The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-115-SC1, 2017

The Cryosphere Discussions

Interactive comment on "NHM-SMAP: Spatially and temporally high resolution non-hydrostatic atmospheric model coupled with detailed snow process model for Greenland Ice Sheet" *by* Masashi Niwano et al.

L. van Kampenhout

l.vankampenhout@uu.nl

Received and published: 1 August 2017

I agree with Xavier Fettweis that this work would be a welcome addition to the literature and the wider RCM modelling community. Some questions came up while reading the manuscript, in particular about the spinup method and the effect of percolation.

L 238-240: I searched Dumont et al. (2014) for their spin-up procedure, but failed to find information on this. Did the authors obtain the method details through personal communication?

L 238-240: I was wondering whether 30 years is sufficient to get a 30-m snowpack into equilibrium with the climate. Was there any remaining drift in e.g. the bottom layer temperature? What climate years were used to forced the spinup?

L 242: It reads like you started with zero snow depth at the beginning of the spinup period. The zero heat flux is then assumed at the bottom of the snow pack, not at 30 m, which is almost never reached? (which you mention in 245-246)

L484-485: Figure 10 shows that runoff is larger for larger IWC value (6%), so the "piping" effect must be dominated by something else. Otherwise, the 2%-bucket model would have produced the largest runoff value.

L 497-502: The authors do not supply any proof of their statement that the formation of ice layers is the reason for the increased runoff. In particular, they do not present melt and refreezing as separate terms. After the formation of (sub-surface) ice layers, one expects the melt to stay roughly the same order of magnitude, yet see a drop in refreezing due to the added effect of lateral runoff.

On the other hand, an increase in runoff could also occur due to increased melt. The reasoning is that when you have higher IWC and more refreezing, warmer snow will result which leads to stronger metamorphism and larger grains, that lower the albedo. The warm snow also will persist throughout winter and helps to bring snow to the melting point in spring. This behaviour is also seen in other models. It would benefit this paper if light could be shed on the exact processes that are dominant in this study.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2017-115, 2017.