Observing System Experiments for MODIS winds in the Joint Center for Satellite Data Assimilation

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9th International Winds Workhop
Annapolis, April 14-18, 2008

Winds impact experiments in two data assimilation systems

- NCEP/EMC Global Forecast System, current operational version (T-384)
- GMAO GEOS-5 (MERRA version; 1x1 degree)
- Experimental period Dec 12, 2007 - Jan 12, 2008.
  - Five-day forecast launched each day at 00Z (NCEP: seven-day forecasts)

Experiments

- Control (RAOBS, SFP, AC winds, Sat SFW, IR and MW sounders, GEO AMV, Polar AMV, …)
- Met Office MODIS Winds screening (per NWP SAF web page)
- No MODIS winds
- No AMVs (both polar and GEO AMVs withheld

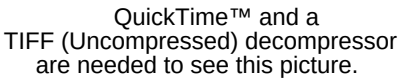
MODIS winds vertical screening

- NOAA
  - Winds are admitted at a given pressure level p, if $(p_t - 50\ hPa) < p < (p_s - 200\ hPa)$, where p_t is the tropopause pressure in the model background

Vertical MODIS wind screening (II)

- Met Office
  - All winds reporting in height at or above 100 hPa·All polar winds below 400 hPa over Greenland and Antarctica
  - All polar WV and CSWV winds below 600 hPa
  - All polar IR winds below 600 hPa over land and sea ice

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.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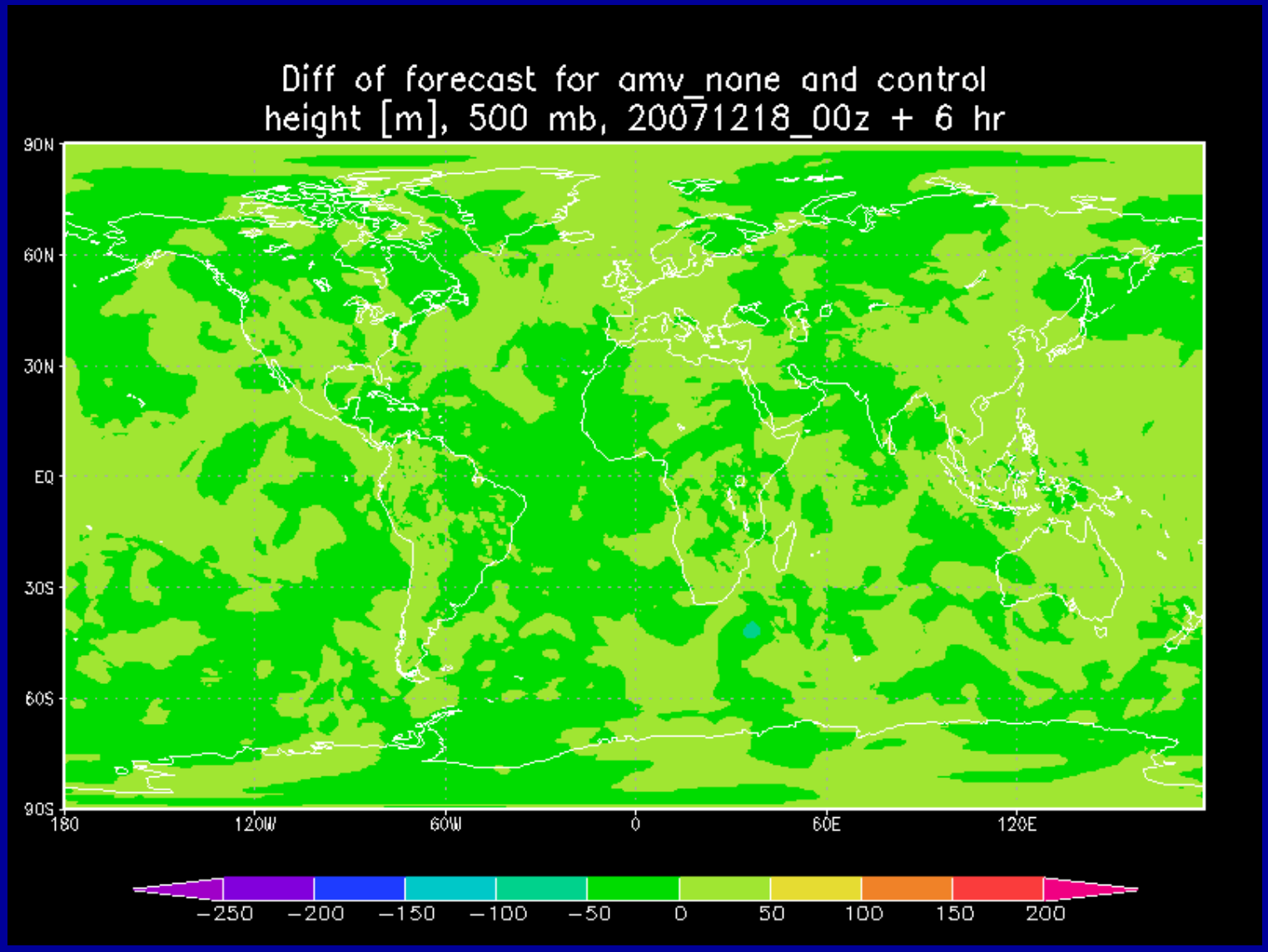

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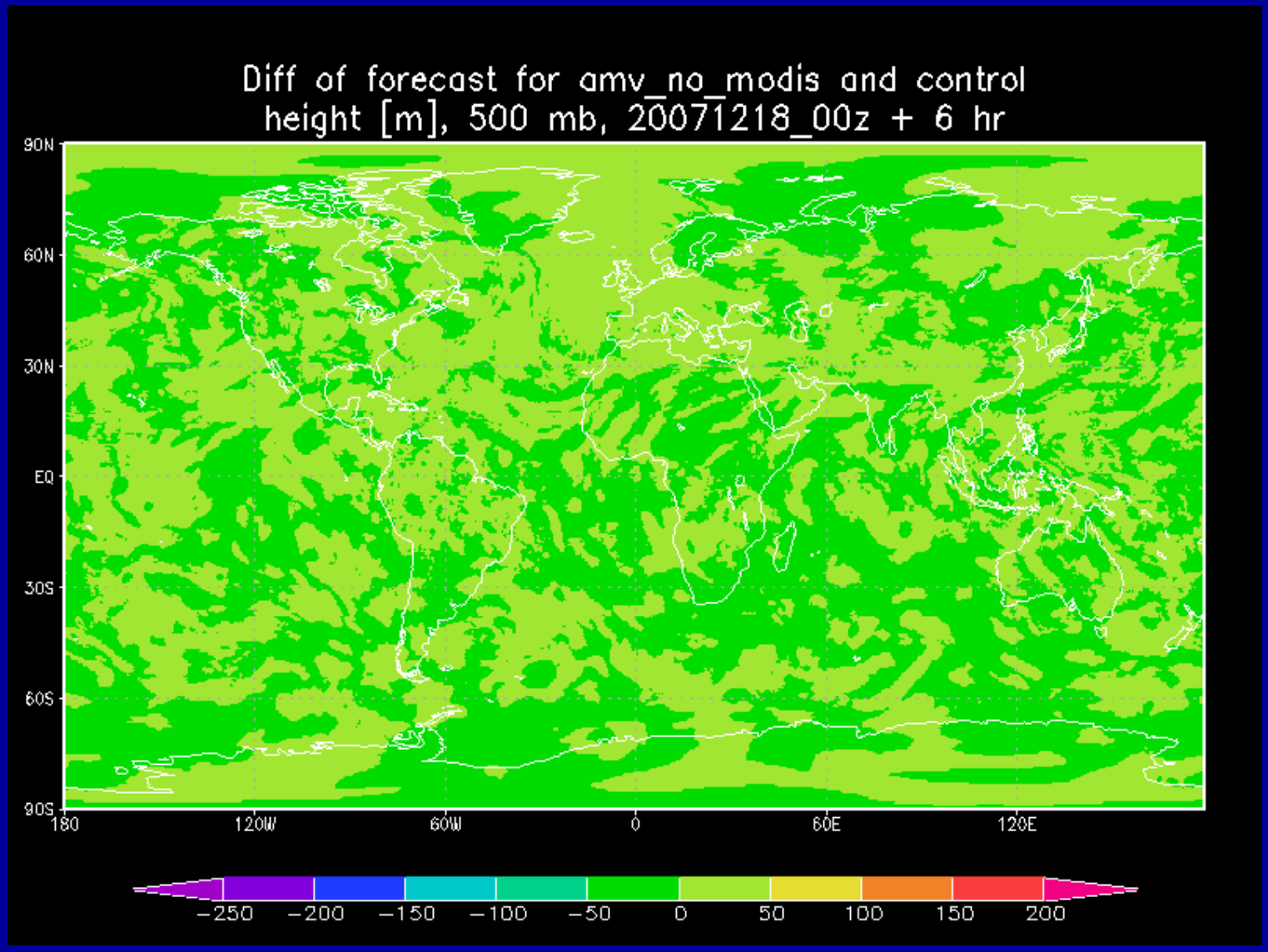
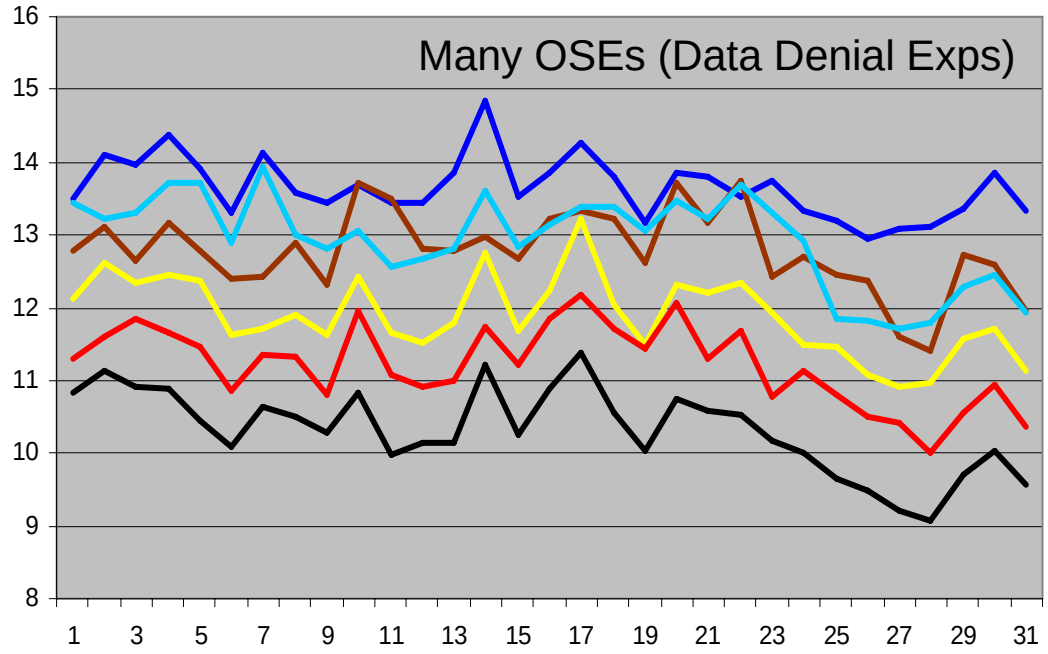
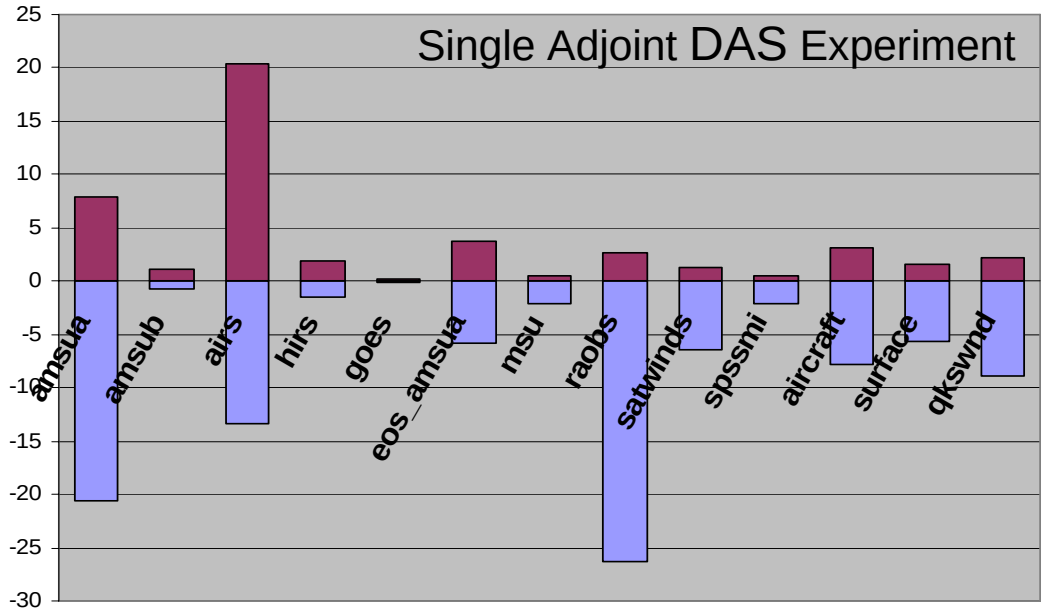

Diff of forecast for amv_no_modis and control
height [m], 500 mb, 20071218_00z + 6 hr
90N
60N
30N
EQ
30S
60S
90S
180
120W
60W
0
60E
120E
−250
−200
−150
−100
−50
0
50
100
150
200

Efficient Estimation of Observation Impact



NASA GEOS-5
July 2005 00z

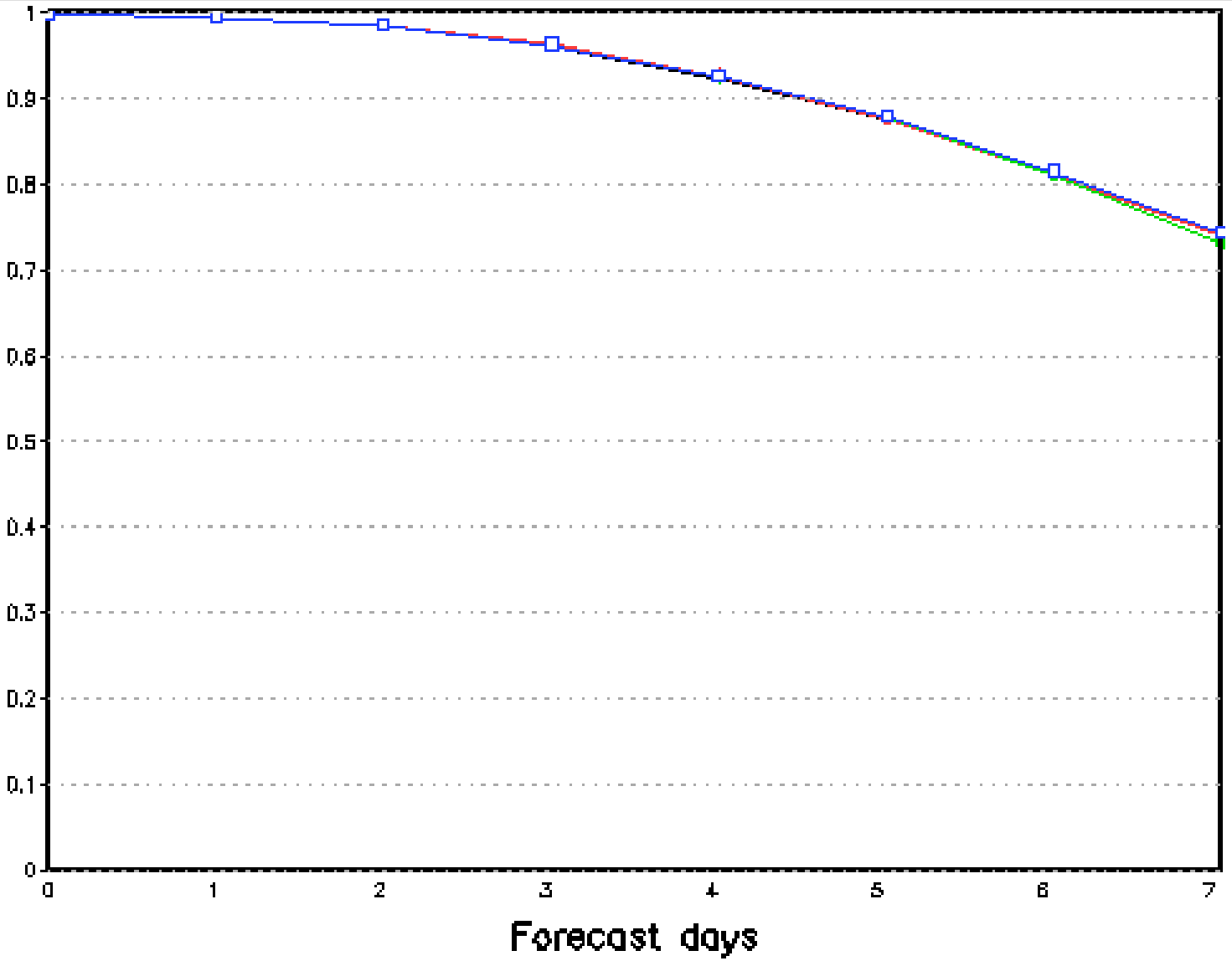


Slide courtesy of Ron Gelaro, GMAO

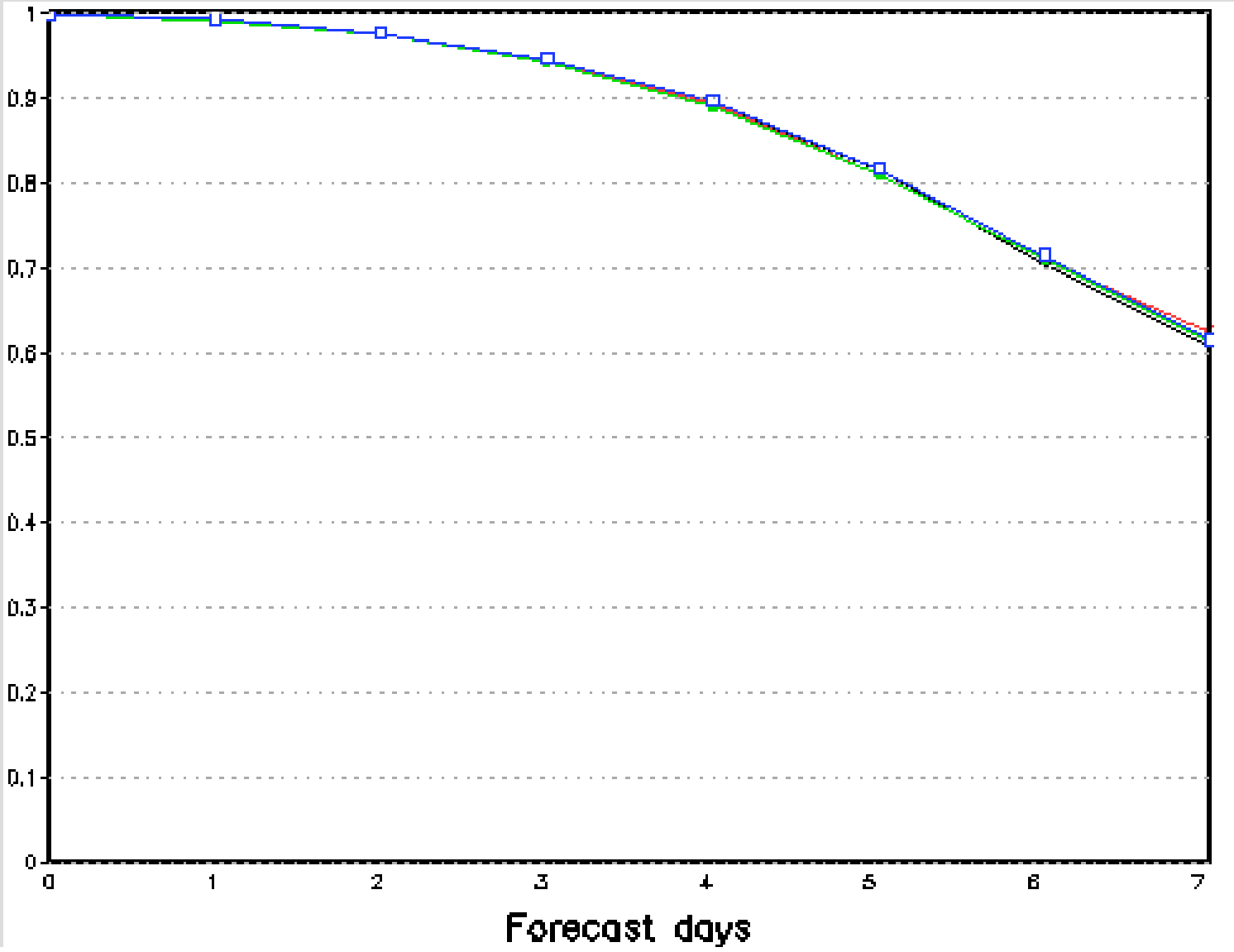
Preliminary conclusion for GMAO experiments

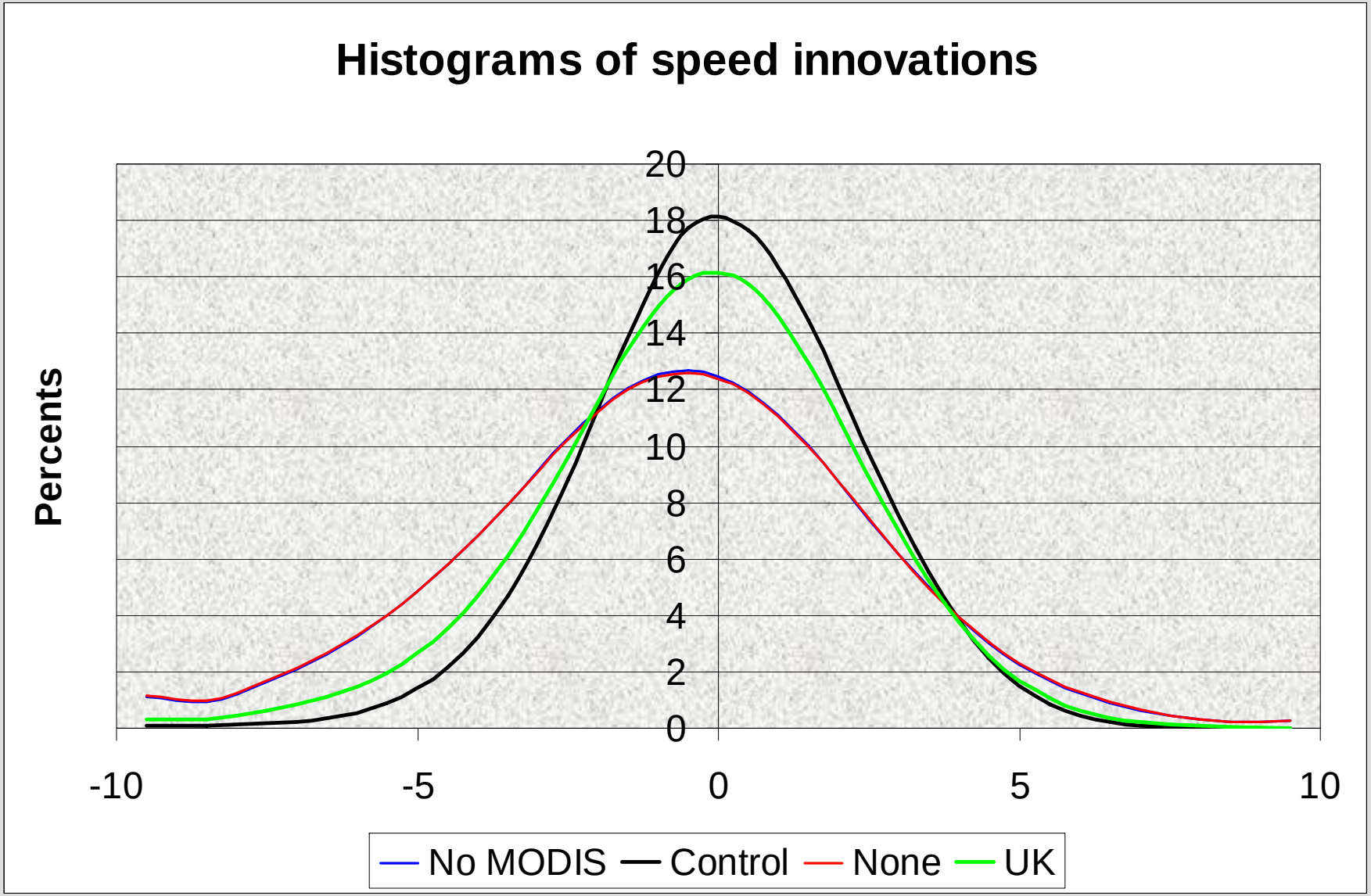
- MODIS winds positive in all regions
  - More so with NOAA screening than with Met Office screening
- "No AMV" experiments show satellite winds as a whole to be detrimental in NH, positive in SH
  - This is in contradiction to past OSEs and to adjoint sensitivity results.

Northern Hemisphere (500 hPa)



Southern Hemisphere (500 hPA)




Histograms of speed innovations
Percents
20
18
16
14
12
10
8
6
4
2
0
-10
-5
0
5
10
No MODIS
Control
None
UK

Preliminary conclusion for GFS experiments

- AMVs (including MODIS) have neutral impact on medium range forecast skill in both hemispheres
- MODIS winds innovations are very substantially improved by assimilating MODIS winds; largely unaffected by GEO winds
  - Information does not seem to be retained and transmitted to lower latitudes