

Review of a manuscript “Melting of Northern Greenland during the last interglacial” by A. Born and K. H. Nisancioglu

The manuscript describes a modeling study of the Greenland Ice Sheet behaviour at 126 ka. The authors use the SICOPOLIS ice sheet model forced with outputs of the IPSL climate model to investigate stability of various parts of the Greenland Ice Sheet. Although a subject of the study and its approach are interesting, there are several major issues in the used methods that need to be clarified. The manuscript presentation requires significant improvement. Below are detailed comments.

Model simulations and interpretations of their results

1. The authors use the GrIS present-day configuration as an initial condition in their simulations. Ice flow is the gravity driven, and to the lowest order is determined by ice thickness. Hence, results of transient simulations, especially relatively short ones performed in this study, are dominated by the ice-sheet initial configuration. Most likely, the present-day configuration is significantly different from the one around 126 ka. Therefore, the obtained results that the locations of ice core sites either remain glaciated or become free of ice can only indicate that the GrIS configuration at 126 ka was larger or similar to the present day. The results of the ensemble simulations have the same caveat, they are subject to the initial configuration.

2. The presented stability criterion appears arbitrary, because it is based on several unjustified assumptions. First, it is assumed that ice sheet is static, since the ice-flux divergence is neglected in equation (1). It shouldn't be too difficult to estimate that term magnitude to assess whether it is indeed negligible. Second, it is assumed that accumulation is constant with time (otherwise the first line in equation (5) is wrong). It is unclear what is the basis of this assumption, and what its justification. The further interpretation of the exponential behaviour of the ratio of the ablation to accumulation rates is ambiguous (lines 18-21, page 3523). It is unclear why $(ABL_{126ka} - ABL_{0ka})/ACC_{0ka}$ reflects a measure of stability. This quantity indicates how much the ablation rate changed in course of the simulation relatively to the accumulation rate at the beginning of the simulation. A statement about magnitudes of the ice flux divergence needed to balance net

surface mass balance (ACC-ABL) is unclear (lines 12-13, page 3524). It is obvious from mass conservation that in order to have no elevation changes the ice flux divergence has to match the net surface mass-balance.

3. A description of the **Ensemble simulations** part is too brief. It is unclear what parameters were explored and what their ranges were.

Manuscript presentation

The manuscript will benefit from better description of ideas and motivations of this study. The goal of this study (investigation of the stability of the GrIS different regions, if I understood correctly), was not identified until the last section of the manuscript. Till that section, it was unclear what the authors were after and why they did all experiments. **Abstract** does not reflect the content of the manuscript. Many parts of the text appear disconnect with previous and following sections. For instance, the first paragraph of the **Results** section (lines 6-18, page 3521) appear out of context. Most part of the discussion is not based on the results of the present study and does not make a connection between this and other studies.

In summary, the manuscript requires additional efforts both in presentation and technical aspects to warrant its publication.