

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-568

Anonymous Referee #1

Referee comment on "Measurement report: Understanding the seasonal cycle of Southern Ocean aerosols" by Ruhi S. Humphries et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2022-568-RC1>, 2022

Humphries et al. provide new seasonally resolved aerosol data over two years from Macquarie Island and combine the new dataset with ship-based observations from the Australian sector of the Southern Ocean. The dataset is valuable as it provides one of the few observations of winter CCN in the region. The seasonal cycle of CN shows a maximum in summer and minimum in winter related to phytoplankton blooms. Slight differences in the timing of the seasonal cycle between various stations is attributed to the variability of phytoplankton in proximal waters. Given the sparse and sporadic measurements in the region and the large uncertainties in aerosol-cloud properties over the Southern Ocean, these data are an important addition to the literature to understand the spatial and temporal variability of CCN over the Southern Ocean. The manuscript is well written and follows a logical structure. I recommend publication and hope the minor comments below are helpful in improving the manuscript.

Minor suggestion

It would be really interesting to include particle size distribution data at Macquarie Island and compare to other sites.

Specific comments

L25 Suggest rewording to "Atmospheric time capsules such as ice cores have been pivotal in reconstructing the past variability of greenhouse gases and a large suite of aerosol constituents. However, ice core proxies are not currently available for all atmospheric parameters" or similar.

L26-27 proxy "of the" atmosphere?

L27-28 I agree that this is the best place to study baseline atmosphere. Its worth noting that the Southern Ocean and high-elevation remote East Antarctic Plateau is now influenced by atmospheric pollution (e.g., lead pollution and synthetic chemicals).

L55 Here is one more: Kremser, S., et al. (2020). "Southern Ocean Cloud and Aerosol data: a compilation of measurements from the 2018 Southern Ocean Ross Sea Marine Ecosystems and Environment voyage." *Earth Syst. Sci. Data Discuss.* 2020: 1-56.

L300 Air mass back trajectories would help here.

L319-320 Please add reference(s).