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Hydrology and Earth System Sciences
Discussions

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

Anonymous Referee #3

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Journal: HESS Title: Subgrid spatial variability of soil hydraulic functions for hydrological modelling Author(s): Phillip Kreye and Günter Meon MS No.: hess-2016-53 MS Type: Research article

General comments: Scientific significance: Good Scientific quality: Good Presentation quality: Good Recommendation: Return to author for major revisions.

The authors present research on the parameterization of physical based spatially distributed hydrological models that accounts for subgrid spatially variability. The procedure is well introduced and I agree that there is a need to advance spatial parametrization of hydrological models to represent heterogeneity of natural systems accordingly. The topic fits the scope of HESS, but, as detailed below, there are still a number of issues that require clarification before the manuscript can be accepted for publication.

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Specific comments

1) The authors use ROSETTA to generate the databases of VGP sets based on trios of soil texture to build the regression models between Ks and the VGP. Overall, I see limited validity in this approach: (1) ROSETTA is a calibrated model which has effective parameters itself, as it is based on an imperfect model structure. This means that parameters found suitable for ROSETTA might not be very applicable in a distributed hydrological model. This was found by Koch et al. (2016) where parameters from a surrogate model (HYDRUS1D) were passed on to distributed models and it became clear that parameters are not easily interchangeable between models. (2) Along these lines it may be doubtful that the regression model between parameters of one model is transferable to another model. I would ask the authors to reflect on their assumption that the regression models found in ROSETTA are still valid in a more complex distributed hydrological model.

2) Section 3.3 nicely presents the workflow of the presented approach. However I would like to ask the authors to clarify how the VGP sets are incorporated in the hydrological model. Again, how can the authors support that the mean Ks value obtained from ROSETTA can be regarded as the mean Ks value for the more complex hydrological model, that may requires model dependent effective parameters (p.12,l.20). Instead a prior calibration of the hydrological model could be used to obtain suitable mean Ks values. How many sets of VGP sets should be used (p.12,l.24)? Also, the authors should give guidance how the subgrid spatial variability can be quantified after all VGP sets are executed (p.12,l.20)? The standard deviation of soil moisture at each cell?

3) Also I did not fully understand if the authors suggest having multiple model scenarios, where each scenario is based on a different Ks value drawn from the Ks distribution for each soil class? Or if they suggest to generate stochastic fields of Ks values that are applied in the distributed model?

4) In section 3.3 the authors address the problem of scale and that a pseudo accuracy

can be created if the model is operated at smaller scales than its input. Often model input comes at various scales and in fact hydrological processes take place at various scales as well. Here, the mHm model (Samaniego et al., 2010) provides a very flexible platform at account for differences in scale in the input data and parameters. The authors should mention modelling alternatives in their manuscript.

5) The authors mention that regression between Ks and the VGP could be artificially caused by ROSETTA. If this is the case, how do the authors support their suggested approach at all? What are the "real" regression models between Ks and other VGP and how wrong is ROSETTA? Again, this should be linked to the question if the same regression model can be assumed valid in a more complex hydrological model?

References

Koch, J., T. Cornelissen, Z. Fang, H. Bogena, B. Diekkrüger, S. Kollet, and S. Stisen (2016), Inter-comparison of three distributed hydrological models with respect to seasonal variability of soil moisture patterns at a small forested catchment, Journal of Hydrology, 533, 234-249.

Samaniego, L., R. Kumar, and S. Attinger (2010), Multiscale parameter regionalization of a grid-based hydrologic model at the mesoscale, Water Resources Research, 46.

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