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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Marine productivity and synoptic meteorology drive summer-time variability in Southern Ocean aerosols" *by* Joel Alroe et al.

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Summary

Alroe *et al.* present a set of aerosol and meteorological observations obtained during a three-week test cruise of the *RV Investigator* between Hobart, Australia and the marginal ice zone of Antarctica along longitude 146°. Measurements made during the cruise include aerosol size distributions between 4 and 673 nm, size distributions of ultrafine aerosol (2-42 nm) using a Neutral Cluster and Air Ion Spectrometer (NAIS) instrument, cloud condensation nuclei (CCN) concentration measurements at 0.5%

supersaturation using a CCN counter, aerosol chemical composition measurements using an Aerosol Chemical Speciation Monitor (ACSM), aerosol hygroscopicity and volatility measurements using a Volatility and Hygroscopicity Tandem Differential Mobility Analyser (VH-TDMA), measurements of black carbon mass using a Multi-Angle Absorption Photometer (MAAP) and radon concentrations using a dual-flow-loop two-filter radon detector.

Using this extensive set of observations the authors draw several conclusions:

1. Although Aitken mode number fraction was around 75% on a number of occasions their relatively small median diameter (~ 30 nm) meant that the presence of increased numbers of Aitken mode particles correlated poorly with measured CCN concentrations. This suggests that nss-SO_4 new particle formation in the region may have little influence on local cloud droplet number concentrations and that further cloud processing or nss-SO_4 condensation is required to grow them to cloud-active diameters.
2. The authors note that CCN concentrations increased in aerosol transported from the Antarctic and Australian continents. This suggests that long-range transport of continental aerosols can effectively influence the entire Southern Ocean south of Australia.
3. As well as influence from the Australian continent, the authors also observed the influence of the Antarctic continent long distances offshore.
4. The authors note the important role the synoptic situation played in mediating aerosol properties during their expedition, especially the role of vertical transport between the marine boundary layer and the free troposphere in enhancing the number of Aitken mode particles.
5. The authors present evidence of a pronounced change in aerosol properties at $\sim 64°$S which they attribute to the transition into the polar atmospheric cell.

Major points

Unfortunately, I cannot recommend that this manuscript be accepted for final publication in ACP since in my eyes the scientific significance of the work is quite simply too low. The authors appear to have collected a nice dataset that is nicely presented in a well-written manuscript. However, the authors have essentially not gone beyond describing their measurements. As such, having read the manuscript I was left wondering what I had learned - the conclusions presented above hardly scratch the surface and are essentially well-established. Given this, my recommendation to the authors would be to submit the dataset and accompanying article to a journal for the publication of articles on original research data such as Copernicus's Earth System Science Data journal. If the authors do want to continue to present this research in ACP they need to delve far deeper into interpreting the data and ask themselves what this dataset can contribute that will take the field as a whole forward - in my eyes this goes beyond major revisions.

Minor points

Page 4, line 5 - In my eyes stating that "the ship and its sampling facilities are discussed in detail" elsewhere is not particularly helpful. I would like to see at least the basic information presented here alongside the data.

Page 6, line 29 - ". . . number fraction towards these distributions" would read better as "number fraction towards these sizes".

Page 14 - Although this is perhaps more personal taste, in my view the conclusions section is rather more of a summary. The conclusions of the paper should be more concise than its current form.

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