Mission Status and Data Distribution of GCOM-W1/AMSR2

Misako Kachi, Keiji Imaoka, Takashi Maeda, Kazuhiro Naoki, and Arata Okuyama
Earth Observation Research Center (EORC), JAXA

Introduction

Japan Aerospace Exploration Agency (JAXA) launched the Global Change Observation Mission 1st - Water (GCOM-W1) or "SHIZUKU" (meaning "droplet" in Japanese) in 18 May 2012 (JST) from JAXA' s Tanegashima Space Center. GCOM-W1 is not a name of single satellite mission. It is a part of global and long-term observation program with two complementary medium-sized satellites (GCOM-W and GCOM-C series) and three generations (10-15 years) for stable data records. The Advanced Microwave Scanning Radiometer 2 (AMSR2) on board the GCOM-W1 satellite is multi-frequency, total-power microwave radiometer system with dual polarization channels for all frequency bands. AMSR2 is a successor of JAXA' s Advanced Microwave Scanning Radiometer for EOS (AMSR-E) on the NASA's Aqua satellite, which was launched in May 2002, and continues AMSR-E observations.

Figure 1 (Left) AMSR2 and GCOM-W1 at Tsukuba Space Center. (Right) Launch of the GCOM-W1 satellite at Tanegashima Space Center.

AMSR2 Instrument

Basic concept of AMSR2 is almost identical to that of AMSR-E: conical scanning system with large-size offset parabolic antenna, feed horn cluster to realize multi-frequency observation, external calibration with two temperature standards, and total-power radiometer systems.

Followings are improvements from AMSR-E.
1) Deployable main reflector system with 2.0m diameter (1.6m for AMSR-E)
2) Frequency channel set is identical to that of AMSR-E except 7.3GHz channels for helping RFI identification
3) Two-point external calibration with improved HTS (hot-load)
4) Add a redundant momentum wheel to increase reliability

Table 1 AMSR2 Standard Products

	Products	Areas	Res.	Accuracy			Range
				Release	Standard	Goal	
	Brightness Temperature	Global	5-50km	±1.5K	±1.5K	±1.0K (systematic) ±0.3K (random)	2.7-340K
GEO	Integrated water vapor	Global, over ocean	15km	±3.5kg/m²	±3.5kg/m²	±2.0 kg/m²	0-70kg/m²
GEO	Integrated cloud liquid water	Global, over ocean	15km	±0.10kg/ m²	±0.05kg/ m²	±0.02kg/ m²	0-1.0kg/m²
GEO	Precipitation	Global, except cold latitude	15km	Ocean ±50% Land ±120%	Ocean ±50% Land ±120%	Ocean ±20% Land ±80%	0-20mm h⁻¹
GEO	Sea surface temperature	Global, over ocean	50km	±0.5℃	±0.5℃	±0.2℃	-2-35℃
GEO	Sea surface wind speed	Global, over ocean	15km	±1.5m s⁻¹	±1.0m s⁻¹	±1.0m s⁻¹	0-30m s⁻¹
GEO	Sea ice concentration	Polar region, over ocean	15km	±10%	±10%	±5%	0-100%
GEO	Snow depth	Land	30km	±20cm	±20cm	±10cm	0-100 cm
GEO	Soil moisture	Land	50km	±10%	±10%	±5%	0-40%

Improvements in Resolution and Swath width

AMSR2 Level-1B and -1R products retain all scan points from Level-1A product, resulting in the increase of swath width. Nominal swath width (instrument assured) is still 1450km, but effective swath width is wider than 1600km after scan-bias correction. In addition, increase of antenna size (1.6 to 2.0 m) resulted in around 18% improvement in spatial resolution at 6.9 GHz channels.

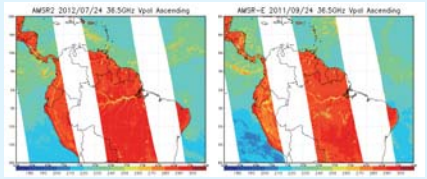

Figure 2 Increase of swath width from AMSR-E.

AMSR2 1617.6km AMSR-E:1457.8km

AMSR2 6.9GHz H-pol AMSR-E 6.9GHz H-pol

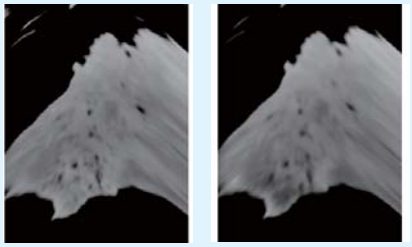

Figure 3 Improved spatial resolution (Australia, not map projected)

Comparison with AMSR-E

AMSR-E Status

Oct.4, 2011	span down and stop observation
Feb.7, 2012	restart observation without rotation
Sep.19&20, 2012	slow rotation trials
Dec. 4, 2012	begin 2rpm rotation

Frequency correction is not required for comparison of AMSR-2 with AMSR-E. It enables wide Tb range comparison over land, ice, and ocean.
AMSR-E observations resumed from December 4, 2012 with 2rpm rotation speed. Geolocation and Tbs are computed by modified software.

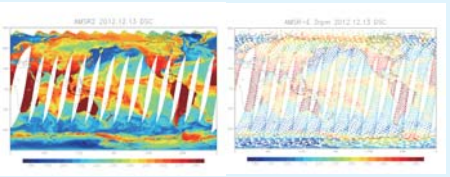

Figure 4 Comparison of AMSR2 (left) and AMSR-E i (right) at 23 GHz V-pol, descending orbit in December 13, 2012. Data amount is reasonable for global-scale analysis. But, data calibration is NOT reasonable, for now, because software tuning is required for 2rpm mode.

L1 Calibration

Various inter-comparisons are in progress using AMSR-E in 2rpm, AMSR-E in 40rpm (past period), and TMI.
Tb differences, AMSR2 - AMSR-E, obtained from the two comparisons are reasonable, considering that AMSR-E calibration for 2rpm mode is not mature at present. Tb differences over the ocean and over the rainforest areas are different from each other.

Inter-comparison with other radiometers shows that AMSR-2 Tbs are 2 to 5K higher than the Tbs of AMSR-E and TMI, and the tb difference has temperature gradient.

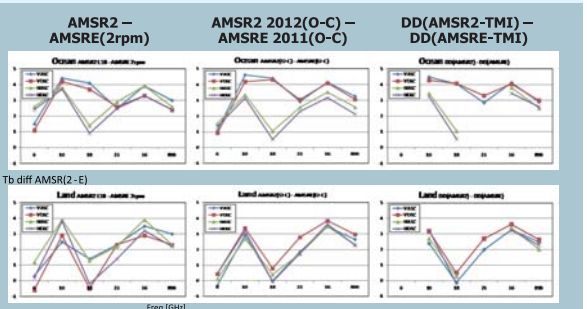

Figure 5 Tb comparison of AMSR2 with AMSR-E(2rpm) (left), AMSR-E 2011 (middle), and double difference of AMSR2-TMI and AMSRE-TMI (right).

L2 Validation (under going)

Toward public release of AMSR2 geophysical parameters, comparison of AMSR2 precipitation products and TRMM/PR rainfall estimates (PR2A25 Estimated Surface Rain) are ongoing. Match-up method is to select the pair of AMSR2 and PR view the same place within 10 minutes. Accuracy is defined as relative error (RE:ratio of root-mean-square error to average precipitation rate) in TMI 10GHz IFOV (63×37km) average to compare with same algorithm for TMI.
Release accuracy of AMSR2 precipition;
RE=50% for over the ocean, and
RE=120% for land.

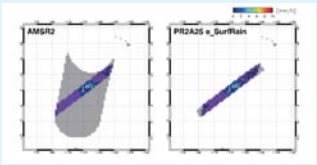

Figure 6 Example of match-up data of AMSR2 and PR.

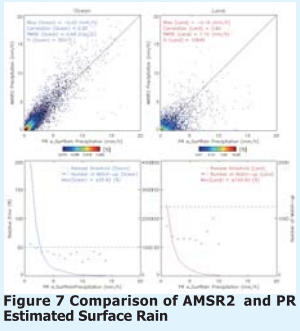

Figure 7 Comparison of AMSR2 and PR Estimated Surface Rain

Future Plans

AMSR2 standard products is distributed through GCOM-W1 Data Providing Service (https://gcom-w1.jaxa.jp/) by http & sftp

* AMSR and AMSR-E data is already available!
* AMSR2 L1 data (Tb) has been distributed since Janurary 24, 2013.
* AMSR2 L2 data (geophysical parameters) will be available in May 2013.
* Near-real-time products will be also available to special users, who conduct joint study/agreement with JAXA, including GPM partners.

AMSR2 browse images of Tb and geophysical parameters are also available from EORC' s JASMES web site.
http://suzaku.eorc.jaxa.jp/GCOM_W/JASMES_daily/index.html