Poster #9-42

Simple Footprint Approximation for Better Interpretation of the Spatiotemporally Dynamic Eddy Covariance Flux Data

Housen Chu[1*], Xiangzhong Luo[1], Stephen Chan[1], Sigrid Dengel[1], Sebastien C. Biraud[1], and Margaret S. Torn[1]

[1] Lawrence Berkeley National Laboratory, Berkeley, CA

Contact: hchu@lbl.gov

BER Program: TES
Project: AmeriFlux Management Project
Project Website: http://ameriflux.lbl.gov/

Global and regional networks of eddy covariance towers such as AmeriFlux and FLUXNET provide the largest synthesized data sets of CO_2, H_2O, energy, and other GHGs fluxes. This includes the FLUXNET2015 and AmeriFlux BASE data sets that have been widely used in many studies to parameterize, calibrate, and validate models such as those from satellite-based remote sensing and land-atmosphere climate models. While the eddy covariance data are well recognized for their rich temporal information, their spatially dynamic nature as a result of the varying source areas from time to time (i.e., so-called flux footprint) is often overlooked. Up to date, the network-wise tower footprint information is still unavailable and that leads to uncertainties and potential biases when comparing the flux data with model results often designated at fixed grids/pixels. This study aims to evaluate the footprint representativeness of the AmeriFlux sites and test the potentials of simple footprint approximation for better interpretation of the spatiotemporally dynamic flux data. We calculated the footprint climatology for ~50 AmeriFlux sites that provided all variables required for two-dimensional analytical footprint models (e.g., cross-wind variance, friction velocity, Obukhov length). We then evaluated the potential bias of source areas by comparing the spatially-explicit flux data against results from several remote-sensing vegetation indices and model results. Our preliminary results showed that the footprint information largely improve the model-data comparability, especially at sites that have relatively limited fetch and/or are located within a relatively heterogeneous landscape. Last, we demonstrated a few alternative approaches for calculating footprints when cross-wind variance, one of the required but usually unavailable key variables, was not provided. Despite the alternatives may not provide spatially-explicit footprints as accurate as the commonly used two-dimensional analytical footprint models, we showed their application values for improving the interpretation of the spatiotemporally dynamic flux data, especially for those earlier data or inactive sites where it is infeasible to recalculate the flux data to include the currently missing cross-wind variance.