

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.

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Received and published: 10 September 2013

Reply to the interactive comment by A. Pitman (C1414):

We here give a more detailed description of the MP-MGA coupling framework in our study, which will also appear in the revised manuscript. The first basic task of micro-GA is to generate multiple set of scheme combinations (10 sets in this study) by selecting one discrete number per one scheme field; each scheme option in a scheme field is assigned with a unique discrete number. These discrete numbers (each scheme selection) and their complete sets (a set of scheme combination) are handled like genes

C1420

and chromosomes in the genetic concept, respectively. Once micro-GA establishes the 10 scheme combinations, it applies these combinations to Noah-MP by editing the “namelist.input” file one by one. The second task is to select the best scored scheme combination based on a customized fitness function. Until Noah-MP finishes all the 10 simulations, micro-GA collects the skill scores of each simulation. The skill scores are calculated by comparing the simulations to the observations based on the fitness function (section 2.2.2). The last task of micro-GA is to generate the next generation (10 scheme combinations) through ‘crossover’ mechanism (exchange of genes’ locations) using the best scored scheme combination from the previous generation. For more detailed information about the mechanism, please refer to the reference section in the manuscript. Micro-GA continues this task, exploring better generations than the previous ones until the skill scores of the simulations converge upon the optimal value. A summary of the MP-MGA operation is provided below (see Fig. 1 in the original manuscript):

1. Micro-GA produces an initial set of scheme combinations through random selections.
2. Micro-GA controls Noah-MP by editing the “namelist.input” for the scheme choices and executing it.
3. After Noah-MP finishes one simulation with the given scheme selections, a skill score is calculated through statistical comparison to the observation data based on the fitness function (the modified Nash-Sutcliffe efficiency in this study).
4. Micro-GA collects the skill scores until all the simulations for the current generation are completed.
5. Once micro-GA collects all the skill scores of the generation, it selects the best one (Elitism) and stores the selected scheme combination for the next generation.

C1421

6. Another set of scheme combinations for the next generation is produced through the “crossover” mechanism using the selected one from the previous step.
7. Micro-GA repeats the steps from 2 to 5 until the generations converge on the true optimal value.

For the conservation of energy and water, Noah-MP checks these balances at every time step during the simulation. Noah-MP is set to quit the simulation when each balance check exceeds the maximum error of 0.01 Wm^{-2} and $0.01 \text{ mm}(\Delta t)^{-1}$ for energy and water, respectively. In that case, Noah-MP does not calculate any skill score, and micro-GA excludes the case in the elitism process (step 5 above) by assigning a meaningless number to the skill score.

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

C1422