



Temporal variability and persistence of soil CO₂ efflux spatial patterns at a mowed and a grazed grassland

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Spatial patterns of ecosystem processes constitute significant uncertainty sources in greenhouse gas flux estimations partly because of the temporal dynamics of the patterns. The aim of this study was to describe the temporal variability of grassland CO₂ flux spatial patterns under varying environmental conditions and to assess the effects of the grassland management (grazing and mowing) in pattern modifications.

For this reason, we conducted spatial measurements on soil respiration (Rs), soil water content (SWC) and soil temperature (Ts) 9 times during a four-year study in the vegetation periods at grazed and mowed grasslands. Altitude (ALT) of the measuring positions were used as background factor, while SWC and Ts were considered as abiotic co-variables in the spatial analysis. The sampling scheme was based on 80×60 m grids of 10 m resolution with a total of 78 sampling points in both study plots. Data analysis was based on variography and kriging.

Altitude showed autocorrelation lengths of 40-50 m in both plots and was an important factor in determining the spatial patterns of the co-variables. Soil water content changed in general inversely, while Ts changed jointly with ALT. Autocorrelation lengths of the Rs patterns were similarly about 30 m on average in both plots. Grazing potentially created increased heterogeneity and regulation of the patterns, while mowing appeared to have had a homogenizing effect resulting in a lesser degree of pattern regulation. We found that SWC and Rs patterns were temporally variable especially in the first two years of the experiment, while these patterns were more persistent (mostly significant correlation at $p < 0.05$ between location ranks) in the second two years, following a wet year. Increased persistence after a wet year indicated not only the homogenizing effect of adequate water supply conditions but also the recovery potential of the grassland after droughts.