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Discussions

Interactive comment on "Subgrid spatial variability of soil hydraulic functions for hydrological modelling" *by* P. Kreye and G. Meon

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The objective of study presented in the paper is to develop a robust procedure to generate various sets of parameterizations of soil hydraulic functions for the description of soil heterogeneity on a subgrid scale. This goal is related to topics of the HESS journal, since it aims at improving the quality of hydrological models. Taking into account the subgrid effects (1) is necessary for increase of accuracy of calculations in the spatially distributed hydrological models, since output variables of the model are often associated with input variables and model parameters nonlinearly, (2) and also gives opens up a wider range of applications for solving related problems that require a description of the various processes at a smaller scale (assessment of intensity of erosion processes, the calculations of the pollutants transfer into the river system, accounting for hydrochemical processes in the catchment, etc.). When solving problems

of the describe the dynamics of water balance components in the distributed model the most important factors are the forcing data, i.e. hydrometeorological characteristics (primarily precipitation and incoming radiation (or the near surface air temperature correlating with it)) and the parameters of the soil cover. Namely to develop the methods of assessing the variability of the soil parameters within the framework of the computational grid of the hydrological model, this work is devoted. It aims to obtain data about the spatial variability of soil hydraulic parameters within the framework of the calculational cells of the catchment, when these data could be obtained indirectly, i.e. using only the information obtained from soil maps (reflecting the spatial distribution of soil classes) without experimental work on determination of the soil parameters. The main soil parameters that are considered in this work, were the parameters of the Mualem - van Genuchten model (VGP) (1980): namely the residual and saturated water content of the soil and the Ks, which is the saturated hydraulic conductivity. The sets of these parameters for different soil types, characterized by different textures (which is determined by the content of silt, sand and clay) were calculated with the use of the software ROSETTA (created in the Laboratory, Salinity, CA, USA; (Schaap et al., 2001)). In a next step, correlations between the Ks values and the VGP of the soil are analysed. As a result of the work, a procedure was developed to obtain the van Genuchten parameters (VGP) and KS values based on soil map information. Software Rosetta, based on neural network analysis, generates van Genuchten parameters and KS values from the soil texture information. In addition, the use of the Monte Carlo method gave the possibility to obtain for different classes of soil not only average values of the relevant parameters (the values of the Ks and VGP), as well as their variability. Obtaining this information is done in a much shorter time than the time required for the preparation and receipt of other input data for hydrological models of large spatial scales. In addition, the procedure is reliable in use and more data (and cost) is not required. When the code ROSETTA is used, it is enough only soil map. The developed technique can be used for any soil classification (e. g., UNSODA, USA; the German soil classification system (in this work), etc.). Presented in the work developments were implemented

into the hydrological modelling system PANTA RHEI (Förster et al., 2012; Förster, 2013; Kreye et al., 2010, 2012; Kreye, 2015) and were used successfully in many practical applications and projects (e.g. Hölscher et al. (2014); Wurpts et al. (2014); Kreye (2015)). It should be noted that although created technique was developed to account for soil heterogeneity, based on the soil parameters of the van Genuchten model, it can be applied when using other models, in which there are values of the Ks and the residual and saturated water content of the soil. In conclusion, we believe that the paper makes a significant contribution to the development of hydrological models and may be published as submitted in the HESS journal.

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