EGU22-11095
https://doi.org/10.5194/egusphere-egu22-11095
EGU General Assembly 2022

Using Artificial Neural Network to estimate surface convective fluxes.

Mathilde Jomé[1], Fabienne Lohou[1], Marie Lothon[1], Jason Kelley[2], and Eric Pardyjak[3]
[1]Laboratoire d'Aérologie, CNRS, Université de Toulouse, Toulouse, France
[2]Department of Soil and Water Systems, University of Idaho; Moscow, ID 83844, USA
[3]Department of Mechanical Engineering, University of Utah, Salt Lake City, UT 84112, USA

The earth's surface and its properties impact, on different scales, the atmosphere. Thus, understanding the interactions between the surface and the atmosphere is important to establish and control global and regional numerical models. As a matter of fact, in February 2019, the Working Group on Numerical Experimentation (WGNE) reported that the bias observed on surface convective fluxes were the second source of errors in global and regional numerical models.

Reducing these errors by getting a better understanding of the impact of the surface-atmosphere interactions over heterogenous land surface is one of the main objectives of the Models and Observations for Surface-Atmosphere Interactions (MOSAI) project. Because experimental set-up that would help to study the impact of surface heterogeneity on surface convective fluxes is quite expensive, we tested a new method, based on Artificial Neural Networks (ANNs), that be proved efficient, in previous studies, in estimating surface convective fluxes at low cost. Standard low-cost meteorological stations are associated with higher-cost surface Eddy-Covariance flux stations so that station measurements can be paired to train the network on estimating surface fluxes based only on classical meteorological variables. Based on this, one may then estimate fluxes using this method on a set of various vegetation covers at the same time.

The first step is to test ANNs on well-known data. Two different datasets are used. The first one (twelve discontinuous sunny days), is a control dataset and allows to perform three type of tests to improve the estimated fluxes. The first group of tests concerns the influence of the training dataset, the second one concerns the topography of the network, and, the last one focuses on the choice of the input meteorological variables. The second dataset helps to deepen this study. The aim is to run the same tests but with a longer dataset (a dataset spanning over the course of an entire year, allowing for larger weather conditions) to propose some experimental deployment plan of the meteorological stations network and the Eddy-covariance station for the training of these stations, to apply this method to a future campaign. The first results proved for both datasets that estimating surface convective fluxes with ANNs using only a few variables and a simple topography is possible and would allow long-term monitoring of the surface energy fluxes over an heterogeneous surface.