Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2019-265-RC1, 2019

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "Evaluating integrated surface/subsurface permafrost thermal hydrology models in ATS (v0.88) against observations from a polygonal tundra site" *by* Ahmad Jan et al.

Anonymous Referee #1

Received and published: 21 December 2019

The article describes various aspects of modeling of tundras ecosystem processes responses (thermal and hydrological) to atmospheric forcing. The importance of this research is obvious due to the observed and projected climate change and the ongoing Arctic amplification.

The authors present and discuss a new version of coupled three-dimentional model of heat and moisture transfer in surface and subsurface layers of soil, considering the processes of snow accumulation, redistribution and thawing, as well as turbulent and radiation flows and heat-insulating effect of snow cover ATS v0.88.

The assumptions and research methods are stated clearly. The set up and

Printer-friendly version

Discussion paper

the execution of the numerical experiments, including initial and boundary conditions setting, mesh construction, multistep model spin-up processing, and obtaining data for comparison with calculation results are described quite fully and accurately. The documentation and the source codes for the ATS model are available at https://github.com/amanzi/ats. The model is being actively used and improved, as evidenced by releases of the new versions of it.

The title matches the content of the paper, and the annotation provides a full description of the numerical experiments. The text is well structured and comprehensive. The language used is advanced and precise.

It is shown that the simulation results reproduce well the temporal dynamics of the observed parameter values, in particular, snow elevation, soil temperature, water table and evaporation. The authors also studied and assessed related research works, having provided well-selected list of references. It is also worth mentioning that ATS is a participant in projects comparing hydrological models, in particular, Kollet, S., et al. (2017) "The integrated hydrologic model intercomparison project, IH-MIP2".

Additional comments, mainly technical:

1. In Fig. 3, the right column: is the color palette similar to the upper right panel of Fig. 1? It might be a good idea to add a colorbar to it or to provide a relevant description in the figure caption for Fig. 3.

2. In Fig. 6, the authors present the thaw depths for two locations (lowland and center) for the years 2012–2014. Unfortunately, it is not quite clear from the legend and the caption if these are simulated or observed depths of thawing. If the presented depths are the results of numerical simulations, then it can be good to also show relevant observational data for comparison, or at least add maximum values for this period (50 cm depth of the zero isotherm (see Fig. 5)) that are in good agreement with modeling results.

Printer-friendly version

Discussion paper

3) In Fig. 10, the legend does not indicate observational data (red line), similar to Fig. 6.

4) For greater convenience, the tick labels could be presented in classical format: month/year or day/year (Julian Date) as, for example, in Atchley, A.L. et al (2015) "Using field observations to inform thermal hydrology models of permafrost dynamics with ATS (v0.83)".

Please also note the supplement to this comment:
https://www.geosci-model-dev-discuss.net/gmd-2019-265/gmd-2019-265-RC1-supplement.pdf

---

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-265, 2019.

Printer-friendly version

Discussion paper