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# ***MDL's Winter Weather Guidance***

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# MOS Precipitation Type



- MDL produces GFS-based and ECMWF-based MOS guidance for precipitation type:
  - Derived from METAR present weather observations.
  - All cycles of GFS and ECMWF.
  - ***NAM MOS precipitation type coming soon!***
  - Used to populate short-range and medium-range alphanumeric text messages (ECMWF guidance is for internal NWS use only).
- 3-category short-range product:
  - Conditional probability of freezing, frozen, and liquid precipitation.
  - Conditional best category.
- 4-category medium-range product:
  - Conditional probability of freezing, snow, rain, and rain-snow mix.
  - Conditional best category.



# MOS Precipitation Type



## Sample Message

KDEN	GFS MOS GUIDANCE														3/04/2010 1200 UTC							
DT /MAR	4/MAR				5				/MAR				6			/MAR				7		
HR	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	06	12	
N/X							27						53						28		51	24
TMP	48	52	51	40	35	32	30	35	47	50	48	40	38	35	32	36	45	48	45	31	27	
DPT	25	25	27	29	29	27	25	25	21	17	18	20	21	21	20	21	21	22	22	23	21	
CLD	BK	SC	SC	SC	SC	OV	OV	OV	BK	BK	BK	SC	BK	SC	SC	SC	SC	SC	SC	SC	SC	
WDR	19	14	13	16	20	20	25	25	28	28	28	22	23	23	22	21	12	10	10	17	21	
WSP	05	12	11	08	08	07	07	07	08	10	11	08	08	07	07	07	10	10	08	07		
P06		1		6		14		20		14		25		8		4		2	3	2		
P12						15		27				26				4		3				
Q06		0		0		0		0		0		0		0		0		0	0	0		
Q12						0		0		0		0		0		0		0	0	0		
T06		5/11	1/	2	0/	1	1/	2	8/	3	1/	1	0/	0	0/	0	2/	8	0/	0		
T12			7/11			1/	2		8/	4		0/	1		2/	8						
POZ	1	1	3	2	2	7	8	3	4	2	3	0	3	3	4	6	3	1	2	0	3	
POS	27	16	18	24	28	65	74	72	31	20	37	57	94	87	95	65	41	18	28	50	91	
TYP	R	R	R	R	R	S	S	S	R	R	R	S	S	S	S	S	R	R	R	R	S	
SNW						0									0						0	
CIG	8	8	8	8	8	8	8	7	8	8	7	8	8	8	8	8	8	8	8	8	8	
VIS	7	7	7	7	7	7	7	1	7	7	7	7	7	7	7	7	7	7	7	7	7	
OBV	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	

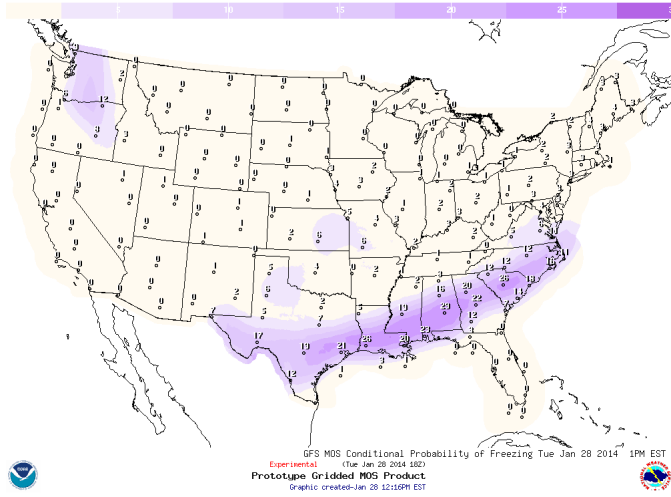
MAV

## Sample Message

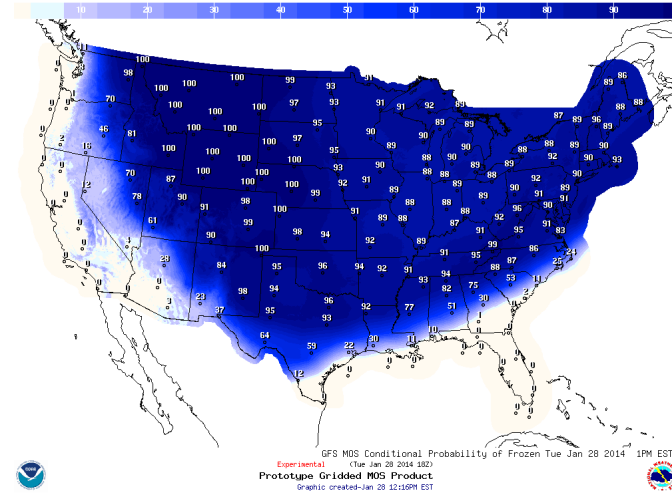
IAD	GFSX MOS GUIDANCE														3/05/2013 0000 UTC						
FHR	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192						
TUE	05	WED	06	THU	07	FRI	08	SAT	09	SUN	10	MON	11	TUE	12	CLIMO					
X/N	47	34	42	32	44	29	45	32	50	33	57	38	58	40	54	29	53				
TMP	42	36	39	34	39	32	41	34	44	37	50	42	52	43	47						
DPT	23	26	28	24	29	24	25	25	29	30	34	34	38	34	28						
CLD	OV	OV	OV	OV	PC	CL	PC	CL	CL	PC	OV	OV	OV	OV	PC						
WND	5	18	20	20	16	13	22	14	8	5	8	5	10	18	14						
P12	36	99	93	36	5	0	7	5	5	7	17	30	35	31	24	24	24				
P24			100		36		7		6		19		53		46		34				
Q12	0	5	5	0	0	0	0	0	0	0	0	1									
Q24			5		0		0		0		0										
T12	1	1	7	2	1	0	1	1	1	1	2	1	5	4	6						
T24		1		9		2		1		1		2		6							
PZP	13	27	4	13	9	6	6	17	13	6	5	4	4	4	5						
PSN	25	4	28	16	45	64	52	32	24	16	2	3	4	4	21						
PRS	28	47	29	45	26	16	15	18	8	3	4	4	3	9	14						
TYP	RS	Z	RS	RS	S	S	S	S	RS	R	R	R	R	R	R						
SNW			4		0		0		0		0										

MEX

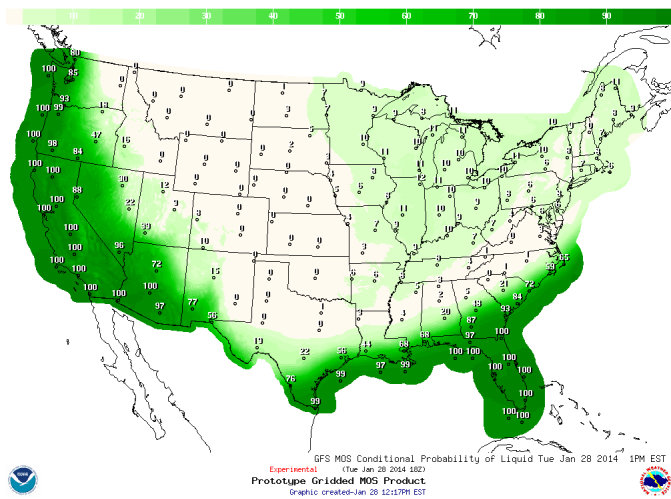
# GMOS Precipitation Type



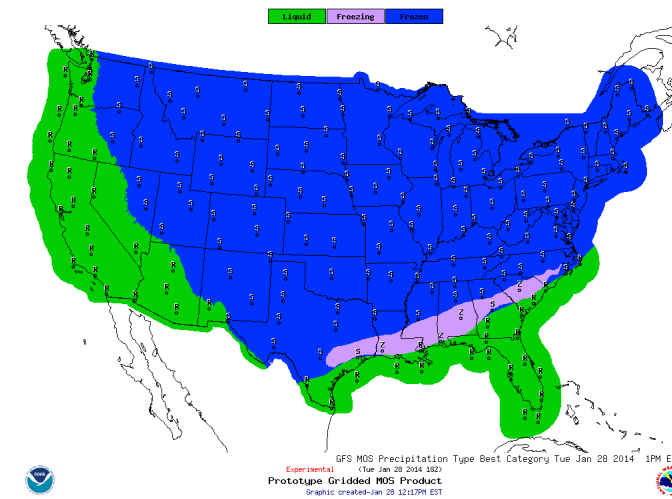
Freezing



Frozen



Liquid



Best Category



# GMOS Precipitation Type

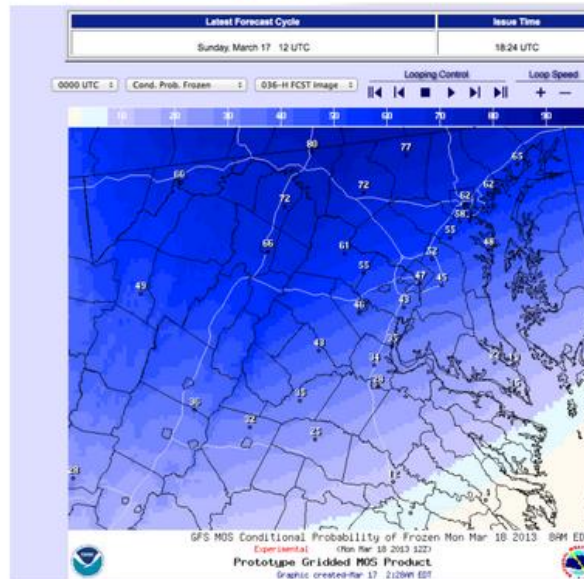


**Bob Ryan**  
@BobRyanABC7



FINALLY A Prob of Precip Type product for local offices -"Experimental"-of course it's spring now #yearslate [twitpic.com/cc86ih](https://twitter.com/cc86ih)

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By Bob Ryan @BobRyanABC7

FINALLY A Prob of Precip Type product for local offices -"Experimental"-of course it's spring now #yearslate



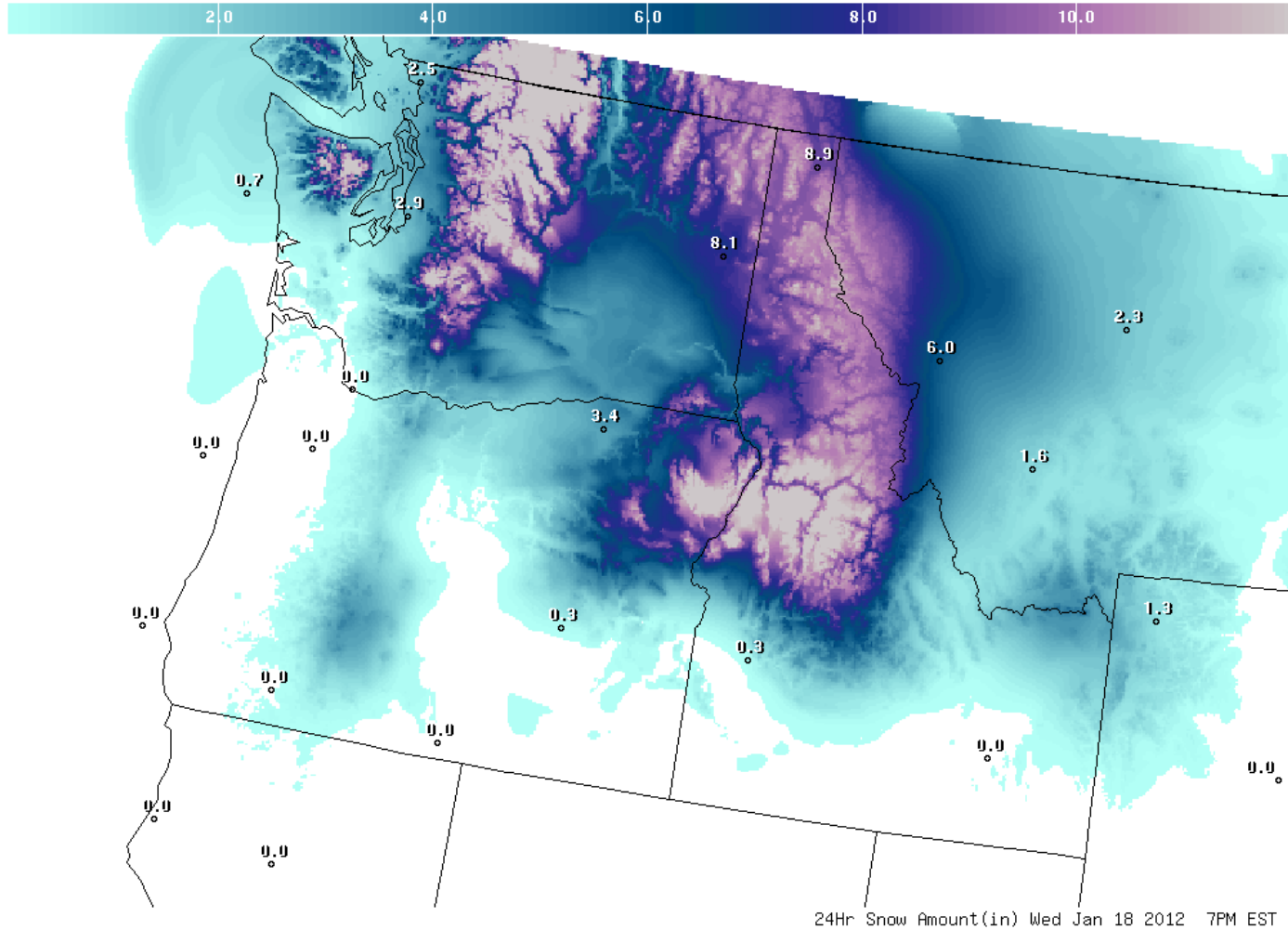
# MOS Snowfall Amount



- MDL produces GFS-based and NAM-based MOS guidance for 24-h snowfall amount:
  - Derived from daily COOP snowfall observations (NCDC).
  - All cycles of the GFS and NAM. ***ECMWF MOS snowfall coming soon!***
  - Probabilities of exceedance for various thresholds, converted to a best category to populate MAV, MEX, and MET text messages.
  - GFS-based gridded MOS guidance for 24-h snowfall amount.
  
- MOS snowfall categories:
  - >T to <2", ≥2" to <4", ≥4" to <6", ≥6" to <8", ≥8"
  
- Experimental thresholds for LWX pilot project:
  - >T to <1", ≥1" to <2", ≥2" to <4", ≥4" to <8", ≥8 to < 12", ≥12"



# GMOS Snowfall Amount



24Hr Snow Amount(in) Wed Jan 18 2012 7PM EST

**Operational** (Thu Jan 19 2012 00Z)

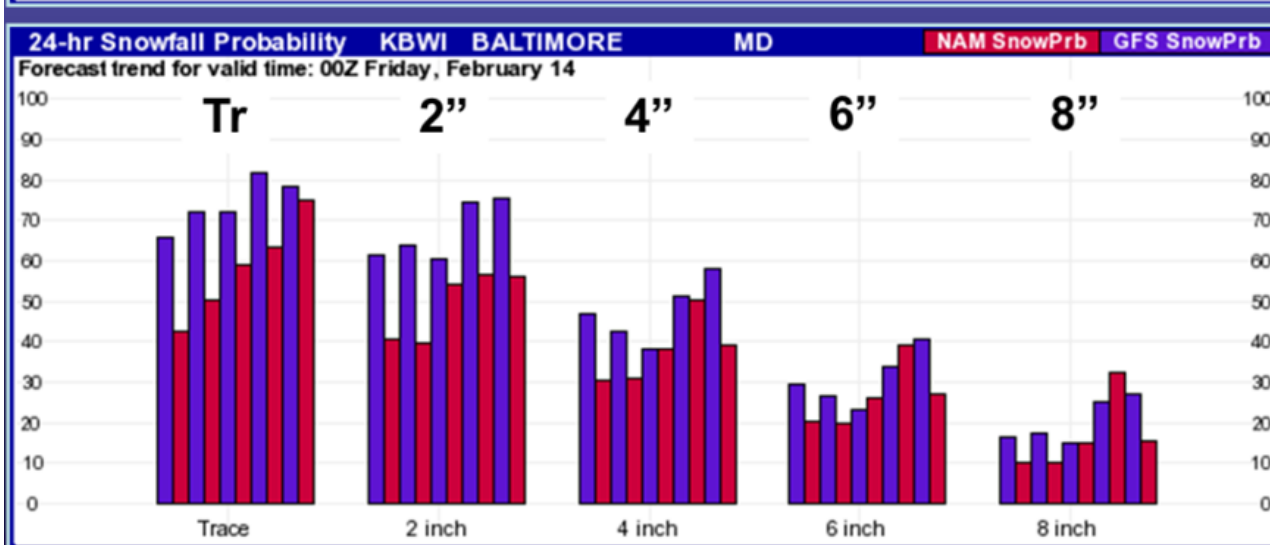
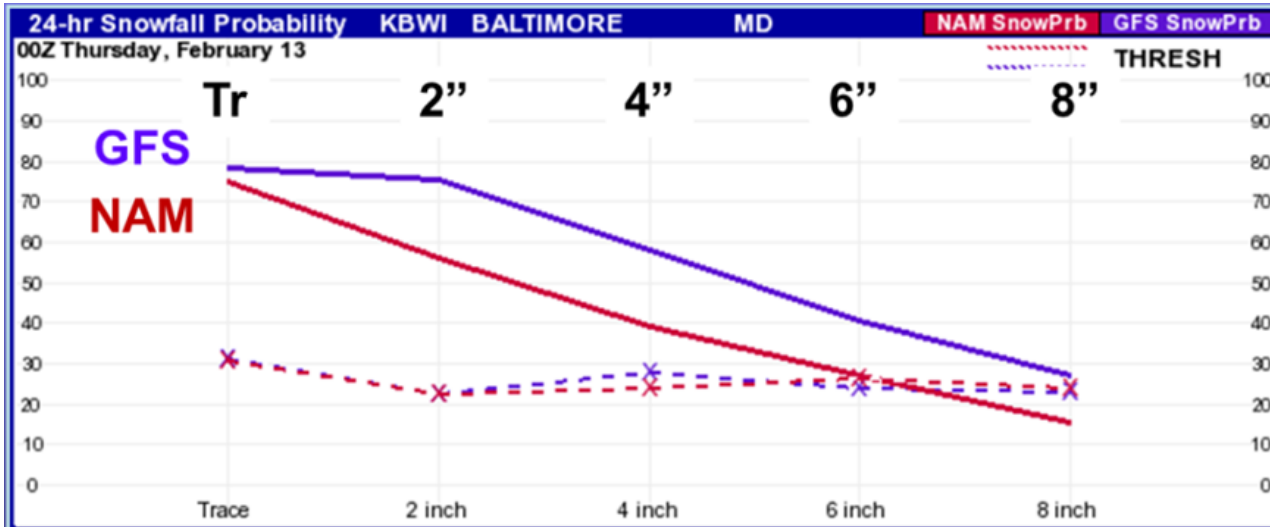
**National Digital Guidance Database**

00z issuance Graphic created-Feb 09 1:26PM EST





# Experimental Snowfall Probability Graphs







# SREF Winter Guidance (SWinG)



- MDL is generating calibrated probability distributions for several variables from the SREF that are traditionally used for rain/snow forecast decisions, e.g. 2-m temperature, 850-hPa temperature, various thicknesses.
- Decaying Average Bayesian Model Averaging (DABMA)

## **Using most recent verification...**

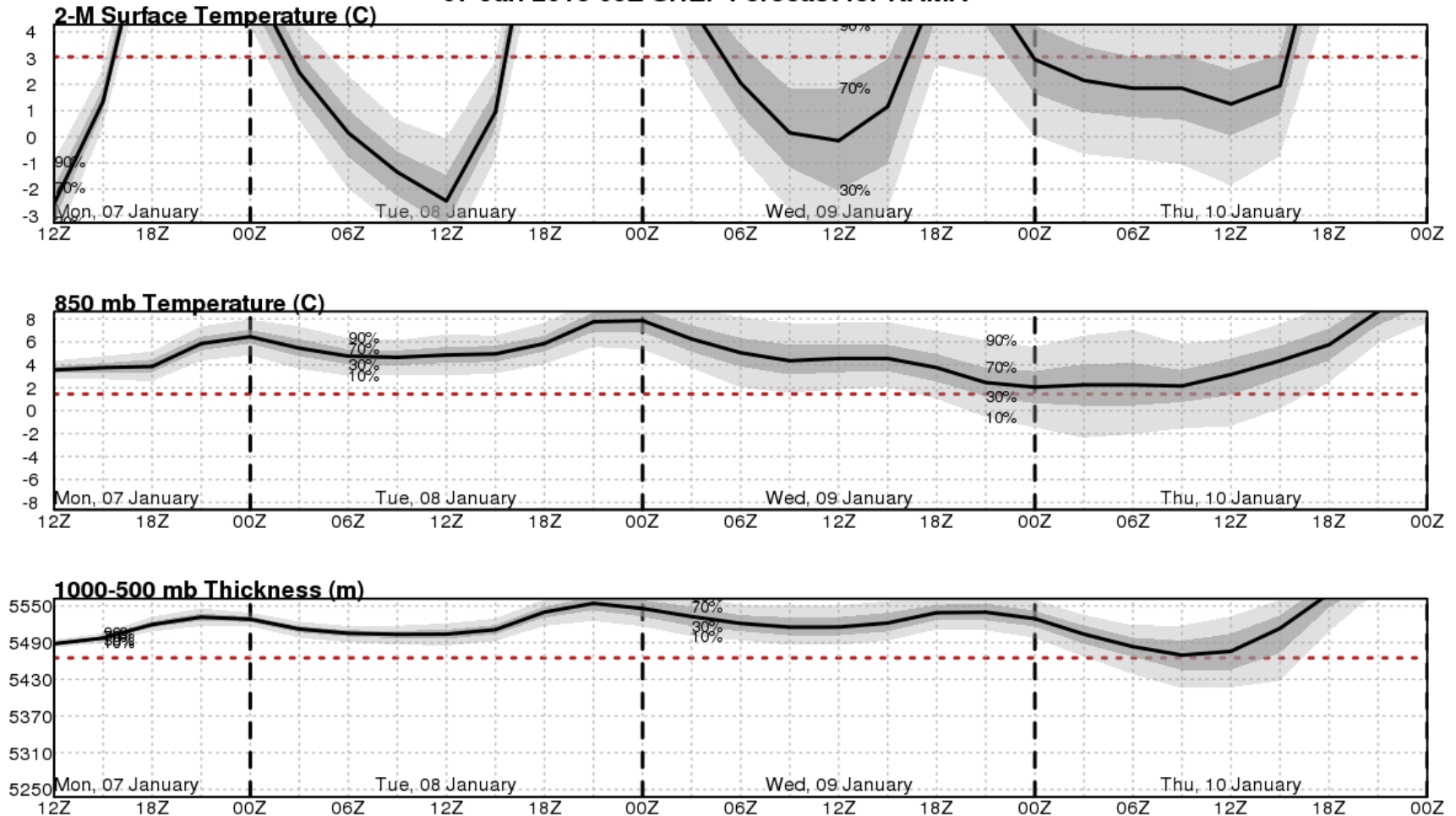
- Correct bias of each member
- Compute relative weights for bias-corrected SREF members
- Correct forecast spread
- Compute probabilities



# SREF Winter Guidance (SWinG)

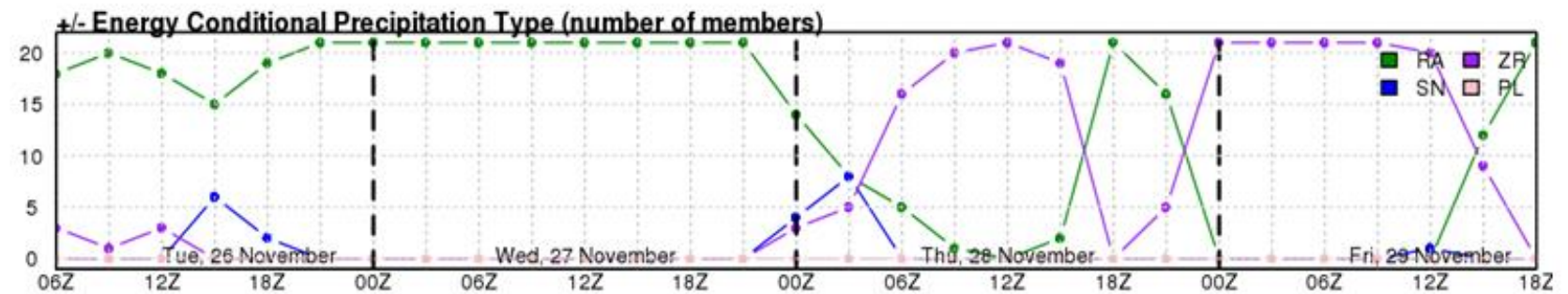
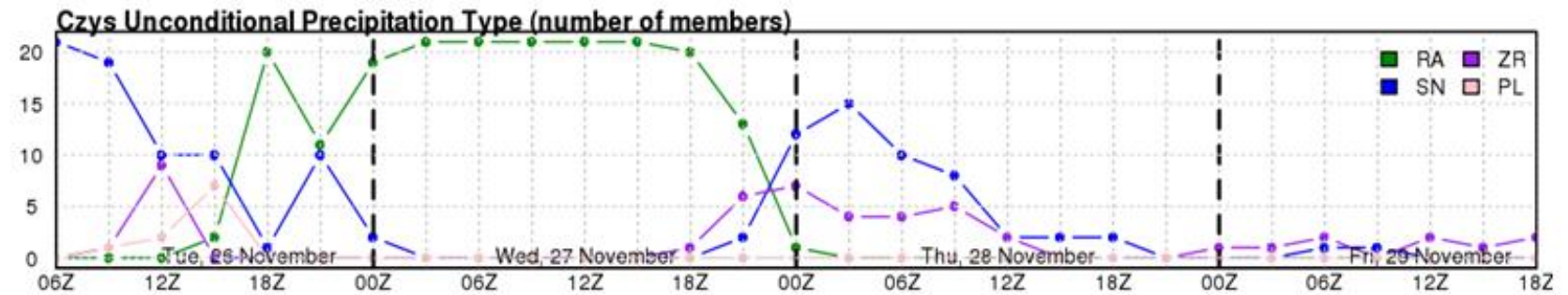
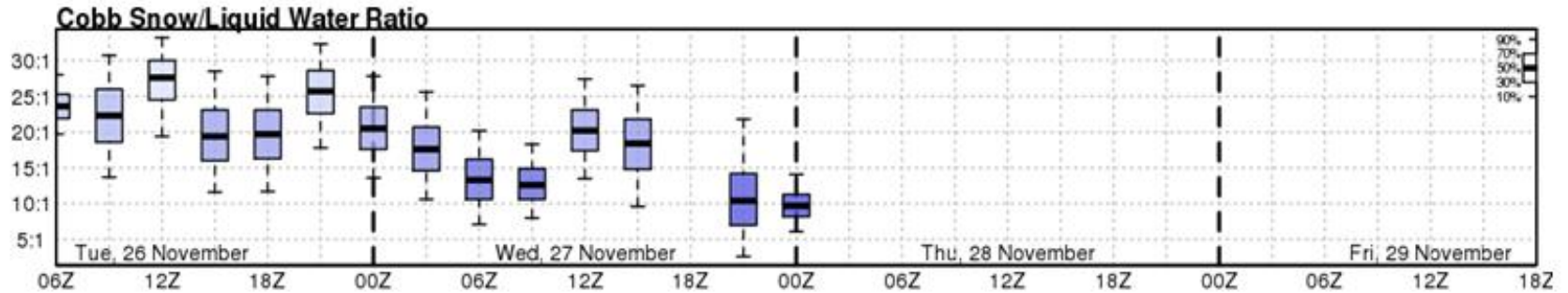


07 Jan 2013 09Z SREF Forecast for KAMA





# SREF Winter Guidance (SWinG)





# SREF Winter Guidance (SWinG)



- MDL is seeking feedback on the usefulness of this product.
- Discontinue or move it into operations? Input during this coming winter season will help us make this decision.
- For questions or comments on MDL's SWinG products please contact John L. Wagner and Bruce Veenhuis.

[John.L.Wagner@noaa.gov](mailto:John.L.Wagner@noaa.gov)

[Bruce.Veenhuis@noaa.gov](mailto:Bruce.Veenhuis@noaa.gov)



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# ***National Blend of Models (NBM)*** ***Winter Weather Elements***



# NBM Background



- Sandy Supplemental Project
- Goal: Develop a set of next-generation foundational gridded guidance products for NDFD weather elements based on NWS and non-NWS model information
  - Beginning with the global models
  - Building upon the regional blends
  - Run centrally on WCOSS supercomputer
  - Future phases to include mesoscale/convective scale models
- Multi-year project with 70+ participants from NWS Regions, NWSEO, NCEP, OAR, STI, AFS, COMET, ...
- Includes upgrades to RTMA/URMA

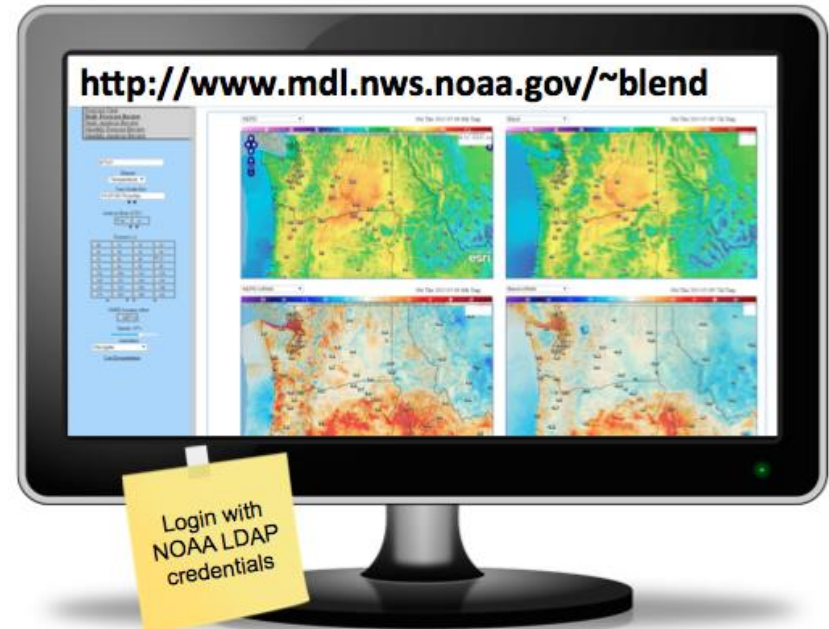


# NBM Development Scope



## Version 1 elements (Dec. 2015):

- Temperature
- Dewpoint
- Daytime Max T and Nighttime Min T
- Sky Cover
- Wind Speed/Direction/Gust
- Probability of Precipitation
- Relative Humidity (derived)
- Apparent Temperature (derived)



## Version 2 elements (Fall 2016):

- Precipitation Type
- QPF
- Snowfall Amount
- Predominant Weather
- Oceanic Winds (Oceanic domain)
- Expansion to AK, HI and PR NDFD domains

Initial development work to occur this Fall with prototypes available for evaluation this winter



# NBM Winter Weather



- Phase 2 of the National Blend of Models (Sept 2016) will include guidance for the following winter weather elements:
  1. Precipitation type best category – every 3 h out to 84 h, every 6 h out to 192 hours.
  2. 6-h snowfall amount – every 6 h out to 84 h.
  
- Tom Hamill & Michael Scheuerer (NOAA-ESRL) have received funding through NGGPS to develop and study advanced post-processing methods for precipitation type and snowfall.
  1. Leveraging multi-ensemble forecast data.
  2. Test statistical classification methods such as quadratic discriminate analysis.
  3. Test new methodologies against existing MOS techniques.





# NBM 6-h Snowfall Amount



- Considerations:
  1. Observations of 6-h snowfall are very limited – perhaps enough for validation, not enough for development.
  2. NBM 6-h snowfall grids must be consistent with 6-h QPF and precipitation type.
  
- Challenging forecast problem:
  1. Need to estimate what fraction of 6-h QPF will fall as snow.
  2. Need to estimate what the ratio of snow to liquid will be for what falls.



# NBM 6-h Snowfall Amount



$$[ \text{6-h snow} ] = [ \text{6-h QPF} ] \times [ \text{snow fraction} ] \times [ \text{snow-liquid ratio} ]$$

**Input A**                      Input B                      Input C

Input A: Grid of 6-h liquid-equivalent QPF

- Methodology being developed by Hamill/Scheuerer.



# NBM 6-h Snowfall Amount



$$[ \text{6-h snow} ] = [ \text{6-h QPF} ] \times [ \text{snow fraction} ] \times [ \text{snow-liquid ratio} ]$$

Input A
**Input B**
Input C

Input B: Fraction of QPF that will fall as snow during 6-h period.  
 Should be derived in a way that is consistent with NBM precipitation type grid (Hamill/Scheuerer), for example:

	0Z	3Z	6Z	9Z	12Z
	[<---3h--->]	[<---3h--->]	[<---3h--->]	[<---3h--->]	
	[<-----6h----->]		[<-----6h----->]		
Ptype best cat	S	S	PL	ZR	R
Snow frac (3h)	1	0.75	0.25	0	
Snow frac (6h)		0.875		0.125	



# NBM 6-h Snowfall Amount



$$[ \text{6-h snow} ] = [ \text{6-h QPF} ] \times [ \text{snow fraction} ] \times [ \text{snow-liquid ratio} ]$$

Input A                      Input B                      **Input C**

Input C: Grid of snow-liquid ratio (SLR) for the 6-h period

- Many papers out there on this topic.
- Would a SLR climatology suffice (e.g. Baxter et al. 2005)?
- Develop a generalized operator (MOS or perfect prog) equation for SLR from 24-h Cooperative Observer reports?
  - Equation gets applied to each 6-h period within the 24-h period.
  - Should be more skillful than a climatology.



# Discussion



- What methods does WPC use for precipitation type?
- What is WPC doing for snow-liquid ratio? Is a climatology good enough?



# Thank you!

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