The Impact of Four Dimensional Thinning on EUMETSAT and JMA AMVs

Xiujuan Su[1] John Derber[2] Andrew Collard[1]

1. IMSG/EMC
2. EMC

Motivation of the study

Hourly AMV products replaced current three hourly products at EUMETSAT, NESDIS and JMA. NCEP data assimilation system is also from 3d to 4d. The three dimensional thinning algorithm in current GSI filters time evolution information from hourly winds.

1. Thinning algorithm

200kmx200kmx100mbx2hr applied to

MTSAT (VIS (242), IR(252), WV(250))

METEOSAT-7(subtype 54), METEOSAT-10 (subtype(57) (VIS (243), IR(253), WV(254)): from 3d to 4d thinning

One observation is chosen based on its location, relative

time and quality marks

2. Experiment Configuration

20131022200 to 20131205, 20140601 to 20140716

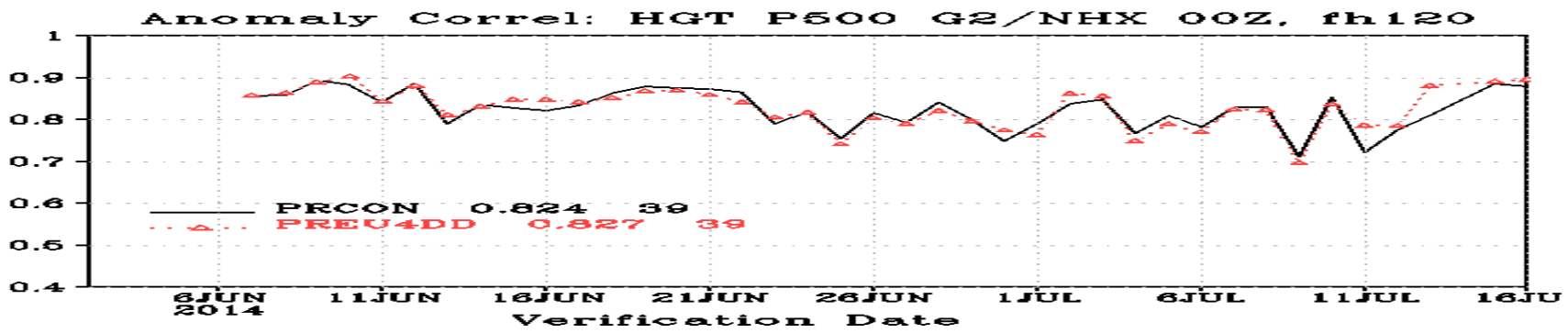
on T670L64e254 semi Lagrange GFS model

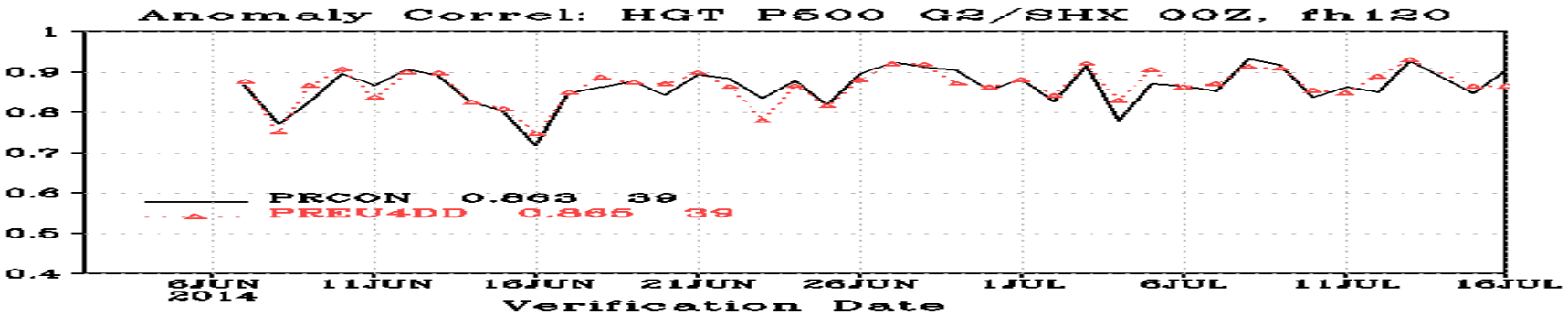
Data counts change (2013102300-2013120218)

- MTSAT VIS: 69488/338366=21%
- MTSAT IR: 395046/2436233=16%
- MTSAT WV: 275144/1529824=18%
- METEOSAT-7 VIS: 96543/376100=26%
- METEOSAT-10 VIS: 406730/340972=119%
- METEOSAT-7 IR: 269414/426286=63%
- METEOSAT-10 IR: 843564/554759=152%
- METEOSAT-7 WV: 456858/1320300=35%
- METEOSAT-10 WV: 760661/473751=161%

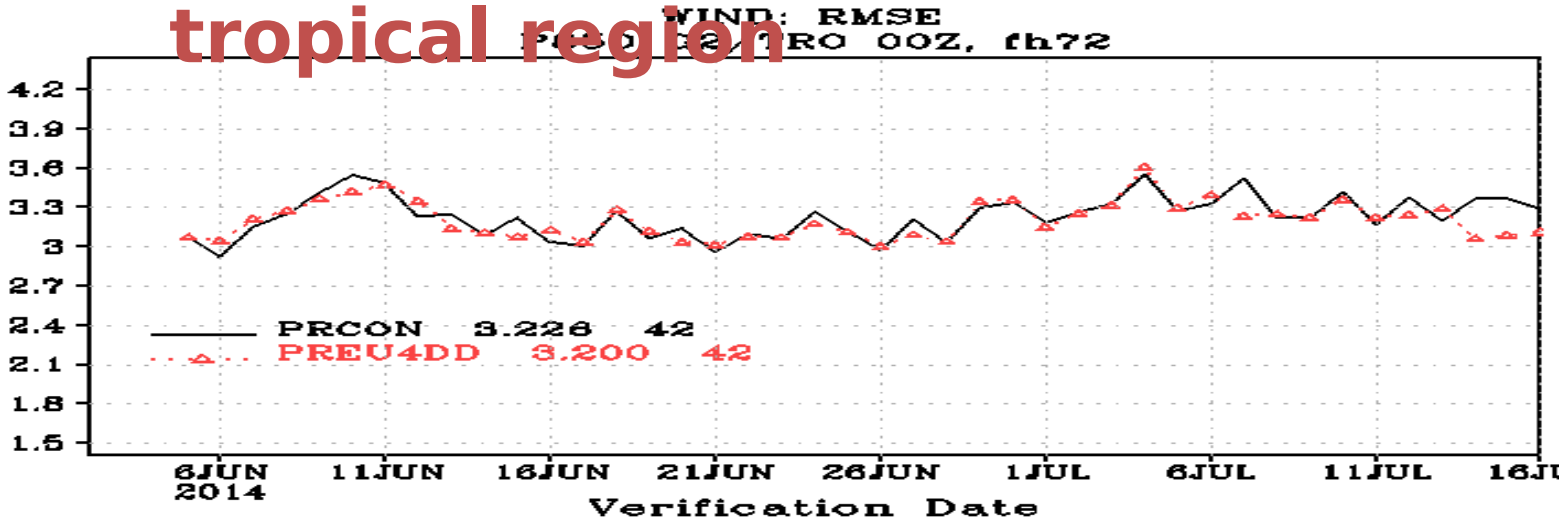
Forecast impacts

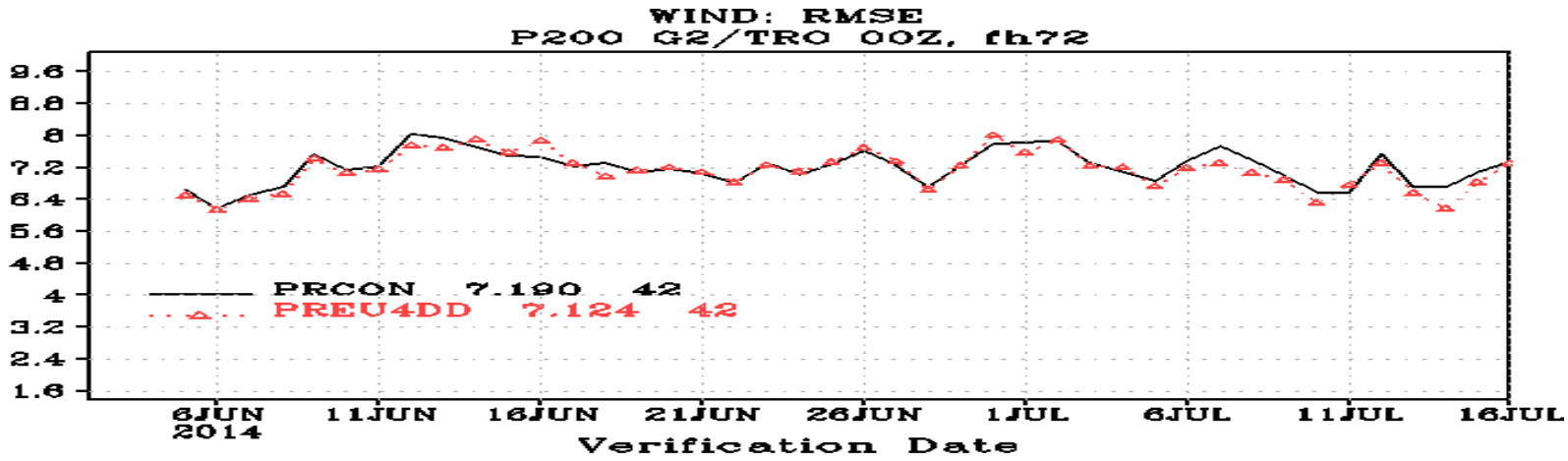
The Forecast impacts from both season are consistent, only results from summer test are presented. PRCON: control run, PREU4DD: parallel run with 4d thinning.



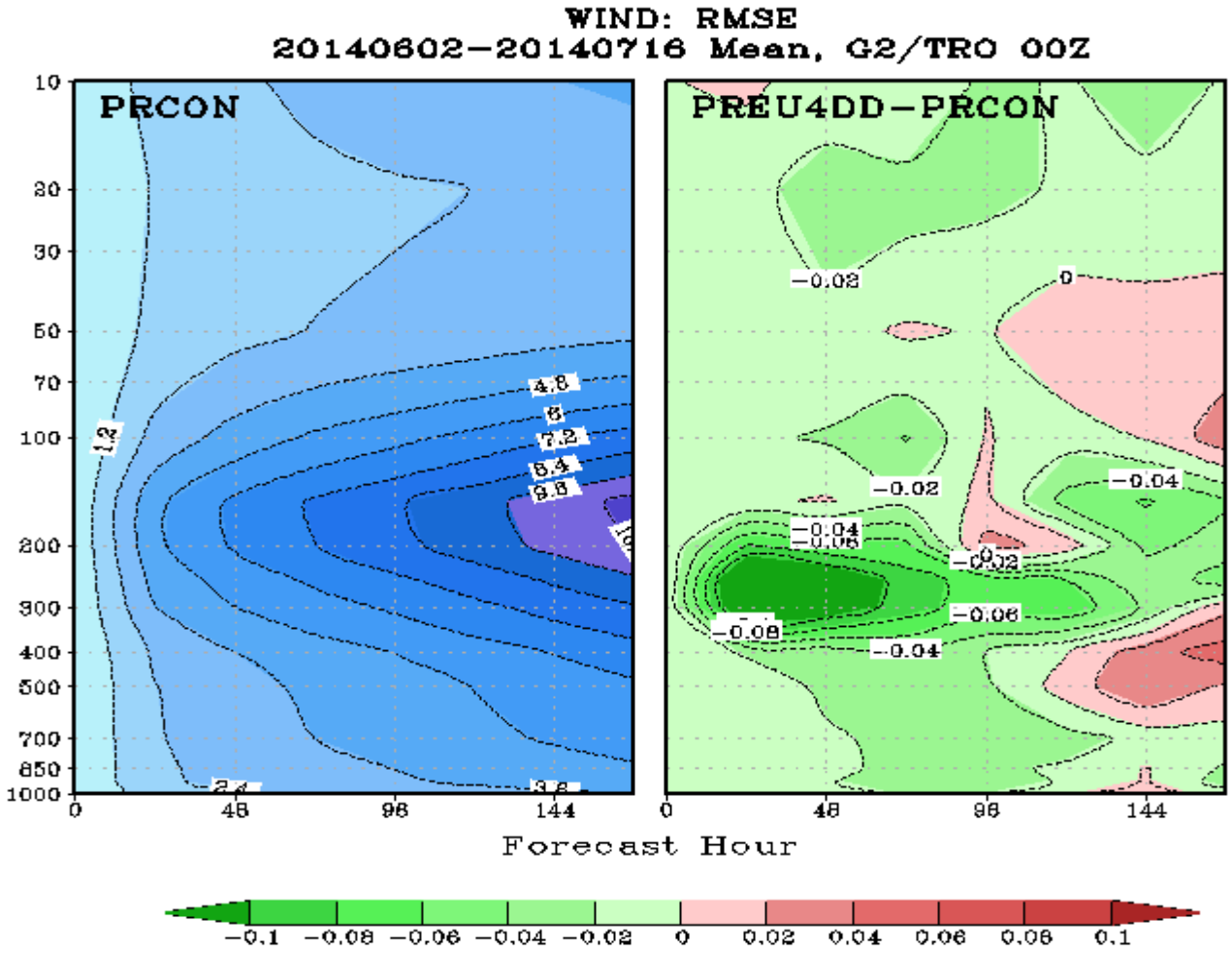


2. Wind vector RMS time series at day 3 in the tropical region

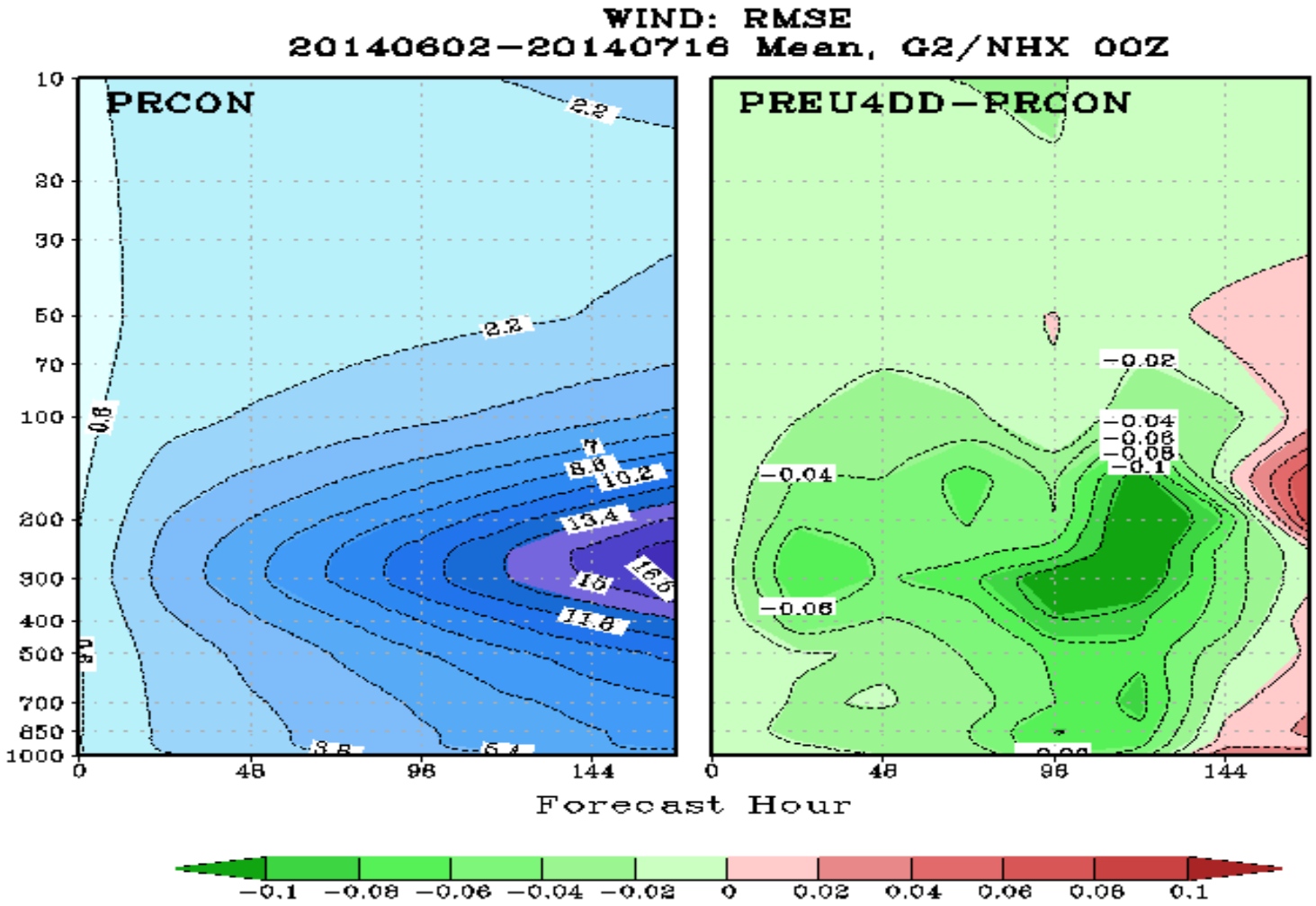




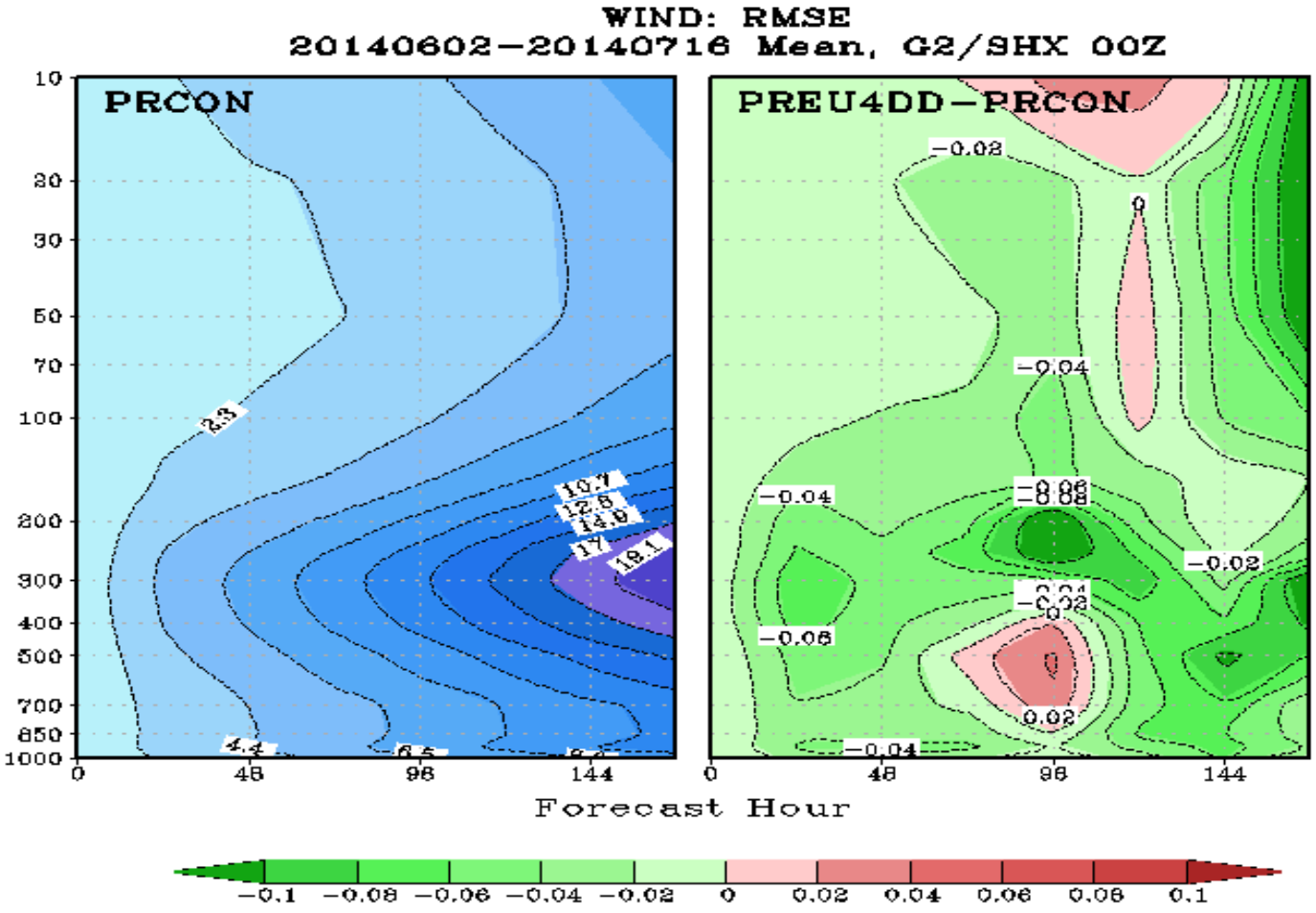
3. Wind RMS vertical profile time series at tropics



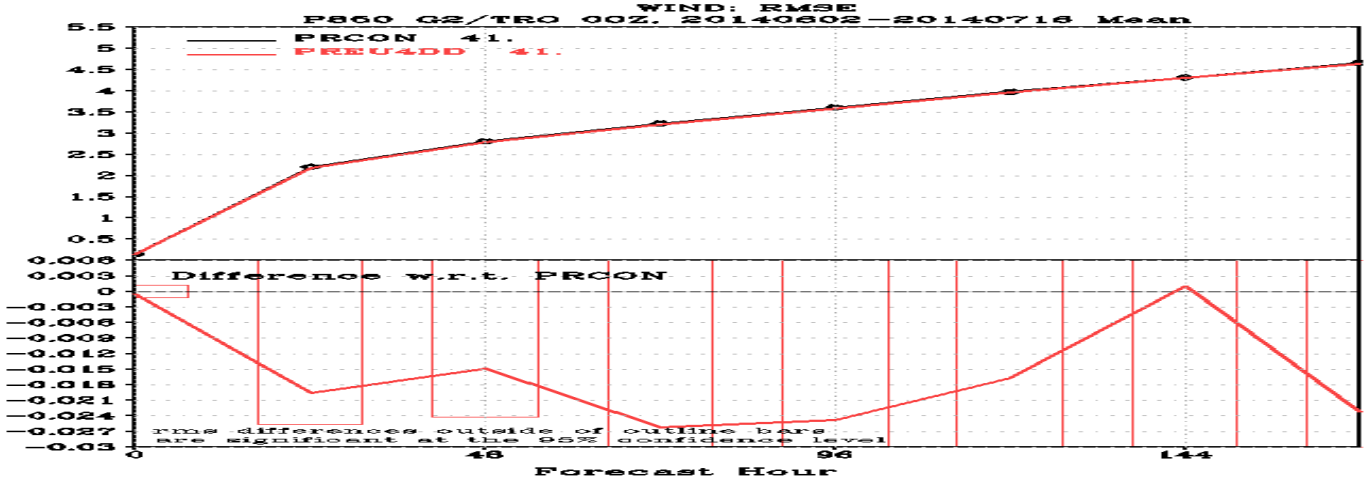
4. Wind RMS vertical profile time series at northern hemisphere

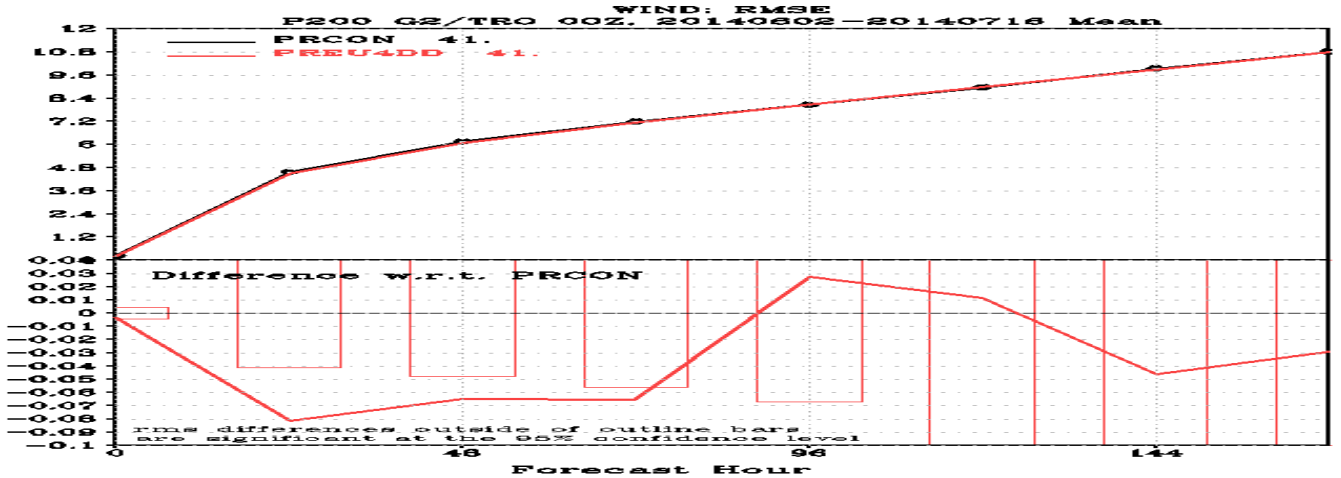


5. Wind RMS vertical profile time series at Southern hemisphere

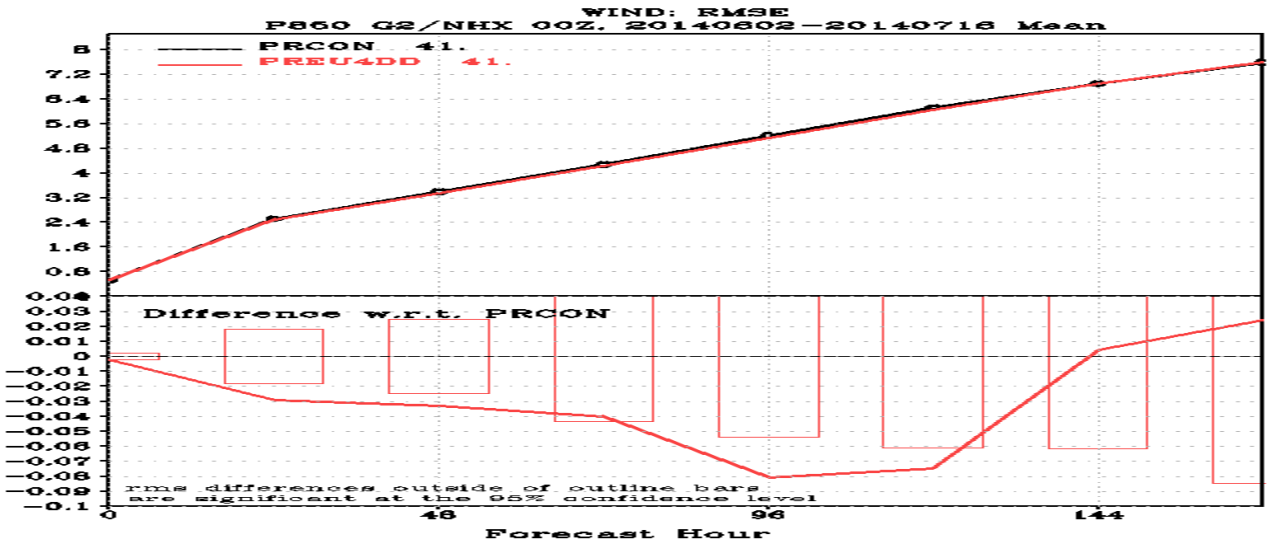


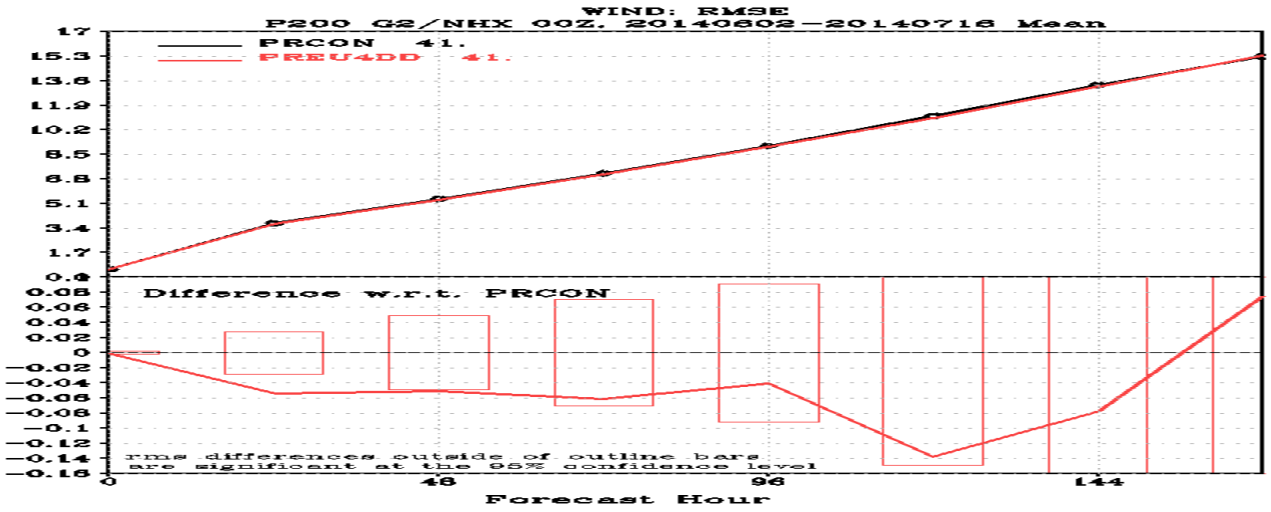
6. Wind RMS at 850mb and 200mb in the tropics



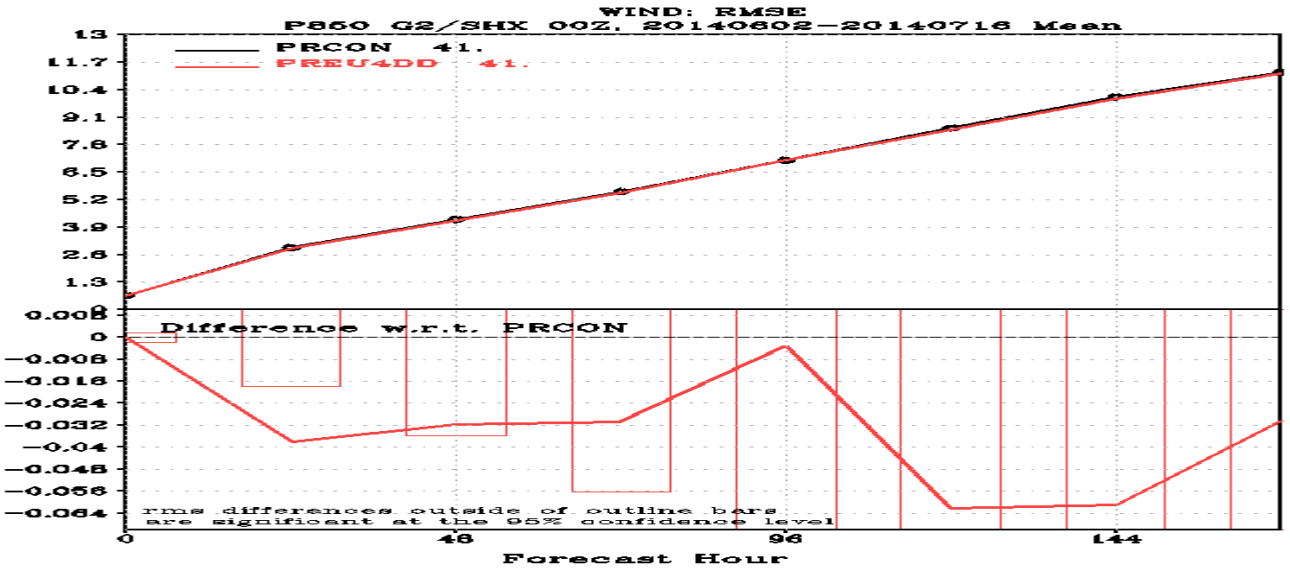


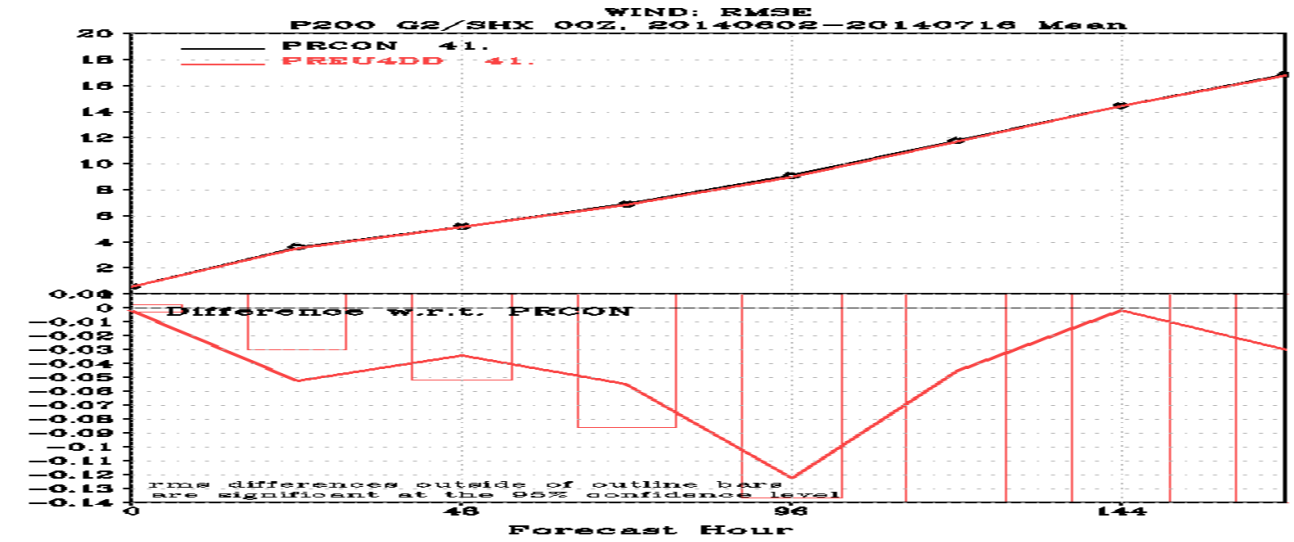
7. Wind RMS at 850mb and 200mb in the northern hemisphere



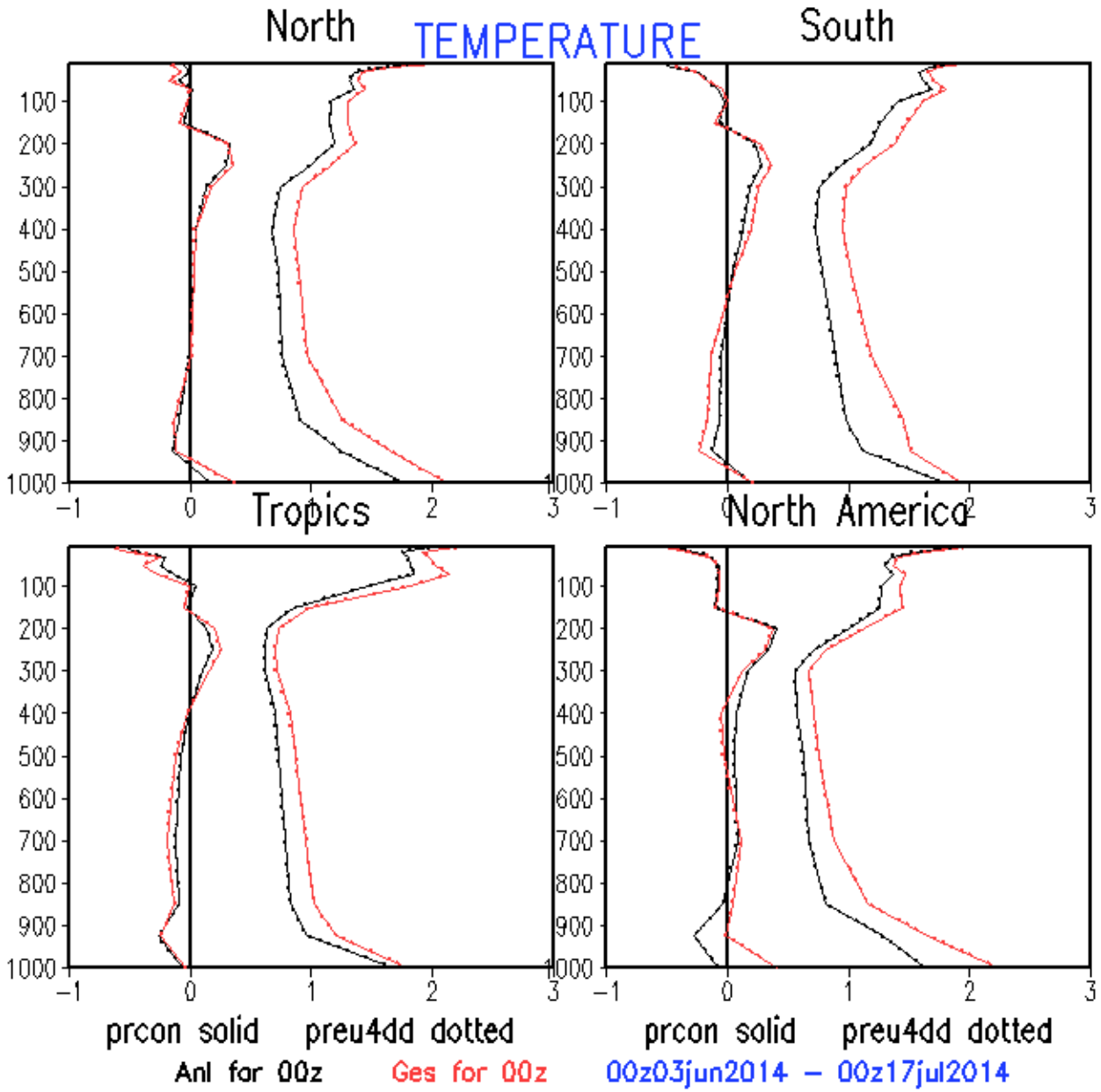


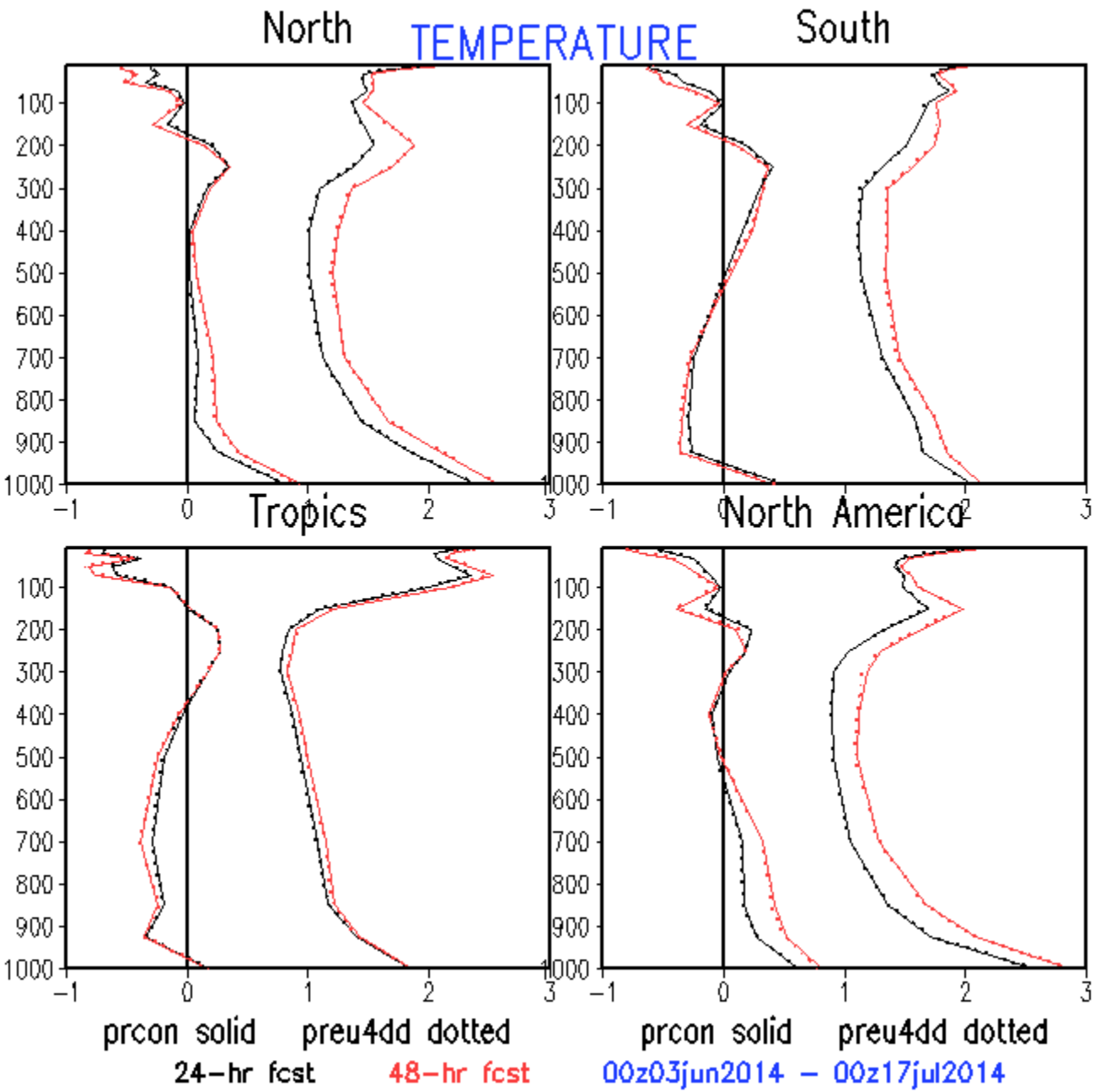
8. Wind RMS at 850mb and 200mb in the southern hemisphere

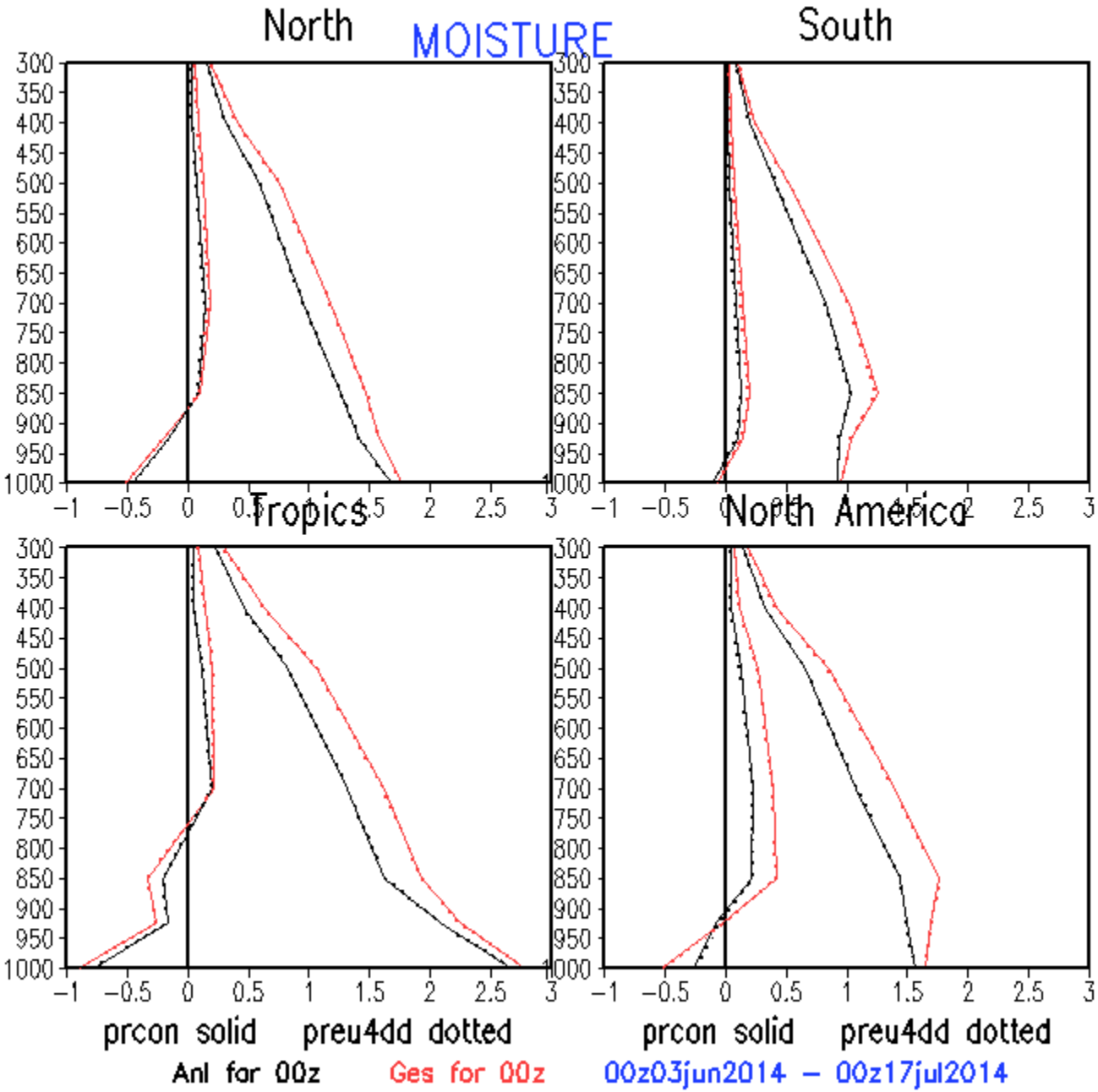


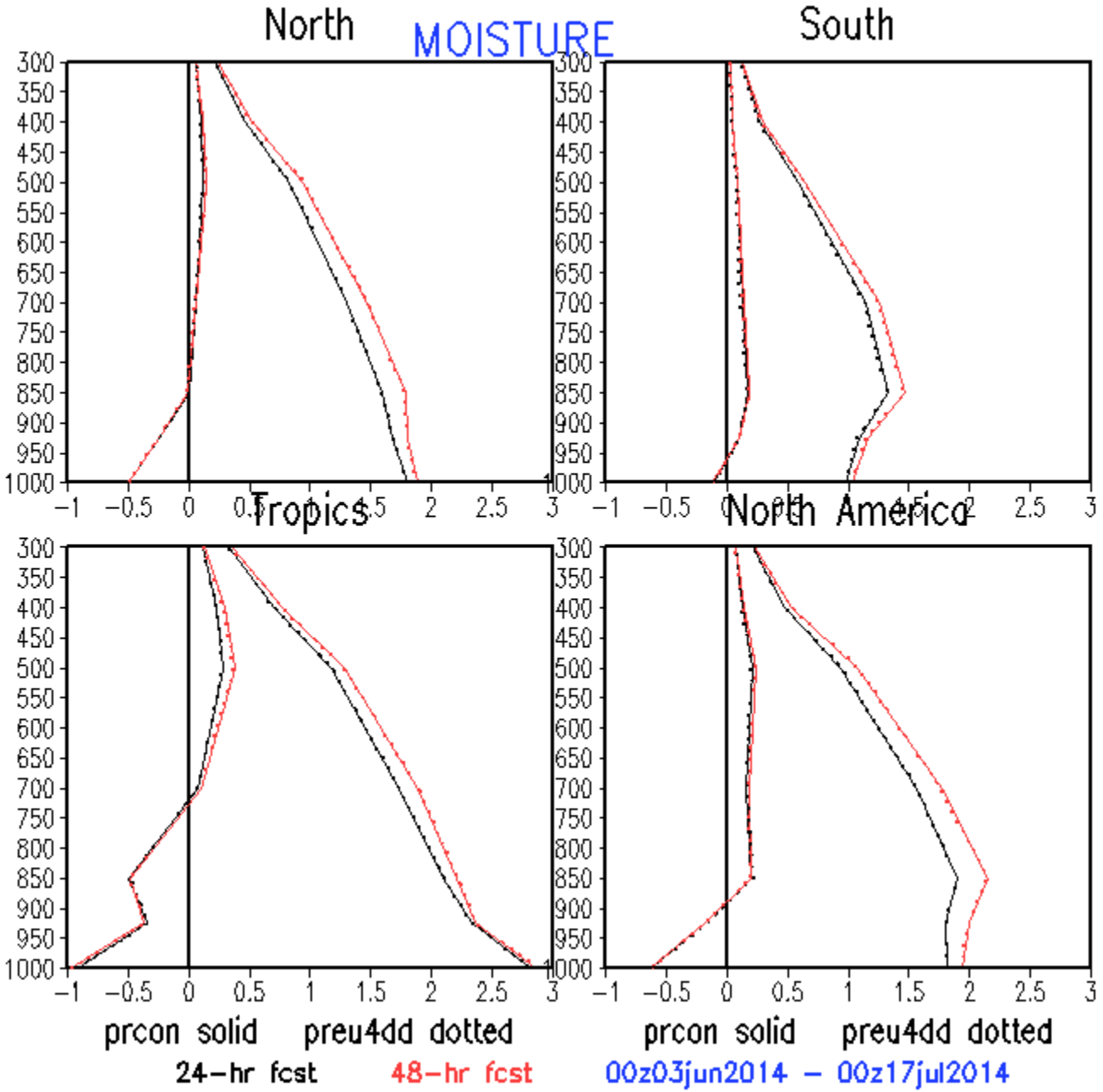


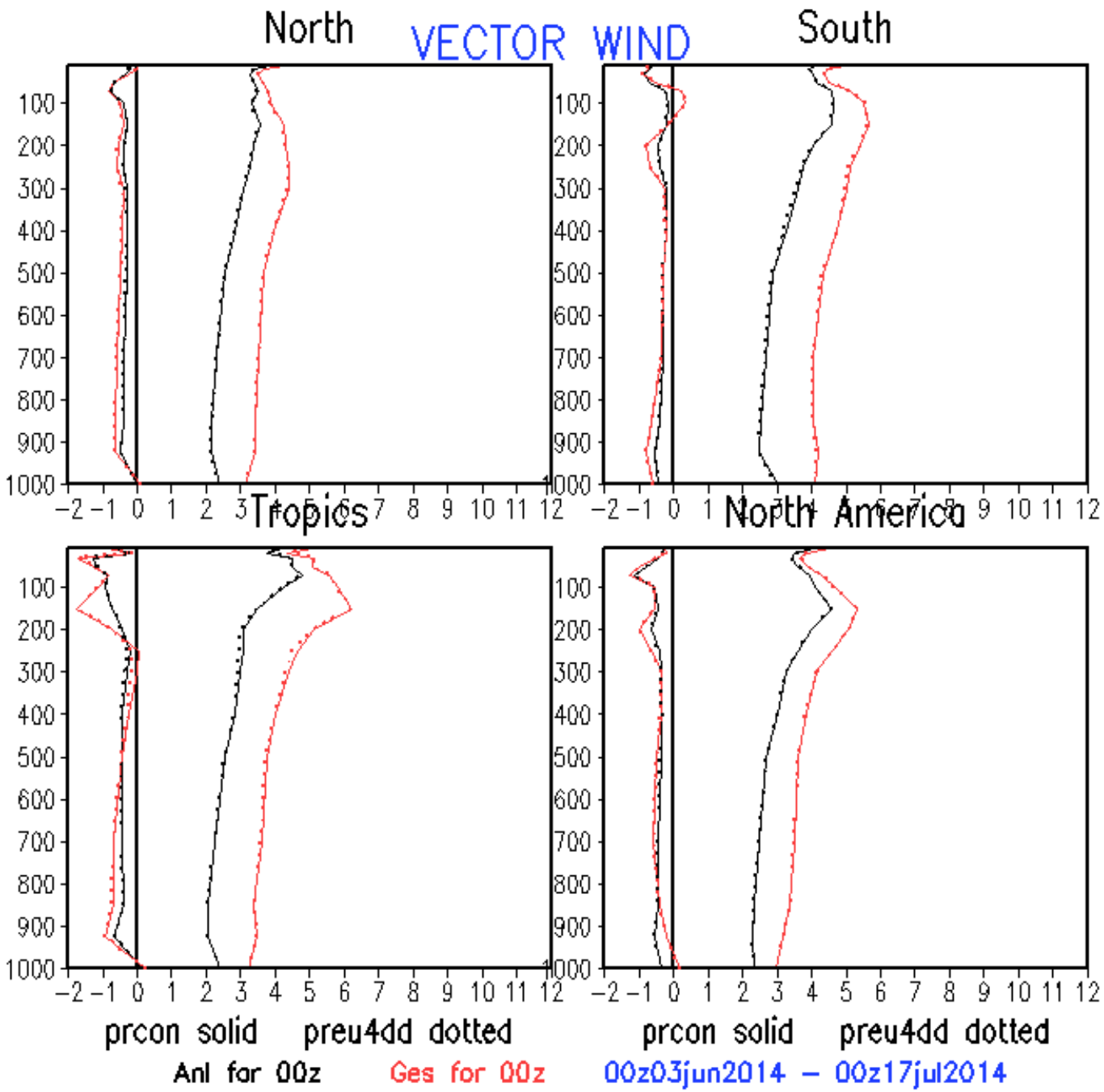
9. Observation Fits to ranwinsonde data

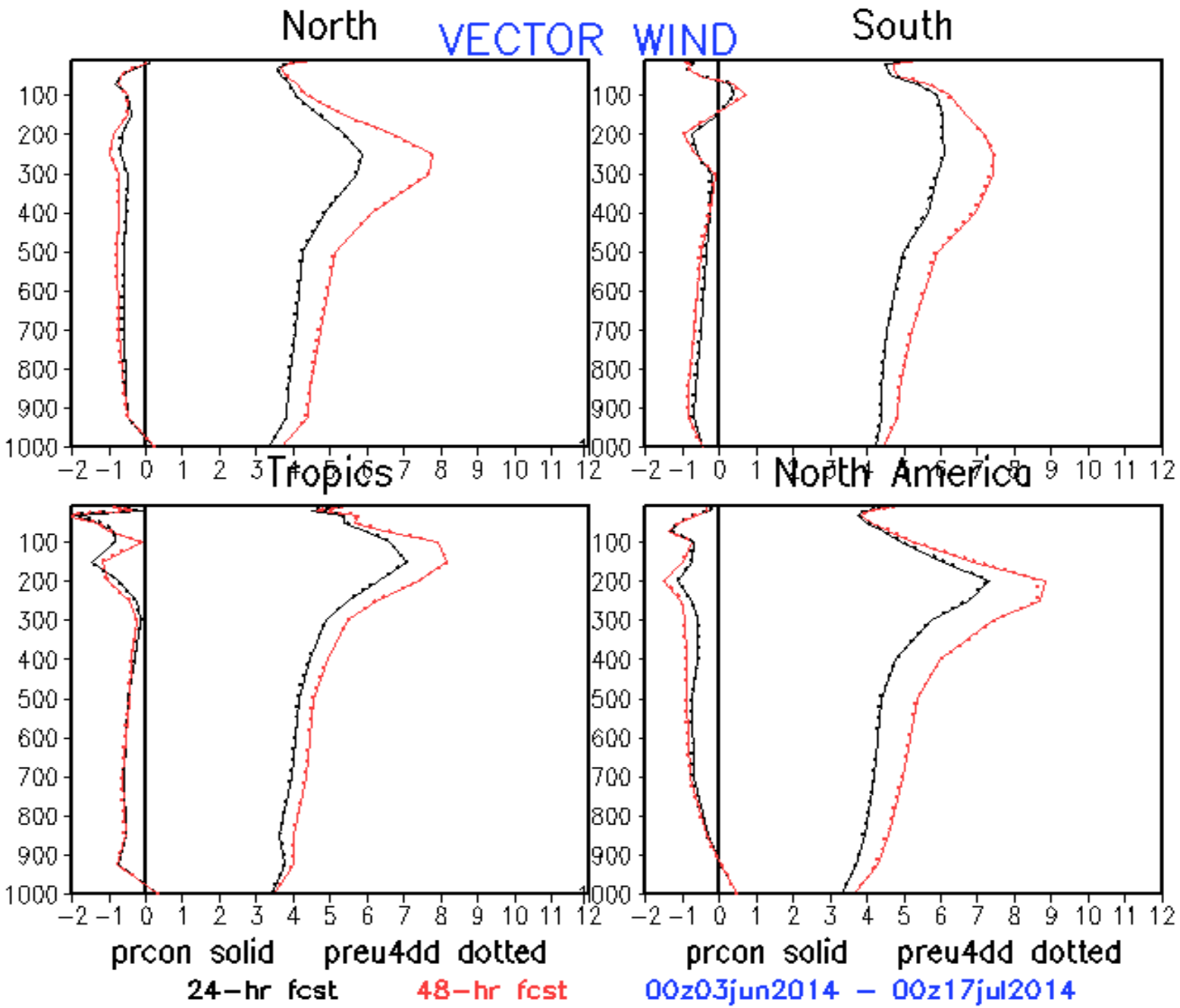



North
TEMPERATURE
South
Tropics
North America
100
200
300
400
500
600
700
800
900
1000
−1
0
1
2
3
prcon solid preu4dd dotted
24−hr fcst
48−hr fcst
00z03jun2014 − 00z17jul2014


North
MOISTURE
South
Tropics
North America
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
−1
−0.5
0
0.5
1
1.5
2
2.5
3
prcon solid preu4dd dotted
Anl for 00z
Ges for 00z
00z03jun2014 – 00z17jul2014


North
MOISTURE
South
Tropics
North America
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
−1
−0.5
0
0.5
1
1.5
2
2.5
3
prcon solid preu4dd dotted
24−hr fcst
48−hr fcst
00z03jun2014 − 00z17jul2014


North
VECTOR WIND
South
Tropics
North America
100
200
300
400
500
600
700
800
900
1000
−2 −1 0 1 2 3 4 5 6 7 8 9 10 11 12
prcon solid preu4dd dotted
prcon solid preu4dd dotted
Anl for 00z
Ges for 00z
00z03jun2014 – 00z17jul2014


North
VECTOR WIND
South
Tropics
North America
100
200
300
400
500
600
700
800
900
1000
−2 −1 0 1 2 3 4 5 6 7 8 9 10 11 12
prcon solid preu4dd dotted
24−hr fcst
48−hr fcst
00z03jun2014 − 00z17jul2014

Summary

- The thinning scheme in GSI was modified from 3 dimensions to 4 dimensions.
- Four dimensional thinning was applied to EUMETSAT and JMA AMV products
- Two season parallel experiments show neutral impacts on both hemispheres and precipitation forecasts (not shown) and significant improvements on wind forecasts globally.
- There is almost no impact on observation fit to rawindsonde observations.