

Temporally-Delineated Sources of Major Chemical Species in High Arctic Snow – Second Response to Anonymous Referee #1

Referee comments received and published: 4 January 2018 (quoted below in blue text)

Response to Referee Comments – Main Text

Referenced to Page/Line #(s) in the original manuscript:

1/5

Referee Comment: "this rich data provided" should be either: this rich data set, or these rich data

Response: Editorial comment revised as suggested. (revised manuscript page/line(s): 1/15)

5/13

Referee Comment: "limited number of snow samples measurements" should be either: snow sample measurements, or snow samples measured

Response: Editorial comment revised as suggested. (revised manuscript page/line(s): 5/13)

Table 1

Referee Comment: (and many times after) MSA is typically used to refer to methanesulfonic acid. MS⁻ is used to refer to methylsulfonate (which is what is measured by IC in melted snow)

Response: The acronym MSA has been replaced with MS throughout the revised text, figures, and tables.

Figure 1

Referee Comment: Still unclear to me what the grey bars signify in this plot. If this is mass of analyte attributed to the factor, is it correct that calculating the ratio of the bar in one factor (for given analyte) over the sum of the 7 bars for that analyte would be the same as percentage shown with diamonds (on the other axis)? If yes, the bars add no information.

Response: The referee is correct in their interpretation of the grey bars in Figure 1: they represent the mass of each analyte loaded onto each factor and the individual mass associated to one factor divided by the total mass of that analyte is equivalent to the percentile loading presented as a black diamond on the same plot. This is simply two means of describing the same information. Given that the total mass loading differs across analytes, the percentile loading is useful in highlighting which factor dominates each analyte while the mass loading is useful in highlighting which analyte dominates each factor by mass. This information is repetitive but facilitates interpretation. This presentation is typical of many PMF papers.

11/12

Referee Comment: use of "enrichment ratios" throughout section 3.2 is a little confusing. In this instance Cl/Na and K/Na have some precedent in the literature where enrichment factors defined as $X/ssRef$ or $X/crustalRef$ are used to assess whether X seems dominated by natural or anthropogenic sources. In this sense, comparing As/Al in snow to the ratio in "global typical" make sense as enrichment ratio, but the comparison to As/Al in local soil not so much. Likewise SO₄/BC and NO₃/BC are just ratios, since there is not really an accepted global mean composition of BB smoke (depends on way too many factor like fire stage, fuel type, moisture, etc.)

Response: The text has been revised to use the term "mass ratios" to describe the ratio of two analytes loaded onto the same factor. The term "enrichment ratio" is only used when comparing that calculated ratio to those observed by previous studies. (revised manuscript sections: 3.2.1 - 4)

19/20

Referee Comment: "within the northern Eurasia"---> within northern Eurasia

Response: Editorial comment revised as suggested. (revised manuscript page/line(s): 19/20)

22/1-3

Referee Comment: some kind of cut and paste error here, seems words are missing

Response: We thank the referee for noticing this error; this was a copy and paste mistake. The line has been revised as follows: "*Both V and Se are typically considered to be tracers of anthropogenic activity, specifically oil and coal combustion (Key and Hoggan, 1953; Rahn, 1971; Berg, Røyset, and Steinnes, 1994; Laing et al., 2014).*" (revised manuscript page/line(s): 22/1)

Response to Referee Comments – Supplemental

S1.1

Referee Comment: camo activities--->camp activites
were used to dividing the--->were used to divide

Response: Editorial comment revised as suggested. (revised supplemental section S1.1)

S3.2

Referee Comment: (under Fig S5)

with the exception of that--->with the exception that
As discussed in Chapter 5--->As discussed in 3.2.7 in main text

Response: Editorial comment revised as suggested. (revised supplemental section S3.2)