Data Denial Exercise: Real Time Mesoscale Analysis and MatchObsAll

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Introduction

- Project: Through the process of data denial determine which analysis system, the Real-Time Mesoscale Analysis (RTMA) or the Match Observations All (MatchObsAll) analysis, is the more representative temperature analysis system in complex terrain
  - Temperature analysis systems aim to give the best representation possible of the temperature over an area. Usually done using both surface observations and a background field.
  - Complex terrain has a large impact on analysis systems, therefore knowing which system is more representative is especially important in PNW
  - Big Picture: Analysis systems aid in the creation and verification of gridded forecasts that the NWS issues as well as other NOAA applications
- Hypothesis: The RTMA should be the more representative analysis in complex terrain due to its more sophisticated and dynamic nature

Background

- Real-Time Mesoscale Analysis (RTMA)
  - A real-time mesoscale analysis over a 5 km CONUS domain. Created using:
    - Background Fields: RUC 13km analyses downscaled to 5 km NDFD grid using RUC lapse rate
      - RTMA terrain (not NDFD)
    - MesoWest/MADIS surface observations
    - Sophisticated analysis system that uses the 2DVAR Gridpoint Statistical Interpolation scheme used by the National Center for Environmental Prediction (NCEP)
  - Products: temperature, dew point, wind, precipitation*, and sky cover*

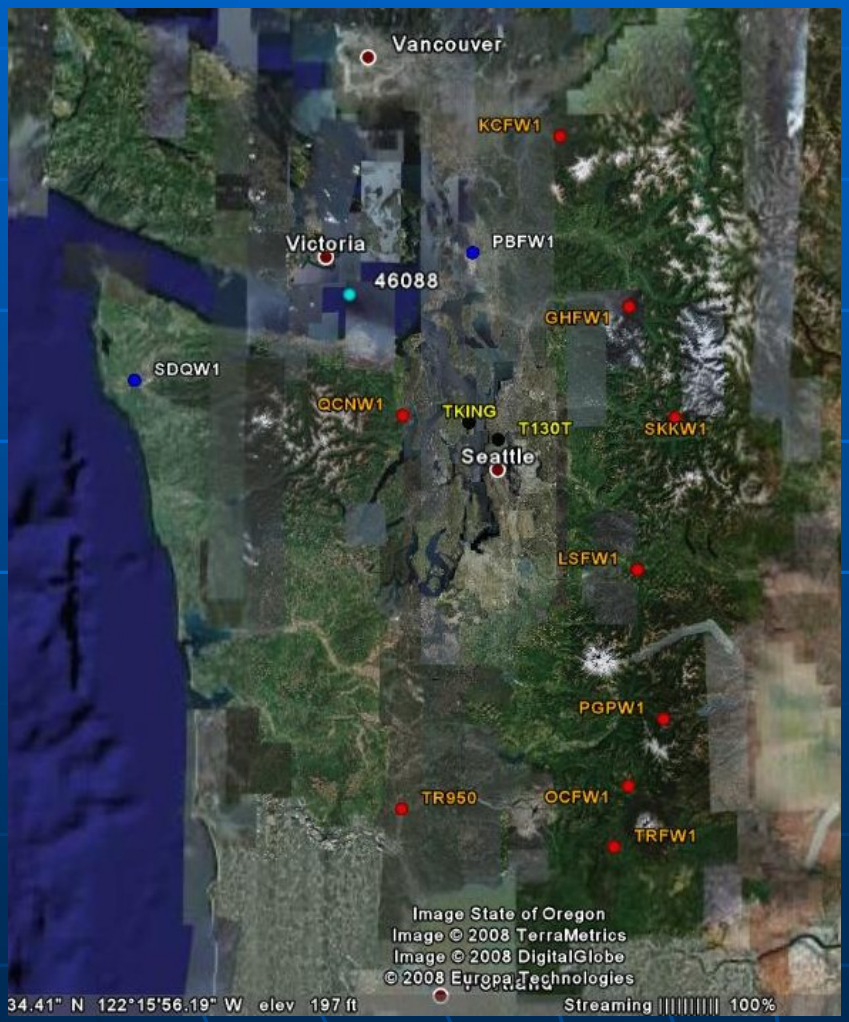
Background

- Match Observations All
  - Simple analysis run at the local forecast office on the Graphical Forecast Editor (GFE) system.
    - Background fields: 12 km GFS initialized MM5 forecasts downscaled to 5 km NDFD grid using model lapse rate
      - NDFD topography
    - MesoWest/MADIS surface observations
    - Utilizes a simple analysis scheme that fits the observations to the background field using a serpentine curve. Unlike the RTMA, the value of a grid point containing an observation much match the observed value.
  - Products: temperature, dew point, wind, and derived grids of RH, max/min RH, max/min temperature

Methodology

- Data Denial
  - Completed by withholding observations from both analysis systems for comparison
  - RTMA and MatchObsAll analyses were compared against 14 withheld stations spread throughout lowlands, mountains, and Strait of Juan de Fuca.
  - Program run that takes the difference between the analysis and the observation at each hour specified and then averages it over the total hours that are being examined.
  - Program gives a mean absolute error as well as an average difference.

Witheld Sites



Mountain Sites

GFHW1: Gold Hill, 3018 ft.
SKKW1: Johnson Ridge, 2001 ft.
KCFW1: Kidney Creek, 2999 ft.
LSFW1: Lester, 1614 ft.
PGPW1: Pigtail Peak, 5899 ft.
TRFW1: Trout Creek, 3615 ft.
OCFW1: Orr Creek, 2549 ft.

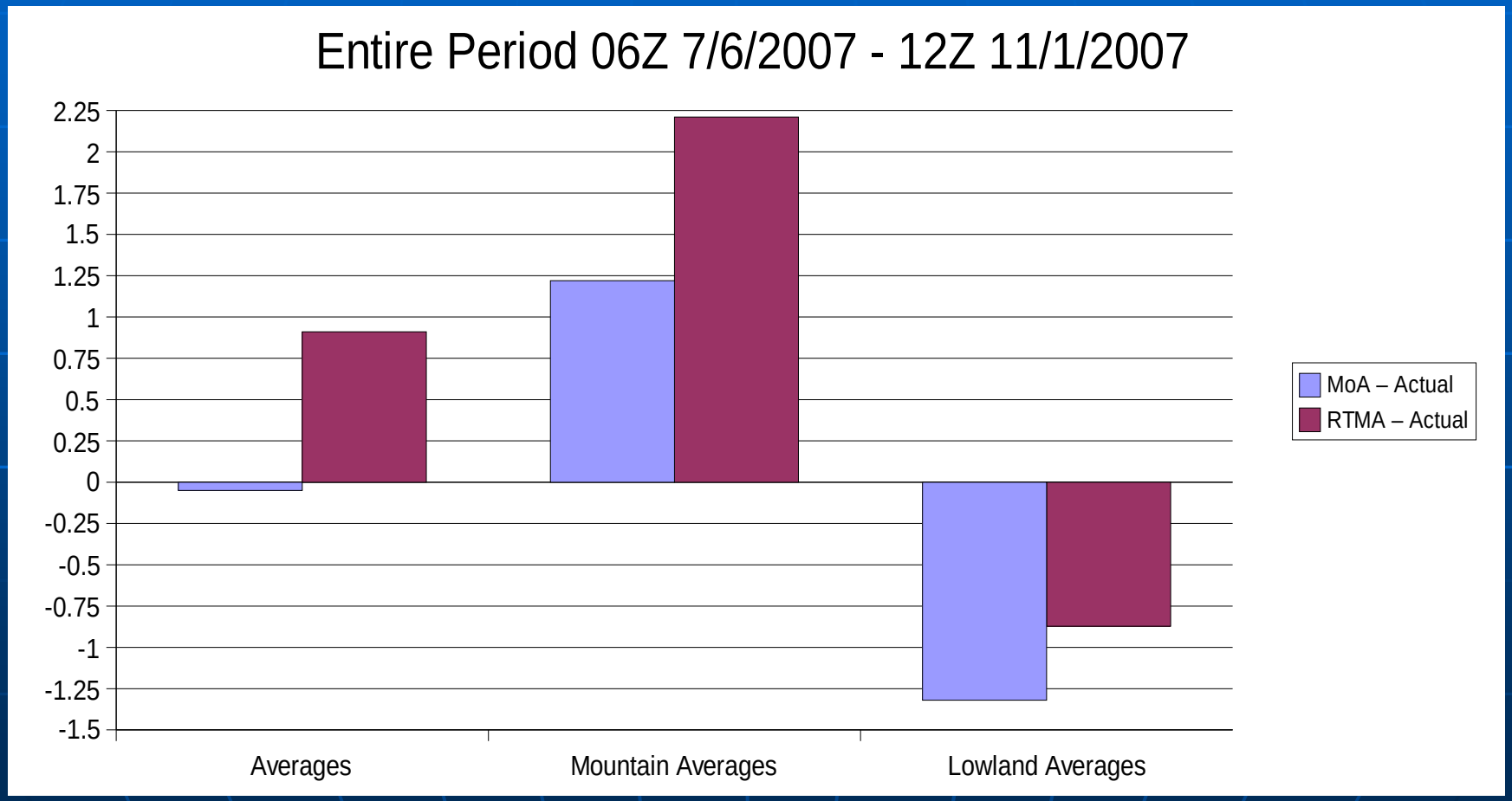
Lowland Sites

TR950: Castle Rock, 213 ft.
TKING: Kingston, 33 ft.
SDQW1: Sol Duc River, 154 ft.
QCNW1: Quilcene, 62 ft.
T130T: 130th St., 354 ft.
PBFW1: Padilla Bay, 7 ft.
46088: Buoy 88, 0 ft.

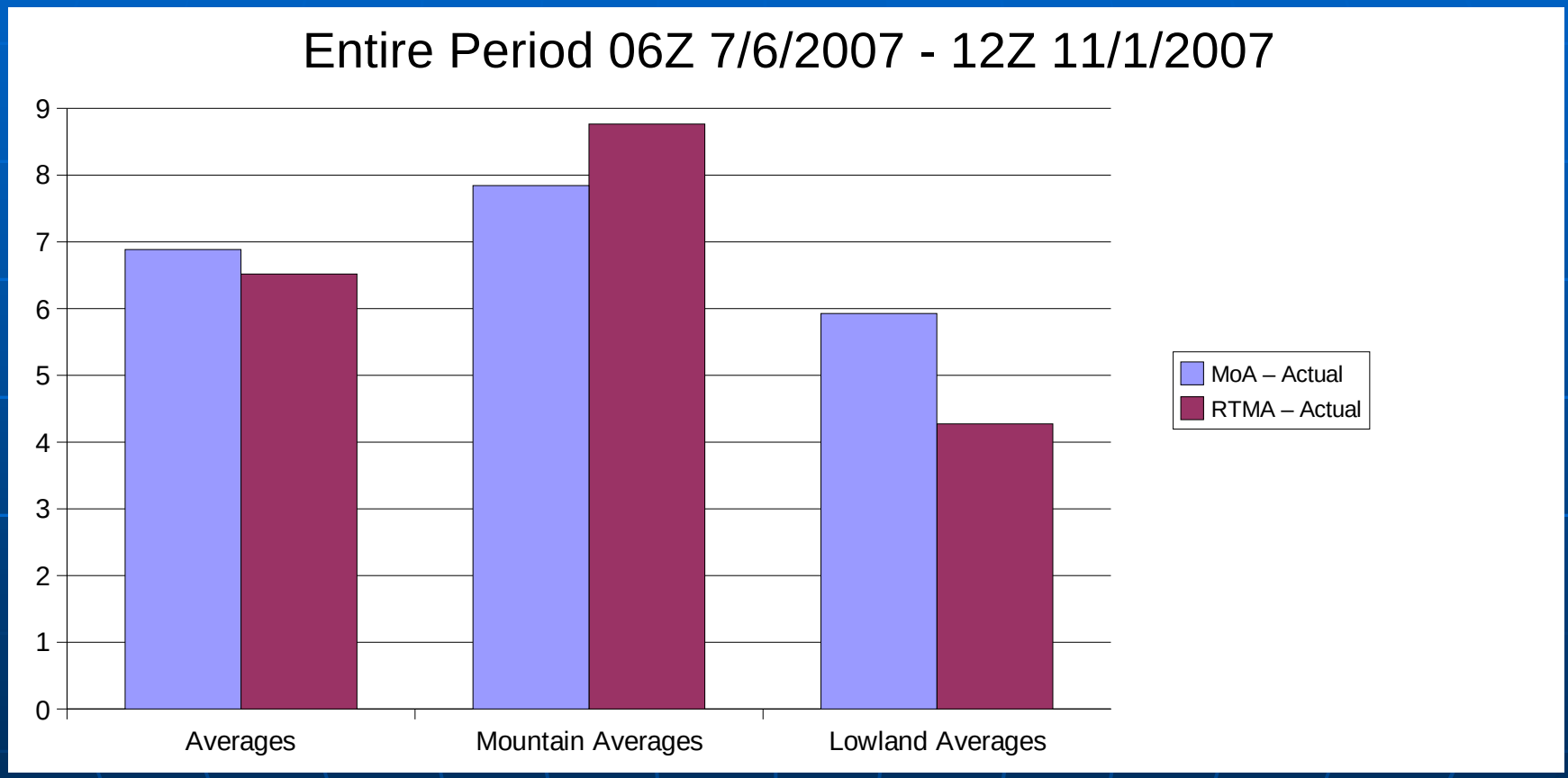
Time Periods

- Entire Period: 7/6/2007 to 11/1/2007
  - 00Z, 06Z, 12Z, 18Z
- Cool Period: 10/1/2007 to 11/1/2007
  - 06Z, 12Z

Average Difference During Entire Period

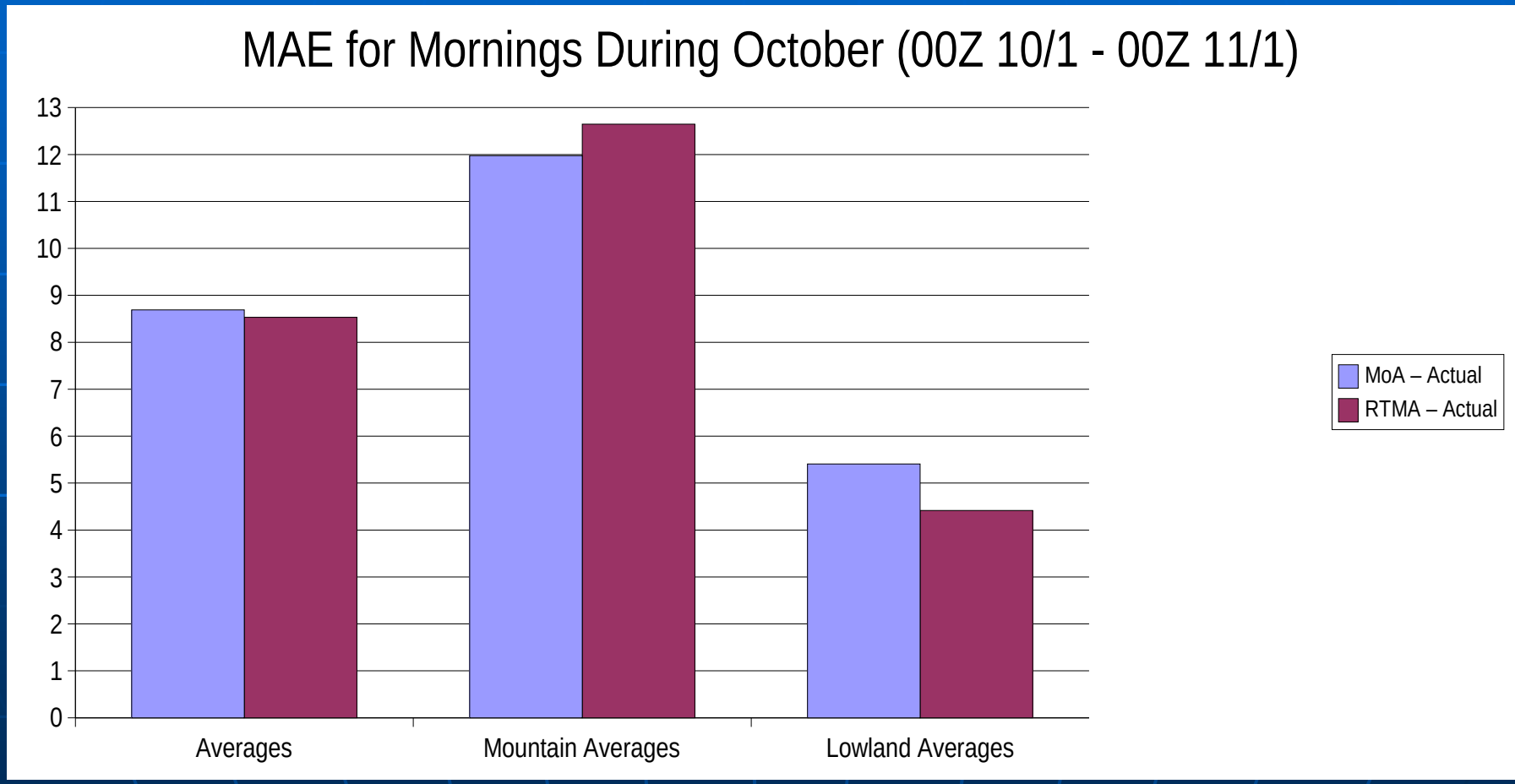


Overall MAE



Overall, the MAEs are pretty close.
The Match Obs All performs better in the mountains, the RTMA performs better in the lowlands

MAE During October Mornings

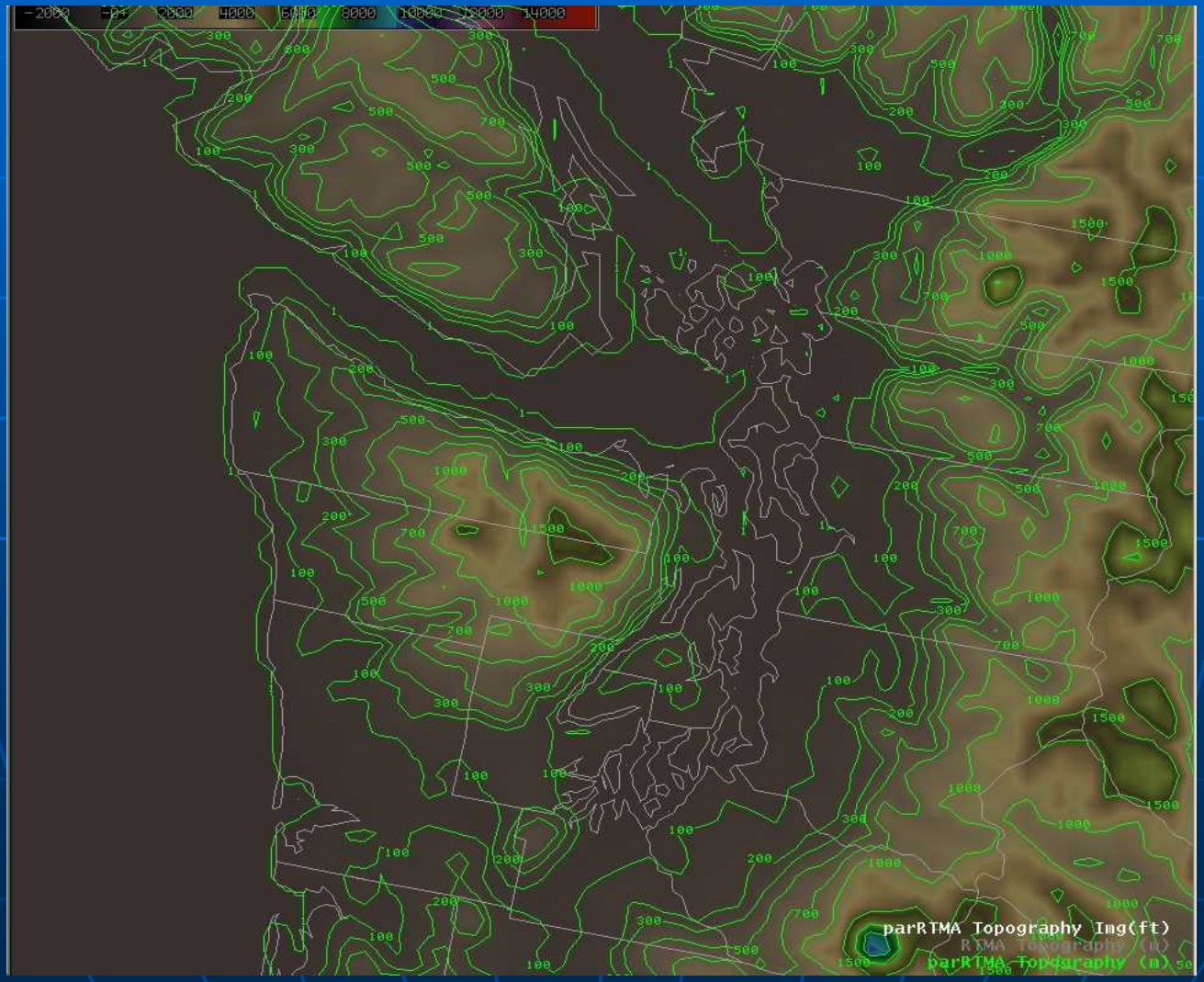


October mornings MAE is larger than the overall MAE in the mountain, but comparable in the lowlands

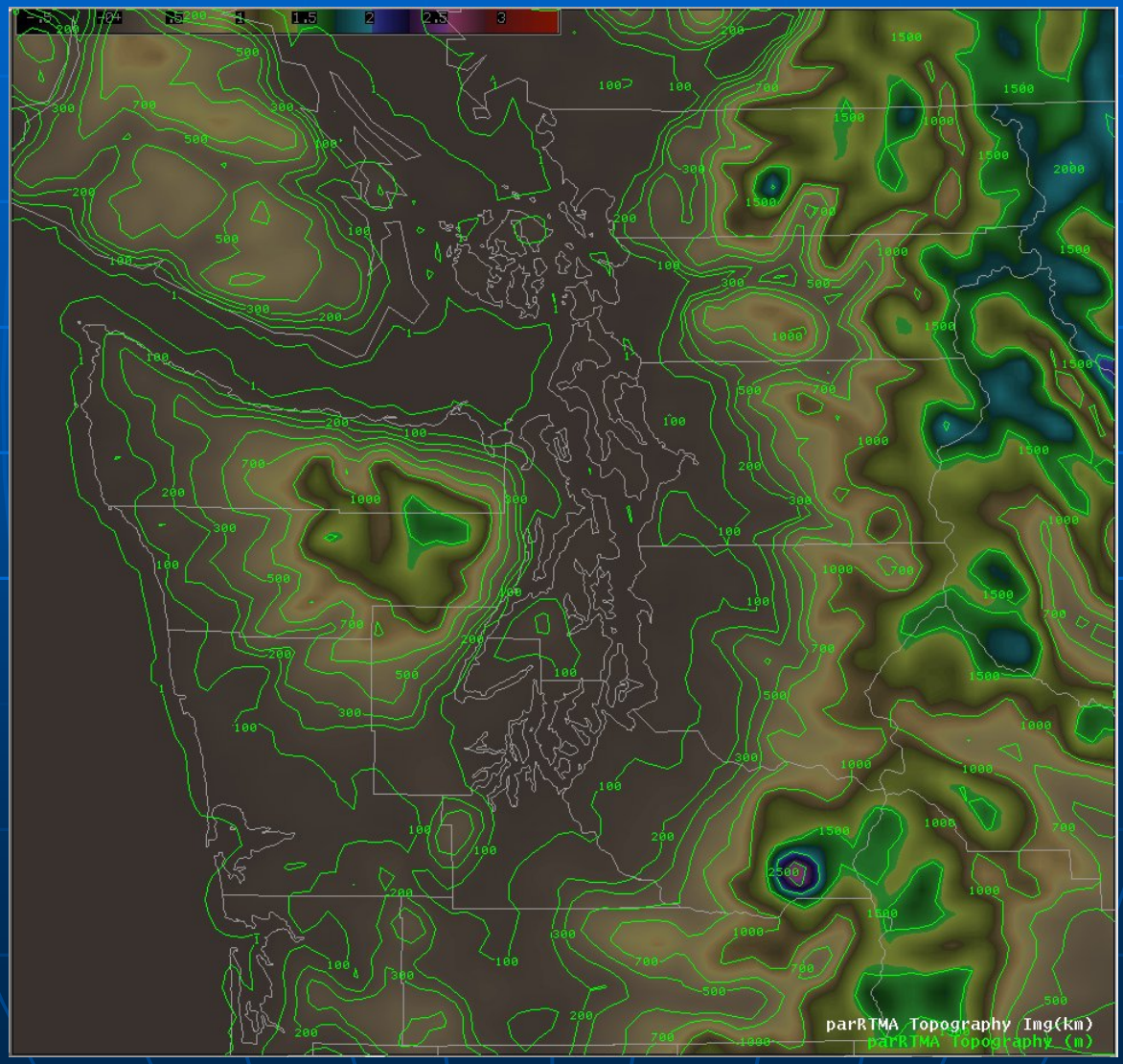
Analyzing the Results

- Generally, the RTMA matched the observations slightly better in the lowlands while the MatchObsAll matched slightly better in the mountains.
- Typically the larger differences occurred during the cooler period of the evaluation (October 06Z – 12Z) at the mountain sites.
- Overall, there were not any significant differences in how well the two analyses matched the observations.

RTMA Topography

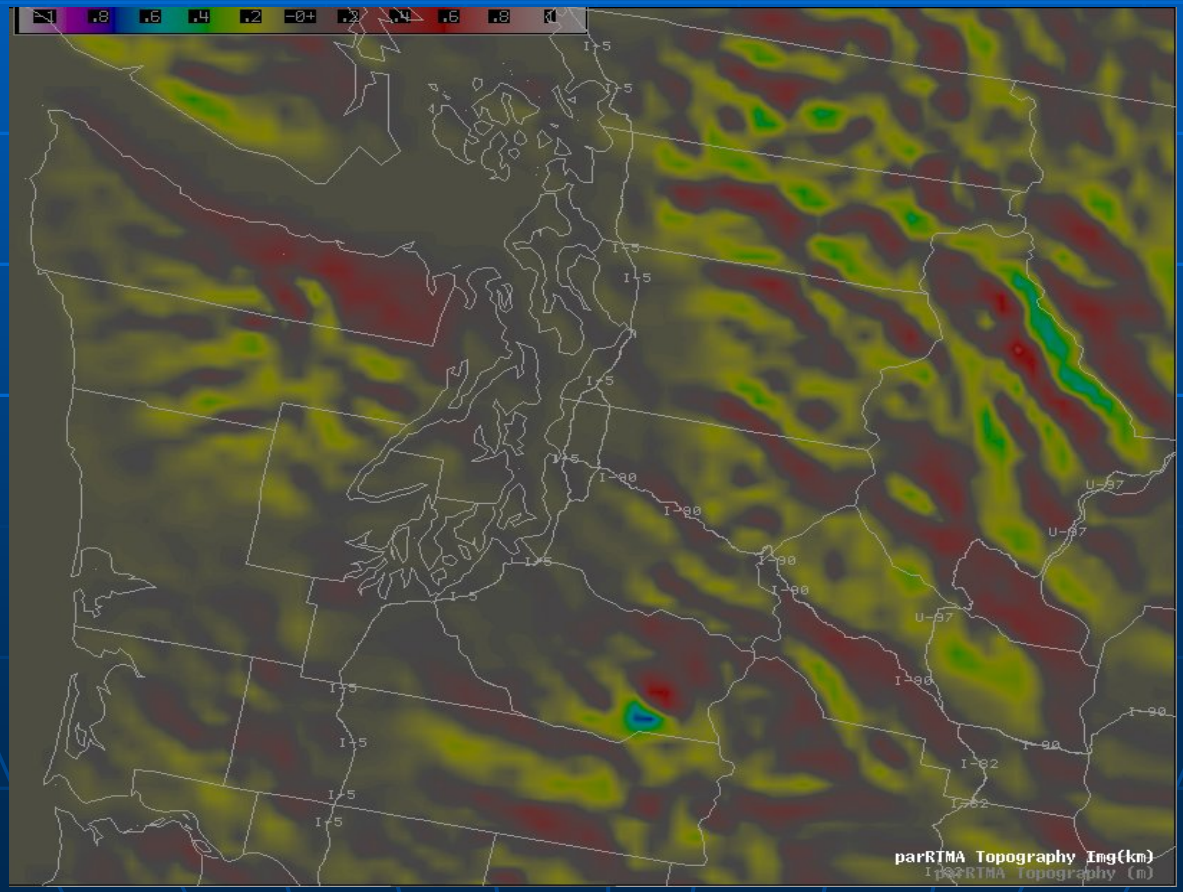


Corrected RTMA Topography



RTMA Topography Difference Field

Below is the a graphic showing the difference between the old topography and the new topography. Red represents areas where the new topography is lower than the old. Yellow and green areas are where the new topography is higher than the old. This shows how ridges and valleys have shifted position in the new topography.



New Topography

Observation Site	MoA Elevation	Old RTMA Elevation	New RTMA Elevation	Actual Elevation
GHFW1	1007	1495	1772	3018
SKKW1	2444	2943	3198	2001
KCFW1	4251	1862	3009	2999
LSFW1	2089	3227	2826	1614
PGPW1	5255	4557	4615	5899
TRFW1	4389	3436	3621	3615
OCFW1	4353	3726	3937	2549
TR950	200	324	321	213
TKING	0	59	37	33
SDQW1	98	4	110	154
QCNW1	52	697	346	62
T130T	400	230	283	354
PBFW1	0	52	26	7
46088	0	0	0	0

Green = Analysis Too Low Orange = Analysis Too High

Summary

- Generally, the differences between both analyses and the observations were similar:
  - MatchObsAll slightly better in the mountains
  - RTMA slightly better in the lowlands.
  - Larger differences during cool period
- Second data denial experiment needed
  - Better evaluation of RTMA (using the corrected analysis)
  - Longer period
  - Additional sites
  - Cool period impacts (lapse rates, etc.)