Geophysical Research Abstracts
Vol. 19, EGU2017-7987, 2017
EGU General Assembly 2017

Mapping soil moisture and surface heat fluxes by assimilating GOES land surface temperature and SMAP soil moisture data

Yang Lu, Susan C. Steele-Dunne, and Nick van de Giesen

Section of Water Resources, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, Netherlands (y.lu-1@tudelft.nl)

This study is focused on estimating soil moisture and sensible/latent heat fluxes by assimilating remotely-sensed land surface temperature (LST) and soil moisture data. Surface heat fluxes interact with the overlying atmosphere, and play a crucial role in the water and energy cycles. However, they cannot be directly measured using remote sensing.

It has been demonstrated that LST time series contain information about the surface energy balance, and that assimilating soil moisture further improves the estimation by putting more constraints on the energy partitioning. In previous studies, two controlling factors were estimated: (1) a monthly constant bulk heat transfer coefficient (CHN) that scales the sum of surface heat fluxes, and (2) an evaporative fraction (EF) which governs the energy partitioning and stays quasi-constant during the near-peak hours. Considering the fact that CHN is not constant especially in the growing season, here CHN is assumed a function of leaf area index (LAI). LST data from GOES (Geostationary Operational Environmental Satellites) and soil moisture data from SMAP (Soil Moisture Active Passive) are both assimilated into a simply heat and water transfer model to update LST, soil moisture, CHN and EF , and to map surface heat fluxes over a study area in central US.

A hybrid data assimilation strategy is necessary because SMAP data are available every 2-3 days, while GOES LST data are provided every hour. In this study, LST data are assimilated using an adaptive particle batch smoother (APBS) and soil moisture is periodically updated using a particle filter (PF). Results show that soil moisture is greatly improved, and that EF estimates are restored very well after assimilation. As forcing data are provided by remote sensing or reanalysis products to minimize the dependence on ground measurements, this methodology can be easily applied in other regions with limited data.