

Response to general comments

5 We would like to thank Dave Prior for the detailed and elaborate comments and suggestion on the manuscript. These were very helpful and improved the manuscript significantly. We have largely implemented the suggestions from the referee in the revised manuscript.

Referee's first comment

10 *Premelting*

Authors response We have modified the writing about premelting as suggested by the reviewer and we have also added some lines (and references) describing the indirect evidence for premelting obtained from attenuation experiments.

15 **Referee's second comment**

A schematic overview at start

Authors response A schematic overview of the structural and stratigraphic complexities has been added to the manuscript (figure 1). It shows the age of the ice, in-situ temperature, $\delta^{18}O_{ice}$ record and the stratigraphic discontinuities. Parameters like grain size and CPO were already shown in Figure 4 (Figure 5 in new version), so they were left out of the overview figure at the start. Related to this new figure we have also changed the descriptions of the finer-grained ice that occurs between 2207 and 2432 m of depth. In the original paper we described the finer-grained ice as glacial, however this ice is late Eemian in age according to the reconstruction of NEEM community members (2013).

25 **Referee's third comment**

Grain numbers in fig 1.

Authors response The second sentence of section 3.1 mentions that only a part of the 90 x 55 mm ice core section is shown, while the pole figures shows all the grain in the 90 x 55 mm ice core section.

30 **Referee's fourth comment**

Woodcock parameter

Authors response The explanation of the Woodcock parameter has been extended in Section 2.1. The equation that calculates the Woodcock parameter (k) from the principal eigenvalues has also been added (Equation 1)

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Referee's fifth comment

Names for the modified flow laws

Authors response

40 **Referee's sixth comment**

Eemian Glacial Facies vs. Eemian ice

Authors response

Referee's seventh comment

45 *Strain energy during GBS*

Authors

We agree that the micrographs show evidence for grain boundary migration, which implies differences in internal strain energy that are probably produced by the basal slip component of deformation. Even when GBS is the rate limiting process both GBS and basal slip accommodate similar

amounts of strain as they are sequential processes. A line has been added Page 11 line 6-8 to cover this comment.

Referee's eighth comment

5 *Split Figure 2 into 2 graphs*

Authors response Figure 2 (Figure 3 in the new version) has been split into two graphs.

Referee's ninth comment

Fig 4.

10 **Authors response** the Figure has been adjusted and is much clearer not. However, we feel that all the information in the caption is needed to interpret the figure correctly, so we decided not the change the caption of this figure.

Referee's tenth comment

15 Minor things: through manuscript

Authors response We have followed the suggestions from the reviewer. The change in Q concerning Glen's temperature dependency is taken from Paterson (1994). In response to reviewer 2, we have added several lines to acknowledge that the temperature dependency we have used is a simplification (Budd and Jacka, 1989).

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Referee's eleventh comment

"Accommodated by"

25 **Authors response** Throughout the entire paper (and the companion paper tc-2018-275) we have adopted the 'rate limiting' terminology instead of the 'accommodated by' terminology. The two bullet points are incorporated in the methods now (Equation 2 and 3 in the new version).

Referee's twelfth comment

The "Glen" law

30 **Authors response** Similar to the companion paper (tc-2018-274) we added at the end of section 2.2 that "the form of Glen's flow law that is most often used has a stress exponent of $n=3$ ". The value of $n=3$ was taken from Paterson (1994) and has been cited accordingly.

Referee's thirteenth comment

Girdle

35 **Authors response** We describe the CPO in the coarse grained Eemian ice as a 'small circle girdle type CPO' or a 'partial girdle'. The last sentence of section 3.1 it is also mentioned that 'the c-axes are distributed in a partial girdle spanning about 30° to 40° from the vertical axis'. The pole figures in Figures 2 and 5 will help the reader further to clarify what kind of girdle type CPO is found in this coarse grained Eemian ice.

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Referee's fourteenth comment

CPOs during GBS in ice.

Authors response we have referenced the Crow et al. paper in part 1.

45 **Referee's fifteenth comment**

Figure Captions

Authors response A few words were removed at some of the figure captions. However, we think that the most of the figure captions explained the figures well and therefore they were not changed or shortened any further.

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