GLOBAL ESTIMATION OF THE SEASONAL VARIATION OF SOIL MOISTURE IN TROPICS FROM TRMM/PR

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The forecasting of drought/flood for several months in advance can be done by numerical simulation like GCM (General Circulation Model). However, its accuracy at the present cannot show good result. One of the reasons pointed out by many scientists is that soil moisture given, as initial condition is severely different from the reality. There are three kinds of methods to estimate soil moisture : (1) direct measurement of soil sampling, (2) calculation by LSM (Land Surface Model), (3) estimation by microwave remote sensing.

The purpose of this study is to estimate global soil moisture by remote sensing, using TRMM/PR (Tropical Rainfall Measuring Mission/Precipitation Radar) in Ku-band 13.8 GHz measures the backscatter from rain drops to estimate rain rates, originally. The backscattering coefficient at land surface observed by TRMM/PR is focused to estimate soil moisture with the following characteristics : (a) incident angle 0° – 18°, (b) frequency of the microwave is relatively high compared with SAR (Synthetic Aperture Radar), (c) number of observations is more than SAR, (d) spatial resolution is relatively coarse, (e) orbit coverage is limited within 37°N-37°S.

We obtained all TRMM/PR 2A21 Data in 1998 with 5745 orbits from NASDA, Japan and converted to 1° x 1° monthly-mean grid data. The results shown that backscattering coefficient (σ^0) is dependent on land cover type and incident angle (θ). The seasonal variation of backscattering coefficient (σ^0) at 3° incident angle is correlated with soil moisture calculated by LSM. It is obviously seen that σ^0 is inverse proportional to LAI. It means that σ^0 is low where LAI is high. In case of 18°, σ^0 and soil moisture is not well correlated and σ^0 is almost constant regardless of LAI.

Backscatter from land surface is summation of two components, soil surface (σ^0_s) and vegetation (σ^0_p). Backscatter from soil surface is attenuated by vegetation, in theory, and strongly dependent incident angle. On the other hand, backscatter from vegetation is scarcely dependent on incident angle. From both observation and theory, we can estimate the mechanism as follows: (σ^0_s) is relatively strong when incident angle is small with opposition of (σ^0_p). Then we made the algorithm to estimate soil moisture form σ^0 with basically used of 3^0 incident angle. To avoid vegetation's effect on σ^0, LAI and σ^0 at 18° incident angle are also used. The σ^0 at 18° is supposed to be equal to (σ^0_p), and (σ^0_s) is supposed to be attenuated 4.8 dB by 1 LAI increased. According to this algorithm, the seasonal variation of soil moisture is well regionally and globally estimated.