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Global Soil Moisture Dataset by AMSR-E satellite observation

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Land surface hydrological quantities have a significant impact on seasonal changes and inter-annual variations of the climate through their interactions with the atmosphere. In particular, variations in soil moisture content affect the heat balance of the land surface. Information on soil moisture conditions over large regions is important for understanding, modeling, and forecasting climate changes. Monitoring of soil moisture is also important in understanding ecological processes and in estimating agricultural harvest yield fluctuations because soil moisture is the water source for vegetation.

Microwave remote sensing using satellites is an effective method for collecting global information on land surface hydrological quantities. The method has two advantages: being able to periodically perform observations over large regions regardless of whether it is night or day, and the sensitivity of these instruments to land surface hydrological quantities due to liquid water having an extremely high dielectric constant in the microwave band compared with soil. In this presentation, we will introduce results of global soil moisture monitoring using the Advanced Microwave Scanning Radiometer for Earth Observing System (AMSR-E). The AMSR-E is a dual polarization radiometer with six frequency bands from 6GHz to 89GHz. It was developed in 2002 by the National Space Development Agency of Japan (NASDA), now the Japan Aerospace Exploration Agency (JAXA), and launched on the Aqua satellite of the U.S. National Aeronautics and Space Administration (NASA). Aqua is still operational and the AMSR-E is also operating normally except for part of the 89GHz system.

The 10-36GHz algorithm (Fujii et al., 2009) was applied to the AMSR-E data to estimate soil moisture. In this algorithm, a look-up table method is used for the estimation of soil moisture from the observed brightness temperatures. Because the water content of vegetation affects the sensitivity of the microwave remote sensing of soil moisture, we used a method for simultaneously retrieving the soil moisture and vegetation water content from two indices , PI and ISW, which are respectively the polarization and frequency differences divided by the average value of brightness temperature. The vegetation coverage correction of look-up table is also performed using the normalized difference vegetation index (NDVI) published as part of the Moderate Resolution Imaging Spectroradiometer (MODIS) vegetation indices (16-Day L3 Global 1 km V5) by the Land Processes Distributed Active Archive Center (LP-DAAC). The AMSR-E data have been archived for more than eight years. In this presentation, some results of AMSR-E soil moisture monitoring will be presented and discussed.

In addition, a future plan on our algorithm development for next satellite program will be also introduced. The JAXA is planning to launch the satellite GCOM-W1 with the Advanced Microwave Scanning Radiometer-2 (AMSR2) onboard in JFY 2011. The GCOM-W1 is the first satellite of the Global Change Observation Mission (GCOM) which consists of two satellite observing system and three generations of each satellite series to continue the observations for 10 to 15 years. The AMSR2 is a successor of AMSR-E. Basic performance of AMSR2 will be similar to that of AMSR-E based on the minimum requirement of data continuity of AMSR-E, with several enhancements including additional channels in C-band receiver. To contribute to the long-term earth observation through the GCOM program, we are trying to modify our soil moisture algorithm to improve accuracy of soil moisture and to make new products related to the land hydrology.

Keywords: AMSR-E, GCOM, Soil moisture