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Climate of the Past Discussions

Interactive comment on "Effect of the Ordovician paleogeography on the (in)stability of the climate" *by* A. Pohl et al.

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Overall comments

This manuscript represents an interesting hypothesis that invokes changes in ocean heat transport to the northern hemisphere as an important driver of change between warm and cold global climate states in the Middle to Late Ordovician. It thus goes beyond those hypotheses that are predicated on CO2 drawdown as the primary driver to initiate Late Ordovician glaciation. A key observation is that uncertainty in the palaeogeographical position of Siberia in the Middle to Late Ordovician needs further discussion.

Specific technical and scientific comments

PAGE 1, LINE 14, suggest rewording to 'The Ordovician Period is characterised by abundant evidence for continental-sized ice sheets.' PAGE 1, LINE 22, 'ocean dynamics are taken into account' PAGE 2, LINE 11 Yes, but perhaps make it clear that this radiation is at the genus and species level and represents the increasing complexity of marine ecosystems: the major organism groups appear in the Cambrian PAGE 2, LINE 11 'paleoecology' to be consistent with the rest of the text in the use of 'paleo' PAGE 2, LINE 23, I think this would be better worded 'organismal evolution' rather than just animal evolution. Likely, changes in the phytoplankton may also have interplayed with global climate PAGE 3, LINE 17 'the ocean' PAGE 4, LINES 5-6, REWORD 'for two time intervals within the Middle {Dapingian at 470 Ma) and Late Ordovician {Katian at 450 Ma)' [Neither the Dapingian, nor the Katian represent the whole of the Middle and Late Ordovician respectively] PAGE 5, I think that many (most?) authors now accept that the Early Palaeozoic glaciation was more long-lived than just the Hirnantian acme. Though not inclusive, see for example, Page et al. 2007, and Vandenbroucke et al. 2009, 2010a and b. PAGE 5, LINE 13 It is not clear why the climate of 450 Ma has been chosen to represent the glacial state. I agree that the world was in an icehouse state at this time, but this is not the Hirnantian maximum? Why not choose to model the latter climate of 445 Ma? More explanation here would be useful. PAGE 5, LINES 22-23, I cannot follow the English for 'we used a cold summer orbit (CSO) like an orbital configuration'? PAGE 6, LINE 6, 'undertaken', not done PAGE 6, LINE 11, 'well sensitive' is grammatically incorrect (though sometimes used in the vernacular), simply use 'sensitive' here PAGE 6, LINE 23, 'we must note' not notice PAGE 7, LINE 6, GCMs PAGE 8, LINE 6 'these results' PAGE 8, LINES 19-20, 'for the same pCO2' PAGE 10, LINE 6 'northwards' PAGE 11, LINE 9, 'developed' PAGE 11, LINE 10 'these' PAGE 11, LINE 25 'energy balance' PAGE 12, LINE 4 'for the same climatic' PAGE 12, LINE 5, do you mean 'enslaved to'? 'captured within' would be better PAGE 13, LINE 4 'enslaved' PAGE 13, LINE 15 'In addition', not besides PAGE 13 GENERAL OBSERVATION. The text here contains many acronyms that often impede the flow of the argument. Sometimes its better to state key acronyms in full, like SICI on page 13. PAGE 13, LINE 31,

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I am always worried by ‘definite proof’, especially related to modelling studies PAGE 13, LINE 32, GCMs PAGE 14, LINE 1, The Ordovician Period (no need for the word ‘time’, since ‘Period’ is a geochronological term that immediately invokes time) PAGE 15, LINE 22, ‘to the mid latitudes’ Page 15, LINE 13, there is widespread evidence for a cooler Late Ordovician climate that persisted well into the Silurian, and began as early as the Sandbian (or earlier). PAGE 15, LINE 18, ‘to explain cooling’ not ‘that cooling’ FIGURE 1 (AND ALSO FIGURE 8), do all palaeogeographical reconstructions for the Ordovician show the same northwards drift of Siberia during the interval 470 to 450 Ma? What is the uncertainty in these reconstructions? This needs further discussion because it is of fundamental importance to the model proposed here.

References cited in review

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