Atmos. Chem. Phys. Discuss., 5, S4309–S4312, 2005
www.atmos-chem-phys.org/acpd/5/S4309/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Constraints on N_2O budget changes since pre-industrial time from new firn air and ice core isotope measurements" *by* S. Bernard et al.

S. Bernard et al.

Received and published: 5 December 2005

Reply to comment by C. Trudinger:

We thank C. Trudinger for the important comment. It was in fact not stated clearly in our paper, but we have indeed used different diffusion constants for the different isotope masses. If we had chosen the same diffusion coefficient for the various isotope masses we would have neglected the diffusional component of the isotope fractionation. What we state in the paper is the relative diffusion constant of the major isotopologue of N2O (m/z=44) relative to the major isotopologue of CO2. The diffusion constants of the individual isotopes are calculated based on their mass differences as

m/z= 44 14N216O: 1.004

m/z= 45 14N15N16O: 0.999656

m/z= 46 14N218O: 0.995441

This is now noted in the revised manuscript.

Reply to comment by referee #1:

7555, 13 Please test your firn model calculations with the different diffusion coefficients for the N2O isotopes N15 and O18.

See reply to comment by C. Trudinger

7556, 18 State what results you refer to here (i.e. Fig 1 or Fig 2).

Actually we refer to both figures. The envelope for the scenarios is shown in figure 2, and the envelope for the resulting firn air profiles in figure 1. This has been clarified in the revised version.

7557, 1-2 Delete 'the model can reproduce the firn and ice data quite well, especially for 15N and 18O' Rewrite as 'For NGRIP, the average difference between the model and the data is less than 0.15permil for 15N and less than 0.20permil for 18O'

Has been rewritten according to the suggestion of the referee.

7557, 27-28 Move the following text to Fig. 2 caption. 'The colour scale represents the probability that a given atmospheric scenario is constrained by the firn data'

Text has been moved according to the suggestion of the referee.

7558, 3 Explain what you mean by a 'certain atmospheric age' Do you mean an exact age?

We wanted to stress the point that the air does NOT have an exact age. Since it is already mentioned in the sentence before that the air has an age spectrum, this part of

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the sentence was confusing and has been removed.

7559, 6 The kink is hard to notice at first. Please alert readers to it by stating the approximate at which the kink occurs.

Has been specified.

7559, 12 Please define the two positions

We mean the nitrogen atom positions in this sentence (has now been specified). They have been defined on page 7553, and are used well above this paragraph.

7561, 22 Can you say why natural sources have probably remained constant, any supporting references?

This is an assumption in our calculations, which has been clarified in the revised version.

7563, 9 Rewrite as 'In principle this may allow us to investigate N2O stratospheric sinks'

Has been rewritten.

7564, 3 Define the 'different time periods'

The time periods are just specified in the sentence before. We have now clarified this by writing: The trends for THOSE different time periods.

7573 Please give a more complete description of the 'best scenario' and 'accepted scenario'. It is not clear whether you are referring to the agreement of your firn profile with that from the South Pole ice core and Cape Grim data or from different density and diffusivity profiles used in the firn model.

Has been clarified

7574 Why not scale the 1d15N plot to show the Berkner Island data that are off scale? Please point out the approximate date of kinks in the plots as they are difficult to see.

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Interactive Comment

We prefer to keep the scale so that the scenarios fill most of the figure for maximum clarity. Therefore we have decided to leave out those values that deviate from this region. We clarified the position of the kinks.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 7547, 2005.