STAR GCOM-W1/AMSR2 Product Development and Validation Project

AMSR2 Level 1 and Level 2 products

STAR GCOM-W1 Project Team

Presented by Ralph Ferraro

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Outline

• GCOM-W1/AMSR2 Instrument Overview

• Project Structure and Schedule

• Product Status, Overview and Examples

• Summary and Path Forward
General Information

- Launched: JAXA, 05/2012
- Swath: 1450 km
- EIA: 55°
- Rate: 40 rpm

<table>
<thead>
<tr>
<th>Center freq. (GHz)</th>
<th>Bandwidth (MHz)</th>
<th>Beam width (3 dB, deg.)</th>
<th>Ground IFOV (km)</th>
<th>Sampling interval (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.925/7.3</td>
<td>350</td>
<td>1.8</td>
<td>35 x 62</td>
<td></td>
</tr>
<tr>
<td>10.65</td>
<td>100</td>
<td>1.2</td>
<td>24 x 42</td>
<td></td>
</tr>
<tr>
<td>18.7</td>
<td>200</td>
<td>0.65</td>
<td>14 x 22</td>
<td></td>
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<tr>
<td>23.8</td>
<td>400</td>
<td>0.75</td>
<td>15 x 26</td>
<td>10</td>
</tr>
<tr>
<td>36.5</td>
<td>1000</td>
<td>0.35</td>
<td>7 x 12</td>
<td></td>
</tr>
<tr>
<td>89.0</td>
<td>3000</td>
<td>0.15</td>
<td>3 x 5</td>
<td>5</td>
</tr>
</tbody>
</table>
The NOAA JPSS Office (NJO) is providing funding to OSD, STAR, and OSPO to operationally generate and make available AMSR2 SDR and EDR products to support NOAA’s user needs.

**OSD has developed a system called the GCOM-W1 Processing and Distribution System (GPDS) to perform the following tasks.**

- Ingest AMSR2 RDRs and ancillary data; Run the JAXA RDR-to-SDR software; Run the STAR GCOM-W1 AMSR2 Algorithm Software Processor (GAASP); Transfer products for distribution; Interact with OSPO monitoring and control systems.

**STAR:**

- Developed a software package, called the GCOM-W1 AMSR2 Algorithm Software Processor (GAASP), to generate the AMSR2 EDRs and perform product reformatting to netCDF4.
- Developed operational documentation for the GAASP package and the EDR algorithms following existing SPSRB templates.
- Delivered the GAASP and documentation to the OSD contractor for integration into their GPDS.

**OSPO:**

- Received the GPDS (with JAXA and GAASP packages integrated into it) from the OSD contractor.
- Operationally run and maintain the GPDS for the lifecycle of the project.
Project Schedule Overview

• Key Milestones – Day 1 Products:
  – Preliminary Design Review – Nov 8, 2012
  – Critical Design Review – May 1, 2013
  – Algorithm Readiness Review – Dec 19, 2014
  – Operational Readiness Review – Aug 21, 2015
  – Operations Commence – Pending for the NDE build 1.0.8 release schedule, targeted on late of Oct 2015

• Since June 2013: Products available in near real-time to users (NHC, JTWC, NRL, etc.) via the GAASP on the STAR GCOM-W1/AMSR2 product development and validation system

• Discontinuities were found the level 1 files that were introduced by the IDPS granules. This necessitated moving to full orbit contacts through IDPS which is currently an ongoing effort.
## STAR GAASP Development

### Delivery 1:

- **Day 1 GAASP Product Capability**
  - Microwave Brightness Temperature (MBT)
  - Cloud Liquid Water (CLW)
  - Sea Surface Temperature (SST)
- GAASP netCDF4 Reformatting Capability
- SPSRB documentation *(See backup slides for Day 1 data flow)*

<table>
<thead>
<tr>
<th>Metric</th>
<th>Day 1 Data Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBT</td>
<td>Total Precipitable Water (TPW)</td>
</tr>
<tr>
<td>CLW</td>
<td>Precipitation Type/Rate (PT/R)</td>
</tr>
<tr>
<td>SST</td>
<td>Sea Surface Wind Speed (SSW)</td>
</tr>
</tbody>
</table>

### Delivery 2:

- **Day 2 GAASP Product Capability**
  - Soil Moisture (SM)
  - Snow Cover/Depth (SC/D)
- Updated GAASP netCDF4 Reformatting Capability
- Updated SPSRB Documentation

<table>
<thead>
<tr>
<th>Metric</th>
<th>Day 2 Data Flow</th>
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</thead>
<tbody>
<tr>
<td>SM</td>
<td>Sea Ice Characterization (SIC)</td>
</tr>
<tr>
<td>SC/D</td>
<td>Snow Water Equivalent (SWE)</td>
</tr>
</tbody>
</table>

### Deliveries 3,4,...

- Updates and enhancements to existing EDRs
• Accounting for residual calibration errors in AMSR-2 TB’s received from JAXA significantly improves the performance & accuracy of geophysical retrieval algorithms
  – Double difference analyses were utilized to characterize the residual calibration biases
    • TMI 1B11 V7 calibrated Tbs were used as a reference radiometer data
Double Difference PDFs

V-Pol

Before correction

After correction

H-Pol

Before correction

After correction
Day-1 Ocean EDR Improvements

• Some issues found in the initial Day-1 ocean products are being addressed
  – Retrieved SST values match models in daytime (ascending AMSR2 passes)
    • Models tend to underestimate SST by ~ 2 K at low winds
  – Small dependence on earth incidence angle (EIA)
    • Apply EIA correction
  – Occasional horizontal lines (artifacts) appear in some Day-1 products
    • Latitude stepwise regressions were not used
– Initial CLW & TPW retrievals utilized all AMSR-2 channels including the 6 & 7 GHz channels
  • Affected by sun glint
  • Not able to get close to coast line due to bigger IFOV of low frequency channels

– Enhanced Day-1 TPW & CLW use 23 & 36 GHz channels
  • No sun glint issues
  • Can get much closer to the coast line
    ➢ Better utilization by NWS in certain regions with complex coastlines
Rainfall/Monitoring over CONUS

201508190852
Data on 0.25 deg grid (UNITS are mm/hr)
AMSR2 Sea Ice Concentration

Seaice (%) NH 2015.06.30 AMSR2 Nasa Team 2
AMSR2 Snow Water Equivalent

SWE (kg/m²) NH 2015.04.27 AMSR2
Near Real-Time and Retrospective AMSR2 Product Portal

http://manati.star.nesdis.noaa.gov/gcom
Summary & Path Forward

- Day 2 products and Day 1 product improvements being finalized in the next GAASP delivery for integration in NDE 2.0 (~October 2015)

- Calibration updates, product updates and continued monitoring and quality control
  - Continue working with JAXA on Level 1 calibration improvements
  - Address JAXA updates to Level 1 processing software
  - Continue validation and product monitoring and implement product updates as needed
  - User product training and outreach
GAASP Software Day 1 Data Flow
AMSR2 Snow Depth

Snow depth (cm) NH 2014.11.13 AMSR2
Enhanced Grody Algorithm Validation with AMSR2