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Interactive comment on "How might the North American ice sheet influence the Northwestern Eurasian climate?" *by* P. Beghin et al.

Anonymous Referee #1

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This paper examines the response of an atmosphere-only GCM to gradually increasing the elevation of the Laurentide ice sheet. The main conclusions are that increasing elevation shifts the jet southwards, causing a southward shift in precipitation over Europe; and that the albedo and topography of the ice sheet have opposite effects on mass balance over the Barents-Kara (B-K) region. The conclusions appear well substantiated by the evidence provided. The paper is similar to Pausata etal 2011, which also examines the separate effects of albedo and topography. It has the added novelty of gradually increasing the topography, but not much use is made of this novelty (see below). As with all such studies, there is the question of model dependence; but the study does a good job of documenting the behaviour of one particular model and can be of interest to the community. I would therefore recommend publication subject to some revision.

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Interactive Discussion
Discussion Paper

Major comments:

- The main novelty of the paper is in the gradually increasing topography, but in fact little use is made of this aspect. How much would the paper in general (and the conclusions in particular) change if you only examined the noIS, 00dhL and 100 dhL cases? What do we learn from the intermediate cases? If the answer is "not much", then I suggest simply removing most of the figures for the intermediate cases, which will streamline the paper and let you show bigger, clearer figures. Otherwise, introduce new text (particularly in the discussion/conclusions sections) to highlight the new knowledge added by the intermediate cases.

- An important conclusion is that ablation rates increase so much over the B-K in the high-LIS cases that they prevent the formation of the FIS. The relevance of this conclusion to the real system is difficult to evaluate, though: the LIS and FIS in fact co-evolved, so the problem of FIS inception in the presence of a full LIS is obviously artificial. It's OK as a first step, but the interest of the paper would increase considerably if a new GCM simulation were performed in which the FIS has the elevation computed by the ice-sheet model in the 00dhL run while the LIS has its full elevation. The GCM outputs could then be fed back into the ice-sheet model to test for self consistency; it's possible that the FIS will be maintained in that case.

Minor comments: Sec 3.2: Temperature changes over the B-K are explained exclusively through changes in advection. While this is reasonably convincing in the summer case, when there is a clear north-south temperature gradient across the B-K, but less so in winter, when there seems to be no gradient at all. I can't tell if this is just because the temperature goes off the scale across the whole B-K region in Fig 3 top right – if so, then adjust the scale so that the temperature gradient can be appreciated. If there really is no gradient, then you need an alternative explanation for the winter cooling – try looking at cloud radiative forcing.

Sec 3.3: Does "precipitation" here refer only to liquid precipitation, or to the total liq-

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uid+frozen precipitation?

Sec 5, l20: Seems to me that Lofverstrom et al (2014) attribute warm temperatures over Siberia to the Fennoscandian ice sheet (see their Fig 8), not the Laurentide as claimed here.

Interactive comment on Clim. Past Discuss., 11, 27, 2015.