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Climate of the Past Discussions

Interactive comment on "Mechanisms and time scales of glacial inception simulated with an Earth system model of intermediate complexity" *by* R. Calov et al.

Anonymous Referee #2

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This manuscript presents a set of studies on the coupling between an ice sheet model and a simplified climate model. These experiments are quite interesting since they provide some very useful insights into the mechanisms of glacial inception. In particular, this paper adresses the question of thresholds associated with the Milankovitch forcing both in an equilibrium context and in a more realistic time dependent framework. This manuscript furthermore clarifies the role of different feedbacks, the ice/albedo feedback present in decoupled simulations, and the ice elevation and dynamics that also have a critical role to play in the inceptions. Finally, the authors are giving some quatifications of the maximum possible acceleration factors than may be used in asynchronous climate - ice sheet coupled simulations. The whole paper is quite well written and is

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of interest for many readers of Climate of the Past. I therefore recommend publication and have only a few minor comments below that the authors may wish to consider in a final version.

In order to better underline the unity of the manuscript, it would be important to provide a better discussion connecting the transient and the equilibrium results. Indeed, the only mention about it appears page 612 line 4: "If the MF is below the value of SIDoff, ... In this case, the glaciation of the NH proceed much faster and large ice sheets can be formed on precessional time scales". This is indeed critical and unsufficiently developped in the paper. For instance, does it implies that no significant NH ice sheet may develop in a transient run if MF > SIDoff ? Only values of SIDon (for 280 and 220 ppm) are plotted on Fig. 5a, so it is difficult to answer the above question. SIDoff (280) is a bit above 440 W.m-2 (Fig.1) and is indeed crossed by the MIS5 run. But do the "kinks" in the curves Fig.5b (MIS5-280 at about -4ky, MIS5-220 at about -2ky, MIS11-220 at about -1ky) correspond to a widespread extension of snow cover, something like the crossing of SIDoff (though with some initial ice already), with an ice-albedo feedback running away ? Since this is the core of the paper, a bit more discussion on this point would be very usefull.

Page 602 line 15. "the precessional angle was changed such that it resulted in a linear change in MF". This is technically correct. But it could be useful for the reader to give some more details, stating for instance that when the precessional angle is changed (from 90 to -90 degrees) then MF goes from a maximum to a minimum, BUT insolation at other latitudes or other seasons may change in very different ways.

Page 616 line 1-20. equation A4 can actually be integrated analytically using standard Gamma functions: f = (4/5) Gamma(2x) Gamma(1+x/2) / Gamma((5/2) x) with x = n/(n+1) For n=3, we get the exact result f = (6 sqrt(pi)/35) Gamma(3/8)/Gamma(7/8) = 0.660995...

Interactive comment on Clim. Past Discuss., 5, 595, 2009.