

Interactive comment on “Change of the ice rheology with climatic transitions – implication on ice flow modelling and dating of the EPICA Dome C core” by G. Durand et al.

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Review of: Change of the ice rheology with climatic transitions - implication on ice flow modelling and dating of the EPICA Dome C core by G. Durand and others

Overall an interesting paper that discusses some of the complications that can arise when anisotropy is considered.

One of the big drawbacks of the paper is poor wording, and many spelling errors. I would strongly suggest running it through a spell checker (which would catch spelling errors like mentionned), although that will not be sufficient by itself.

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Interactive Discussion

Discussion Paper

The title is difficult. I have a hard time understanding it. Does "THE ice rheology" exist? And change with transitions ?

I would suggest something like "Changes in ice rheology during climate variations - implications for ice flow modeling and dating of the EPICE Dome C core"

The linear model gives a 10-fold enhancement in shear, impressive.

The discussion of the model results is short and somewhat unclear. Also, a few more words about the possible effects of the large viscosity contrast between layers is needed (is the value always interpolated, or can there exist sharp boundaries, very sharp !).

There are no major errors in the paper I think, but it needs some work. Like stated above the wording is at times difficult, also I think there might be a few references added in several places; I mention a few below. And there are a few points that need clarification.

I will not write out all the spelling/wording error I find. But some of the major ones are listed below, along with more general comments.

In the following words surrounded by "[" "]" are to be deleted (suggestion), "(" ")" are comments, and "CAPITALS" are words to be added.

ABSTRACT:

* The study of the distribution of [the] crystallographic orientations (the fabric) [along] IN ice cores [supplies] PROVIDES information on [the] past and current ice flow[s] [of] IN ice-sheets.

* Line 2, p. 1188, "BesideS ... strengthening of [its] fabric ..."

* The sentence "Such strengthening[s] were already observed for sites located on an ice-sheet" is very poorly worded. Perhaps "Such strengthening of fabric has already been observed ...", why "... on an ice-sheet", not "... at other locations", "in other

ice-cores", ... ???

* Modification of viscosity. Is it really the viscosity? At best I think one could talk about effective viscosity.

INTRODUCTION AND ONWARD

* Ice core studies HAVE (YIELDED) provided a large set of paleoclimatic data FOR [over] the last FEW hundred[s] thousand[s] years.

* P. 1188, l:22-23. "... conferring an outstanding anisotropy ...", don't understand "con-ferring" here, should also be spelled with two r's (according to editor at least). Why not use "... which leads to the strong anisotropy of single ice crystals."

* P. 1190, l: 10. Is the temperature -10°C really magical, or is it more a function of accumulated strain ?!

* Also, rapid changes in stress state, as is mentioned later in the paper could affect the fabric (see also Thorsteinsson, Th. E. D. Waddington, and R. C. Fletcher. Spatial and temporal scales of anisotropic effects in ice-sheet flow. *Annals of Glaciology*, 37, pp. 40-48, 2003.)

* P.1190, l:16. Might also want to include a reference where the effects of anisotropy on flow in an ice-sheet was studied, for example in the paper: Thorsteinsson, Th., E. D. Waddington, K. C. Taylor, R. B. Alley and D. D. Blankenship. Strain-rate enhancement at Dye 3, Greenland. *Journal of Glaciology*, 45(150), pp. 338-345, 1999.

* L:18. Sorry about this, but it seems relevant, folding due to fabric was also considered in Thorsteinsson, Th. and E. D. Waddington. Folding in strongly anisotropic layers near ice-sheet centers. *Annals of Glaciology*, 35, pp. 480-486, 2002.

* L:21. Perhaps good to define texture here.

* L:12. FIGURE 1 [On Fig. 1 are] show[n]S the evolution of [measured parameters (deuterium and dust content)] along EDC within the interval 1500-2000 m.

- * L:15. Use EVERY instead of [each].
- * P.1191, L:2. [sim]~
- * P. 1193, l:9. "... futurE ...", also, dating charts, some how does not sound good.
- * L:10. What is a higher order anisotropic ice flow model ??? Could mean different things I assume, need to explain.
- * P: 1193, last line, p. 1194, l: 1. "As mentioned in the introduction, existence of non-randomly distributed fabric[s] leads to anisotropic behaviour[s], so that Glen's flow law, WHICH IS generally used for ice sheet modeling IS NO LONGER APPLICABLE [does not hold anymore]."
- * P. 1194, l: 15. What is the measure of how far fabric is from orthotropic symmetry ?
- * P. 1206, l: 4. Check the word "voluntary". Might skip it even.
- * P. 1207, l: 15. Here fluidity is used for the first time. Need to define or just use viscosity throughout; simpler to keep the same wording throughout.

FIGURES

- * Fig. 2. Explain arrows in the caption.
- * Fig. 6. Evolution of WHAT needs to appear sooner.

Interactive comment on Clim. Past Discuss., 2, 1187, 2006.

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