

## ***Interactive comment on “Deposition of ionic species and black carbon to the Arctic snow pack: Combining snow pit observations with modeling” by Hans-Werner Jacobi et al.***

### **Anonymous Referee #1**

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In this paper the authors are combining a variety of field observations data from Ny Ålesund (Svalbard) with modelling in order to improve the understanding of aerosol removal and deposition in the Arctic. For being in the Arctic Ny Ålesund has a large variety of observational data available and thus this is a suitable site for such a study. The paper describes the data, methods, model and conclusions very clearly and it is a generally well written providing important knowledge of in particular sea salts, nitrate, nss sulfate and BC deposition to the winter snowpack. However, before the paper is accepted for publication I would like to see the following aspects better explained. Data from two snow pits from two glaciers are used in this study. The glaciers are both situated in the Kongsfjorden area but are fundamentally very different. Austre Lovenbreen

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is a low elevation, small valley glacier where the surrounding topography are affecting both the precipitation distribution (wet deposition) and wind and turbulence (dry deposition). The other glacier, Kongsvegen, is much larger, has a different elevation distribution and thus deposition and precipitation distribution. What was the reason for selecting these particular sites?

In addition to the fundamental differences between the two glaciers I also wonder about the spatial variability at each of these sites? How representative is one snow pit for this particular glacier?

Would the elevation difference between the two snow pits sites, Zeppelin and Ny Ålesund have any effect on the conclusions from this study?

Is it possible that the surface height changes recorded by the ultrasonic ranger is affected by rain and/or windblown snow and giving misleading results regarding precipitation events?

The citation of relevant papers is fine but I do miss the mentioning of one important study; one of the landmark studies regarding BC in Ny Ålesund which also presents observational evidence of dry deposition on higher elevation glacier snow- something that is not often seen in the Arctic. Stohl, A., et al. Arctic smoke – record high air pollution levels in the European Arctic due to agricultural fires in Eastern Europe in spring 2006, Atmos. Chem. Phys., 7, 511-534, <https://doi.org/10.5194/acp-7-511-2007>, 2007.

Finally, I would like to congratulate the authors to an interesting and well-written study!

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-215>, 2019.

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