

Interactive comment on “What glaciers are telling us about Earth’s changing climate” by W. Tangborn and M. Mosteller

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Thank you to the authors for replying so quickly and providing additional information. I believe that the overall approach adopted by the authors is appropriate. The model has been developed and validated over many years. However, I believe that additional details are required to enable the reader to reproduce the calibration methodology and assess its suitability. Below are further details of my understanding of the Nelder and Mead (1965) method, and the additional information I believe is still required.

The downhill simplex algorithm of Nelder and Mead (1965) is a heuristic search method. It begins at a user-defined start position in the parameter space and then, via iteration, moves “downhill” to find the minimum value of a specified objective function (e.g., the RMSE between observations and model results). The aim of the method

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is to identify a single optimal solution. The “simplex” method (which is not authored by Nelder and Mead) is used for solving linear problems, and therefore to avoid confusion I suggested using “downhill simplex” throughout the article.

Monte Carlo and downhill simplex methods are similar in that they are both used to search the parameter space for optimal solutions. Monte Carlo is a “brute force” search method that is an exhaustive search across the entire feasible parameter space. This will often require many (>1000) parameter sets to be run for the parameter space to be sampled in sufficient detail. In contrast, downhill simplex is a heuristic search method that converges on an optimal solution. As a result, the number of parameter sets that must be sampled before an optimal solution is identified is far fewer. It is not clear from the article how Monte Carlo sampling has been used by the authors. They state that they have used the heuristic Nelder and Mead (1965) method, but also seem to have used some sort of Monte Carlo Sampling. I wonder if the authors have used a modified version of Nelder and Mead (1965)?

In order for the reader to be able to understand and reproduce the method, additional information is required. Specifically: (1) The initial parameter values that were selected; (2) the objective function that was minimised (which has now been provided); and (3) boundary conditions (e.g., was the algorithm stopped from selecting unrealistic parameter values?).

One thing I do not understand is why the first 15 iterations of the algorithm use values specified by the authors? The method of Nelder and Mead (1965) only requires a single initial point to be specified by the user. Again, I wonder if the authors are using a modified version of Nelder and Mead (1965)?

The authors state in their response that “The question of whether the simplex algorithm can get stuck in a local minima and will not find the global optimum solution is not easily answered”. A common approach in the scientific literature to address this problem is to run the downhill simplex algorithm multiple times from different starting

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positions. The global solution is then selected as the solution with the smallest objective function value. An alternative would be to add a caveat to the discussion regarding the optimality of the calibration.

Interactive comment on The Cryosphere Discuss., 8, 3475, 2014.

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