

Response to comments from Reviewer 2

Authors' replies in blue. All reference to figures, equations or lines in the paper refer to the initially submitted paper.

The authors use a novel approach to estimate the strength of the molecular diffusion in the ice dated back to MIS 19, the oldest interglacial recorded in an Antarctic ice core. The diffusion length is deduced from the analysis of the spectral properties of the isotopic time series with the use of a Bayesian approach. The only, but important, assumption is that the spectral properties of MIS 19 are similar as those of younger isotopic stages (MIS 1, MIS 5 and MIS 9).

The authors conclude that the diffusion length is 31 +/- 5 cm, which is much shorter than in the previous works (40-60 cm). It's a very good news for the climatologists seeking for the Earth's oldest ice, and this is one of the reasons why I like this manuscript.

We are glad the reviewer recognises the improvement of our new approach and the optimistic outlook it provides for current and future deep ice core studies

I do not have major comments on the MS, only a couple of minor suggestions:

Line 61 – you have a citation of this dataset in the “Data availability” section, so it's possible to remove it from here.

Removed in the revised version

Table 1 – the depth range for MIS 1 starts from 7.755 m and the time range from 0 ka, but at the depth of 7.6 m the age a priori cannot be 0 years.

This happened due to rounding, corrected in the revised version

Line 87 – significantly affect?

Corrected in the revised version