

Product version up-grade and new release information

JAXA/EORC FY2021 JAXA Joint PI meeting GCOM-W&AMSR3 session



List of AMSR2 standard products



Product	Target Area	Spatial Resolution	Release Accuracy	Standard Accuracy	Validation Result	Latest Version
Brightness Temperature	Global	5-50 km	±1.5 K	±1.5 K	< 1.4 K	2.2
Total Precipitable Water	Global, over ocean	15 km	\pm 3.5 kg/m²	\pm 3.5 kg/m²	1.5 kg/m ²	2.1
Cloud Liquid Water	Global, over ocean	15 km	\pm 0.10 kg/m 2	\pm 0.05 kg/m 2	0.04 kg/m ²	2.2
Precipitation	Global, except cold latitudes	15 km	Ocean \pm 50% Land \pm 120%	Ocean \pm 50%Land \pm 120%	Ocean 48% Land 86%	2.1 -> 3.0
Sea Surface Temperature	Global, over ocean	50 km	\pm 0.8 $^{\circ}$ C	\pm 0.5 $^{\circ}$ C	0.46 $^{\circ}$ C	4.0 -> 4.1
Sea Surface Wind speed	Global, over ocean	15 km	\pm 1.5 m/s	\pm 1.0 m/s	0.96 m/s	4.0
Sea Ice Concentration	Polar region, over ocean	15 km	±10%	±10%	9%	3.0
Snow Depth	Land	30 km	\pm 20 cm	\pm 20 cm	18 cm	2.1
Soil Moisture	Land	50km	±10%	±10%	4%vol	3.0



List of AMSR2 research products

Product	Target Area	Spatial Resolution	Release Accuracy	Validation Result	Product Status
All-weather Sea surface Wind speed	Ocean	60 km	\pm 7 m/s	\pm 4.07 m/s	Released
10 GHz Sea Surface Temperature	Ocean	30 km	\pm 0.8 $^{\circ}$ C	\pm 0.48 $^{\circ}_{\circ}$ C (>= 9 $^{\circ}$ C) \pm 0.62 $^{\circ}_{\circ}$ C (all-range)	Released
Multi-band Sea Surface Temperature	Ocean	30 - 50 km	\pm 0.8 $^{\circ}$ C	\pm 0.47 $^{\circ}$ C	Released
Soil moisture and vegetation water content by land assimilation model	land over the continents of Africa and Australia	25 km	Soil moisture: \pm 8% Vegetation water content: \pm 1 kg/m ²	-	Developing
Land Surface Temperature	Land	15 km	Forest \pm 3 $^{\circ}$ C Non-dense Vegetation \pm 4 $^{\circ}$ C	Forest \pm 3 $^{\circ}$ C Non-dense Vegetation \pm 4 $^{\circ}$ C	Released
Vegetation Water Content	Land	10 km	\pm 1 kg/m²	_	Developing
High-resolution Sea Ice concentration	Ocean at high latitudes	5 km	±15%	±15%	Released in FY2021
Thin Sea Ice detection	Okhotsk Sea Bering Sea Hudson Bay	15 km	80%	88.3 - 97.8 % (Okhotsk, Bering Sea, Hudson Bay)	Released
Sea Ice Motion vector	Ocean at high latitudes	50 km -> Di	±6 cm/s r. Yoshizawa will show	the validation resu	Release preparing Its on DAY3
Total Precipitable Water over land	Land	15 km	\pm 6.5 kg/m 2	vs GPS: 2.59 kg/m ² vs Sonde: 3.48 kg/m ²	Released
Sea Ice Thickness (< 20 cm)	Polar region, over ocean	15 km	Thin solid ice: \pm 10 cm Frazil ice: \pm 3 cm	-	Developing
Sea Ice Thickness (>= 20 cm)	Polar region, over ocean	15 km	\pm 20 cm	-	Developing



GCOM-W

Summary of the HSI algorithm and validation method

Algorithm developer

Prof. Georg Heygster (University of Bremen)

Algorithm overview

High resolution sea ice concentration product detects the ratio of the sea ice area in each pixel with 5 km spatial resolution mainly using the 89 GHz vertical and horizontal polarization brightness temperature based on the characteristics of the brightness temperature and its polarization difference.

Validation method

Sea ice concentration was compared with detected by Aqua/MODIS visible reflectance (Band1: 620-670 nm, Band3: 459-479 nm, band4: 545-565 nm) data in the sun-lit area.



Validation result (Northern Hemisphere)



Achieved the target accuracy in the Northern Hemisphere validation



Validation result (Southern Hemisphere)



Algorithm revise and parameter tune-up is on going to achieve the target accuracy



Target Area Expansion



We focused on the only Arctic sea in the initially algorithm development phase, however in the publish phase, we expanded the target area to 43N including Okhotsk sea.

2016.03.16 Range: 90N-50N



2016.03.16 Range: 90N-43N



FY2021, we have released in public the HSI product as a research product focused on Northern Hemisphere





Revision of AMSR2 PRC & SST products

JAXA/EORC GCOM-W research group

2022.01.17 The Joint PI Meeting of JAXA Earth Observation Mission FY2021



Major Version Up of AMSR2 Precipitation product (PRC) to V3

The PRC product is now available in Ver. 2.1 (updated on March 2015).

Improvements of the AMSR2 PRC V3 algorithm

- NOAA Autosnow data (sea ice and snow cover information) was added to the reference data.
 - As a result, the range limitation of the estimated area (less than 60 degrees latitude) has been removed.
 (already introduced in GSMaP V04)
- Based on the relationship between the scattering bias of the conventional GSMaP algorithm and the precipitation characteristics observed by the DPR, the following improvements were implemented.
 - The index of the Frozen Precipitation Depth (FPD) is calculated from the temperature lapse rate and relative humidity in the middle and lower troposphere. This index is used to vary the precipitation profile and the density of solid precipitation particles in the forward calculation part. (already introduced in GMI V05 (GSMaP V05))
 - In the retrieval part, the FPD and the ratio of Convective Precipitation (ratioCP) per pixel are estimated using ground precipitation intensity, non-uniformity of precipitation estimated from brightness temperature, and polarization difference at 89 GHz. These index and the surface temperature are used to statistically correct the scattering retrieval values. (Newly developed in AMSR2 V05, not yet introduced in GSMaP V05)

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Validation method

- Validation method
 - Simultaneous observation by GPM Dual-frequency Precipitation Radar (DPR) and AMSR2 are averaged in 50 km spatial resolution, and the relative error (ratio of RMSE against average rain rate) is calculated.
 - Comparison of surface rain rate estimated by AMSR2 and DPR when orbit crossing time difference of the GCOM-W and TRMM satellites is within 10 minutes.(Only the 100km width of the nadir is used, which is less affected by DPR sidelobe clutter.)
 - Only the match-up data for which both DPR and AMSR2 are between 0 mm/h and 20.5 mm/h are used.
 - For each of AMSR2 and DPR, the monthly mean of the 0.5-degree grid are calculated respectively, and the zonal mean are compared using the grid where the both of AMSR2 and DPR data exist.
 - Period: July and October 2014, January and April 2015

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Results of Matchup with DPR



Comparison of monthly zonal mean with DPR (land 89A, January 2015)



Comparison of monthly zonal averages with DPR (ocean 89A, January 2015)



Validation result & Future work

- The accuracy of AMSR2 PRC Ver.3 has been slightly improved compared to Ver.2 for both sea and land. In particular, the estimation of weak rainfall, such as overestimation over land at mid-high latitudes, has been greatly improved.
- The major upgrade of PRC(V3) was approved.
 - The past data will be reprocessed.
 - The evaluation period will be extended as much as possible before the release of PRC (V3), and a comparison with PR V07 will be also conducted.
 - We will coordinate with GPM group to introduce the revision of AMSR2 V3 algorithm as the minor revision of GPM/GSMaP V05.

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Minor Version Up of AMSR2 Sea Surface Temperature (SST)



The SST product is now available in Ver. 4.0 (updated on October 2020).

 A downward trend in AMSR2 6 GHz SST has been observed in the Northern Hemisphere low latitude region (10N-40N) since the end of 2019. It has been noted by users. However, the 10 GHz SST and multi-band SST have not been affected.



Improvements of the Ver 4.1 SST algorithm

- 1. Refinement of land surface radiation calculations.
- 2. Calculation of sea surface temperature in high wind areas
- 3. Change in atmospheric correction
- 4. Changing the correction of the brightness temperature trend
- 5. Reviewing the impact of REI Meeting of JAXA Earth Observation



Validation method

Validation method

- Used data:NOAA iQuam Ver.2.1 buoy dataset
 - moored, drifting, argo float
 - Match-up data from the same buoy is limited to one per hour.
- Matchup condition
 - Matchup AMSR2 and buoy data included in NOAA iQuam Ver.2.1 buoy dataset with time difference within 2 hour and distance less than 30 km.
 - AMSR2's 10 pixels near the buoy are averaged when SSTs are spatially homogeneous (differences of max and minimum SST is less than 3 degC).
- Period
 - January 1, 2020 September 30, 2021

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Validation results (6GHz SST Time Series)

- AMSR2 6G SST downward trend against buoys at 10° N-40° N is resolved.
- The downtrend is resolved in both of Ascending and Descending orbits.
- It was confirmed that there was no problem in the comparison of the time series of the global mean (strong wind = OFF, rainfall = OFF).



Validation results (6GHz SST Scatter plot)



Validation results & Future work

- The verification was conducted from January 1, 2020 to September 30, 2021. It was confirmed that the downward trend of 6 GHz SST was resolved, and the accuracy was not affected.
 - The accuracy of 10 GHz SST and multi-band SST was confirmed in the same way.
- The minor upgrade of SST(V4.1) will be approved.
 - The past data will be not reprocessed. (We plan to reprocess at next major upgrade.)
 - The evaluation period will be extended to all period before the release of SST (V4.1).