Interactive comment on "Multiobjective sensitivity analysis and optimization of a distributed hydrologic model MOBIDIC" *by J. Yang et al.*

Anonymous Referee #2

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I applaud the authors for an enjoyable paper that makes a nice, easy-to-comprehend contribution. I accept publication subject to several minor comments.

1. [line 17, p. 3510] The authors state "a factor can be a model parameter or a group of model parameters". When they say, a "group": do they mean both spatially distributed parameters, and sets of spatially distributed parameters? This could use clarification.

2. [line 19, p. 3512] The authors' methodology screens out and excludes certain model parameters. The authors should review and cite van Werkhoven et al (2009), Advances in Water Resources. The van Werkhoven study showed that if the wrong metrics were used for reduction of parameters, the Pareto sets can drastically change.

3. [section 3.2] In this section, the review by Efstratiadis and Koutsoyiannis (2010),

Hydrological Sciences Journal, should be cited. Additionally there is a typo in the second reference to Kollat and Reed.

4. I commend the authors on comparing the results to single objective optimization (equation 6).

5. I would recommend some more discussion of Figure 3. Why was it that the factors look like they are appearing in "groups"? I found it difficult to interpret the results of this figure.

6. Several comments about the multiobjective calibration:

6a. When the authors say "converged" what do they mean? They do this both for the SOO and MOO results; mathematical convergence to the true optimal solution cannot be proven.

6b. The authors claim eNSGAII took more model simulations. This seems like an obvious result – eNSGAII is a population based technique for finding solutions to multiple objective problems. It's like comparing apples and oranges, so to say.

6c. What were the eNSGAII parameters? Injection rate? Initial population size? This is going to affect the computational efficiency (see 6b).

6d. Was the MOO optimization repeated for multiple random seeds? Was the single objective optimization repeated for different starting points? This is standard practice, and if the authors did not do this it may call the optimization results into question. For example, they claim "Nelder-Meld [...] was dependent on starting point" [line 4, p. 3521]. This implies that they tried multiple runs, but I'm not sure.

6e. If they did NOT try multiple runs, one justification for this is the computational time that the simulation model takes to run. However, this changes the tone of the study a bit. Now, the use of eNSGAII is to just get good parameter sets – you can't make as many claims about convergence if you don't repeat the study several times for multiple random seeds.

7. In the results, is there an approach to choose one solution, and navigate the trade-offs? The authors may want to refer to Kollat and Reed, 2007, Environmental Modelling and Software for one possible approach. One criticism of multiobjective calibration is that users can eventually only use one parameter set, so approaches should be designed to try to facilitate that choice of parameters.

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