Observation Impact of Satellite Winds in NASA GEOS-5 Forecast System

Dagmar Merkova* and Ron Gelaro**

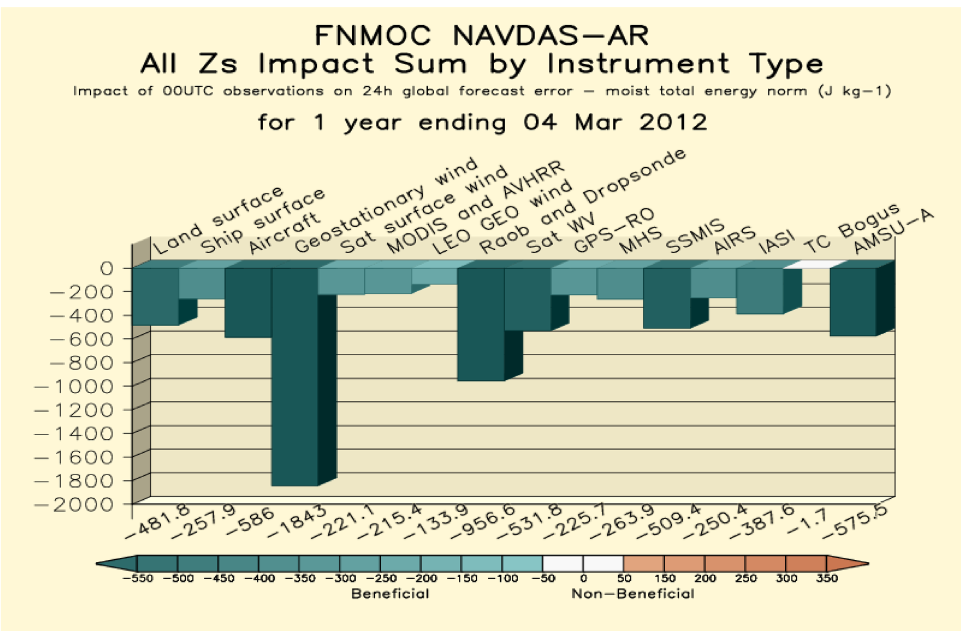
** GMAO NASA Greenbelt, MD; Science System And Applications, Inc.; ** GMAO NASA, Greenbelt, MD*

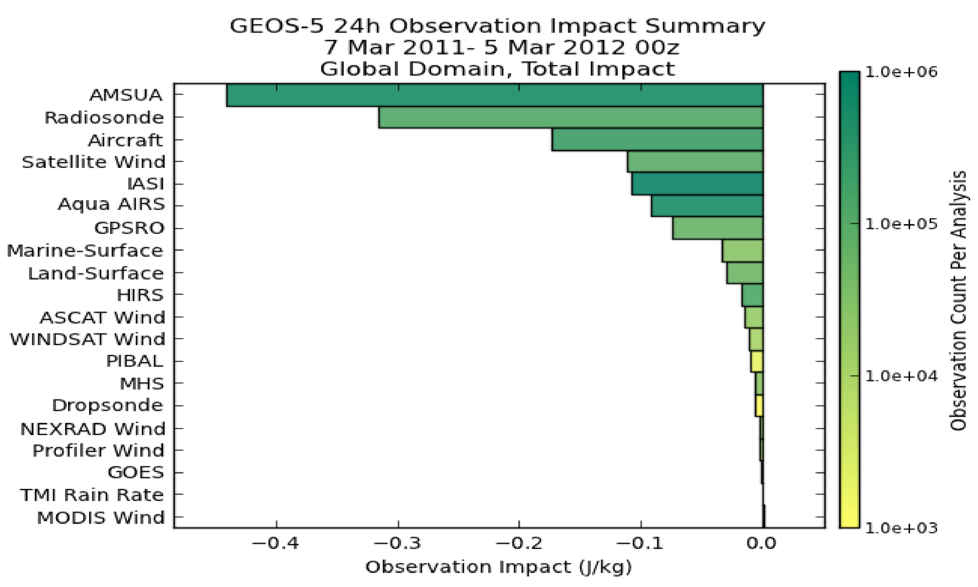
Motivation

Observation Impact from Geostationary Winds in NRL NOGAPS data assimilation system is for some period relatively larger compare to the other forecast centers.

Possible reasons are:

- Greater number of assimilated satellite winds
- Use of super-ob wind vectors
- Difference in data source and quality control
- Data assimilation methods





AMV Observations

Notable differences in observing system

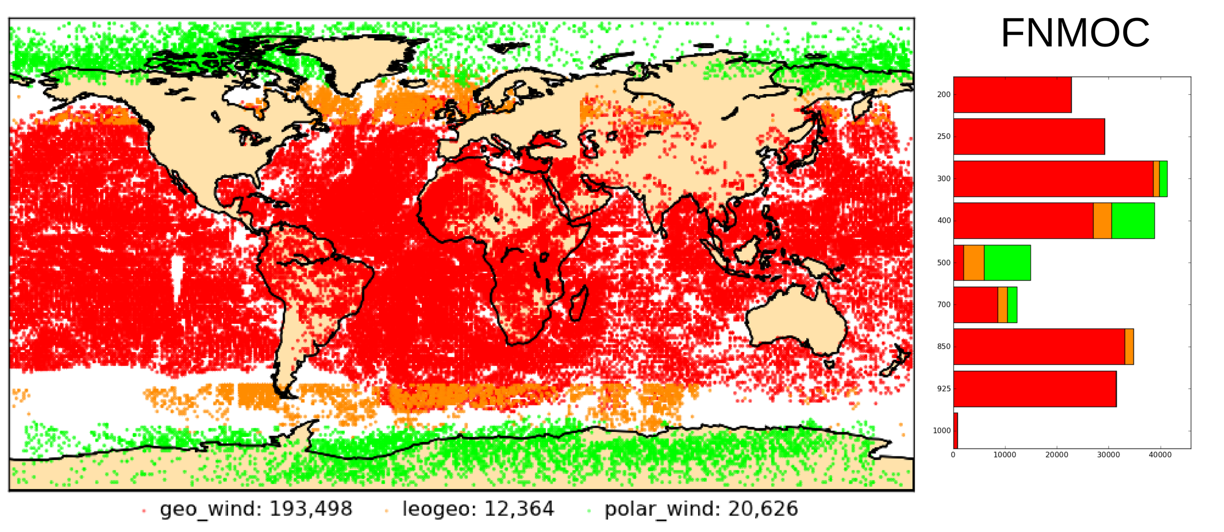
- GMAO assimilates higher number of radiances (1.5x)
- NRL assimilate more satellite geostationary satellite Winds (4x)

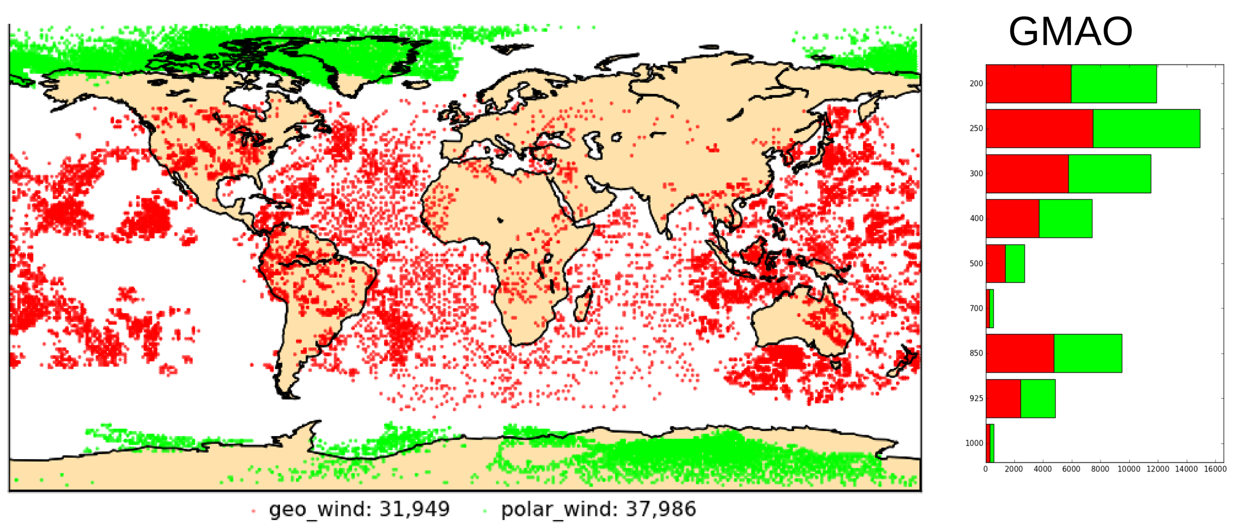
	SatWind	AMSU-A	Hyps IR	All Obs
GMAO	90	520	1220	2500
FNMOC	350	350	800	2200

Different sources for Satellite winds

- GMAO: NESDIS, EUMETSAT, JMA
- NRL: NESDIS, EUMESAT, JMA, AFWA, CIMSS

Atmospheric Motion Vektors (AMV)

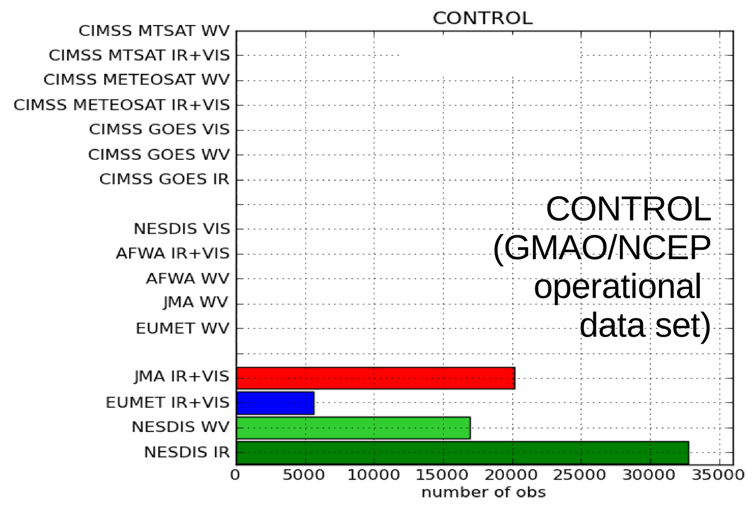


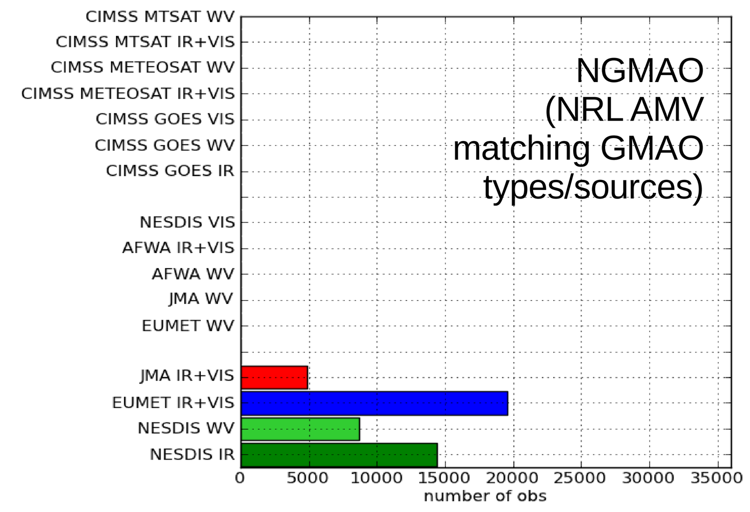


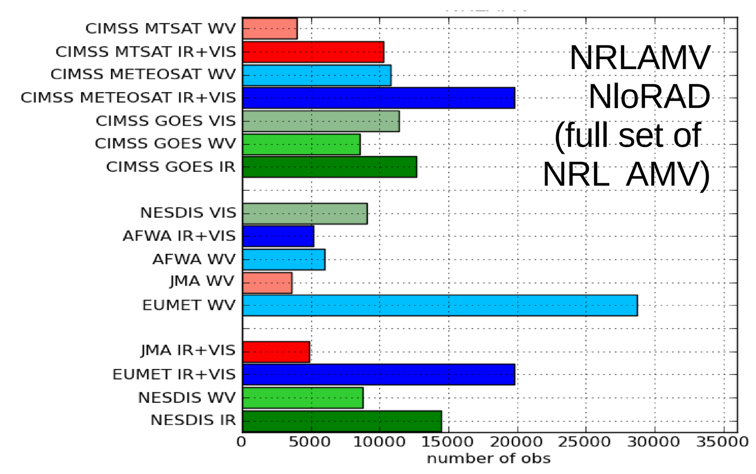
Experimental Configuration

GEOS-5 Forecast System (reduced resolution)

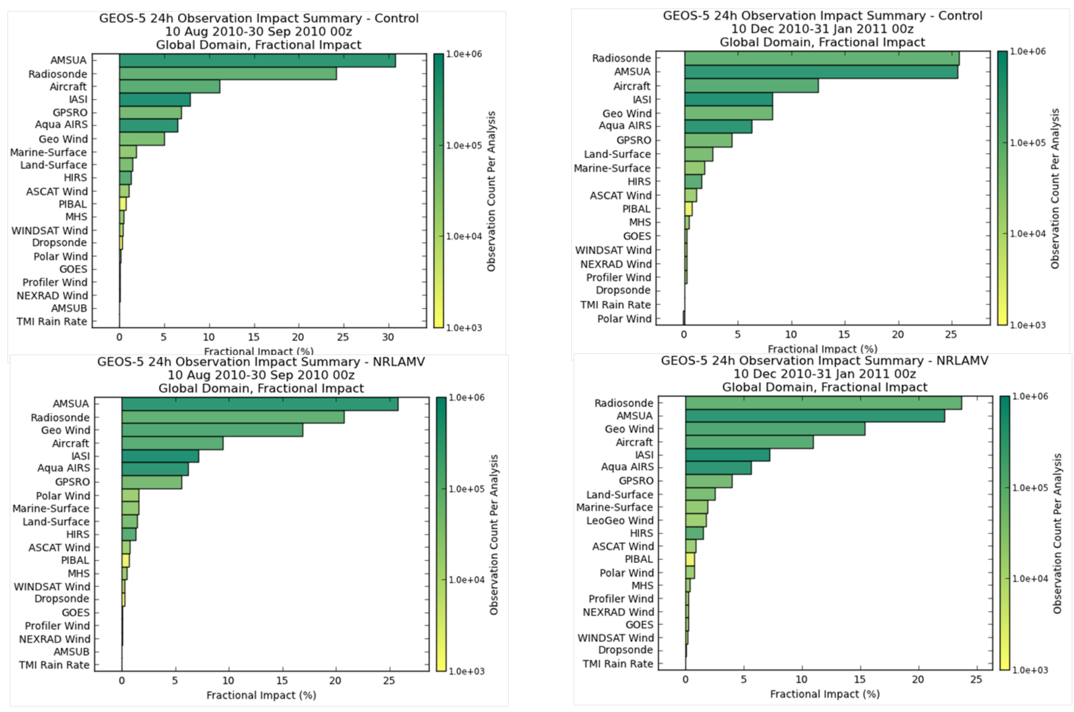
- GEOS-5 AGCM + GSI analysis (~½° L72)
- 6-h assimilation cycle, 3DVar
- 5-day forecasts, adjoint-based 24h obs impacts at 00z (dry energy norm, sfc-150 hPa)



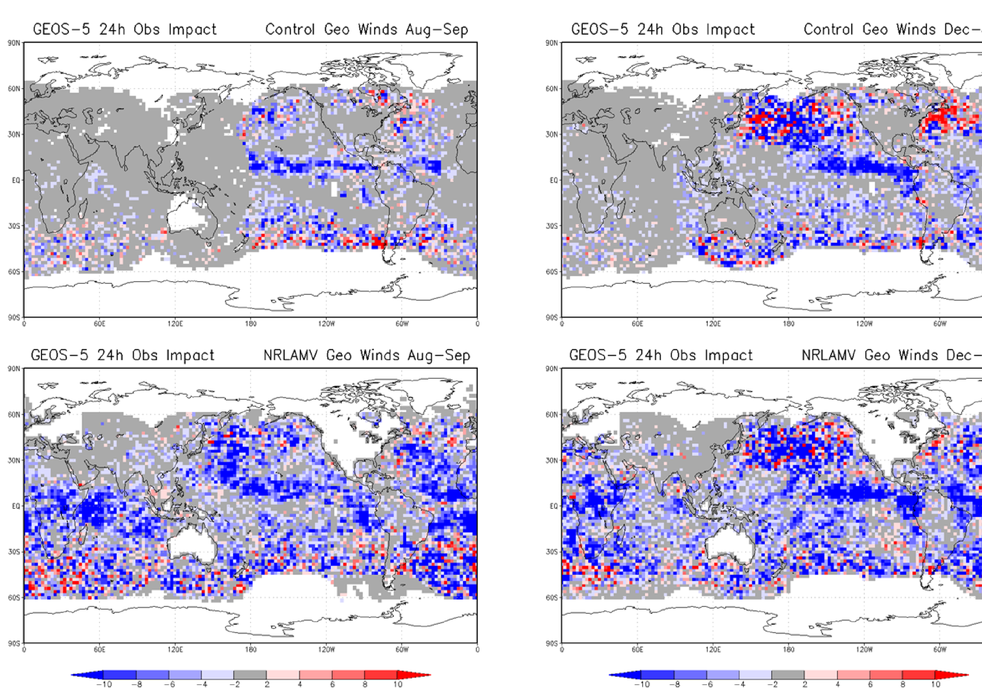




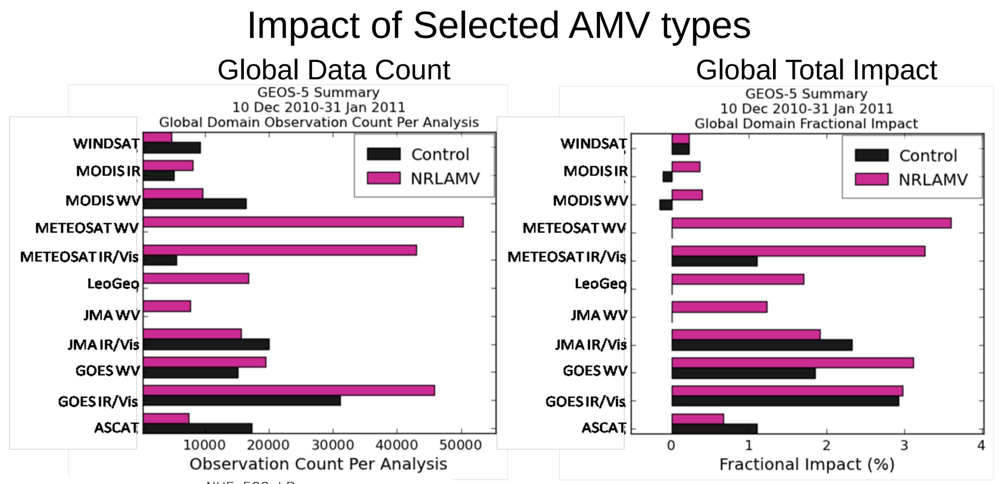
CONTROL & NRLAMV

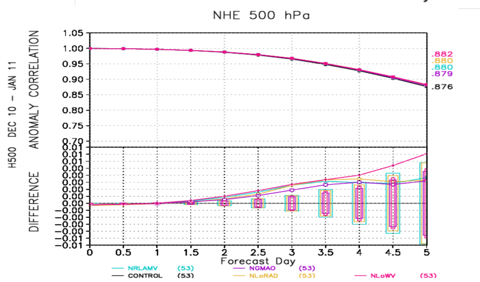


Gridded Total Impact of Geo Winds



Impact of Selected AMV types

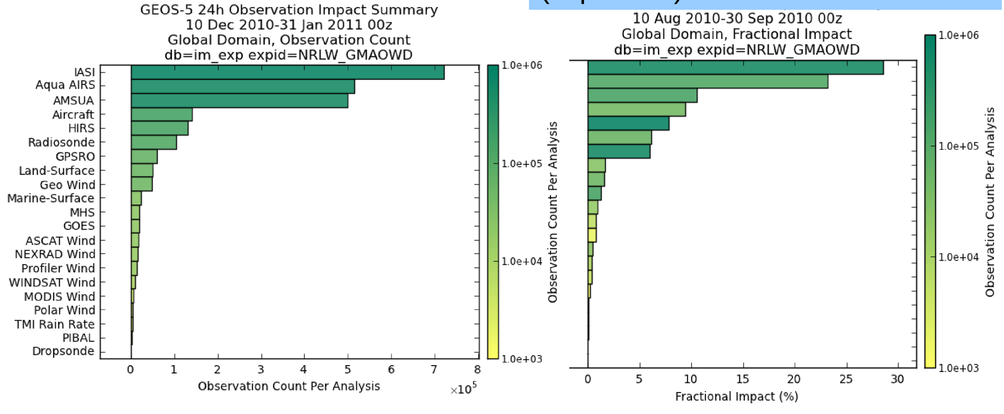


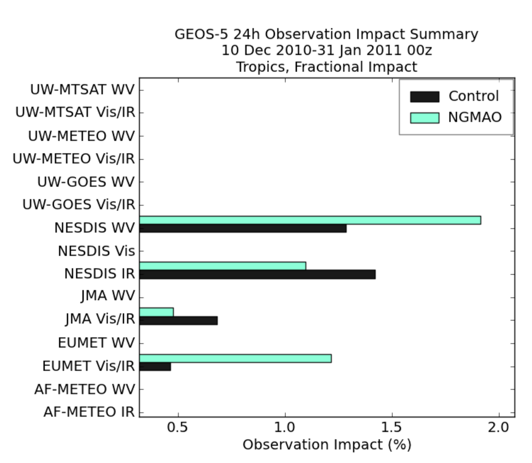


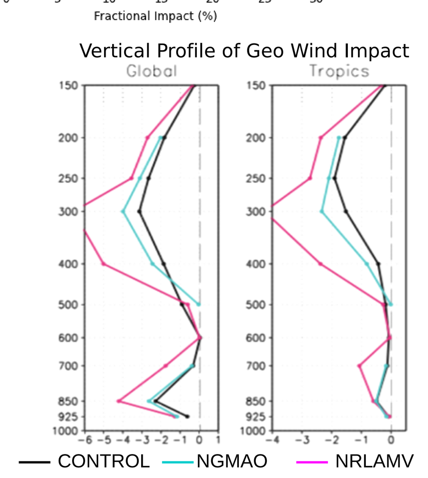
- Data count correlate well with data counts
- Forecast skill is mostly improved
- Impact of MODIS polar winds is negative in Control run (under the investigation)

NGMAO

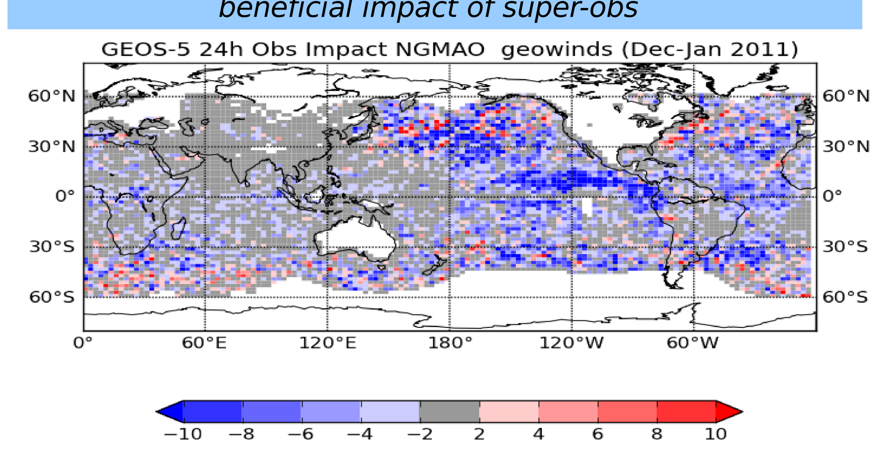
Subset of NRL AMV types and sources matching GMAO control (super obs)







NGMAO Geo Wind impact is bigger than Control: suggests beneficial impact of super-obs

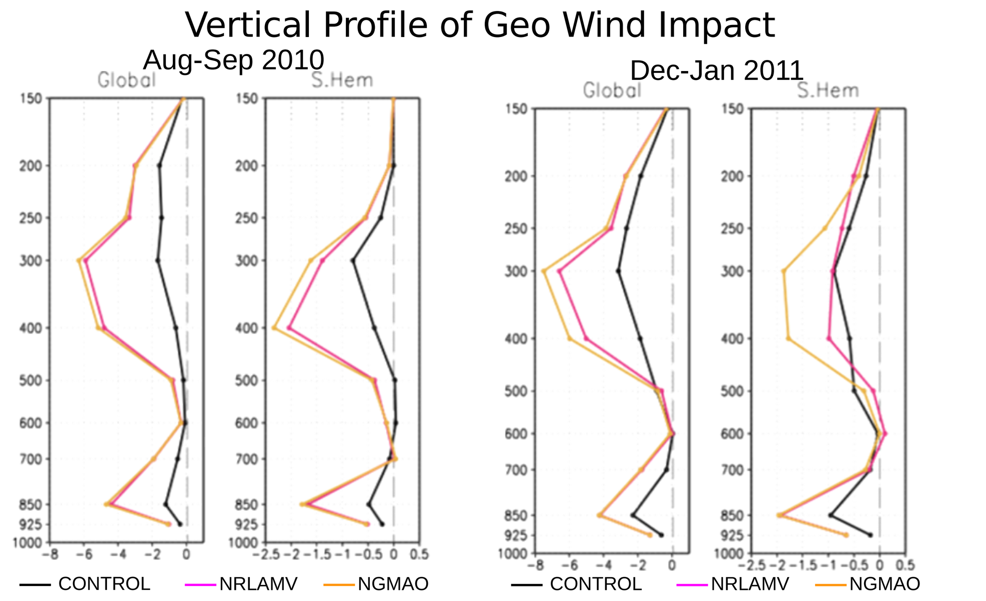


NLoRAD

Thinning box is increased to simulate number of radiances in FNMOC NRL system:

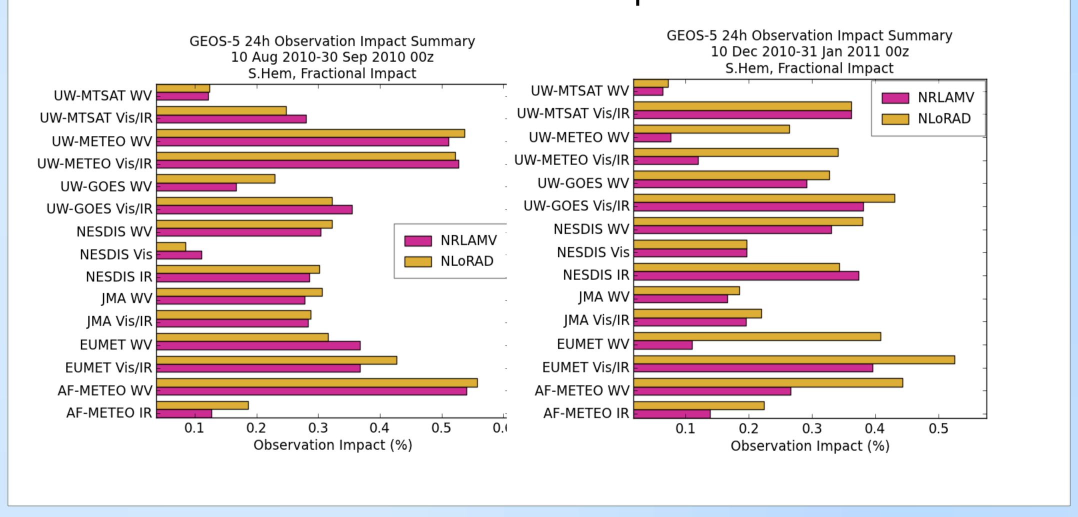
- for AMSUA (145 --> 180 km)
- AIRS and IASI (180 --> 225 km)

Vertical Profile of Geo Wind Impact



Evidence of larger AMV impact when fewer radiances assimilated, but mostly in S.Hem during summer

Relative Impact of Geostationary Winds
Southern Hemisphere



Conclusions

- Assimilation of NRL AMVs improved observation impact of satellite winds in GEOS-5 data assimilation system.
- The greater volume of the NRL AMVs appears to be primary reason for larger impact
- Other differences (superobing, , radiance reduction) seems to have more seasonal and spatial variations
- Additional AMV from subpolar regions (LeoGeo) in NRL AMV set of observations had positive impact on the system.
- Forecast skill of the system using any subset of the NRL AMVs was generally improved.
- Robustnost of the system suggest that removing some part of the observing system will be compensated by remaining observations.

Acknowledgments

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