

Interactive comment on “Glacial-interglacial dynamics of Antarctic firn columns: comparison between simulations and ice core air- $\delta^{15}\text{N}$ measurements” by E. Capron et al.

Anonymous Referee #2

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Capron et al. present an impressive compilation (including new data) of $\delta^{15}\text{N}$ data from firn cores in Antarctica. Those data are in conflict with what $\delta^{15}\text{N}$ should be according to firn densification models during glacial periods. They offer three hypotheses for the origin of this mismatch: faulty input parameters to the model, convective zone, and snow to ice metamorphosis susceptible to impurities in the snow. Several options to solve the problem are discussed. The manuscript reads very hard. The discussion of reasons for the model data mismatch is not very clear. Several points are taken up in different sections. The manuscript needs to be written much more to the point and shortened. The nomenclature is confusing. Speaking about $\delta^{15}\text{N}$ as data and as a model parameter needs to be clearly distinguished. I suggest using 'diffusive column

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height' as the model parameter and then adding another axis to the figures. There are too many figures in the manuscript; figures 4, 5 and 6 can be combined.

Specific remarks

Page 6054, line 21: 'continuous snow material' should maybe be replaced with 'homogeneous'.

Page 6059, lines 18-26: How big is the effect of where the diffusion stops? Why take 21%?

Page 6060, line 3: 'configuration of the BI drilling site'. I guess what is meant is the flow regime of BI.

Page 6061, line 15: Typo Dd18O should be d18O.

Equation 1: Delta mass should have the unit of kg/mol not g/mol. The delta value is given in per mil which is not obvious. Per mil is a prefix; therefore delete the factor of 1000 in the equation.

Page 6055, line 17: the Goujon and Arnead models are no longer the 'most recent' once. Replace 'most recent' with e.g. 'state of the art'.

Section 5.2: The title of this section is confusing. Also the entire section can go into the appendix and be replaced with the last sentence referring to Parrenin et al., 2012b.

On several occasions there is claimed that 'the successive patterns of $\delta^{15}\text{N}$ trends during the deglaciation' is similar in the $\delta^{15}\text{N}$ data and model output. That is hard to see and I would like to see an in depth analysis of that statement.

One of the main points of the discussion is the different response of the firnification models to accumulation and temperature changes. This very important point (including figure 8) should be introduced early on in the manuscript.