

**Developing Assimilation Techniques
For Atmospheric Motion Vectors
Derived via a New Nested Tracking
Algorithm Derived for the GOES-R Advanced
Baseline Imager (ABI)**

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Project Summary



Investigate and assess the quality of Atmospheric Motion Vectors (AMVs) derived from the new nested tracking algorithm developed for the GOES-R ABI with respect to the National Center for Environmental Prediction (NCEP) Global Forecast System (GFS). *Assess the impact* of these AMVs on the accuracy of GFS forecasts.

- **Goals**

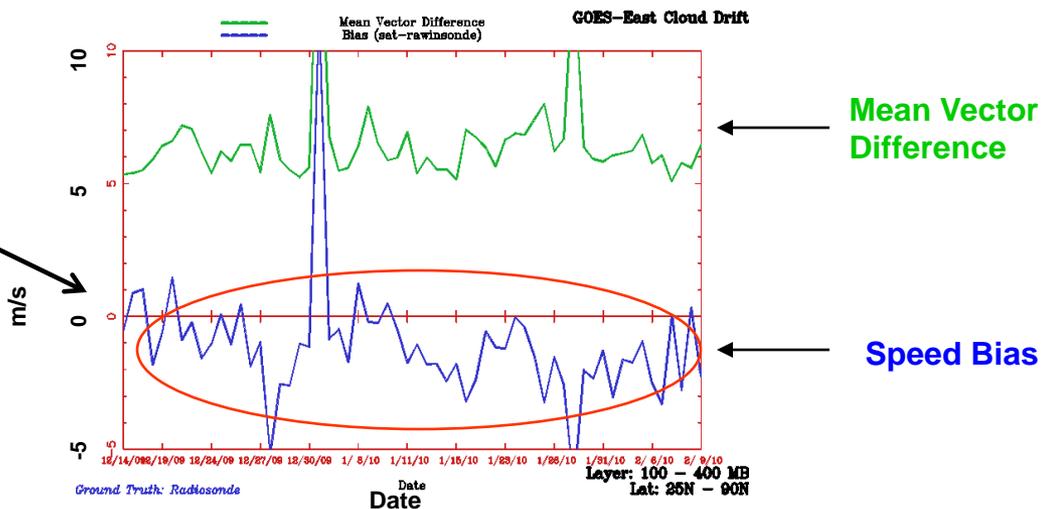
- Develop new assimilation techniques for AMVs derived using the Nested Tracking Algorithm developed for GOES-R ABI
- Support transition of these new assimilation techniques into NCEP operations
- Prepare NCEP for GOES-R AMVs



Recalling the GOES-R Nested Tracking Winds Algorithm



GOES-12 Satwinds vs. Rawinsonde (100-400 hPa)

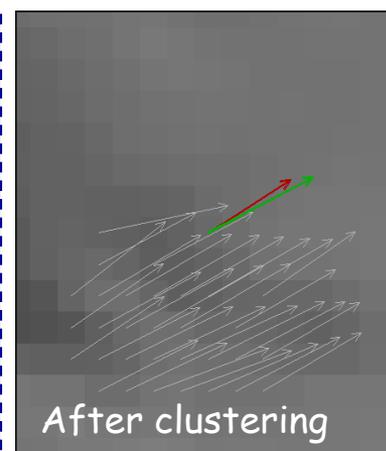
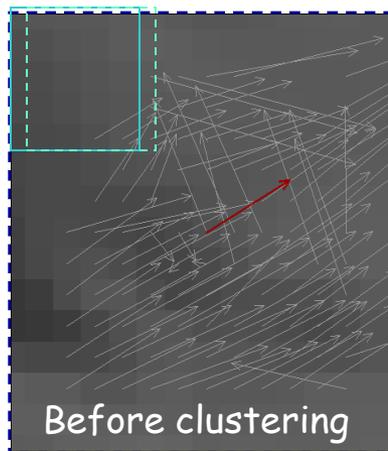


- Designed to minimize observed slow speed bias of satellite winds using heritage winds algorithm; a significant concern for NWP

- NCEP, ECMWF, MetOffice all employ asymmetric error checks for GEO winds.

- Reject satwind observations that are in the slow tail of the O-B distribution
- The winds have to create problems for them to purposely use a non-normal distribution.

Nested Tracking

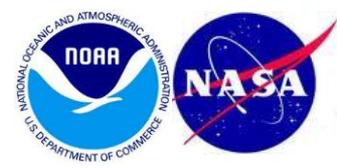


Motion of entire box
SPD: 22.3 m/s

Average of largest cluster
SPD: 27.6 m/s



Overview of Approach



- Compare GOES-R proxy AMVs to NCEP GFS Global Analysis to develop quality control measures
- Assess impact of the Nested Tracking Algorithm AMVs on the NCEP GFS assimilation and forecast
- Exercise GOES-R proxy AMVs from creation to assimilation within an operational NCEP GFS simulation



Summary of Planned Work



- Evaluation of proxy GOES-R ABI AMVs for 2 different seasons (summer/winter)
 - Evaluate Obs-GFS background statistics (O-B)
- Investigate/develop quality control procedures

YEAR 1

-
- Assimilate AMVs for 2 seasonal GFS runs
 - Control (no AMVs); Test (with proxy GOES-R AMVs)
 - Retrospective; no operational time constraints
 - Develop new winds BUFR table to accommodate new AMV information

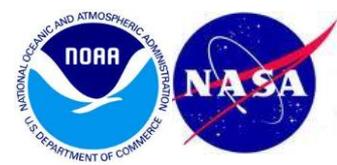
YEAR 2

-
- Assimilate AMVs for 2 seasonal GFS runs
 - Control (Heritage algorithm AMVs); Test (GOES-R proxy AMVs)
 - Near real-time; with operational time constraints

YEAR 3



Accomplishments to Date (*Year 1*)



- Accessed Meteosat-9/SEVIRI winds by AWG winds team (*Proxy GOES-R AMVs*)
 - Visible, SWIR, WV, and LWIR winds
- Completed ~10 day simulations in July and Dec 2011
 - Using NCEP GFS Data Assimilation System on S4 Computer System at Univ. Wisconsin
 - Passive monitoring of proxy GOES-R AMVs
 - **Analyzing Observation – Background (O-B) Statistics**
 - Examining O-B dependence on algorithm parameters as well as traditional metrics to develop appropriate quality control measures



Accomplishments to Date *(Year 1)*



Presenting on following slides:

- Two season Obs – GFS Background (O-B) metrics for the GOES-R Proxy AMVs (*Met-9/SEVIRI AMVs derived from the 10.8um band*)
- Preliminary evaluation of QC parameters



AMV Locations

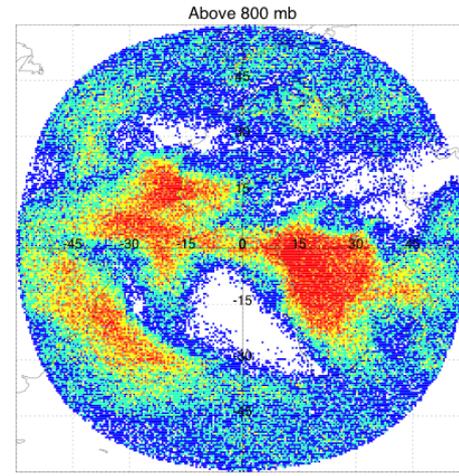
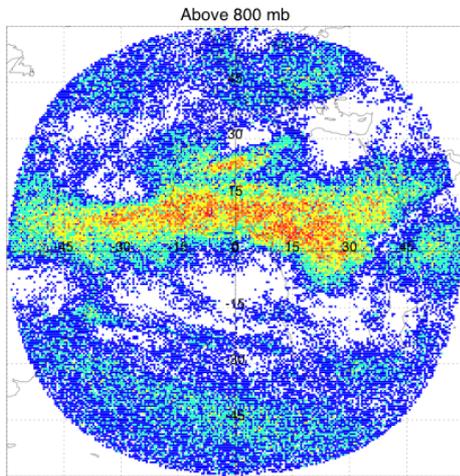


GOES-R Proxy AMVs Derived Using Met-9 10.8um Band

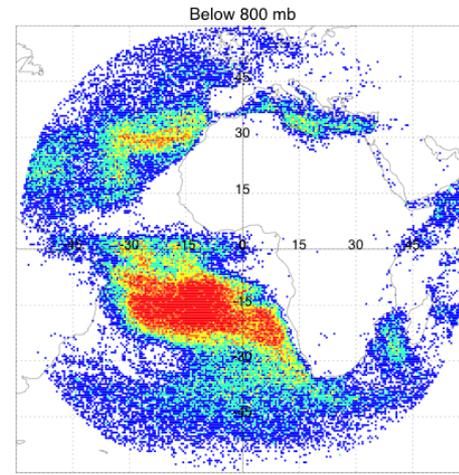
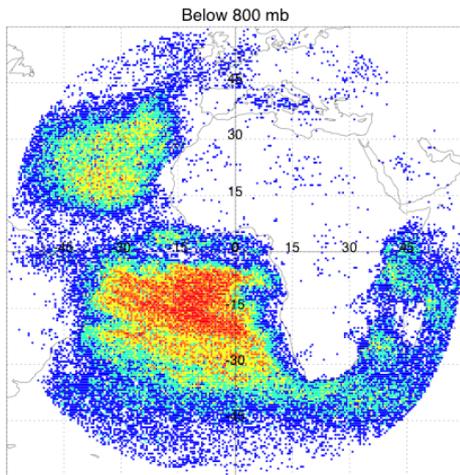
July 2011

Dec 2011

Above
800 hPa



Below
800 hPa



Total Number: 364,618

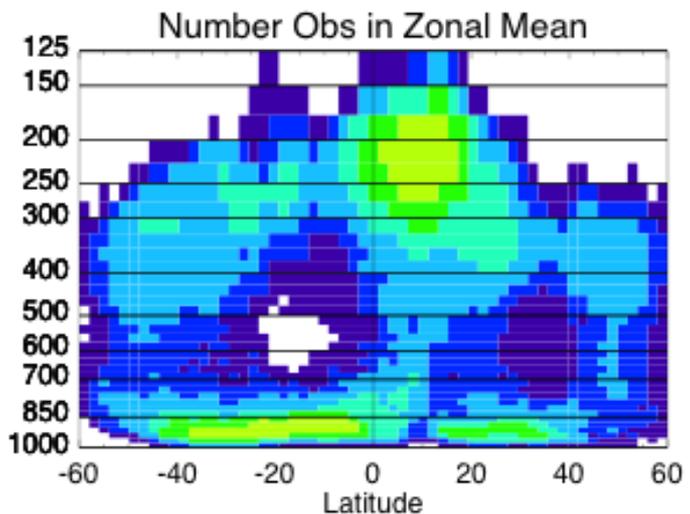
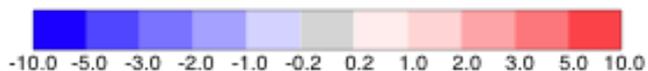
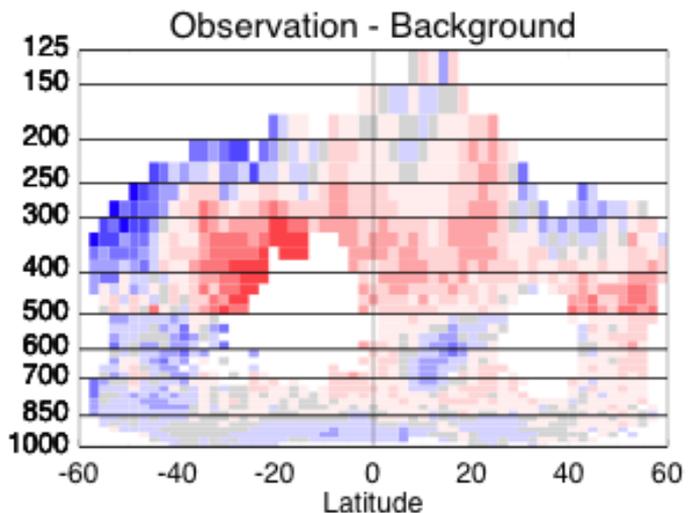
Total Number: 479,431



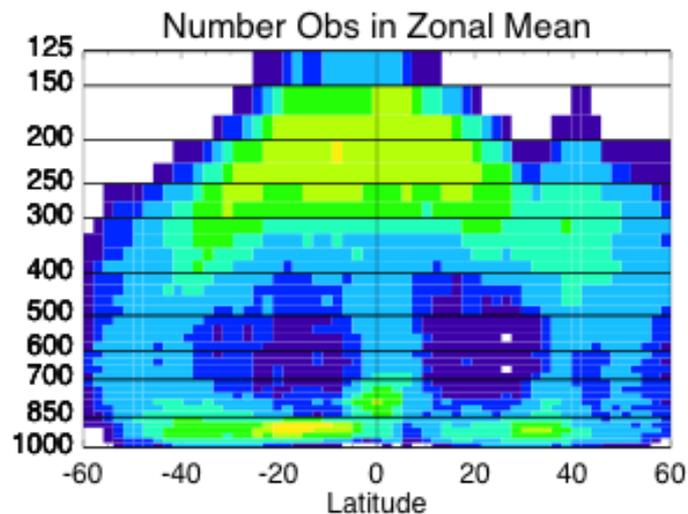
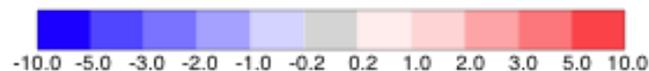
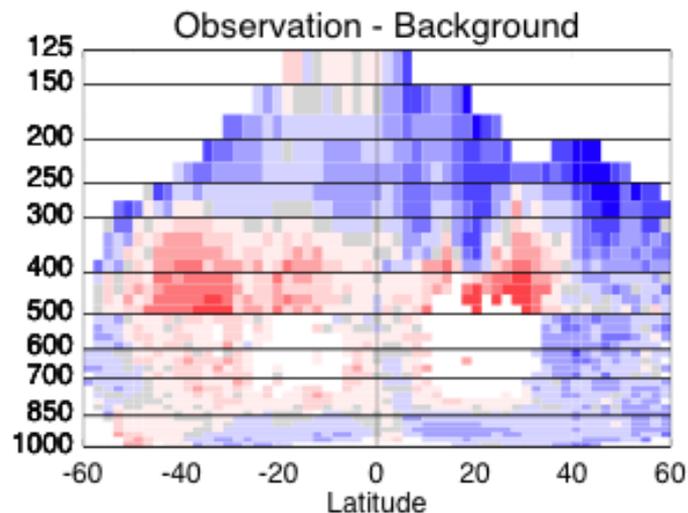
O-B Zonal Mean Speed (m/s)



July
2011

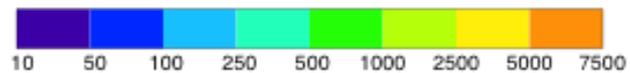
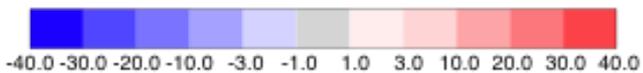
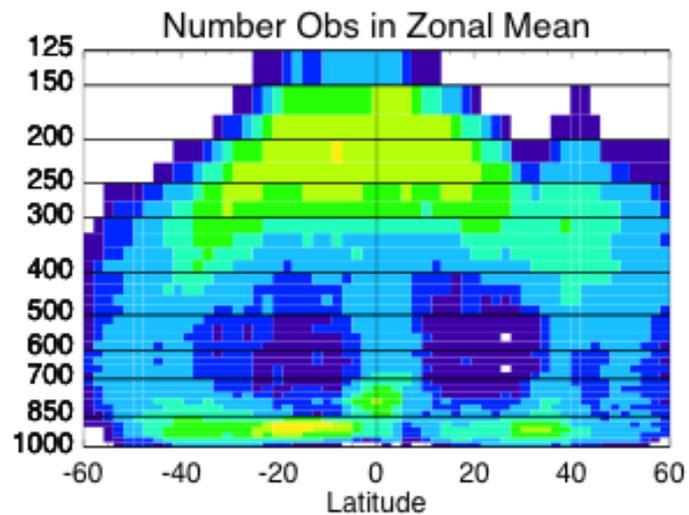
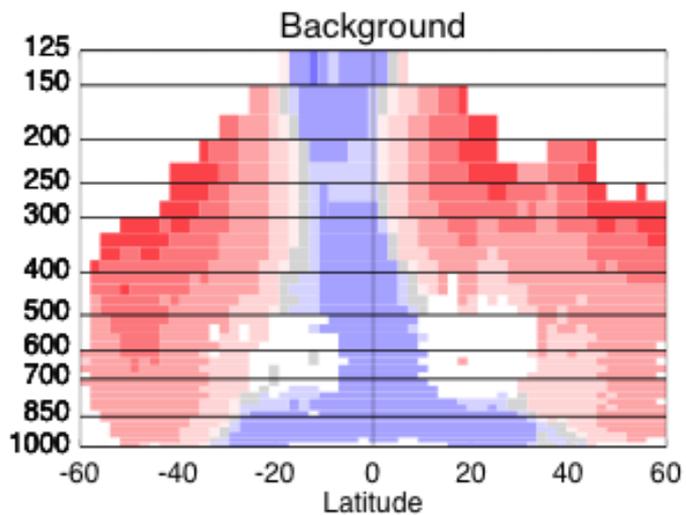
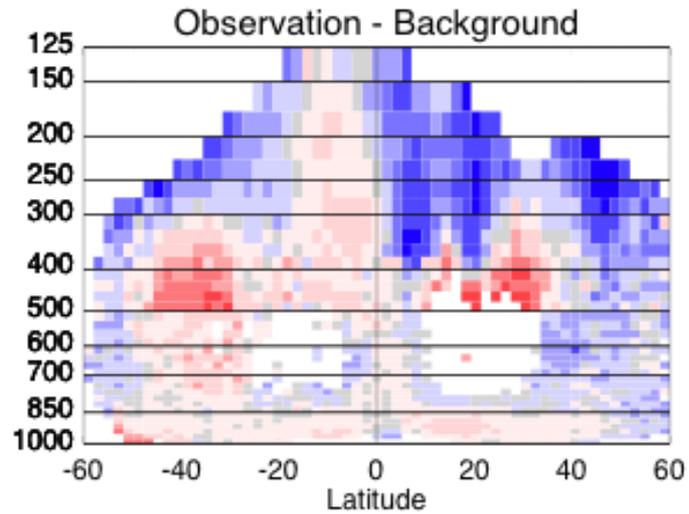
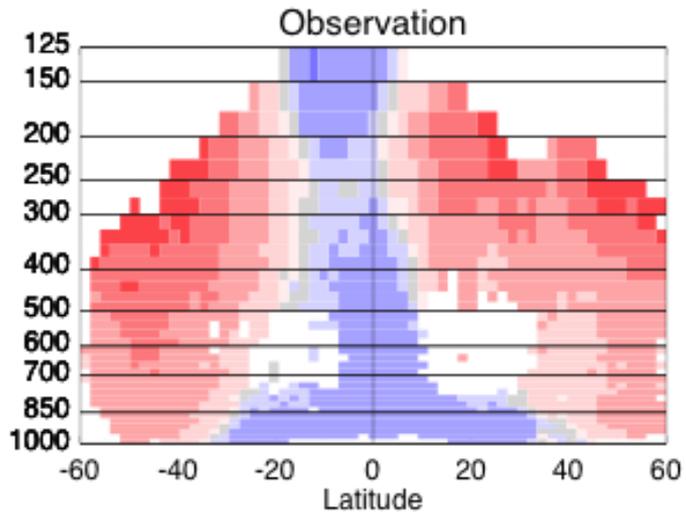


Dec
2011



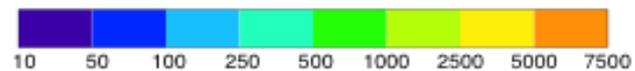
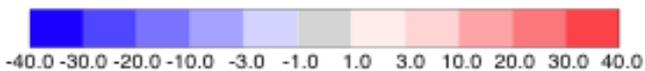
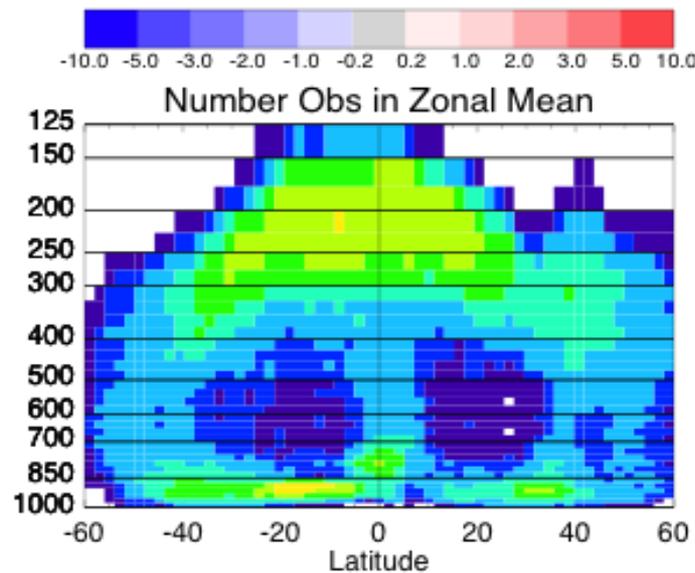
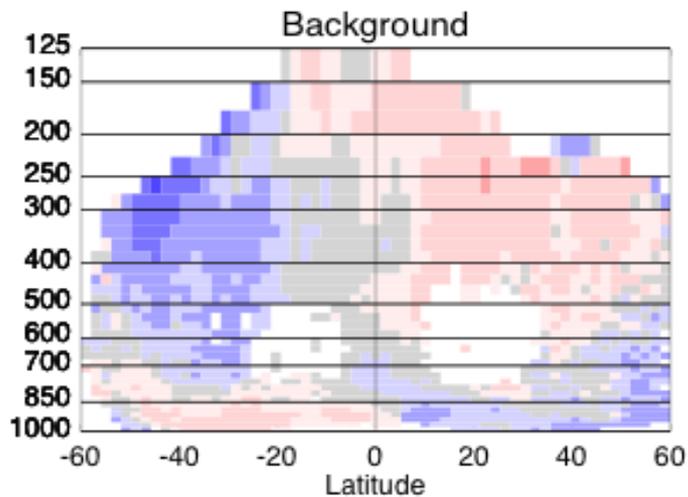
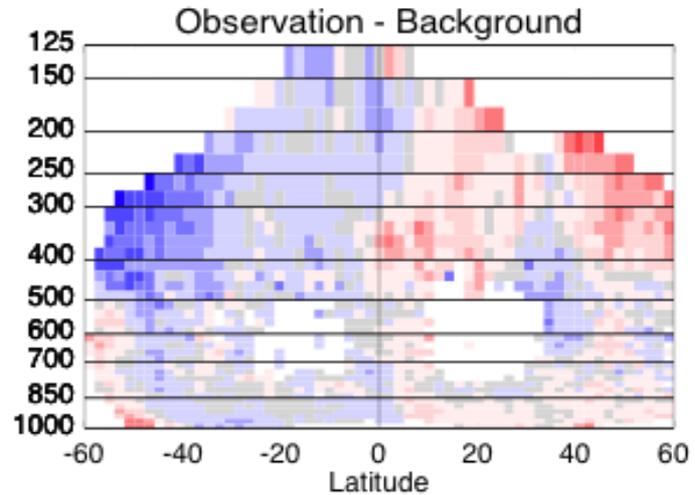
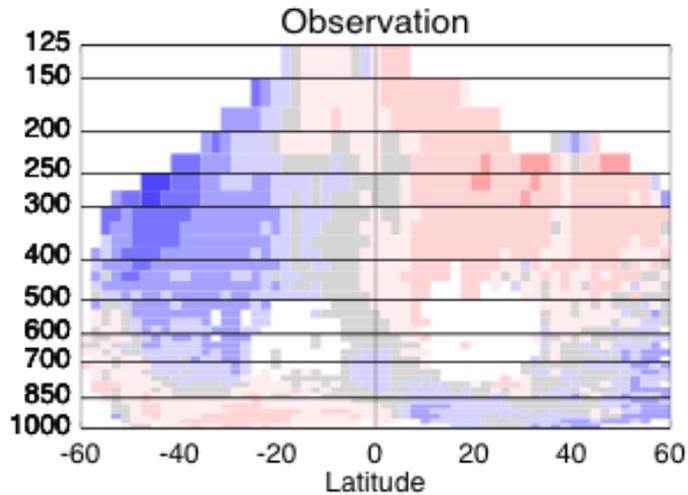


Dec 2011 Zonal Mean u-component (m/s)





Dec 2011 Zonal Mean v-component (m/s)

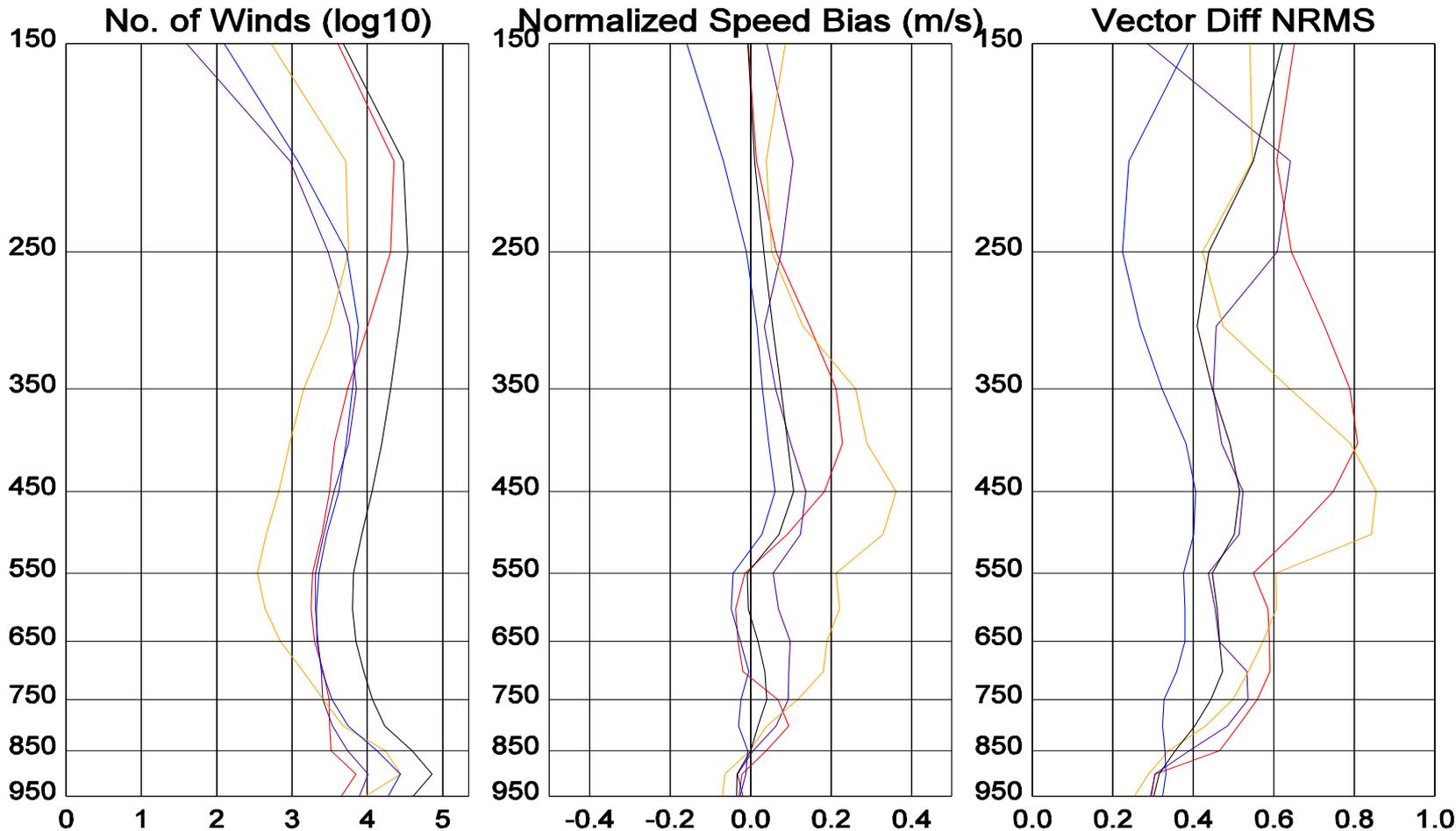




O-B for 4 regions - July 2011



No quality controlled applied



All Data – Black

Tropics ITCZ (0-20N)
Tropics (20S-0)

Northern Hemisphere (20N-60N)
Southern Hemisphere (20S-60S)



Quality Control Parameters

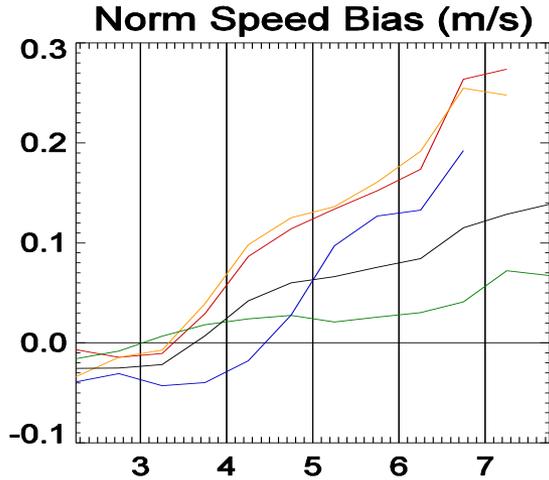


- **Traditional metrics:** AMV quality indicators: QI and its components & Expected Error (EE)
- **New GOES-R AMV Algorithm parameters:** cluster sample size, CTP standard deviation, correlation, number of clusters found in the target box
- **Atmospheric conditions:** temperature gradient and wind shear ± 200 mb layer around AMV

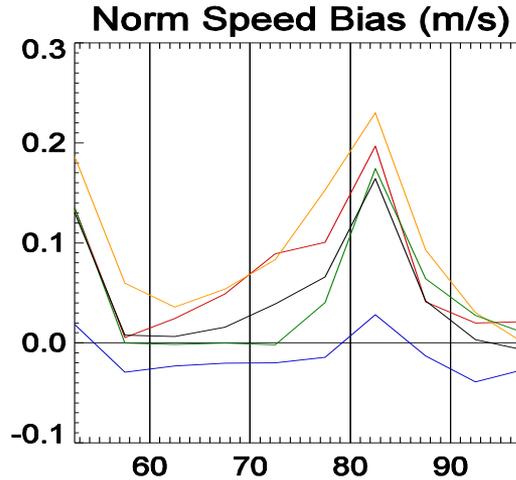
O-B as a f(AMV quality indicators)

July 2011

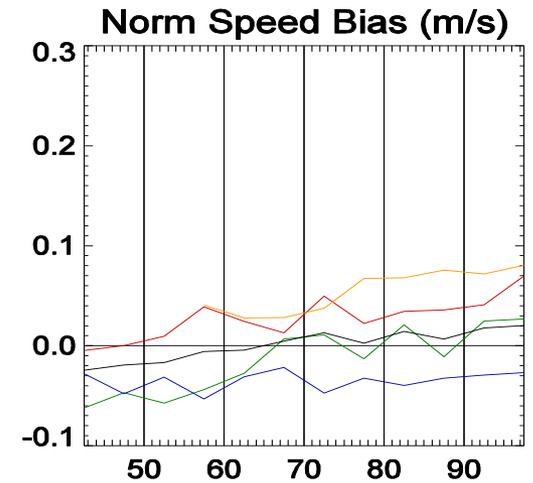
Expected Error



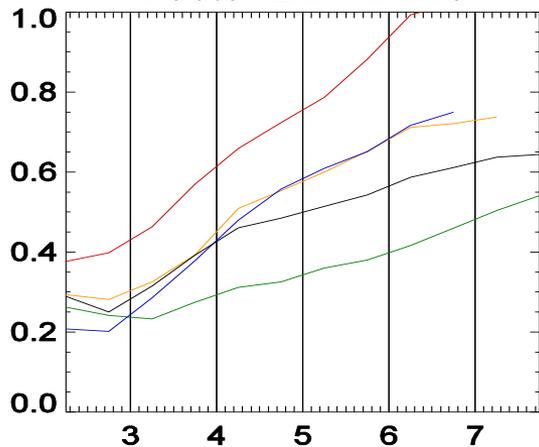
Quality Indicator QI



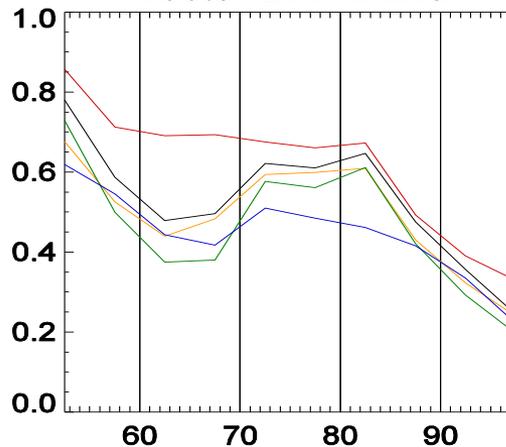
Local Consistency QI6



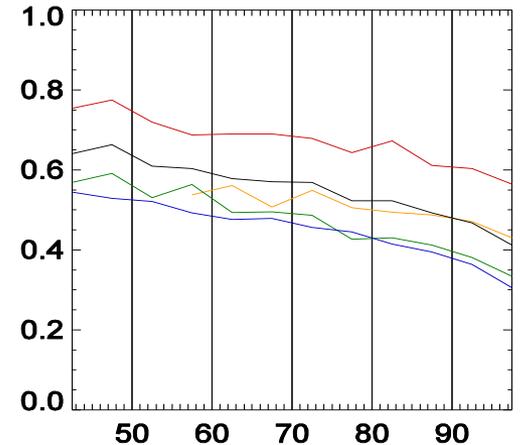
Vector Diff NRMS



Vector Diff NRMS



Vector Diff NRMS



All Data – Black

Tropics ITCZ (0-20N)
Tropics (20S-0)

Northern Hemisphere (20N-60N)
Southern Hemisphere (20S-60S)

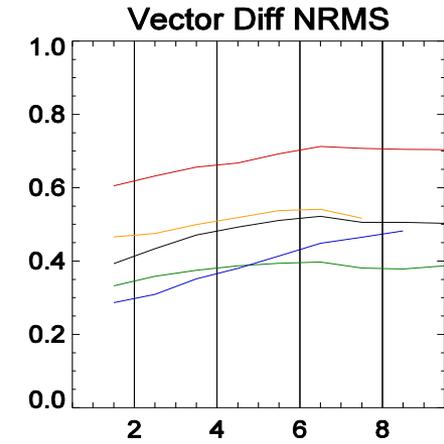
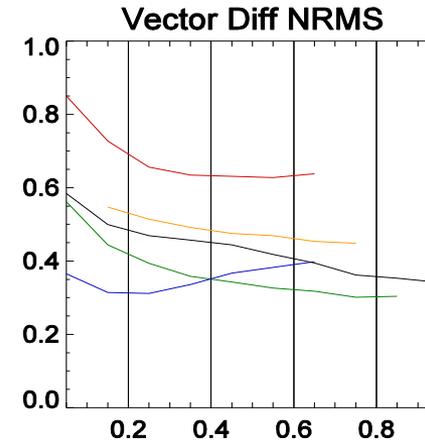
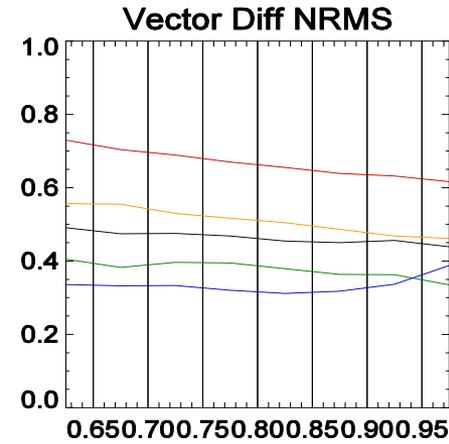
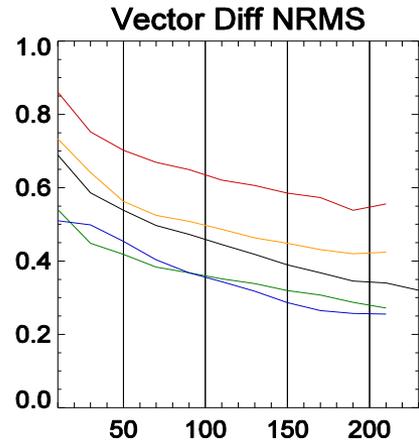
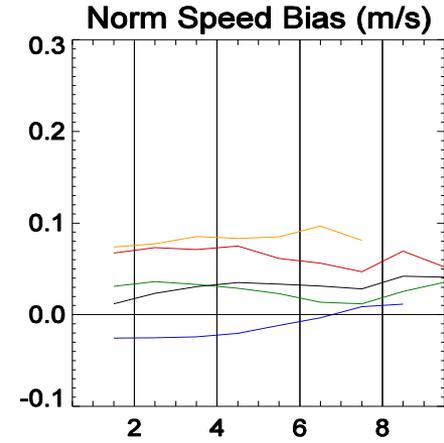
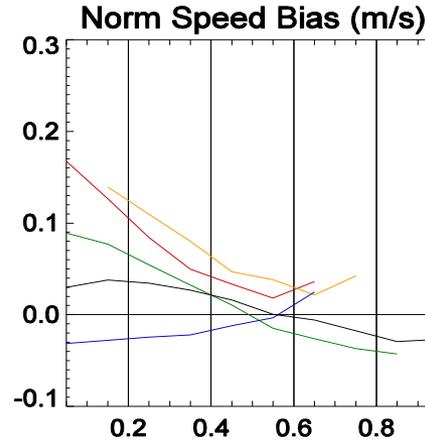
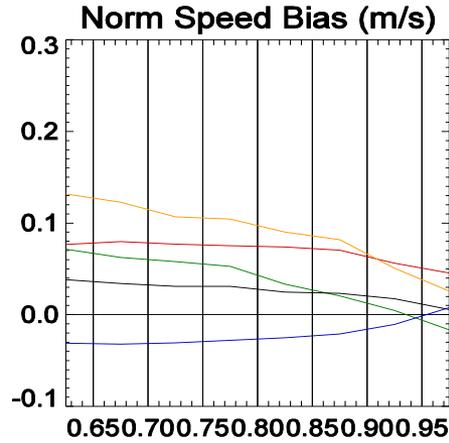
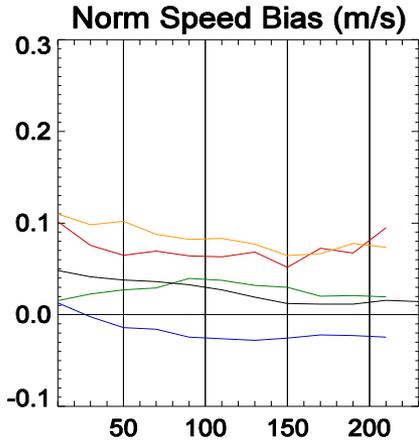
O-B Dependence on GOES-R ABI Nested Tracking Algorithm Parameters (July 2011)

Cluster Size

Correlation

CTP St. Dev

of Clusters

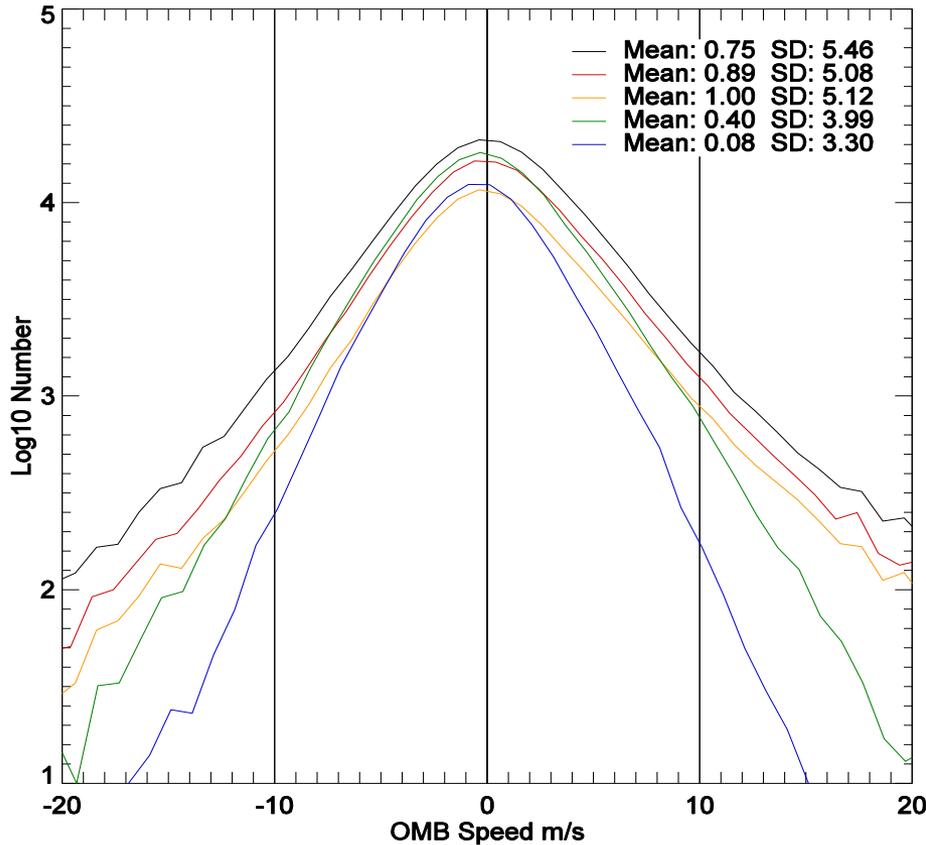


All Data – Black
Below 800mb (60N-60S)

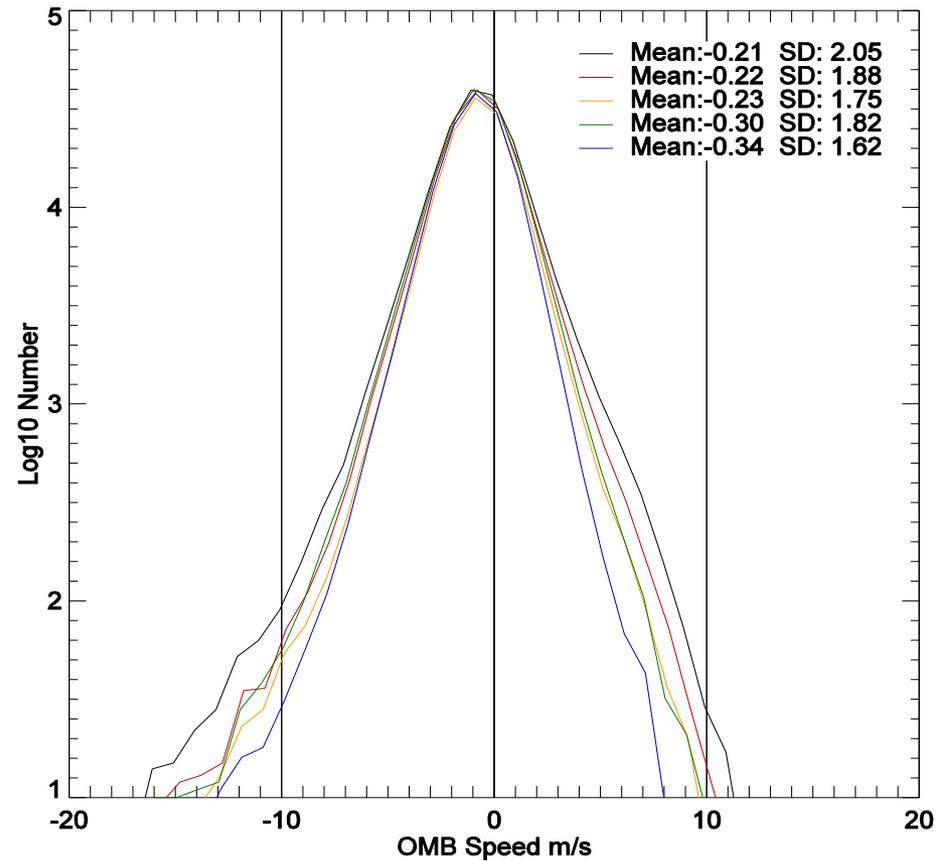
Tropics ITCZ (0-20N) AMVs above 800 mb
Northern Hemisphere (20N-60N)
Southern Hemisphere (60S-20S)

Applying QI & EE Limits to O-B Number Distribution for Speed (July 2011)

Above 800mb



Below 800mb



Black - No QC

Red - QI > 60

Yellow - QI > 80

Green - EE < 5

Blue - EE < 4



Feedback Received from NWP Community



**11th International Winds Working Group Meeting (IWW11) held
Feb 20-24, 2012 in Auckland, New Zealand**

- NWP centers would like more information about the AMVs related to height assignment confidence or other metrics
- NWP centers are very interested in obtaining and performing experiments with our GOES-R proxy winds
 - Like the new AMV algorithm approach and are pleased to see the speed bias is significantly minimized
 - See opportunities for enhanced QC and potential for positive forecast impacts

IWW Web Page: <http://cimss.ssec.wisc.edu/iwwg/iwwg.html>



PLANS - Year 2



- Complete 2 seasonal (summer/winter) GFS assimilations
 - Experiment will use proxy GOES-R AMVs (Meteosat-9 AMVs)
 - Control will have no AMV data in the Meteosat-9 region
- Evaluate implemented quality control measures
- Examine new data impact on assimilation and forecast metrics
- Perform rawinsonde comparisons for AMVs used in GFS runs
- Complete AMV BUFR Table and Encoder



PLANS - Year 3



- Add the comparison of 2 seasonal GFS assimilations using the heritage AMV algorithm applied to the SEVIRI input
- Test new AMV data in an operational setting with BUFR input stream
- Examine GOES-R AMV proxy operational run for assimilation and forecast impact

Year 3 is important:

- Near real-time testing using the new wind product BUFR files will be vital to day 1 readiness at NCEP...
- Takes time to run these experiments...



Summary



- **Good progress; on track**
 - NCEP GFS system being run on S4 super computer resource at the Univ. of Wisconsin
 - Completed two seasons involving passive monitoring of GOES-R proxy AMV datasets
- **O-B statistics for the GOES-R proxy AMVs look promising**
 - O-B speed histograms
 - Tropics – need attention in general; opportunities exist
- **Finalize decisions on QC parameters to use and move forward with**
- **Begin assimilation experiments (using AMVs) once QC parameters and GSI QC scheme are ready**
- **Goal: NCEP readiness to assimilate GOES-R winds day 1**
- **Potential collaborations with other NWP centers to help with their readiness to assimilate GOES-R winds**



Backup