	18%	
GDPS	1	1	1		GDPS	1%	1%	1%	
GEPS	20	20	20		GEPS	12%	14%	18%	
NAVGEMD	1	1	1		NAVGEMD	1%	1%	1%	
NAVGEME	20	20	20		NAVGEME	12%	14%	18%	
ECMWFD	1	1	1		ECMWFD	1%	1%	1%	
ECMWFE	<b>50</b>	<b>50</b>	<b>50</b>		ECMWFE	<b>31%</b>	<b>36%</b>	<b>44%</b>	
NAMNest	1				NAMNest	1%			
SREF	26	26			SREF	16%	19%		
RDPS	1				RDPS	1%			
REPS	20				REPS	12%			
	<b>162</b>	<b>140</b>	<b>114</b>			100%	100%	100%	30

# NAEFS Bias Correction

## (Decaying average method)

### 1). Bias Estimation:

$$b_{i,j}(t) = f_{i,j}(t) - a_{i,j}(t_0)$$

### 2). Decaying Average (Kalman Filter method)

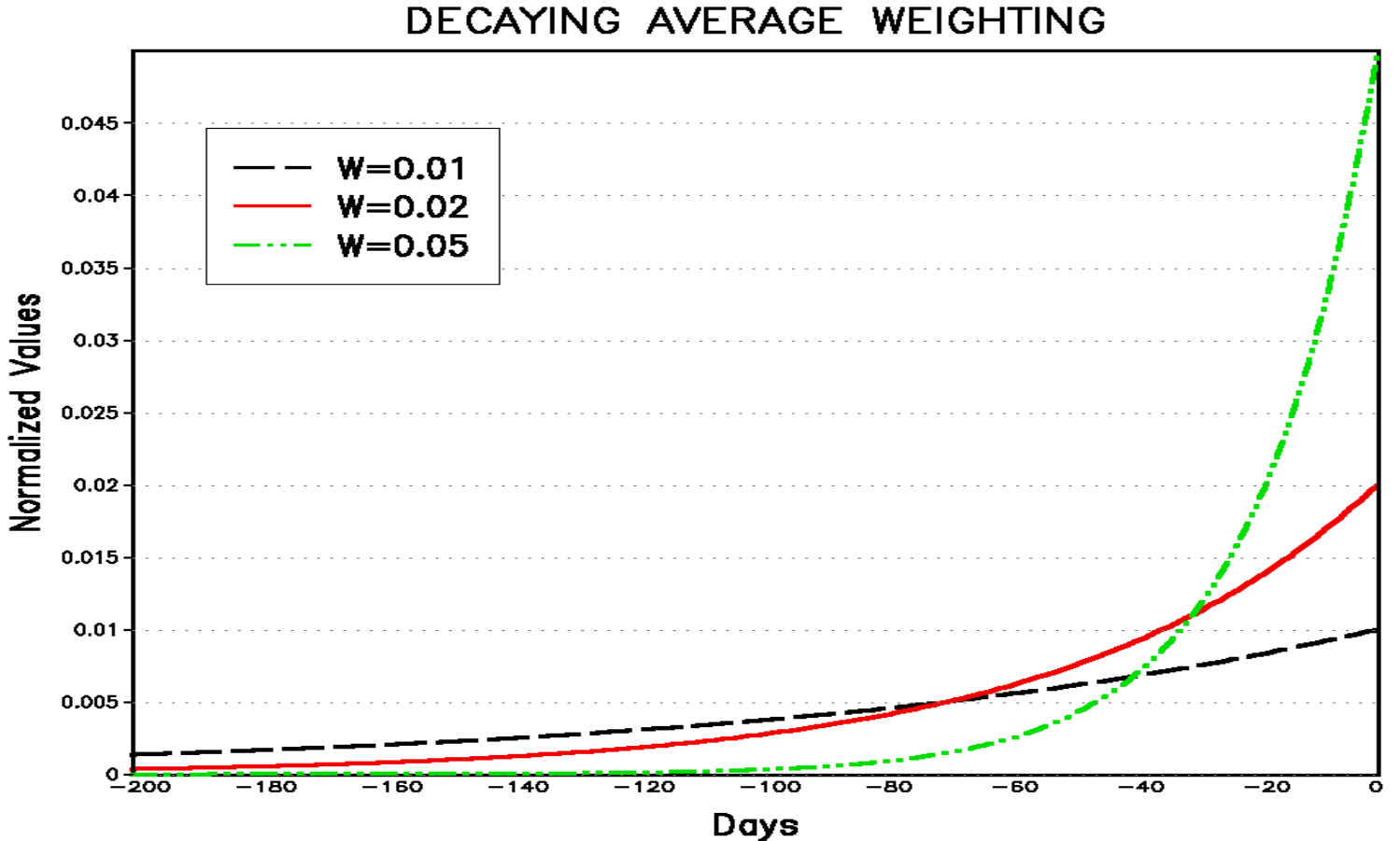
$$B_{i,j}(t) = (1-w) \cdot B_{i,j}(t-1) + w \cdot b_{i,j}(t)$$

3). Decaying Weight:  $w = 0.02$  in GEFS bias correction (~ past 50-60 days information)

### 4). Bias corrected forecast:

$$F_{i,j}(t) = f_{i,j}(t) - B_{i,j}(t)$$

[Ref: Cui, Toth, Zhu and Hou, 2012](#)



[Simple Accumulated Bias](#)

Assumption: Forecast and analysis (or observation) is fully correlated

# Influence of recent obs on bias correction

Alpha setting	Past 10 days	Past 20 days	Past 30 Days
0.050	41%	68%	85%
0.045	37%	63%	79%
0.040	34%	57%	73%
0.035	30%	52%	67%
0.025	23%	41%	54%
SuperBlend	~20(17-23)%	~30(23-37)%	~45(35-55)%
BCCONSAII	33%	67%	100%