EGU22-5547
https://doi.org/10.5194/egusphere-egu22-5547
EGU General Assembly 2022

Aerosol-cloud interactions over the central Arctic Ocean

Paul Zieger[1,2], Linn Karlsson[1,2], Andrea Baccarini[3,4], Patrick Duplessis[5], Darrel Baumgardner[6], Ian M. Brooks[7], Rachel Chang[5], Lubna Dada[3,4], Kaspar R. Dällenbach[4], Radovan Krejci[1,2], W. Richard Leaitch[8], Caroline Leck[2,9], Matthew E. Salter[1,2], Heini Wernli[10], Micheal J. Wheeler[11], and Julia Schmale[3]

[1]Stockholm University, Air Research Unit, Department of Environmental Science, Stockholm, Sweden (paul.zieger@aces.su.se)
[2]Bolin Centre for Climate Research, Stockholm University, Sweden
[3]Extreme Environments Research Laboratory, École Polytechnique fédérale de Lausanne, Switzerland
[4]Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, Switzerland
[5]Department of Physics and Atmospheric Science, Dalhousie University, Canada
[6]Droplet Measurement Technologies, LLC, USA
[7]Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, UK
[8]Climate Research Division, Environment and Climate Change Canada, Canada
[9]Department of Meteorology, Stockholm University, Sweden
[10]Department of Environmental Systems Science, ETH Zürich, Switzerland
[11]Air Quality Research Division, Environment and Climate Change Canada, Canada

The physical and chemical properties of aerosol particles are important for the formation of cloud droplets and ice crystals. This is especially true for pristine regions such as the Arctic, where particle number concentrations are often very low. Observations from these regions are still sparse due to the technical challenges involved.

Here, we present recent results of detailed in-situ observations of aerosols and clouds performed on board the Swedish icebreaker *Oden* over the central Arctic Ocean in 2018. We show that Aitken-mode particles, i.e. particles below 70 nm diameter, contribute significantly to cloud-forming particles (here termed cloud residuals), especially towards autumn with the start of the freeze-up of the sea ice. These cloud-forming Aitken-mode particles coincided with air that spent more time over the ice, while accumulation-mode dominated cloud residuals showed more of an oceanic influence, as shown using air back trajectory analysis. At the same time, the Aitken-mode dominated cloud residuals were associated with changes in the average chemical composition of the accumulation mode showing an increased organic contribution, in contrast to the accumulation-mode dominated cloud residuals, which showed an increased sulfate contribution. The Hoppel-minima in both whole-air and cloud residual size distributions was almost unchanged, suggesting only little addition of aerosol mass due to aqueous-phase cloud processing. Our highly detailed observations of aerosol-cloud interactions over the central Arctic Ocean close to the North Pole provide valuable insights into the properties and the origin of particles that are relevant for cloud formation in this remote region of our planet.

This work is currently in review at the Journal of Geophysical Research (JGR).