Hydrology and Earth System Sciences Discussions

Interactive comment on "Assimilating scatterometer soil moisture data into conceptual hydrologic models at the regional scale" *by* J. Parajka et al.

Anonymous Referee #2

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General comments:

The paper provides a comprehensive study of the use of scatterometer soil moisture data in the calibration of hydrological models for both gauged and ungauged catchments. The overall quality of the paper is good, technically sound, and the presentation of the work is well structured and clear. The conclusions of the study are clearly presented and thoroughly discussed.

The paper provides a valuable contribution to the research on use of remote sensing data for improving hydrological model prediction. It is recommended for publication in HESS subject to minor changes according to the comments given below.

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Specific comments:

1. A critical aspect when using multiple sources of information in the calibration of hydrological models is the combination and balancing of the different types of data. In the calibration, runoff data (that combines 2 different performance measures), snow data, soil moisture data and prior parameter information are used. Thus, the calibration problem is multi-objective (up to 5 objectives) and the solution will not, in general, be a unique set of parameters but will consist of a number of Pareto optimal solutions according to the trade-offs between the different objectives. The authors use an aggregated measure for optimisation with predefined weights on the different objectives, which correspond to a single solution on the Pareto surface. It is not described how these weights are determined, and thus where on the Pareto surface solutions are sought. In other words, do the weights provide a balanced solution with equal weighting of the different objectives or do they reflect priorities to certain objectives? The influence of the different objectives on the aggregated objective measure is difficult to interpret because the objectives have different scales. One way of handling this is to calculate weights as part of the optimisation as discussed by Madsen (2003).

2. Related to the comment above, I think it would be useful to discuss the results of the calibration with and without soil moisture data in a multi-objective context. Basically, the results reflect the trade-off between the soil moisture objective function and the objective function that includes runoff, snow and prior parameter information. Because of this trade-off you would expect an increase in the performance of soil moisture simulation but at the expense of decrease in performance of runoff and snow simulation. But how the trade-off will affect the calibration results depends on the shape of the Pareto front. Again, this is difficult to interpret because of the assigned weights and the applied aggregated objective function, Eq. (11).

3. For measuring the performance of soil moisture simulation the correlation coefficient is applied. What is the reason for applying this measure? The correlation coefficient measures the best linear relationship between simulated and observed soil moisture

and not the 1:1 relationship as reflected in the Nash-Sutcliffe coefficient. You may have a perfect correlation even if you have a significant bias and a scaling difference between simulated and observed data.

4. The snow cover simulation error measure is not shown in Tables 4-5 for the calibration of ungauged catchments?

Technical corrections:

1. I would expect "(1-r)" instead of "r" should be used in Eq. (12).

2. Page 2764, line 7: Shouldn't it be "r" instead of "Rˆ2"?

References:

Madsen, H., 2003, Parameter estimation in distributed hydrological catchment modelling using automatic calibration with multiple objectives, Advances in Water Resources, 26, 205-216.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 2739, 2005.

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