

Interactive comment on “Ice thinning, upstream advection, and non-climatic biases for the upper 89% of the EDML ice core from a nested model of the Antarctic ice sheet” by P. Huybrechts et al.

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The comments from the two reviewers are generally positive and suggest that it will be possible to prepare a paper that is acceptable for CP. The manuscript is very well written, but details on the models and sensitivity experiments are missing. I strongly suggest to add a supplementary material with all those details. So I would ask the authors to consider and answer all the points made by the reviewers, and to be especially careful:

- To give more details on forward models. This includes:

- Physical parameters, such as the viscosity (including temperature dependency), the enhancement factor, the basal sliding, the thermal conductivity, etc.
- Numerical parameters, such as the time steps.
- Boundary conditions:
 - * What is the boundary condition at surface in FSM? I suppose it is a stress condition ($P = P_{\text{atm}}$), but in this case, the present day surface may not be in steady state. It would be interesting to put a graph with the vertical movement of surface for the present.
 - * Topography (Cf. Richard's comment): How well is it known, (not only in EDML area, but also all along the particles' paths)? Did you perform sensitivity experiments? In this case, please put a graph in the supp.
 - * geothermal heat flux: Did you perform sensitivity experiments with recent maps by Shapiro et al. or Llubes et al.?
- Coupling schemes
 - It is not very clear (at least for me) how this transition zone for scheme 1 does work. Are bedrock and surface elevations those of the LSM, ie a smoothed version of the data?
 - It is not very clear how the coupling scheme 2 does work (p700, l13-23). Please add more details (and sensitivity experiments) on:
 - * correction of the vertical velocity to satisfy the mass conservation
 - * influence of horizontal velocity at boundary condition
 - * correction for other variables: temperature, basal melting, sliding velocity, dH/dt , dB/dt , etc.
- You may show some snapshots of the LSM surface for several typical climates, compared to the simulation for the present, and also compared to the surface el-

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evation data. I have the impression that your approach is roughly equivalent to a spatially homogeneous translation of the surface in the FSM model. That means that the EDML flow line is roughly constant during time. Could you have a discussion on these results of the LSM? Which parameters may have an influence on the EDML flow line? (eg., grounding line position in the Filchner ice shelf) How well are they known for the past? This is a critical part of your modelling results.

- Mention more clearly the possible limitations of the current approach, and draw some perspectives on them:
 - Surface accu pattern is assumed constant in time. But accu pattern seems correlated to the temperature field (Oerter et al., AG, 2000), so that the accu pattern may be very different for a different climate. Isochronal layers may help constraining this parameter.
 - As usual, rheological properties of the ice may be a lot more complicate than in our models (Cf. Durand et al., this issue).
 - You mention clearly the uncertainty of basal melting. But the uncertainty on basal sliding is also very important. As we know that there is basal water at EDML, there is a good chance that basal sliding is not zero.
 - The temperature field comes from the LSM, which is OK for the present study, but will definitely be a limitation if we want to look in more details at the basal layer.
- Title is a bit long. What about: “ Dating and interpretation of the EDML ice core with a nested ice flow model ”?
- I do not agree with the justification for $\beta=0.046$. Cf. discussion at EPICA meeting, and Parrenin et al., JG, 2006: it is not possible to reconstruct temporal variations of accu from the isochronal layers (just temporal variations of the accu pattern). Mention you used $\beta=0.046$ but remove this explanation.

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- Other minor points

- p698, I18: why “ near to the surface ”?
- p698, I19: “ They are also required ” They are not really required, but the SIA does not produce realistic results below this resolution
- p700, I20: what is the “ rate factor ”?

Interactive comment on Clim. Past Discuss., 3, 693, 2007.

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