Review comments on the paper entitled “Improved modeling of Siberian river flow … frozen soil hydrology scheme in a land surface model” by Finney et al.

The paper discussed an important issue about the effects of frozen soil. Land surface models for use in climate models realized the importance of frozen soil, but most of the researches were on its thermal effects, very few models focused on its hydrological effects. This paper tested a frozen soil scheme proposed by Niu and Yang (2006). Actually, Niu and Yang’s scheme was not rigorously tested and only applied in a specific land surface model, CLM. The paper is well organized and needs some minor edits:

1. It is not clear how the original JULES represents frozen soil – water phase changes. I guess it may be included in a paper of Cox (1999)? So better to include a description of the scheme in Appendix.

2. The use of TRIP, a river routing model is pretty unique than the work of Niu and Yang. Better to provide a little detail of TRIP, or at least a key parameter, the flow speed or the time scale parameter, e.g., the effective water flow velocity in CLM is a global constant, v =0.35 m3 /s. This will greatly affect the time of river discharges.

3. The decay f parameter should be the same for the surface and subsurface according to the TOPMODEL . However, TOPMODEL does not account for infiltration-excess runoff. CLM made the one for the surface different from that for the subsurface to increase surface runoff, a compensating factor for infiltration-excess. Just an explanation.

4. “Figure 2” not found in the text. Should be added somewhere in the 2nd paragraph of page 316.

5. The forcing data of Sheffield (2006) should also have humidity. Better to be included in the text.

6. van Genuchten scheme is a good feature of the model. Most major LSMs use Brooks and Corey (1964), which seems outdated. So better to see the same improvement under VG scheme.

7. I am sure GSWP2 over-corrected snowfall for snow gauge under-catch problems. Can you add a plot to show how well JULES simulates SWE and snow depth over these river basins? Correct snowfall can not ensure that the simulated SWE is correct, because of the complicated representation of snow surface sublimation, interactions with vegetation canopy, snow surface energy budgets, and snowmelt processes.

8. Better to use “mm/day” than “kg m-2 s-1” in figures 7 & 8.