A New Approach in Downscaling Microwave Soil Moisture Product using Machine Learning

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Understating the soil moisture pattern has significant impact on flood modeling, drought monitoring, and irrigation management. Although satellite retrievals can provide an unprecedented spatial and temporal resolution of soil moisture at a global-scale, their soil moisture products (with a spatial resolution of 25-50 km) are inadequate for regional study, where a resolution of 1-10 km is needed. In this study, a downscaling approach using Genetic Programming (GP), a specialized version of Genetic Algorithm (GA), is proposed to improve the spatial resolution of satellite soil moisture products. The GP approach was applied over a test watershed in United States using the coarse resolution satellite data (25 km) from Advanced Microwave Scanning Radiometer – EOS (AMSR-E) soil moisture products, the fine resolution data (1 km) from Moderate Resolution Imaging Spectroradiometer (MODIS) vegetation index, and ground based data including land surface temperature, vegetation and other potential physical variables. The results indicated the great potential of this approach to derive the fine resolution soil moisture information applicable for data assimilation and other regional studies.