Estimating surface fluxes using eddy covariance and numerical ogive optimization

Estimating representative surface fluxes using eddy covariance leads invariably to questions concerning inclusion or exclusion of low-frequency flux contributions. For studies where fluxes are linked to local physical parameters and up-scaled through numerical modelling efforts, low-frequency contributions interfere with our ability to isolate local biogeochemical processes of interest, as represented by turbulent fluxes. No method currently exists to disentangle low-frequency contributions on flux estimates. Here, we present a novel comprehensive numerical scheme to identify and separate out low-frequency contributions to vertical turbulent surface fluxes. For high flux rates (|Sensible heat flux| > 40Wm^{-2}, |latent heat flux| > 20Wm^{-2} and |CO2 flux| > 100 mmolm^{-2} d^{-1}) we found that the average relative difference between fluxes estimated by ogive optimization and the conventional method was low (5–20 %) suggesting negligible low-frequency influence and that both methods capture the turbulent fluxes equally well. For flux rates below these thresholds, however, the average relative difference between flux estimates was found to be very high (23–98 %) suggesting non-negligible low-frequency influence and that the conventional method fails in separating low-frequency influences from the turbulent fluxes. Hence, the ogive optimization method is an appropriate method of flux analysis, particularly in low-flux environments.