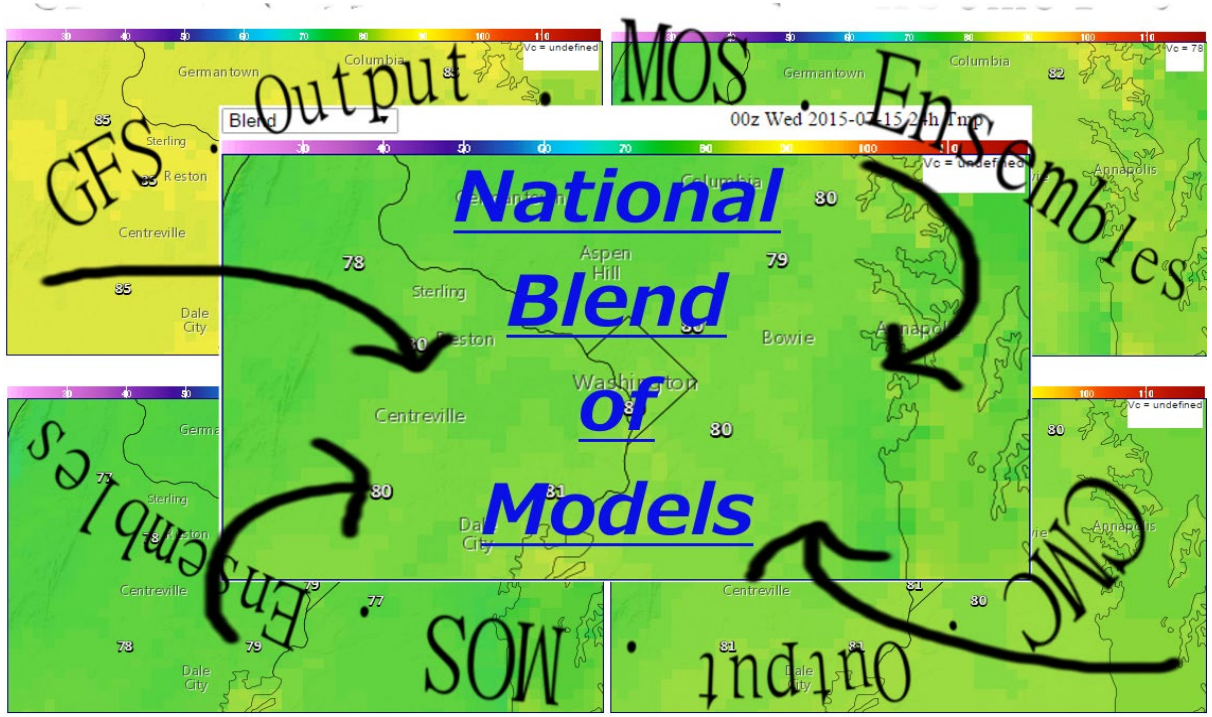
What's new in NBM v3.2 in Oct 2019?: NSPR Dec 2018

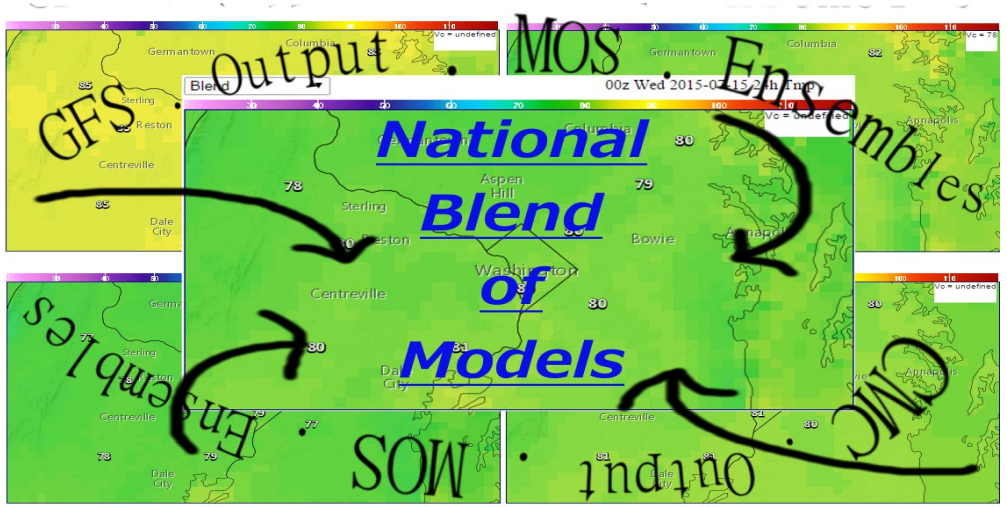
Jeff Craven, Chief SMB

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

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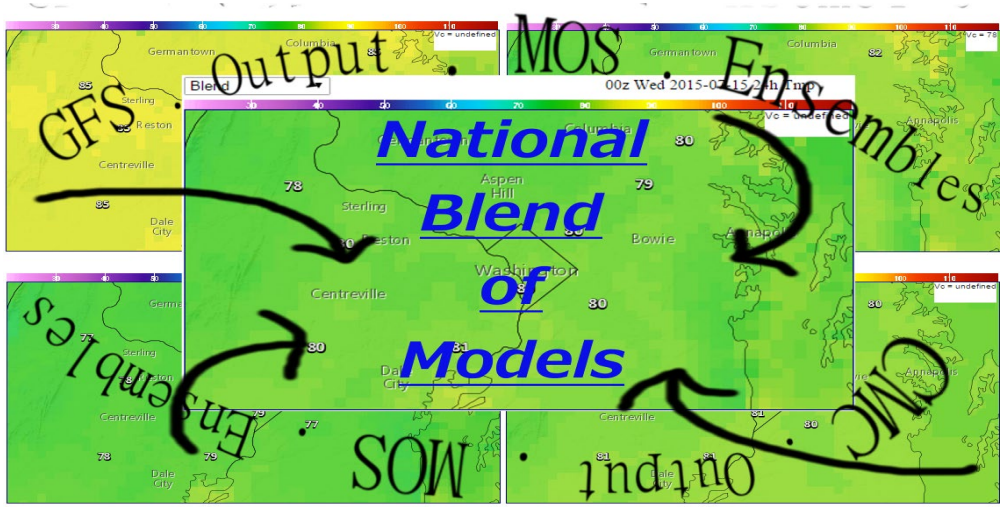

New NWP

- 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

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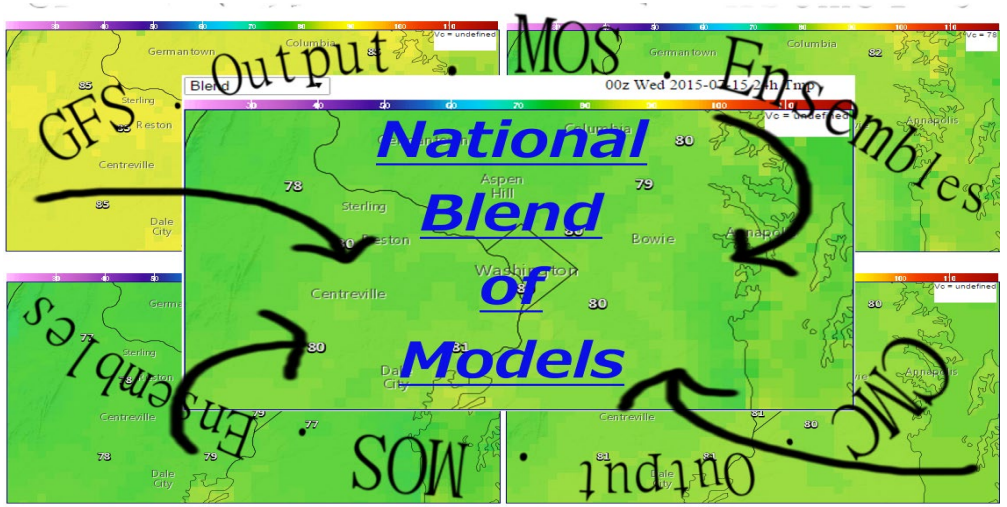

NWP resolution changes

- 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

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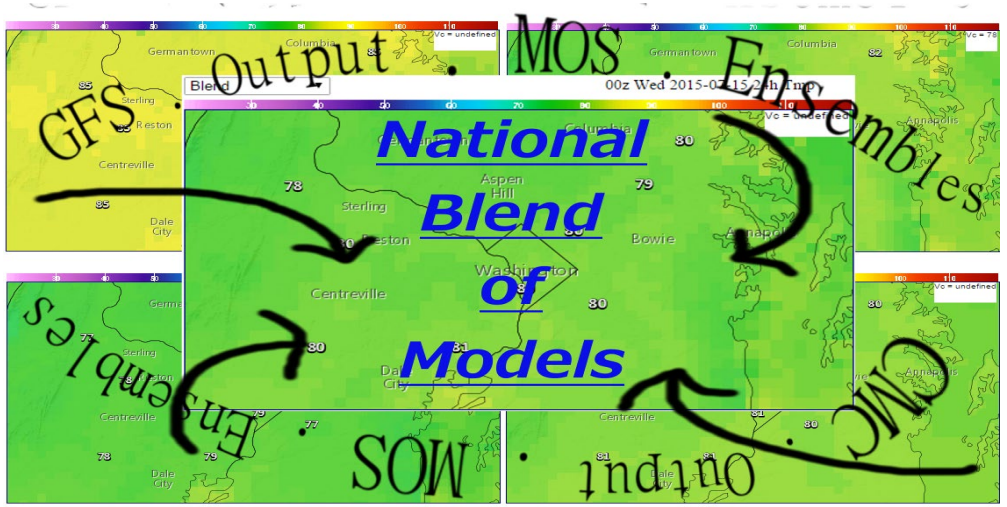
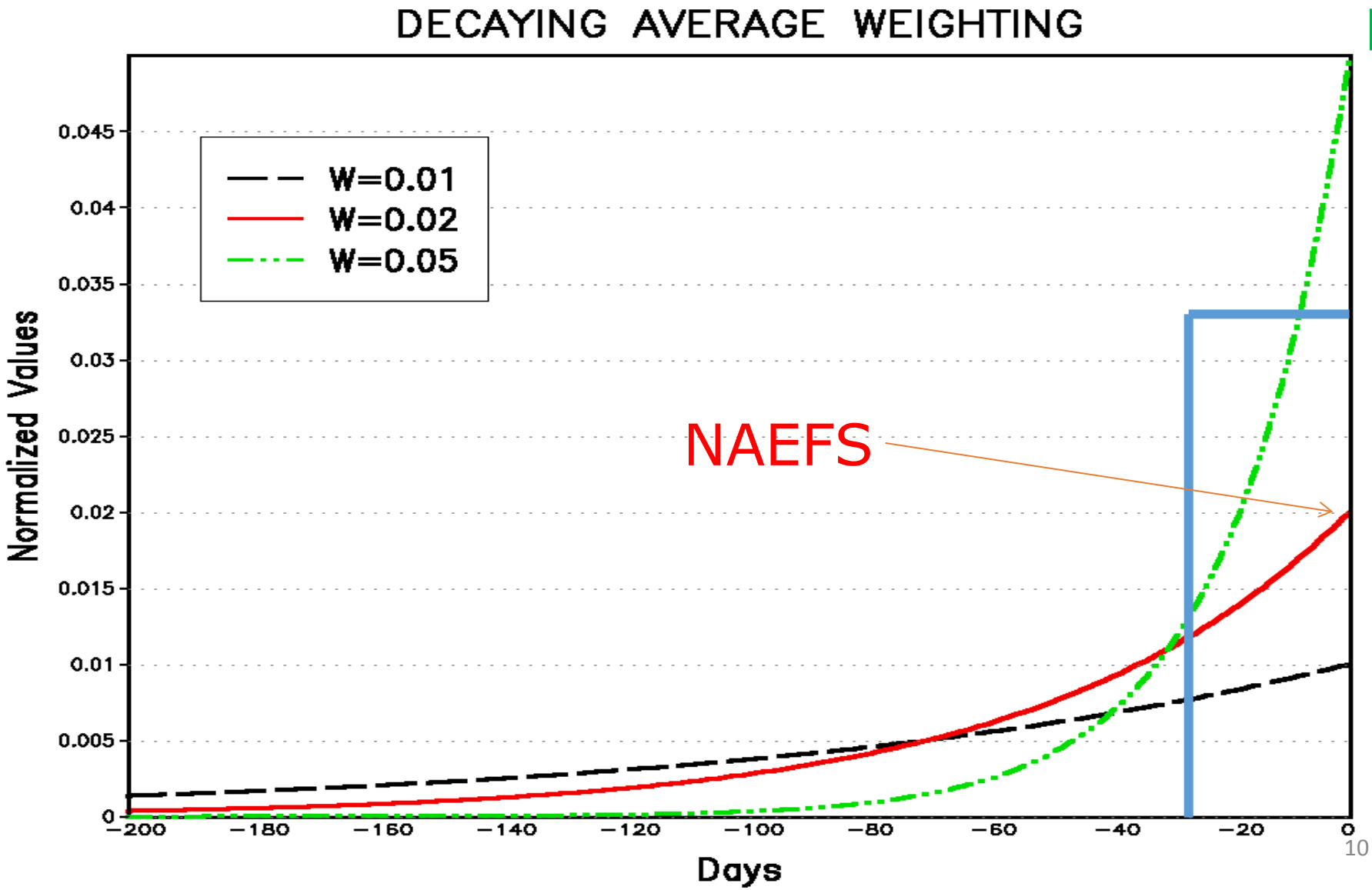


Comparing Linear Regression to Decaying Average Weighting



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%

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 Tw > 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 10th, 50th, 90th 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

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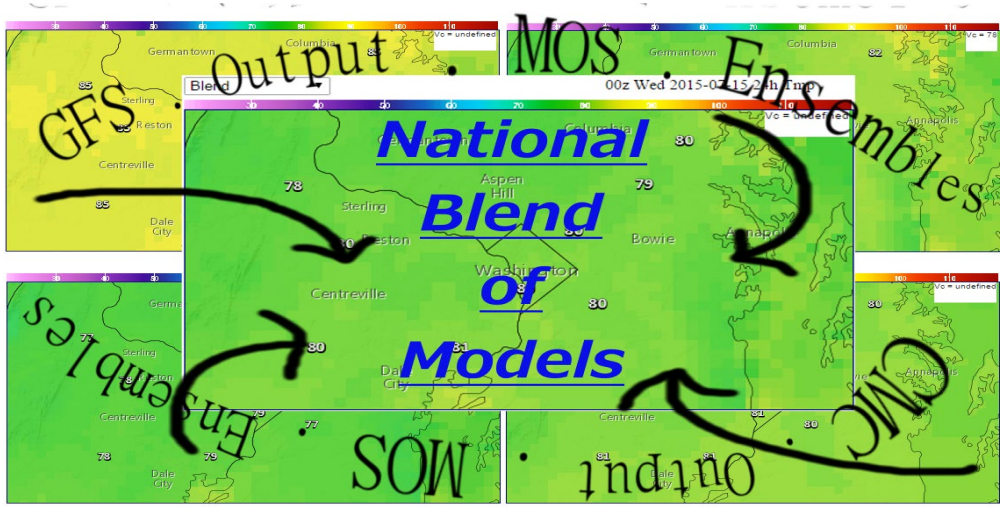


New parameters/elements

- 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

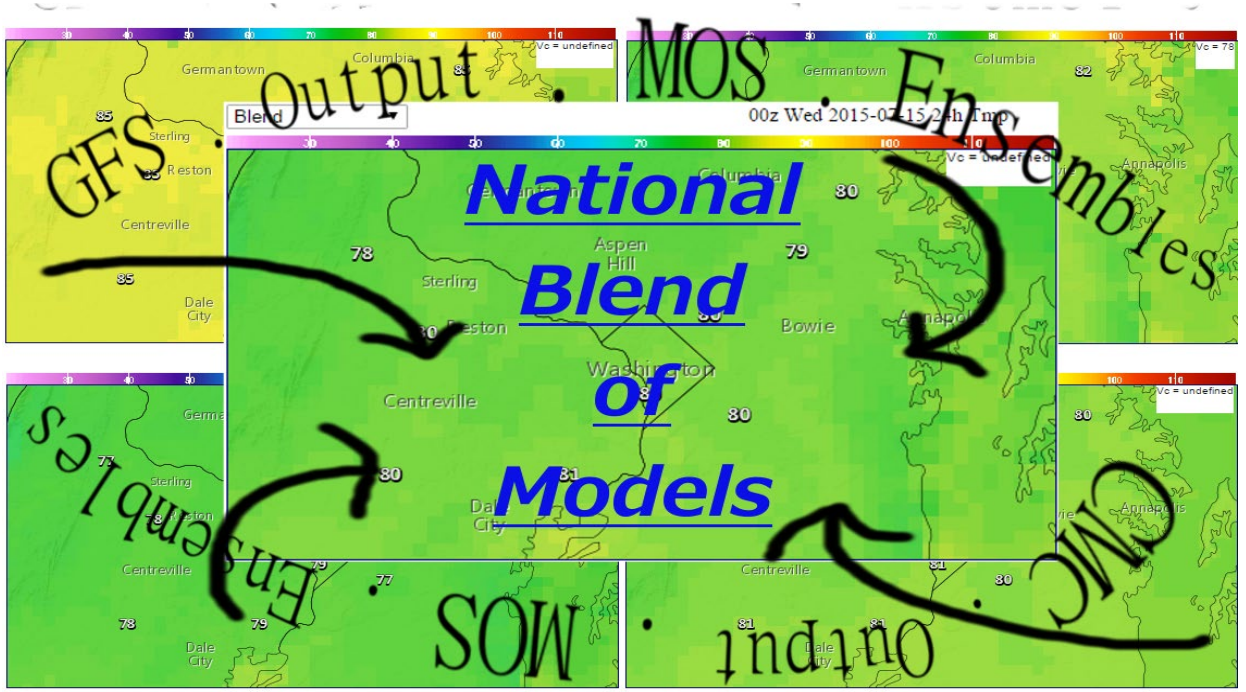
- PoP12 Oceanic
- QPF06 Oceanic
- Sea Ice Concentration Oceanic
- Ceiling Height and Visibility 39-72 hour (CONUS, AK, HI, PR)
- MUCAPE (all domains)
- Tropical Wind (Oceanic, CONUS, HI, PR)
  - 35% HWRF, 35% HMON, 30% rest of NBM
  - gTCM (Official NHC forecast) inserted on top (34+ knots)

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

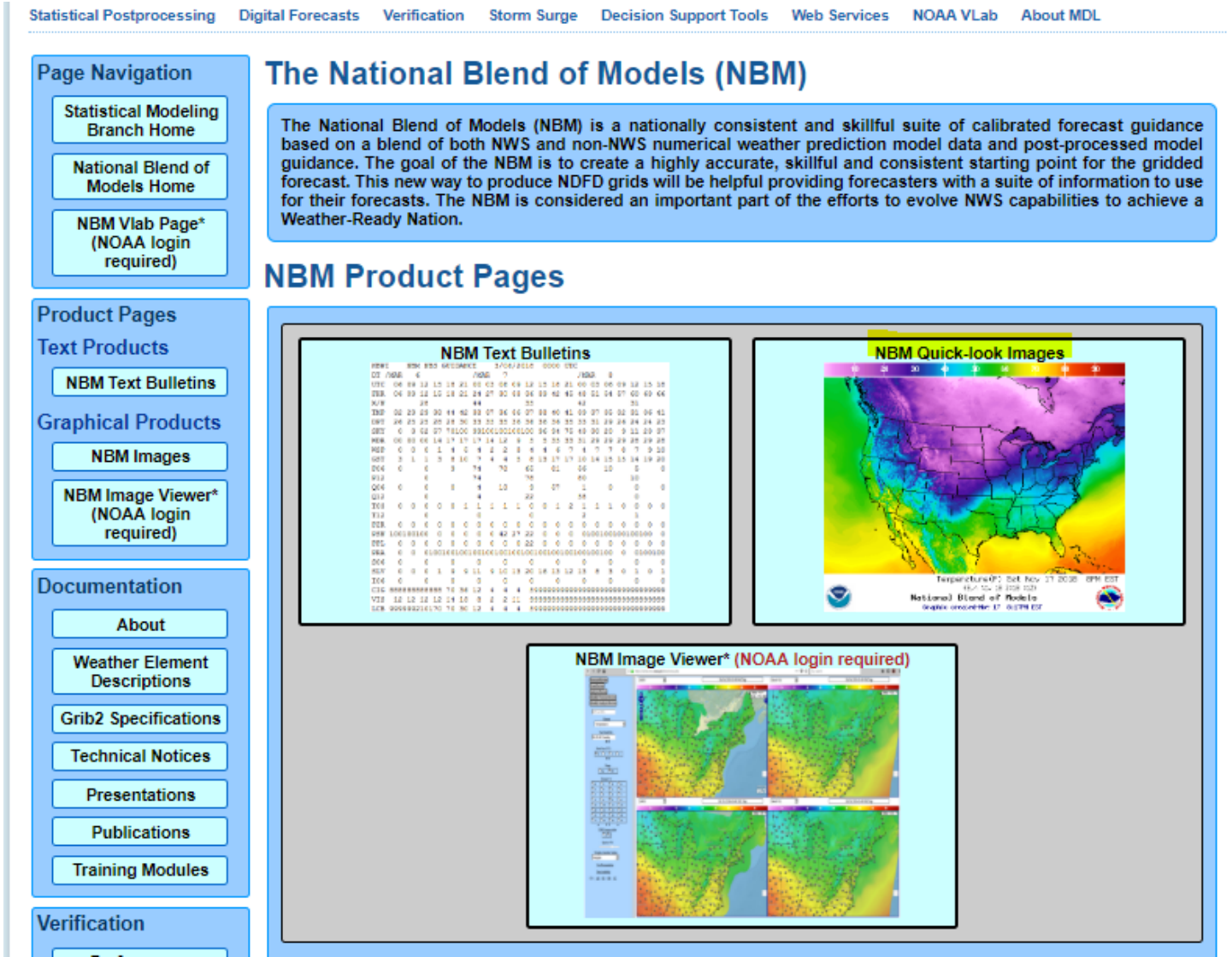
- Schedule: Code freeze April 2019
- Science Brief and NCO code handoff June 2019
- Implementation of NBM v3.2 October 2019



BACKUP

NBM Home Page

- https://www.weather.gov/mdl/nbm_home



NBM v3.1 QPF06 weights

QPF06 Projections 6, 12	
Model	Weight
QMD	12
HRRR	**40**
HRRRX	10
RAP	5
RAPX	3
HiResW NMMB	5
HiResW ARW	5
HiResW ARW2	5
GMOS	0
NAM	5
NAMNest	10
Total	100

QPF06 Projection 18	
Model	Weight
QMD	15
HRRR	
HRRRX	**27**
RAP	5
RAPX	3
HiResW NMMB	10
HiResW ARW	10
HiResW ARW2	10
GMOS	0
NAM	5
NAMNest	15
Total	100

QPF06 Projection 24, 30, 36	
Model	Weight
QMD	**20**
HRRR	
HRRRX	**20**
RAP	
RAPX	5
HiResW NMMB	10
HiResW ARW	10
HiResW ARW2	10
GMOS	0
NAM	5
NAMNest	**20**
Total	100

QPF06 Projections 42, 48	
Model	Weight
QMD	**50**
HRRR	
HRRRX	
RAP	
RAPX	
HiResW NMMB	
HiResW ARW	
HiResW ARW2	
GMOS	0
NAM	5
NAMNest	45
Total	100

NBM v3.1 PoP06 and PoP12 weights

PoP06 PoP12 Projection 6, 12	
Model	Weight
QMD	**55**
HRRR	5
HRRRX	5
RAP	5
RAPX	5
HiResW NMMB	5
HiResW ARW	5
HiResW ARW2	5
GMOS	5
NAM	5
Total	100

PoP06 PoP12 Projection 18	
Model	Weight
QMD	**60**
HRRR	
HRRRX	5
RAP	5
RAPX	5
HiResW NMMB	5
HiResW ARW	5
HiResW ARW2	5
GMOS	5
NAM	5
Total	100

PoP06 PoP12 Projection 24-36	
Model	Weight
QMD	**65**
HRRR	
HRRRX	5
RAP	
RAPX	5
HiResW NMMB	5
HiResW ARW	5
HiResW ARW2	5
GMOS	5
NAM	5
Total	100

PoP06 PoP12 Projection 42, 48	
Model	Weight
QMD	**85**
HRRR	
HRRRX	
RAP	
RAPX	
HiResW NMMB	
HiResW ARW	
HiResW ARW2	
GMOS	5
NAM	10
Total	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	**50**	**50**	**50**		ECMWFE	**31%**	**36%**	**44%**	
NAMNest	1				NAMNest	1%			
SREF	26	26			SREF	16%	19%		
RDPS	1				RDPS	1%			
REPS	20				REPS	12%			
	162	**140**	**114**			100%	100%	100%	

NAEFS Bias Correction
(Decaying average method)

1). Bias Estimation:

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

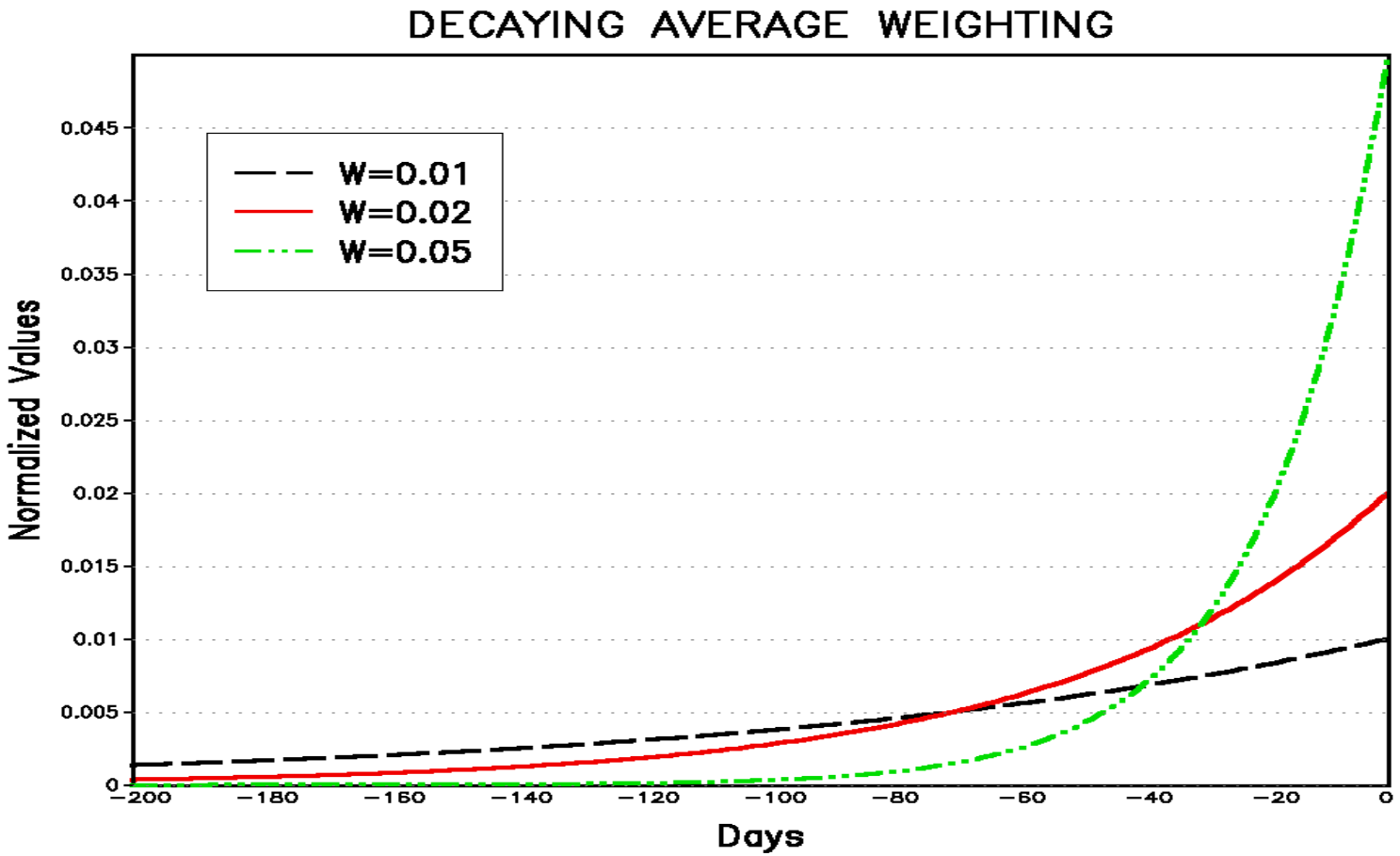
2). Decaying Average (Kalman Filter method)

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

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

4). Bias corrected forecast:

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



Simple Accumulated Bias

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

Ref: Cui, Toth, Zhu and Hou, 2012

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)%
BCCONSAll	33%	67%	100%