

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 #2

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The study of Ruppel and others investigate how BC emitted by both natural and anthropogenic sources reaches the Arctic and deposit to the snowpack in Svalbard. The study is relevant, as it includes both measurements from snow pit and ice cores, and modeling (transport and chemistry). Transport chemical models are a great tool to investigate Arctic climate responses to emissions of short-lived pollutants. However, bringing constraints from measurements is required to evaluate such models. This paper discusses carefully multiple factors that can bring uncertainties in both BC measurements and modeling. It is easy to read, and well written. I would support its publication if the points I list below could be addressed.

C1

Applying the EUSAAR_2 protocol to EC measurements in liquid phase sample is not straightforward, as eg the sample needs to be filtered, and that the efficiency of filters to capture EC can be limited (Eg Torres et al., 2014; Lim et al., 2014). Lim et al. (AMT, 2014) have reported that the filtration efficiency (ie the amount of EC retained on a filter) can be as low as 20% for small EC particle diameters (eg 100 nm MED). I am wondering if such artifact might partially explain the fact that modeled BC deposition are higher than observed EC deposition. Overall, any information about the size distributions of BC in snow/ice would be interesting, as larger particles could drive larger observed EC concentrations (and seasonal melt at the surface of the glacier can promote larger BC particles by aggregation). Considering the challenge of measuring BC in snow, combining results from different analytical methods would be more solid. If additional measurements are not possible (eg involving an SP2 analyzer) for this study, the manuscript should at least include more discussion about potential uncertainties related to the analytical method. I understand that discussion on that topic is included in the 2014 Ruppel paper, but I would recommend at least to refer more clearly to it.

The EC data should include quantified uncertainties.

The paper misses a direct comparison between model atmospheric BC and direct atmospheric observations, eg from Ny Alesund Station. This would support more clearly the model outputs (as only suggested in the manuscript).

I understand that observed EC deposition does not corroborate directly with global-scale emission patterns. Can we learn more by considering regional emissions patterns? The emissions description seems to miss details about such regional patterns, and their relative impacts at the study site.

P5-L35 : typo “Ilike”

P11-l7 typo “second may”

2017.

C3