Recent works on satellite winds in NCEP data assimilation system (GSI)

Xiujuan Su John Derber James Jung

OUTLINE

1. Background
2. Assimilation Schemes
3. Experiment Set Up and Results
4. Summary

BACKGROUND

- Satellite winds sometimes cause poor global model forecast performance
- Poor quality satellite winds often occur when the height assignment method used in satellite wind process is not reliable
- Extensive satellite wind quality control was applied at other NWP centers
- The water vapor cloud top winds from JMA and EUMETSAT have reasonable quality, but are not assimilated in GSI

ASSIMILATION SCHEME

- Examine O-B and O-A statistics for all satellite winds assimilated in GSI
- Compare characteristics among satellite wind and conventional wind observations
- Compare results with similar studies

  (Jung et al, other NWP centers)
- Determine the observation error for JMA cloud top water vapor winds

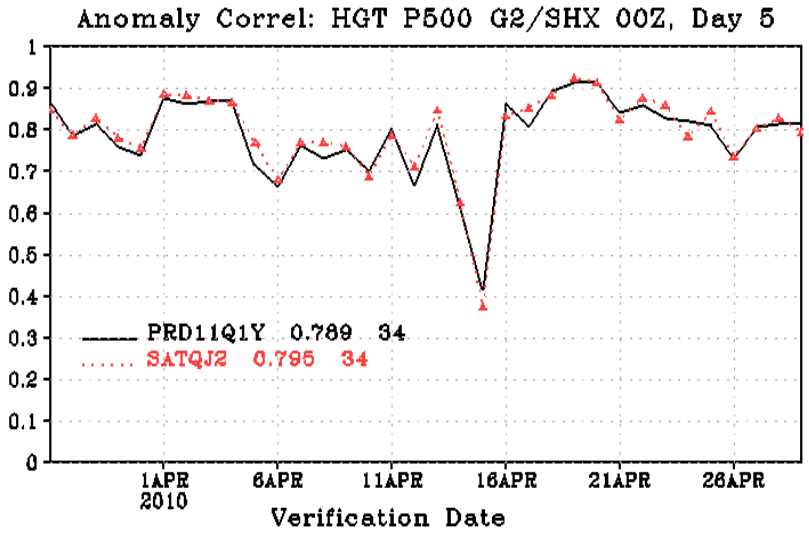
ASSIMILATION SCHEME

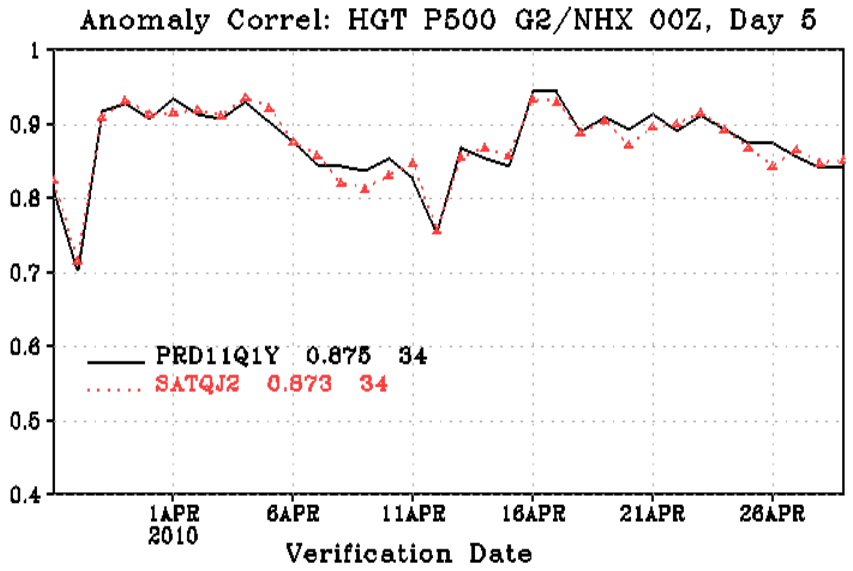
- Tropopause check to remove data above tropopause, also data above 125mb
- Remove data where assigned pressure greater than 950mb for all satellite winds
- Apply asymmetric gross check at different heights for different satellite winds
- Remove the data with large height assignment uncertainty between 800-400mb for most IR winds, surface to 400mb for water vapor cloud top winds

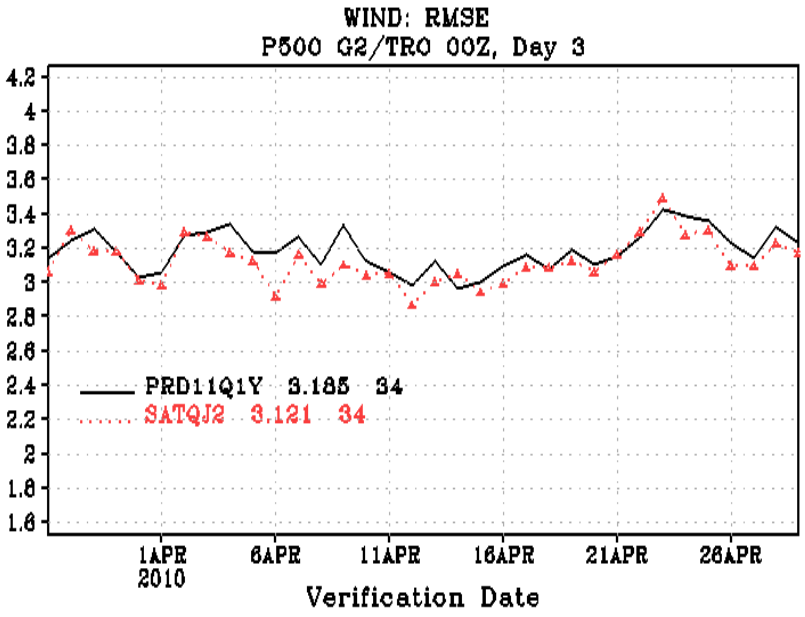
Experiment Set Up and Results

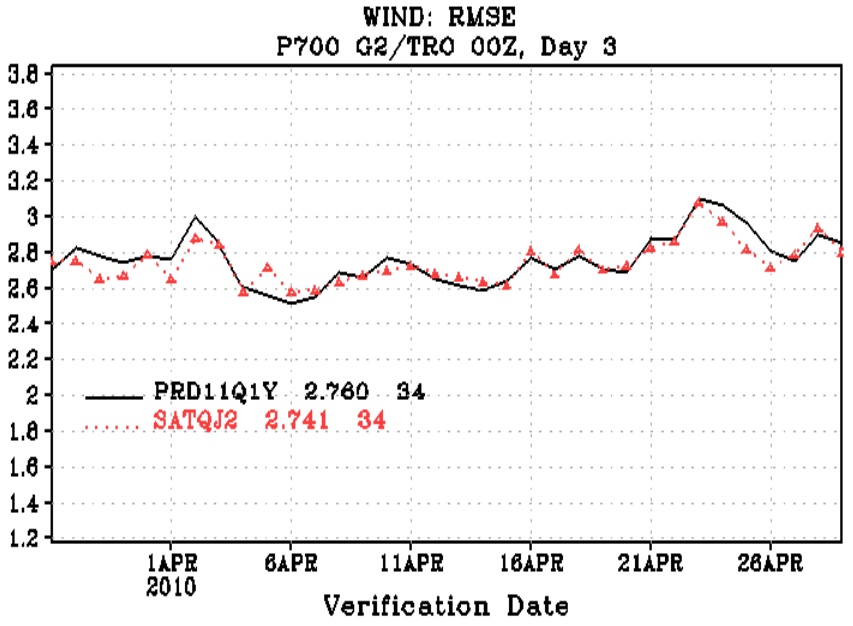
- The experiment was set for the period from March 22 to May 2, 2011, with NCEP GFS and GSI T574L64 system implemented in May 2010
- Results

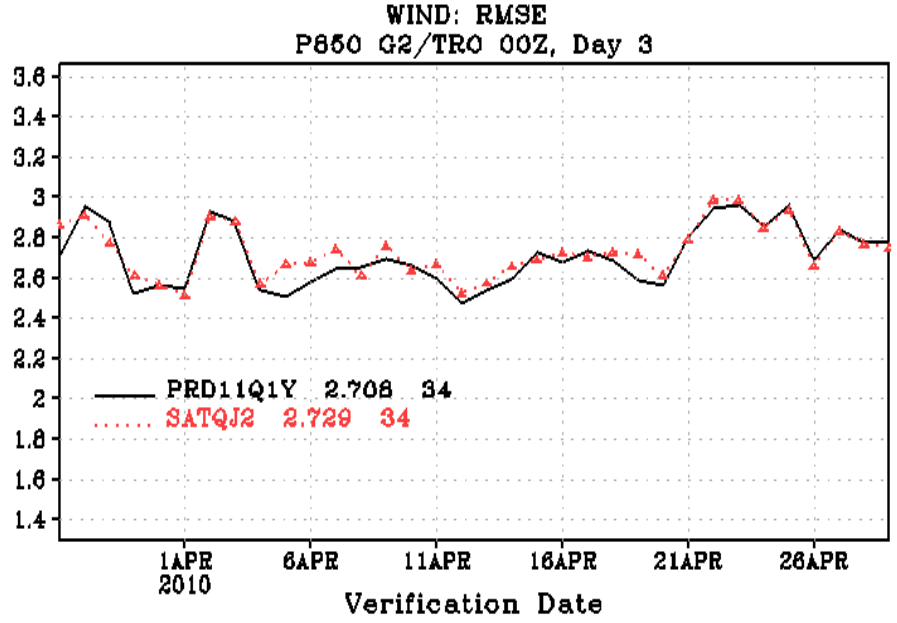
1. Impact on the forecast (control: black line, red: experiment)

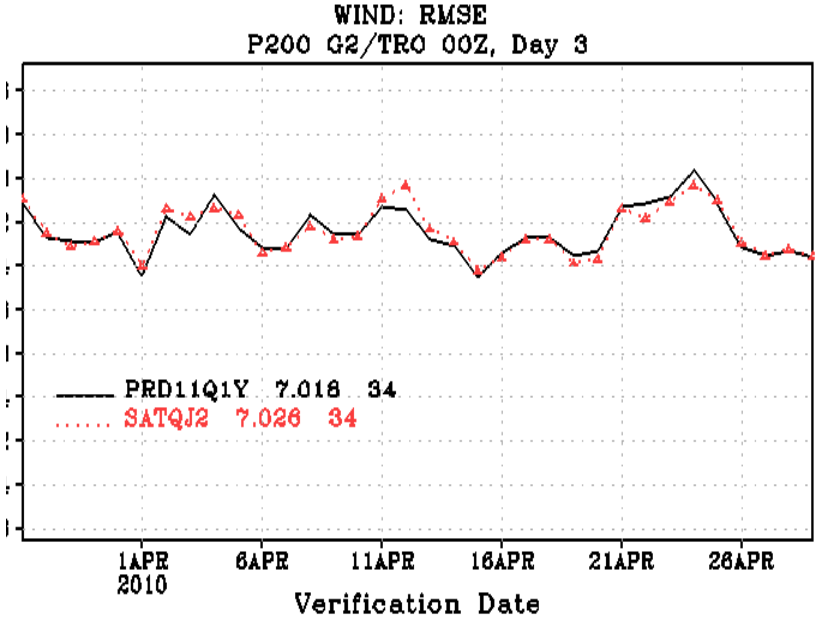




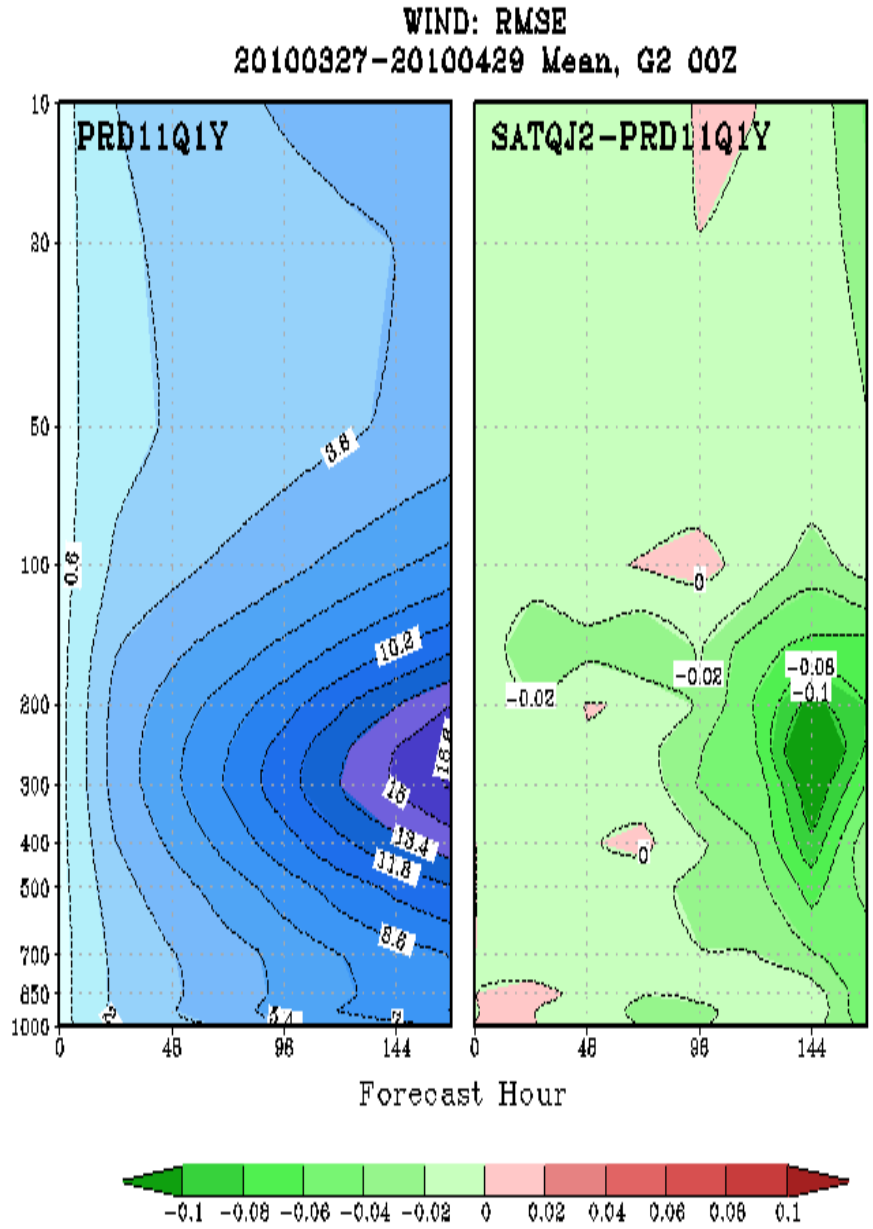

WIND: RMSE
P500 G2/TRO 00Z, Day 3
PRD11Q1Y 3.185 34
SATQJ2 3.121 34
1APR 2010
6APR
11APR
16APR
21APR
26APR
Verification Date

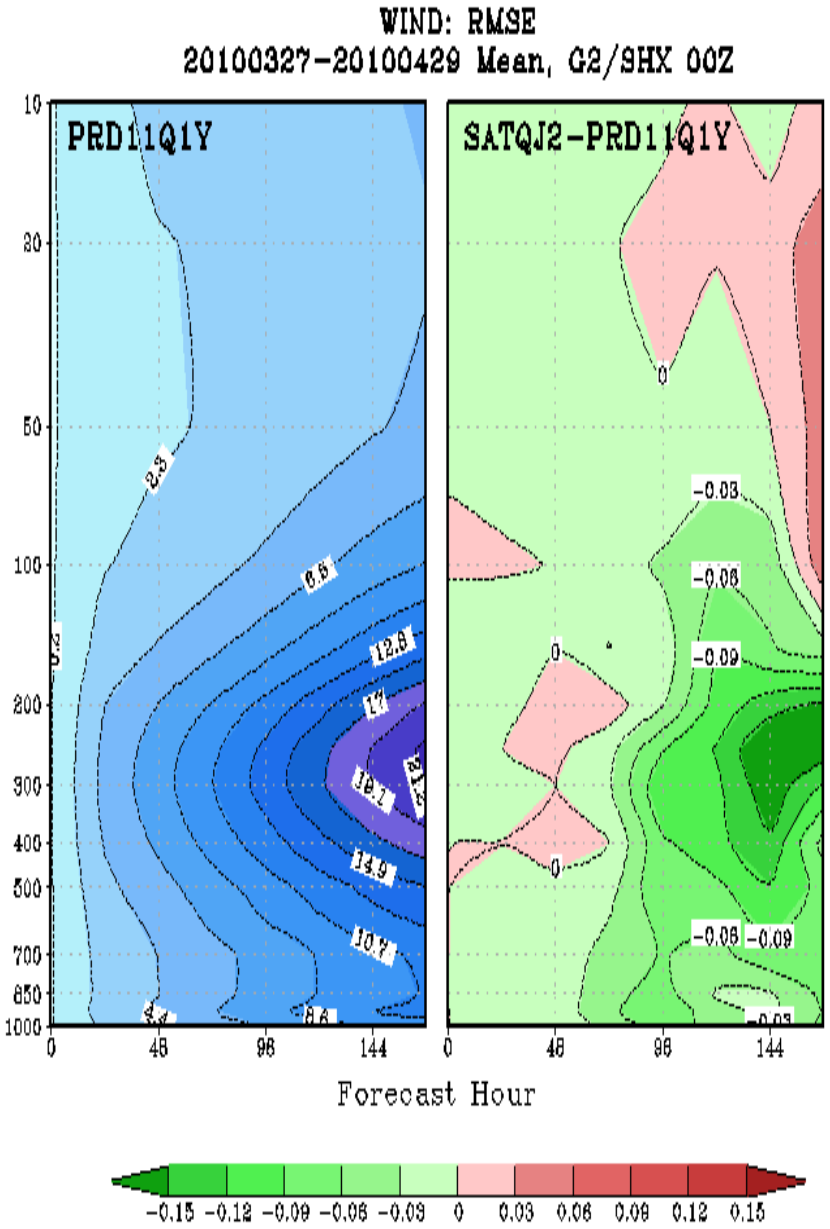

WIND: RMSE
P700 G2/TRO 00Z, Day 3
PRD11Q1Y 2.760 34
SATQJ2 2.741 34
1APR 2010
6APR
11APR
16APR
21APR
26APR
Verification Date


WIND: RMSE
P850 G2/TRO 00Z, Day 3
PRD11Q1Y 2.708 34
SATQJ2 2.729 34
1APR 2010
6APR
11APR
16APR
21APR
26APR
Verification Date

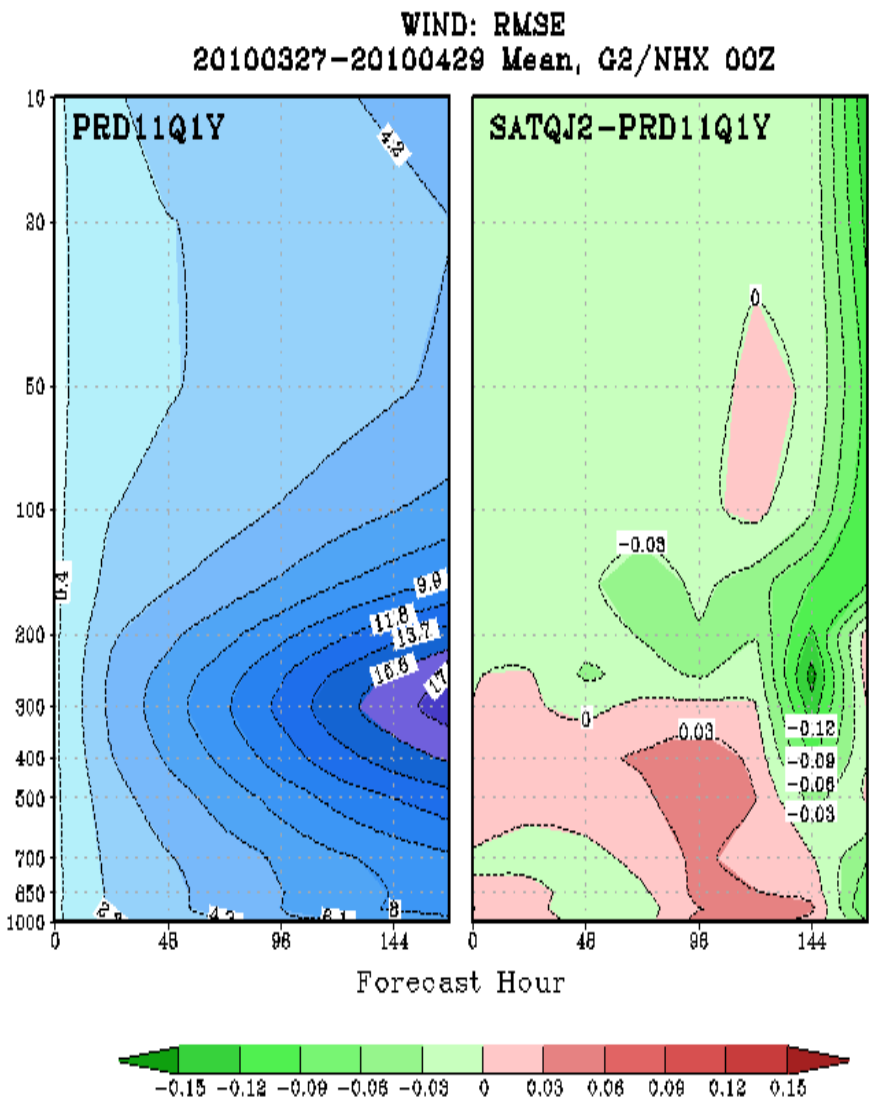

WIND: RMSE
P200 G2/TRO 00Z, Day 3
PRD11Q1Y 7.018 34
SATQJ2 7.026 34
1APR 2010
6APR
11APR
16APR
21APR
26APR
Verification Date

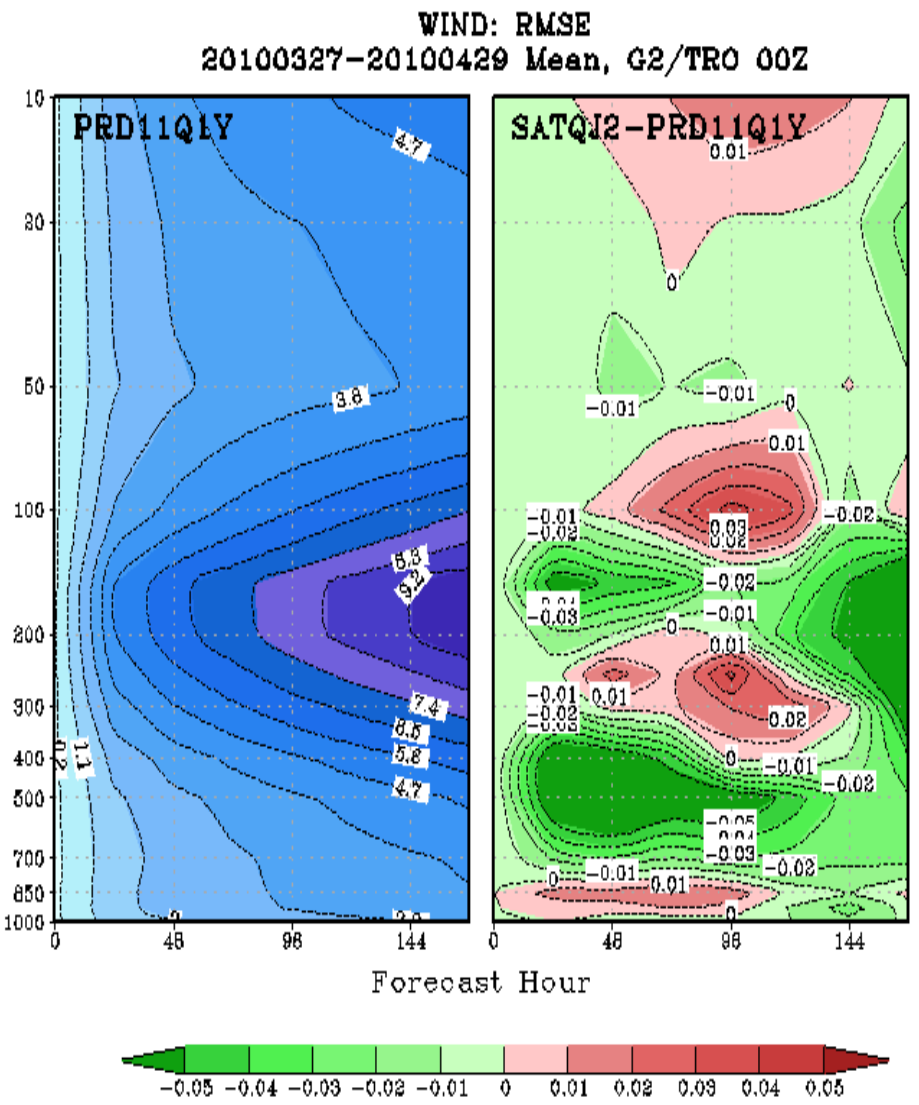
- The mean RMSE of F (forecast)-A (Analysis)



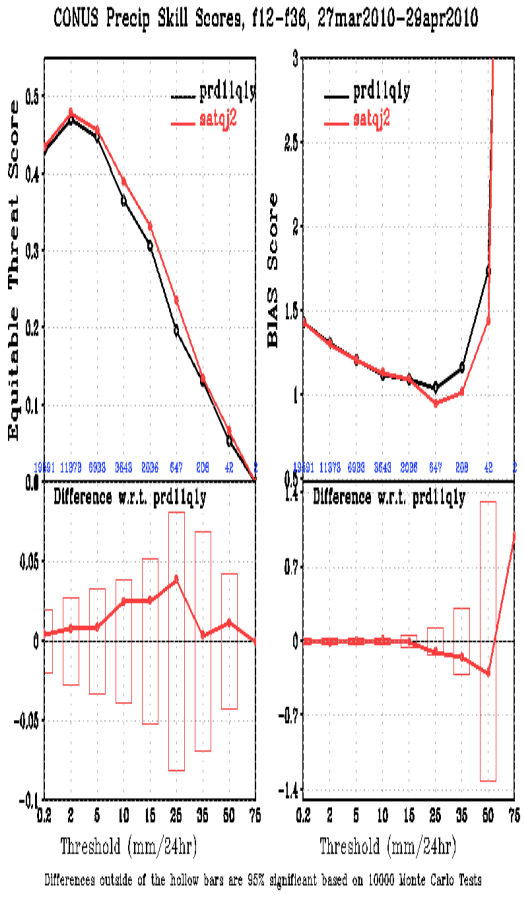


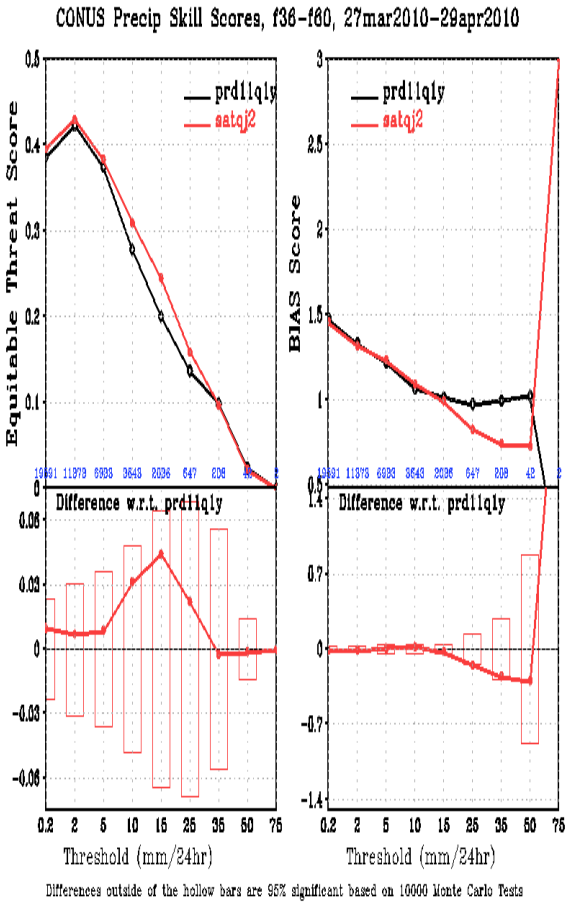
- Northern Hemisphere and Tropics

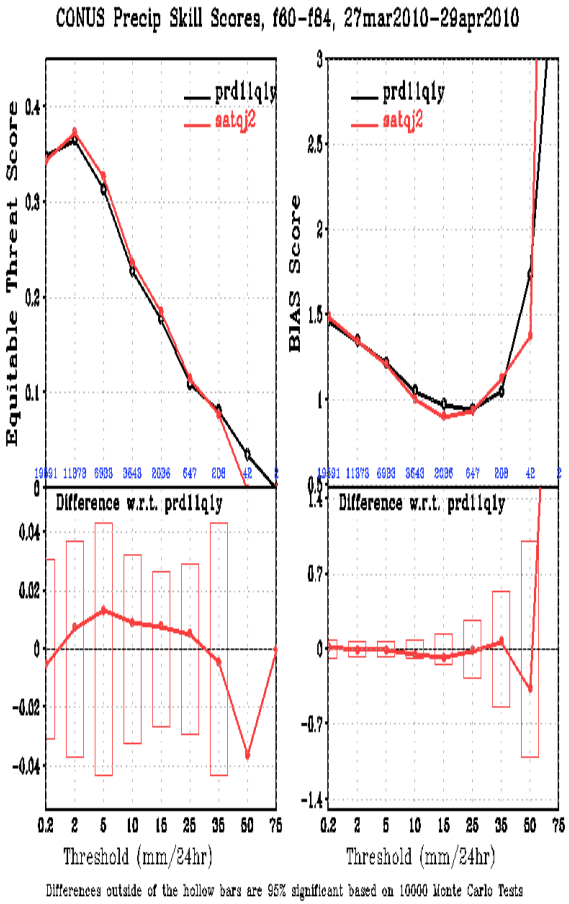




2.Impact on precipitation forecast over CONUS

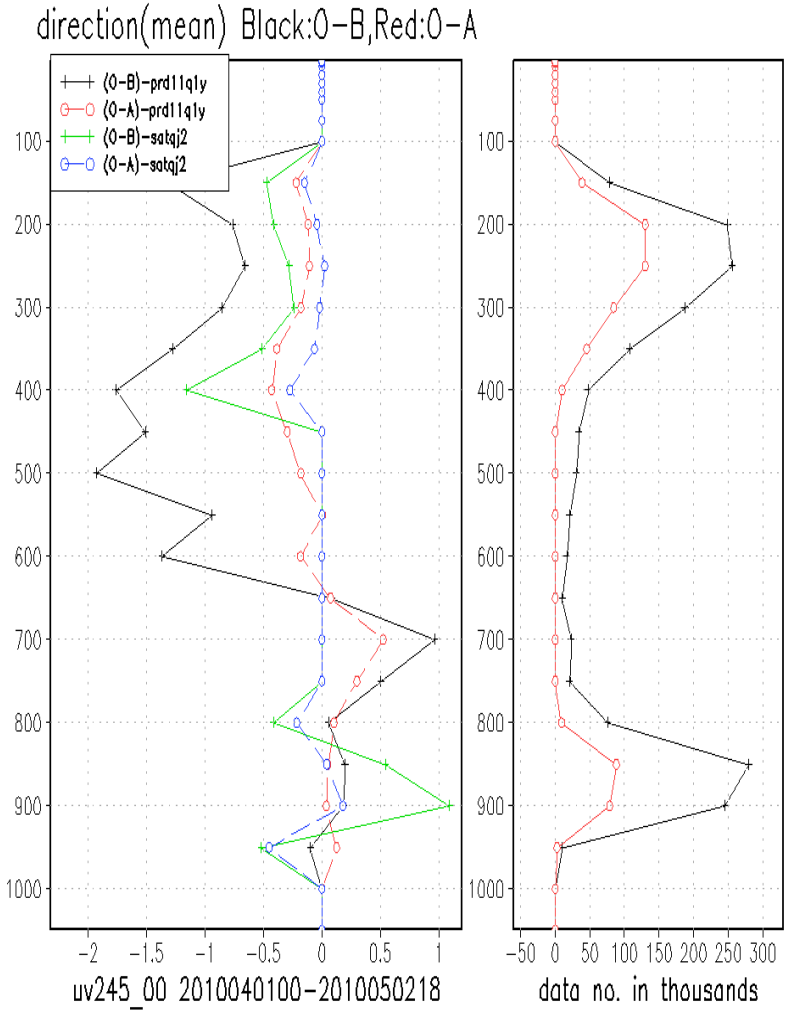


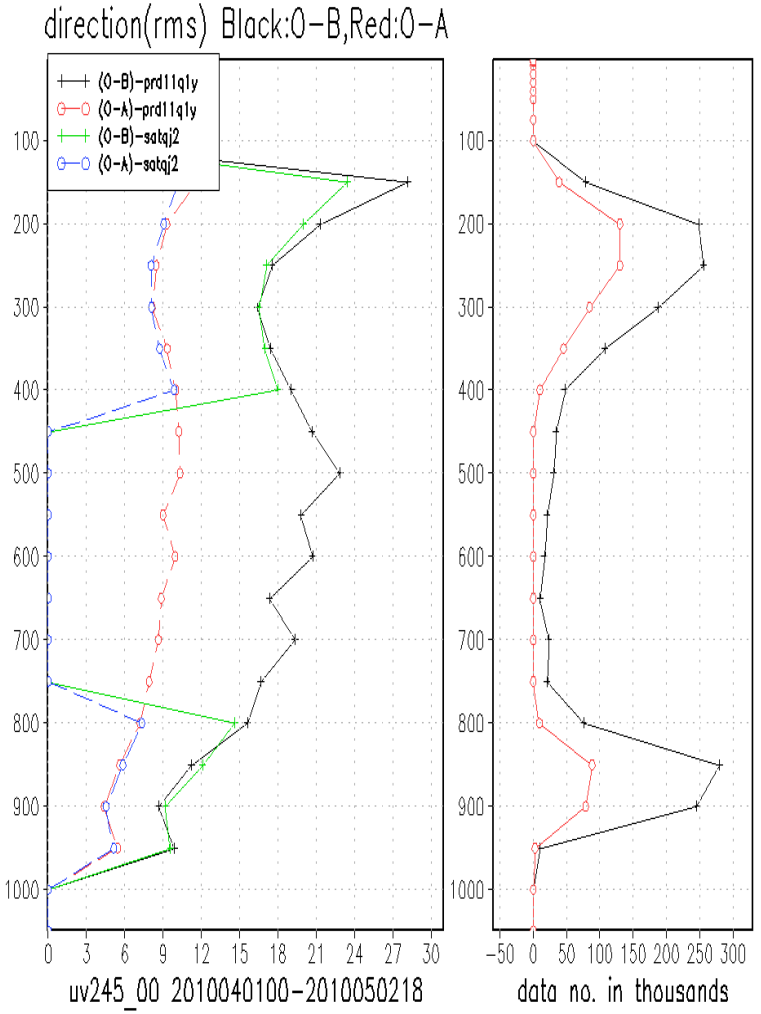




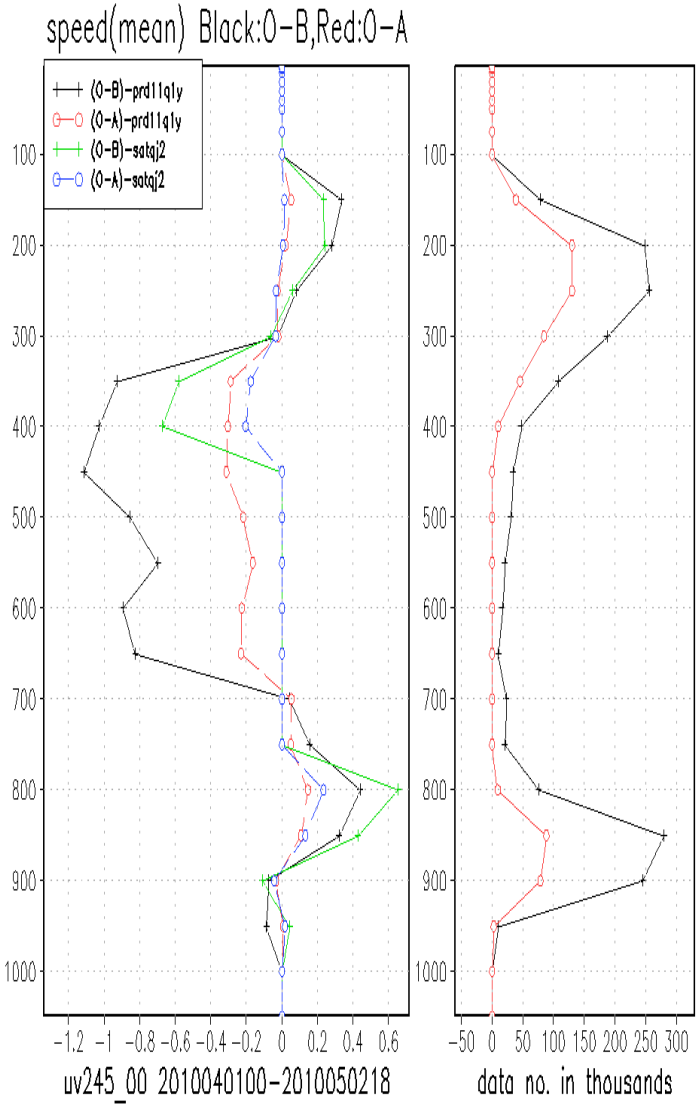
3. The impact on the fit to observations

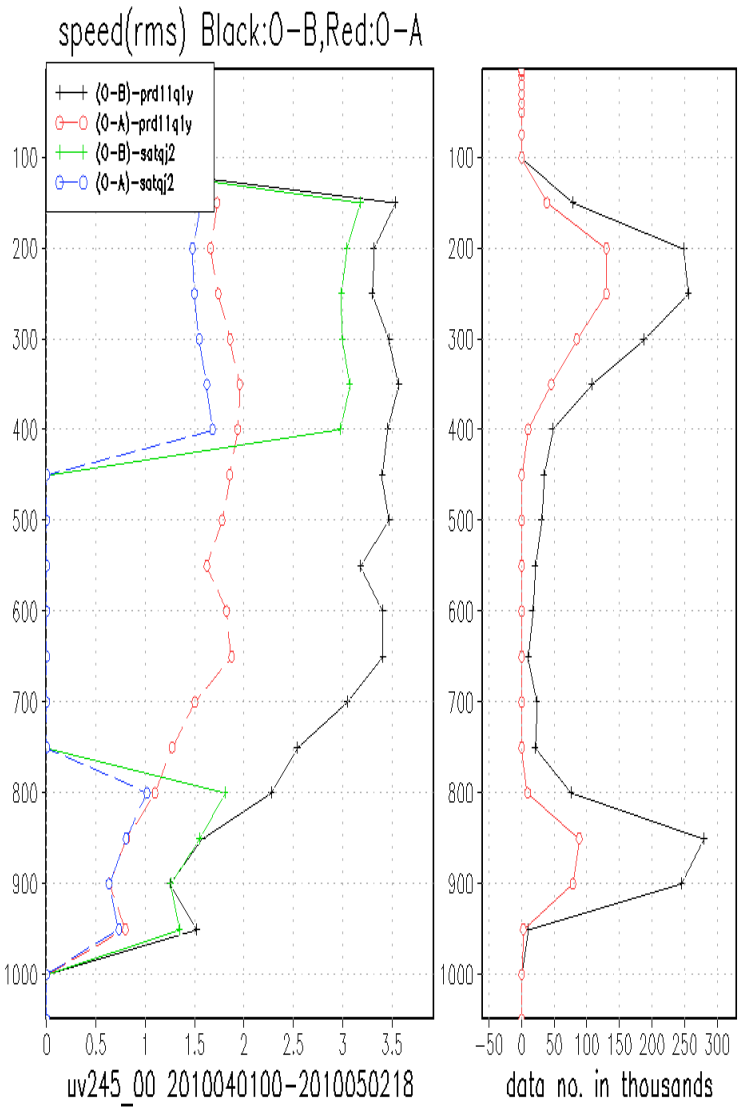
- Satellite winds (GOES IR wind) Direction



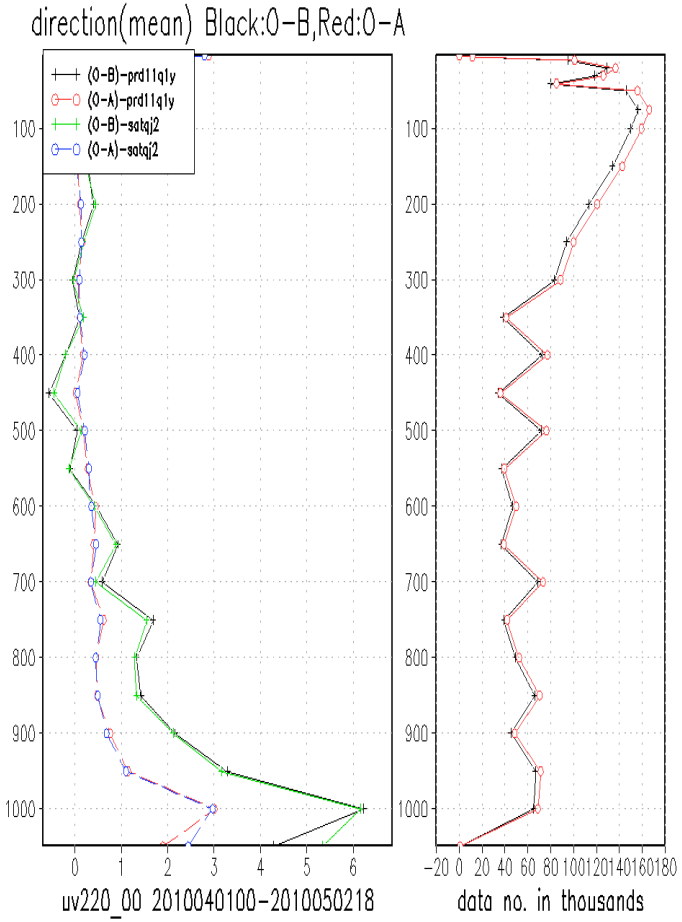


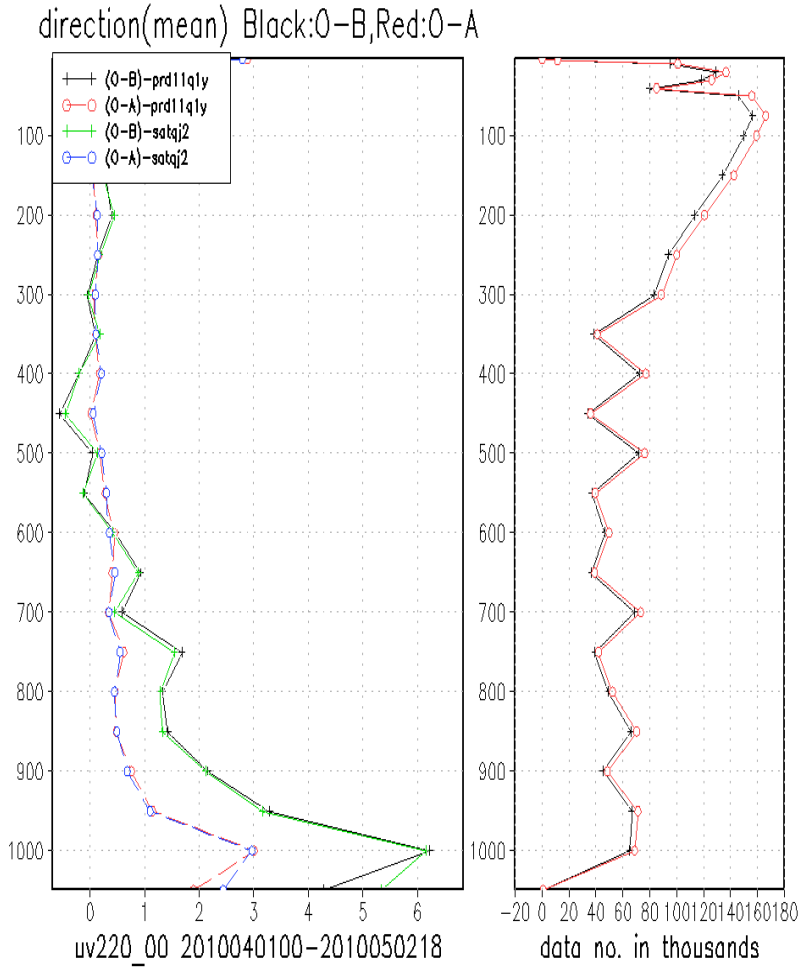
- # Continued - Speed



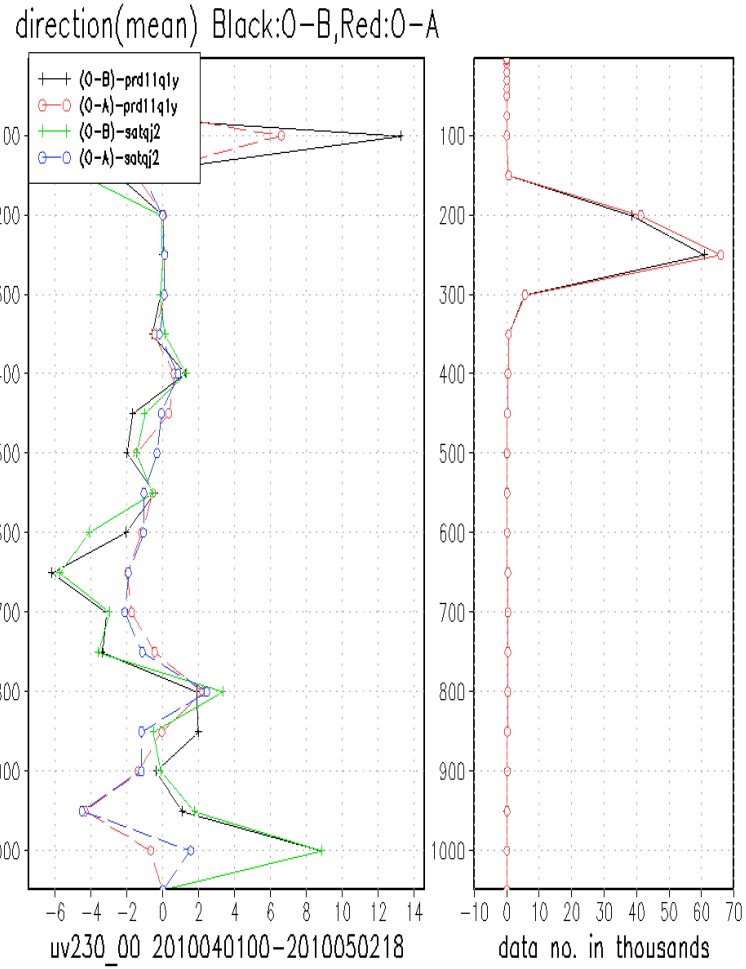


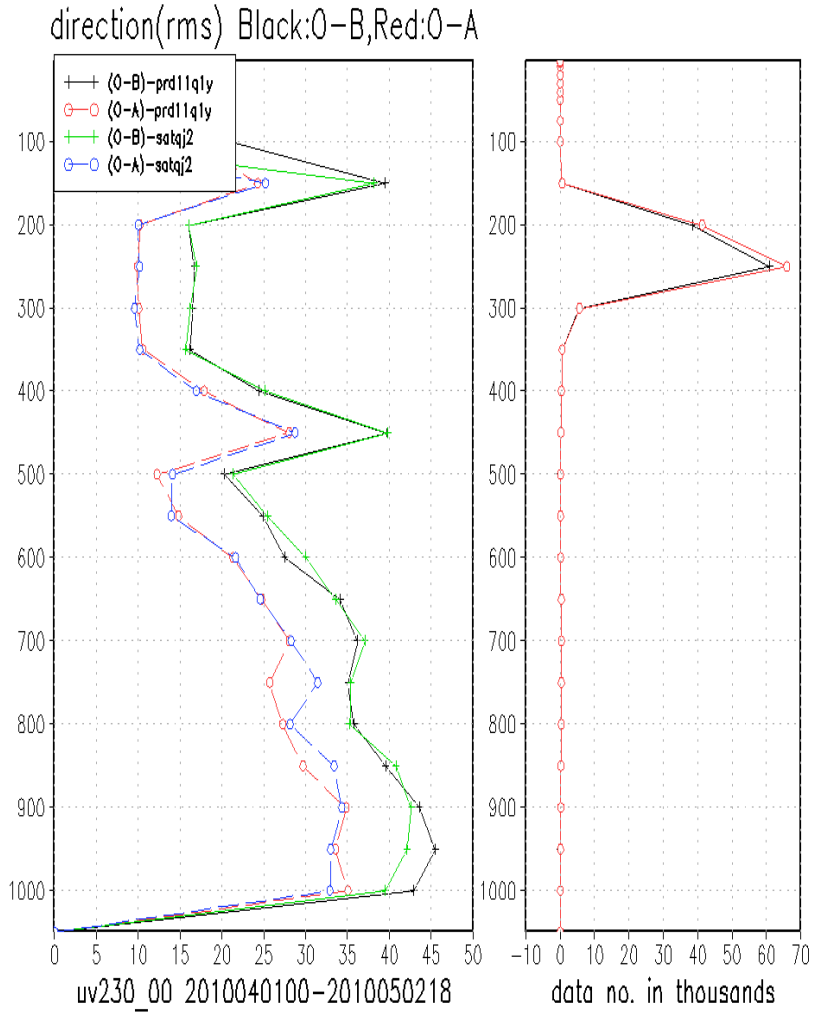
- Impact on Rawinsonde wind



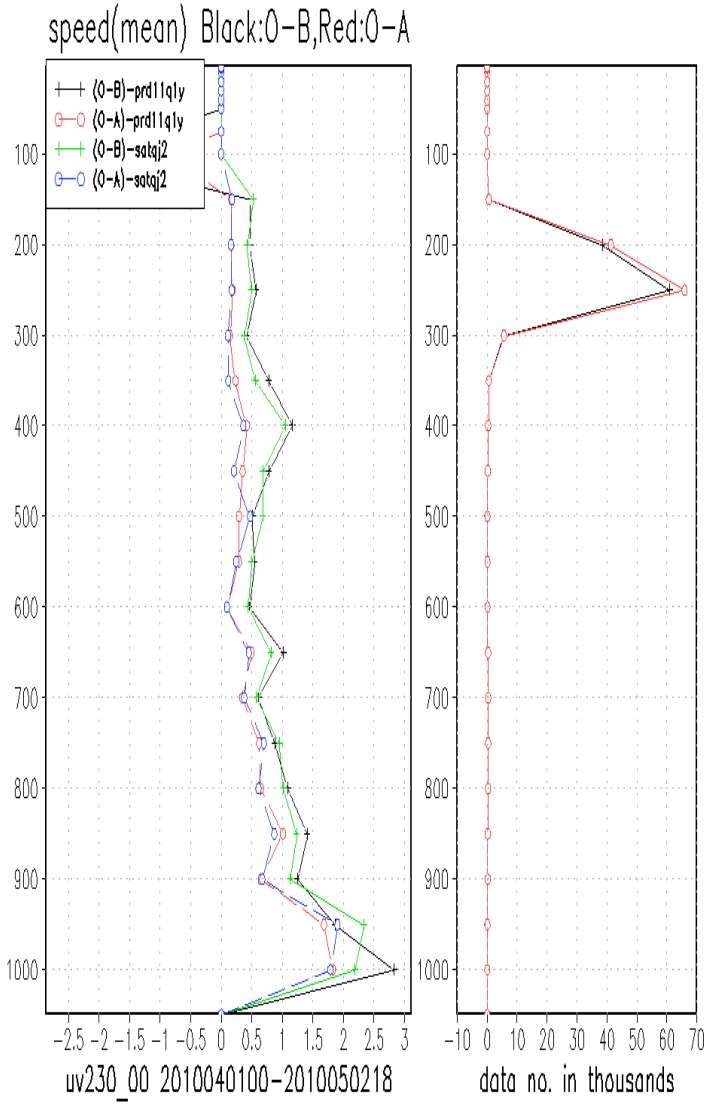


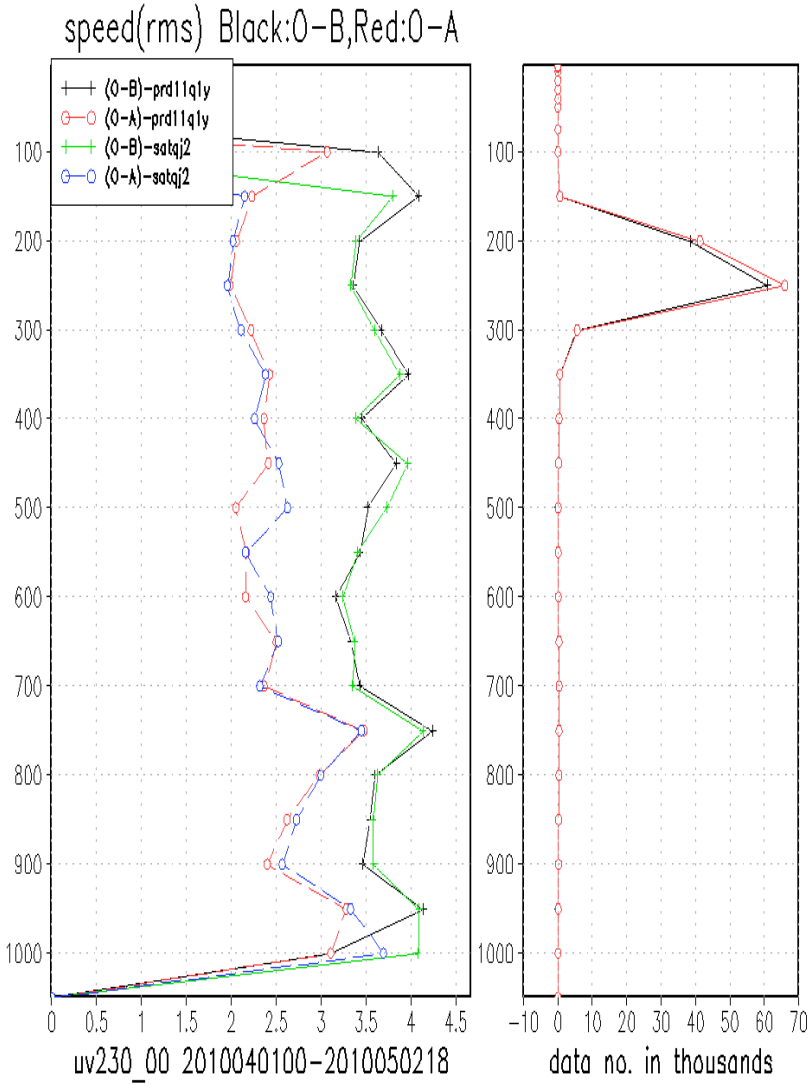
- Impact on aircraft wind





- Continued - Speed





SUMMARY

- The new satellite wind quality control scheme in the GSI is based on examining O-B and O-A statistics, Jung et al. study and other NWP center's quality control schemes.
- The results show that neutral forecast impacts at mid latitude and positive impacts in the tropics between 700 and 500mb, where much of the added quality control is applied.
- There are positive impacts on CONUS precipitation 12 hour to 84 hour forecasts

- In terms of observation fit, the most improvements are for all satellite wind observation, in bias and RMS of speed and direction.
- Significant improvements on the observation fit are also seen for other conventional wind observations, including rawinsonde and aircraft wind observations. The results also show more conventional data is assimilated.