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Identifying reduced soil parameter sets for regional modelling

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Regional models for prediction of fluxes between soil and atmosphere and/or soil and groundwater require a parametrisation of the soil hydraulic properties (depending on the applied model for unsaturated water dynamics). Fully coupled climatic models are numerically demanding, and therefore a reduced set of soil parameters has to be identified for rather large areas of land which optimally represents the heterogeneity of the subsurface (i.e. the spatial soil pattern). As the processes are inherently nonlinear a simple averaging of heterogeneous parameter fields is prohibitive. Also the temporal pattern of transpiration, leaching and (reactive) solute transport can not be adequately reproduced by oversimplified parametrisations. It is state of the art to choose a rather arbitrary "representative profile" for this purpose.
Soil survey on the other side is able to delineate a rather detailed inventory of soils for a given region. Data bases of soil properties combined with pedotransfer functions can provide a large and spatially resolved set of soil physical parameters including uncertainties. The challenge is to reduce this information to a meaningful set of characteristic soil profiles and to determine corresponding weights for the larger region. We suggest that this can be done based on modelling soil water dynamics in response to external forcing by representative climatic patterns followed by scaling of the resulting fluxes and travel time distributions for the whole region. The resulting response pattern can then be used to derive the desired reduced and weighted set of characteristic profiles which can be coupled to regional soil-atmosphere models.