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Linking the field-scale spatial pattern of bare soil respiration with organic carbon fractions and other covariates

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Soil heterotrophic respiration fluxes at field scale exhibit substantial spatial variability. Chamber-based measurements of respiration fluxes were carried out within a 40x180 m bare soil plot.
Soil temperatures were measured simultaneouslyto the flux measuremnts.
Further, we used measurements of total soil organic carbon content, apparent electrical conductivity as well as mid-infrared spectroscopy- based carbon fractions as co-variates. Futher, basic soil properties like e.gtexture were determined as co-variates. After computing correlation coefficients, a stepwise multiple linear regression procedure was used to spatially predict bare soil respiration from the co-variates. In particular the soil carbon fractions and the apparent electrical conductivity show a certain, even though limited, predictive potential. In a fist step we applied external drift kriging to determine the improvement of using co-variates in an estimation procedure in comparison to ordinary kriging. The relative improvement using the co-variates in terms of the root mean square error was moderate with about 12%. In a second step we applied simulated annealing to perform stochastic simulations conditioned with external drift kriging to generate more realistic spatial patterns of heterotrophic respiration at plot scale. The conditional stochastic simulations revealed a significantly improved reproduction of the probability density function and the semivariogram of the original point data.