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Standard Dataset of Brightness Temperature Resampled by Antenna Pattern Matching for Microwave Radiometer AMSR2 on GCOM-W1 Satellite

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The operation of the Advanced Microwave Scanning Radiometer for Earth-Observation System (AMSR-E) loaded on Aqua satellite stopped in October, 2011 after more than 9-years observation. But after that, the successor of AMSR-E (AMSR2) was developed and loaded on GCOM-W1 (Global Change Observation Mission 1st - Water) satellite. GCOM-W1 satellite was successfully launched in May, 2012. AMSR2 is a microwave radiometer almost similar to AMSR-E, but some important improvements are made (i.e., expansion of its main reflector's size, addition of 7.3-GHz channel to detect radio frequency interferences at 6.9 GHz). GCOM-W1 satellite is deployed into a sun-synchronous sub-recurrent orbit, and AMSR2 observes microwave powers emitted from anywhere on the Earth almost twice a day, daytime in an ascending track and nighttime in a descending track.

When we use a satellite-borne microwave radiometer data that have a main reflector shared by plural feed horns, there is an inevitable problem, the differences of footprints' sizes among frequencies. In case of AMSR2, the smallest footprint's size of 89 GHz (3×5 km^2) has just one percent of the broadest one of 6.9 GHz (35×62 km^2). Under the circumstance, when brightness temperatures (T_b values) of plural frequencies are obtained from the same geolocation, it is difficult to compare them one another because their observation areas are absolutely different.

The concept to solve this problem is simple: actually, after a satellite-borne microwave radiometer observed on the Earth's surface, footprints which give brightness temperatures of each frequency densely distribute on it with overlaps at several-kilometer intervals (i.e., 5 km as for 89 GHz and 10 km as for other frequencies in AMSR2). The footprint is an antenna pattern projected to the Earth's surface. The antenna pattern's shape is generally like a 2-dimensional Gaussian distribution. The center of the antenna pattern has strong sensitivity, and its circumjacent part has weak sensitivity. Here, it can be assumed to synthesize small antenna patterns of high frequency densely distributing in a large antenna pattern of low frequency in order to emulate it. If well-modified weighting coefficients of synthesized small antenna patterns are calculated, the large antenna pattern can be accurately emulated by the small antenna patterns with the weighting coefficients. The T_b values of the high frequency corresponding to the small antenna patterns are then averaged with the weighting coefficients. This averaged Tb represents the 'resampled' T_b of the high frequency virtually measured in the large antenna pattern. The methodology of resampling by antenna pattern matching based on this concept is known as the Backus-Gilbert method. Since this methodology was proposed, many studies have been performed until now.

For AMSR2, the dataset of T_b calibrated from a microwave power measured in a footprint for each frequency is defined as a level 1B (L1B) product. On the top of that, that of T_b resampled based on the Backus-Gilbert method is newly defined as a level 1R (L1R) product to be released to public. In this presentation, we show the details of the current implementation of the L1R product, some improvements planned in the next version upgrade, and the validation results for the L1R product.