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Calculating soil gas fluxes from gas concentration profiles: can we use standard DS models or should we use site-specific DS models?

Sinikka Paulus (1), Hubert Jochheim (2), Stephan Wirth (3), and Martin Maier (1)

(1) Chair of Soil Ecology, Freiburg University, Germany, (2) Leibniz Centre for Agricultural Landscape Research (ZALF), Institute of Landscape Systems Analysis, Müncheberg, Germany, (3) Leibniz Centre for Agricultural Landscape Research (ZALF), Institute for Landscape Biogeochemistry, Müncheberg, Germany

The apparent gas diffusion coefficient in soil (DS) is an important parameter describing soil aeration. It also links the profiles of soil gas concentration and soil gas flux using Fick′s law. Soil gas diffusivity depends mainly on the structure of the pore system and the soil moisture status. There are several standard DS-models available that can easily be used for calculating DS. Another, more laborious option is to calibrate site specific DS models on soil core samples from the respective profile.
We tested 4 standard DS models and a site-specific model and compared the resulting soil gas fluxes in two forest soils. Differences between the models were substantial. Another very important effect, however, is that standard DS models are usually derived from a single soil moisture measurement (device), that can result in an substantial offset in soil moisture estimation. The mean soil moisture content at a depth can be addressed more accurately by taking several soil cores. As a consequence, using standard DS models in combination with a single soil moisture measurement is less reliable than using site-specific models based on several soil samples.