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Hydrology and Earth System Sciences
Discussions

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

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Dear Editor and Dear Reviewer,

We thanks for the comments from Anonymous Referee #1. These comments will be very valuable to improve this manuscript. Below is our point-by-point reply to these comments:

1.A flowchart figure is suggested to add to clarify the methodology, i.e., the relationship between the two sensitivity methods.

Our reply: we agree and will add the following sentence to clarify the relationship: In the literature (e.g., Yang 2011), for over-parameterized cases, Morris method is firstly

suggested to screen out insensitive factors, and then SDP method is applied to quantify the contributions of the sensitive factors and their interactions. In this study, as we only have nine factors (as listed Table 1), these two methods are applied individually and their results will be compared with each other.

2.The single objective optimization is performed with the Nelder–Mead Simplex algorithm, why not use the Genetic Algorithm and make the comparisons fairer. In fact, epsilon-NSGAII is also very effective for single objective optimization

Our reply: we agree that epsilon-NSGAII is also very effective for single objective optimization. However, as stated in lines 8 and 9 of page 3514 "And SOO was done with the classic Nelder–Mead algorithm (Nelder and Mead, 1965) which is widely used in MOBIDIC applications", one objective of this paper is "Multiobjective sensitivity analysis and optimization provides an alternative way for future MOBIDIC modelling" (lines 24 and 25 of page 3506).

3.In section 5.2, the high flows are underestimated (that can be observed in Fig. 9) because the logarithm scale of the observed and simulated flows (SRMSE and MARD) are chosen. It needs to justify that the purpose of the hydrologic model is not for the flood forecasting. Particularly, MARD seems to more address the normal flows.

Our reply: we agree that objective function is a reflection of modelling purpose. The case study is not for flood forecasting and we will add this statement.

4.In section 5, the authors used SDP method to discuss multiobjective sensitivity analysis quantitatively. This study did not give a threshold for the sensitivity index (vertical axis in Fig. 4) that the factors could be screened out clearly, i.e., has a very low sensitivity index (Fig. 4) while it is chosen as a sensitive factor.

Our reply: though SDP is a quantitative approach, it cannot estimate contributions from higher order interactions (see section 3.1.2). The successful use of SDP depends on the uncertainty that SDP explains. Instead of using a threshold, it is more meaningful

to combine the results with the knowledge of the case study. In Figure 4, for objectives SRMSE and MARD, it explains over 80%, we can easily identify the five sensitive parameters; for WBI, it explains only 58% total uncertainty, we selected rWcmax based on comparison with Morris results and evaporation characteristic though sensitive indices (main effect and quasi total effect) of rWcmax are low. We explained the process in section 5.1.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 3505, 2014.