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The New Version of Brightness Temperature Product of Microwave Radiometer AMSR2 onboard GCOM-W1 Satellite

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The Japan Aerospace Exploration Agency (JAXA) launched the GCOM-W1 (Global Change Observation Mission 1st - Water) satellite on 17 May 2012 (UT). The main mission of the GCOM-W1 satellite is to monitor the global water cycle, for which it has onboard the Advanced Microwave Scanning Radiometer-2 (AMSR2). The AMSR2 has multifrequency microwave receivers, and like many other satellite-borne microwave radiometers currently in orbit, its multifrequency feedhorns share a single rotating antenna dish.

Because AMSR2 is designed to make a sharp antenna beam for each frequency, the FOV (field of view) size of each frequency differs substantially from one another: the higher the frequency, the smaller the FOV size. Therefore, the multifrequency data (brightness temperature, T_B) represent responses of areas quite different from one another, even if the multifrequency T_B values are obtained by the same measurement. Lack of consideration of the difference in FOV sizes will be an important reason for the deterioration of the accuracy of geophysical values retrieved from multifrequency T_B values.

To solve this problem, we can consider to replicate a large FOV of low-target frequency by adequately summing small FOV of high-source frequency spreading within it. One way to achieve this is with the Backus-Gilbert (BG) method, and there have been many studies related to this issue. The BG method provides a way to calculate the intensities for small-source FOVs to replicate a large-target FOV as accurately as possible. T_B values that correspond to source FOVs (source T_B values) are averaged using these intensities as weighting coefficients. Thus, the T_B synthesized from the source T_B values, i.e., the weighted mean of the source T_B values becomes equivalent to the source frequency's T_B measured by a target FOV. The source frequency's synthesized T_B and the target frequency's T_B enable us to evaluate more accurately the difference in the microwave emission characteristics between the two frequencies, which contributes to the improvement of the accuracy of geophysical values retrieved from them. Depending on the calculation, the weighting coefficients can be positive or negative. If more negative weighting coefficients appear to replicate a target FOV accurately, an unexpected value for the synthesized T_B is more likely to be calculated. Therefore, the appearance of negative weighting coefficients should be controlled while a target FOV is replicated accurately. We investigated the most appropriate implementation of the BG method for the L1R product, and the smoothing factors used in the method were dynamically determined for all modified brightness temperatures.

JAXA released two data products for the T_B of the AMSR2: level 1B (L1B) and level 1R (L1R). The L1B product includes T_B values from the native FOV of each channel, and the L1R product includes the T_B values modified with weighting coefficients using the BG method. These products are available to free download from the GCOM-W1 Data Providing Service (https://gcom-w1.jaxa.jp/), and updated to the new version (2.0) in April 2014. In this paper, we present the details of the new version of AMSR2's L1B and L1R products.