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Mapping vegetation patterns in arable land using the models STICS and DAISY

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Several statistical methods exist to detect spatial and / or temporal variability with regard to ecological data-analysis: Semivariance-analysis, Trend surface analysis, Kriging, Voronoi polygons, Moran's I and Mantel-test, to mention just some of them. In this contribution, we concentrate on spatial vegetation patterns within the soil-vegetation-atmosphere (SVAT) system.
Using variography, spatial analysis with a geographic information system and self-organizing maps, spatial patterns of yield have been isolated in an agro-ecosystem (see poster contribution EGU 2009, EGU2009-8948). Data were derived from two agricultural plots, each about 5 hectare, in the area of Newel, located in Western Palatinate, Germany. The plots have been conventionally cultivated with a crop rotation of winter rape, winter wheat and spring barley.
The aim of the present study is to find out if the existing natural spatial patterns can be mapped by means of SVAT models. If so, the discretization of a landscape according to its spatial patterns could be the basis for parameterization of SVAT models in order to model soil-vegetation-atmosphere interaction over a large area, that is for up-scaling. For this purpose the SVAT models STICS (developed by INRA, France) and DAISY (developed at Tåstrup University, Denmark) are applied. After a wide sensitivity analysis both models are parameterized with field data according to the given situation of each of the detected spatial patterns.
The results of the simulation per representative location of a pattern are validated first with field data concerning yield, soil water content and soil nitrogen; besides, above ground dry matter, root depth and specific stress indices are used for validation. The conclusions that can be made with regard to up-scaling are discussed in detail. In a second step the results of the STICS model are compared with those of the DAISY model to analyse the models' behaviour, to get further knowledge about the inner structure of the model and finally to examine crucial model structures as well as differences between STICS and DAISY.