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Spatial analysis of evaporation in a small catchment

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Evaporation is one of the most important processes in describing the land surface- atmosphere interactions since it connects the energy and water balances. Knowledge of the spatial variations in evaporation allows us to better estimate runoff generation processes and crop yields as well as improve regional water balances at a larger scale. However much is still unknown about quantifying evaporation over non-uniform surfaces due to the non-linearity of the evaporation process.

The purpose of this project is to measure the spatial distribution of evaporation using a variety of micro-meteorological techniques over a heterogeneous land surface in our 64Ha experimental HOAL catchment at Petzenkirchen for a period of three years. The land use in the catchment is 87% arable land, 5% pasture, 6% forest and 2% paved surfaces with the main crops grown being winter wheat and maize. In the catchment the following micro-meteorological measurement devices are already present; an open and closed path eddy-correlation system, a Bowen ratio system and a surface layer scintillometer.

The scintillometer and the open path gas analyser will be moved throughout the catchment to capture as much of the heterogeneity of the catchment as possible using the sensor footprints.

The catchment is also instrumented with a soil moisture content network and a detailed monitoring network of discharge measurements of the stream that flows through the catchment.

This research will focus on minimizing and resolving measurement differences associated with the use of different devices and studying the evaporation distribution. The measured data will be applied to hydrological models at the same scale as the catchment and then at larger scales in combination with remote sensing data to test whether knowledge of the small scale patterns of evaporation can be upscaled. The spatial and also temporal data will be used to study land-atmosphere interactions using the optimality based transpiration models of Schymanski et al (2009) and Cowen & Farquhar (1977).