

Interactive comment on “Transient thermal modeling of permafrost conditions in Southern Norway” by S. Westermann et al.

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This manuscript deals with a new transient permafrost model, *CryoGrid 2*, which is described in detail, validated with observations from two profiles of shallow boreholes, and applied subsequently on the whole area of Southern Norway. The methodology used is state of the art, and the paper is in general well written. I conclude that it can be published with minor revisions.

I think the main section which needs improvement/reorganization is the discussion. It is rather lengthy and a bit report-like. Though I like the thorough discussion of the possible error sources and shortcomings, I suggest to condense it a bit and concentrate on the results obtained and the immediate consequences. On the other hand, I would prefer to have also some discussion on how This Manuscript deals with a new transient

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Some particular questions/comments concerning the other sections:

- Section 2.1: In P5350 L15ff the choice of the mixing law given in eq.4 is based on simplicity (simpler than, e.g., the geometric mean?), and on our general lack of understanding what the best model under permafrost conditions. However, it would be useful to have a short discussion of (a) how important is this choice, and (b) under which conditions there are large differences between the different mixing laws.
- Section 2.3: It would be useful to the reader do give a few more details on the numerical solution. In section it would be nice to have a few words here which finite difference methodology was employed here including the implementation of boundary conditions. Depending on the discretization method it may be advisable to use a smoother change of cell size (there is a factor of 4 at 1.6m). Why not simply use a log-spaced grid? A better description of the discretization would also ease the understanding of the treatment of the snow cells. Also it would be helpful to know the particular solver used in SUNDIALS for the nonlinear MOL solution. It may also be interesting to know what makes the solution so time

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consuming, and which accuracy are you are you aiming at?

- Section 3: How are grid cells with different types of soil/bedrock are treated? Do you use an ensemble for all present types? What is the resolution of the NGU 2010 map?
- Conclusion: From Table 2 and I would not conclude that most of the data are well reproduced. A deviation of 1K is pretty large at 2m depth. But from my viewpoint there is a basic problem with a validation at local sites without "local" parametrization, as the authors explained e.g. for Juv-BH4. I suggest to include a more general comment on this problem of "downscaling" in the conclusion section. I also suggest not to use the itemized style for the conclusion, but this may be a matter of taste.

Interactive comment on The Cryosphere Discuss., 6, 5345, 2012.