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 (ECWMF 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 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
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
```

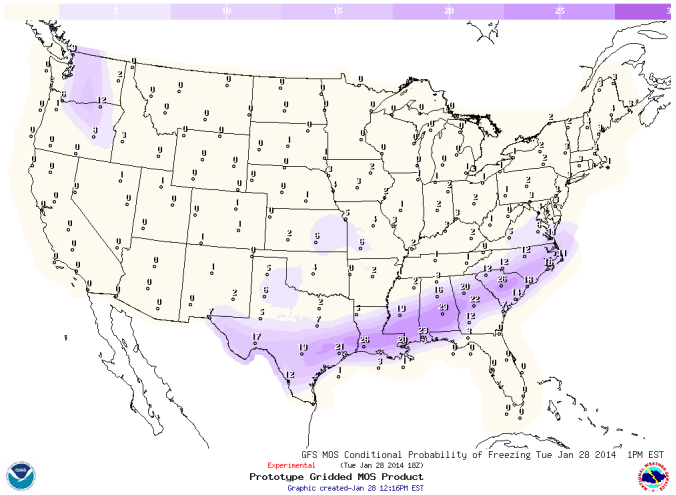
MAV

Sample Message

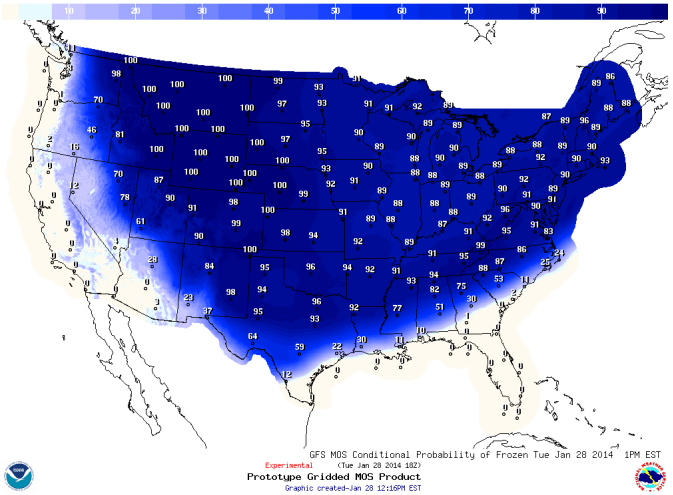
```
IAD   GFSX MOS GUIDANCE   3/05/2013  0000 UTC
FHR  24| 36  48| 60  72| 84  96|108 120|132 144|156 168|180 192
TUE  05| WED 06| THU 07| FRI 08| SAT 09| SUN 10| MON 11| TUE 12 CLIMO
X/N  47| 34  42| 32  44| 29  45| 32  50| 33  57| 38  58| 40  54 29 53
TMP  42| 36  39| 34  39| 32  41| 34  44| 37  50| 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

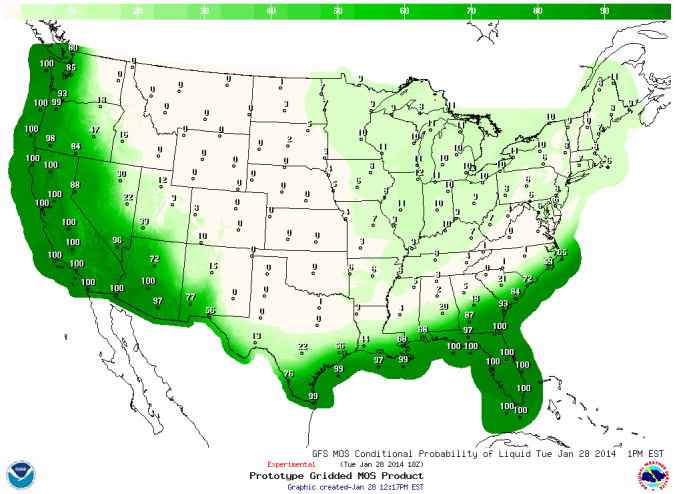
GMOS Precipitation Type



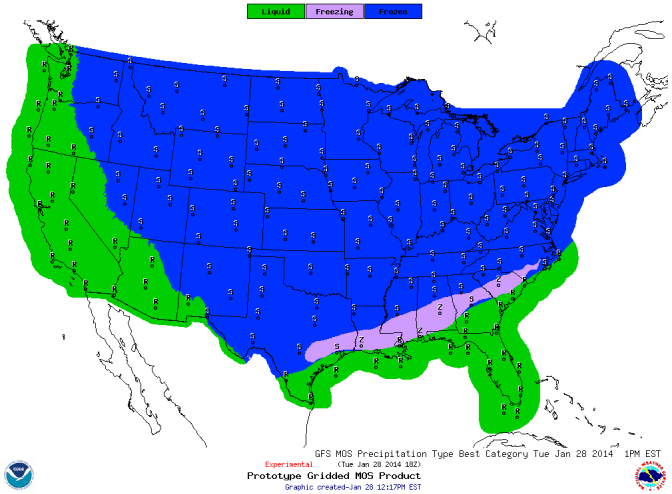
Freezing



Frozen



Liquid



Best Category

GMOS Precipitation Type

Bob Ryan
@BobRyanABC7

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

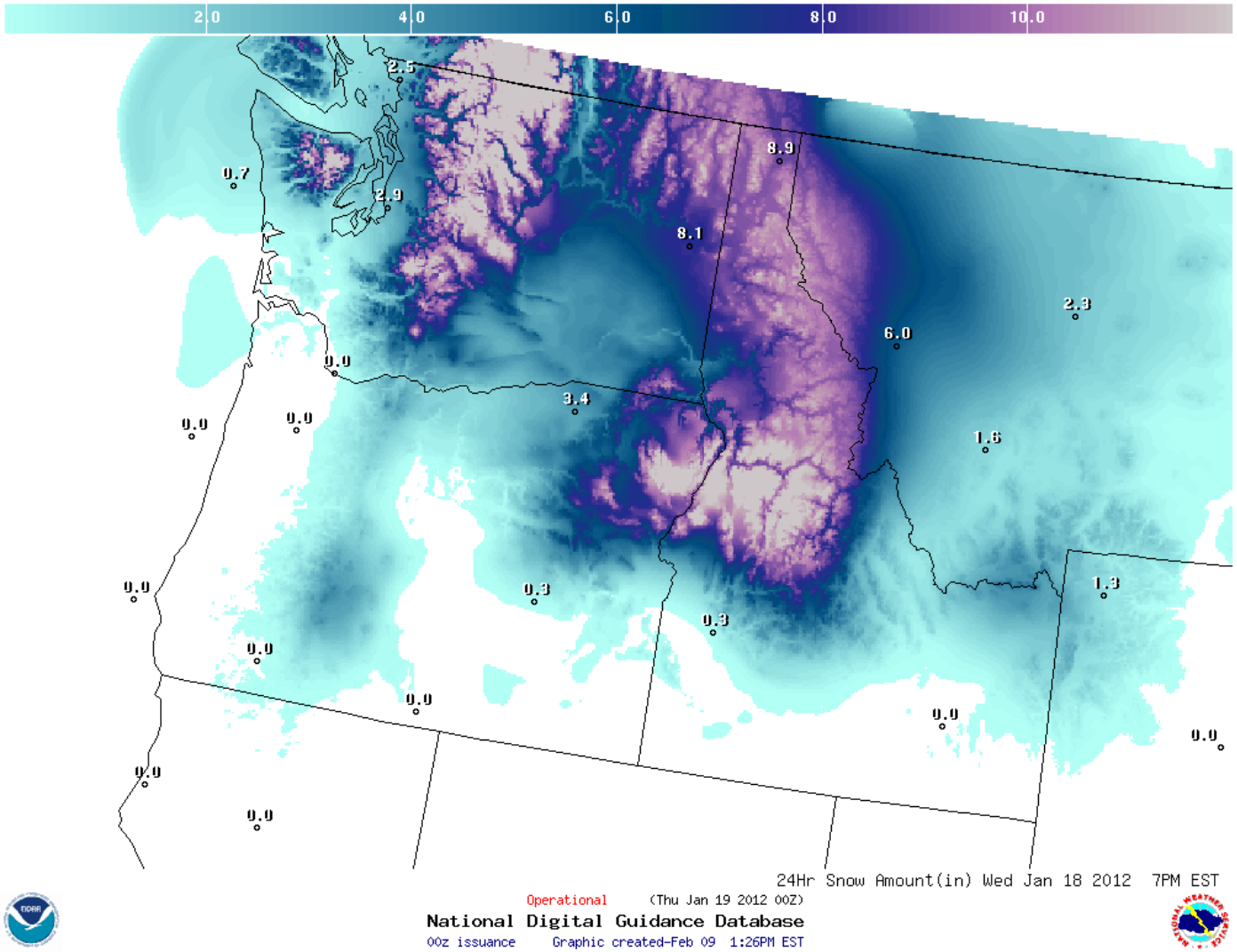
- MOS snowfall categories:

  >T to <2”, ≥2” to <4”, ≥4” to <6”, ≥6” to <8”, ≥8”

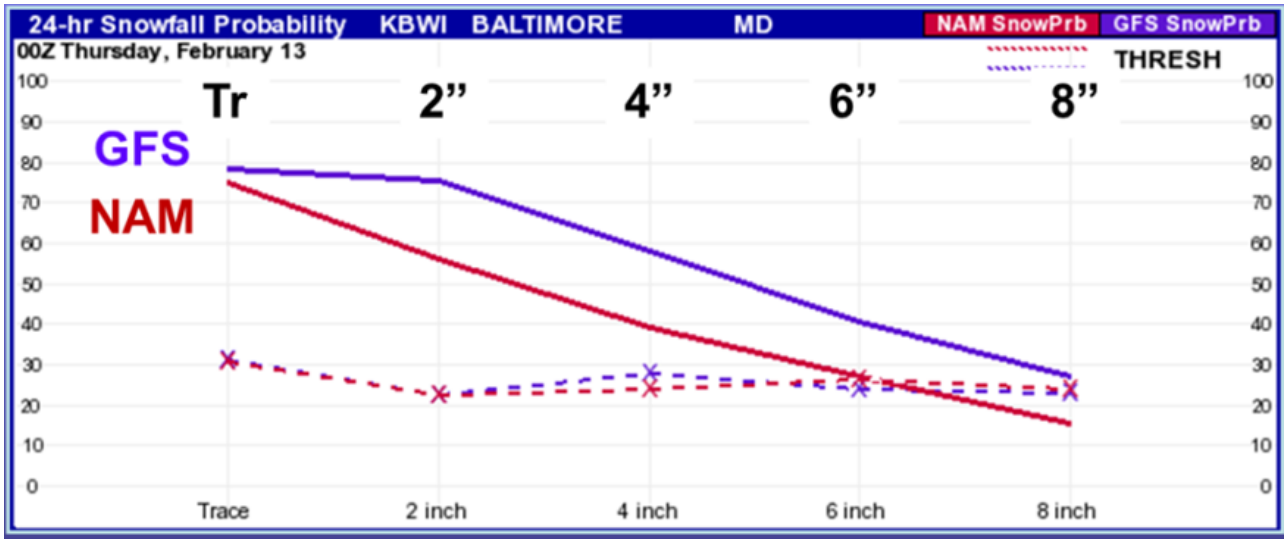
- Experimental thresholds for LWX pilot project:

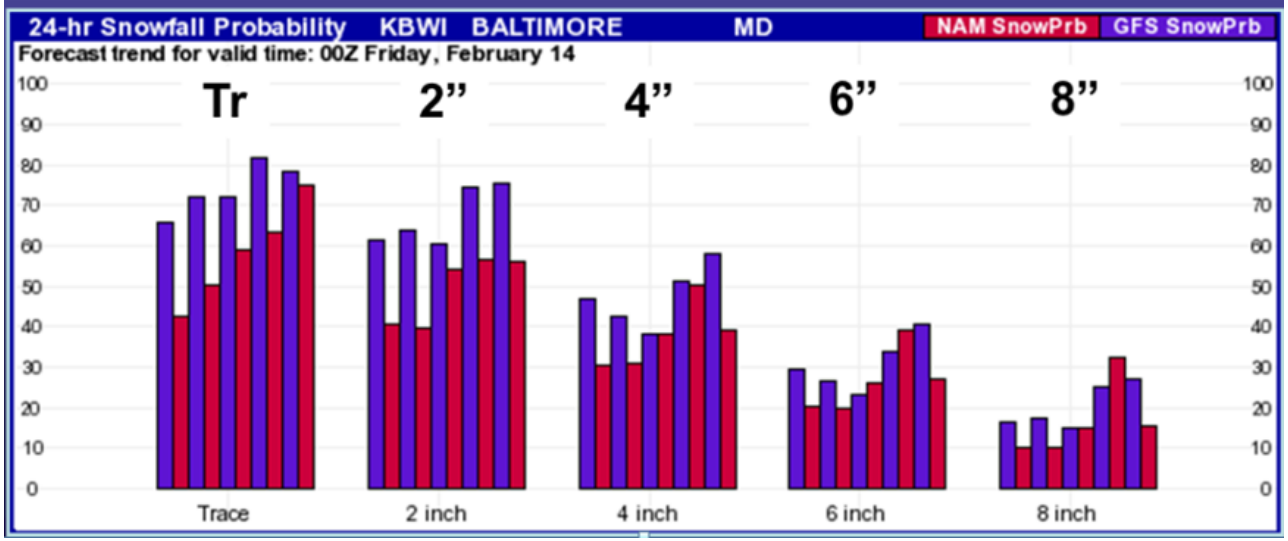
  >T to <1”, ≥1” to <2”, ≥2” to <4”, ≥4” to <8”, ≥8 to < 12”, ≥12”

GMOS Snowfall Amount



Experimental Snowfall Probability Graphs





SREF Winter Guidance (SWinG)

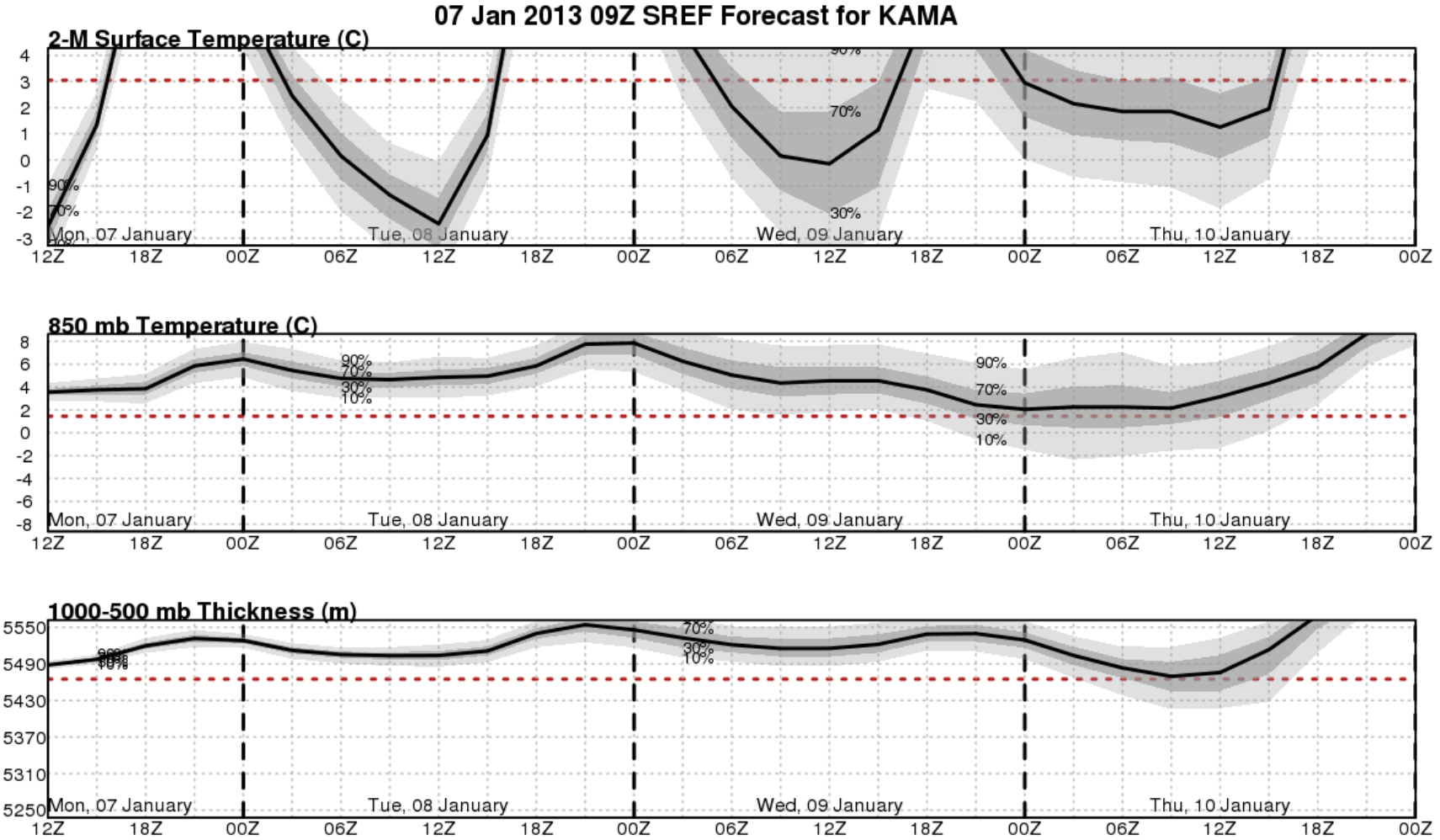
- MDL is generating calibrated probability distributions for several variables from the SREF that are traditionally used for rain/snow forecast decisions, e.g. 2-m temperature, 850-hPa temperature, various thicknesses.

- Decaying Average Bayesian Model Averaging (DABMA)

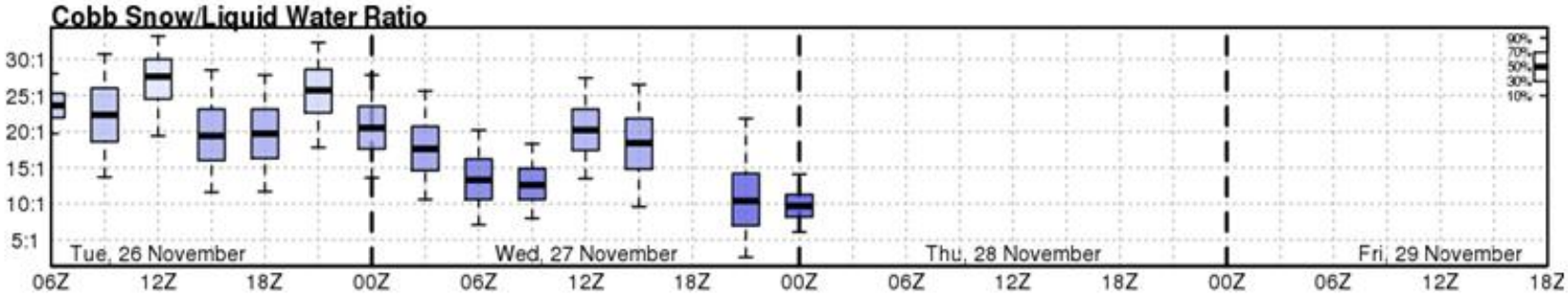
Using most recent verification...

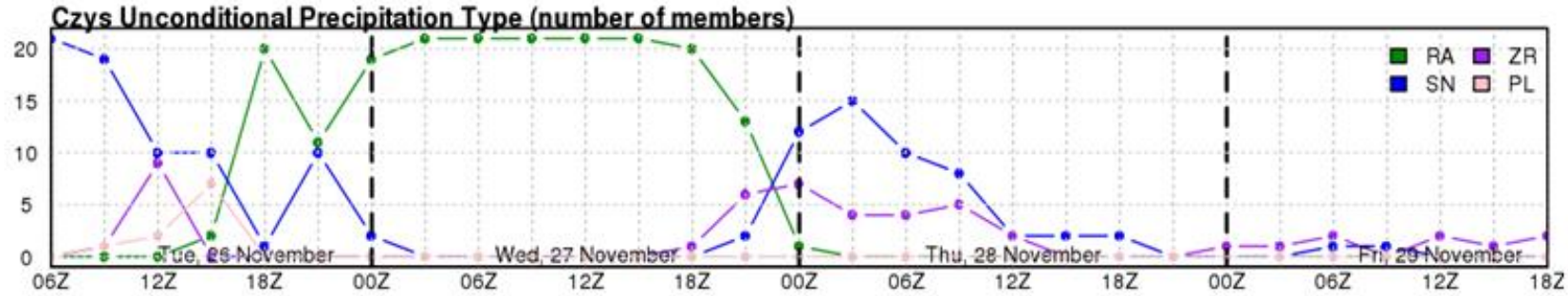
- Correct bias of each member
- Compute relative weights for bias-corrected SREF members
- Correct forecast spread
- Compute probabilities

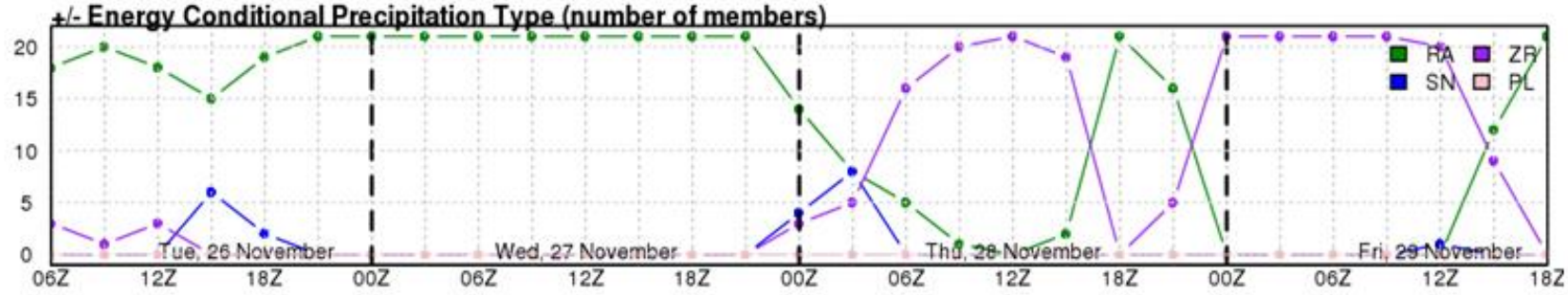
SREF Winter Guidance (SWinG)



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

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National Blend of Models (NBM) Winter Weather Elements

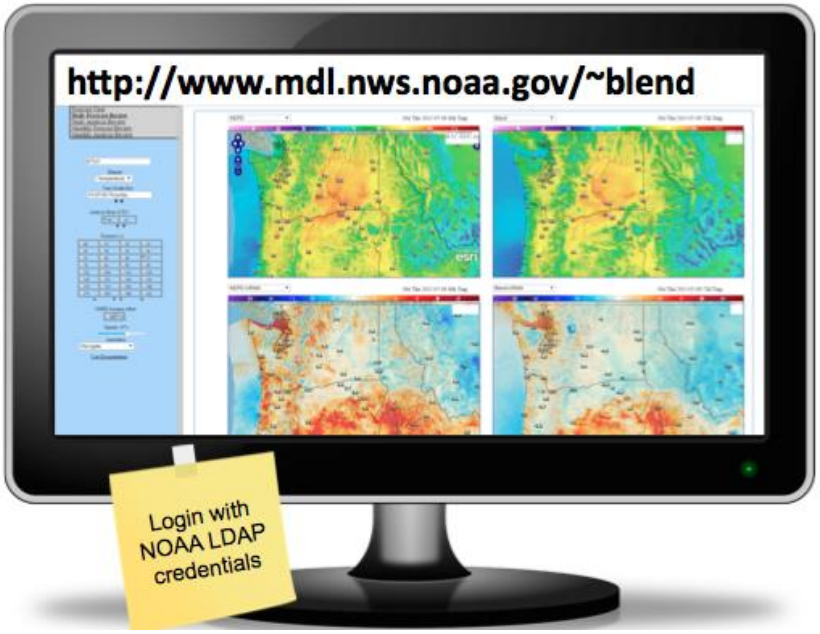
NBM Background

- 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

[6-h snow] = [6-h QPF] x [snow fraction] x [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

[6-h snow] = [6-h QPF] x [snow fraction] x [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

[6-h snow] = [6-h QPF] x [snow fraction] x [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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