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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ship emissions measurement in the Arctic from plume intercepts of the Canadian Coast Guard Amundsen icebreaker from the Polar 6 aircraft platform" *by* A. A. Aliabadi et al.

Anonymous Referee #2

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GENERAL REMARKS

The manuscript presents results from an in-depth study on emissions from a single icebreaker vessel operating in Arctic waters. Although there is already extensive information available on the gaseous and particulate emissions from marine Diesel engines, this study adds significant data on ship emissions in the Arctic. The study is well designed and carefully conducted. It covers both the experimental determination of emission factors and the investigation of ship emissions transport in the marine boundary layer under the specific conditions of Arctic waters.

The manuscript is in the scope of the journal and the presentation of the material is clear and well structured. Few minor revisions should be considered before publication in ACP. Technically, most of the figures require careful revision because they are hard to read in the current version.

SPECIFIC COMMENTS

1| The only major comment concerns the determination of emission factors from the plume encounters. In the present form, the authors report average emission factors for each investigated species. However, this way of presenting the data neglects potential effects of transformation of the species during plume expansion and atmospheric transformation. Combining the information shown in Figures 9, 10, and 11, it becomes evident that plume encounters were measured at plume ages between 100 and > 1000 s. This span of plume ages should allow the investigation of emission factors at various plume ages, i.e., the determination of effective emission factors. It is recommended to determine emission factors separately for all plume encounters and plot the data as a function of plume age. Doing this would permit investigating whether there was chemical or physical transformation of the investigated species during plume ageing; see for example the results on particle ageing shown in Petzold et al. (2008) and Tian et al. (2014).

2| In the section on applied particle instruments, the information on lower detection sizes is missing. Reporting aerosol data as "CPC", "OPC" or "UHSAS" is misleading. Instead they should be reported as, e.g., N_(OPC, D_p 250 nm) etc. Then the reader recognizes directly the aerosol mode covered by the respective instrument. Furthermore, minimum detection diameters of the instruments should be added to Section 2.2.3.

3| Careful revision of all figures is strongly recommended. They should be made much simpler and need to be enlarged. Figures 12 to 16 are not really necessary since the information is already contained in the extensive tables.

4| The presentation of emission factors in Tables 3 – 6 should focus on the comparison of reported values with data for similar engine types. Currently, the tables list all values available in literature without giving information whether or not the investigated engines are comparable to the engines operated aboard the Amundsen. Giving more weight to those engines of similar types would increase the readability of Tables 3 – 6 significantly.

MINOR REMARKS

Page 1, line 7: suggested rephrasing: “Canadian Coast Guard icebreaker Amundsen”.

Page 6, line 169: change to “(OPC GRIMM Model 1.129).

REFERENCES

Petzold, A., Hasselbach, J., Lauer, P., Baumann, R., Franke, K., Gurk, C., Schlager, H., and Weingartner, E.: Experimental studies on particle emissions from cruising ship, their characteristic properties, transformation and atmospheric lifetime in the marine boundary layer, Atmos. Chem. Phys., 8, 2387–2403, 2008.

Tian, J., Riemer, N., West, M., Pfaffenberger, L., Schlager, H., and Petzold, A.: Modeling the evolution of aerosol particles in a ship plume using PartMC-MOSAIC, 14, 5327-5347, doi: 10.5194/acp-14-5327-2014, 2014.

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