Geophysical Research Abstracts
Vol. 13, EGU2011-10347, 2011
EGU General Assembly 2011

The impact of covariance measures on the energy balance closure

Eva Falge (1), Andrei Serafimovich (2), and Peter Werle (3)

(1) Max Planck Institute for Chemistry, Biogeochemistry Department, Mainz, Germany (e.falge@mpic.de, +49-(0)6131-305579), (2) University of Bayreuth, Dept. of Micrometeorology, Bayreuth, Germany (andrei.serafimovich@uni-bayreuth.de), (3) Institute for Meteorology and Climate Research Atmospheric Environmental Research, Garmisch-Partenkirchen, Germany (peter.werle@kit.edu)

A problem of the eddy covariance method is the common absence of a surface energy balance. That is the sum of sensible and latent heat fluxes is often less than the difference between net radiation and soil heat flux. A number of studies discussed potential reasons ranging from sensor alignment and flow distortion, non-ideal terrain and inconsistent source areas, to flux divergence, averaging periods, local advection or effects of turbulent organized (coherent) structures. To address the systematic underestimation of the surface energy balance we question prerequisites to be fulfilled for the application of the classical covariance measure in eddy covariance theory.
The eddy covariance method utilizes the classic covariance function between two random variables X and Y, Cov(X,Y) = E [(X-E[X]) (Y-E[Y])], with E[Z] being the expected value of Z. Prerequisites to be fulfilled are stationarity of E[X] and E[Y] over the averaging period or finite second moments for X and Y. Reprocessing 20 Hz raw data we explore the effects of application of an alternative covariance measure on the magnitude of sensible and latent heat fluxes. The chosen covariance measure is derived from the two-sample variance (Werle 2010, AgrForMet 150, 832-840), and devoid of prerequisites.
The lack of surface energy balance sets major limits on the use of eddy covariance data for model testing, calibration, or validation, as most models of energy fluxes are based on energy balance closure. Hence, testing of alternative covariance measures provides a starting point for the derivation of sensible and latent heat flux products compatible with the surface energy balance concept, and of better use in the modeling community.