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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Model calculations of the age of firn air across the Antarctic continent" *by* K. A. Kaspers et al.

Anonymous Referee #1

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Antarctic firn contain large amount of air which is several decades old and in some place area could be older than one century. By sampling this air it is thus possible to get large amount of pre-industrial air. This paper deal to the prediction of the best place to sample the oldest air. The approach is to model the firn densification and the air diffusion through the open pores down to the close-off with the results of a climate model as input.

My main concern is the choice of the densification model. The authors have chosen to use the Herron-Langway model and only it and in my mind they should also have used at least the Pimienta model to test the sensitivity of the prediction. The reason is that the H-L model tends to over estimate the close-off depth in the area of relatively high accumulation rates where the Pimienta model do a better job. This is true not only for South Pole as mentioned but also and more obviously for DE08 (note that

unfortunately, this site is missing in the figure 7). For this test, the Pimienta model has the advantage on the Arnaud model that the same input parameters than the Herron Langway model have to be included. I don't think it will change the location of the oldest air but I am pretty sure that it will reduce the close off depth and thus the age of the air at the bottom and it will allow to give a better envelope to the predictions.

Concerning the tortuosity in Fabre et al. (2000), the authors have misinterpreted the linear relationship between the open porosity and the tortuosity. This unique linear relationship had been established on small individual samples and the conclusion of the paper is that it cannot be used on real firn. For real firn inverse or tuned method has to be used has proposed here. Thus I suggest to delete the first paragraph of part 2.2.4

Finally note that firn results have been published for Vostok (Bender et al. GRL, 1994) and Dome F (K. Kawamura Thesis) which could be used for comparison. Looking at the figure 6 it seems that the predicted close off depth should be too large also.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 1817, 2004.