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Interactive comment on "Instability of Northeast Siberian ice sheet during glacials" *by* Zhongshi Zhang et al.

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We would like to use this opportunity to thank Marcus and Johan for reading and commenting our paper. We will take the comments/suggestions into account in our revised version.

We have read most of the paper written by Marcus and Johan. In particular, "The North American Cordillera-An impediment to growing the continent-wide Laurentide Ice Sheet" is very important to explain why coupled models can not simulate a large Laurentide Ice Sheet as reconstructed. We do agree that the ice sheet – stationary wave feedbacks have been studied in recent years. However, our paper is the first to point out how a NE Siberian ice sheet amplifies atmospheric stationary waves, leading

to surface warming in the North Pacific, ablation of the NE Siberian ice sheet, and ultimately a swing to the Laurentide-Eurasian configuration.

Although Marcus and Johan criticize our major conclusion for it being highly artificial and a direct from idealized experiments, we argue that our study is an important step to reconsider the well-established idea about ice sheet developments during glacials. Earlier modelling and geological studies have revealed that a large NE Siberian ice sheet is not impossible. If we do not neglect these studies, we have to investigate the mechanism behind the waxing and waning of the NE Siberian ice sheet. Our study is the fundamental step to distinguish the internal ice sheet – stationary wave feedbacks to the external climate variations (caused by changes in orbital and/or greenhouse gas forcings) in the mechanism.

As we already write in our paper, when we consider both our new modelling results and the existing geological evidence for the history of the NE Siberian ice sheet, we believe the established idea of a gradual expansion into the Laurentide-Eurasian ice sheet configuration has to be revaluated. Our simulations neglect some interactions between the ice sheet and climate variabilities on an orbital timescale, since we run the model to equilibrium with a fixed climate forcing at each step. It still raises some fundamental questions about glacial climate, not least: why was NE Siberia glaciated during some glacials and not others? The internal atmosphere-ocean-vegetation-ice sheet feedbacks highlighted in this study seem to be the key to answer this question. How orbital forcings influence the internal feedbacks to lead to the presence or absence of the NE Siberian ice sheet in past glacials is a question for the future as the possibilities for running transient simulations.

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