Geophysical Research Abstracts
Vol. 20, EGU2018-12233-1, 2018
EGU General Assembly 2018

A framework for investigating land–atmospheric interactions based on global balloon soundings

Hendrik Wouters (1), Irina Petrova (1), Chiel van Heerwaarden (2), Ryan Teuling (2), and Diego G. Miralles (1)
(1) Ghent University, Department of Forest and Water Management, Ghent, Belgium (hendrik.wouters@kuleuven.be), (2) Wageningen University and Research, Meteorology and Air Quality

Interaction between land surface properties and the atmosphere occurs at a wide range of spatial and temporal scales. Accordingly, a large number of climate and weather phenomena are influenced by land surface processes and the characteristics of the landscape. At the local to regional scales, soil moisture and vegetation variability can impact the formation and evolution of clouds and storms, as well as the development of droughts and heat waves. Most of the research in the area of land-atmospheric feedbacks over global scales and climatological time scales has concentrated on climate model simulations or statistical analysis of satellite data. Understanding of land-atmospheric interactions is challenging, yet highly relevant for the timely forecasting and adaptation to extreme weather events. Direct flux observations from systems such as eddy-covariance towers are sparse, and even when available they still require detailed statistical analyses to discriminate the effect of land processes on atmospheric variables.

Here, we introduce a new framework referred to as CLASS4GL. Within this framework, available data from satellite remote sensing and weather balloons from the past 40 years over the globe are combined and used to constrain and initialise a conceptual model of the atmospheric boundary layer (i.e. CLASS). Unlike complex climate models, the proposed framework is fully guided by observations. Initialized with morning observations of surface and atmospheric profiles on every day, it allows us to easily track the daytime response of the atmosphere to any sort of land surface perturbation. The global scope of the application enables us to easily inspect the differential response of different ecosystems and climate regimes to particular states of the land surface. We demonstrate the framework's capability in representing the daytime boundary-layer evolution observed from all balloon soundings available around the globe. The framework is applied within the frame of the DRY–2–DRY project to investigate the effect of soil moisture on the initialisation of convective clouds during drought events.