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Hydrology and Earth System Sciences Discussions

Interactive comment on "Sensitivity analysis of Takagi-Sugeno-Kang rainfall-runoff fuzzy models" *by* A. P. Jacquin and A. Y. Shamseldin

Anonymous Referee #3

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This is an interesting topic on the continuously growing topic of applying sensitivity analysis to hydrological models. The topic is appropriate for publication in HESS. The paper is generally good and interesting, but a few aspects are missing, which I discuss below. I think addressing these points would significantly improve the manuscript. - P. 1968: The first sentence of the introduction is too simplistic a view of the calibration problem. There are clearly other problems such as model structural uncertainty, errors in input and output data etc. that cause problems during calibration. It is not just the parameters! - Table 3: The authors should add an explanation of the meaning of the parameters into the table to make it easier for readers not familiar with the models to follow the paper. - P. 1981: It seems to me that the measures R2 and REP should be

correlated, which would have an impact on the results and conclusions. Did the authors check for this? - P. 1983: A better reference for MCAT is Wagener and Kollat (2007, Environmental Modeling and Software). - P. 1984: The authors just show a single plot of the RSA results. However, since they use a subjective interpretation of these plots (which is fine in general), it would be good to see more results in order to understand how the authors interpret the plots. I suggest that the authors add more RSA plots and more depth on this discussion. - P. 1985. I do not agree with the authors’ statement that the RSA method only presents the first-order sensitivity of the model parameters without interactions. This is not correct. The RSA approach actually (implicitly) considers parameter interactions since it allows for all the parameters to vary simultaneously. It is this similar to the total sensitivity calculated in Sobol. However, the RSA approach has a strong tendency to have sensitivity results to be dominated by a few parameters. The interaction is important though since non-sensitivity of parameters in the RSA approach can be caused by strong interactions with parameters! The authors could easily check this by varying pairs of parameters only and by looking at the resulting response surface plots. - The authors never mention the actual performance of their model in representing the different watersheds. This is important though since sensitivity analysis is only meaningful if the model is a good representation of the watershed input-output behavior. It would be good to add a Nash Sutcliffe Efficiency for example. - Tables 5-8 contain the results, but are very difficult to analyze without spending a lot of time on them. There must be better ways to help the reader by adding visual aids! For example, why not highlight highly sensitivity parameters by making the background gray, or by making them bold. It is important for the reader to see patterns in the tables and the authors should help the reader to do so easily! - There was a recent paper by van Werkhoven et al. (2008, Water Resources Research) that showed a tremendous variability in sensitivities across different watersheds. It would be very interesting if the authors could discuss their results in the context of this research to see whether this result has general validity.

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