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Interactive comment on "On searching for optimized set of physical parameterization schemes in a multi-physics land surface process model" *by* S. Hong et al.

Anonymous Referee #2

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Overall comments:

This paper attempts to identify the optimal physical parameterization schemes for the Noah-MP model using a genetic optimization algorithm. The idea itself is interesting and scientifically valid, and if correctly implemented, can provide valuable guidance to the effective use of the Noah-MP model (and other models alike) that otherwise would be difficult to use due to the complexity and various choices of the parameterization schemes. However, in the current paper, the implementation of the optimization strategy is essentially flawed (see comments below) and needs to be rectified before it is acceptable for publishing in GMD. I hence recommend the manuscript be returned to the authors for major revision.

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Specific comments:

- The current study is missing an important component of a calibration experiment: validation. Without validation, it is unclear how the optimal scheme combinations obtained through the GA-based calibration can be effectively applied to an independent time period for the same region. I would suggest the authors to split the 10-yr datasets into two time periods and use one period for optimization and the other for validation.

- One fundamental weakness of the manuscript in its current form is that the description of the optimization process is unclear and too brief to follow for a typical geosciences reader. For example, how was the random sampling of initial scheme combinations done exactly (e.g., what types of distribution was used)? Also, with the elitism, how many sets of scheme combinations were keep for the crossover procedure each time, and how was the crossover conducted exactly? Section 2.2 should be extended to include details that would answer these questions.

- The purpose of the 3-yr experiment in Section 3 should be clearly stated. If the main purpose is to identify the appropriate number of generations to facilitate the 10-year optimization experiments described in Section 4, discussions should be included to clarify why this number from the 3-yr experiment is considered valid for the longer 10-yr experiments. In addition, it is highly likely that this number would be different for regions with different climatic characteristics. For instance, one would expect the convergence of the optimization process for an arid region to be much slower than the convergence for a temperate or humid region. This might partially explain why the optimal scheme selection based on the maximum number of generations from experimenting with KOR (semi-humid) performs so poorly for RE2 (arid). Hence, I would argue that the experiment described in Section 3 should be conducted separately for each of the four regions to facilitate the 10-yr experiments in Section 4.

- In Section 4, more discussions should be included to enable proper interpretations of the results. For example, why is the performance for RE2 and RE3 is so poor (an

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mNSE of -0.39 is essentially unacceptable)? Also, it is stated (P4519, L26) that SCF(1) and INF(1) contribute most to the achievement of the best mNSE for RE1. How was this conclusion derived? Similarly, the statement near the end of Section 4 that the selection of the SFC scheme is important in all regions except RE2 is also unsupported. I would also suggest that the authors evaluate the NSE of evaportranspiration and runoff separately for better analysis. In addition, other metrics such as RMSE could also be added for the analysis of ET and runoff.

- In this study, the parameters within each scheme are not calibrated. The authors should discuss how this may have impacted the validity of the optimal schemes obtained.

- Abstract, L8: why are there 10 different land surface parameterization fields? There are only 8 listed in Table 1.

- P4518, L11-15: "The fast decrease in the average skill score ... in a generation is less than 5%". This sentence is unclear and confusing and should be rephrased for clarity.

- The paper could have included a more extensive literature survey on calibration of land surface models and the identification of model structure.

- Finally, the overall writing of the paper should be improved.

Interactive comment on Geosci. Model Dev. Discuss., 6, 4511, 2013.

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