

Interactive comment on “The Importance of Blowing Snow to Antarctic Aerosols: Number Distribution and more than Source-Dependent Composition – results from the 2ODIAC campaign” by Michael R. Giordano et al.

Anonymous Referee #1

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Review of "The Importance of Blowing Snow to Antarctic Aerosols: Number Distribution and more than Source-Dependent Composition – results from the 2ODIAC campaign" by M. Giordano et al.

This study reports particle size and chemical composition of Antarctic aerosol particles with a focus on blowing snow and the influence of wind speed. Measurements were taken during two field studies in 2014 and 2015 covering Antarctic late winter to summer seasons. The location was near the McMurdo research station on the sea ice. The main findings of this work include that a) the aerosol chemical composition, in

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particular sodium and chloride, is a function of wind speed rather than air mass origin as characterized through back trajectory analysis, b) the submicron particle halogen cycling is different from the supermicron particle, and c) more detailed studies are needed to fully understand the enrichment, depletion and cycling of halogen species in Antarctica. The manuscript is well-written and clearly organized. The manuscript can be published with minor revisions.

General comments

There seems to be a shift of focus between the title/introduction and conclusions. While the manuscript puts emphasis on the influence of wind speed on the aerosol population the conclusion mainly focuses on the halogen cycle. A section in the introduction on the halogen cycle is needed. For example, the two last result subsections use the reference Legrand et al. (2017) heavily, while he is not mentioned in the introduction.

The title is cryptic: “more than Source-Dependent Composition” is not a description of this work’s content that will inform the reader directly of what this manuscript is about. What about: The importance of blowing snow to aerosol and the halogen cycle in coastal Antarctica: Influence of Source region versus wind speed.

The notation of the chemical species throughout the manuscript is confusing: e.g., chloride, Cl, Cl⁻, Chl. I suggest to introduce a notation that makes clear with which instrument the species was measured, e.g., Cl⁻ for IC results, Chl for AMS results. Please check the manuscript throughout, sometimes the ionic charge is not provided (forgotten). Below are some hints, but I might not have spotted all.

Specific comments

Aerosol size distribution information based on AMS measurements are not provided in this manuscript. Therefore the description of size calibrations could be omitted to make the manuscript shorter. In section 2.3, p. 7, second paragraph: Please include a brief description of the model by Salcedo et al. (2010) so the reader does not have to look

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up another publication to understand how the authors arrived from the e-folding time of 40 to the modelled Chl and Na concentrations as shown in Fig. 1. p. 9, l. 21: It is not clear whether those data points are shown as well. Please make this evident in the text.

p. 9, l. 27: “chloride losses” Do they refer as relative to Na⁺ or to the total chloride concentration? p. 10., l. 3: How can winter blizzard conditions be more consistent with the 2ODIAC campaign which happened later in the season?

p. 12, l. 30: Are those the total numbers of trajectories or just at one release height? Please specify in the manuscript.

Figure 5: It would be helpful to make all data points grey and overlay them by wind speed binned averages with standard deviations.

p. 14, l. 15f: What was the size range of particles that Hara et al. (2014) measured? From the text it is not evident that the comparison makes sense.

Section 3.7: Could the vertical displacement of the back trajectories be an indicator of possible processes? The authors looked at source regions which do not provide a clear hint, but potential influence of high tropospheric or stratospheric air masses could be important.

Conclusions: p. 22, l. 8: The mixing state of particles has not been mentioned before in the manuscript. If there is a strong argument for external halogen mixture, this needs to be included in the respective results section. It will also be highly informative to include a couple of sentences what more information of the halogen cycle in Antarctica will be important for.

Technical comments

p. 3, l. 10: elaborate which elements are meant by “marine elements”

p. 5, l. 26: “an” instead of “An”

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p. 7, l. 11: “Figure 1 shows how the wind direction and...” The wind direction is not shown, but can be added easily.

p. 7, l. 28: “and sodium my occur in the data.”

p. 8, l. 1: “freezer in Antarctica.” Admitted, there is a limited total number of freezers in Antarctica, but more specificity is desirable, e.g., the research site’s freezer.

p. 8, l. 19: delete “while in the field and subsequent data analysis”

p. 8, l. 21f: It is not clear what is meant by “increasing temporal resolution patterns.”

p. 9, l. 6: “it”

p. 9, l. 27: “was” instead of “is not clear.”

p. 10, l. 24 / p. 11, l. 10-12: Do you mean “SO₄ 2-“?

p. 11, l. 2f: The abbreviations have not been introduced.

p. 11, l. 32: sulphate or sulfate?

p. 12, l. 15: “differences that”

p. 12, l. 29: SI or Supplemental Information?

p. 13, l. 19: “Two” instead of “Several”

p. 13, l. 25: “which in turn is a function...”

p. 14, l. 14: “These results are...”

p. 14, l. 33: It is unclear what is meant by “make up the aerosol to inland continental snow.”

p. 15, l. 27: It is unclear what is meant by “by extension concentrations.”

p. 16, l. 9f and elsewhere: The hyphens turn out very long and spaces are missing.

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p. 17, l. 2: “region” instead of “point”. The sources are rather regions that specific points.

p. 17, l. 5: Delete “it was quickly noted that”

p. 17, l. 16: replace “in the AMS” by “as measured by the AMS”. The original formulation, here and elsewhere, sound like the species are generated within the AMS.

p. 17, l. 33 and elsewhere: sometimes it is written Figure x or Fig. x or figure. Check the journal style.

p. 18, l. 5: “ that the increased chloride concentrations as measured by the AMS are not. . .”

p. 18, l. 13 and elsewhere: Do you refer to the IC measured species Cl⁻ and Na⁺? Or the AMS derived species Chl and Na?

p. 19, l. 13 and elsewhere: if this is the AMS derived ratio use Chl:Na

p. 19, l. 25: Do you mean at intermediate high wind speeds?

p. 20, l. 14: “with the AMS” instead of “in the AMS”

p. 20, l. 20: “by Maffezzoli” according to the sentence structure

p. 21, l. 21: “summer”, l. 26: delete “overall”

p. 21, l. 27f: the notation of the chemical species is not clear,

p. 21, l. 29: Based on AMS measurements

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