

# **A spatial framework for assessing current conditions and monitoring future change in the chemistry of the Antarctic atmosphere**

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## Author Comments to Anonymous Referee 2

1) Overall, I think the paper deserves publication, but it should be reformatted considerably to give it a clearer focus, articulated on specific scientific questions or hypotheses...

A1) We have re-organized the paper to focus more clearly on the properties of the glazed areas and the volcanic contributions to the snow chemistry.

2) some efforts should also be made to better constrain the interpretation of EOF analyses using statistical validation tools.

A2) We have removed the EOF sections.

3) I find that the conclusions section (section 4) is mixed with elements of discussion that should really be included in the previous section (section 3.4.4).

A3) Have moved volcanic discussion elements from section 4 to section 3.4.4

4) I suggest the meaningfulness of the various eigenvectors should be tested against Monte-Carlo simulations with fake, random data series.

A4) As mentioned in A2, we have removed the EOF sections. Therefore, Monte-Carlo simulations are now superfluous.

5) I assume that there is probably a strategy to archive these data in an open data repository,

A5) The data will be available on the Ice Reader database and at NSIDC.

6) The present title is too vague does not announce the subject explicitly.

A6) Have changed the title to: Variations in snow and firn chemistry along US ITASE traverses and the effect of surface glazing.

7) There are too many tables, especially those presenting EOF results.

A7) We have removed all the EOF tables.

8) Sometimes the ordinates are linear, sometimes on a log-scale, and the axes are so small as to be barely readable.

A8) If we change the graphs such that the three axes for each element are identical, the reader would not be able to clearly see the variability of the firn sections. We have included a set of plots with three identical axes for each element as supplemental material. We have also increased the size of the font on all axes.

9) The numbers at the top of the plots that identify the coring sites and which allow one to determine the direction of progression are almost unreadable, such that one does not know easily where the distance (on the x-axis) is measured from. The overlays of colours on Fig. 10 are also difficult to decrypt.

A9) We have increased the font size on all figures and explained where the distance (on the x-axis) is measured from in the figure caption.

We have used semi-transparent colour overlays on figure 10 in order that the reader can get an idea of when an element is being over-estimated. Therefore, we have not changed the overlays.

10) The data presentation should be greatly simplified and presented as in Betler et al.

A10) We do not wish to change our current plots to colour-coded maps because that format would not allow us to present the required data (i.e. detection limits, standard deviations, etc.)

\*\*\*We wish to thank the anonymous reviewer for the comments which help to improve our manuscript\*\*\*