Assessing the forecast impact of WindSat/Coriolis data in the NCEP GDAS/GFS

Li Bi

Tom Zapotocny

James Jung

Michael Morgan

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WindSat Capabilities

- Demonstrate the capability of polarimetric microwave radiometry to measure the ocean surface wind vector from space.
- WindSat will aid with the forecast of short-term weather, issuance of timely weather warnings and the gathering general climate data.

Experiment Design

- Work with the Joint Center for Satellite Data Assimilation (JCSDA) to evaluate the forecast impact of assimilating both Navy WindSat data and NESDIS WindSat data in the NCEP GDAS/GFS. A Jan 2007 version of the GSI and GFS using the sigma-p hybrid coordinates were used and run at T382L64.
- Calculate RMS error and bias for both Navy WindSat and NESDIS WindSat data to determine quality control procedures for operational use of the data.
- Data time period: 17 Feb – 30 March 2007.

Work Progress

- Run GFS with all data types including QuikSCAT (control)
- Run GFS including Navy WindSat data
- Run GFS including NESDIS WindSat data
- Investigate forecast impact for WindSat winds

$$FI = 100 \times \left\{ \left(\sqrt{\frac{\sum_{i=1}^{N} (C_i - A_i)^2}{N}} - \sqrt{\frac{\sum_{i=1}^{N} (D_i - A_i)^2}{N}} \right) \Big/ \sqrt{\frac{\sum_{i=1}^{N} (C_i - A_i)^2}{N}} \right\}$$

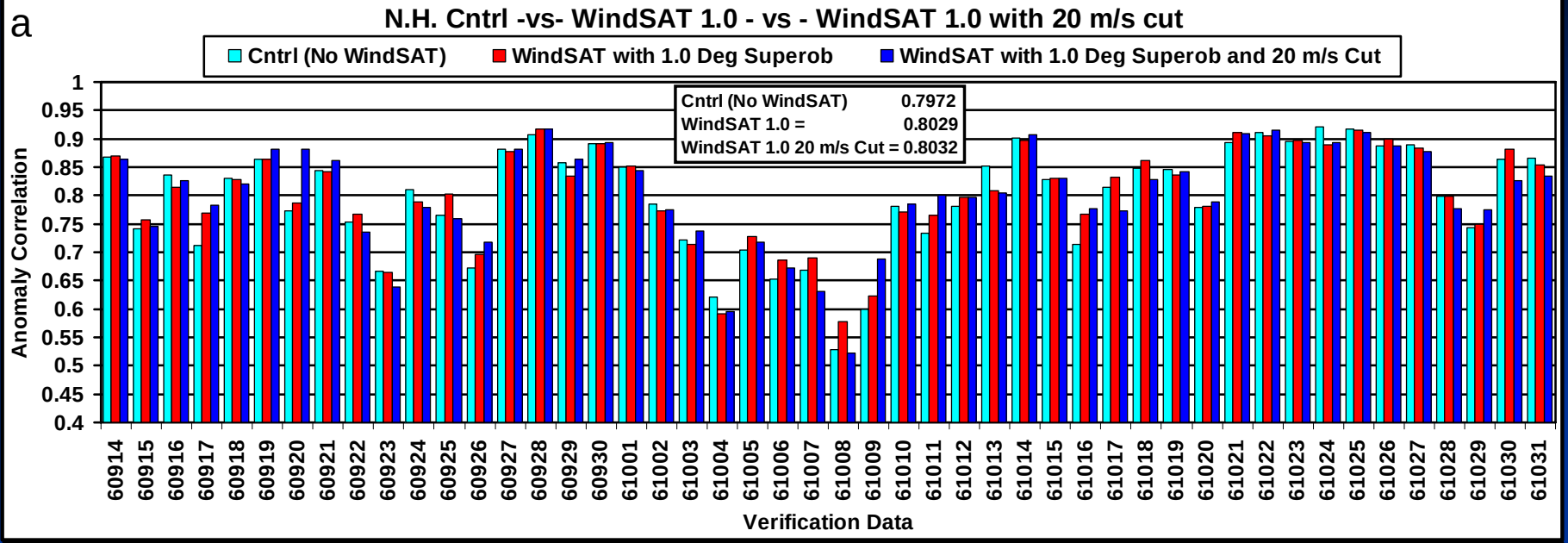
Error in control **Error in experiment** **Error in control**

Additional WindSat Quality Control

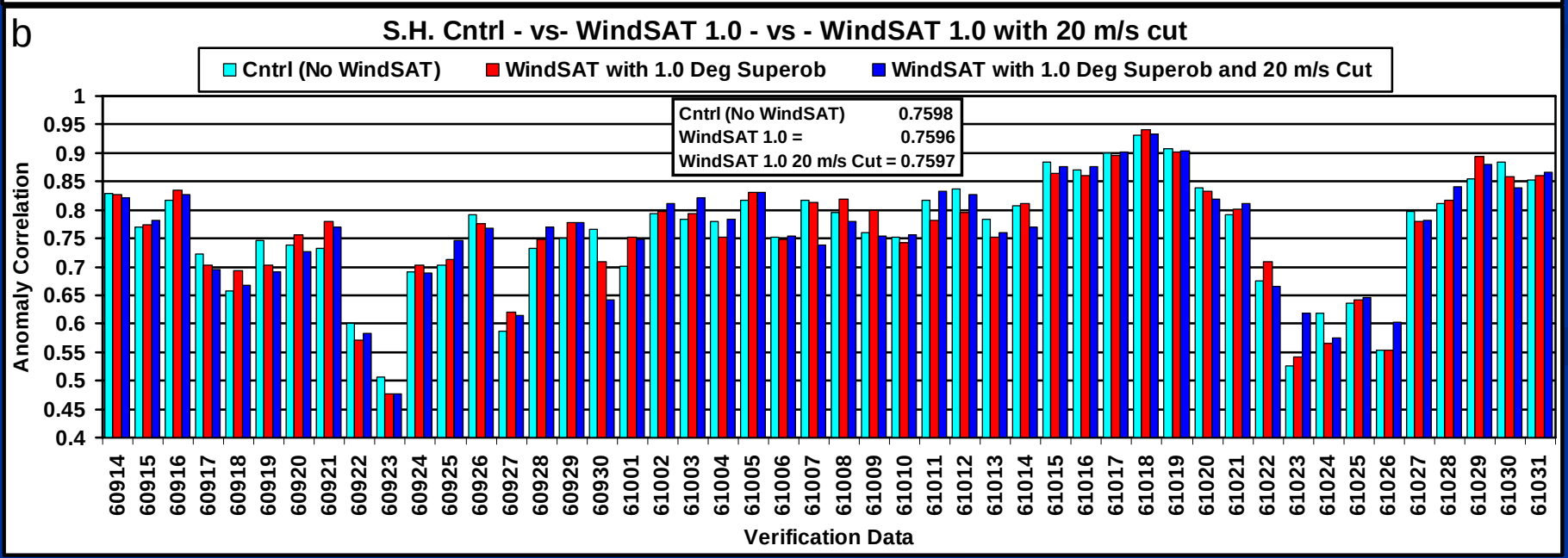
- Data used at 6 hour synoptic times with a plus/minus 3 hour window.
- All observations over land, near coast, over ice, and potentially rain contaminated are rejected before superobing.
- Superobed to 1 X 1 degree boxes.
- If the absolute value of the superobed wind component is more than 6 ms^{-1} from the corresponding background wind component the observation is rejected. This only removed the extreme outliers.
- Any superobed observations that are over 20m/s are rejected.
- Any superobed observations that are less than 4m/s are rejected for NESDIS WindSat.

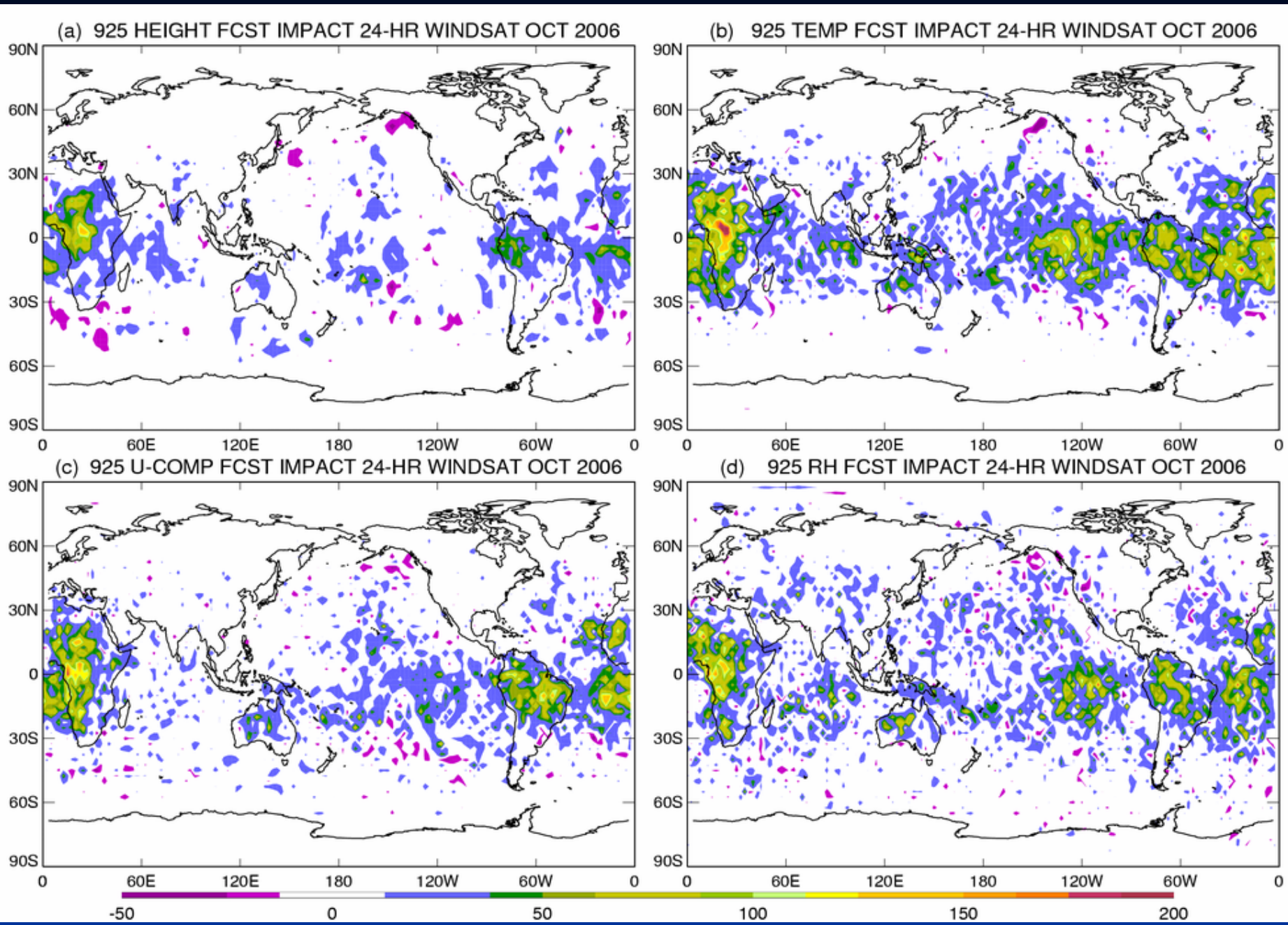
Three way comparison of anomaly correlation for the period of 14 Sep – 31 Oct 2006

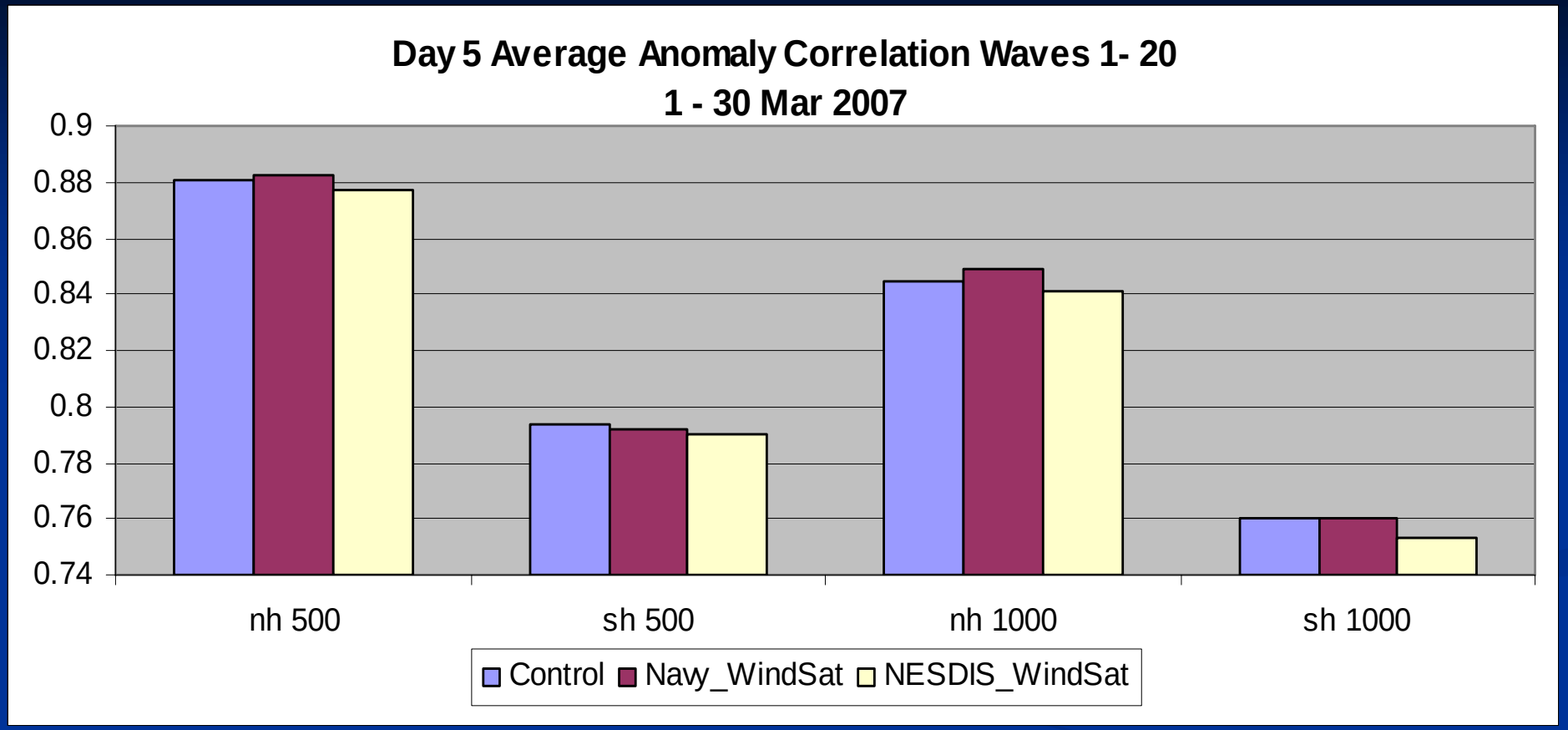
a



b




(a) 925 HEIGHT FCST IMPACT 24-HR WINDSAT OCT 2006
(b) 925 TEMP FCST IMPACT 24-HR WINDSAT OCT 2006
(c) 925 U-COMP FCST IMPACT 24-HR WINDSAT OCT 2006
(d) 925 RH FCST IMPACT 24-HR WINDSAT OCT 2006
90N
60N
30N
0
30S
60S
90S
0
60E
120E
180
120W
60W
0
-50
0
50
100
150
200



- *Control*

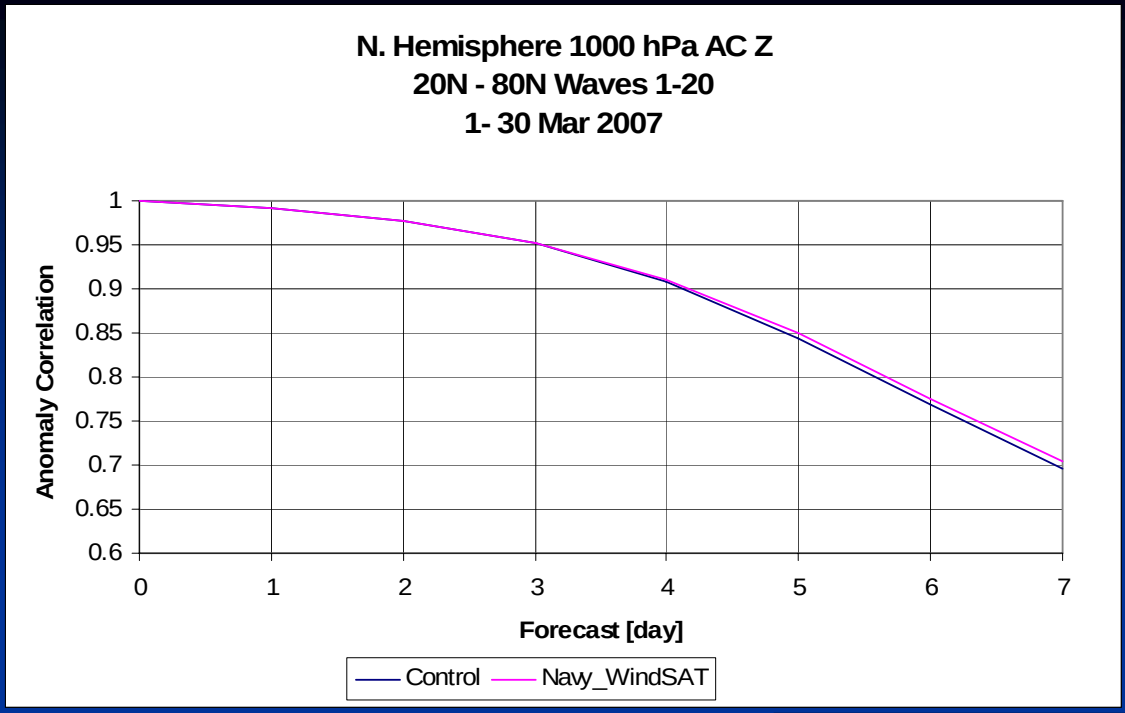
  ----- T382L64 to 7 days using GSI

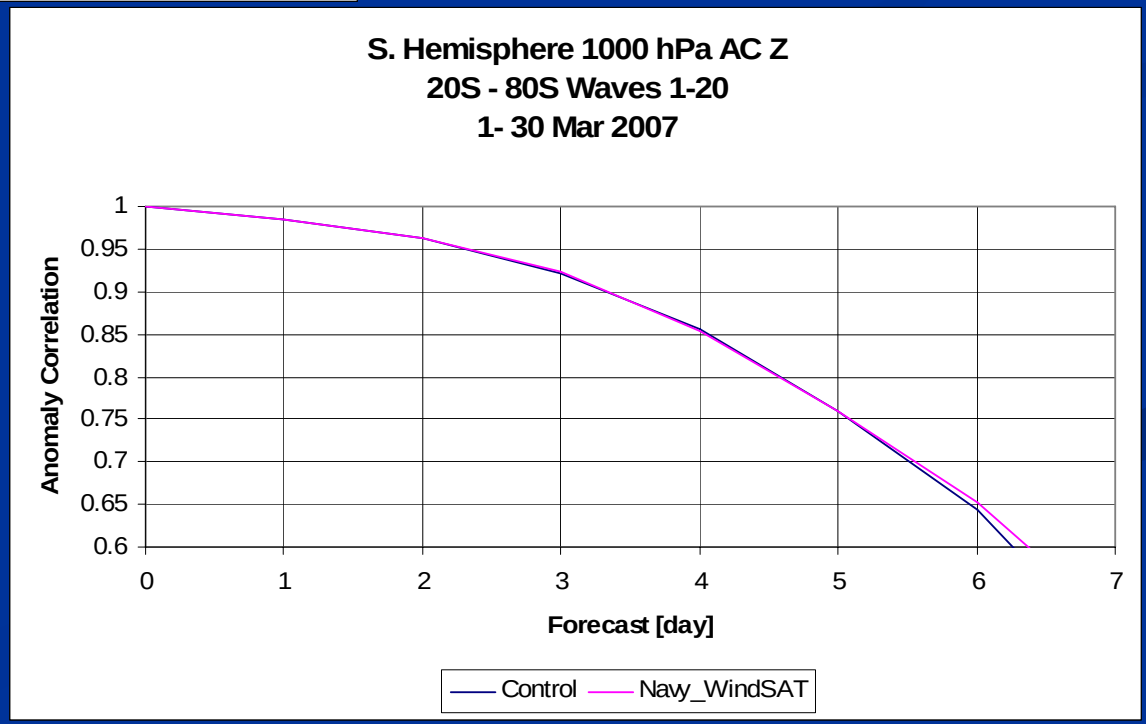
- *Navy_WindSat*

  ----- T382L64 to 7 days (Control + Navy WindSat data superobing to 1 deg and all values greater than 20m/s are rejected)

- *NESDIS_WindSat*

  ----- T382L64 to 7 days (Control + NESDIS WindSat data superobing to 1 deg and all values greater than 20m/s are rejected)


N. Hemisphere 1000 hPa AC Z
20N - 80N Waves 1-20
1- 30 Mar 2007
Anomaly Correlation
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
1
2
3
4
5
6
7
Forecast [day]
Control
Navy_WindSAT


S. Hemisphere 1000 hPa AC Z
20S - 80S Waves 1-20
1- 30 Mar 2007
Anomaly Correlation
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0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
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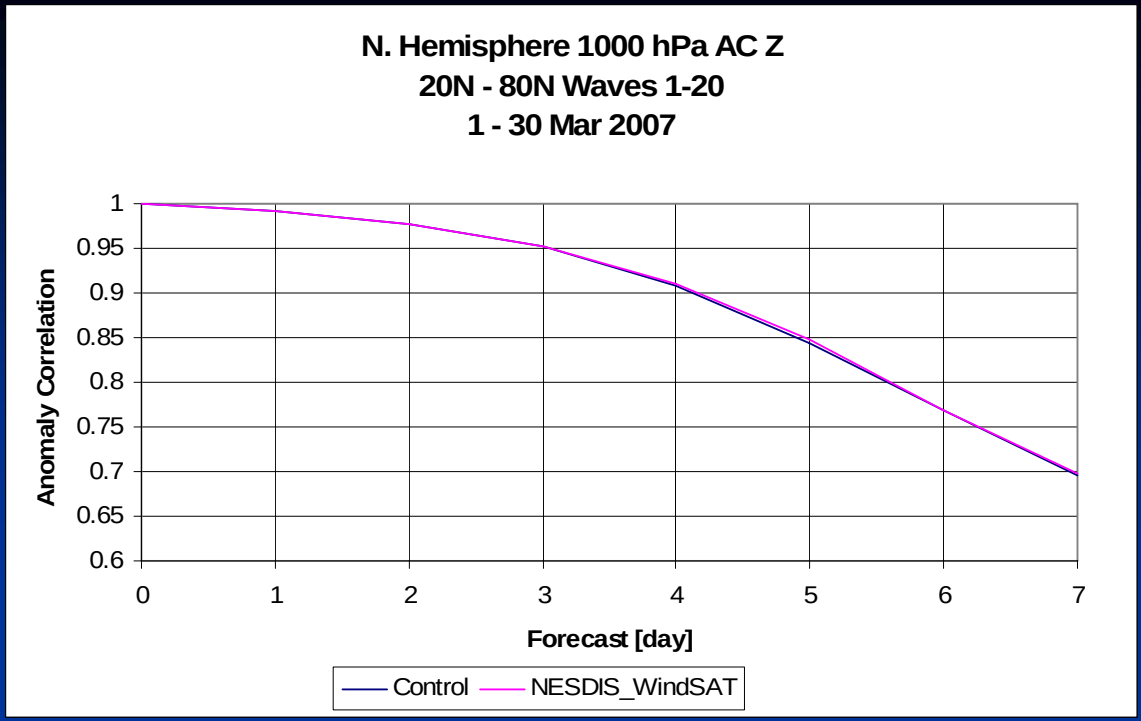
7
Forecast [day]
Control
Navy_WindSAT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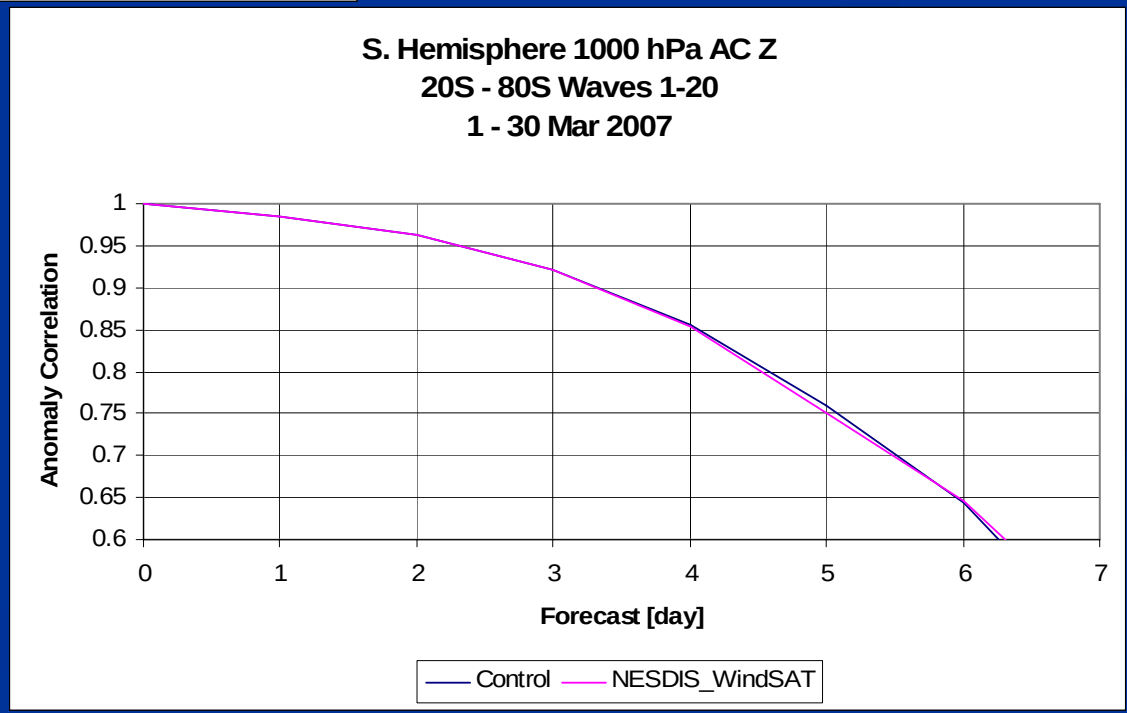
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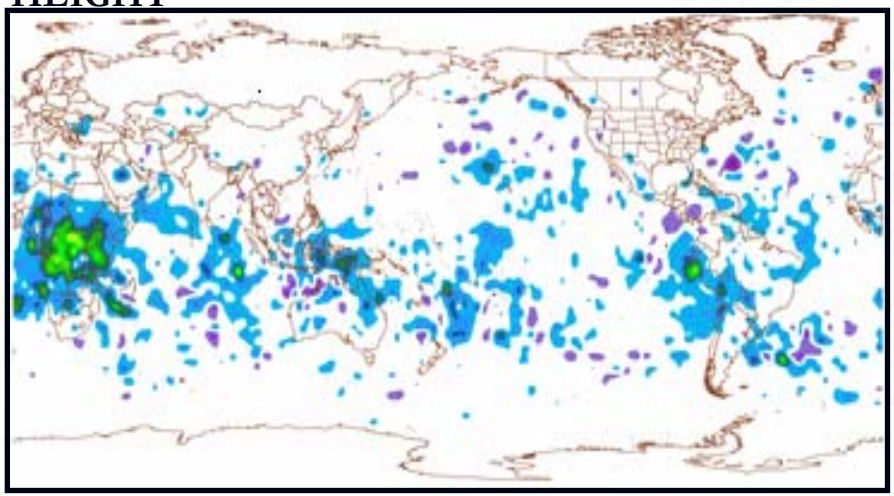
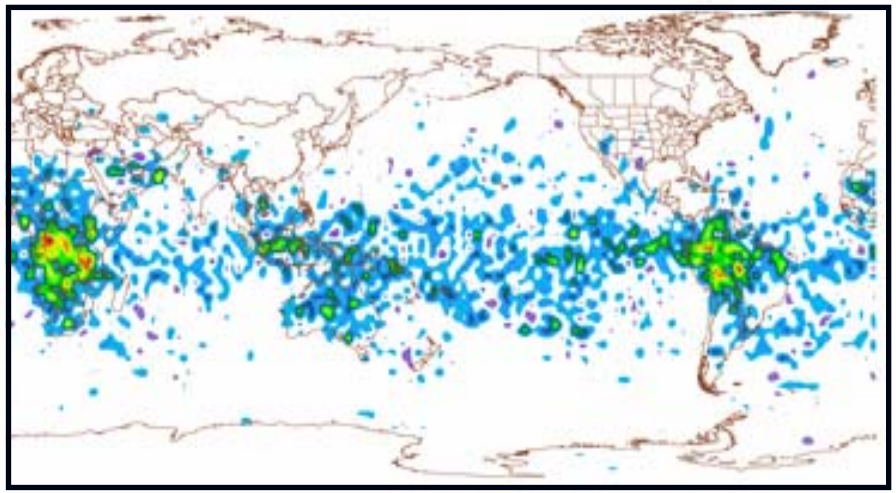
Forecast [day]
Control
NESDIS_WindSAT

1000 hPa FCST IMPACT 24-HR NAVY WINDSAT MARCH 1 – MARCH 30 2007

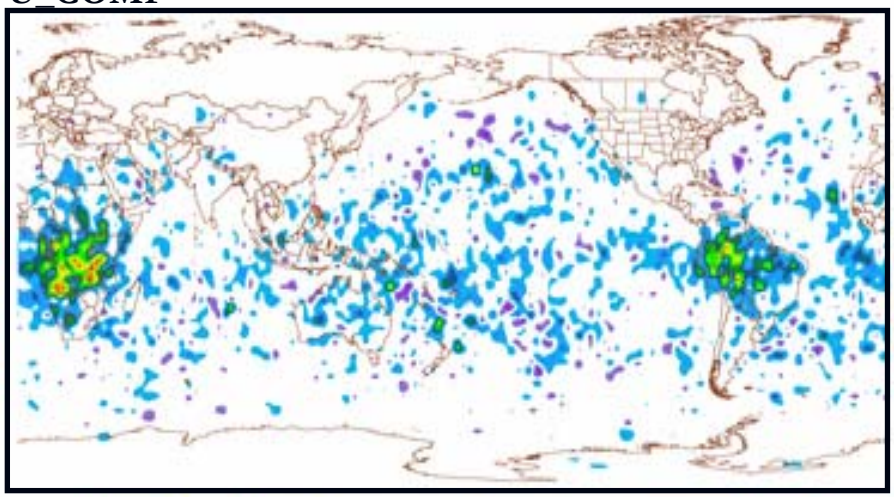
HEIGHT



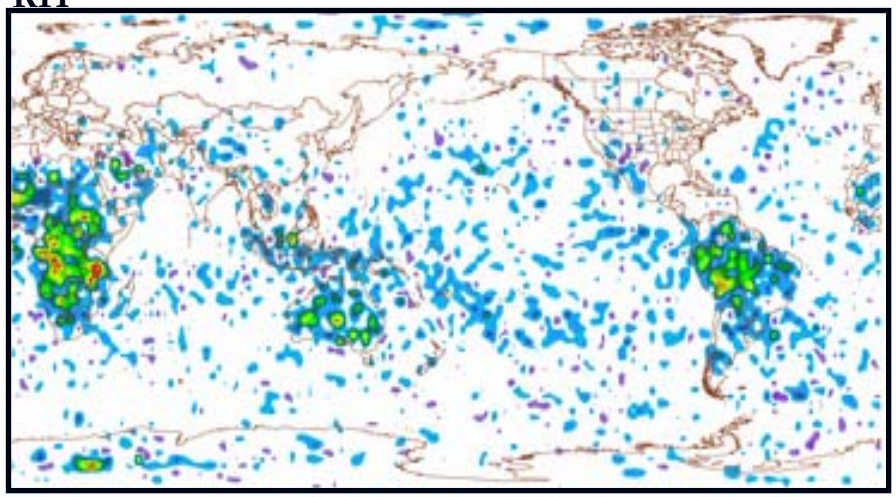
TEMP



U_COMP

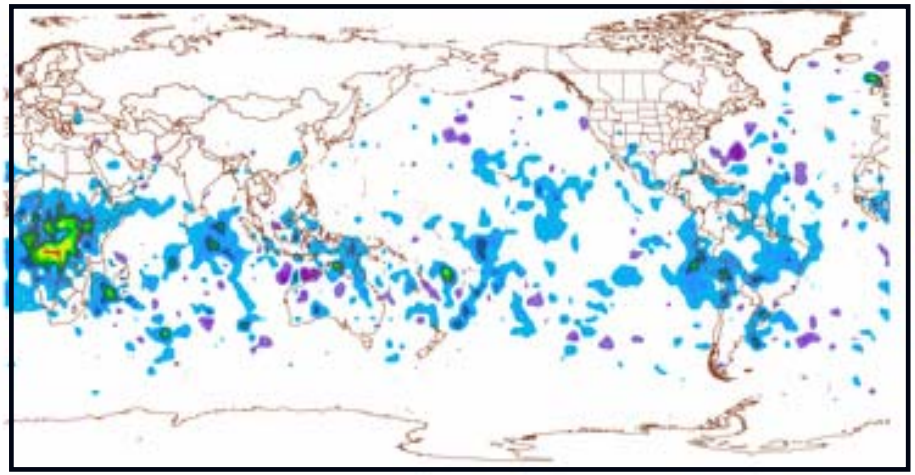


RH

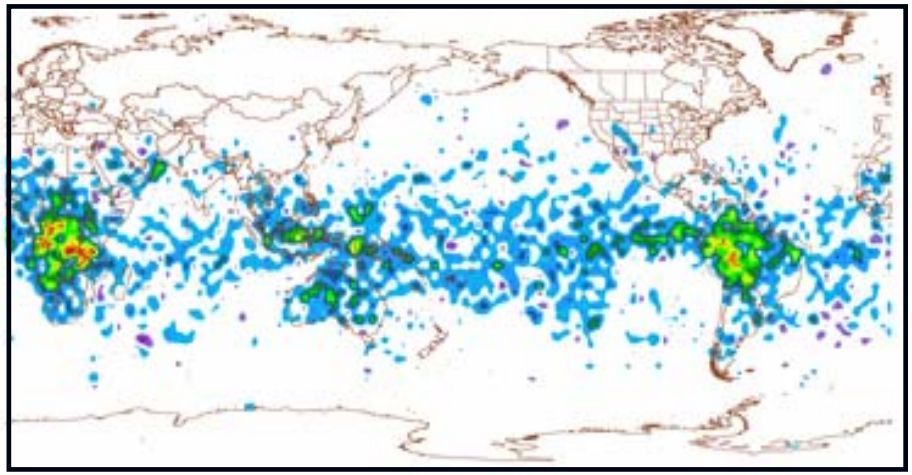


1000 hPa FCST IMPACT 24-HR NESDIS WINDSAT MARCH 1 – MARCH 30 2007

HEIGHT



TEMP



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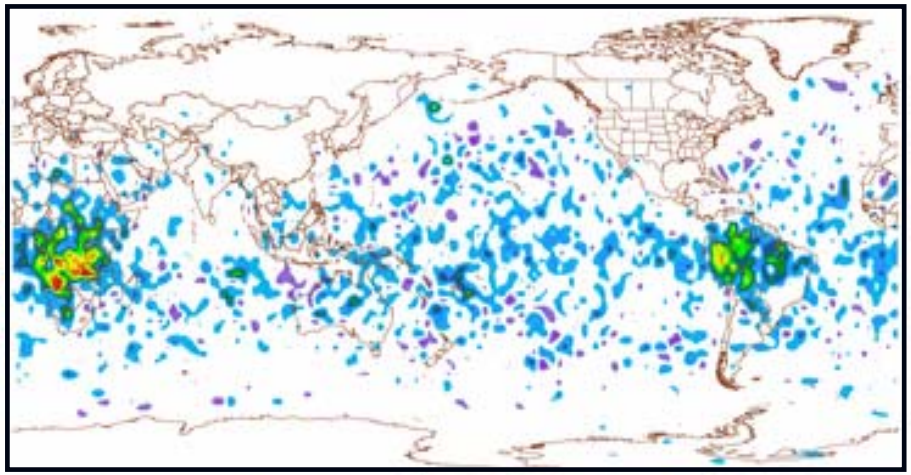
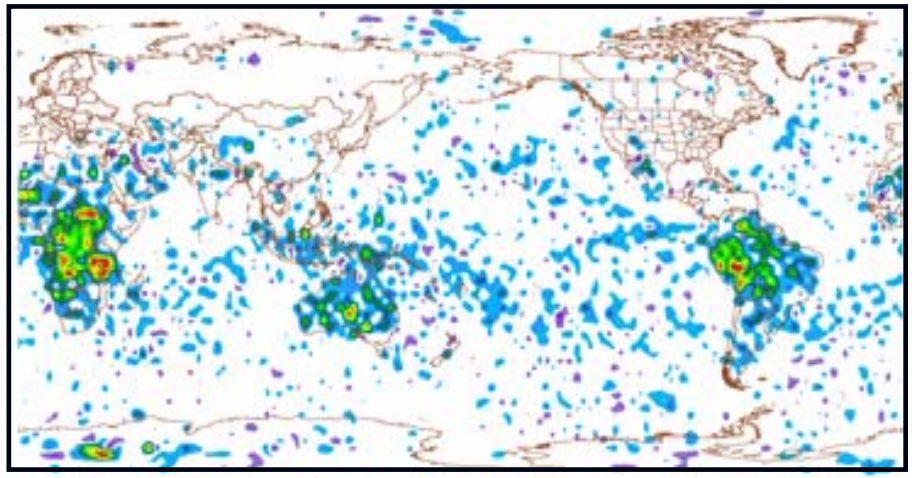
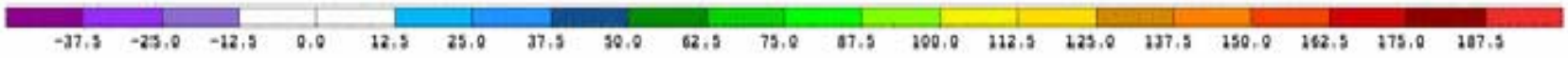


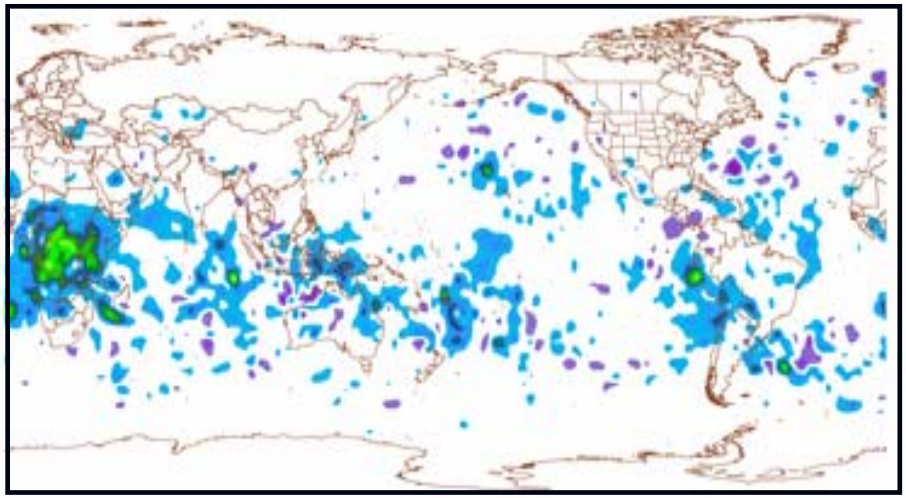
RH



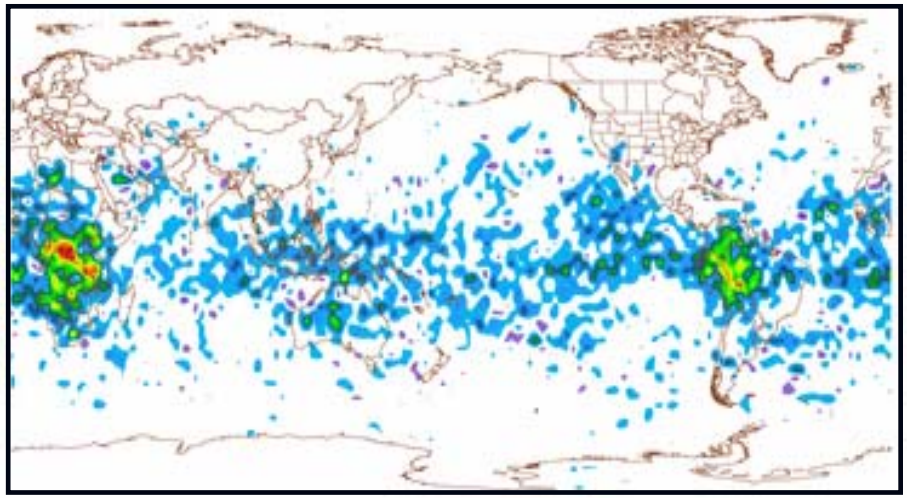


925 hPa FCST IMPACT 24-HR NAVY WINDSAT MARCH 1 – MARCH 30 2007

HEIGHT



TEMP



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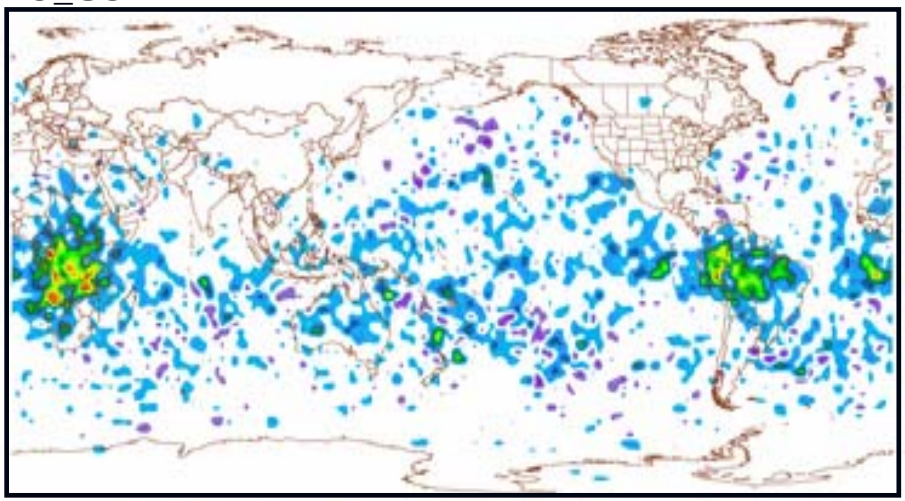
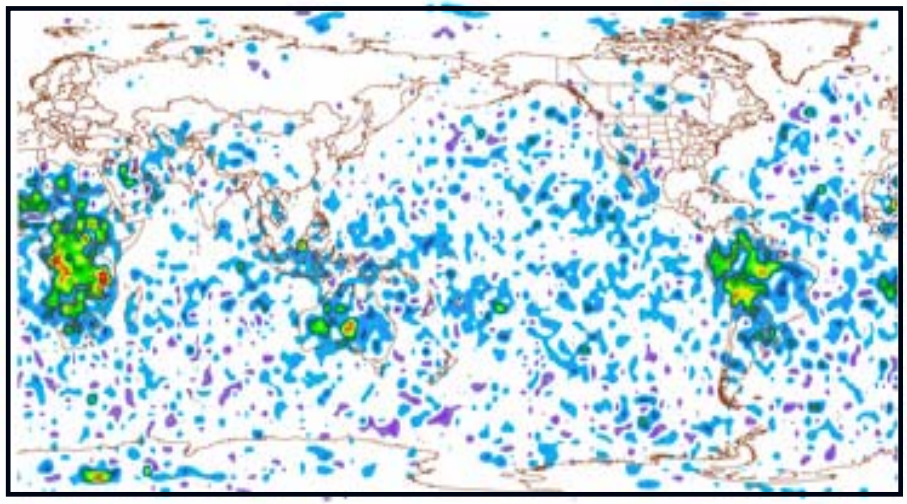
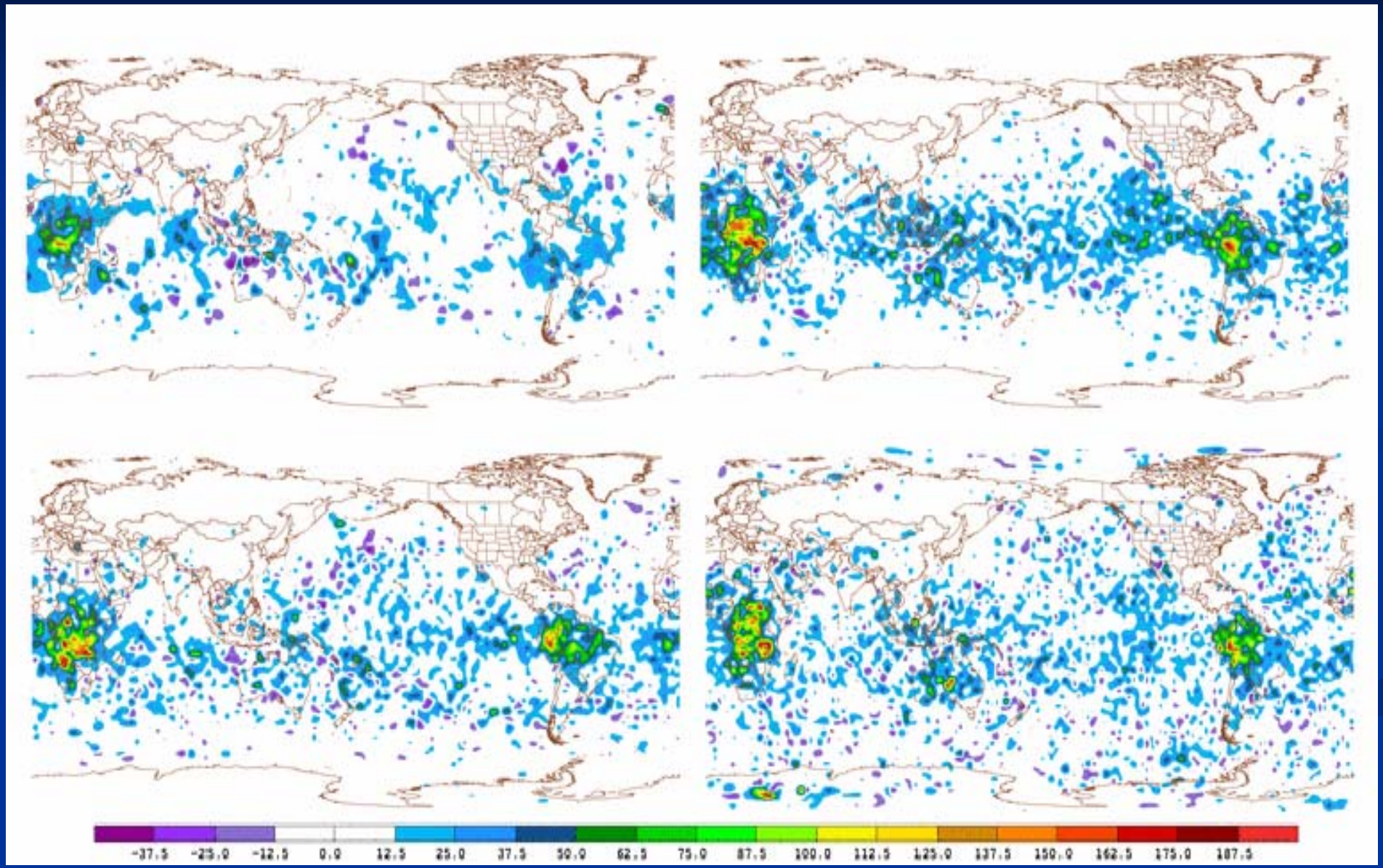


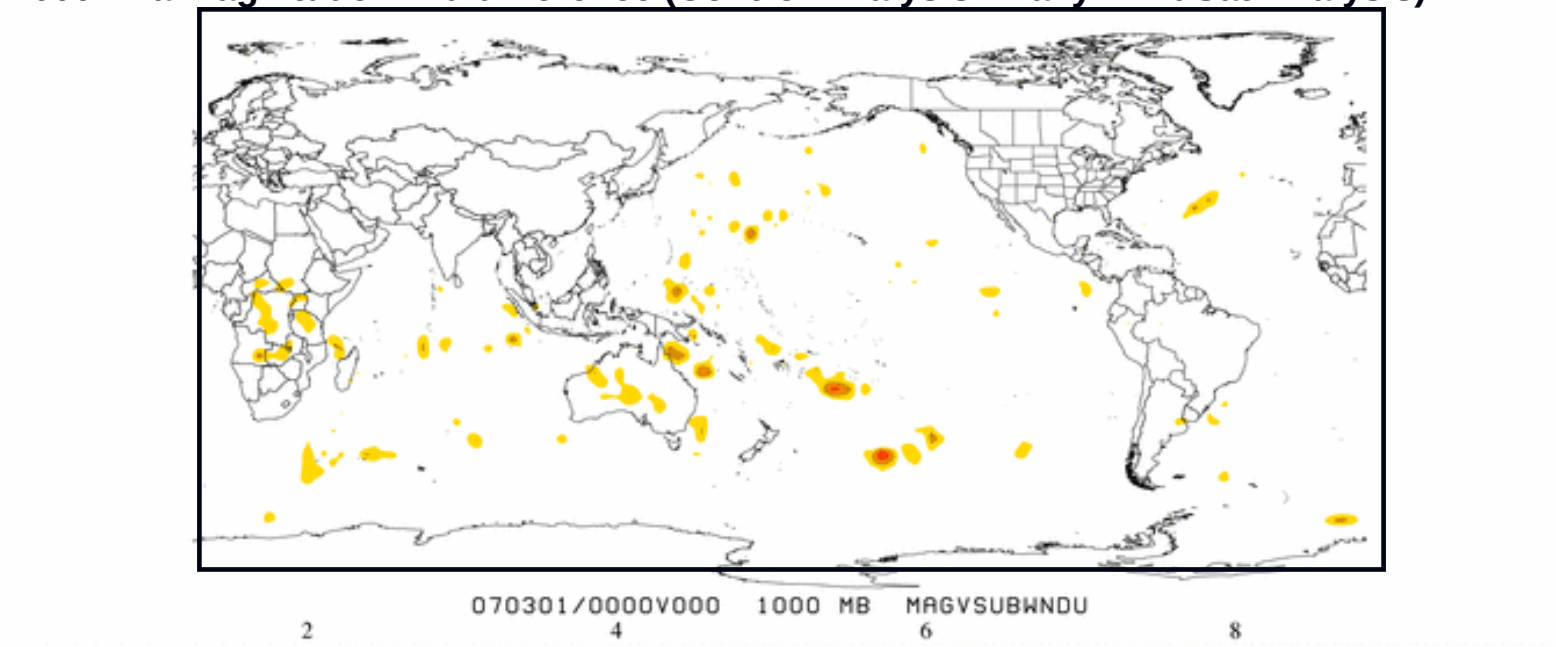
RH



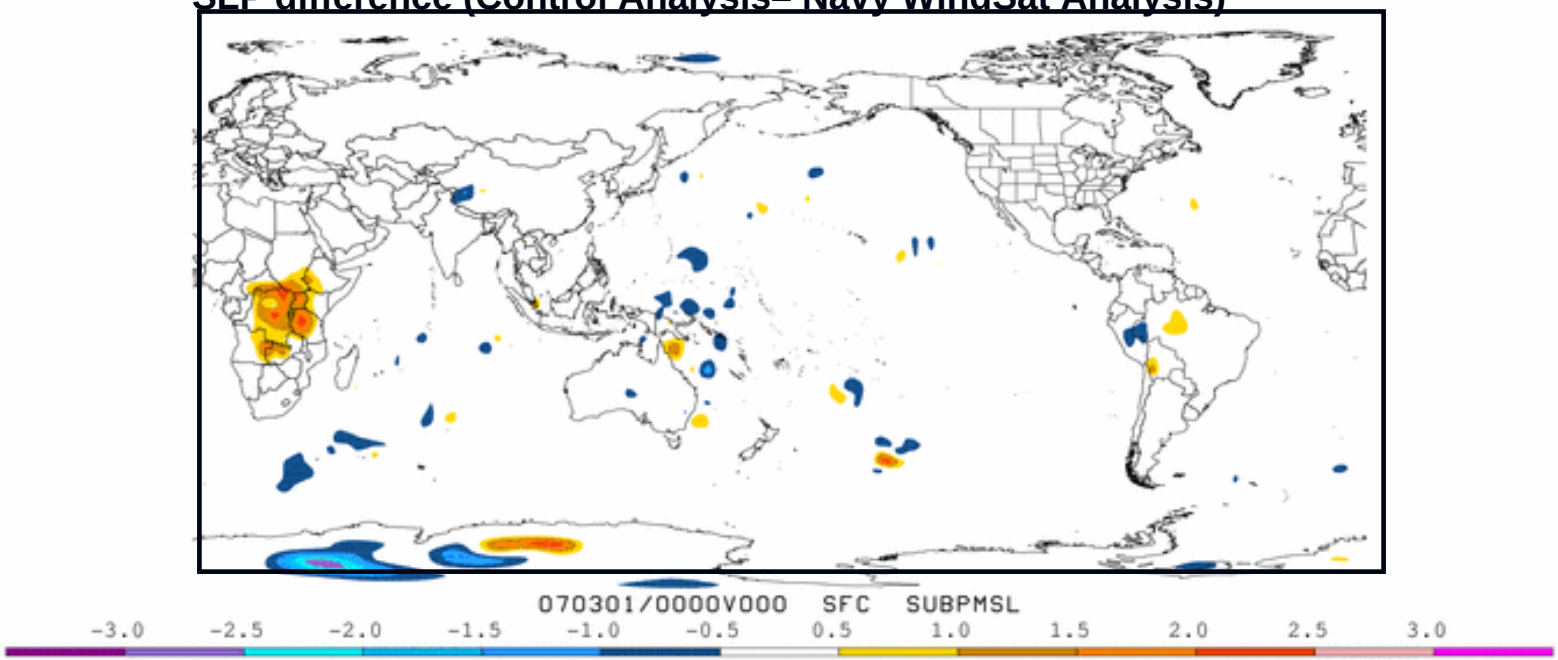
925 hPa FCST IMPACT 24-HR NESDIS WINDSAT MARCH 1 – MARCH 30 2007



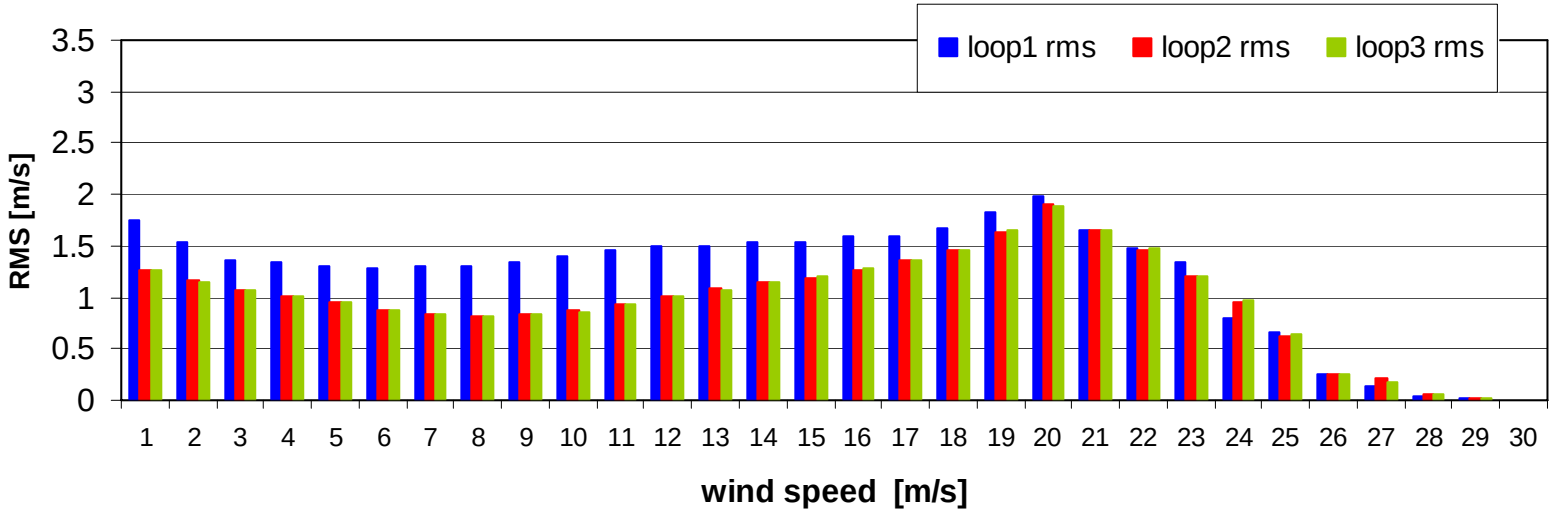
1000 hPa magnitude wind difference (Control Analysis– Navy WindSat Analysis)



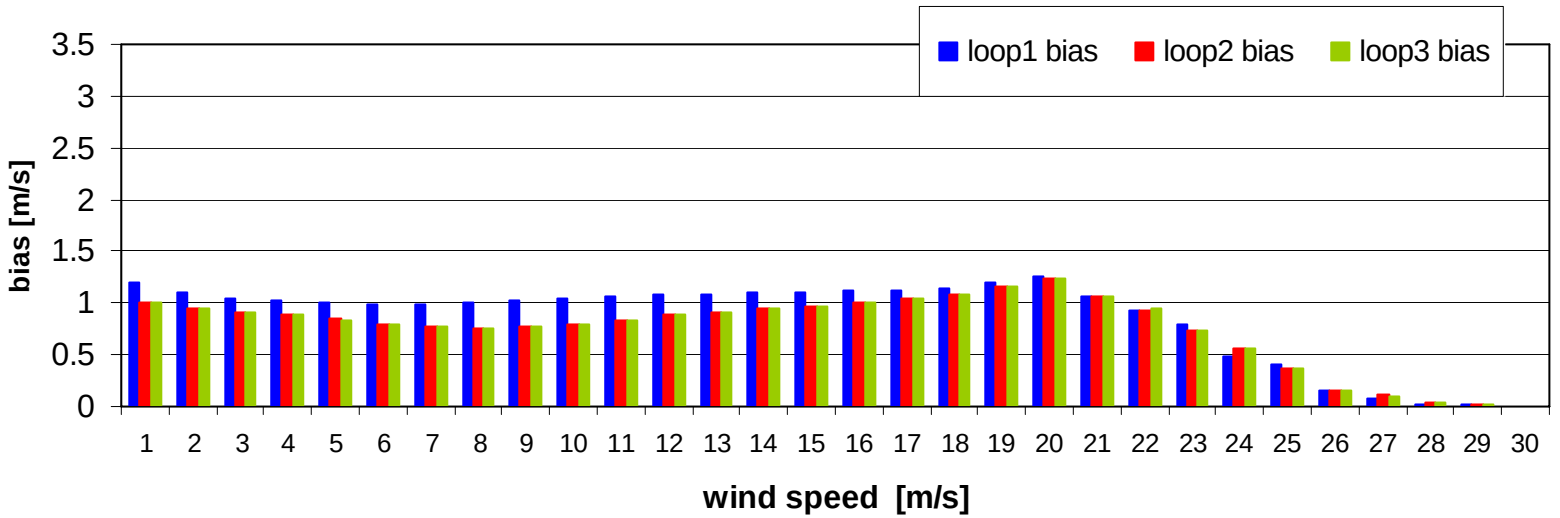
SLP difference (Control Analysis– Navy WindSat Analysis)



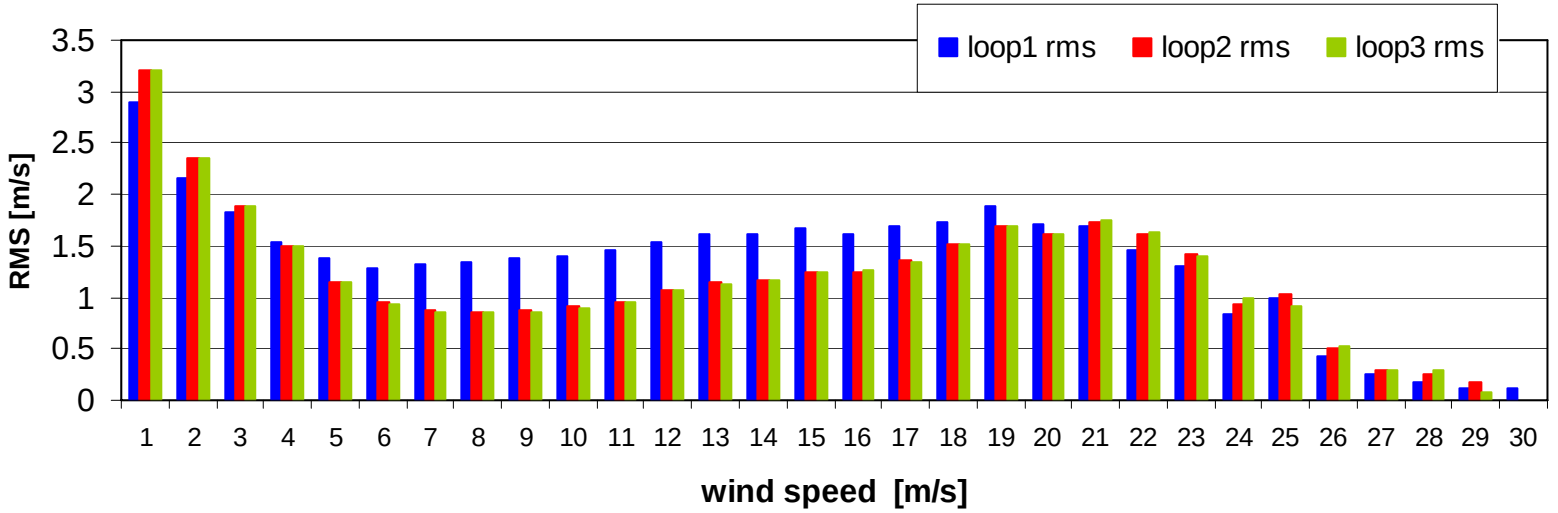
RMS by bin for NAVY WindSat GDAS (2007030100-2007033018)



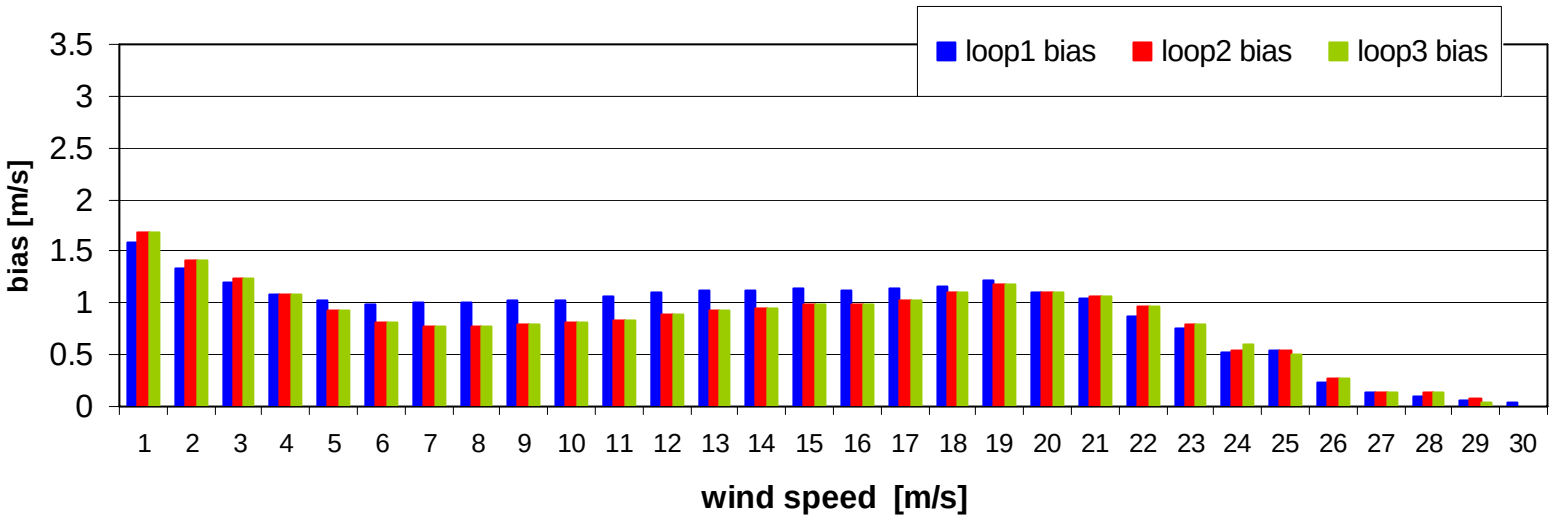
bias by bin for NAVY WindSat GDAS (2007030100-2007033018)



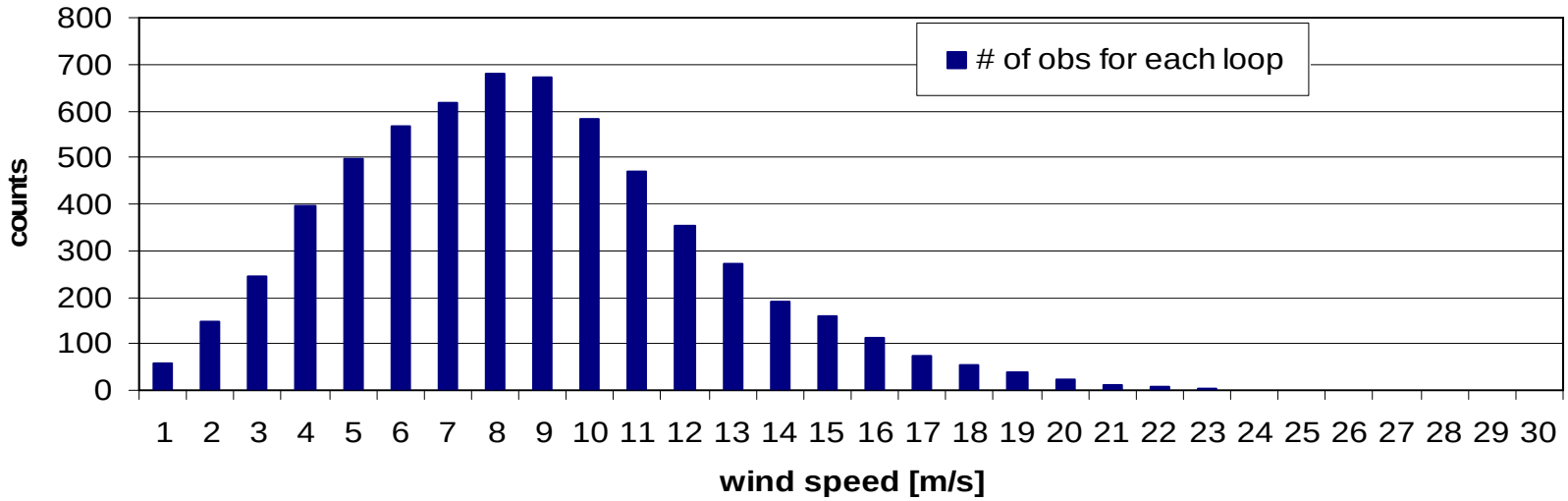
RMS by bin for NESDIS WindSat GDAS (2007030100-2007033018)



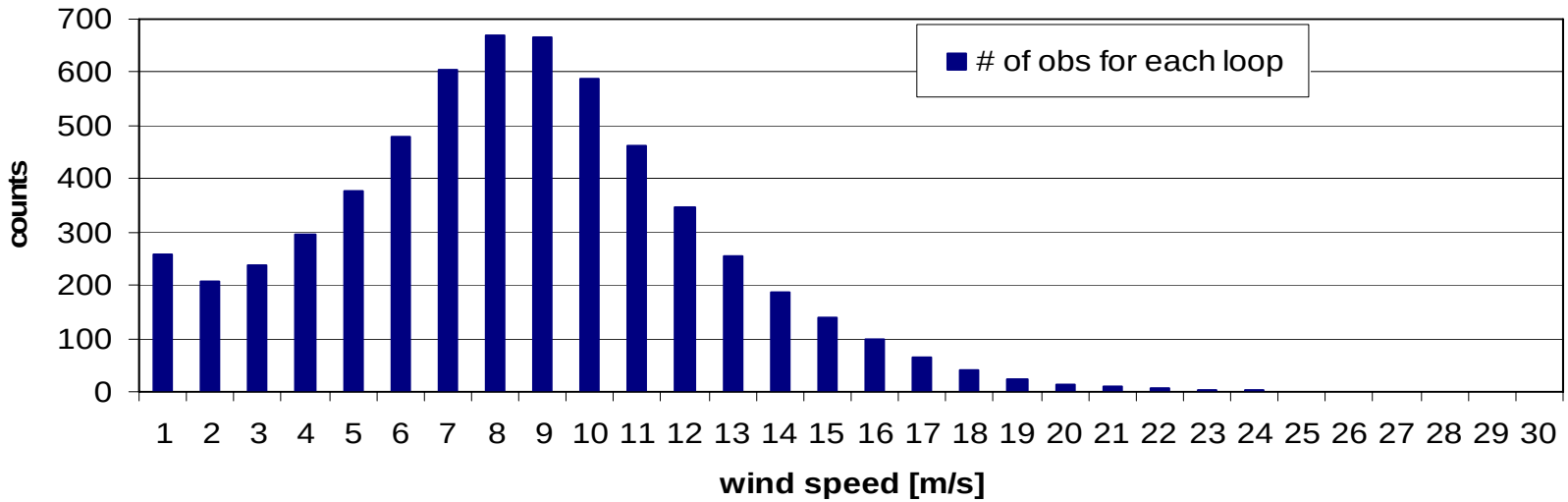
bias by bin for NESDIS WindSat GDAS (2007030100-2007033018)



of obs counts by bin for Navy WindSat GDAS (2007030100-2007033018)



of obs counts by bin for NESDIS WindSat GDAS (2007030100-2007033018)



Future Goals

- Continue to investigate additional quality control procedures and WindSat forecast impacts during 2007 hurricane season.
- Develop a direct assimilation method for the WindSat radiances into the GFS and conduct assimilation experiments comparing results obtained from the Navy and/or NESDIS retrieval with the direct assimilation of the radiances.

Conclusions

- Preliminary results indicate that Navy WindSat improved the forecast at mid-latitudes.
- The NESDIS WindSat improved the forecasts in the tropics.
- The NESDIS version has more slow wind speed observations which generally have greater O-B errors.
- The Navy WindSat product typically has higher and more consistent observation counts.

Acknowledgements

- Prof. Michael Morgan (UW-AOS) for giving insightful advice and for local computer resources.
- Stephen Lord (NCEP) for computer resources and tape space.
- Stacie Bender and Dennis Keyser for collecting and processing our various data streams.
- Peter Gaiser and Zorana Jelenak for providing the Navy and NESDIS WindSat data.