Clim. Past Discuss., 9, C198–C199, 2013
www.clim-past-discuss.net/9/C198/2013/

Climate of the Past Discussions

Interactive comment on "Assessing the impact of late Pleistocene megafaunal extinctions on global vegetation and climate" *by* M.-O. Brault et al.

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Received and published: 18 March 2013

I enjoyed this paper and the continued discussion of land surface and thus climate impacts associated with changes in megafauna. The authors of this study attribute the climate impacts of changes in high latitude vegetation cover (mostly shrubs and some trees) to changes in albedo. I want to suggest that the authors also consider the possible impact greenhouse warming from changes water vapor content associated with higher transpiration rates.

The feedback mechanism of increased transpiration rates from a shift to deciduous vegetation cover (trees and shrubs) leading to warming through the greenhouse effect has been considered in the literature (Swann et al. 2010, Lawrence and Swenson 2011, Bonfils et al. 2012) and found to be of the same order of magnitude as the

impact of albedo change. In personal communication with authors of Doughty et al. 2010 it was acknowledged that they did not consider this effect, and looked only at the correspondence between albedo and surface temperature - so comparison with their findings would not acknowledge this mechanism.

From the figures provided in this manuscript it is difficult to evaluate the relative importance of albedo and water vapor changes. In figure 3c the climatology of temperature change is plotted showing a maximum in late June/early July at 60N (although the numbers on the contour lines are too small to read). The seasonality of such a temperature change is consistent with the expected seasonality in increased transpiration, and not necessarily with the expected changes in albedo. I suggest that the authors compare seasonality of changes in albedo, transpiration, column water vapor content, and if possible, changes in the residence time of water vapor in the Arctic atmosphere. It may be that this model results show only the effect of changes in albedo, but readers are unable to evaluate this from the information presented.

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D. M. Lawrence and S. C. Swenson. Permafrost response to increasing arctic shrub abundance depends on the relative influence of shrubs on local soil cooling versus large-scale climate warming. Environmental Research Letters, 6(4):045504, Oct-Dec 2011.

C. Bonfils, T. Phillips, D. Lawrence, P. Cameron-Smith, W. Riley, and Z. Subin. On the influence of shrub height and expansion on northern high latitude climate. Environmental Research Letters, 7:015503, 2012.

Interactive comment on Clim. Past Discuss., 9, 435, 2013.