Geophysical Research Abstracts
Vol. 16, EGU2014-6936, 2014
EGU General Assembly 2014

Application of an energy balance correction method for turbulent flux measurements based on buoyancy

Wolfgang Babel (1), Doojdao Charuchittipan (1), Peng Zhao (1), Tobias Biermann (1), Kathrin Gatzsche (1,2), Thomas Foken (1,3)

(1) Department of Micrometeorology, University of Bayreuth, Bayreuth, Germany (wolfgang.babel@uni-bayreuth.de), (2) Institute for Meteorology, University of Leipzig, Leipzig, Germany, (3) Member of the Bayreuth Center of Ecology and Environmental Research

The energy imbalance in flux measurements between the atmosphere and the surface is a well-known problem, but unsolved due to the complexity of possible reasons and potential error sources. In order to provide unbiased budgets, however, eddy-covariance measurements of sensible and latent heat flux should be corrected according to the closure gap. Recent studies utilising turbulent flux data and LES models suggest that the transport of the missing turbulent flux is triggered by meso-scale circulations, not detected by eddy-covariance measurements within typical averaging intervals of 30 minutes. These motions on longer timescales are driven by buoyancy, suggesting that the missing turbulent flux is a missing buoyancy flux.

Based on this assumption we present an energy balance closure correction method according to the buoyancy flux. The effects are compared with the results obtained by the commonly used correction according to the Bowen ratio (Twine et al., Agr. Forest Meteorol., 2000). We show that in general both correction methods could be applied to daytime fluxes and conditions with positive Bowen ratios. Finally the corrected turbulent fluxes are compared with different simulations of SVAT-type models for Tibetan grassland sites and a central European spruce forest site. The model performance with respect to the used data correction method is linked to the different mechanism of closing the energy balance within the model.

Model validation requires energy balance closure correction in case the model relies on the energy balance equation. We conclude that mechanistic model development of turbulent flux parameterisations should recognize the recent hypotheses concerning the energy balance closure rather than fitting just to the uncorrected eddy-covariance data.