The Cryosphere Discussions

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Reply on RC2

Katharina M. Holube et al.

Author comment on "Sources of uncertainty in Greenland surface mass balance in the 21st century" by Katharina M. Holube et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-128-AC2, 2021

We would like to thank the Anonymous Referee #2 for the constructive review, especially for the valuable hint that selecting only one ensemble member can result in errors in assigning variance to inter-model uncertainty or internal variability. One suggested alternative, forcing our snow model with the ensemble mean of each GCM, would lead to a non-negligible bias in SMB, because the averaging reduces the variability (Zolles and Born, in prep.). We plan to realise the referee's second suggestion: forcing the snow model with the ensemble members of a single GCM and then applying the method by Hawkins and Sutton (2009). We can only employ the ensemble members for which all of BESSI's input variables are available. Lehner et al. (2020) studied ensembles of several GCMs to evaluate the method of Hawkins and Sutton (2009). They found that a portion of the internal variability is indeed wrongly assigned to the inter-model uncertainty, but a large number of GCMs can still provide a robust estimate of inter-model uncertainty. Thus, we expect a conservative estimation of the variance fraction wrongly attributed to the inter-model uncertainty when we apply this method.

We further plan to explain the impact of linearly downscaling the input variables to the snow model grid in more detail, and to revise the manuscript including the figures according to the further comments of the referee.

References

Hawkins, E. and Sutton, R.: The Potential to Narrow Uncertainty in Regional Climate Predictions, Bulletin of the American Meteorological Society, 90, 1095-1108, https://doi.org/10.1175/2009BAMS2607.1, 2009.

Lehner, F., Deser, C., Maher, N., Marotzke, J., Fischer, E. M., Brunner, L., Knutti, R., and Hawkins, E.: Partitioning climate projection uncertainty with multiple large ensembles and CMIP5/6, Earth System Dynamics, 11,
491-508, https://doi.org/10.5194/esd-11-491-2020, 2020.