This manuscript describes improvements in modeling permafrost thermal dynamics in the JULES land surface model. The presented work includes valuable information on crucial thermo-physical processes important to all permafrost modeling applications. It will be extremely useful to make these measurements from the Samoylov study site available as a package for other modelers as well. I have a few minor suggestions and comments after addressing which, I would recommend this work for publication.

1. The model was tested on a site located in the continuous permafrost zone. It would be helpful to know how model performs in the discontinuous zone (e.g. boreal forest)? It would be interesting to test the model in the several sites corresponding to different ecosystems.

2. L17. It is common to call the maximum depth of thaw ALT. However, the ALT definition assumes that the thawed layer refreezes every year. In some regions where active layer depth is greater than 1 meter refreezing may not occur to which ALT would not be an appropriate term.

3. L15. Does that mean that moss layer thickness in the spatial model (paper in preparation) will be the same everywhere?

4. L18-19. How is the percentage of moss cover defined for the spatial 2D case?

5. It is a bit confusing reading about bedrock vertical layer thickness in subsection 2.2.3 and then reading subsection 2.2.5 about soil vertical resolution. It took some time to figure out that bedrock could be added on, and is not included in the 'extended to 10 m' soil column. I suggest to better structure the flow of the paper, so that soil column is in one section, and bedrock thermal diffusion is in the other one.

6. I suggest moving snow paragraph L6-17 in subsection 2.3.2 to snow subsection 2.2.4, and renaming 2.3.2. subsection to 'Soil characteristics'. Also it would be interesting to know what formulas were utilized to determine changes in snow density.

7. 2.3.3. I suggest coming up with more descriptive abbreviations. For many people 'std' is associated with standard deviation. That will save reader's time while understanding the most important Figure 5.

8. Section 2.4, L17. Does that mean that $\theta_{u,n+1} + \theta_{f,n+1}$ is always equal to 1? For better clarity, I suggest including a table that corresponds to figure 4, say for day 180, and showing $i, d_z, \theta_{u,n+1}, \theta_{f,n+1}$.

9. In conclusion, I would suggest rewriting the conclusion section to further stress the two main points discussed in the 'results and discussion' section. In particular, reiterate that soils in the continuous permafrost zone are organic rich, covered by moss, and saturated. Therefore including all of the corresponding physics into the land surface models are extremely important to better model permafrost dynamics in the high Arctic.

Figures
Figures 5 and 6 need more descriptive legends. For Figure 6B, I suggest making colors discrete and labeling the 0°C isotherm, as it will make it more readable.