P1.37 Comparisons and Evaluations between the Oceansat-2 (OSCAT) and ASCAT Scatterometers over Tropical Cyclones

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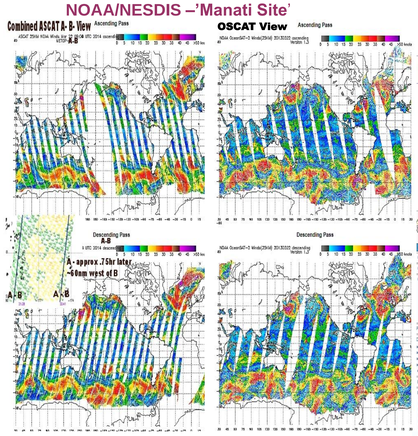
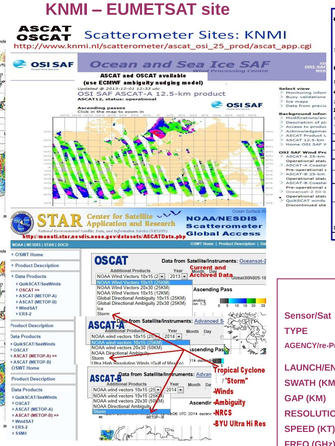
Coverage and Availability of Scatterometer: OSCAT vs. ASCAT and WindSAT

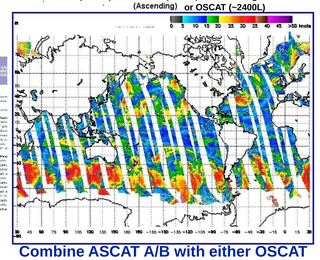
NOAA/NESDIS –'Manati Site'



KNMI – EUMETSAT site



ASCAT (~2200L) and WindSAT (~1800L) Combined Image (Ascending) or OSCAT (~2400L)



Combine ASCAT A/B with either OSCAT or WindSAT to increase coverage

Sensor Characteristics

Sensor/Sat	QuikSCAT	ASCAT A/B	WindSAT	OSCAT-2
TYPE	Active	Active	Passive	Active
AGENCY/re-Processed	JPL/NESDIS	ESA/KNMI	US Navy	India/KNMI
LAUNCH/END	1999/Nov09(end)	2006/12	2003	2009
SWATH (KM)	1800	2 X 550	~1100	1836
GAP (KM)	0	600	N/A	N/A
RESOLUTION (KM)	25 (12.5)	50 (25)	25	50 (25)
SPEED (KT)	4-80	5-60	10-40	5-60?
FREQ (GHz)	13.4 (Ku-Band)	5.6 (C-Band)	6.8	13.5(Ku-Band)
COVERAGE (90%)	1 Day	~1 Days (wvtwo)	~2 Days	~1 Days
ASCND NODE (LST)	600	2200	1800	2400

Two Sensor (A/B) ASCAT Coverage

Advantage
- Comparison of two independent views
- Obtain ~100km additional coverage
- 2nd sensor still available if 1st goes down

Disadvantage
- Does not significantly add to coverage
- Same large spacial gaps
- Same local times and 12-hr gap in view
- In WPAC too late for 00/12Z analysis

Specialized Views

(KNMI view as a backup)

NOAA/NESDIS "Storm Page" (for each NRL TC/ INVEST)
- -Winds
- -Ambiguities
- -Normalized Radar Cross-Section (NRCS)
- -BYU Ultra High Resolution

OSCAT Sensor

- -Coverage similar to QuikSCAT
- -In WPAC too late for 00/12Z analysis
- -Availability at NOAA/NESDIS is dependent upon two outside agencies

Goal of Study

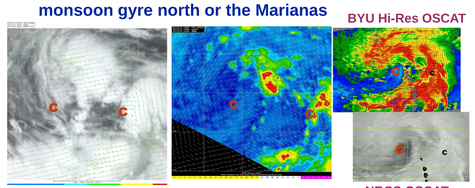
- -Compare reliability, depiction and accuracy over tropical cyclones
- -Find strengths and weaknesses
- -Assess comparative loss with QuikSCAT
- -Evaluate NRCS and BYU Hi-Res products to assist analysis
- -Use of integrated techniques, especially with microwave imagery

Goal of Scatterometer Data for TC Analysis

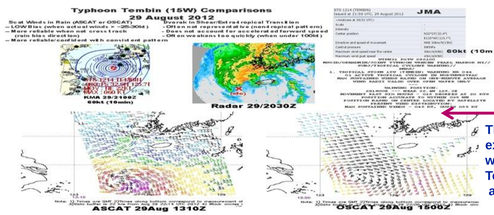
- **Positioning and Motion**
- **Minimum (at least) maximum wind**
- **Structure and Structure Change (Wind Radii)**
- **Genesis and (Surface) Genesis processes**
- **Extratropical Transition and Dissipation**

Case Studies of Different Tropical Cyclone Characteristics

Typhoon Man-Yi (16W) development from a monsoon gyre north or the Marianas



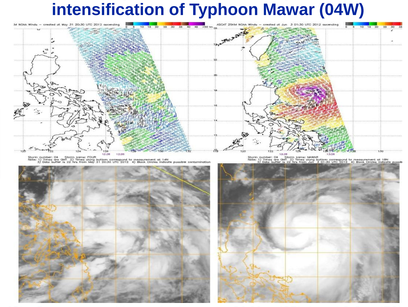
Development was slow with a large light and variable wind center. At this time winds were beginning to consolidate about one circulation center as better seen in the OSCAT NRCS and BYU Hi-Res images.



Typhoon Tembin (15W) approaching Japan

The intensity of a tropical cyclone that has begun extra-tropical transition is often underestimated when intensity is solely based on the Dvorak Technique. Use of scatterometer will often give a higher minimum intensity value (>60kt).

ASCAT depiction of the development and intensification of Typhoon Mawar (04W)

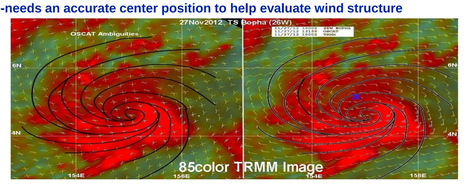


48hr Structure and intensity between 31 May (25kt) and 2 Jun (70kt)

Examples of Scatterometer/MI Data and Use of Dvorak Analysis

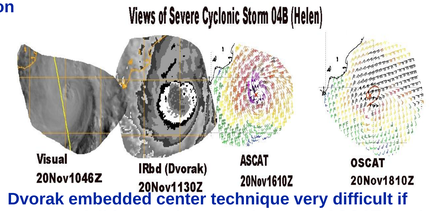
Super Typhoon Bopha (26W) on its way to rapid intensification

--needs an accurate center position to help evaluate wind structure



Use of 85 color TRMM microwave imagery required to determine ambiguity and wind solutions

Views of Severe Cyclonic Storm 04B (Helen)



Dvorak embedded center technique very difficult if eye not visible, no microwave imagery: ASCAT can help!

Future Scatterometer Needs:

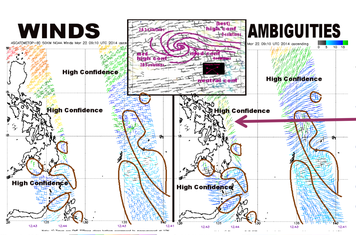
- Higher Wind Speeds Detected
- Higher Resolution with less 'gaps'
- Less Sensitive to Rain (or be able to detect) when rainfall is affecting the measurements)
- Shorter 'refresh' time (minimum 4X/Day)
- Need for future Operational 'support' Automated ambiguity selection (e.g. circulations)

Possible FUTURE SCATTEROMETERS:

- RapidSCAT (International Space Station)
- Dual Frequency Scatterometer (Japan/US)
- Extended Ocean Vector Wind Mission (XOVWM) - NASA

(i.e. NO CHANGE in satisfying these requirements in the past four year, (Ref: Edson, 2010))

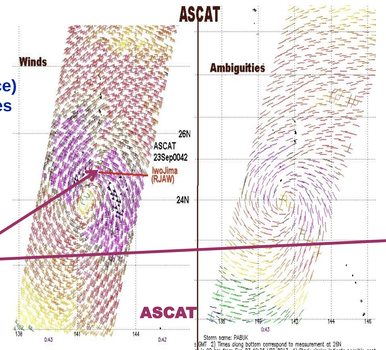
Comparison of Directional Ambiguities between ASCAT and OSCAT



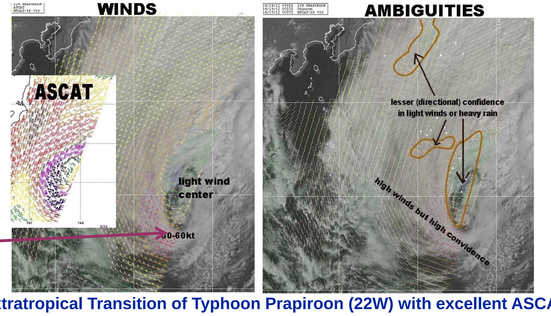
ASCAT

- Primary two opposite ambiguities (high confidence)
- 3- and 4- solution ambiguities (less confidence)
- -- Light wind centers
- -- High rain rates
- -- two inside edges of swath
- -- Higher winds

Excellent Depictions here and here!



Typhoon Pabuk (16W) approaching Iwo Jima



Extratropical Transition of Typhoon Prapiroon (22W) with excellent ASCAT Coverage—light wind center only place with lesser confidence

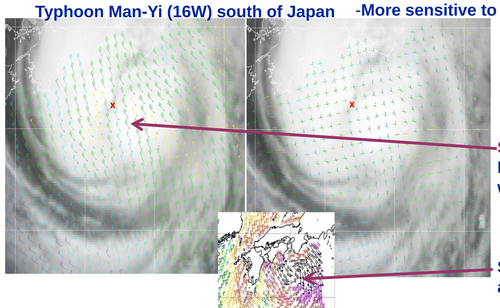
OSCAT

-Many more 3- and 4- solution ambiguities (lower confidence)

-Indication that 'most likely' solution, less reliable than either QuikSCAT or ASCAT

-More sensitive to heavy rain

Typhoon Man-Yi (16W) south of Japan

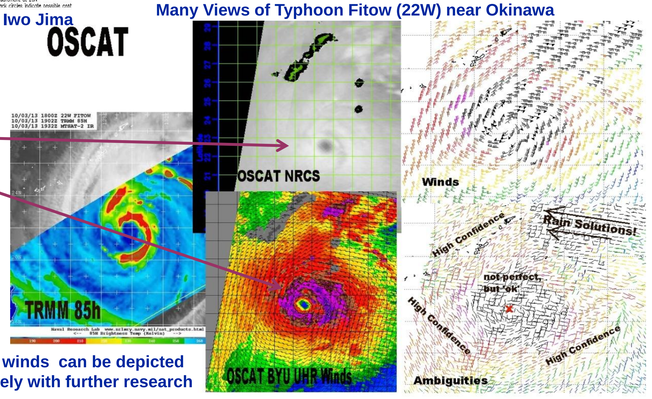


Solutions on left (top)

Example of poor depiction when model nudging was not available.

Same solution with model assistance (bottom)

Many Views of Typhoon Fitow (22W) near Okinawa



OSCAT (better)

- -Microwave (85h) –left
- -NRCS—top, center
- -BYU High Res—Bottom center
- -Wind Solution
- -Ambiguity Solutions

OSCAT winds can be depicted accurately with further research

Conclusion:

With QuikSCAT scatterometer gone, the use of the combined existing scatterometers, ASCAT A & B, OSCAT and WindSAT, along with the available microwave imagery… in an integrated approach to tropical cyclones satellite reconnaissance…remains the best way to maintain the necessary vigilance required for tropical cyclone analysis. OSCAT (when available) has not proven to be as reliable as either QuikSCAT or ASCAT. None of the scatterometers have yet proven their ability to equal the QuikSCAT sensor in coverage and in determining TC centers and providing reliable wind speeds in excess of 25-30 m/s.

References

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Edson, Roger T., 2010: Life after QuikSCAT…Tropical Cyclone Analysis using Microwave Imagery and Data. The *29th Conference on Hurricanes and Tropical Meteorology*, Tucson, AZ, Amer.Meteor.Soc., PDF_168761. (email: Roger.Edson@noaa.gov)

Acknowledgments

The author would like to thank Dr. Paul Chang, NOAA/NESDIS, and Dr. David Long, BYU MERS Laboratory for their continued effort in providing the latest effort in scatterometry research in near real time. Dr. Ad Stoffelen, KNMI, Netherlands has kept us all up-to-date on the latest characteristics and data flow coming from both ASCAT and OSCAT through the EUMETSAT offices. Dr. Mark Lander, University of Guam and Mr. Jeff Hawkins, Naval Research Laboratory (NRL), Monterey continue to support and encourage me and they remain enthusiastic participants in evaluating and learning about satellite-based remote sensing in the tropics, and over tropical cyclones, in particular. Each day we all try find a better way to allow the tropical cyclone analyst find an easier way to make tropical cyclone forecasts and warnings to the public in order to save lives and property.