NASA Programmatic Perspectives:
Present Status and the Way Forward

Peter Hacker and Eric Lindstrom
NASA Science Mission Directorate
Earth Science Division
9 May 2011
The Past Year: Events and Meetings

- 2010 International Ocean Vector Winds Science Team Meeting
  Barcelona, Spain, 18-20 May 2010
- New 4-year grants for NASA OVWST start summer 2010 to 2014
- NASA-NOAA-ISRO-EUMETSAT-KNMI collaborate on OSCAT-2 validation
- NASA-NOAA-JAXA-JPL meet on GCOM-W2 (DFS and AMSR) Dec. 2010
- First Oceansat-2 International AO Science Meeting
  Ahmedabad, India, 23-25 March 2011
- EUMETSAT/ESA Scatterometer Science Conference
  Darmstadt, Germany, 11-13 April 2011
- NASA Senior Review (extended missions including QuikSCAT), May 2011

Present Status: OVW Science Team in place;
Scatterometers in orbit;
Ongoing research activities;
Funding for another 3 years ($17.8 million for 4 years).

P. Hacker, NASA  International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
Research on the multiyear time series of QuikSCAT and SeaWinds standard backscatter and vector wind products, improve estimates, reduce biases. (atm, ocean, interdis, climate)

Geophysical analyses that exploit the frequent sampling or that combine observations from multiple wind sensors including QuikSCAT;

Advanced techniques that quantify the accuracy of measurements and products;

Advanced products that have increased temporal resolution, spatial resolution, and/or accuracy, based on Ku-band data and other measurements and models;

Intercalibrated Ku-band and C-band or passive microwave observations to understand physical processes related to rain and the ocean surface;

Assimilation and analysis techniques to improve the impact and effectiveness of scatterometer and vector wind measurements for operational uses (weather, hazards, climate forecasts).
Welcome to New Science Team Members

Ted Durland/OSU and Tom Farrar/WHOI
(with Dudley Chelton)
Covariability of wind and sea surface height in the tropical Pacific

Melanie Fewings/UCSB
(with Libe Washburn, Clive Dorman, Tim Liu, Ralph Milliff)
Satellite and land-based remote sensing of atmospheric wind relaxations and the oceanic response in the California Current Large Marine Ecosystem

Larry O’Neill/OSU
(with Tracy Haack/NRL)
Seasonal Variability of the Mesoscale Coupling of Wind Stress and Sea Surface Temperature over Mid-Latitudes
Status of QuikSCAT

• The QuikSCAT antenna stopped rotating in November 2009, and winds over a large swath cannot be estimated.

• The SeaWinds radar continues to operate normally and is collecting calibrated sigma0 measurements.

• The new QuikSCAT mission goal is to provide a facility for cross-calibration of multiple Ku-band scatterometers to a known, well calibrated source, enabling climate data consistency.

• We have collected over 1 year of data at the ISRO OSCAT angles.

P. Hacker, NASA
International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
### OCEANSAT-2 SCATTEROMETER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALTITUDE</strong></td>
<td>720 KM (Nominal)</td>
</tr>
<tr>
<td><strong>FREQUENCY</strong></td>
<td>Ku-BAND (13.5 GHz)</td>
</tr>
<tr>
<td><strong>CONFIG.</strong></td>
<td>PENCIL-BEAM</td>
</tr>
<tr>
<td><strong>INC. ANG. (DEG)</strong></td>
<td>49.0</td>
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<tr>
<td><strong>POLARIZATION</strong></td>
<td>HH</td>
</tr>
<tr>
<td><strong>SWATH (KM)</strong></td>
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<tr>
<td><strong>IFOV (KM)</strong></td>
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<tr>
<td><strong>OUTER ANG. (DEG)</strong></td>
<td>57.6</td>
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<tr>
<td><strong>POLARIZATION</strong></td>
<td>VV</td>
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<tr>
<td><strong>SWATH (KM)</strong></td>
<td>1800</td>
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<tr>
<td><strong>IFOV (KM)</strong></td>
<td>30 x 69</td>
</tr>
</tbody>
</table>

**Diagram:**
- **SCAT:** 49.33 DEG
- **SCAT:** 42.66 DEG
- **720 KM ALTITUDE**
- **SUB-SAT TRACK:** 700 KM
- **SUB-SAT TRACK:** 900 KM

**Note:**
- Two-Beam System
- B S Gohil
- ISRO
Operational (L2B) & High-Resolution Winds from OSCAT
(Phyan Cyclone: Nov 10, 2009: 19 GMT)

From B S Gohil, ISRO, talk

P. Hacker, NASA  International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
OSCAT data are flowing to KNMI, NOAA, JPL, others. Winds meet Oceansat-2 mission goals. Improvements are still needed for operational use and as a CDR.

P. Hacker, NASA  International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
Plenary Session on Current and Past Missions-
- ASCAT mission overview, Hans Bonekamp, EUMETSAT
- The importance of calibration and intercalibration for climate studies: The case of C-band scatterometry, Pascale Lecomte, ESA
- The climate consistency of QuikSCAT and ASCAT, Ernesto Rodriguez, JPL
- Current status of Oceansat-2 scatterometer, Kirti Padia, ISRO

Thematic Sessions-
- Cal/Val & Processing: ASCAT, ERS-2, MetOp-A, Oceansat-2 (7 talks)
- Wind and Wind Stress (19 talks)
- Soil Moisture Retrievals and Applications (8 talks)
- Snow and Ice Retrievals and Applications (6 talks)
- Novel Applications and Future Missions (9 talks)

ASCAT data are a great resource for research and applications.
European Scatterometer Heritage

ERS SCAT  MetOp-A  ASCAT
From Maurice Borgeaud

P. Hacker, NASA  International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
ASCAT Swath Data 7 May 2011

Ascending NRT Winds

Data are available from:
KNMI, NOAA, PODAAC/JPL

Descending NRT Winds

P. Hacker, NASA
International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
Ultra-High Resolution (UHR) Products
David Long’s Group, BYU
(pushing forward the potential utility of scatterometer data)

- ASCAT C-band data from KNMI, NOAA are 12.5 km and 25 km (6.25 km at KNMI).
- High signal to noise of ASCAT enables good quality UHR winds at 2.5 km resolution.
- Tradeoffs between noise and resolution.
- UHR winds are available closer to the coast and cover a wider swath.
- Ongoing research on simultaneous wind and rain retrieval (UHR SWR retrieval).

*NASA Scatterometer Climate Record Pathfinder (SCP) project-

- Enhanced resolution SZF products used for land, vegetation, ice/snow and extent of large oil spills.

P. Hacker, NASA  International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
Parma (rev 15334, 23 Oct 2009)
Color is UHR wind speed.
Barbs are 12.5 km speed/direction.
UHR: higher speeds, closer to coast, wider swath.

Desirable product for near-shore, high resolution, ocean models.
Lots of activity at the OST-ST and coastal group meetings in Portugal in 2010.
Lisan Yu, WHOI (Value of the CDR)

- Global ocean surface wind fields from microwave radiometers and scatterometers, July 1987 to 2008;
- Objectively Analyzed air-sea Flux (OAFlux) product;
- Global daily ocean vector wind analysis on 0.25-degree resolution.

Fig. 4 OAFlux wind stress vectors averaged over the period 1987-2008 (top) and the linear trend vectors derived from the annual mean time series 1988 to 2008 (bottom).
Trends and Co-Variability in SSH and Wind Stress  (Lisan Yu)

- Linear trends in AVISO SSH, 1993-2008 (background color);
- Mean wind stress vectors (black);
- OAFlux wind stress trend vectors (red).

Fig. 7 Linear trends in AVISO SSH for the period 1993-2008 (background colors) superimposed with trend vectors OAFlux wind stress for the period 1988-2008 (vectors in red) for the tropical Indian and Pacific Oceans. For reference, the mean wind stress vectors are shown in black.
NASA needs from Science Team Members
or
How you can help the IOVWST (and NASA)

- Deliver scientific breakthroughs and well-cited publications.
- Keep NASA and the rest of the Science Team informed of scientific breakthroughs and publications.
- Actively attend and support Science Team meetings.
- Respond as needed to requests from the Project Scientist and Team Leader for scientific and technical input.

- Please Submit Annual Reports ASAP.
- If possible, include a PowerPoint slide with figure and text showing an interesting recent result (based on a publication is most desirable but not necessary).
Our Special Thanks to:
Meeting Organizers, and
Participants.
We look forward to
a productive meeting.

Thank you!

P. Hacker, NASA  International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
BACKUP SLIDES
Science Teams are organized around a measurement/parameter rather than around a mission.

Ocean Vector Winds (OVWST) was re-competed in 2009-
- 20 proposals selected
- $17.8 M for 4 years (starting in 2010)
- 2 projects by ST leaders (M. Bourassa and E. Rodriguez)

- Ernesto Rodriguez, QuikSCAT Project Scientist, JPL
- Mark Bourassa, OVWST Team Leader, FSU
- Robert Gaston, QuikSCAT Project Manager, JPL
- Eric Lindstrom, QuikSCAT and OVW Program Scientist, NASA HQ
Post-EPS wind scatterometer concept development status
   Chung-Chi Lin, ESA/ESTEC

On performance measures for spaceborne wind sensors
   Maria Belmonte Rivas, National Centre for Atmospheric Research

System description and performance of the scatterometer of CFOSAT satellite
   Xiaolong Dong, Center for Space Science and Applied Research, Chinese A.S.

QuikSCAT follow-on-activities in the US
   Paul Chang - NOAA/NESDIS, Ernesto Rodriguez – JPL Jet Propulsion Laboratory

The ESA MICROWAT Mission: Measuring contemporaneous high resolution ocean vector winds and sea surface temperature
   Craig Donlon – presented by Klaus Scipal ESA/ESTEC

Interactions of AVHRR brightness temperatures and ASCAT sigma-Os
   Anne O’Carroll, EUMETSAT

A synergic use of SAR Doppler shift and NRCS for ocean remote sensing applications
   Alexis Mouche, CLS Collecte Localisation Satellites

Overview of the NASA Soil Moisture Active Passive (SMAP) mission
   Wade Crow USDA/ARS US Department of Agriculture/ Agricultural Research Service
   (presented by Ernesto Rodriguez – JPL )

Improving global satellite soil moisture records by combining scatterometer and radiometer observations, Wouter Dorigo, Technische Universität Wien

P. Hacker, NASA

International Ocean Vector Winds Meeting, Annapolis, Maryland, USA, 9-11 May 2011
Senior Review: QuikSCAT and Future Scatterometer Missions

QuikSCAT Climate Measurement Continuity

<table>
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<th>Fiscal Year</th>
<th>07</th>
<th>08</th>
<th>09</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
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</thead>
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Ku-Band Scatterometers
- Launched Jun 1999: QuikSCAT
- Launched Sep 2009: Oceansat-2 India
- Launch 2012: ScatSat India (to 2018)
- Launch Sep 2011: HY-2A China
- Launch 2014: CFOSat China/France

Data Products
- Ku-Band climate record-relevant OVW time series
- QuikSCAT Cryosphere data products
- Cross-calibrated, stable, and verified reprocessed OVW
- Cross-calibrated, stable, and verified reprocessed cryosphere

At risk without NASA funding

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