Near-Real Time Ocean Surface Vector Winds from RapidScat

Paul S. Chang,
Zorana Jelenak,
Seubson Soisuvarn
Faozi Said
NOAA/NESDIS/STAR

Many thanks to the JPL/NASA RapidScat Team

Key Facts About the NASA ISS-RapidScat Mission

Launch: September 21, 2014 on a SpaceX Dragon spacecraft.

Mission duration: 2 years. May extend if Columbus ISS site remains available.

Instrument: Dual-polarization, Ku-band pencil beam scatterometer using engineering hardware from the QuikSCAT mission.

Measurement accuracy: QuikSCAT-level accuracy with 25 and 12.5 km spatial resolution.

Measurement swath: ~800 km (varies with ISS altitude)

Data products: near real-time (NRT) data produced by JPL and distributed by STAR for NOAA's operational users, science data distributed through NASA's Physical Oceanography Data Active Archive Center (PODAAC).

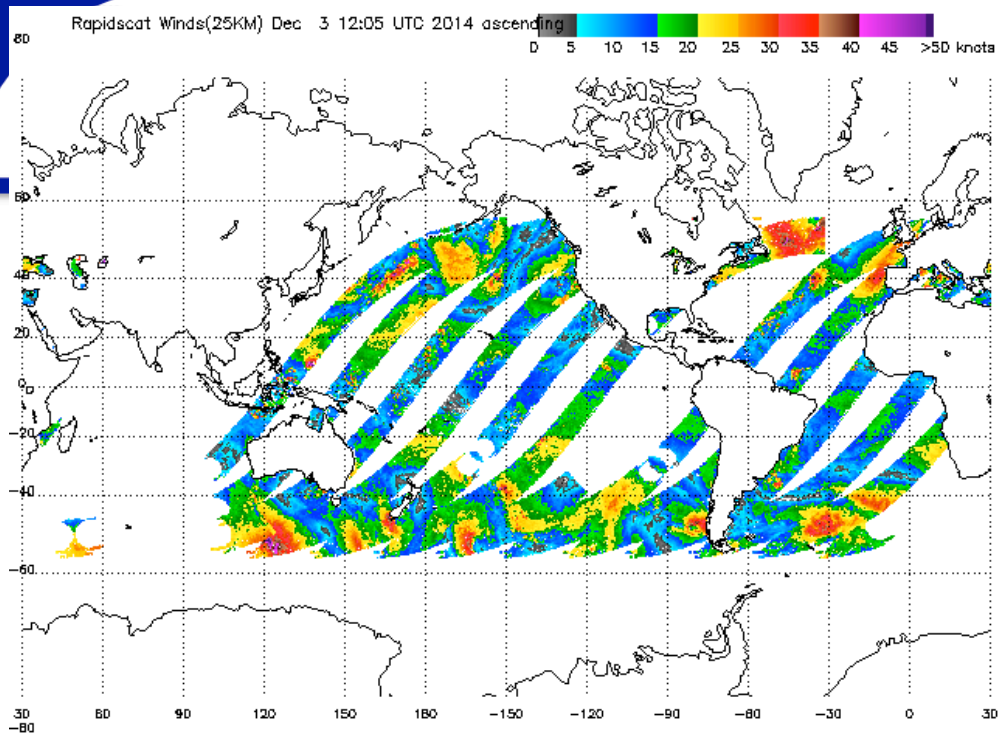
Mission timeline: the instrument was assembled largely from QuikSCAT and new parts, integrated and tested in less than 2 years,

RapidScat Data Available in NRT

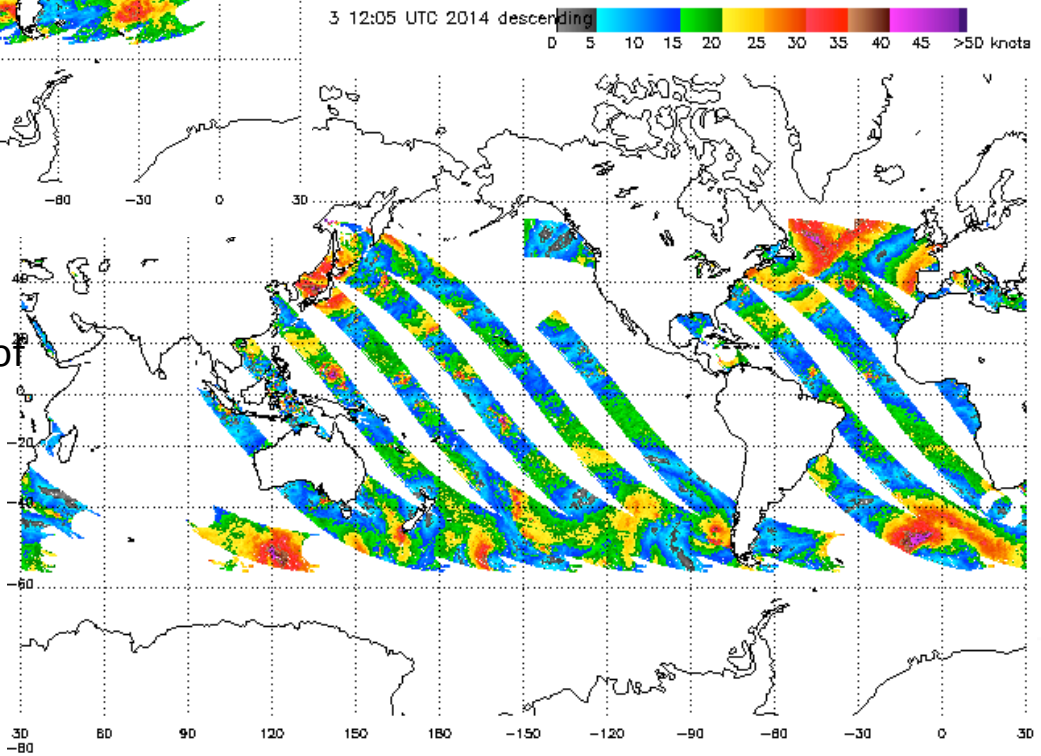
- Data of opportunity
  - Wind products produced by JPL and distributed to NOAA operational users via NESDIS/STAR

- Daily RapidSCAT NRT wind maps available at http://manati.star.nesdis.noaa.gov/datasets/RSCATData.php/RSCATData.php
  - To gain access to NRT data email: Paul.S.Chang@noaa.gov

- NAWIPS RapidScat-lite files containing selected wind vectors in form of QuikScat like 25km and 12.5km liite files
  - Ambiguity lite files available soon

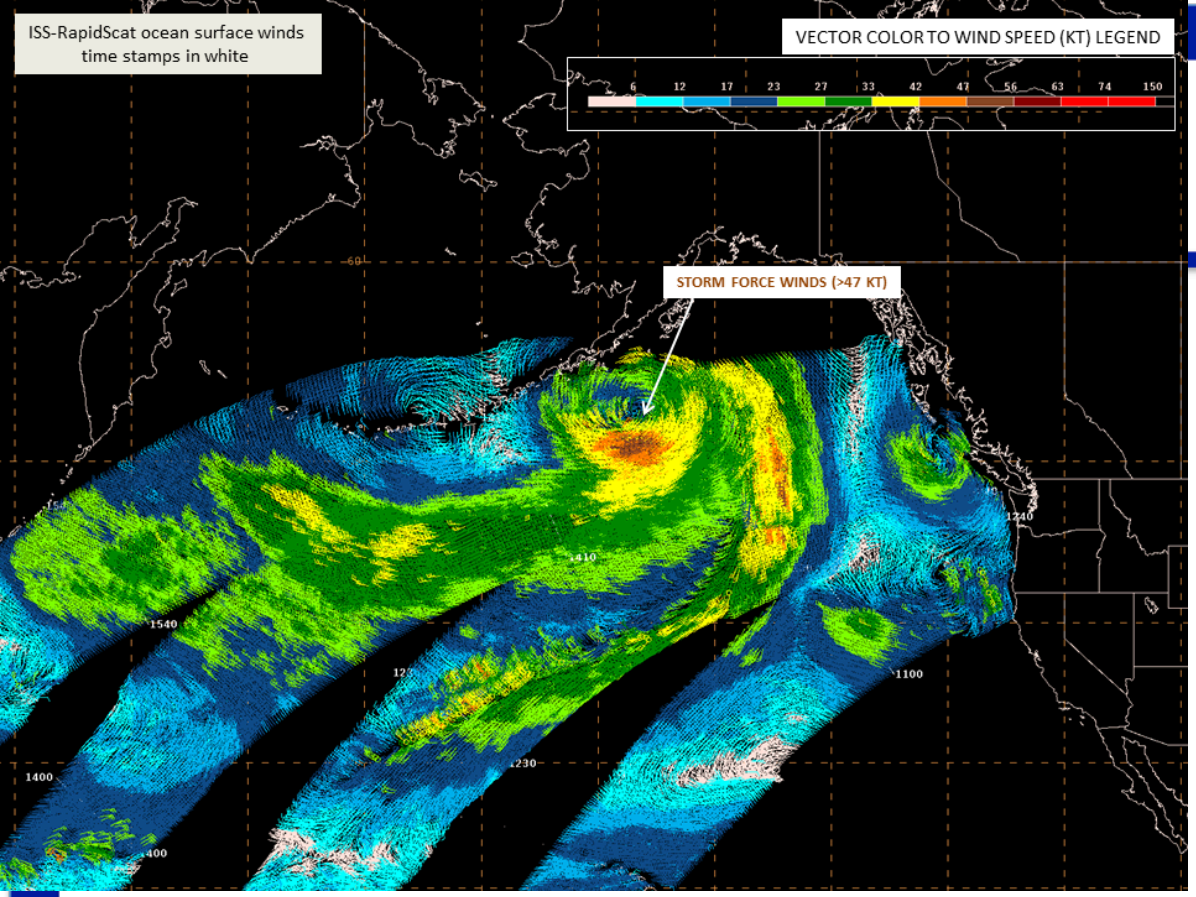


- RapidScat publicly available in NRT via NESDIS/STAR Ocean Winds Manati web page since Dec 1st 2014



- Global images and zoomed in images of selected winds
- Zoomed in images of all ambiguities
- Tropical Storm centered wind vector retrievals
- Tb and u and v-wind component monitoring pages
- Alerts to RapidScat scheduled outages

http://manati.star.nesdis.noaa.gov/datasets/RSCATData.php



RapidScat announced on OPC Social Media Outlets

A major accomplishment at the Ocean Prediction Center and a huge boon for marine forecasting: as of this morning, November 20th, we are now receiving experimental data from the RapidScat instrument flying aboard the International Space Station! Similar to ASCAT, OSCAT and QuikSCAT, RapidScat will provide remotely sensed ocean surface wind speeds and directions. With such a huge void of radar and surface observations over the oceans, remotely sensed ocean surface winds play an instrumental role in marine decision making, forecasting, and modeling.

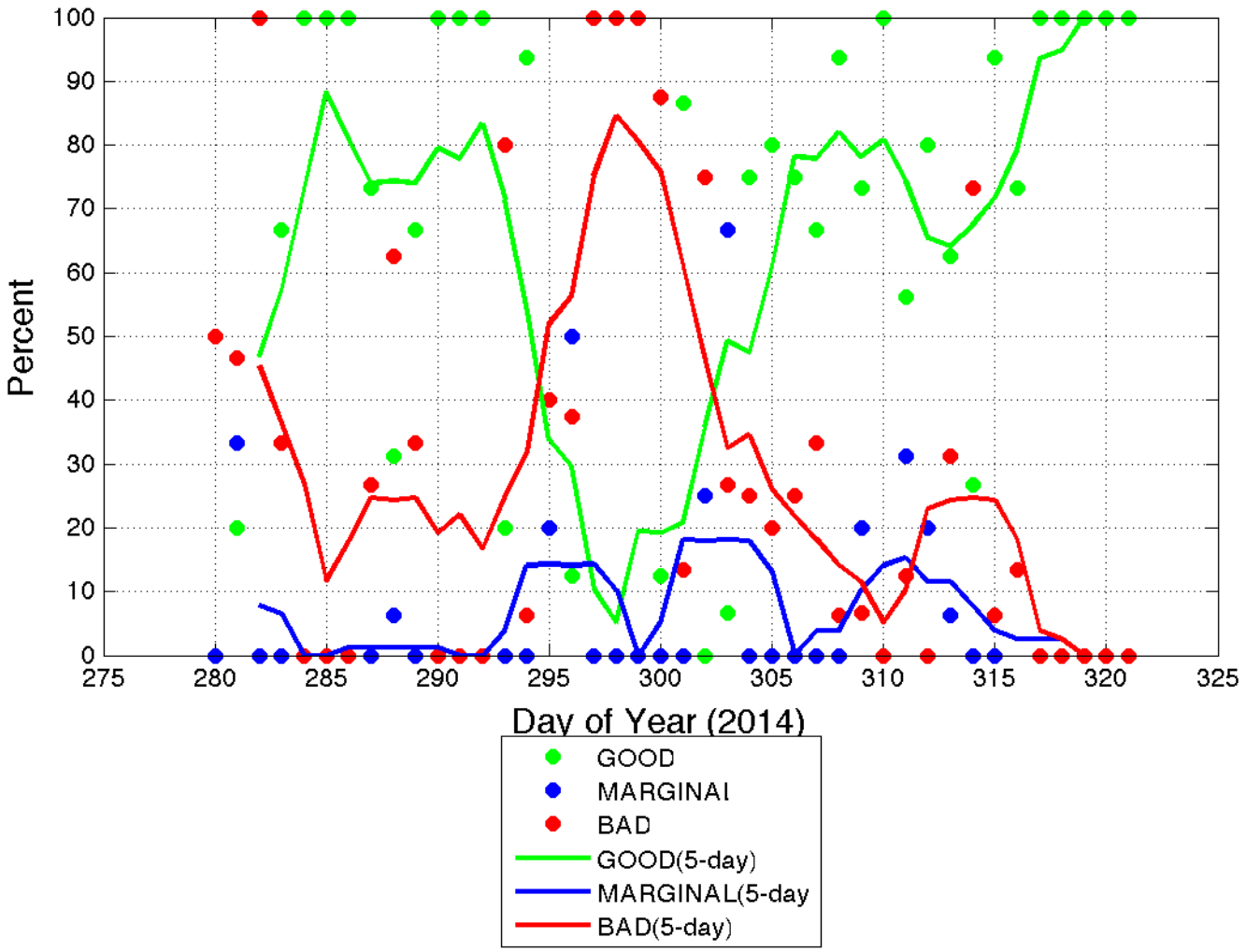
For more information: http://www.jpl.nasa.gov/missions/iss-rapidscat/

Data Quality

RapidSCAT data labels

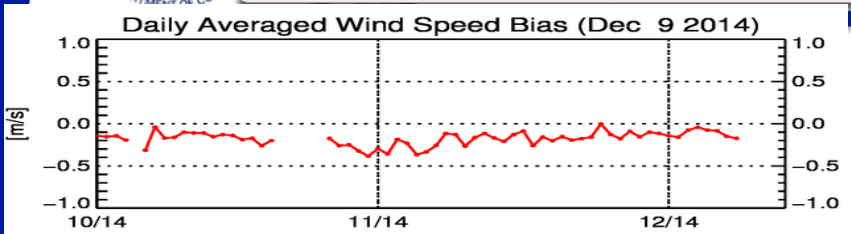
- GOOD passes are when the radar is on and the space station attitude is stable
- MARGINAL passes are when the attitude is so-so.
  - Marginal passes are when the attitude is so-so. Back scatter measurement error varies in this situation. Some measurements are good. Others are not. Marginal wind fields have accurate winds but also have lots of gaps where winds were not retrieved
- BAD passes are the ones when the radar was turned off or the space station was flopping around.
  - These things happen for various reasons. For example radar have to be turned off to avoid irradiating astronauts on a spacewalk for or when the space station may spin about to allow a cargo vessel to dock in the preferred manner.
- Only GOOD and MARGINAL data are available in NRT

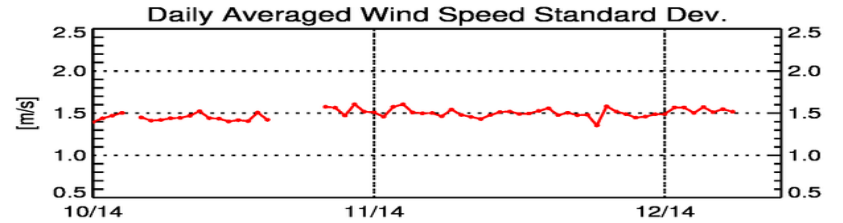
% of Available NRT Data 10/02/2014-11/21/2014

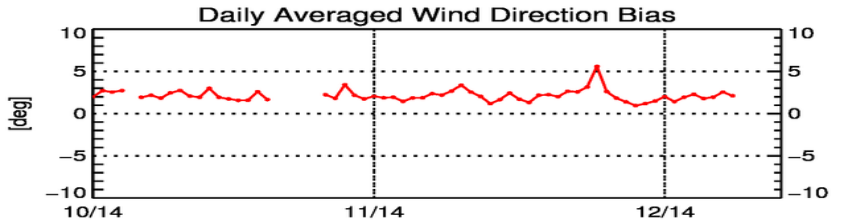


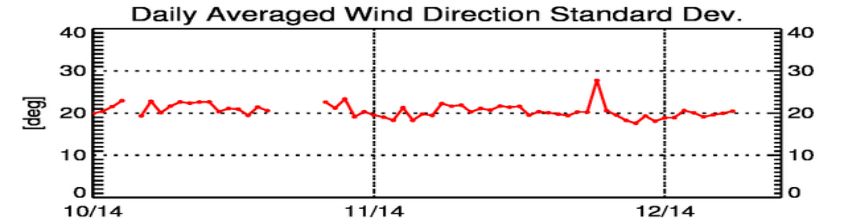
Monitoring

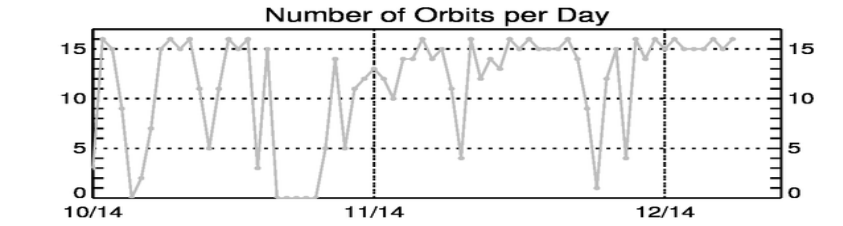
http://manati.star.nesdis.noaa.gov/datasets/RSCATData.php

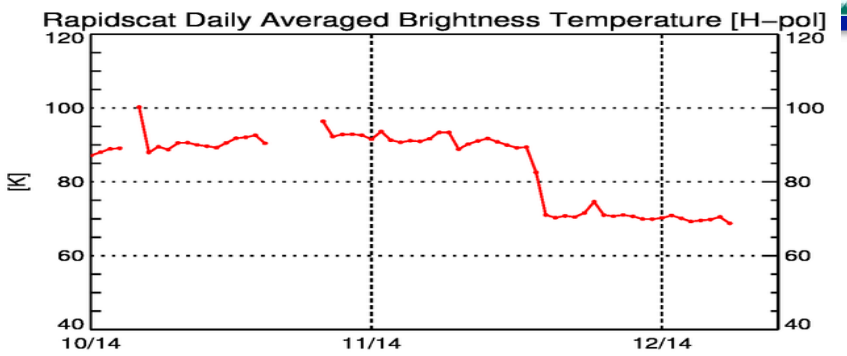


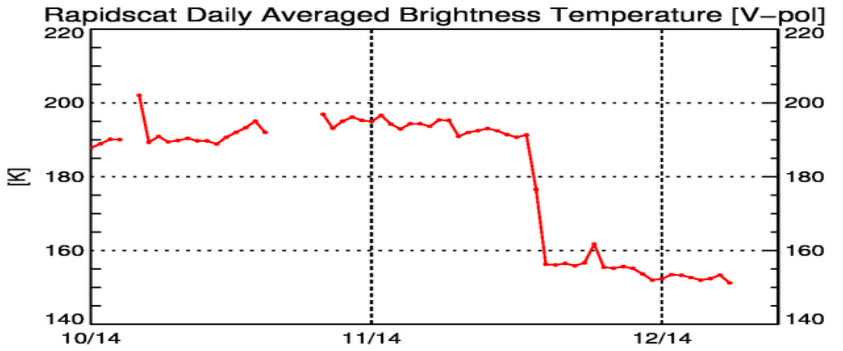


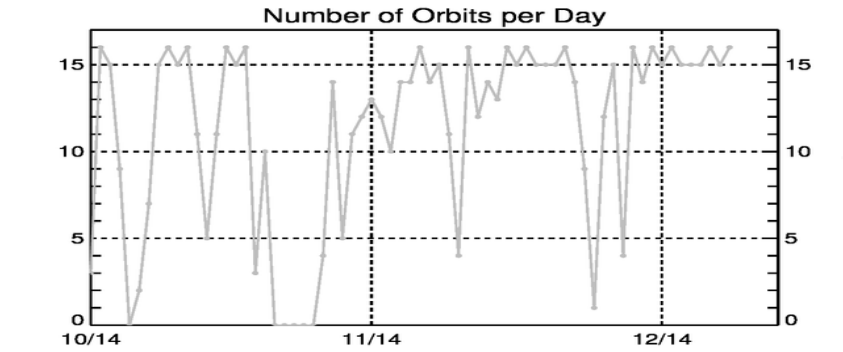












RapidScat Scheduled Outages

http://manati.star.nesdis.noaa.gov/rscat_images/monitor/RapidScat_Scheduled_Outages.txt

Start	End	Description
Jan ??, 2015 (mid Jan)	???	RS may be off during an EVA for IDA prep
Wed Jan 14, 2015 UTC ????	???	RS will be off during the departure of Dragon SpX-5
Thu Dec 18, 2014 UTC ????	Thu Dec 18 UTC ????	RS will be off during the arrival of Dragon SpX-5, (launch Dec 16, Tues, 19:31 UTC)

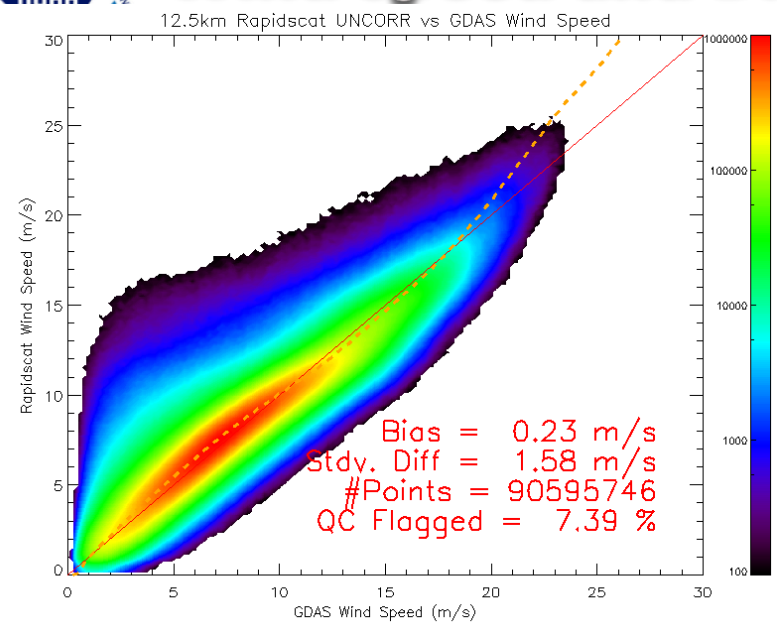
Past Events:

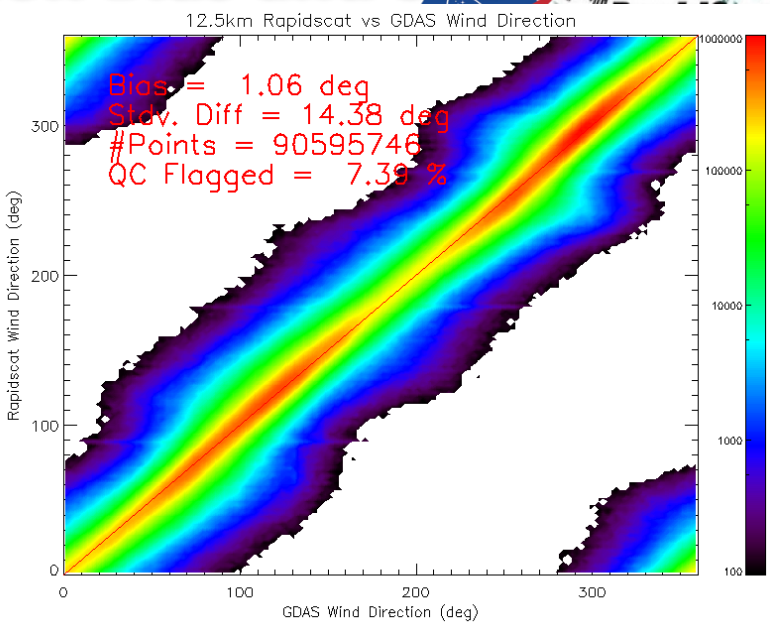
Thu Nov 27, 2014 UTC 0030	Thu Nov 27 UTC 1837	RS was off during a reconfiguration of the Columbus Module. No data for RS Revs 1002-1013
Sun Nov 23, 2014 UTC 1235	Mon Nov 24 UTC 2235	Arrival/docking of Soyuz 41S. ISS attitude changed 20 degrees. No data for RS revs 948-969
Wed Nov 12, 2014 UTC 1211	Wed Nov 12 UTC 1517	RS Rev 777 no data and 778 marginal. ISS maneuvered to avoid debris UTC1235
Sun Nov 09, 2014 UTC 2000	Mon Nov 10 UTC 1630	RS was off during the arrival of a visiting vehicle - no data for revs 735-749

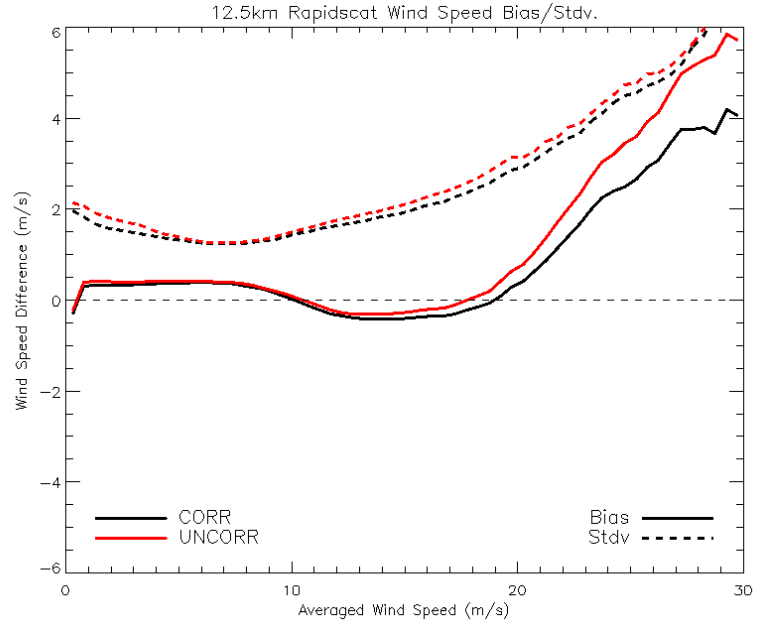
Validation Results

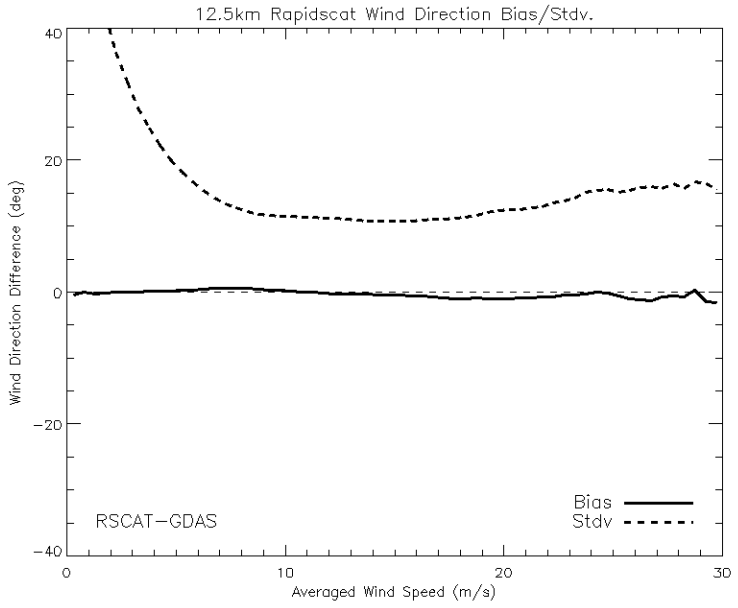
- 12.5km products
  - Uncorrected and corrected wind product
- RapidScat Version3 Cal/Val data package
  - Revs 161 - 948
  - Exclude MARGINAL and BAD revs
- Matchup with NCEP's GDAS Winds
  - Flagged retrieved WVC about 3-7%

Wind Speed and Direction Bias and STD

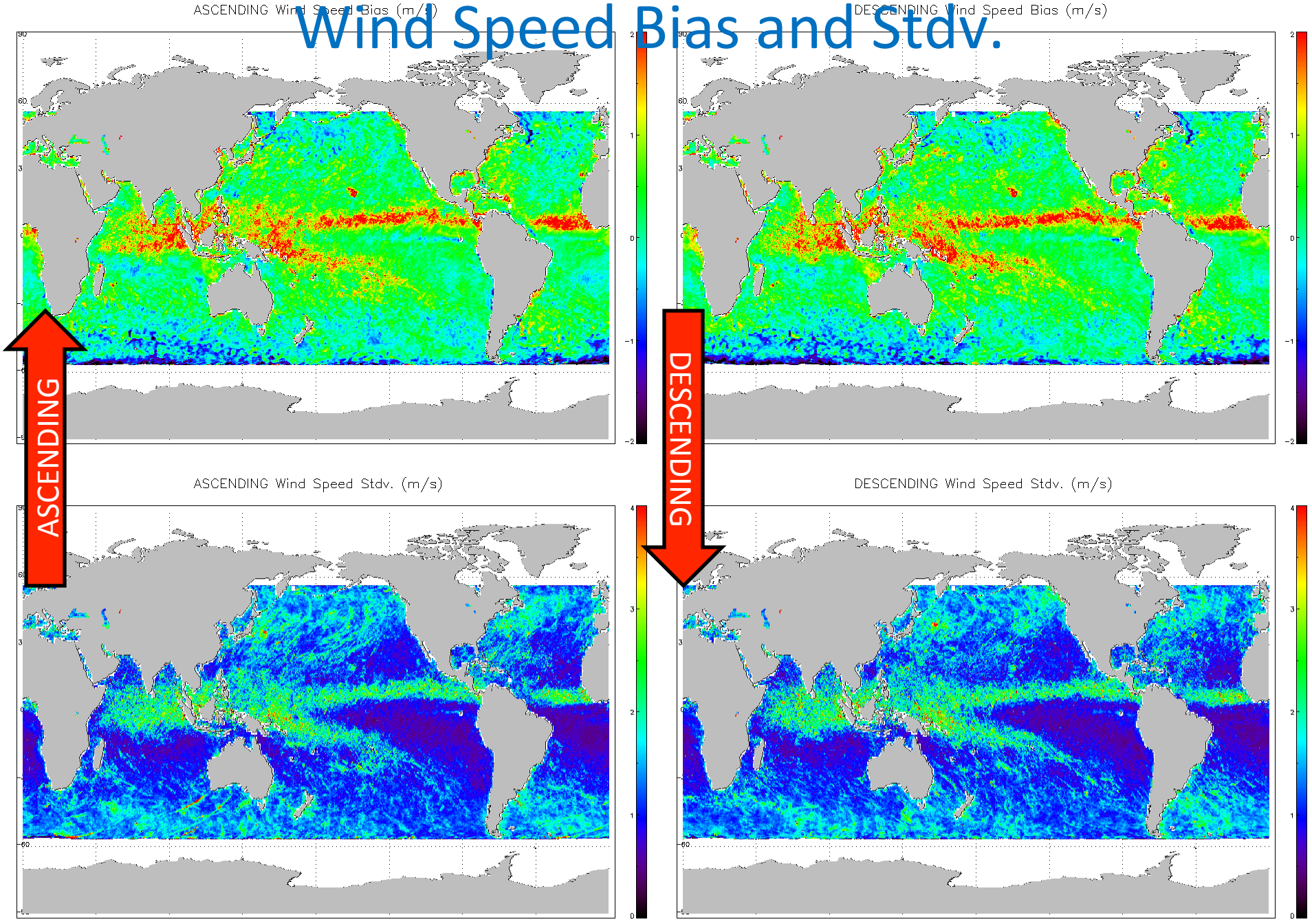




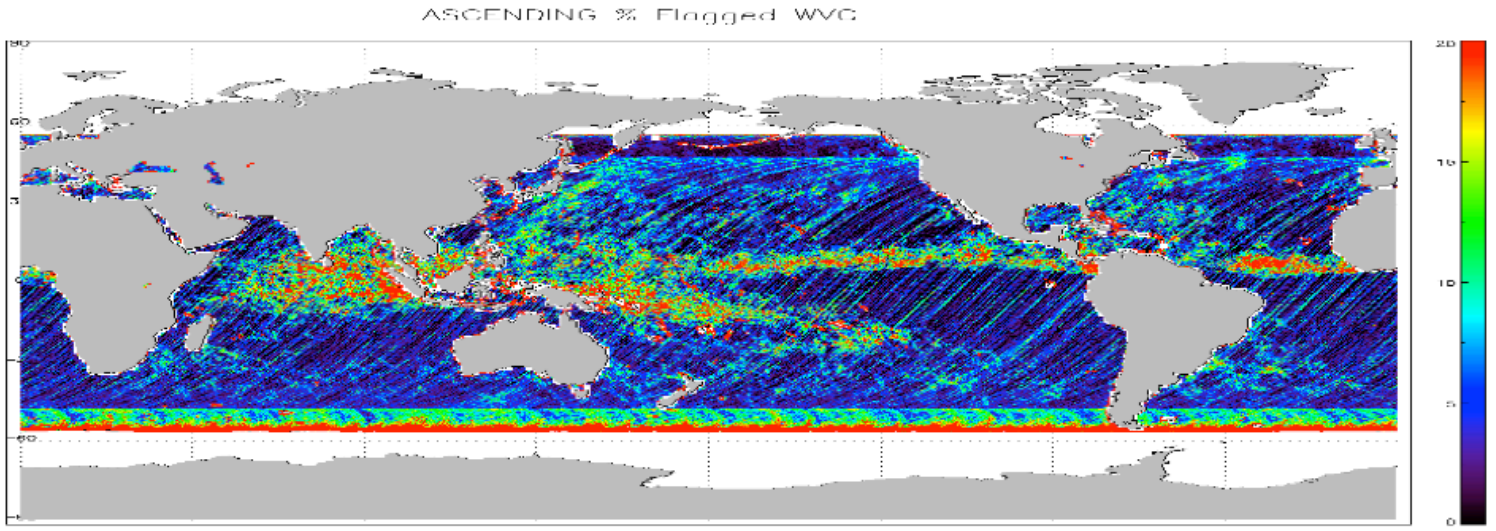


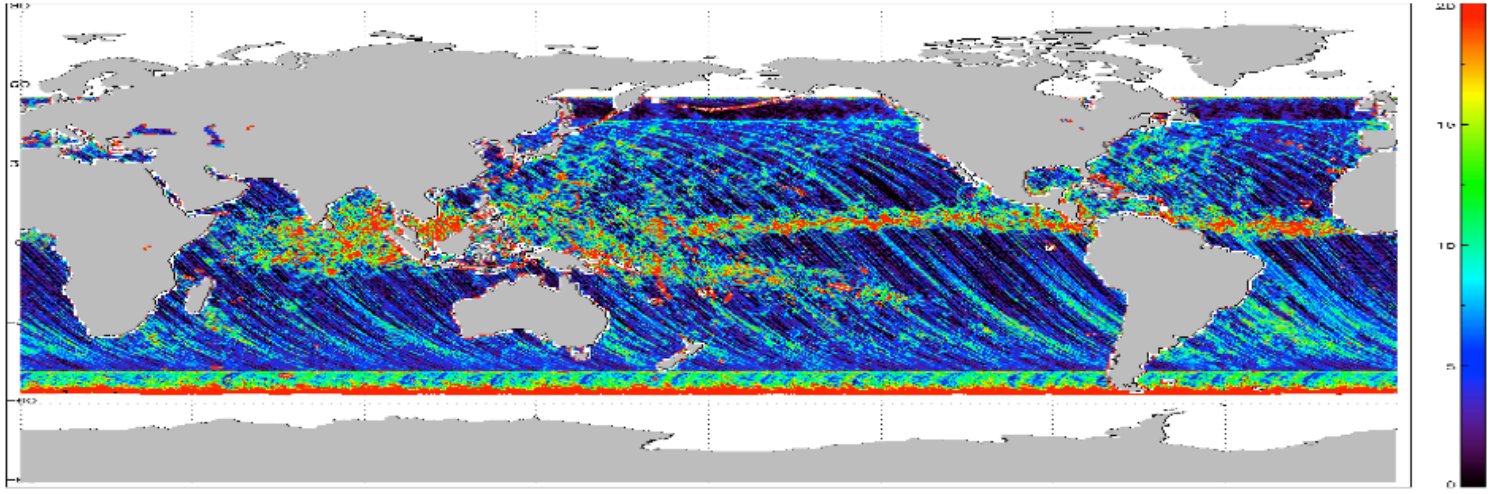


Wind Speed Bias and Stdv.

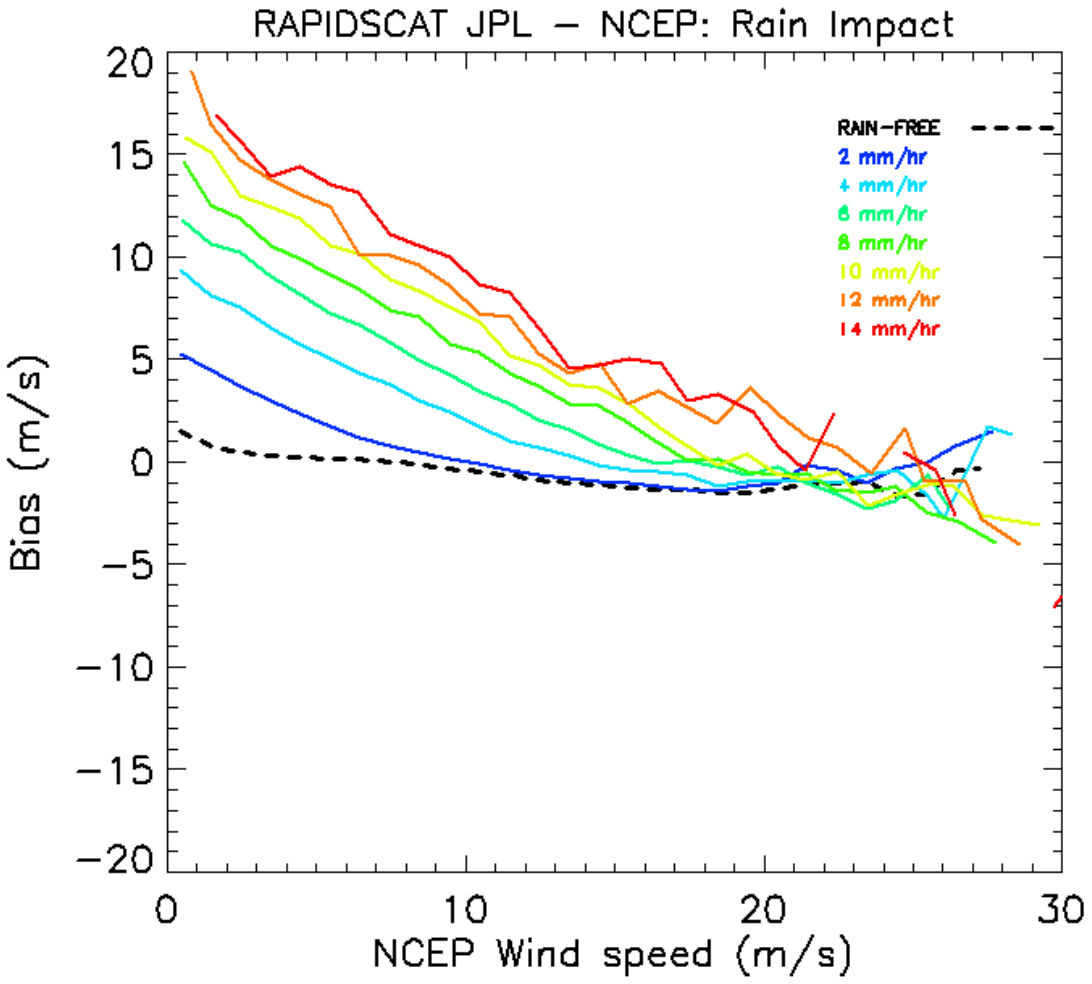


Percentage of Flagged WVC Geographical Distribution



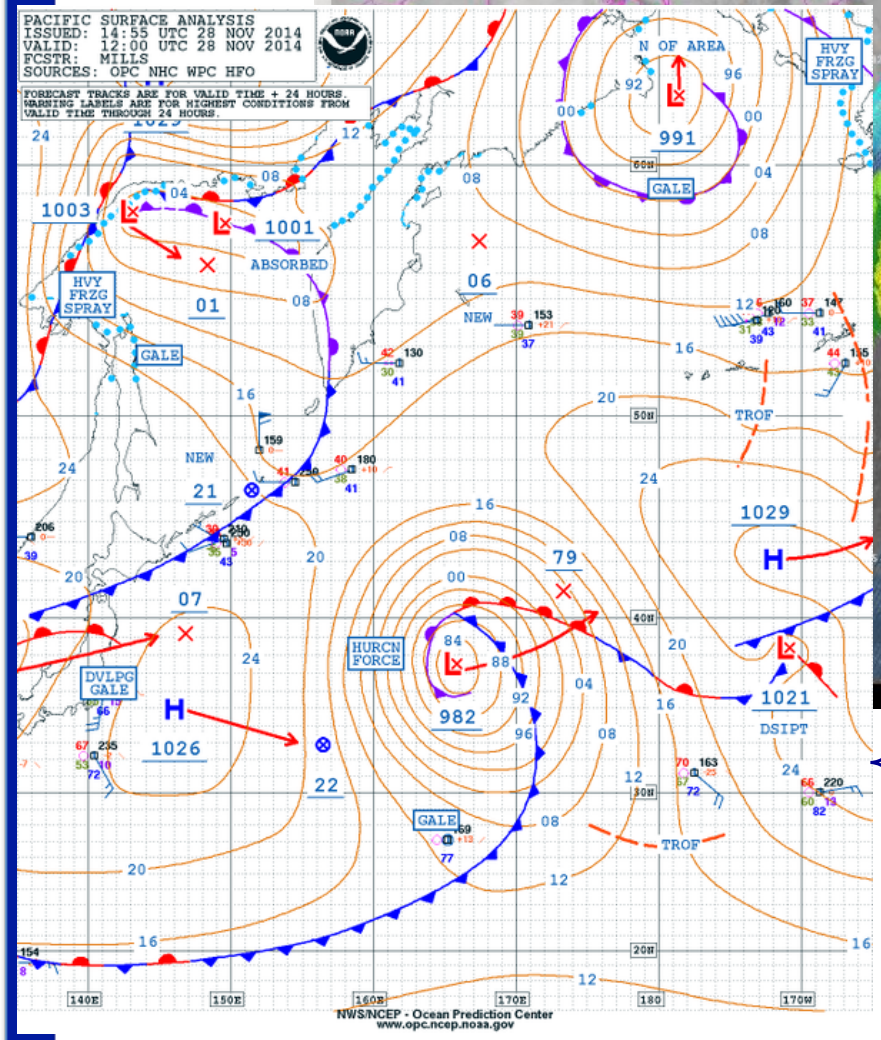


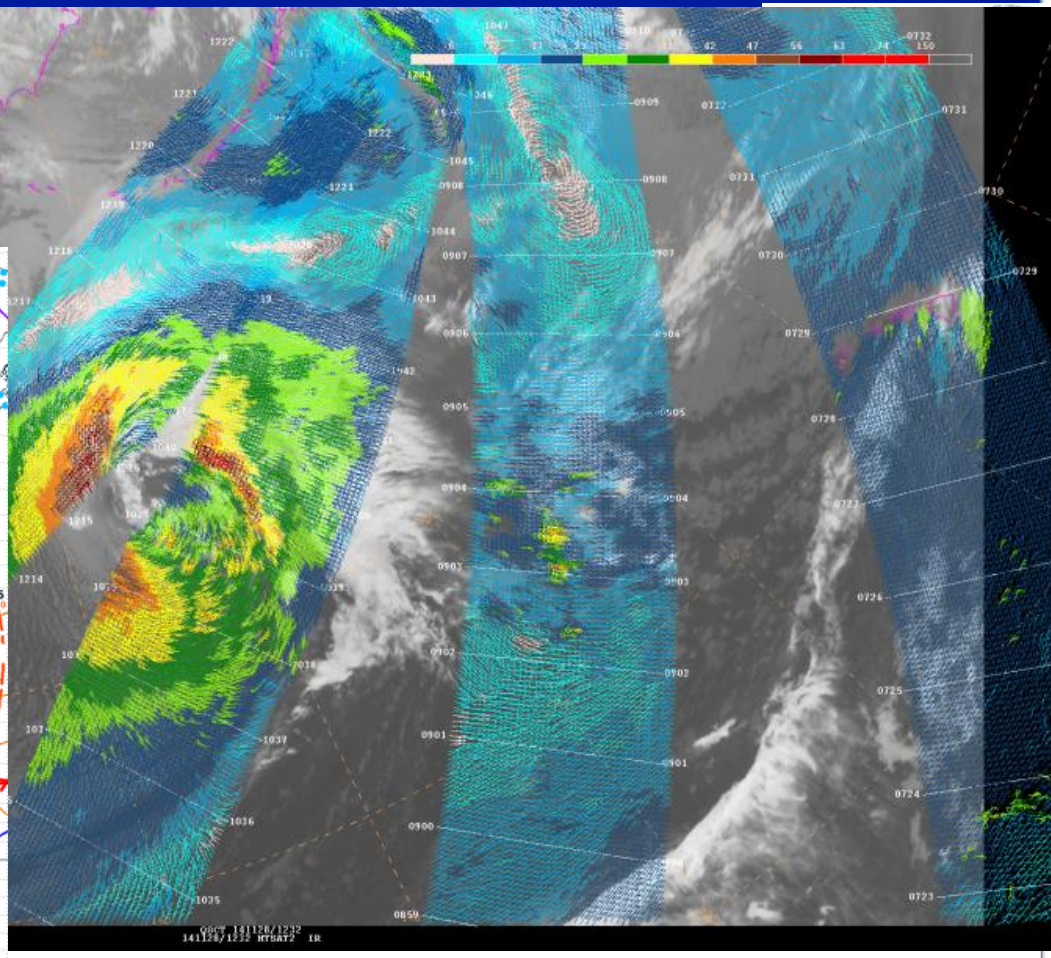
Rain Impact



Courtesy of Lucrezia Ricciardulli RSS

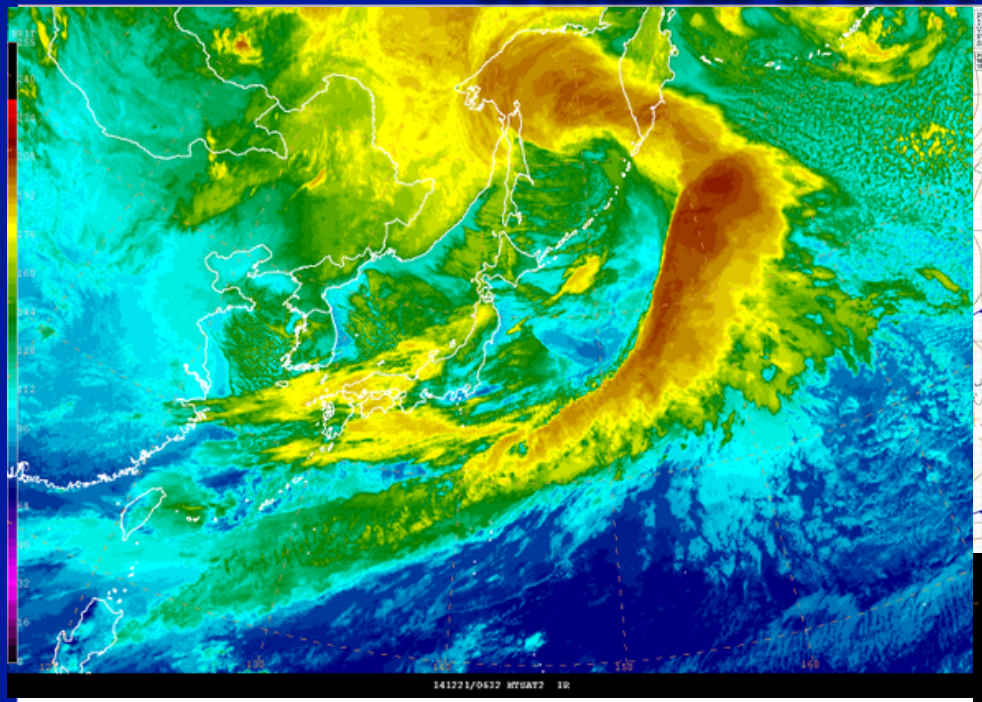
NRT Data Utilization

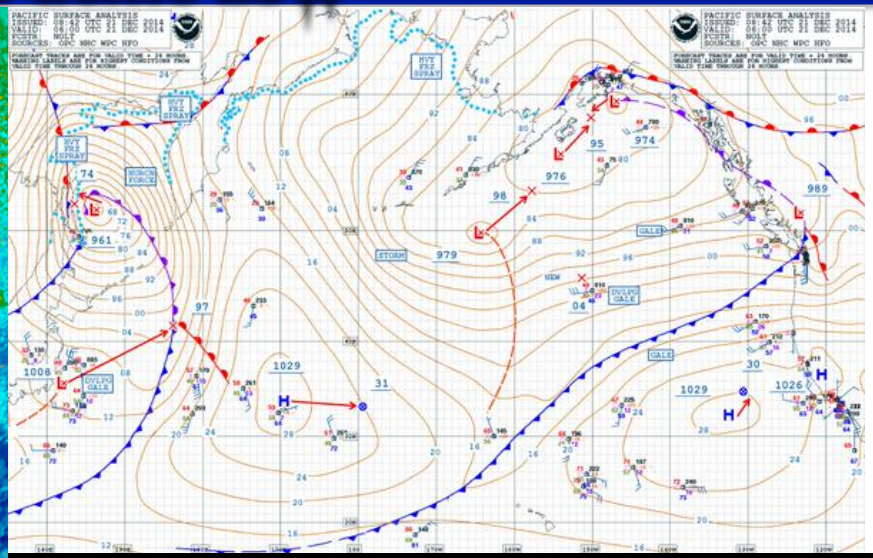


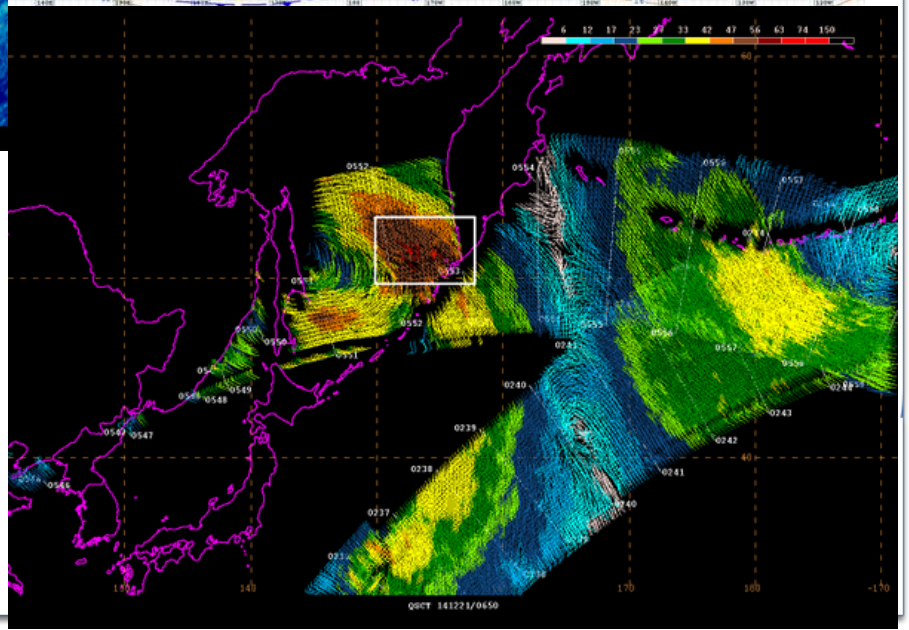


- RapidScat reveals HF winds at the northern part from storm center low on November 28th,2014 at its 10:39Z pass. OPC upgraded its 12Z warning to hurricane force

RapidScat Reveals Hurricane Force Winds in West Pacific Low

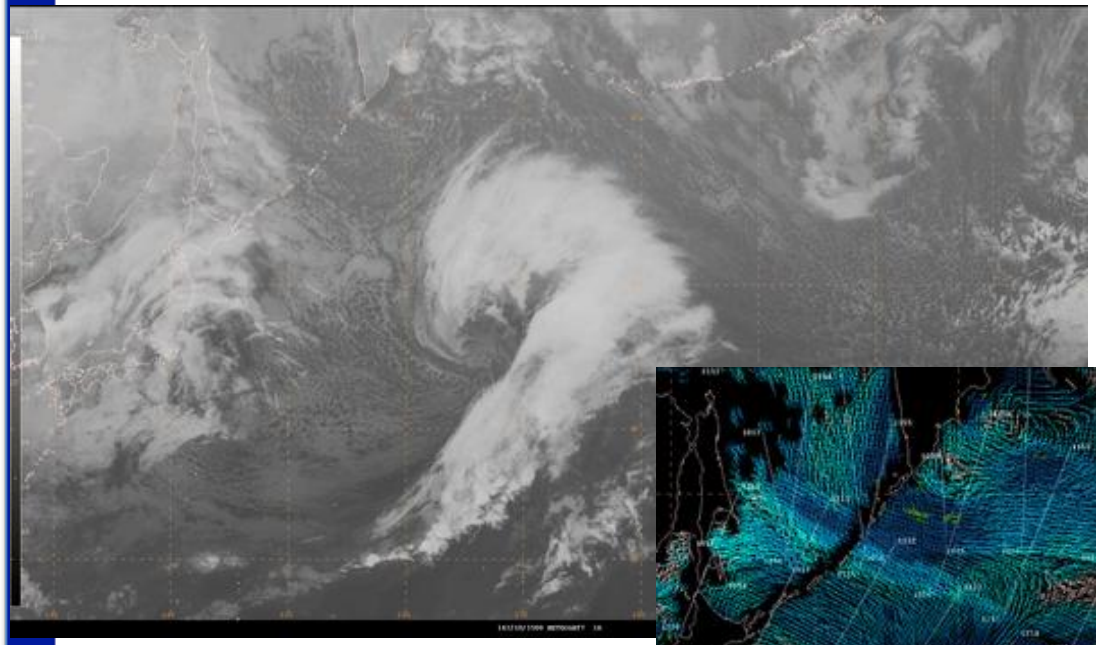


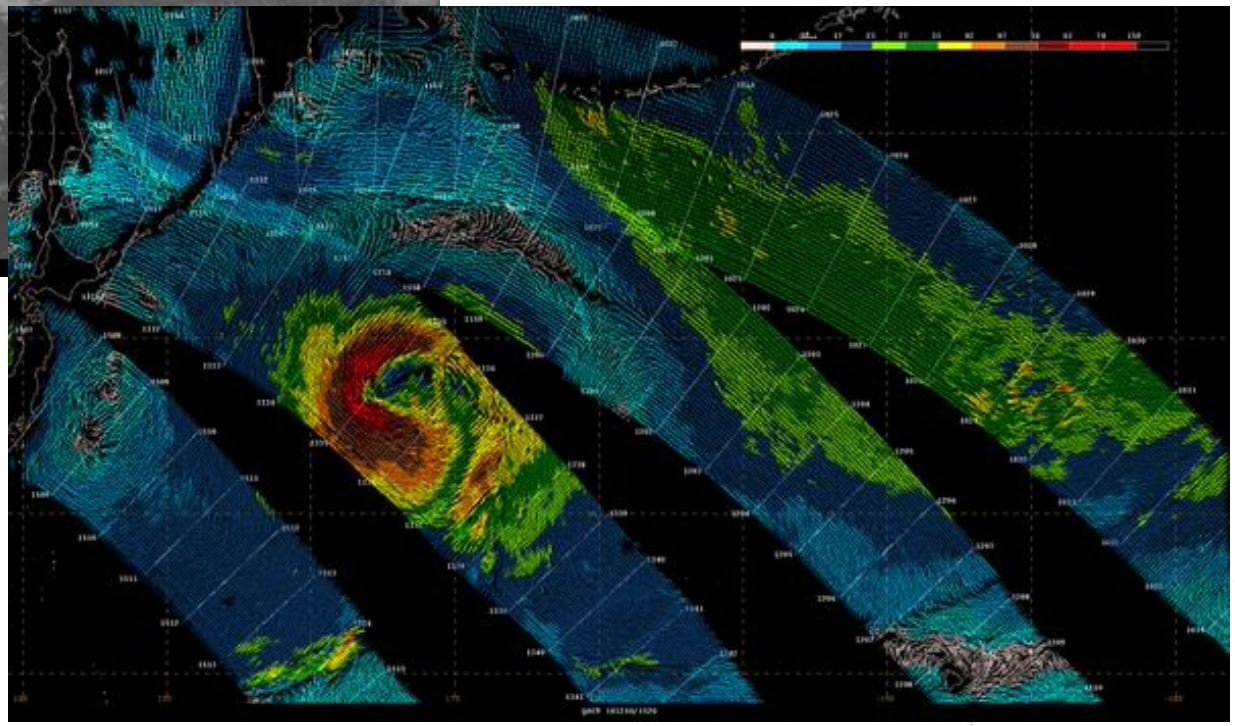




12/21/2014 MTSAT-2 IR image, RSCAT wind retrievals, & 06Z OPC surface analysis show 961mb in West Pacific hurricane force low

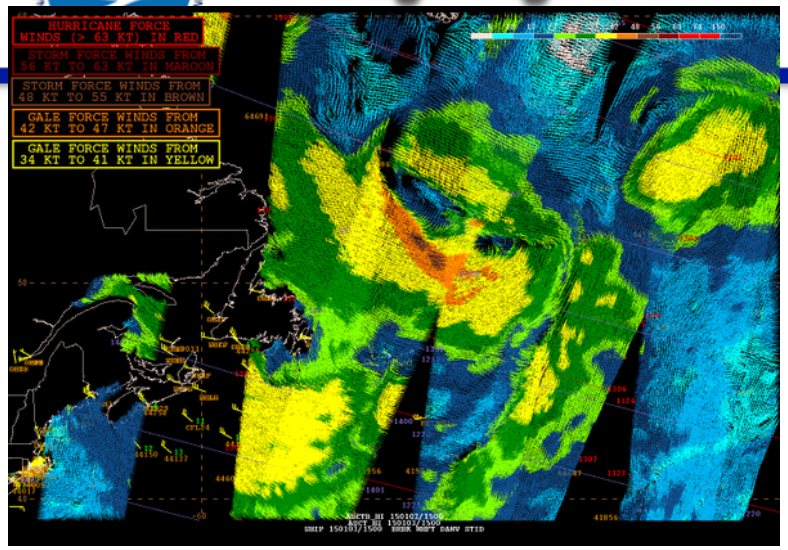
RapidScat Hurricane Force Wind Retrievals

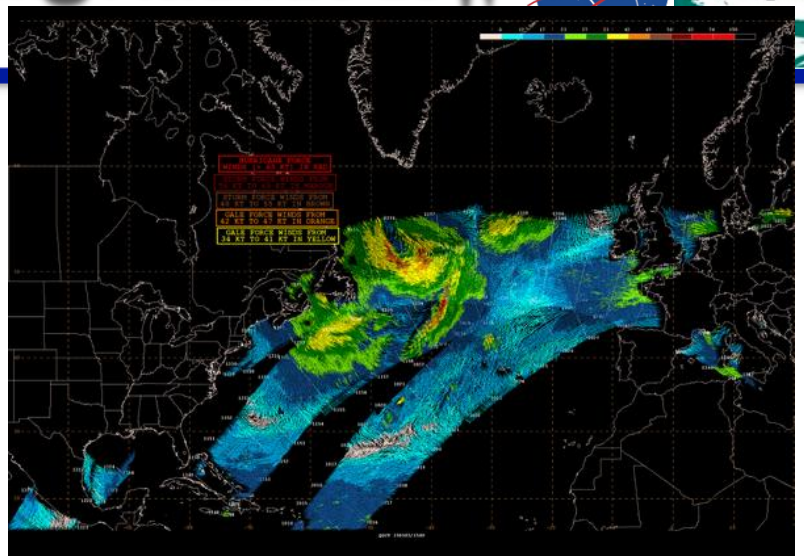




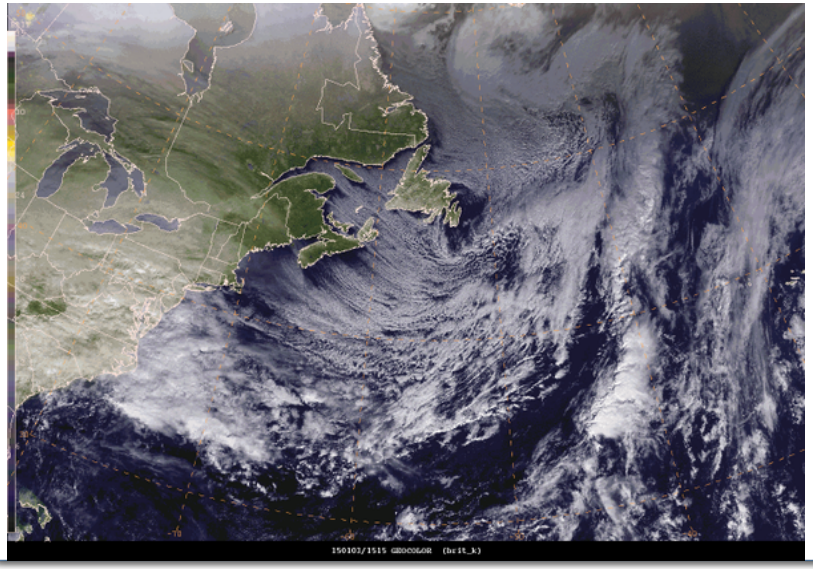
12/10/2014 RapidScat confirms hurricane force winds (brightest reds) in W/SW quadrants of Pacific low pressure

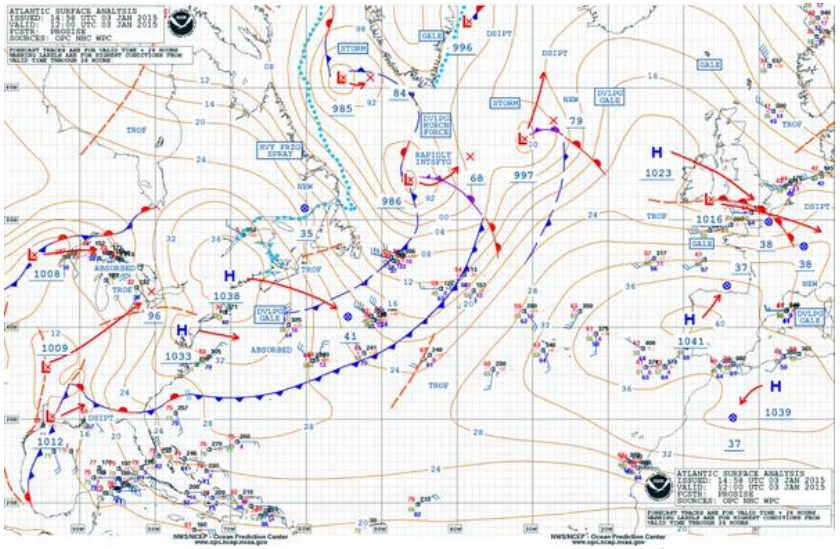
Rapidly Intensifying Atlantic Low



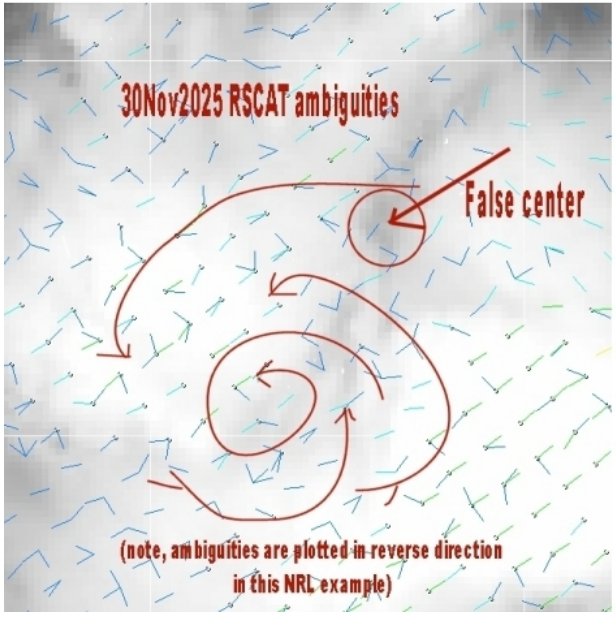


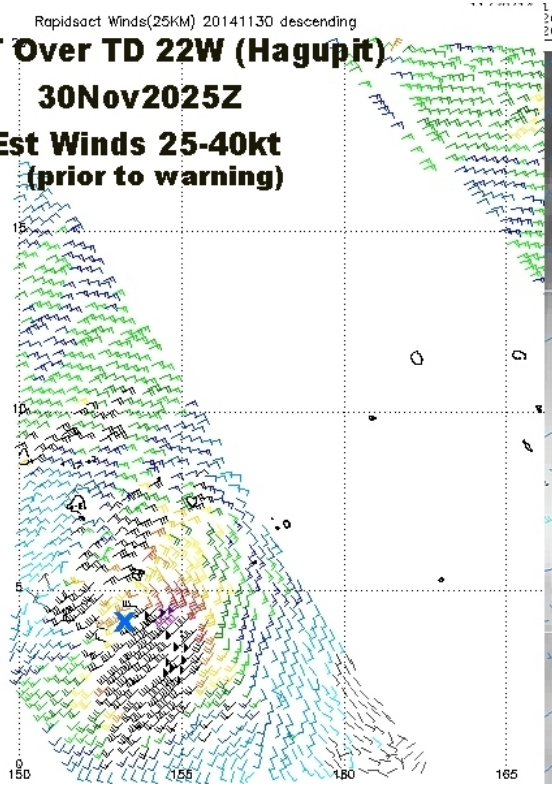
01/03/2015 13Z RSCAT and 15Z ASCAT winds, Geocolor sat. image and 12Z OPC analysis within

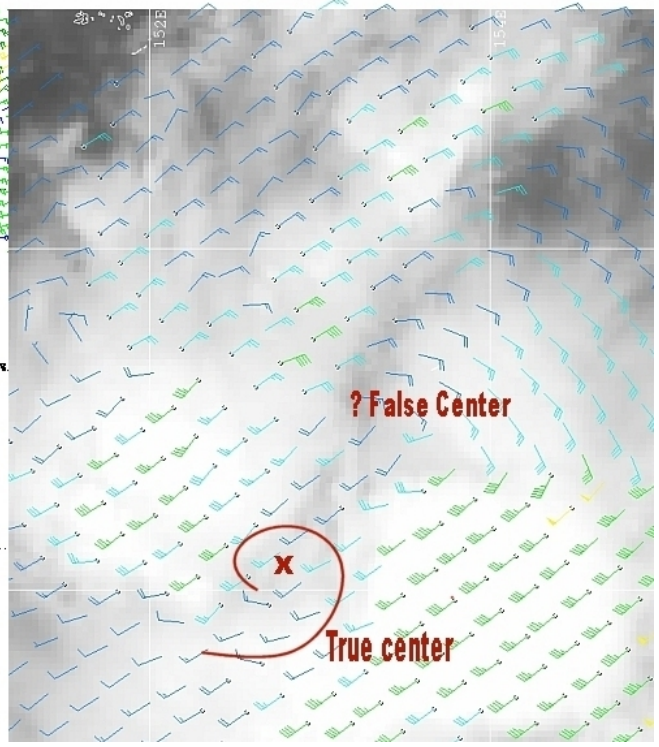




RapidScat Ambiguities reveal TC Center Location







RapidScat in support of Orion test Launch/ Splashdown Dec 14th, 2014 @1229Z

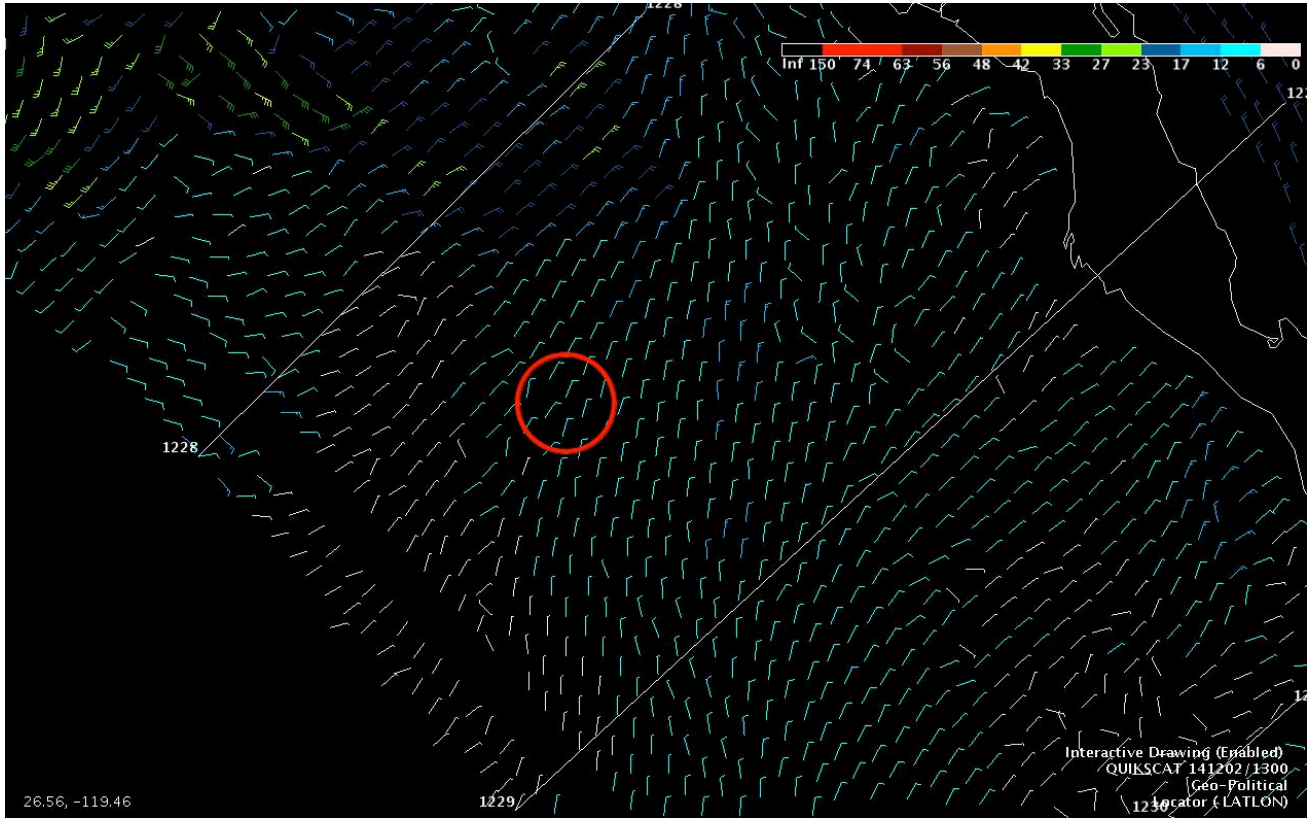
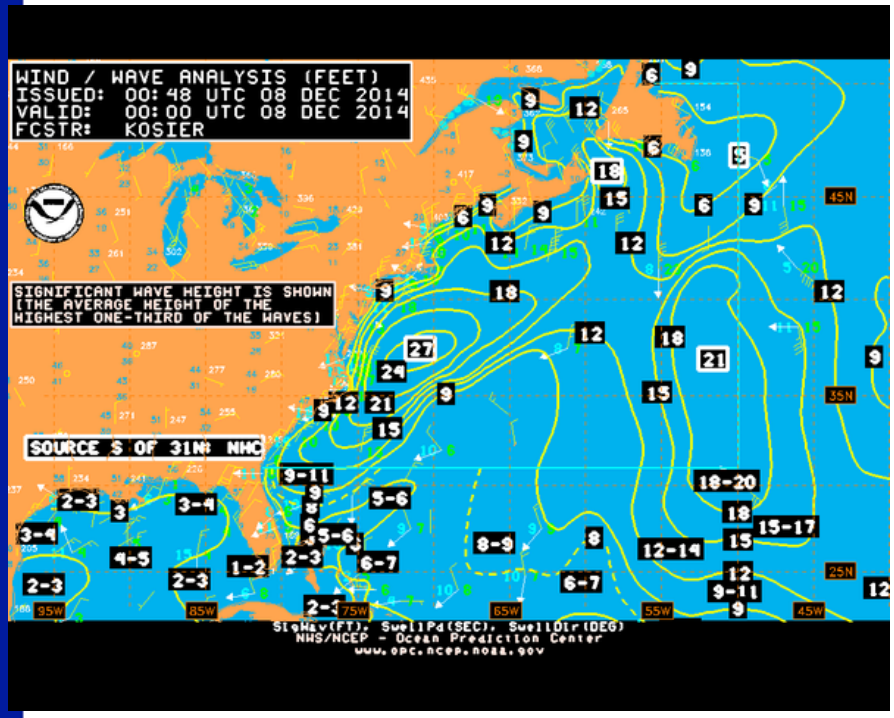


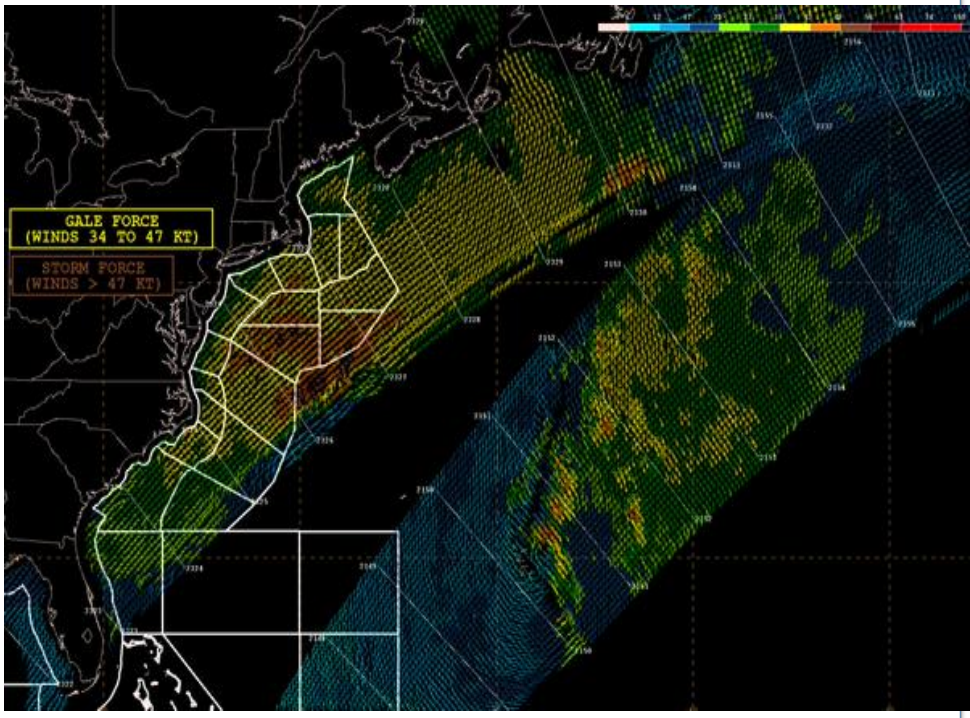
Image courtesy of **Tim Garner, NWS/Johnson Space Center**

- RapidScat winds were requested to support first test flight of NASA's Orion spacecraft. Orion is suppose to be launched Dec 4th, 2014 for 4 1/2h test mission.
- RapidScat wind data was made available in AWIPS2 readable form for this support

Coastal Region Wind and Wave Forecast and Warning Support

12/07/2014 00Z OPC Atlantic wind/wave analysis chart with corresponding RapidScat wind data





Summary

- RapidScat is providing near real-time ocean surface vector wind data
- Quality comparable to that of QuikSCAT but there are still areas for improvement
- 25km and 12.5km products are available in the NWS NAWIPS/NMAP environment and are being used to support the forecasting and warning process
- The ISS orbit provides an opportunity to cross-calibrate satellite scatterometers and characterize the diurnal variability of OSVW.