

## ***Interactive comment on “Source attribution of Arctic aerosols and associated Arctic warming trend during 1980–2018” by Lili Ren et al.***

**Anonymous Referee #1**

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In this study an aerosol tagging scheme is coupled to a climate model (CAM5-EAST) to quantify the source attribution to Arctic black carbon (bc) and sulfate from 16 different regions during 1980–2018. The modelled surface concentrations are compared with measurements at four Arctic stations. Regional temperature sensitivity factors are then applied to estimate the changes in surface temperatures due to the trends in BC and SO<sub>4</sub>.

Source attribution of Arctic aerosols is a relevant scientific topic within the scope of ACP. The authors present their data in a structured way and the figures are clear. However, before consider acceptance, I recommend the authors work more on presenting their results in light of related work.

1. How does this study contribute to new knowledge in the field? What do you con-
- C1

tribute that is different (model/data set/time period)? I would highlight this in the abstract, introduction and conclusion.

2. Your conclusions are not new (but it is still very important to test what others have done!), but I would then add, ‘as also shown in ...etc etc. For instance, it have been shown in other studies that the declining emissions in Europe and the collapse of the Soviet Union are the main reasons why we see declining trends in the Arctic and that emissions from Asia contribute to higher level aerosols in the high-Arctic.

3. I would also compare your numbers with other studies. Do they differ from other studies or do they support other findings? If different; try to explain why.

4. The authors use sensitivity factors to estimate the temperature response to the declining trends. This method needs to be explained in Methods along with uncertainties.

5. Can you please add a description in Methods on how BC and sulfate are treated in the model? Aging, mixing etc.

Specific comments by line number:

Title: You are only looking at BC and SO<sub>4</sub>, so I would change ‘aerosols’ to reflect that + specify surface warming, and not just warming.

L23: Wouldn’t a decrease in BC, at least hypothetically, lead to a cooling?

L32: You need to specify that you have calculated the surface temperature response using sensitivity factors (and not by running a climate model).

L42: What other regions do you refer to here? Most aerosols are emitted NH mid lats?

L140: What kind of aerosol-cloud interaction are included in the model?

L197: Where in the Arctic are those emissions mostly from? I would assume northern Russia?

L226: Could you be more specific on where the Kevo site is located besides close to

western Eurasia?

L217: Can you split these two sentences; one for bc and one for sulfate so it is easier to follow?

L257: Could you remind us which regions those are?

L280: this is the first time you report concentrations in ug/m3 decrease and not % decrease. Can you add the total concentration number as well, so we can relate the number?

L313: 'during'? How is this calculated? First and last 5 years?

L329: What is a moderate value?

L332: this is the first time you mention the tropical region?

L348: I would decrease the number of significant figures for these temperature response numbers, as the uncertainties are much higher.

L394: Can you list these references you refer to here?

L400: 'to some extent' seem vague.

L408: Increase compared to what?

Figure 1: it is hard to see the letters/dots representing the observation sites. Could another plot be made in this figure, zooming in on the Arctic (90-60N) and only showing the stations for example?

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-3>, 2020.