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Hydrology and Earth System Sciences Discussions

Interactive comment on "Reply to J. Vrugt's comment on "How effective and efficient are multiobjective evolutionary algorithms at hydrologic model calibration?"" *by* P. Reed et al.

P. Reed et al.

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In response to Dr. Seibert's review, a few clarifying points may help readers

(1) What is the MOSCEM-UA algorithm? MOSCEM-UA is simply the search algorithm and its input options in the original source code. Pre-conditioning with single objective optimization was not an option. (2) Is MOSCEM-UA with initial sampling really that much better? In February 2006, we provided Dr. Vrugt with our best approximation for Pareto optimal set for the Leaf River test case from our HESS paper. He could show the impact of his proposed pre-conditioning for MOSCEM-UA. In terms of the larger and more computationally intensive Shale Hills test case MOSCEM-UA had limitations that were independent of pre-conditioning that degraded its performance [see Section

5.3 in Tang et al. (2006)].

In addition to the primary review comments above, we can provide a bit of discussion on some of the other issues raised by Dr. Seibert. (1)“Obviously there are not only many different optimization algorithms but each of those has many options for settings (or parameters).” We agree and this issue does have relevance to the HESS audience because when using optimization algorithms often the “experimentation cost” for setting parameters is not often highlighted in published literature (for exceptions see (Aly and Peralta 1999; Reed et al. 2000; Bayer and Finkel 2004). Consider our Shale Hills test case where every algorithm run takes 1-week of computation using a LINUX cluster [our “experimentation cost” for this analysis would have been more than 420 days of continuous computation if we had used a single processor as discussed in Tang et al. (2006)]. Our Epsilon-NSGAII research seeks to reduce user “experimentation costs” with auto-adaptive population sizing, archiving, and robust parameterization.

(2)“The situation is different for more complex models but for those even 5-10000 run are often not feasible.” We would like to highlight that hydrologists may want to place a higher priority on the use high performance computing to expand the scope of issues that can be analyzed with complex models. Our Shale Hills test discussed above is an example or Tang et al. (In Press) where more than 1.6 million simulations where used to characterize the spatially distributed sensitivities of a highly complex hydrological model ($>$600 days of continuous computation if we used a single processor).

(3)“Questions like data uncertainties and which types of data to use in multiobjective model evaluations seem more important to me than the discussion on the optimal optimization algorithmsĚ” We fully agree that data uncertainties and choices for data type are very important (e.g., What are your prediction objectives? What state should be monitored? Where? How often? With what procedure?). In fact, these questions are relevant to the network design problem which is similar to a multiobjective combinatorial knapsack problem (see Kollat and Reed 2007). It would be helpful to have efficient, effective, and reliable multiobjective tools that could advance hydrologists ability to study

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these types of problems.

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