EGU24-16865, updated on 28 Mar 2025
https://doi.org/10.5194/egusphere-egu24-16865
EGU General Assembly 2024

Observation of fluorescent primary biological particles at the North Pole: A case of inter-coupled system behaviour?

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Aerosol-cloud interactions remain among the most uncertain key parameters in the fast-changing Arctic climate system. Arctic clouds often consist of both liquid droplets and ice crystals, the abundance of which is constrained by the availability of ice nucleating particles (INP). We present observations of fluorescent primary biological aerosol particles (fPBAP), shown to be potent INP, obtained during the Arctic Ocean 2018 expedition onboard the Swedish icebreaker Oden in August- September of 2018, at the North Pole. The fPBAP were recorded on a single-particle level using a Multiparameter Bioaerosol Spectrometer, as a part of a complete setup for measuring physical and chemical aerosol properties. Potential sources of fPBAP during an extended period of high concentrations are investigated using a combination of auxiliary measurements, trajectory analysis, remote sensing data, ocean biogeochemistry reanalysis data, and model experiments with WRF-Chem. Our evidence suggests that the observed case of increased fPBAP concentration at the North Pole was caused by transport of fPBAP enriched marine aerosol from a source within the Arctic region, but in open water south of the pack ice. We also highlight how future interdisciplinary efforts can be used more efficiently to improve the source mapping of Arctic fPBAP, which is needed to assess their overall climate-relevance in the polar regions.