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Hydrology and Earth System Sciences Discussions

Interactive comment on "Matching ERS scatterometer based soil moisture patterns with simulations of a conceptual dual layer hydrologic model over Austria" *by* J. Parajka et al.

Anonymous Referee #1

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This paper presents the results of a multivariate soil moisture/discharge calibration of a hydrologic model across Austria. The paper is interesting. However, a number of issues need to be resolved before the paper can be published.

My major remarks are:

- I have a problem with naming the calibration procedure "multi-objective". It is not because multiple datasets are used that the objective functions for each of them are in contradiction. As a matter a fact, in this case, improving the soil moisture simulations should also improve the runoff simulations, if the model works well and if the data are

good. I know that improving one will not necessarily improve the other, but still, multi-objective calibration (and as a consequence the appearance of a Pareto-front) means that the objectives are in contradiction. Here, this is clearly not the case. Therefore, the method should be referred to as "multivariate calibration" or something similar.

- I also have a problem with the weights used in the objective function. wr is the weight of the runoff, 1-wr the weight of the soil moisture. However, assume that the range of the soil moisture data is between approximately 0 (residual soil moisture) and 0.5 (porosity). On the other hand, Figure 6 shows the the runoff can range between 0 and 20 or more. Thus, in the objective function, runoff is going to have a much stronger weight than soil moisture, even if wr is very low. If the soil moisture is expressed in percentages, the opposite will be true. Thus, even though the weights wr and 1-wr of the runoff and soil moisture, respectively, sum up to one, they are no reflections of the weights of either of these variables in the objective function. This is going to have a huge impact on the model results. The consequence of this calculation of the objective function needs to be thoroughly analyzed before the paper can be published. By thoroughly analyzing, I mean, taking a number of catchments with different ranges of runoff, and checking the impact of wr on the resulting model parameters and soil moisture/runoff simulations. This way we can assess whether the impact of the choice of wr is similar for catchments with a different range of values for the discharge.

Some minor remarks:

- The authors need to carefully reread the paper. A number of sentences are incomplere, and there are a number of grammatical/spelling errors.

- Introduction, page 3316, first paragraph: referring to papers from 1999 and a few years after, and in the same sentence using the words "recent years", is inconsistent, they were published almost a decade ago. More importantly, some of the studies referred to in the first sentence of this paragraph do not assimilate soil moisture at all, even though the sentence begins with the statement that they do. Please correct.

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Interactive Comment

- Same paragraph: Parajka (2006) is not the only study that focussed on the use of remote sensing soil moisture data for improving runoff predictions. Please complete.

- Model description: please add a paragraph on how the snow module works.

- Page 3323: why was the agreement between scat and model data not expressed in terms of the RMSE, as is done for the runoff ? Also, please extend the square root sign to include the second product in the denominator as well.

- Page 3332. If the soil moisture from the ERS is calculated through normalizing backscatter coefficients, and then using this ratio to interpolate between very wet and very dry observations, somebody should urgently assess how realistic that is. From what I know, soil moisture has a strong nonlinear relationship with backscatter. So it is very well possible that the range of uncertainty in the soil moisture products is too high to be useful. The authors don't need to do this analysis, but they should write a couple of sentences about it, and relating this to their results (the model tends to overestimate the SCAT soil moisture as compared to SCAT).

- Same page, line 12. I don't agree that soil moisture has an extreme temporal behavior. Unless during rainfall, it doesn't change that much during the day.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 3313, 2008.