GCOM-W/AMSR2 積雪深標準プロダクトの現状

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Current Status of the GCOM-W/AMSR2 Snow Depth Standard Product

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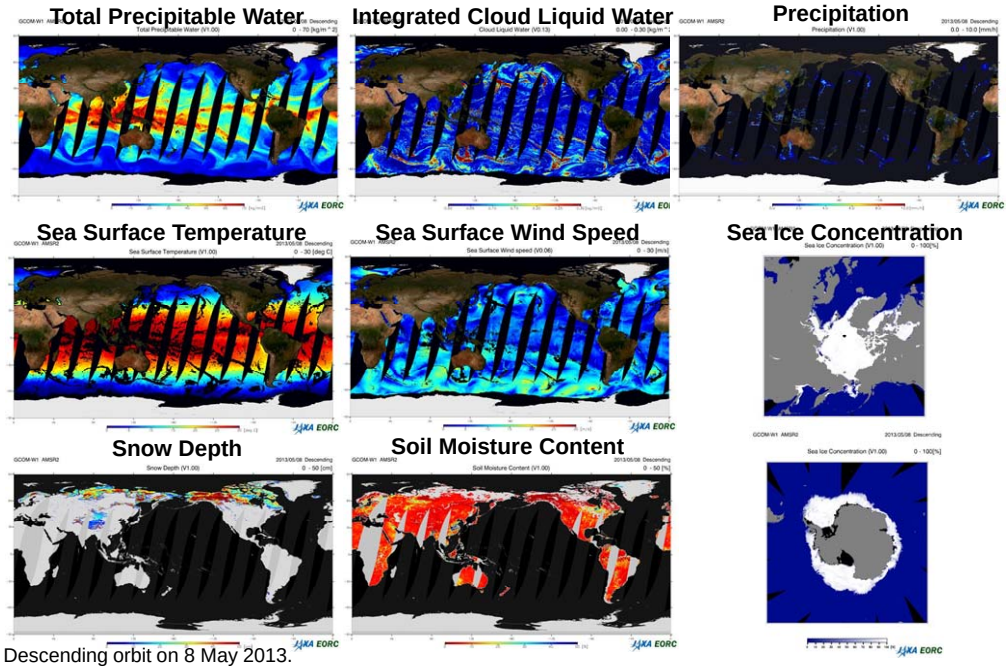
The Global Change Observation Mission 1st - Water (GCOM-W1) or "SHIZUKU" was launched on May 18, 2012 (JST) from the JAXA's Tanegashima Space Center. Subsequently, the GCOM-W1 satellite was joined to the NASA's A-train orbit since June 29, 2012 to succeed observation by the Advanced Microwave Scanning Radiometer for EOS (AMSR-E) and to provide combined utilization with other A-train satellites. The Advanced Microwave Scanning Radiometer 2 (AMSR2), which is a successor of AMSR-E, onboard GCOM-W1 has started its scientific observation since July 3, 2012. AMSR-E was halted its scientific observation on October 4, 2011, but has restarted observation in slow antenna rotation rate since December 4, 2012 for cross-calibration with AMSR2. JAXA opened the AMSR2's brightness temperature products to the public since January 2013 after initial calibration/validation period by the GCOM-W1 Data Providing Service (https://gcom-w1.jaxa.jp/). Thereafter, the retrieval algorithms of standard geophysical products for water vapor, cloud liquid water, precipitation, sea surface temperature, sea surface wind speed, sea ice concentration, snow depth and soil moisture were modified, and JAXA opened these standard geophysical products to the public since May 2013 (Figure 1).
AMSR2 snow depth standard product is focused on from among these standard geophysical products here. AMSR2 snow depth standard product was developed by Dr. Richard Kelly (University of Waterloo). JAXA evaluated this product using the in situ snow depth data of the Global Summary of the Day (GSOD, 1,007 stations) from July, 2012 to May, 2014. In the result, 17.6 cm (Mean Absolute Error, MAE) estimation accuracy was achieved, and it was satisfying ±20cm AMSR2 standard accuracy (Table 1). However, several problems were identified: Positive bias over the East Eurasia, Negative bias over the West Eurasia, Increment of these biases in the snow melt season and Overestimation over the Tibetan Plateau (Figure 2). The cause of these biases were checked and this product is improving toward the achievement of ±10 cm AMSR2 goal accuracy.

第一期水循環変動観測衛星「しずく」（GCOM-W1）は、2012 年 5 月 18 日 1 時 39 分（日本時間）に、H-IIA ロケット 21 号機にて、種子島宇宙センターから打上げられ、7 月 3 日より観測を開始した。「しずく」は、NASA の Aqua 衛星に搭載している改良型高性能マイクロ波放射計（AMSR-E）の後継センサである、高性能マイクロ波放射計 2（AMSR2）を搭載する。なお、AMSR-E は、2002 年 5 月の打上げ以降、9 年以上にわたって観測を続けてきたが、アンテナの回転摩擦の増大により、定常観測に必要な回転速度（毎分 40 回転）を維持する限界に達したため、2011 年 10 月 4 日に観測および回転を自動で停止した。2013 年 1 月 25 日に輝度温度データの一般提供を GCOM-W1 データ提供サービス（https://gcom-w1.jaxa.jp/）より開始し、5 月に積算水蒸気量・積算雲水量・降水量・海面水温・海上風速・海氷密接度・積雪深・土壌水分量などの高次地球物理量の一般提供を開始した (Figure 1)。
ここでは、これらの高次地球物理量の内、AMSR2 積雪深標準プロダクトに着目した。JAXA では、Dr. Richard Kelly (University of Waterloo)により開発された AMSR2 積雪深標準プロダクトの検証を Global Summary of the Day (GSOD) 1,007 地点の地上観測積雪深データを用い、2012 年 7 月から 2014 年 5 月までを対象に実施した。その結果、AMSR2 標準精度±20cm を満たす 17.6cm(絶対平均誤差)の精度を達成した (Table 1)。しかし東ユーラシアにおける正のバイアス・西ユーラシアにおける負のバイアス・融雪期における両バイアスの増加・チベット高原における過大評価などの課題も確認されている(Figure 2)。現在、これらのバイアスの原因について調査を行い、AMSR2 目標精度±10cm の達成に向け、プロダクトの改良を行っている。



Descending orbit on 8 May 2013.

Figure 1. AMSR2 Geophysical Parameters

Table 1. Estimation accuracy on the validation result of the AMSR2 snow depth standard product: GSOD 1,007 stations, Jul. 2012 – May 2014, Descending and Ascending

Validation Season	MAE [cm]	Bias [cm]	RMSE [cm]	R	Sampling Number
All (June-May)	17.663	-3.012	24.521	0.351	209242
Mid-Winter Season (October-February)	15.229	-1.538	21.154	0.410	147482
Snow Melt Season (March-May)	24.179	-6.560	31.630	0.193	59338

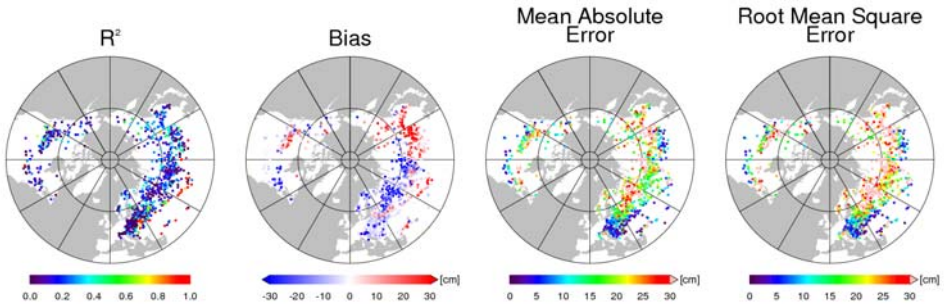


Figure 2. Global map on the validation result of the AMSR2 snow depth standard product: GSOD 1,007 stations, Jul. 2012 – May 2014, Descending and Ascending

References

Richard Kelly, The AMSR-E Snow Depth Algorithm: Description and Initial Results, Journal of The Remote Sensing Society of Japan, 29, 1, 307-317 , 2009.