EGUsphere, author comment AC1
https://doi.org/10.5194/egusphere-2022-797-AC1, 2022

Reply on RC1

Anthony Gruber et al.

Author comment on "Multifidelity Monte Carlo estimation for efficient uncertainty quantification in climate-related modeling" by Anthony Gruber et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-797-AC1, 2022

Dear Anonymous Referee #1,

Thank you for your helpful comments and for your interest in our work. Below are responses to your specific questions:

1) By "alternate sampling strategies" we mean that a user might be using (or may want to use) some other sampling scheme besides traditional MC for the truth model, e.g., Latin hypercube sampling, quasi-MC sampling, or sparse grid sampling, as doing so often results in lower costs for a given accuracy tolerance. Therefore, the choice of sampling scheme is determined by how we want to sample the truth model and its surrogates. While we use MC sampling in this work, other choices are possible and would produce analogues to the MFMC method, e.g., MFLH, MFQMC, or MFSG.

2) Note that all F^k will never be removed according to our criterion; in the most extreme case, at least the high-fidelity model F^1 will remain. On the other hand, if this occurs, we obtain the useful information that none of the surrogates F^2, …, F^k are effective at increasing estimation accuracy or reducing computational costs, i.e., we are stuck using MC on its own and should look for other, more informative, surrogates. To address the other question, there should never be a loss of accuracy relative to MC regardless of the model set. The worst-case scenario is if all the surrogates fail the second test, in which case we are left with traditional MC using F^1. Hence, there is no loss of accuracy in MFMC; its worst-case accuracy is simply equal to that of MC using the truth model. However, if at least one surrogate survives the second test, then the MFMC method guarantees that costs are reduced without compromising accuracy.

3) We agree that it is a good idea to mention this explicitly. Any future versions of the manuscript will include this change.

Thanks again, and please let us know if you have other questions.

Best,
Anthony, Max, Lili, Rihui, and Zhu