

Interactive comment on “Methoxy aromatic acids in an Arctic ice core from Svalbard: a proxy record of biomass burning” by Mackenzie M. Grieman et al.

Anonymous Referee #3

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The location of the Lomonosovfonna ice core, in conjunction with the author's previous work on the Akademii Nauk ice core provide the opportunity to examine biomass burning across the high Arctic. The authors use similar techniques for both ice cores, where the biomass burning records are similar for approximately 200 years, but then deviate after 1400 CE until the present. The authors ascribe this divergence to an "atmospheric reorganization" due to possible changes in the SNAO, but this argument can be more thoroughly developed, as detailed in the points below. While few easily-accessed paleoclimate records exist near the Akademii Nauk ice core, Svalbard has been extensively studied for decades. It is surprising that the authors only briefly touch on the extensive paleoclimate information and modern aerosol transport data from Svalbard in their

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study.

Page 1 Lines 5 and 6: “Vanillic acid levels are high (below the limit of detection to 0.1 ppb) from 1200-1400 CE, then gradually decline into the 20th century.” Concentrations below the level of detection cannot be high by definition.

Page 1 Line 9 to 10: Are Siberia and Europe the primary source regions throughout the time period of the entire study? Or are they the primary modern source regions?

Lines 19 to 20: “Boreal wildfire areal extent appears to have increase significantly with warming during the past few decades” needs a citation.

Page 3 Lines 20-29: Why do you use ten-year bin averages rather than, for example, 10-year moving averages? If the dating uncertainty below 80 m is 10 years, then are ten-year bin averages too narrow of a time frame? It is essential to explain your reasoning in this section.

Page 4 Line 5: Why did you choose to start the trajectories at 100 m above the ice surface?

Page 4 Lines 8 and 9: What is the latitudinal boundary for North America, Siberia and Europe in your study?

Section 3.1: Either refer to this section in Page 3 Lines 20-29 or else move the entire section to immediately follow the current Page 3 lines 20-29 where you first describe that you use 10-year bins for your data.

Page 5 Lines 13 and 14: Were the geometric means and standard deviations used because of the skewness? I think that this is what you would like to say, but please rephrase to your meaning is clear.

Page 5 Line 15: At the deepest section of the core, how many samples do you have in each 10-year bin?

Page 5 Lines 28-30: Can this long-term decreasing trend be caused by decomposition

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or degradation of VA and p-HBA through time? (Refer the reader to Section 3.6 to demonstrate that you have considered these possibilities).

Section 3.4 and Conclusions: Stating that an “atmospheric reorganization” due to changes in the SNAO affects the differences in biomass burning tracers is quite a bold statement. Although you describe the spatial patterns of the SNAO, a figure can better demonstrate the influence of the SNAO on transport affecting these two ice cores sites. The back trajectories for the positive SNAO index (1970-1979 CE) and negative (1948-1957 CE) can help depict the source regions and transport paths. Figure 2 of Folland et al., (2009) is an excellent example of the spatial extent of the summer NAO. However, plotting an example of the spatial patterns for a positive SNAO (1970-1979 CE) and negative SNAO index (1948-1957 CE) can also add essential support to your argument. Section 3.5: You mention that “the long-term trends in the VA/p-HBA ratio presumably reflect changes in the relative contributions of fuel types or changes in atmospheric transport”. I kept expecting you to tie these possible changes in atmospheric transport back to the discussion of the SNAO. This lack of a mention of causes of these atmospheric changes is surprising in light of the previous section.

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