

## ***Interactive comment on “The cooling signature of basal crevasses in a hard-bedded region of the Greenland Ice Sheet” by Ian E. McDowell et al.***

**Martin Lüthi (Referee)**

[martin.luethi@geo.uzh.ch](mailto:martin.luethi@geo.uzh.ch)

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This is a very interesting contribution on the many puzzles of the Greenland under-ice environment. This manuscript should be considered for publication once the comments in the annotated PDF have been addressed. However, given some shortcomings of the modeling (or maybe just missing descriptions), it is unclear to me whether this will be ready for publication.

General comments

While the argumentation of the paper is logical and easy to follow, I have some reservations about the claims of measurement accuracy, especially given the very crude calibration in the field after deployment.

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The description of the "modeling" is quite unclear. First it sounds like no numerical model is used, but then suddenly there are model results. Please provide details on the model used (FE, FD, ...), spatial and temporal resolution, solution accuracy, implementation details (if not from a standard package). How does this model treat the phase transition (Stefan Problem)? Is there an enthalpy scheme involved (probably not, why not)? Is dissipation due to ice deformation considered as changing source? How is vertical stretching dealt with, which alters temperature gradients, and therefore heat fluxes, over time?

Initial and boundary conditions for the modeling exercise seem rather ad-hoc. They should be justified, and it should be shown that the conclusions don't depend on the specifics of these values.

The conclusion that refreezing of water-filled crevasses is intriguing, but it is unique? Could vertical stretching/compression, and thus altered heat fluxes, account for the observed cooling?

Specific comments are highlighted in the manuscript

Please also note the supplement to this comment:

<https://tc.copernicus.org/preprints/tc-2020-206/tc-2020-206-RC1-supplement.pdf>

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-206>, 2020.

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