THE INFLUENCE OF MESOSCALE PHENOMENA ON THE ATMOSPHERE-BIOSPHERE EXCHANGE

Thomas Foken
University of Bayreuth, Dept. of Micrometeorology
thomas.foken@uni-bayreuth.de

Typical experiments of the atmosphere-biosphere exchange are realized on the plot scale by the spatial extension of the footprint. The most important example is the FLUXNET network. However, experiments on the landscape scale often limit the atmosphere-biosphere interaction with turbulent transport processes. and Larger horizontal scales are highly connected with larger vertical and also larger time scales. Such boundary layer phenomena also have influences on transport processes on the plot scale, where boundary layer measuring technique is missing.

One of the most investigated phenomena is that of Low-Level Jets, a night time phenomenon in about 100 to 400 m height which increases the surface fluxes due to the strong shearing. Because night time data are often gap filled this increased respiration flux is often not recognized. Similar effects are caused by gravity waves, also a night time phenomenon. To identify these phenomena, at least remote sensing technique for the atmospheric boundary layer is necessary. Both phenomena are very much related to the specific site conditions. Therefore site specific boundary layer experiments are helpful in investigating the flux contribution of such phenomena. Even a careful analysis of flux data can give a hint.

Local circulation systems also have a strong influence on turbulent fluxes because the friction is related to these systems and is also a forcing parameter for fluxes. Therefore the daily cycle of turbulent fluxes is also related to circulations like land-sea breezes or mountain-valley circulations. A special phenomenon is the generation of free convection near the ground with high fluxes but low friction velocity (below the u_* criterion). Such measurements can be easily eliminated. Free convection events near the ground have an influence on the generation of clouds some hours later. At high altitudes with a low cloud base the phenomenon has a much stronger influence on the cloud generation, but the clouds are also triggering the phenomenon. A careful data analysis is necessary to identify high quality data in a non-steady state environment.

While most of the boundary layer phenomena can be seen by a careful analysis of turbulent flux data, chamber measurements are only comparable to standard flux measurements. The increase of fluxes due to boundary layer phenomena cannot be identified with chamber measurements in most of the cases.

The recommendation from this investigation is that the focus of investigations of the biosphere-atmosphere interaction should not only be on the biosphere but also on the atmosphere and thereby on the structure of the atmospheric boundary layer and mesoscale circulations. It should also be kept in mind that the phenomenon of the unclosed energy balance at the surface is caused by similar circulations. Because the experimental basis (financial support, manpower) is often limited, at least larger projects should conduct some short period experiments to investigate these often site specific phenomena.

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