Geophysical Research Abstracts
Vol. 21, EGU2019-12496, 2019
EGU General Assembly 2019

Assimilation of satellite-based geophysical variables to improve land evaporation estimates

Brecht Martens (1), Hans Lievens (2,1), Niko E.C. Verhoest (1), and Diego G. Miralles (1)

(1) Laboratory of Hydrology and Water Management, Ghent University, Ghent, Belgium , (2) Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium

Land evaporation is an essential component of the climate system linking different bio-geochemical cycles. Yet, it is one of the most uncertain components of the hydrological cycle in terms of magnitude and spatio-temporal variability. Over the last decades, much effort has been put on developing and advancing techniques to accurately measure or estimate this flux remotely. The Global Land Evaporation Amsterdam Model (GLEAM) is a conceptual model designed to estimate land evaporation – and its separate components such as transpiration – from a wide variety of satellite observations and at global scales. The model calculates potential evaporation using the Priestley and Taylor equation and applies multiplicative evaporative stress factors based on root-zone soil moisture and vegetation state to convert potential into actual evaporation. The root-zone soil moisture is calculated using a simple water-balance model. Several studies have already investigated the potential to improve the estimated root-zone soil moisture through the assimilation of satellite observations, ultimately aiming at better estimating land evaporation. Given the wealth of satellite-based datasets of soil moisture, and the specific coupling of soil moisture and the evaporative flux in GLEAM, different approaches to optimally incorporate these datasets into GLEAM have been considered in the past. While the default version of the model adopts a rather simple Newtonian Nudging scheme to assimilate surface soil moisture datasets into GLEAM, other studies have investigated the potential of more advanced Kalman filtering techniques. Also, the direct assimilation of active radar backscatter coefficients and passive radiometer brightness temperatures through the coupling of GLEAM to a set of radiative transfer models has been investigated. These studies have mainly focussed on improving the soil moisture estimates of GLEAM, while current efforts are exploring the potential of assimilating satellite observations related to the state of vegetation, such as land-surface temperature and sun-induced fluorescence. In the future, obstacles to jointly assimilate these different geophysical variables into GLEAM will need to be tackled. In this presentation, results of these different data assimilation experiments will be summarized, together with the challenges faced to improve land evaporation estimates through data assimilation and potential pathways for future research.