

## ***Interactive comment on “Impacts of large-scale atmospheric circulation changes due to winter sea-ice retreat on Black Carbon transport and deposition to the Arctic” by L. Pozzoli et al.***

**Anonymous Referee #3**

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Pozzoli et al. investigated how the black carbon transport and deposition in the Arctic is affected by changing atmospheric circulations. The topic is important given the radiative forcing effects caused by black carbon and other absorptive aerosols could significantly affect Arctic climate. I think this paper should be of great interest to the readers. The simulation experiments and statistical analysis of how the changing atmospheric circulation could affect black carbon transport and deposition in the Arctic is well constructed. Uncertainty and robustness of the statistical analysis is also discussed. However, I think some caveats exist in the link between Arctic warming and changing atmospheric circulation and possible feedback mechanism proposed in this paper. More detailed discussions should be included in order to support this argument.

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Overall, it is an important study, and should be considered for publication, after the issues mentioned in the reviews have been resolved. Some suggestions for improvements are listed below:

Comments: Page 4, Line 13-15: Please provide more analysis and discussion of how well the Gaussian distribution assumptions hold. Or please cite other references which could support the assumption of Gaussian distribution here.

Page 7, Line 16 - 19: "Annually varying anthropogenic emissions are used for the REF simulation, and the BC anthropogenic emissions remained almost constant globally during the simulated period (1980 - 2005), 4.9 Tg/year, however large changes occurred in those source regions which are also mainly contributing to the transport of BC to the Arctic (Figure S1)." I think this part should include more details, such as a list of names of those regions have large changes in this period?

Page 8, Line 24 - 26: Please specify how the arrows are determined from the trends. Is that a qualitative representation of the tendency of main atmospheric circulation path? Is that path corresponding to black carbon transport path?

Page 9, Line 4 - 7: "This pattern, as the negative phase of the NAO, is characterized by weaker westerlies, colder and drier conditions in Scandinavia and Russia, warmer temperatures over Greenland and Canadian Archipelago with higher precipitations and BC deposition. Dynamically it also imposes stable conditions in which the pollution may accumulate in the polar dome over the Arctic." I think more analyses or references should be provided here to support the argument about changes of atmospheric conditions associated with negative phase of NAO. Also, please clarify the relationship between higher precipitation and BC deposition over Greenland and Canadian Archipelago and the stable condition mentioned later. It's not clear that whether it is most parts of the Arctic becomes more stable except Greenland and Canadian Archipelago? I think additional analysis is necessary for this part.

Page 12, Line 4-5: "Different studies found significant connections between the winter

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sea ice retreat in the Arctic observed in the last decades and changes in the large scale atmospheric circulation." Please add reference papers to this section.

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1007, 2016.