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Interactive comment on "Presence of rapidly degrading permafrost plateaus in southcentral Alaska" *by* B. M. Jones et al.

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REVIEW

Benjamin M. Jones, Carson A. Baughman, Vladimir E. Romanovsky, Andrew D. Parsekian, Esther L. Babcock, Miriam C. Jones, Guido Grosse, and Edward E. Berg PRESENCE OF RAPIDLY DEGRADING PERMAFROST PLATEAUS IN SOUTHCENTRAL ALASKA

GENERAL COMMENTS:

This manuscript is based on complex study of degrading frozen peat plateaus in the area of warm isolated permafrost. Such studies are very important because permafrost degradation strongly affects environment and infrastructure. Permafrost dynamics near

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the southern margin of the permafrost region is extremely complicated and has been studied very poorly, so this paper makes a significant contribution to permafrost science.

The manuscript contains unique information and is clearly written, and I strongly support its publication. Though I don't have any major concerns, I believe that this manuscript needs some minor revision. These are my main recommendations:

1. I recommend to add several more references:

Kuhry, P. 2008. Palsa and peat plateau development in the Hudson Bay Lowlands, Canada: timing, pathways and causes. Boreas 37(2): 316–327. DOI: 10.1111/j. 1502-3885.2007.00022.x

Sannel, A.B.K., Kuhry, P. 2008. Long-term stability of permafrost in subarctic peat plateaus, west-central Canada. The Holocene 18(4): 589–601.

Sannel, A.B.K., Kuhry, P. 2011. WarmingâĂŘinduced destabilization of peat plateau/thermokarst lake complexes. Journal of Geophysical Research 116, G03035, doi:10.1029/2010JG001635, 2011

Zoltai, S.C. 1993. Cyclic development of permafrost in the peatlands of northwestern Alberta, Canada. Arctic and Alpine Research 25(3): 240–246.

Riddle, C.H., Rooney, J.W., 2012. Encounters with relict permafrost in the Anchorage, Alaska, area. Proceedings of the Tenth International Conference on Permafrost, Salekhard, Yamal-Nenets Autonomous District, Russia, June 25–29, 2012, 1, pp. 323–328.

Jorgenson, T., Shur, Y.L., Osterkamp, T.E. 2008. Thermokarst in Alaska. In Proceedings of the Ninth International Conference on Permafrost, Vol. 1, June 29–July 3, 2008, Fairbanks, Alaska, Kane DL, Hinkel KM (eds). Institute of Northern Engineering, University of Alaska Fairbanks; 869–876.

Jorgenson, T., Kanevskiy, M., Shur, Y., Osterkamp, T., Fortier, D., Cater, T., Miller, P. 2012. Thermokarst lake and shore fen development in boreal Alaska. In Proceedings of the Tenth International Conference on Permafrost, Vol. 1 International contributions, June 25–29, 2012, Salekhard, Russia, Hinkel KM (ed.). The Northern Publisher: Salekhard, Russia; 179–184.

Riordan, B., Verbyla, D., McGuire, A.D. 2006. Shrinking ponds in subarctic Alaska based on 1950–2002 remotely sensed images. Journal of Geophysical Research 111, G04002, doi:10.1029/2005JG000150, 2006

Nossov, D.R., Jorgenson, M.T., Kielland, K., and Kanevskiy, M. (2013) Edaphic and microclimatic controls over permafrost response to fire in interior Alaska. Environmental Research Letters 8 (3), 035013, doi:10.1088/1748-9326/8/3/035013.

Kanevskiy, M., Jorgenson, T., Shur, Y., O'Donnell, J.A., Harden, J.W., Zhuang, Q., Fortier, D. 2014. Cryostratigraphy and permafrost evolution in the lacustrine lowlands of West-Central Alaska. Permafrost and Periglacial Processes 25 (1): 14–34. DOI: 10.1002/ppp.1800

O'Donnell, J.A., Harden, J.W., McGuire, A.D., Kanevskiy, M.Z., Jorgenson, M.T., Xu, X. 2011. The effect of fire and permafrost interactions on soil carbon accumulation in an upland black spruce ecosystem of interior Alaska: implications for post-thaw carbon loss. Global Change Biology 17: 1461–1474. DOI: 10.1111/j.1365-2486.2010.02358.x

2. I'm not satisfied with your explanations of low EIF values (0.09 to 0.13) calculated for your study sites (Pages 19-20, Lines 433-443). You wrote that "Lewkowicz et al. (2011) demonstrated that features with EIF values below 0.33 likely results from ice-poor permafrost and/or a high unfrozen water content of the permafrost," but in the cited paper high unfrozen water content is supposed to explain low electrical resistivities, not low EIF. I'm not sure there is any correlation between low EIF values and high unfrozen water content, because you already mentioned (Line 440) that frozen peat contains a

lot of excess ice. Even in warm permafrost, only a fraction of pore ice transforms into unfrozen water, while relatively large (clearly visible) ice lenses and inclusions remain frozen (according to your description, "...frozen peat ... appears to be ice-rich, with a number of ice bands, ice lenses, and ice inclusions"). Probably low EIF values in your case result mainly from the nature of peat, which keeps its volume upon thawing pretty well in comparison with ice-rich mineral soil.

Besides, you didn't provide any information on ice content of soils (except EIF). It will be good to compare ice content values obtained from frozen cores with EIF values. If you don't have such data, you may find some information obtained from similar peat plateaus of boreal Alaska or Canada. For example, our team has published several papers with some ground-ice data: see Jorgenson et al., 2012, 2013; O'Donnell et al., 2012; Kanevskiy et al., 2014. I also recommend to add photos and descriptions of your frozen cores to Results.

SPECIFIC COMMENTS:

Page 1, Line 24. I recommend to add "at some locations" or "the minimum depth" after "but."

Page 5, Lines 111-118. I recommend to move this text to Methods.

Page 7, Line 148. I recommend to replace "These features are..." with "Degradation of permafrost plateaus is..." I also recommend to move this sentence to Introduction.

Page 13, Lines 298-300. You are talking about hummocks and depressions but you didn't describe micro-topography in the paper. I recommend to add a short description to Chapter 2 (Study area).

Page 19, Lines 422-431. You already presented these data in Results, so I recommend to shorten this paragraph.

Page 22, Lines 489-499. Something is missing here.

Page 22, Lines 495-496. I recommend to add several more references (see attached file).

Page 23, Lines 520-522. I recommend to add several more references (see attached file).

Page 24, Lines 545-546. I recommend to add one more reference (Shur and Jorgenson, 2007).

Page 47, Figure 7. I recommend to show expected permafrost boundary with dashed (or dotted) line (see attached file). Also it will be good to show the thickness of peat.

More comments and suggestions (small edits mostly) are provided in the attached file.

Good luck!

Mikhail Kanevskiy, Institute of Northern Engineering University of Alaska Fairbanks

Please also note the supplement to this comment:
http://www.the-cryosphere-discuss.net/tc-2016-91/tc-2016-91-RC1-supplement.pdf

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