P2.19

Recent Developments/Improvements in Objective Analyses of Observations/Forecasts for Localized Aviation MOS Products at the Meteorological Development Laboratory

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1. Introduction

As part of the Localized Aviation MOS Program (LAMP), the Meteorological Development Laboratory (MDL) is providing gridded observations (0-h proj.) and gridded LAMP forecast guidance (1-25-h proj.) for 2-m surface temperature (T), 2-m dewpoint temperature (Td), ceiling height (C), and visibility (V) at each hour for forecasters in preparing the National Digital Forecast Database (NDFD). This presentation focuses on improvements over operational LAMP T/Td gridded products and new developments of LAMP 10-m wind gridded products covering 0-25 h.

We describe the intensive effort needed to assure temporal consistencies between gridded observations (0h) and the first projection (1h) of gridded LAMP forecasts and also from 1h to 25h by showing a method developed with an augmentation algorithm. In the current operational augmentation procedures, data derived from the Short-Range Ensemble Forecast (SREF) system are used to augment the station LAMP T/Td forecasts; this augmentation was necessary to provide detail for the 2.5-km resolution grid. For this new development, we instead use observations and MOS forecasts for augmentation, which are adjusted with LAMP forecasts and weighted by projection (i.e., with higher weighting of observations in earlier projections and higher weighting of MOS forecasts in later projections). Another important capability required in our objective analysis scheme is the effective computation of vertical changes with elevation (VCE). In the T/Td suite, the lapse rate for each station point is computed by using neighboring pairs of stations and then used to make vertical adjustments over grid points. To compute wind's VCE at each station point, we use surface and Global Forecast System (GFS) upper level data.

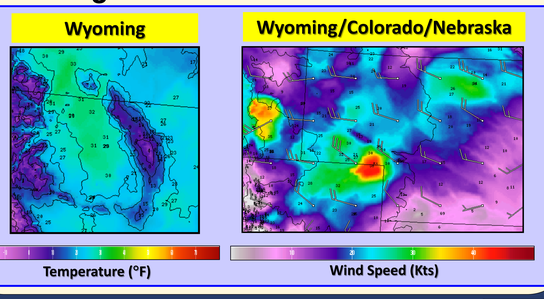
2. BCDG Scheme & Pre-Processors

Bergthorssen-Cressman-Doos-Glahn (BCDG) Objective Analysis Scheme (Glahn et al. 2009, Glahn and Im 2011, Im and Glahn 2012)

- Successive Correction:
  Correcting each grid pt on each pass with the stn data in the immediate vicinity
- Land/Water Sep. (Land, Ocean, Lake)
- Vertical Changes
- Variable Radius of Influence R (varies with data density)
- Buddy Checks (QC)
- Terrain-Following Smoother
- Spot Remover (Variable Radius Smoother)
  : Dist. to closest stn -> weighted avg. of all grid pts in the circle

3 Pre-processors in BCDG are made to save run-time in advance.
1) Station Pairs to compute Lapse Rate
2) Variable Rs for each station
3) Station Pairs to compute Adjusted values for Augmentation

3. Fitting Observations in BCDG Scheme



4. GLMP Suite

GOBS (00 h) + GLMP (01-25 h)

Nowcasting — Forecasting

00 h 01 02 03 04 05 06 07 … 12 … 25 h

GOBS Nowcasting grids issuing at ~HH:30

GLMP Forecasting grids issuing at ~HH:40 (GMOS: Only 06 09 12 … →)

"Critical for Aviation Operations" LAMP has been shown to be an improvement over MOS mainly by adding OBS as predictors.

5. Problem in Current Operational GLMP Suite

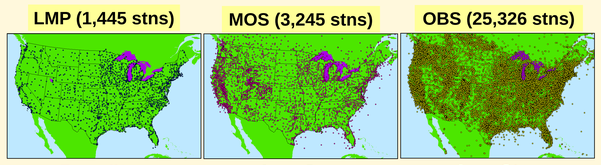
Temporal Discontinuity between GOBS and GLMP

Why?

Used Short Range Ensemble Forecast (SREF) to fill LAMP Spatial Gaps

6. New Augmentation Method

Distributions of LAMP/MOS/OBS data



Base Stns — No Water Points, No Canadian Points

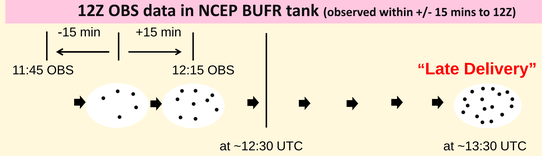
Aug. Stns — Helpful in later projections & Useful because MOS data always available

Aug. Stns — Very helpful in earlier projections & Useful due to large # of OBS

OBS Preparation

METAR, Mesonet, C-MAN, Moored Buoy, Tide Gauge

12Z OBS data in NCEP BUFR tank (observed within +/- 15 mins to 12Z)



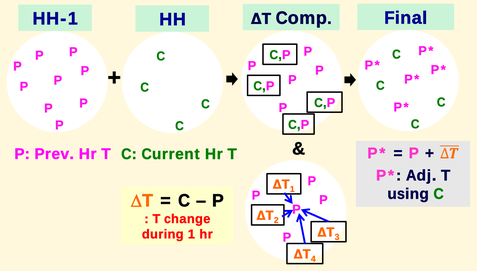
12Z GOBS Nowcasting Grid: 12Z OBS data at 12:30 UTC +11Z OBS data at 12:30 UTC

12Z GOBS Verification Grid: 12Z OBS data at 13:30 UTC

❖ Planning to do for +/- 30 mins instead of +/- 15 mins window

Augmentation in GOBS

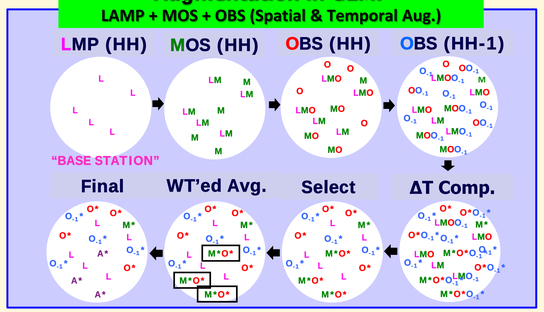
With Previous Hr. data (Temporal Aug.)



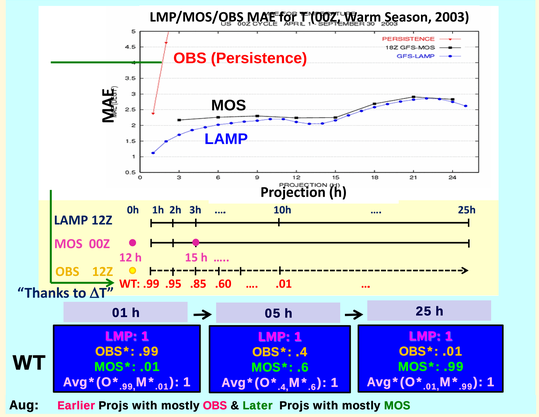
6. New Augmentation Method (Cont.)

Augmentation in GLMP

LAMP + MOS + OBS (Spatial & Temporal Aug.)

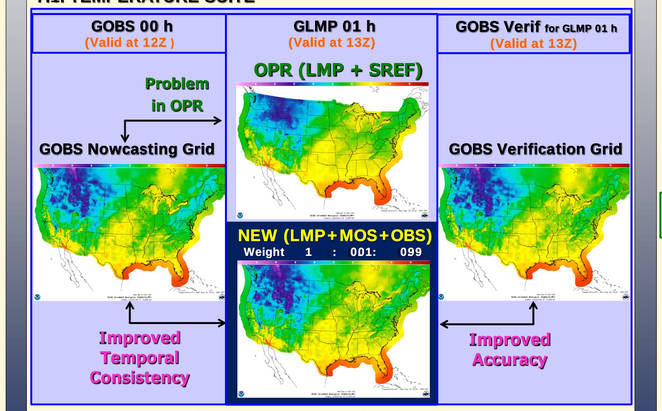


Augmentation Weighting in GLMP



7. Results: Improvements

7.1. TEMPERATURE SUITE

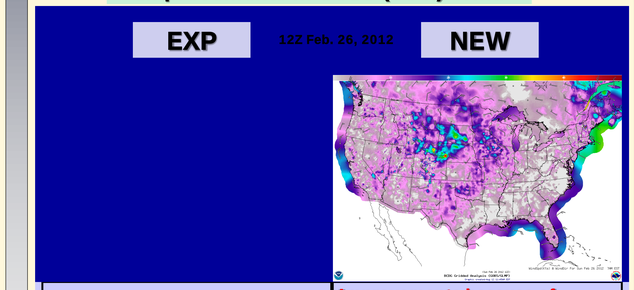


Analyses of temperature for 1200 Z cycle on 12 September 2012. GOBS nowcasting grid (left panel), GLMP 1-h projection grid issued in operations (upper middle panel), GLMP 1-h projection grid for the next implementation (bottom middle panel), and the corresponding verification grid (right panel).

7. Results: Improvements (Cont.)

7.2. WIND SUITE

Improvements in GOBS (00 h) Wind

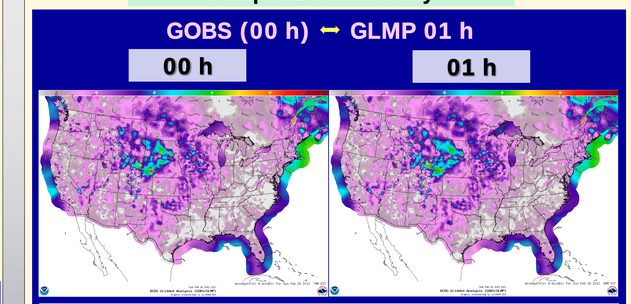


- Old station dictionary (much smaller # of stns)
- Vertical Change Computation by using Neighboring Pair Stns pre-processed
- Variable R pre-processed
- Without Variable Radius Smoother

Improvements because of:

- Recent stn. dic. (more # of stns, recent info => Details)
- Better Vertical Change Comp. by using Surface & GFS Upper Level Data
- + Vari. R computed on-the-fly
- With Variable Radius Smoother
- Water area improved by MOS & better L/W assign. & Bogus pts

Temporal Consistency



How to get temporal consistency:

Input data to GLMP: LAMP + OBS*(adjusted by LAMP) + MOS*(adjusted by LAMP)

WT: 1 0.9 0.1

❖ Tossed OBS info obtained from GOBS is passed into GLMP

8. Scheduled Implementations

The Upgraded MDL GOBS/GLMP (00-25 h) T/Td/C/V and New Wind/Gust/Opaque Sky Cover will be available at NCEP Central Operations.

References

Glahn, B., and J.-S. Im, 2011: Algorithm for effective objective analysis of surface weather variables, Preprints, *24th Conf. on Weather and Forecasting*, Seattle, WA, Amer. Meteor. Soc., 10A.4.

———, K. Gilbert, R. Cosgrove, D. P. Ruth, and K. Sheets, 2009: The gridding of MOS. *Wea. Forecasting*, 24, 520-529.

Im, J.-S., and B. Glahn, 2012: Objective analysis of hourly 2-m temperature and dewpoint observations at the Meteorological Development Laboratory. *Natl. Wea. Dig.*, 36(2), 103-114.

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