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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Do contemporary (1980–2015) emissions determine the elemental carbon deposition trend at Holtedahlfonna glacier, Svalbard?" *by* Meri M. Ruppel et al.

Anonymous Referee #1

Received and published: 20 June 2017

Review of "Do contemporary (1980-2015) emissions determine the elemental carbon deposition trend at Holtedahlfonna gloacier, Svalbard"

General comments:

I find the topic of the paper to be very interesting and timely. Increased understanding of BC deposition on snow and ice is crucial for further improvement of our understanding of climate change in the Arctic. The paper is generally well written and easy to follow. I do believe that there is lacking some discussion on the limitations of how BC is treated in the chemical transport model and, more specifically, how this affects the results and general conclusions in the work. I recommend publication if the points listed below are

addressed.

Specific comments:

P4, Line 14: Exchange "surface area" with "cross sectional area" for clarity.

P5, Line 29: Define Dp

P5, Line 36: Take care to specify when you are taking about atmospheric concentrations. Here it just says "modelled BC levels".

P5, Line 36: "...systematically low, but the seasonality in atmospheric BC concentrations is captured well..." Can you show this somehow? What are the observations like? Could you for example plot observed atmospheric BC concentrations at Ny Ålesund on your Figure 5. So far you have not shown or given any numbers to support your statement.

P6, Line 4: Please exchange "generally similar" with "in the same range" or something along those lines.

P6, Line 24: "... no clear decadal trend". Did you check this statistically? Visually, there seem to be a decreasing trend. You also make a statement that there is a weak trend both on p10, Line 15 and p 13 line 7.

P6, Section3.3: This section is a bit confusing. There are clear conclusions drawn here like "The model results suggest that 98.7 % of BC is wet-deposited at Holtedahlfonna." while there is no mentioning of model limitation in treatment of this or any other process for that matter. There is discussion in section 4, but at the very least, this discussion needs to be mentioned in section 3.3.

The fact that the model underestimates the atmospheric concentration by a factor of ten (?) should be emphasized and discussed in greater detail. Why does this happen? It there too much wet or dry deposition? Is the transport off? Are the emission inventories that off? Are all processes equally badly/well treated so that your statement that 98.7

% of the BC is wet-deposited holds? When 9/10 of the BC is missing (is it?) it seems a bit crude to give such a specific number for the source of surface BC?

P13, Line 9: Model limitations/uncertainty in the 99% number should be mentioned here as well.

P13, Line 19-21: Sentence starting with “The fact that the observed EC deposition trend. . .” How so? Please elaborate.

P13, Line 27: Consider removing “somewhat”. The numbers are lower, not only briefly so.

Figure 4a): Would be nice to have time of year on the figure as you are referring to seasonality in this figure on P6 Line6.

Technical corrections:

P3, Line 25-28: Give coordinates either for both sites or none of them.

P3, Line31: Please rewrite the sentence: “To obtain a hard surface to drill 80 cm of the snow pack were removed”. It is confusing.

P5, Line 35: Misspelled the word like.

P6, Line 27: Punctuation

P10, Line 21:Please insert the word “one”, that is: “. . .deposition from one data point to the next. . .”

P11, Line7: “...the second may. . .” Correct typo.

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