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The Cryosphere Discussions

Interactive comment on "The influence of climate and hydrological variables on opposite anomaly in active layer thickness between Eurasian and North American watersheds" *by* H. Park et al.

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The authors deal with a complex but a cutting edge issue of permafrost and active layer studies though modeling. Based on modeling, they found that change in thawing index of air temperature alone cannot explain the changes in active layer thickess in general, over North America Arctic regions in particular. Overall, the study is worth to publish in "The Cryosphere". I have a few minor comments:

1). line 1 Abstract: "... permafrost active layer thickness (ALT) ..." is not a precise description. The active layer is not part of permafrost. I suggest that "...active layer thickness (ALT) over permafrost ..." or "... active layer thickness (ALT) in permafrost

regions ...", or just saying "... active layer thickness (ALT) ..."

2). line 3 on page 2539: "...; Bekryaev et al., 2010)," should be "...; Bekryaev et al., 2010)."

3). p. 2544, line 25: "... soil organic matter simulated by the model." I am not quite clear here, soil organic matter is purely simulated or input data. The peat content or peat thickness is critical for this study and it should be clearly stated. If it is simulated, the authors need to describe the simulated peat content and thickness for the top layers.

4). I am not quite clear what is the depth of the lower boundary? It may state somewhere and I missed.

5). p. 2546, lines 20-21: The authors should provide a number to explictly state the simulated permafrost regions with the IPA permafrost regions over the study area. Zhang et al. (1999) found that permafrost regions occupy approximately 22.79 million kmˆ2 in the Northern Hemisphere. It is understandable there there is a difference. See:

Zhang, T., Roger G. Barry, K. Knowles, J. A. Heginbottom, and J. Brown, 1999. Statistics and characteristics of permafrost and ground ice distribution in the Northern Hemisphere, Polar Geography, 23(2), 147-169.

6). p. 2547, line 1: "The significant decrease in ALT ...", I would suggest that the authors may soften the sentence a little. The reality is that overall ALT in North America shows large inter-annual variation with no significant trend based on CALM data. However, some sites indeed shou increase in ALT, majority show no change, some show decrease or cooling of permafrost. Looked at Fig 1B, the dark blue area is still much less than red area in North America.

7). In Discussion section, suggest to add a few lines about possibility of melting ground ice at or near the permafrost surface. For example, the work done by Liu et al. (2010; 2012).

Liu, L., T. Zhang, J. Wahr (2010), InSAR measurements of surface deformation over

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permafrost on the North Slope of Alaska, JOURNAL OF GEOPHYSICAL RESEARCH-EARTH SURFACE, 115, F03023, DOI: 10.1029/2009JF001547

Liu, L., K. Schaefer, T. Zhang, and J. Wahr (2012), Estimating 1992-2000 average active layer thickness on the Alaskan North Slope from remotely sensed surface subsidence, JOURNAL OF GEOPHYSICAL RESEARCH-EARTH SURFACE, 117, F01005 DOI: 10.1029/2011JF002041 Published: JAN 14 2012.

8). The authors may also like to read the paper by Fan et al. (2011). This paper will directly support the authors' conclusion in this study.

Fan, Z.S., J.C. Neff, J.W. Harden, T. Zhang, H. Veldhuis, C.I. Czimczik, G.C. Winston, and J.A. O'Donnell (2011), Water and heat transport in boreal soils: Implications for soil response to climate change, SCIENCE OF THE TOTAL ENVIRONMENT, 409(10), pp. 1836-1842, DOI: 10.1016/j.scitotenv.2011.02.009

Based on this work and modeling effort by Zhang et al. (2008) (already cited), relatively dry peat layer, especially the top layer (within the 20 cm depth), may play a much more important role in reducing ALT, while thin snow cover may be important to account for less permafrost warming or slightly cooling but minor role for ALT change.

Interactive comment on The Cryosphere Discuss., 6, 2537, 2012.