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Interactive comment on "The importance of a surface organic layer in simulating permafrost thermal and carbon dynamics" *by* E. Jafarov and K. Schaefer

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Surface organic layer (SOL) plays an important role in soil thermal dynamics and especially permafrost dynamics. There are several modeling studies, which have already implemented the effects of SOL, in land surface models and ecosystem models. Jafarov and Schaefer tried again to implement SOL in SiBCASA. This work is worth for publish after the following issues on dynamic SOL are addressed.

1. How dynamic SOL is implemented?

The description of SOL dynamics might be too simple. For example, in Pg. 3144 Ln. 2 "the excess organic material was essentially "compressed" into the top soil layer,

resulting in a 2 cm simulate SOL".

Does SiBCASA have dynamic soil structure? When top soil layer has excess soil carbon, will a new soil layer be created and added to the top? It is well-known that above-ground litter fall will accumulate on the top of soil, it will not transfer quickly down to the next soil layer as implemented in the SiBCASA. I suggest the authors make this point clear.

2. What will SiBCASA do if disturbances happen?

The authors claimed that SiBCASA performed better than previous version in regions with discontinuous permafrost. These regions have boreal forests and usually have wildfire. Yi et al. (2010) also implemented the processes of buildup of SOL and removal by wildfire in Terrestrial Ecosystem Model; and Yuan et al. (2012) evaluated the role of wildfire in soil thermal dynamics and ecosystem carbon in Yukon River Basin of Alaska. Although the authors mentioned that SiBCASA does not consider disturbance in this version. It is important to provide a prospective for the further development and application of SiBCASA in relating to disturbance since wildfire is common in boreal forest regions. Tundra regions are having more wildfires.

Currently, the Discussion part is too short. I suggest the authors provide more discussion on 1) the differences among different methods of dynamic SOL implementation; 2) the shortcoming of assuming soil carbon transferring downward; and 3) disturbances.

References:

Yi, S., A. D. McGuire, E. Kasischke, J. Harden, K. L. Manies, M. Mack, and M. R. Turetsky (2010), A Dynamic organic soil biogeochemical model for simulating the effects of wildfire on soil environmental conditions and carbon dynamics of black spruce forests, J. Geophys. Res., 115, G04015, doi:10.1029/2010JG001302.

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Interactive comment on The Cryosphere Discuss., 9, 3137, 2015.