



# Assimilating OSCAT Surface Winds Retrievals in the NCEP GDAS/GFS

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*JCSDA 11<sup>th</sup> Workshop on Satellite Data Assimilation  
06/06/13*



# Outline

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- OSCAT background information
- Steps towards OSCAT assimilation in GSI
- OSCAT QC discussion and results
- Verification results
- Future work

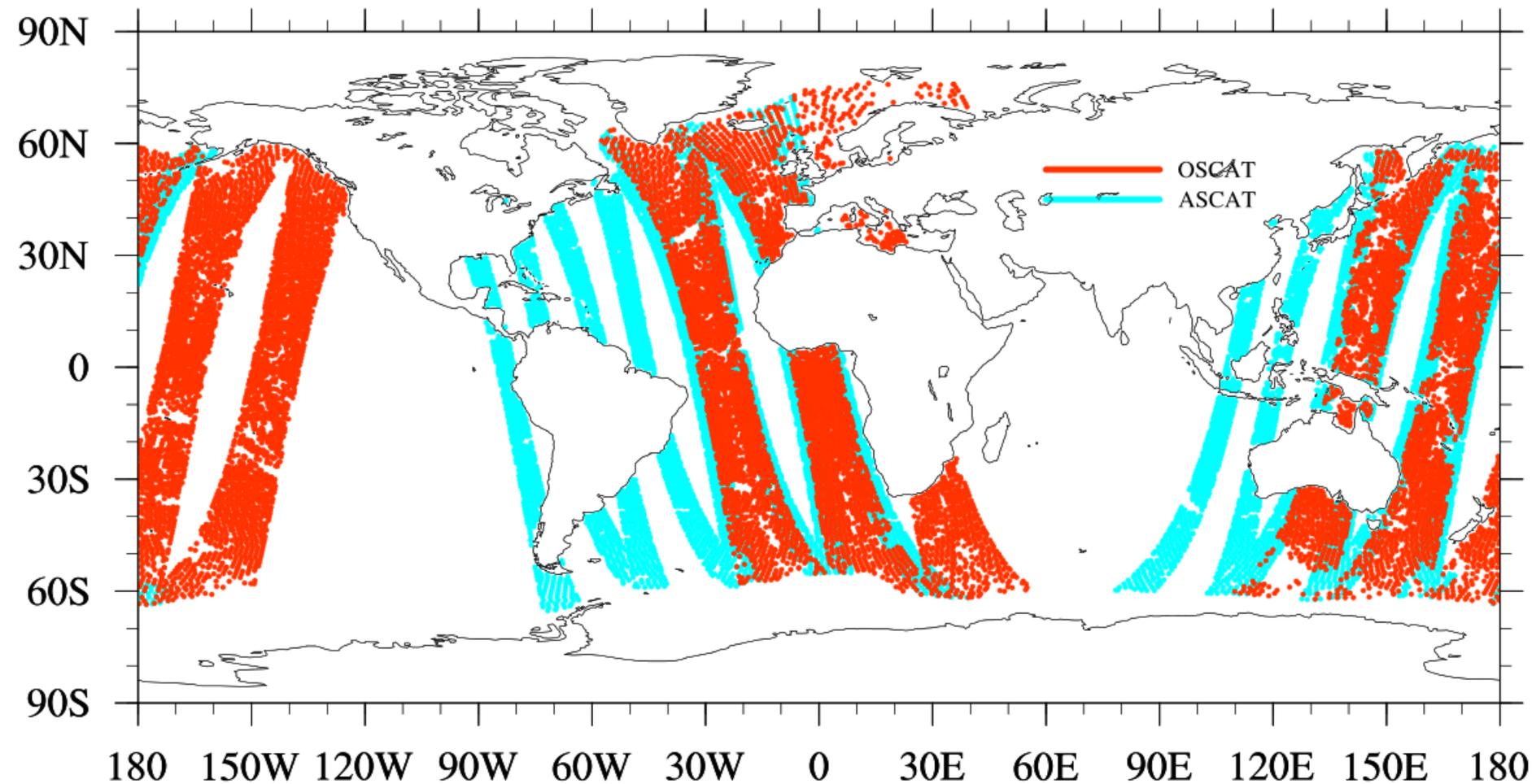
# OceanSat-2 Scatterometer- OSCAT Introduction

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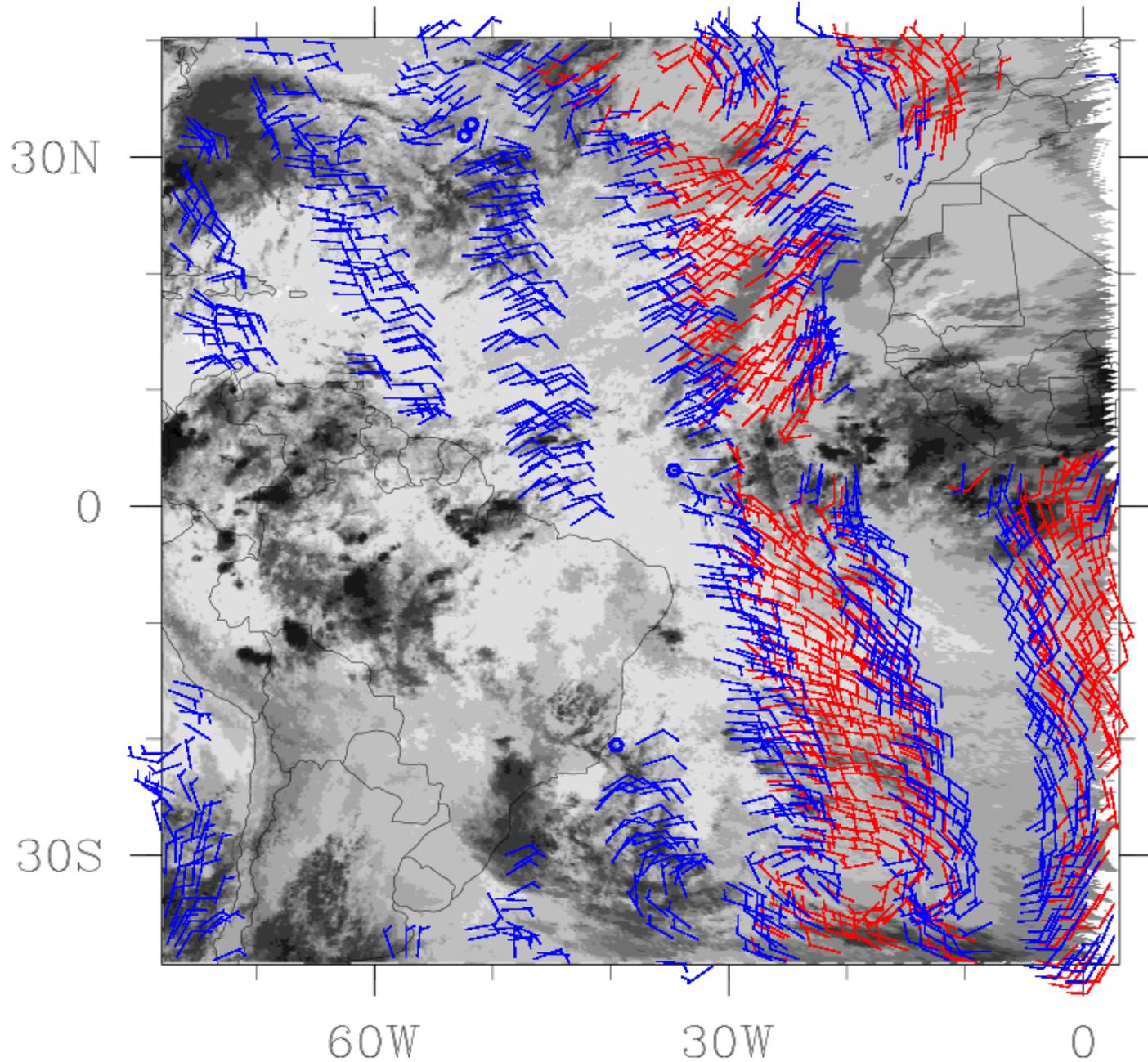
- OSCAT is a Ku-band scatterometer with similarities to QuikSCAT
  - Launched Oct 2009 on board of OceanSat-2 satellite by ISRO.
  - Provide ocean surface wind speed and direction measurements.

Parameter	OSCAT
Operational Frequency	13.515 GHz
Polarization (Inner/Outer)	HH/VV
Altitude at Equator	720 km
Orbit Near Repeat Cycle	2 days
Local time at asc/desc node	noon at desc node
HH 3dB footprint (Az x El)	26.8 x 45.1 km
Incidence Angle (Inner)	49 deg
Incidence Angle (Outer)	57 deg
Swath Diameter (Inner)	1400 km
Swath Diameter (Outer)	1836 km

# ASCAT/OSCAT Orbit +/- 3h 2012052500



# ASCAT/OSCAT Wind Vectors



# Steps towards assimilating OSCAT in GSI

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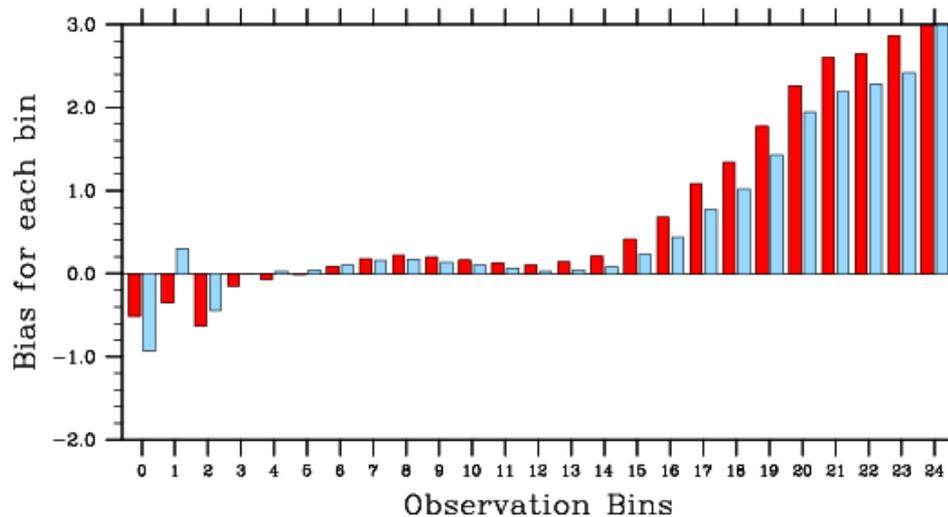
- Receive and archive OSCAT WMO BUFR data (50KM) from KMNI daily. (Archive data since May 2012 ~ present)
- Read OSCAT dump directly from GSI.
- Two season experiment run for impact study.
- Real-time OSCAT data ingesting systems has been built up on CCS and WCOSS in preparation for operation for both global and regional model.
- GSI codes reviewed and merged.

# Quality Control

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- Current QC used for OSCAT assimilation
  - Data within +/-3 hours synoptic window.
  - High wind speed cut off:
    - 20m/s
  - u and v component check:
    - 6m/s
  - Vector Check  $\sqrt{\frac{(\delta u)^2 + (\delta v)^2}{(speed)^2}}$  :
    - 1.0

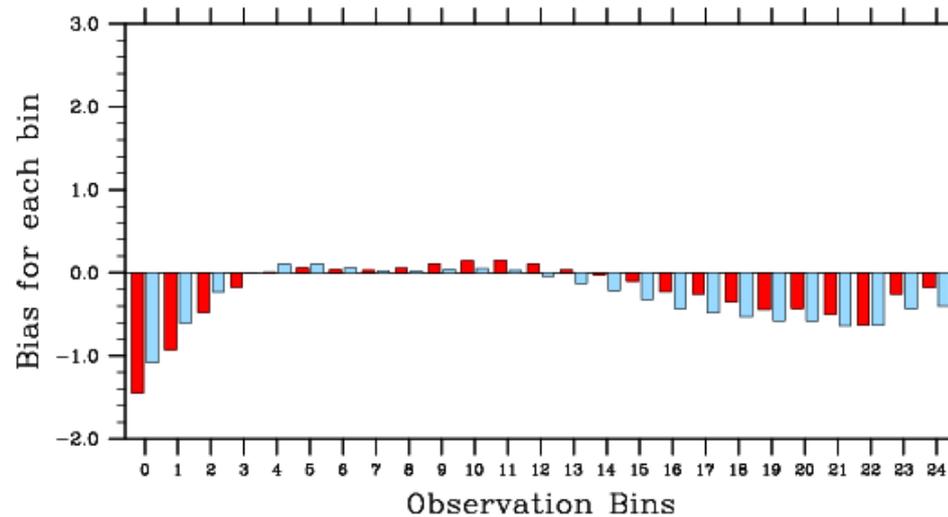
OSCAT Spd Bias Stats 1-30 June 2012



spdbias OB  
spdbias OA

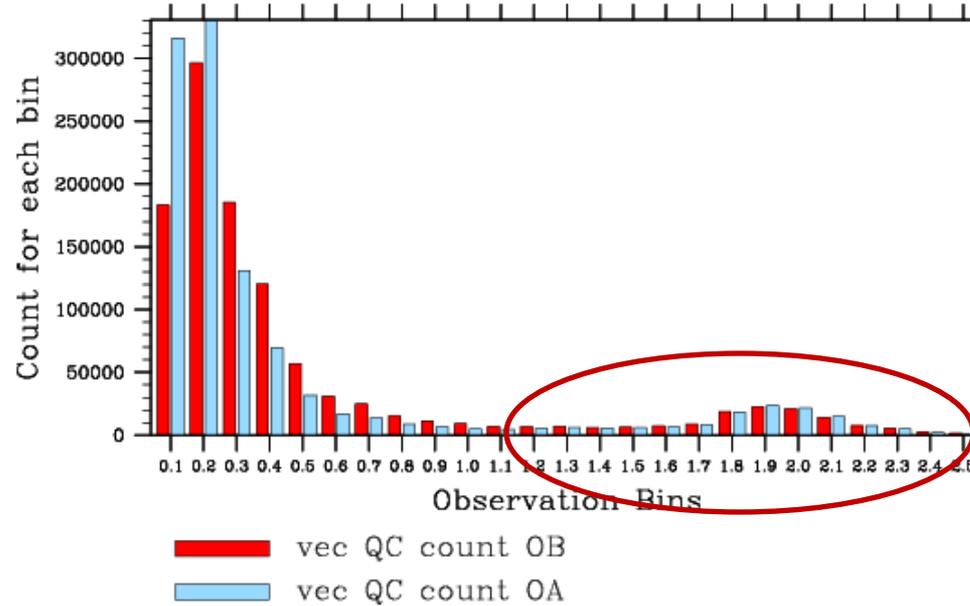
*Speed bias before winds assimilated*

ASCAT Spd Bias Stats 1-30 June 2012



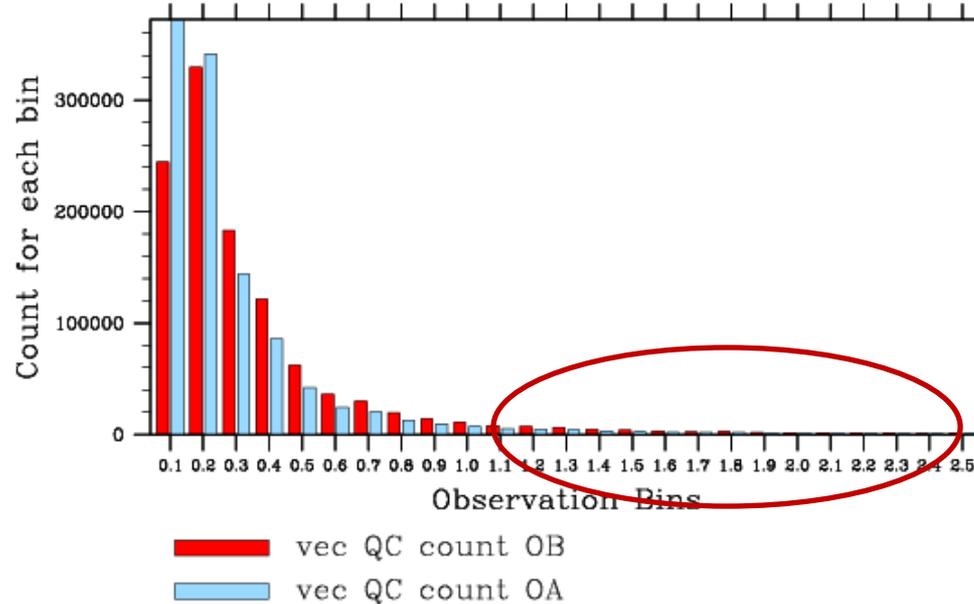
spdbias OB  
spdbias OA

OSCAT Vector QC Total Counts Stats 1-30 June 2012

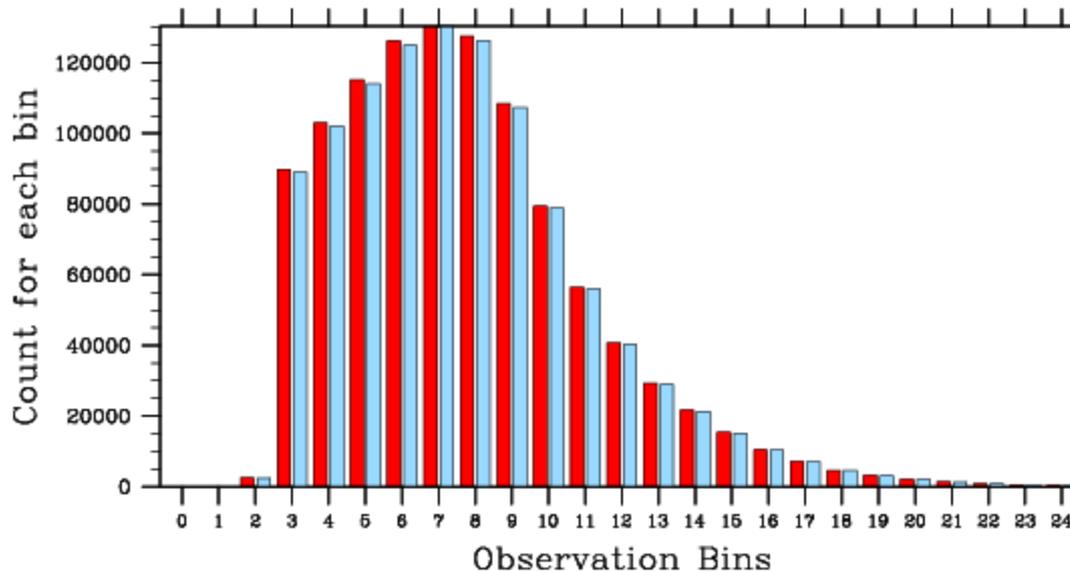


***Vector Check QC before winds assimilated***

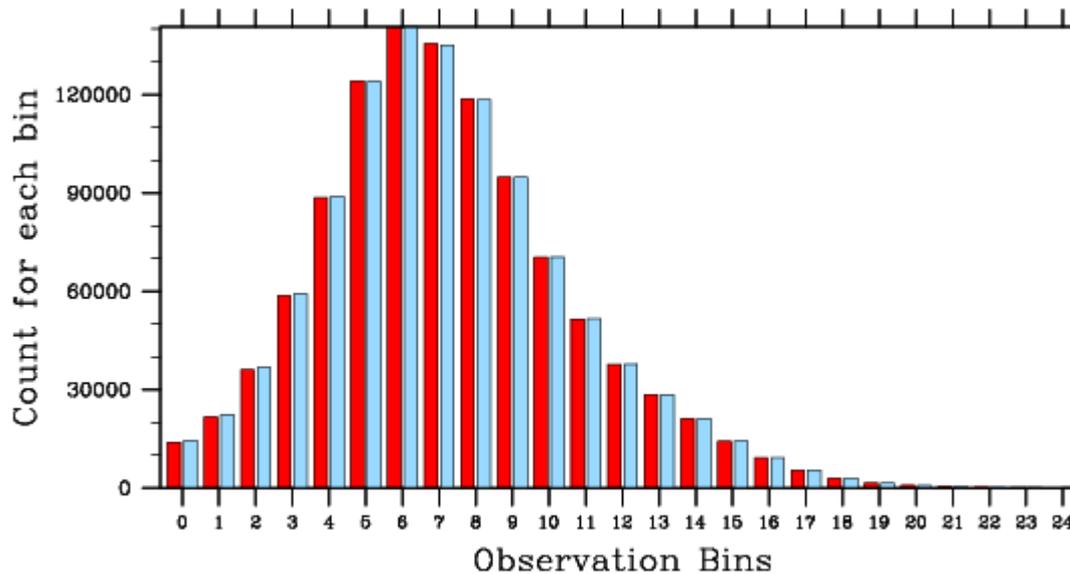
ASCAT Vector QC Total Counts Stats 1-30 June 2012



OSCAT Spd Total Counts Stats 1-30 June 2012



ASCAT Spd Total Counts Stats 1-30 June 2012



*Speed counts histogram before winds assimilated*

■ spdcoun OB  
■ spdcoun OA

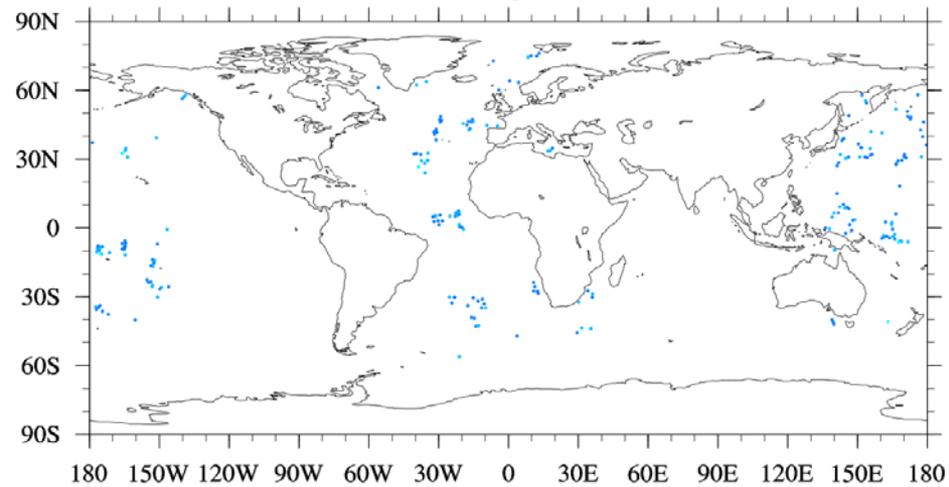
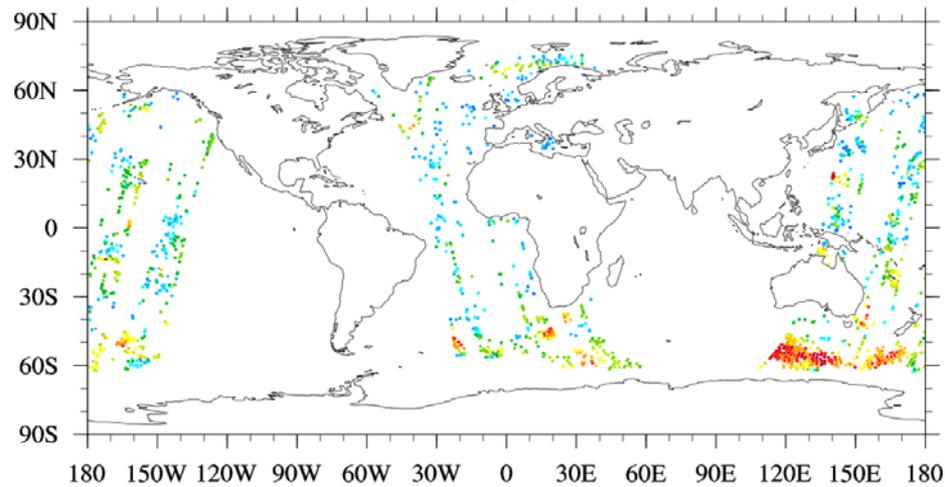
9332 obs assimilated, 1628 obs rejected, 14.8% rejected rate

**2012052500 rejected speed loop2**  
**From 20m/s and 6m/s u/v qc check**

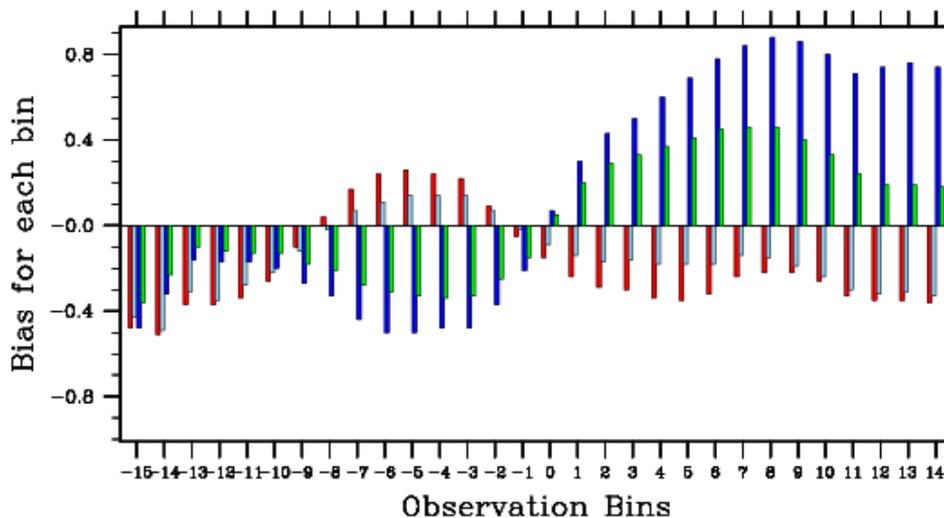
**2012052500 rejected speed loop2**  
**From 1.0 Vector qc check 727 total obs**  
**rejected due to this check**

**OSCAT Wind Spd 2012052500**

**OSCAT Wind Spd 2012052500**

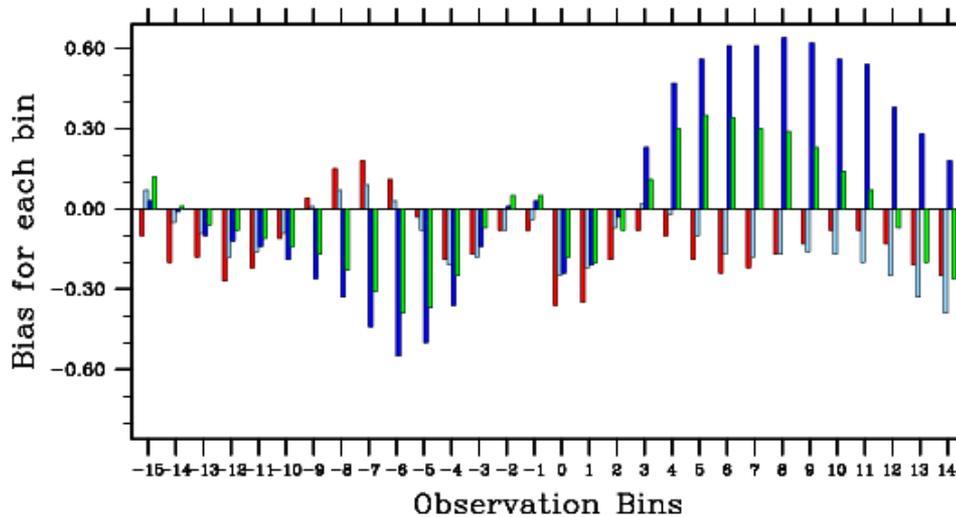


OSCAT U/V Bias Stats 1-30 June 2012



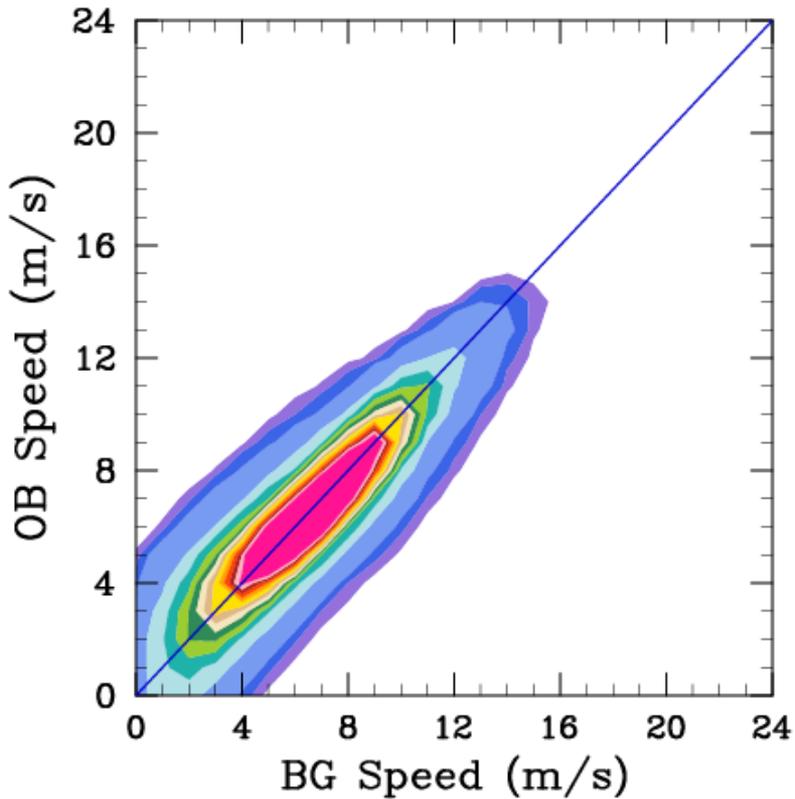
*U/V bias histogram with winds assimilated*

ASCAT U/V Bias Stats 1-30 June 2012

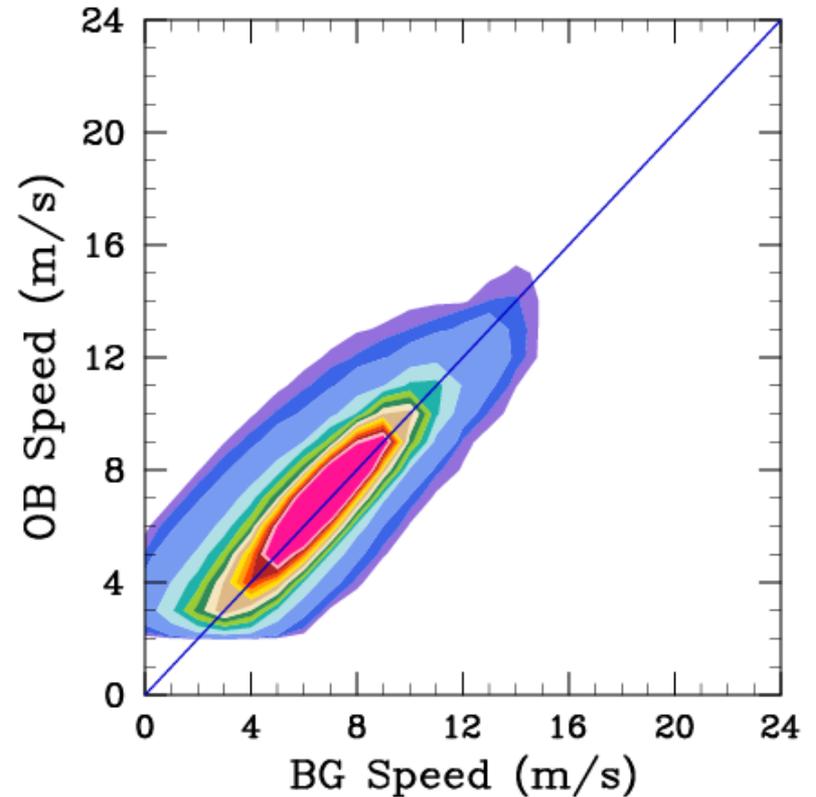


**2012060100-2012063018 Tropics**

Density plot of ASCAT (20S,20N)



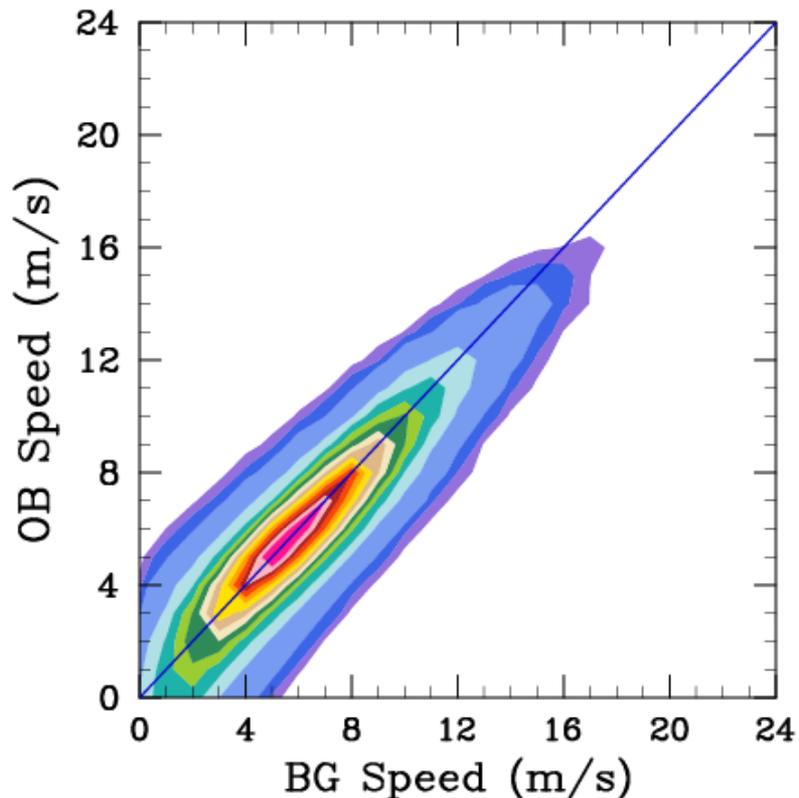
Density plot of OSCAT (20S,20N)



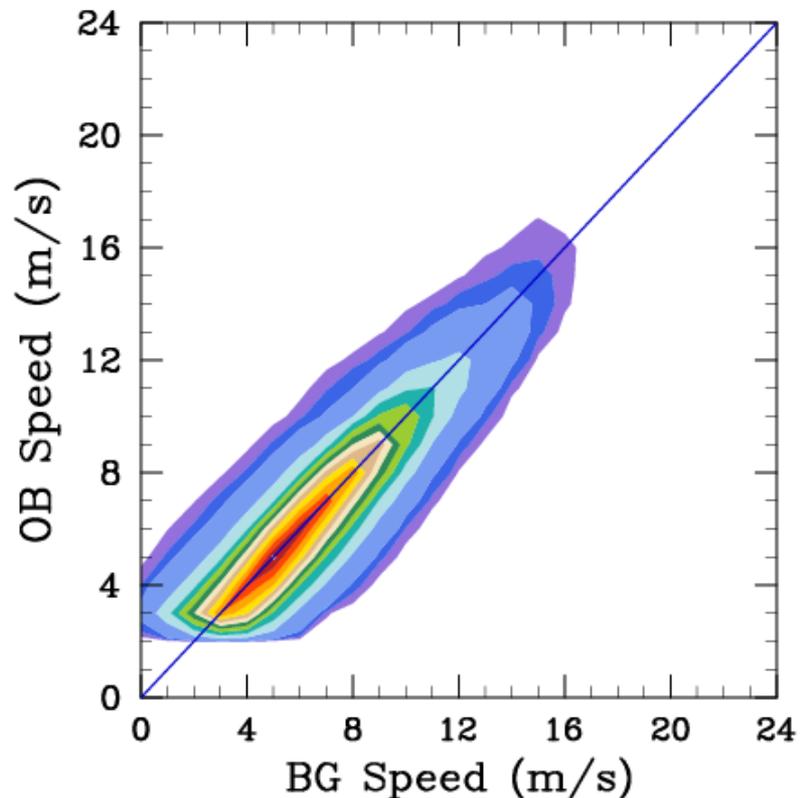
***Density plots of assimilated obs from loop 1***

## 2012060100-2012063018 Northern Hemisphere

Density plot of ASCAT (20N,90N)



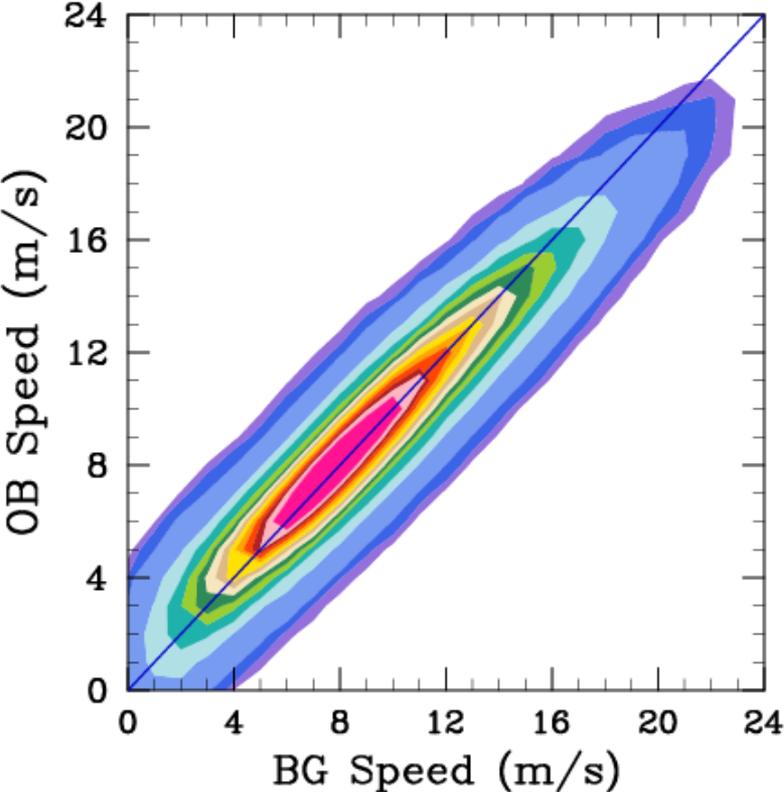
Density plot of OSCAT (20N,90N)



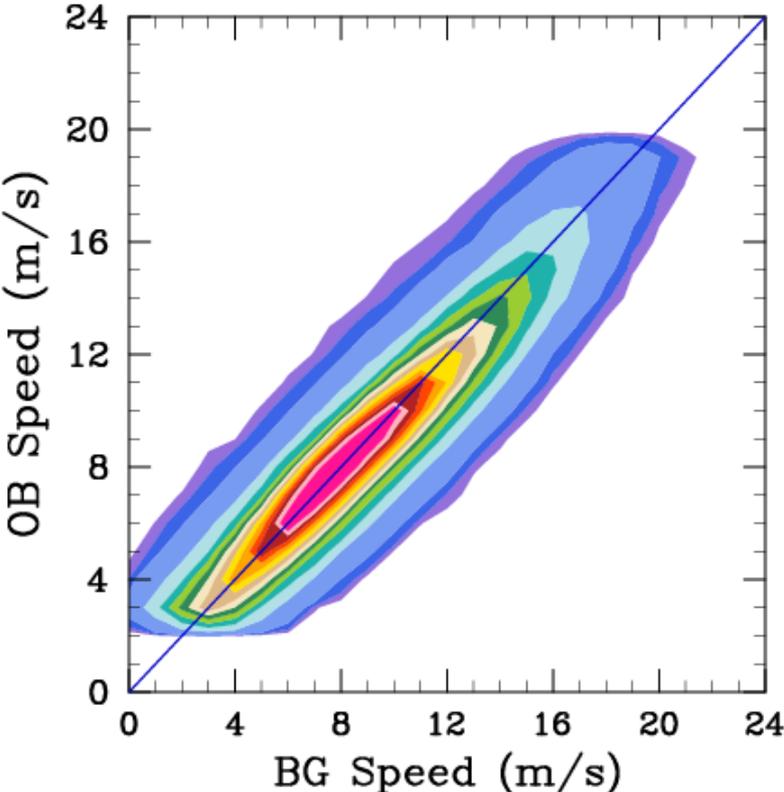
*Density plots of assimilated obs from **loop 1***

2012060100-2012063018 Southern Hemisphere

Density plot of ASCAT (90S,20S)



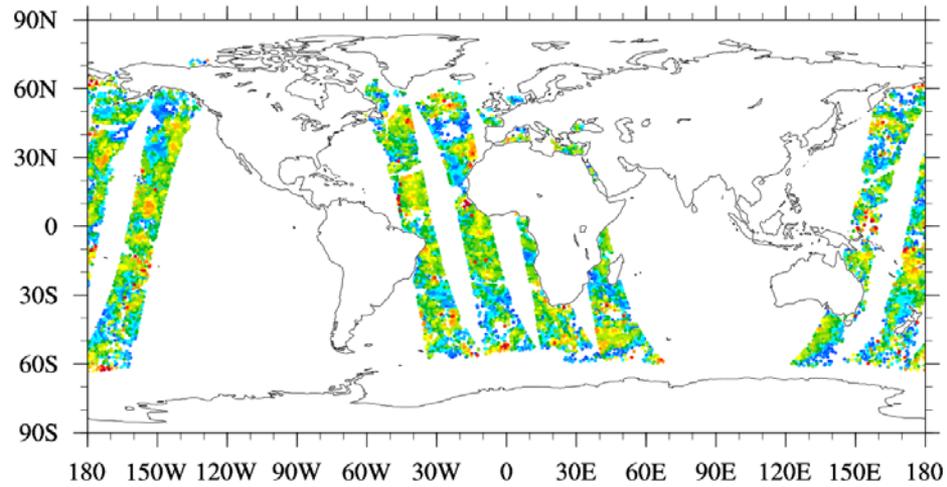
Density plot of OSCAT (90S,20S)



Density plots of assimilated obs from *loop 1*

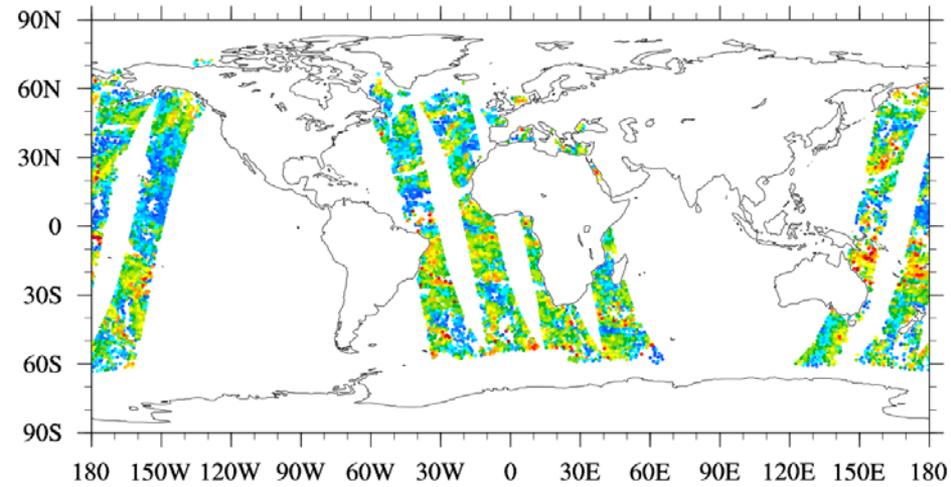
## O-B U departure

OSCAT Wind U/V bias 2012062500



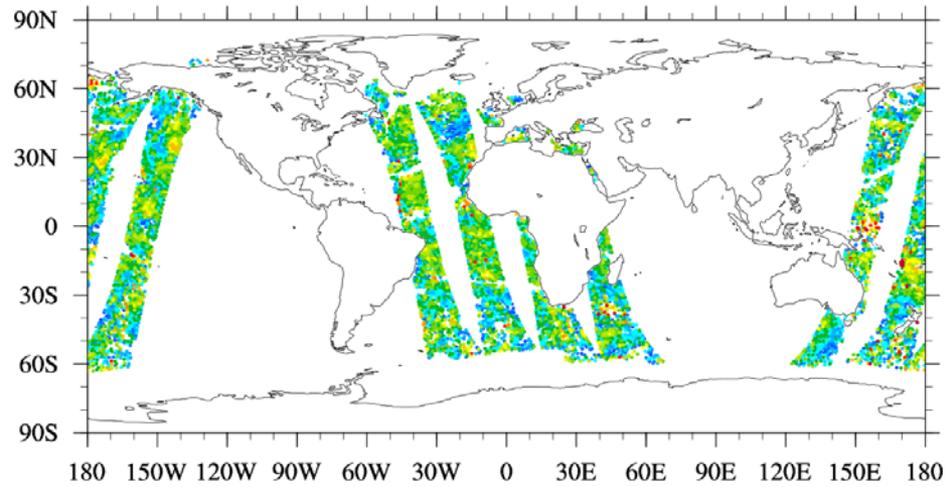
## O-B V departure

OSCAT Wind U/V bias 2012062500



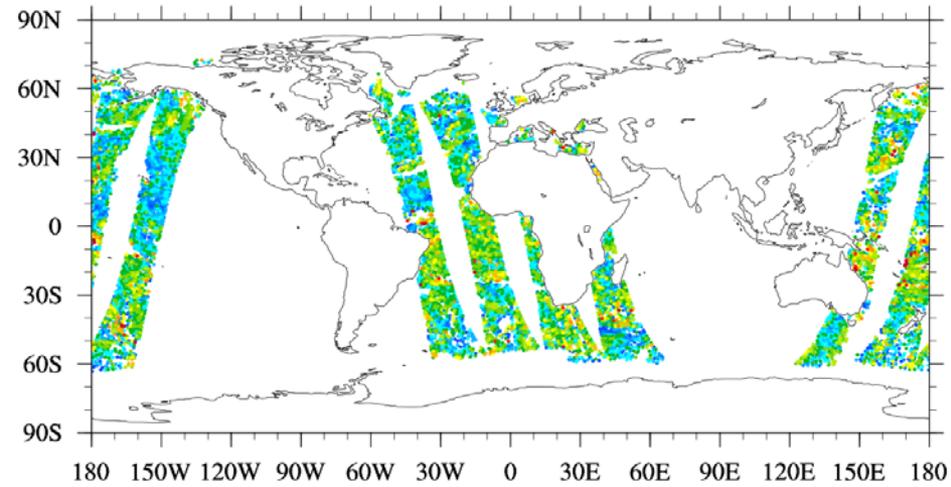
## O-A U departure

OSCAT Wind U/V bias 2012062500



## O-A V departure

OSCAT Wind U/V bias 2012062500

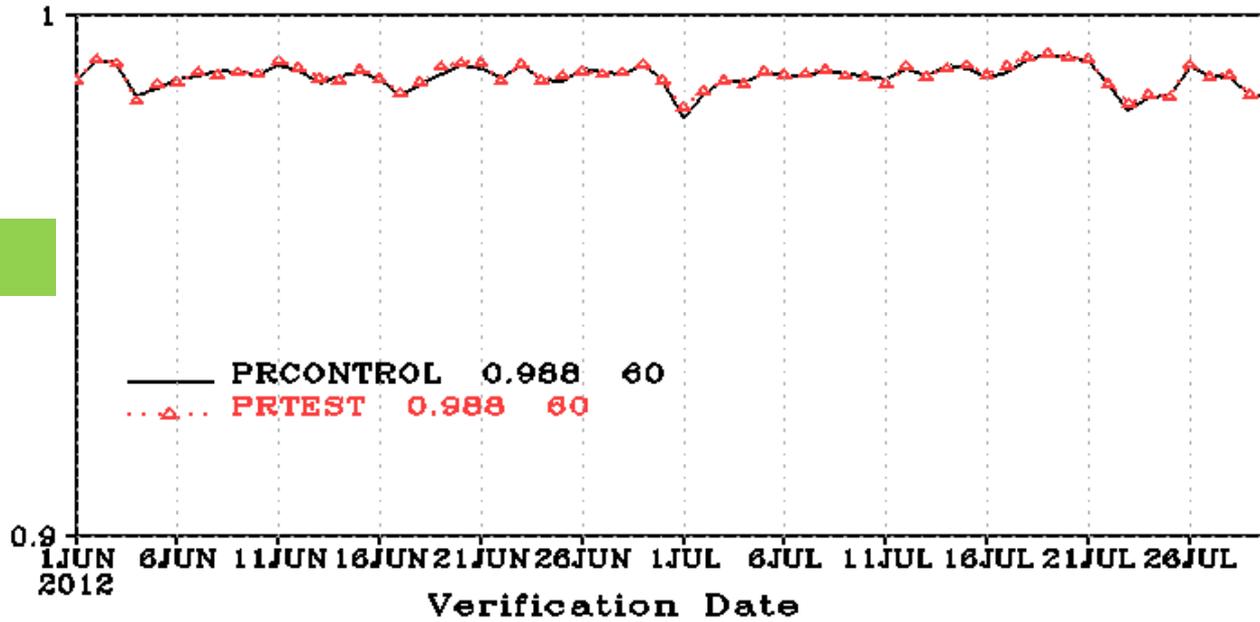


# Verification Stats

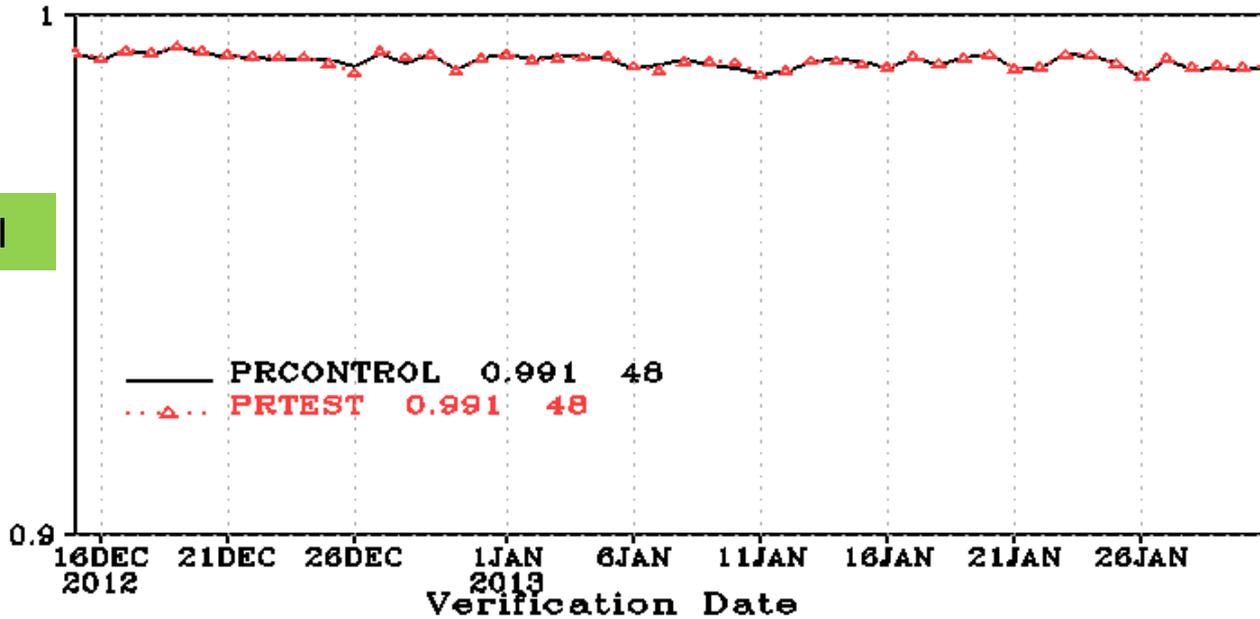
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- AC daily score and die off curve for both seasons.
- RMSE mean for both seasons.
- Forecast differences between control and experiment.
- RMS differences for surface fields.

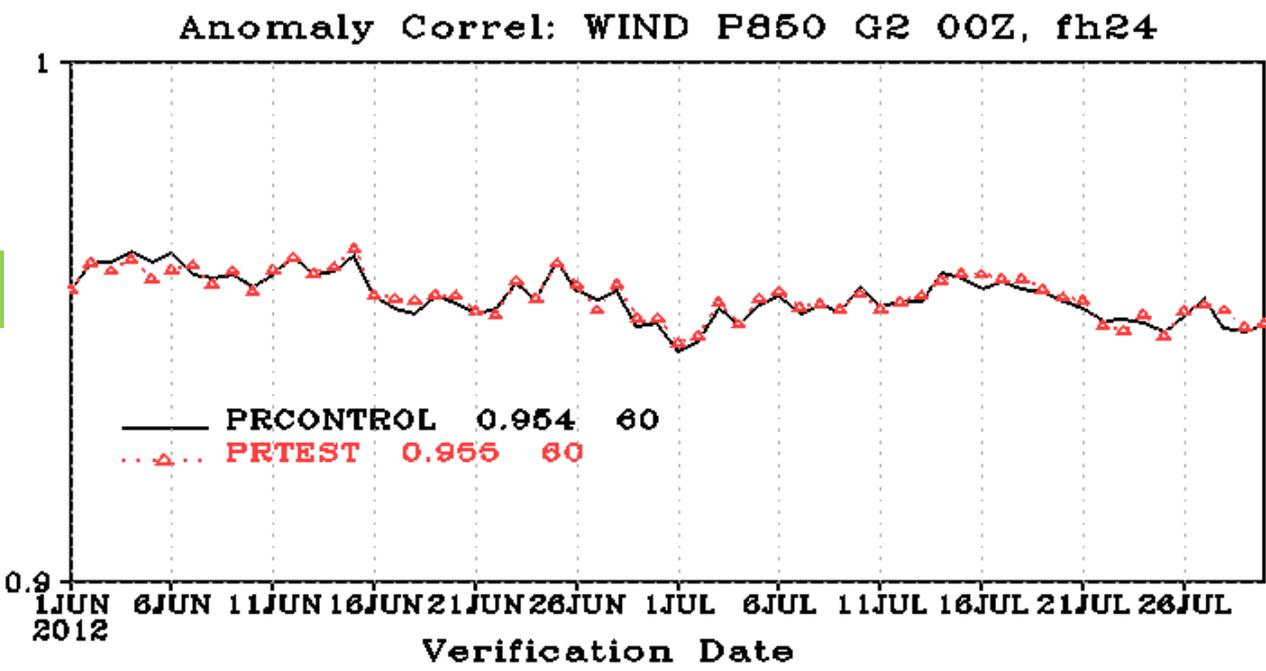
Anomaly Correl: HGT P1000 G2 00Z, fh24



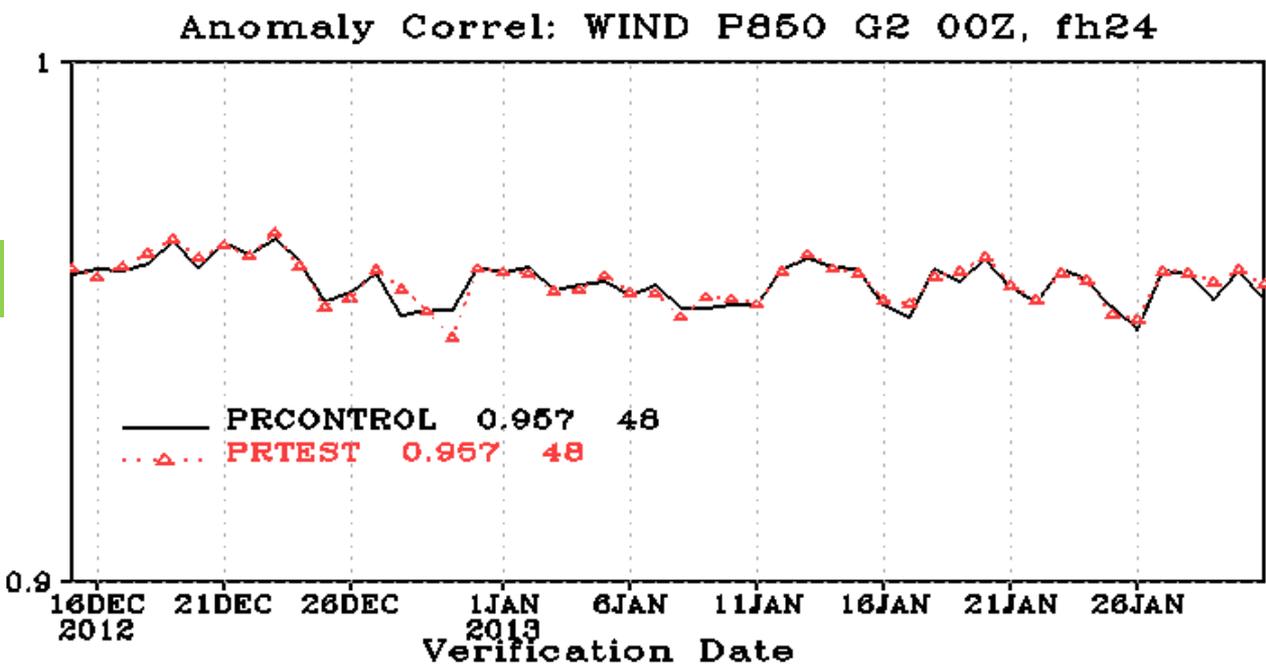
Anomaly Correl: HGT P1000 G2 00Z, fh24



Season I

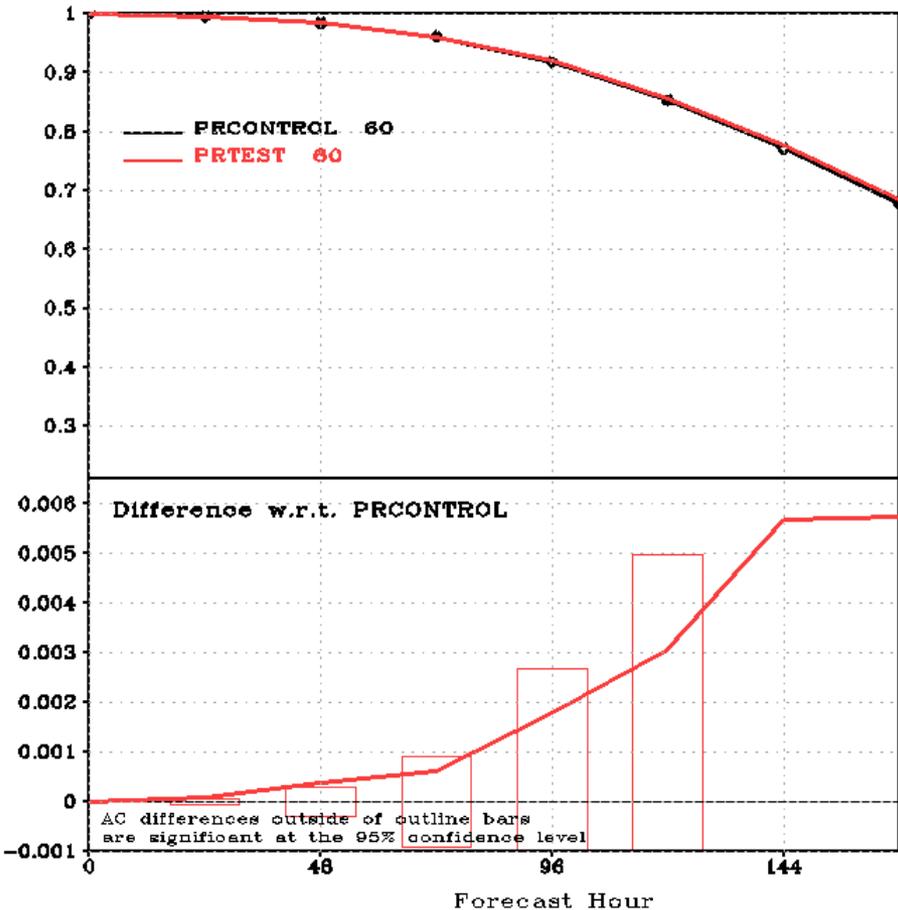


Season II



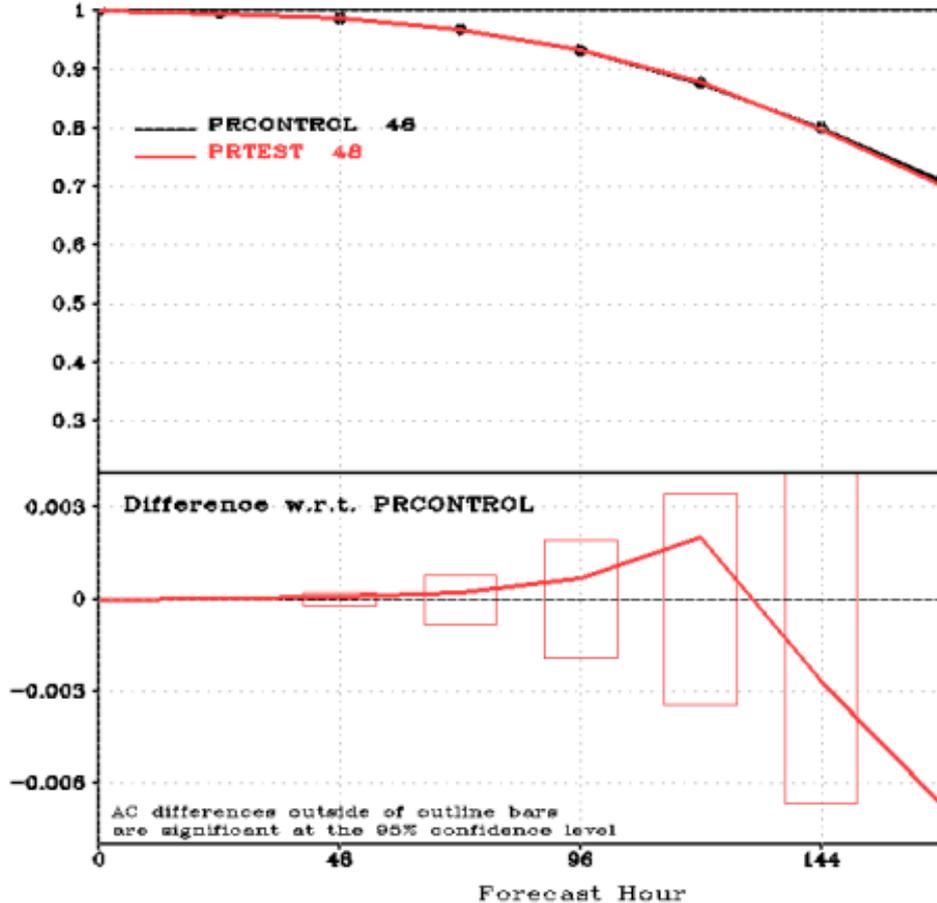
## Season I

AC: HGT P500 G2 00Z, 20120601-20120730



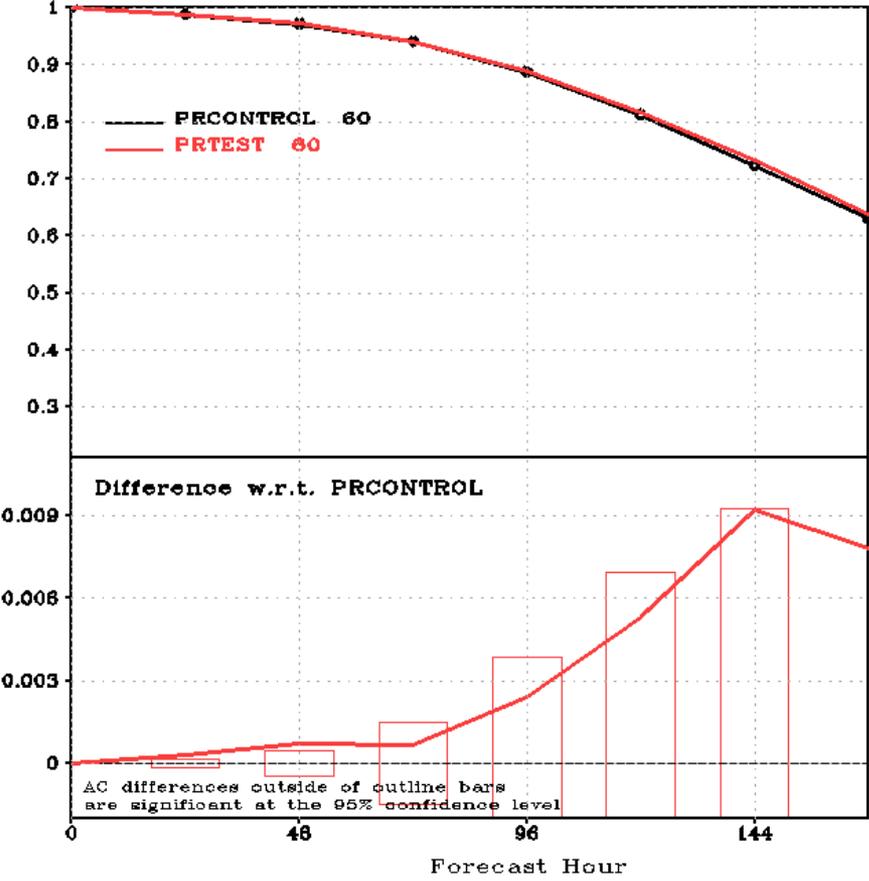
## Season II

AC: HGT P500 G2 00Z, 20121215-20130131



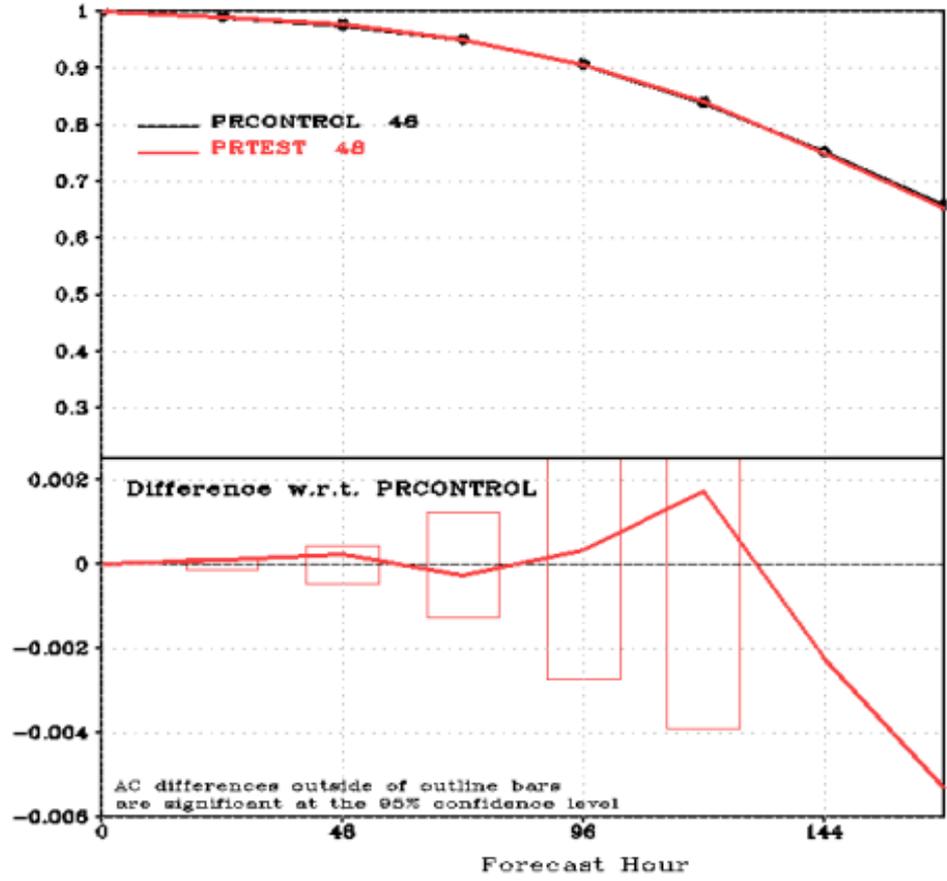
## Season I

AC: HGT P1000 G2 00Z, 20120601-20120730



## Season II

AC: HGT P1000 G2 00Z, 20121215-20130131

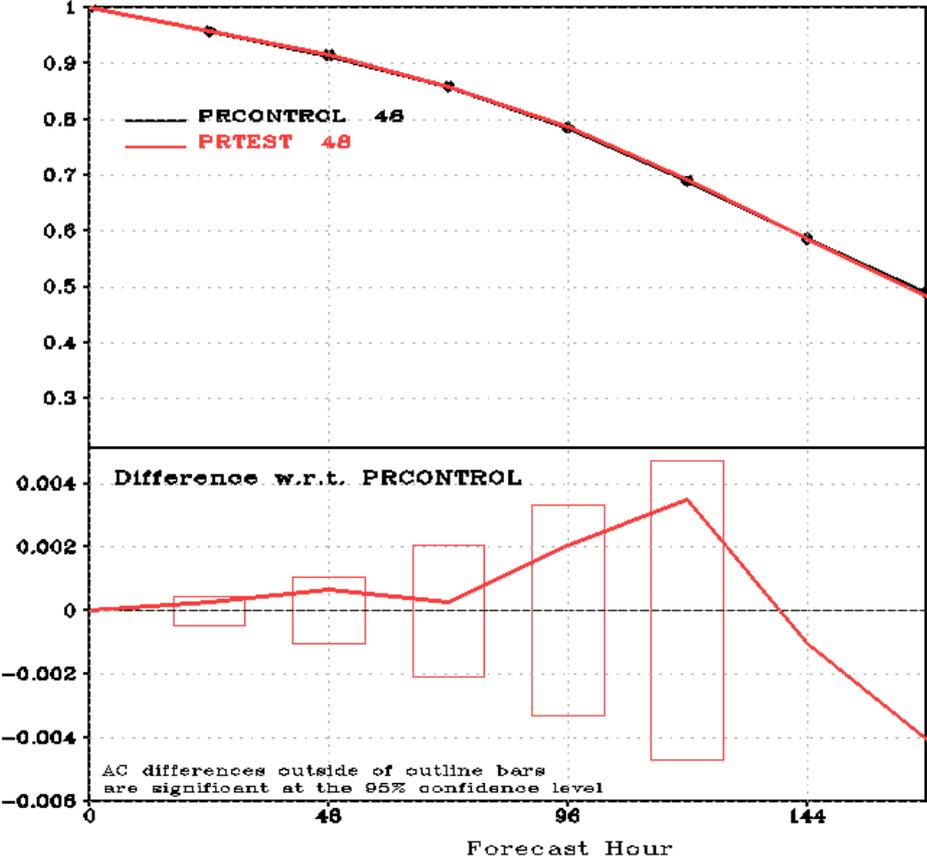
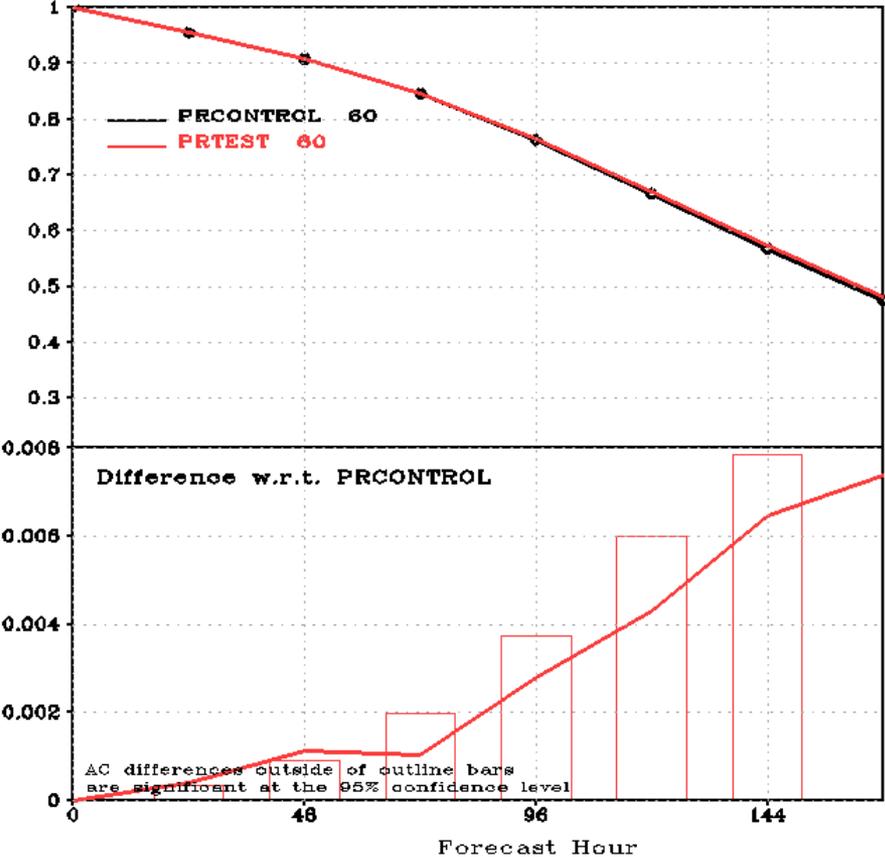


# Season I

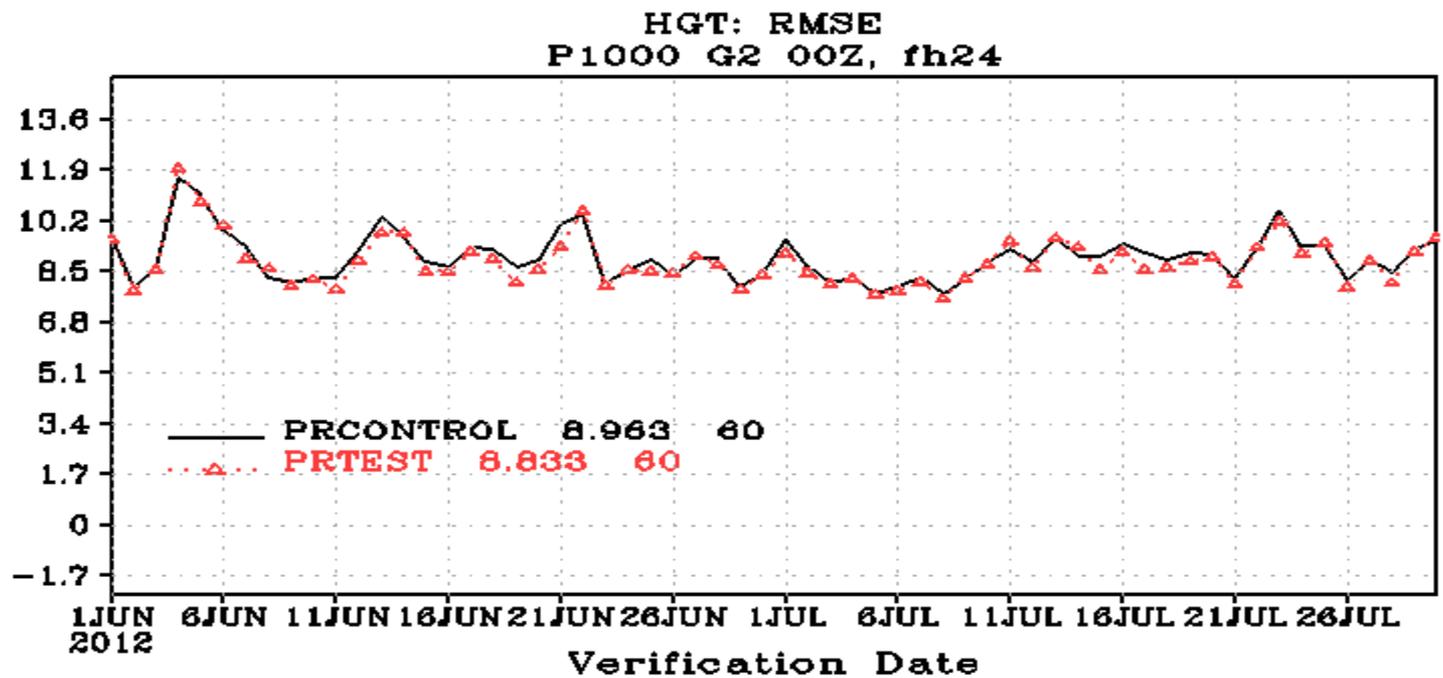
# Season II

AC: WIND P850 G2 00Z, 20120601-20120730

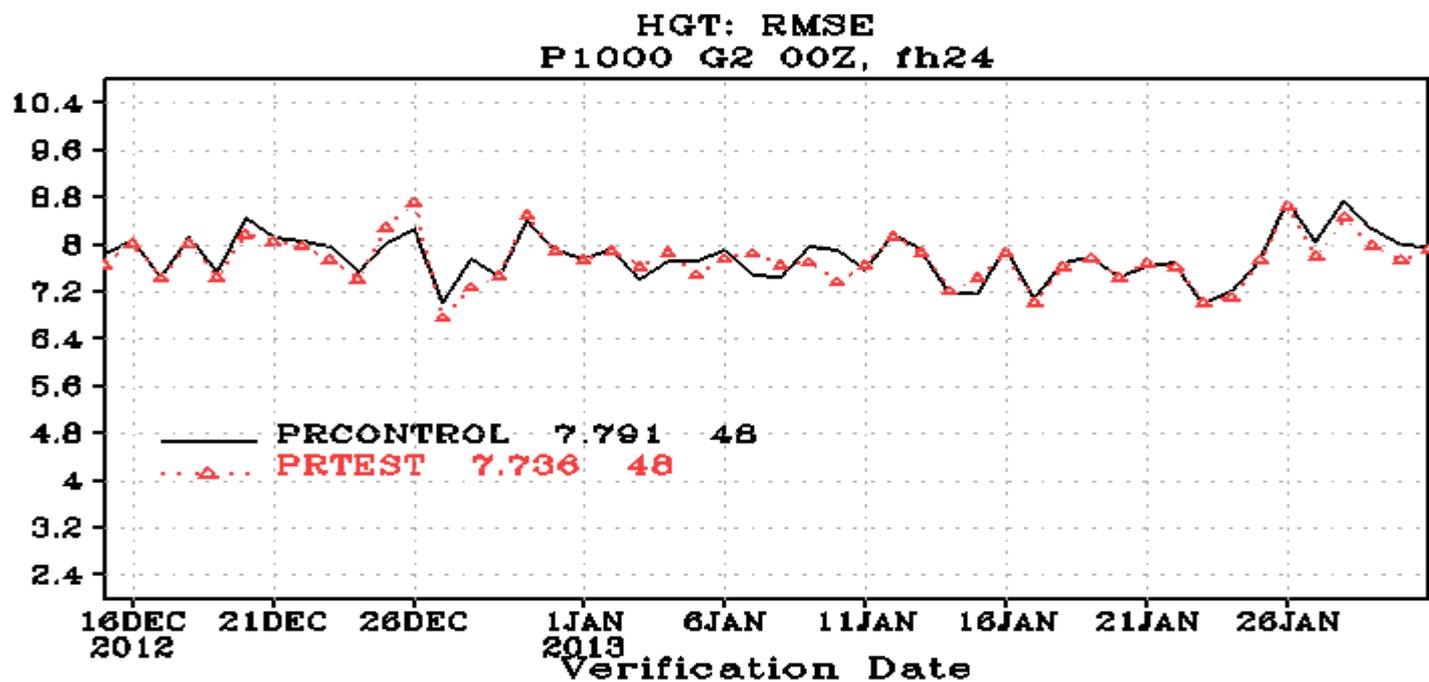
AC: WIND P850 G2 00Z, 20121215-20130131



Season I

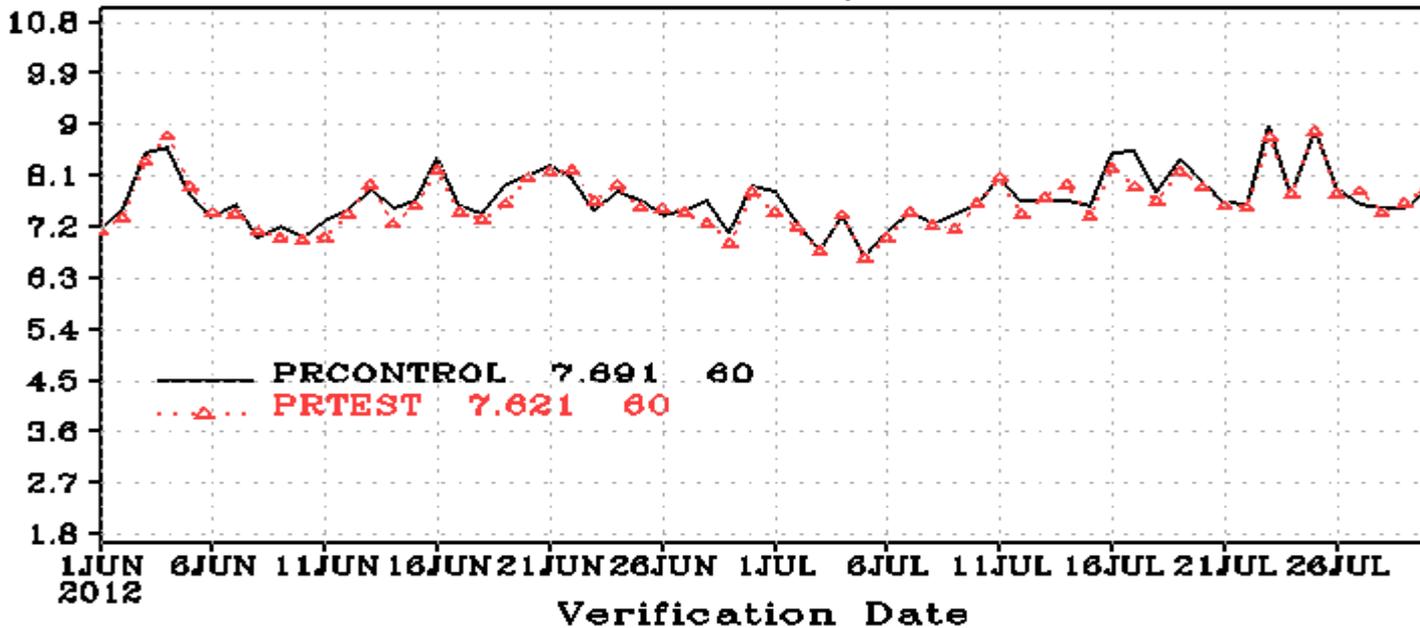


Season II



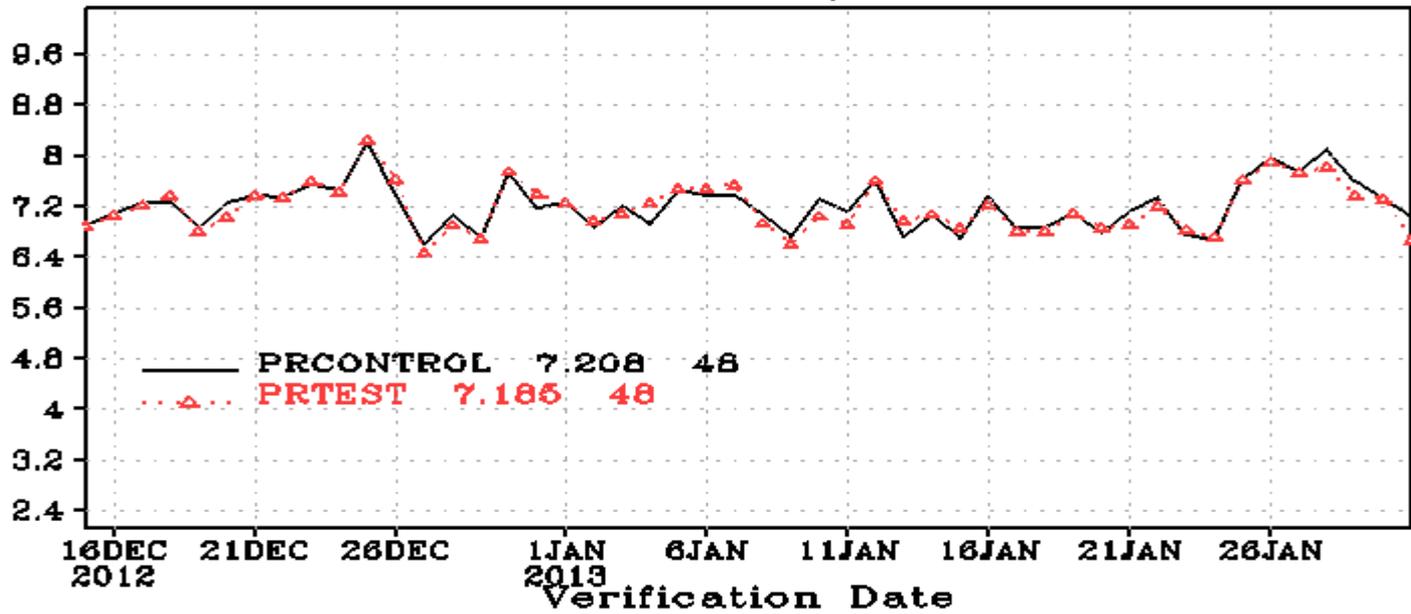
HGT: RMSE  
P500 G2 00Z, fh24

Season I



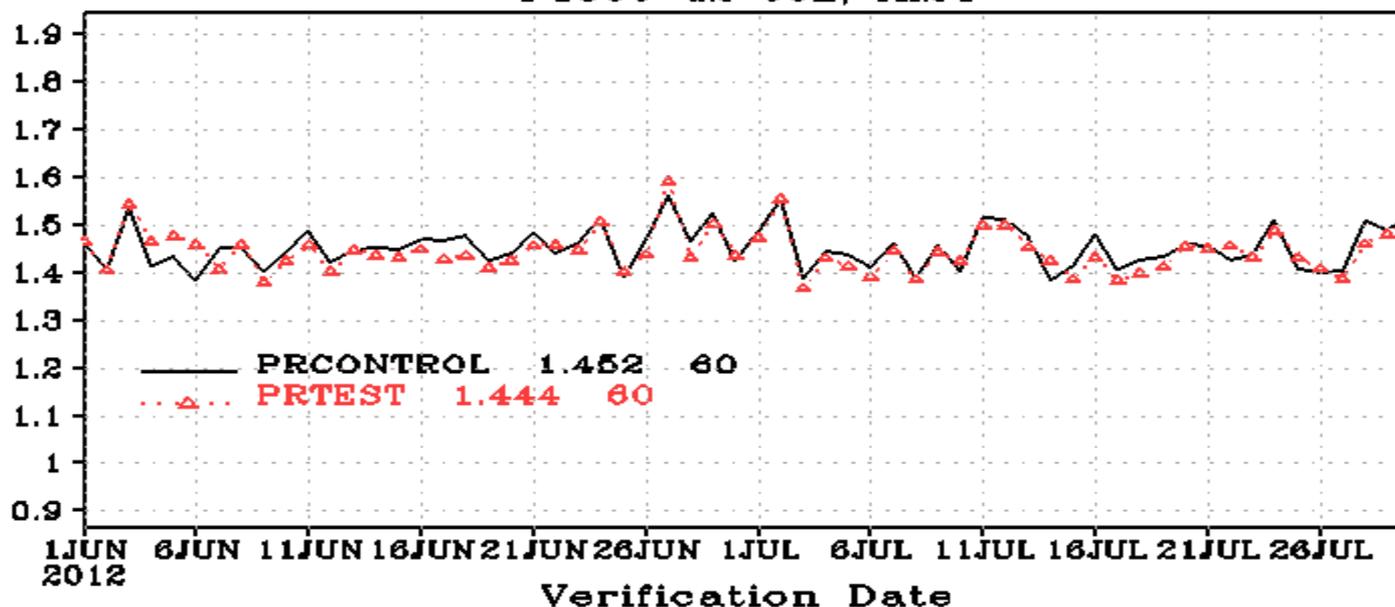
Season II

HGT: RMSE  
P500 G2 00Z, fh24



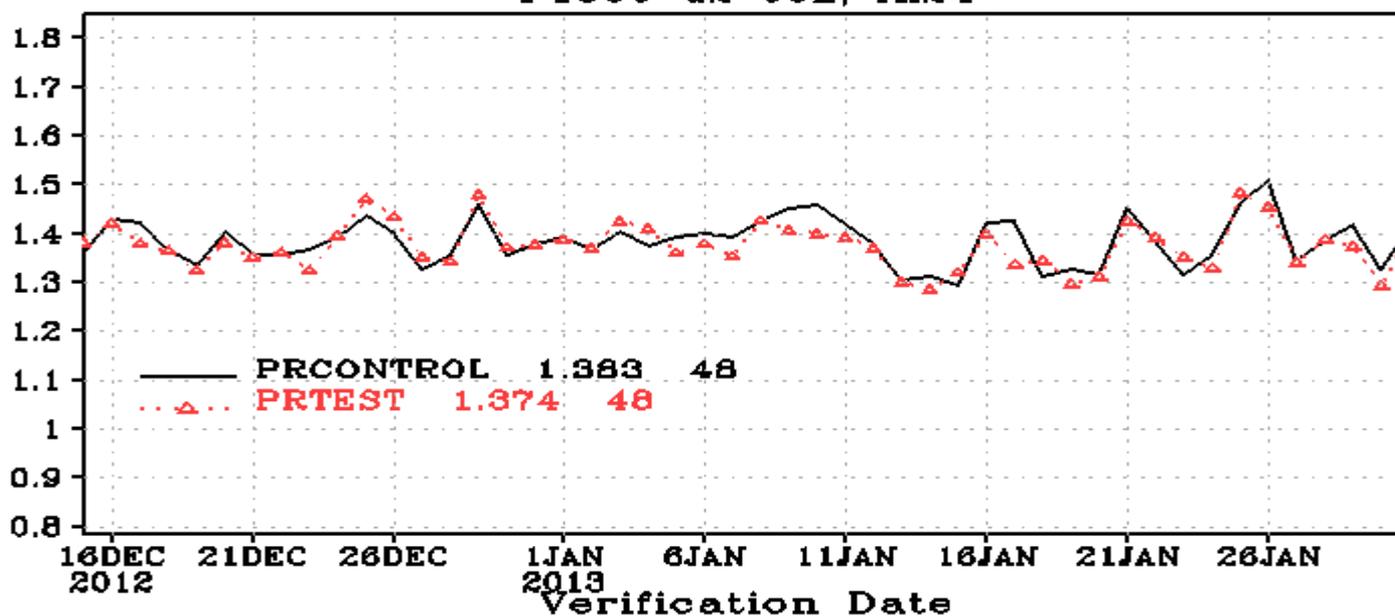
U: RMSE  
P1000 G2 00Z, fh24

Season I



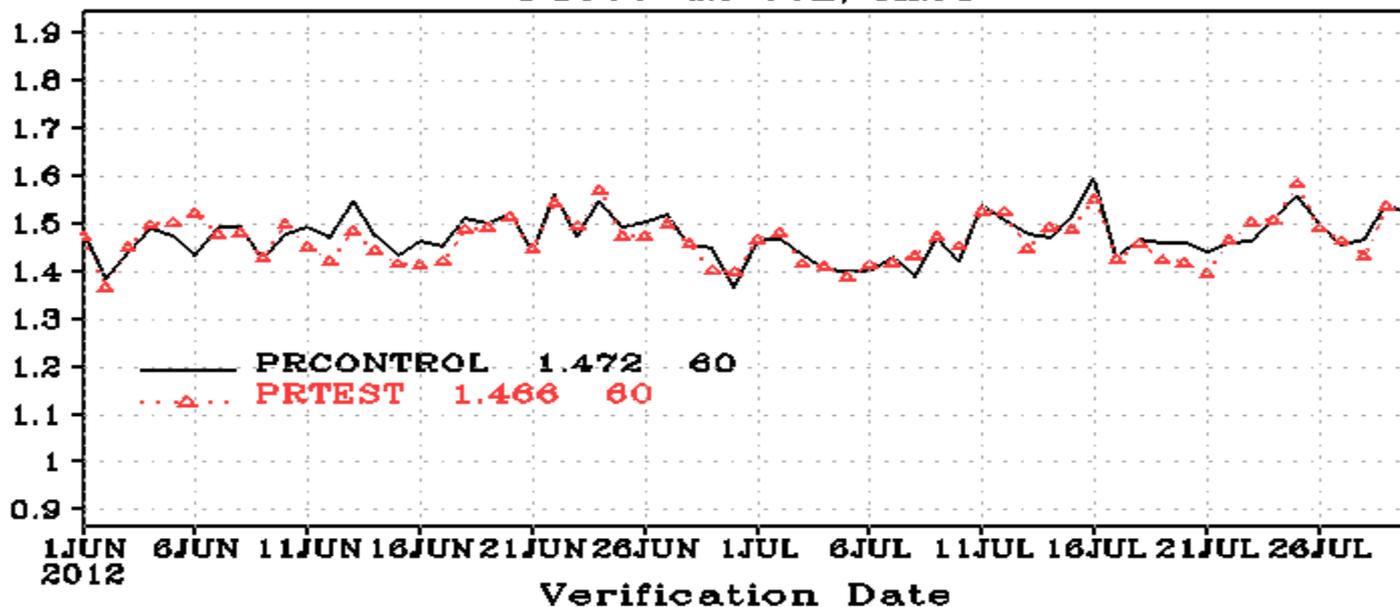
Season II

U: RMSE  
P1000 G2 00Z, fh24

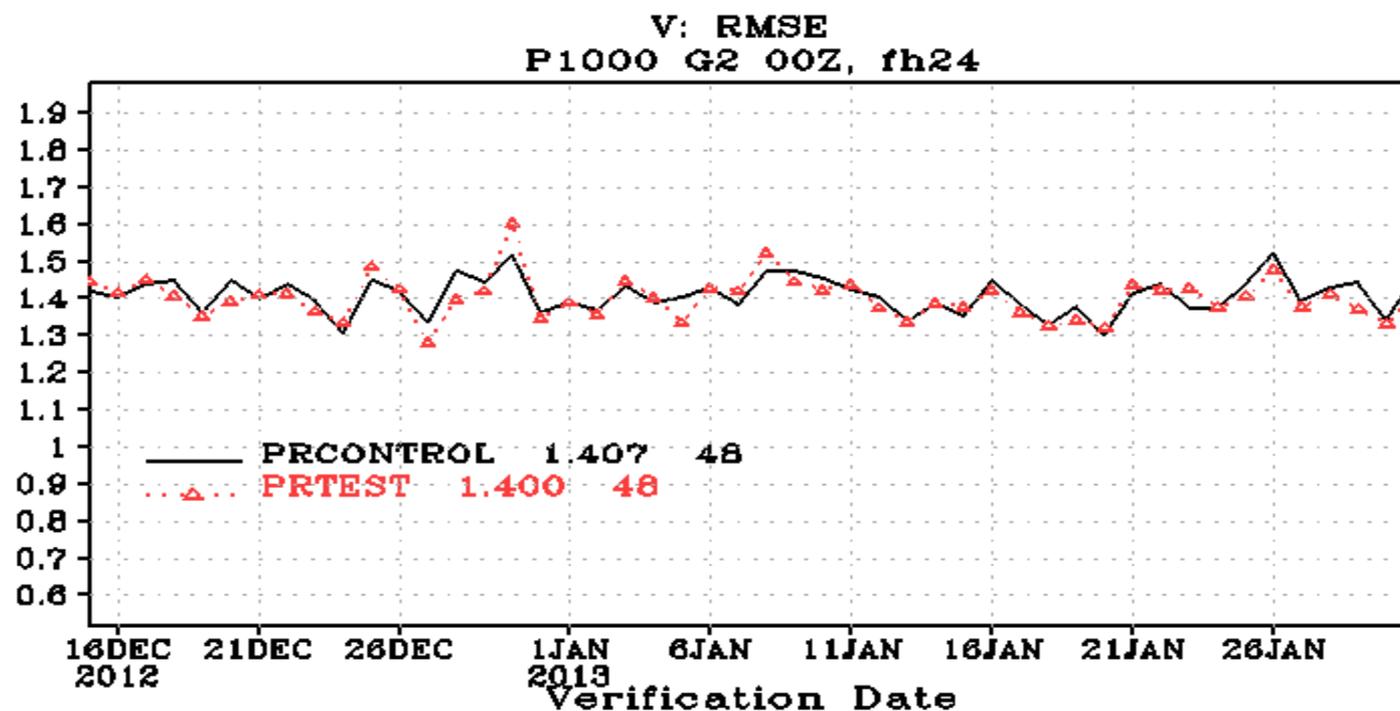


V: RMSE  
P1000 G2 00Z, fh24

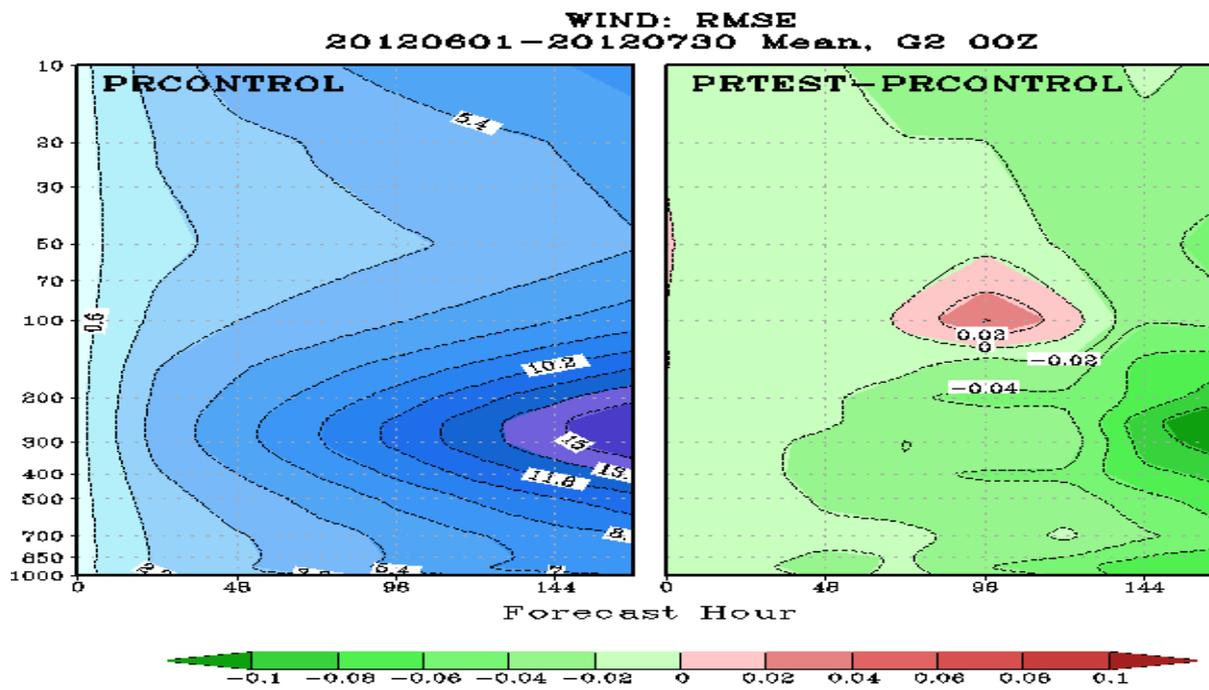
Season I



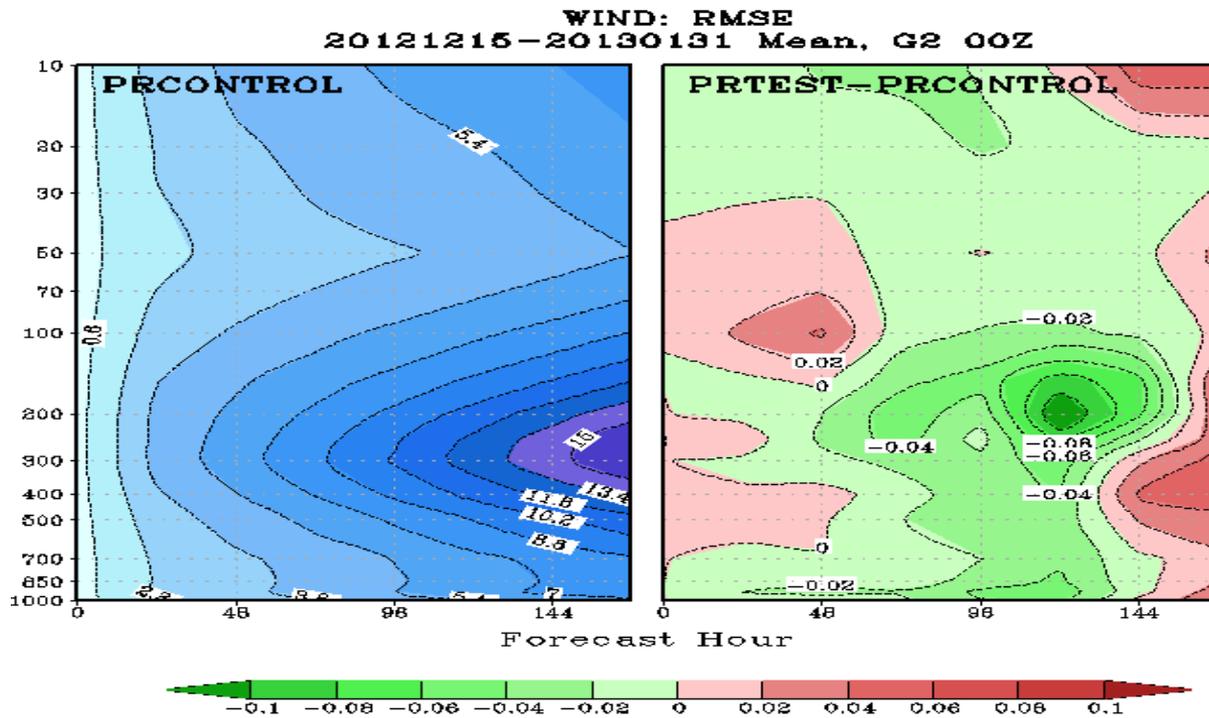
Season II



Season I



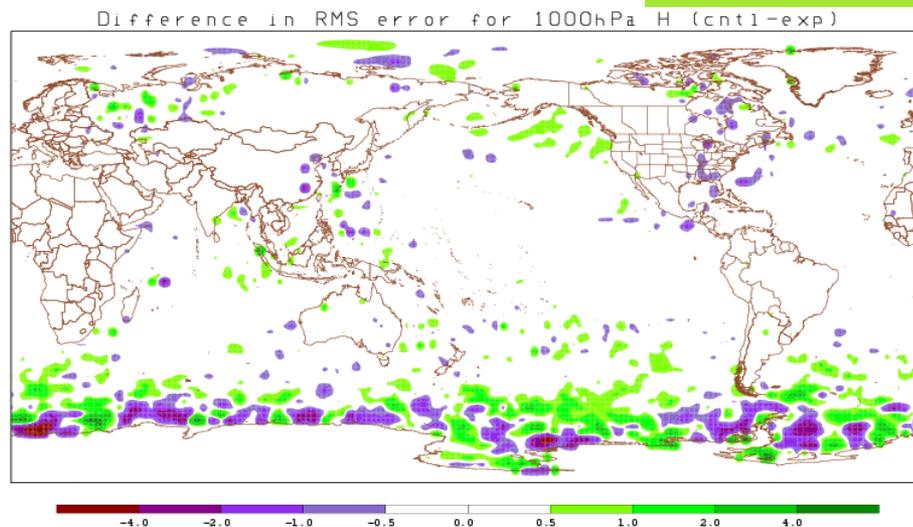
Season II



# RMS Difference (control – OSCAT exp) for 1000hPa H

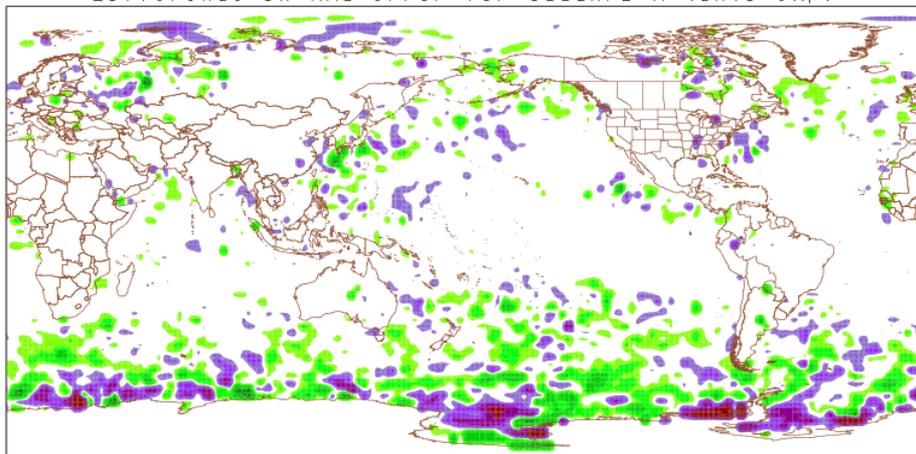
12hr fcst

- **Model Resolution:** T574 (~35km); 64 levels
- **DA system:** Hybrid-Ensemble and an analysis resolution of T574 (~35km)
- **Period:** 15 May – 30 July 2012 f48 forecast - Analysis
- **Experiments:** Cntl (operation full observing system) vs. Exp (Cntl + OSCAT)



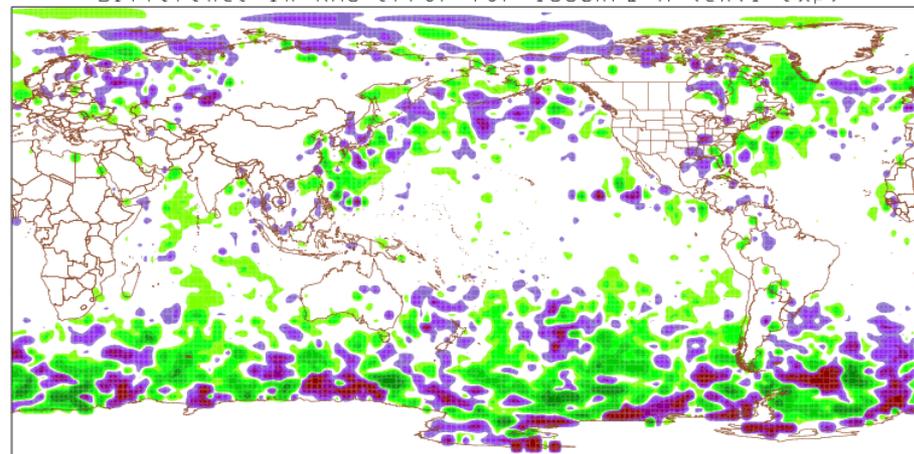
24hr fcst

Difference in RMS error for 1000hPa H (cntl-exp)



48hr fcst

Difference in RMS error for 1000hPa H (cntl-exp)

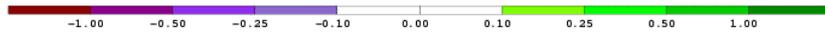
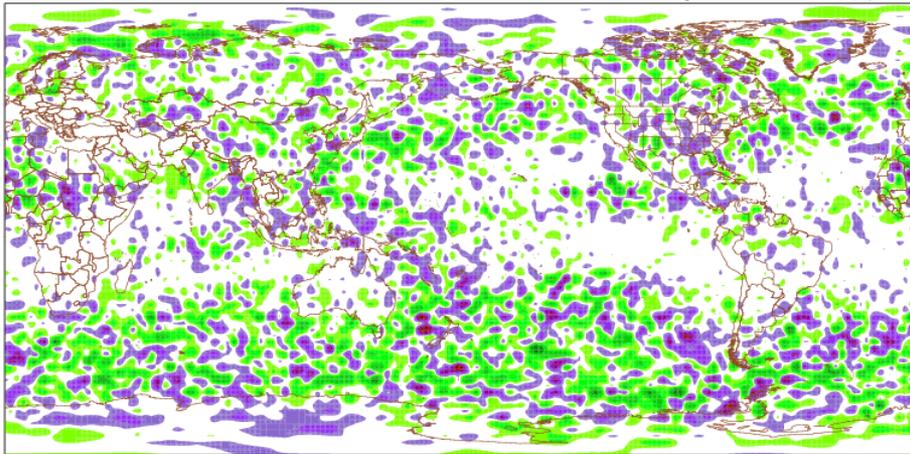


← Scat bad → Scat good →

# RMS Difference (control – OSCAT exp) for U and V

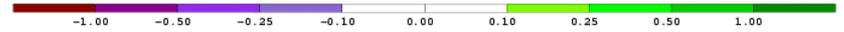
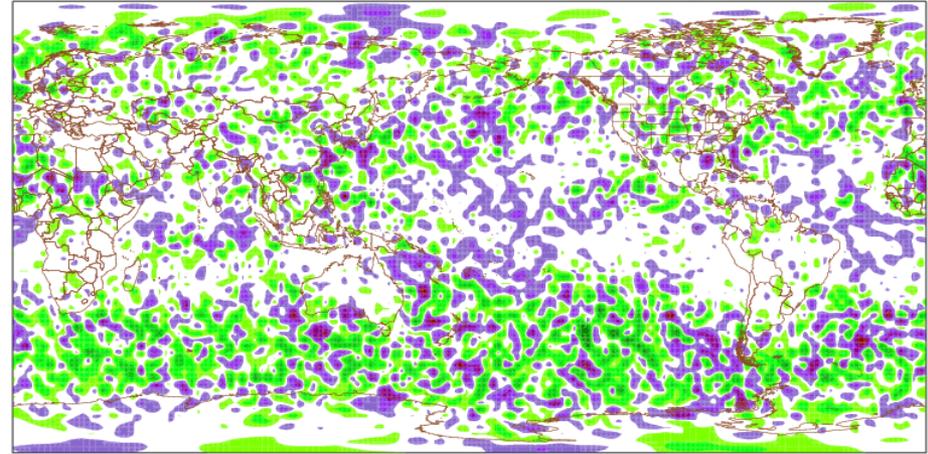
48hr fcst - analysis

Difference in RMS error for UGRD 0.9950 sigma (cnt1-exp)



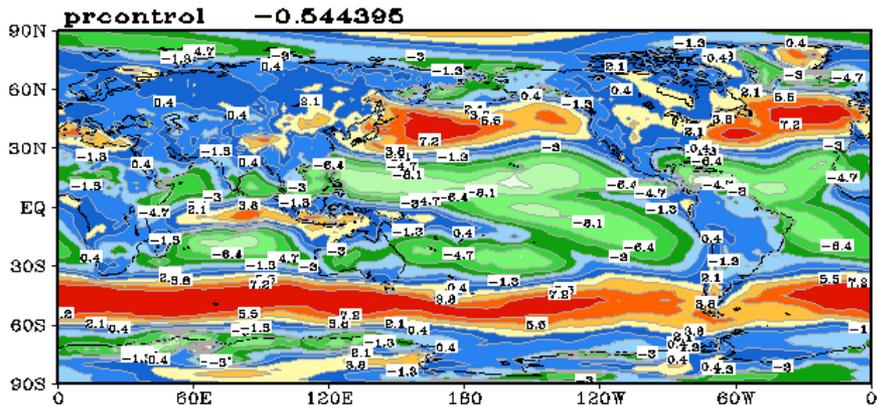
0.9950 sigma UGRD

Difference in RMS error for VGRD 0.9950 sigma (cnt1-exp)

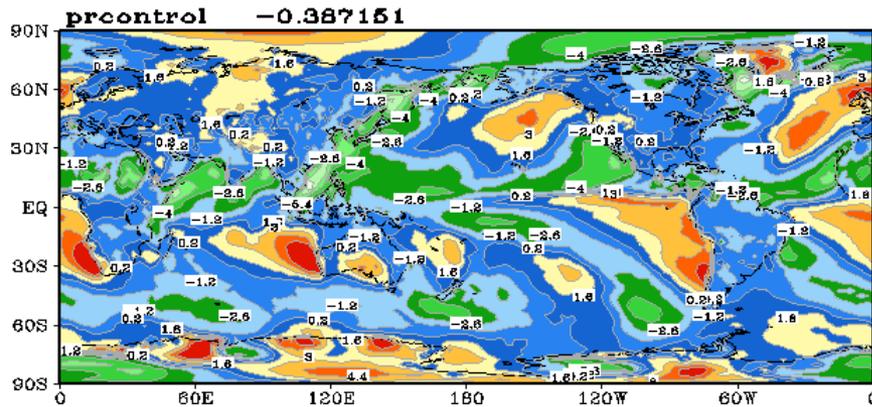


0.9950 sigma VGRD

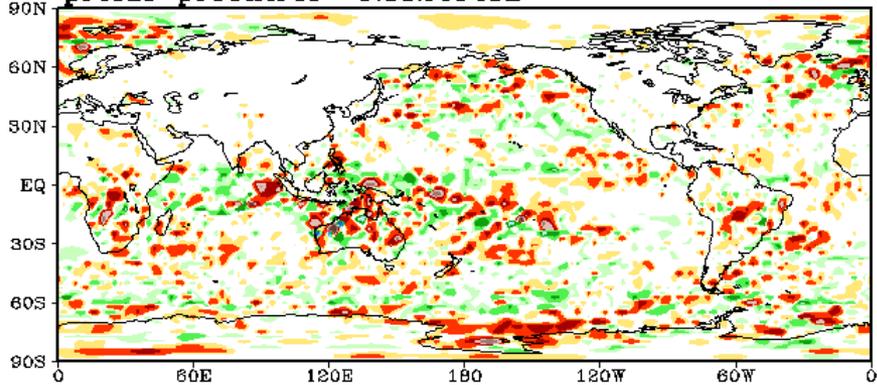
$s=.995$  U Wind [m/s], 00Z-Cyc 15Dec2012-28Jan2013 Mean  
(f06 f12 f18 f24) Post-Hour Average



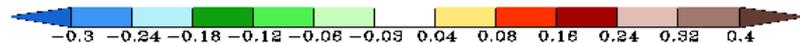
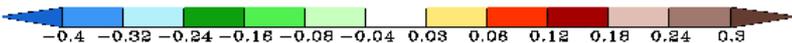
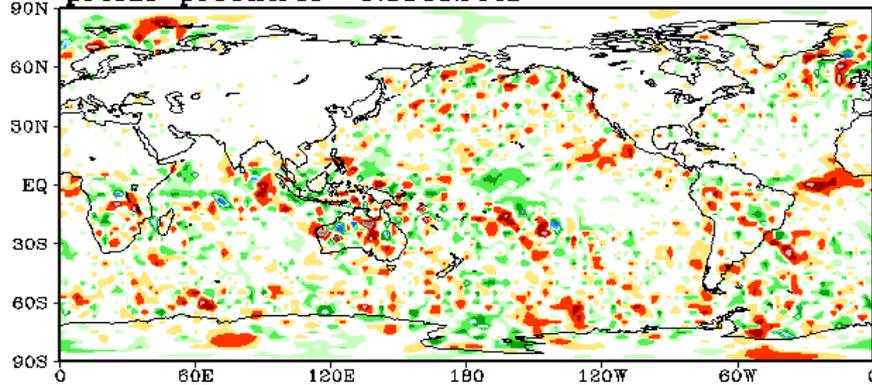
$s=.995$  V Wind [m/s], 00Z-Cyc 15Dec2012-28Jan2013 Mean  
(f06 f12 f18 f24) Post-Hour Average



**prtest-precontrol -0.00248408**



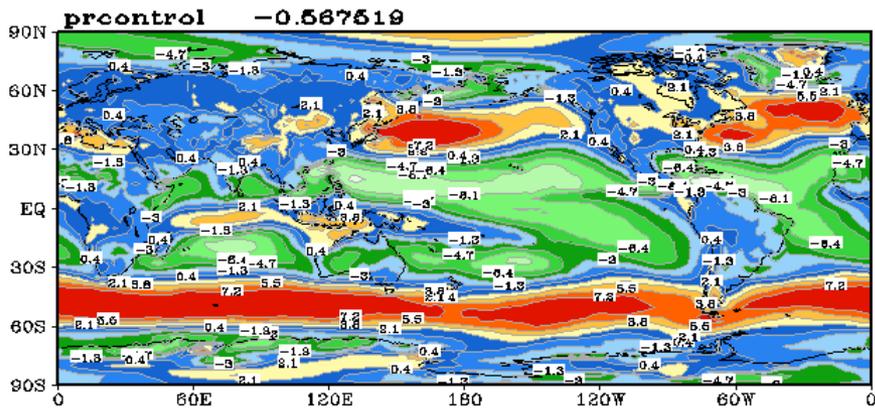
**prtest-precontrol -0.00102445**



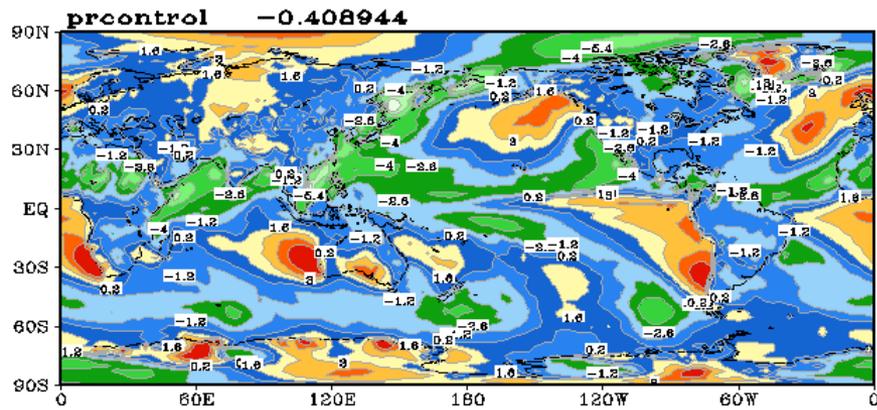
**f24 fcst difference for 0.9950 u**

**f24 fcst difference for 0.9950 v**

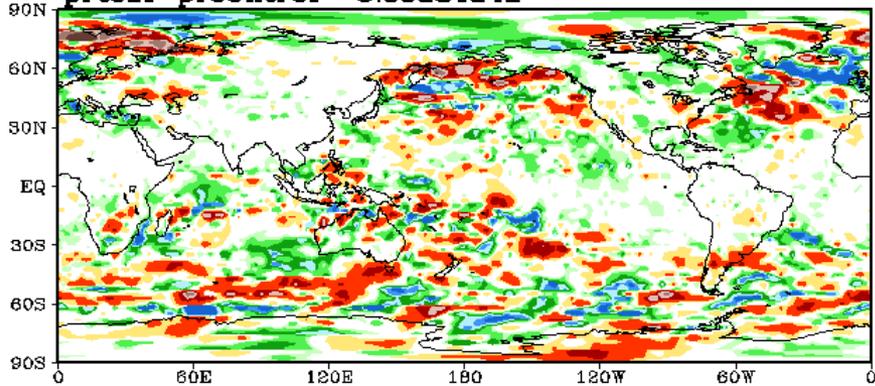
$s=.996$  U Wind [m/s], 00Z-Cyc 15Dec2012-28Jan2013 Mean  
(f102 f108 f114 f120) Post-Hour Average



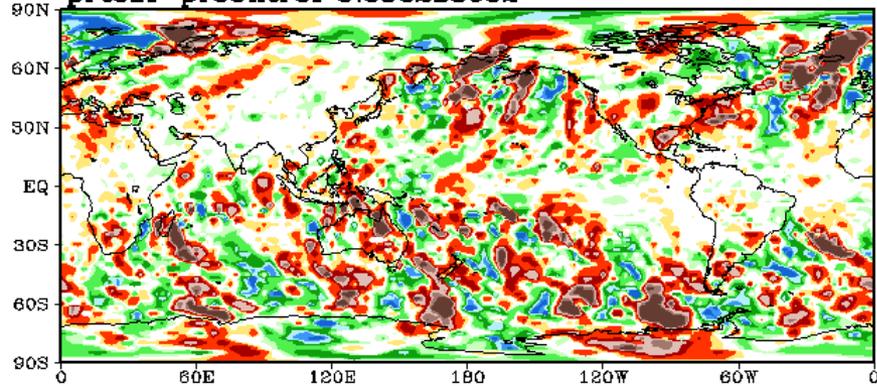
$s=.996$  V Wind [m/s], 00Z-Cyc 15Dec2012-28Jan2013 Mean  
(f102 f108 f114 f120) Post-Hour Average



**prtest-precontrol -0.00831848**



**prtest-precontrol 0.00285902**



**f120 fcst difference for 0.9950 u**

**f120 fcst difference for 0.9950 v**

# Summary and Next Step

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- OSCAT is currently in transition for use in the NCEP GFS.
- Working with NCEP on QC and impacts for OSCAT assimilation in the NMM and HWRF.
- Results from two-season OSCAT assimilation in GSI show slight positive/neutral impacts.
- Current QC methods for OSCAT assimilation work well from the diagnosis stats.
- OSCAT performance is compliment to that of existing ASCAT winds.
- Look at hurricane stats for summer season.