

Review: “Emulating the future distribution of perennial firn aquifers in Antarctica”

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1 General

In this paper, the authors analyze the formation of perennial firn aquifers in Antarctica under future emission scenarios using a machine-learning emulation of a firn model. They use several climate models and show the distribution of resulting firn aquifer, mostly as a total number of years with a firn aquifer until 2100. There are considerable differences in the predictions based on the climate models, which confounds the interpretation. The paper is straightforwardly constructed and presents the results factually. The paper lacks a central message and the title reflects the factual read out of results. I am not opposed to this paper being published and I submit a few ideas / questions in the sections below.

2 Remarks

1. SSP5-8.5 is (currently) an unlikely emission scenario, so I think it could be worth providing some context.
2. Although firn aquifer can form in certain conditions, they only appear in a few regions. There are many reasons that might prevent PFAs from developing in these places, e.g. ice lens, surface rives, or hydrofracture.
3. The distribution of firn aquifers in Antarctica has been computed already, and the climate models are uncertain, so I am curious what we learn from the emulation. I agree that it is a less computationally expensive way to perform the simulations.
4. I am not entirely convinced by the data in figure 2 suggesting that there is a significant spread between the firn model and the emulation.

3 Specific comments

1. Figure 5 could have more location labels, especially the Enderby Land part. A similar comment applies to all of the maps.
2. Figure 5: there are pretty significant differences in the location and duration of PFAs for the different climate models. How should we interpret this uncertainty?
3. Acknowledgements: in which sections was ChatGPT used?