TCD-9-6733-2015: “Impacts of snow and organic soils parameterization on North-Eurasian soil
temperature profiles simulated by the ISBA land surface model”, by Decharme et al.

General comments:

The manuscript describes improvements of a land surface model (ISBA) on snow and subsurface dynamics, and evaluates their impacts on snow using in-situ snow observation at a site in the French Alps, and on snow and soil themperature profile using observation-based data sets for Northern Eurasia. For snow, inclusion of modestly detailed parameterization on snow layering, snow compaction, and snow albedo was evaluated, while inclusion of organic soil for thermal and hydraulic parameterization was examined for the subsurface regime. Overall, the new schemes led to improved skills in snow and soil temperature calculations. Although each piece of improvements, *per se*, is not new, it provides a new set of land surface parameterizations of the mediate complexity (a necessary and justifiable degree of compromise for coupling with meso- to global-scale atmospheric/hydrological models). The manuscript is appropriately structured and written, mostly providing sufficient information and details that readers would require to understand/assess the work done. Apparently, authors are more familiar with snow pack than with subsurface thermal regime, showing shortcomings in evaluations and discussions on the latter. Some terms are found not adequate and typing errors are found here and there. Details of these issues are given below.

Considering what are mentioned above, the manuscript will be worth published in The Cryosphere if the issues below are adequately addressed and resolved.

Specific comments:

P.6742, l. 12 and after: Dimension of viscosity is (Pa s), but it is shown as (Pa s^{-1}) throughout the manuscript. Please check and revise them adequately.

Section 3.1.2: Influence of strong winds on snow pack may appear in two ways: snowdrift and wind crust. In this study, it looks only the former is considered and nothing is mentioned about the latter. Any comments on this in the text?

P. 6754, l. 17 and after: I am not comfortable to the term "global" score, seemingly used in contrast to "seasonal," since usually it is used in the spatial domain meaning for the entire earth. I am not sure if this is a familiar term in some communities, but would recommend another wording, like "total" or something like this.

P. 6755, ll. 6-9: "In terms of snow…in Table 2." These sentences are not clear to me.

P. 6755, l. 12: Is "SWE" relevant here?

P. 6759, l. 1: Please give more details on "topographic indexes".

P. 6759, l. 22 and after: The term "ablation" is used in the text for springtime snow-layer shrinking. It could be adequate for glaciers and ice sheets, but "melting" sounds more appropriate for snow pack change to me.

P. 6760, l. 15-17: "In winter, …parts of domains." I am not sure on what this sentence states.
A new paragraph should start after this sentence.

P. 6760, ll. 22-23: The clause "even if a slight cold bias appears at the subsurface" is not clear to me what it means.

P. 6760, l. 28: Should also refer to Figure 11 (left, bottom).

P. 6761, ll. 14-19: "However, this comparison…shallower than 1.5 or 2m." It

is not clear what the authors want to claim by these sentence.
Colour scheme of the bottom two panels in Figure 12 is misleading or insincere. There are no clear correspondence to the type of IPA-defining permafrost zonation (continuous, discontinuous, etc.) and depth of active layer.
A multi-year observation data set of active layer thickness is available from the CALM project (https://nsidc.org/data/ggd313), which should cover (a part of) the integration period.

P. 6765, l. 7: What is meant by "soil carbon degradation"?

Technical corrections :

- Equation numbering is often not matching. "Eq. (9)" (p. 6746, l. 18) may be "11"; "Eq. 16" (p. 6762, l. 22) may be "17" or "18"; "Eq. (8)" (p. 6764, l. 1) may be "10"; and "Eq. 16" (p. 6764, l. 7) may be 18.
- P. 6747, l. 7 : "a_{η}=0.1 K" may be "a_{η}=0.1 K^{-1}"?
- P. 6748, l. 10: "0.00192" may be "0.0192"?
- P. 6755, l. 16: "show" to be corrected to "shown."
- P. 6757, l. 5: "As for snow depth,…" to be "Similar to snow depth,…"?
- P. 6757, l. 22: "in" Beer et al. (2013).
- P. 6758, l. 28: HSWD should be HWSD.
- P. 6759, l. 5: Is "first" needed?
- P. 6759, l. 28: "withthe" should be "with the". I found similar typing errors in the manuscript, although I don't enumerate all of them.
- P. 6760, l. 11: "discrepancies". Maybe "differences" is better since it is NOT expected that these two would agree.
- P. 6761, l. 7: "in the western part of the domain" I would suggest to change to "to the west of the Ural Mountains".
- P. 6761, ll. 11-12: I would suggest to change to (something like) "via a linear interpolation between the last positive node going down from the surface and the first negative node"
- Figure 12 caption: Remove "maximum" (l. 4), supposing what is meant here is the average of yearly active layer thickness (maximum thaw

depth of a year) over the period.

- P. 6761, ll. 23-24: “agreement with these estimation than those by NEW.”
- P. 6762, l. 6: “evaluated on snow for the Col de Porte”