Aircraft observation of aerosols and clouds in the Arctic

*Sho Ohata[1], Atsushi Yoshida[1], Moteki Nobuhiro[1], Kouji Adachi[2], Makoto Koike[1]

1. Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo, 2. Meteorological Research Institute

The Arctic is warming more rapidly than the rest of the globe, but the contributions from forcing and feedback mechanisms associated with aerosols and clouds remain uncertain. During March-April in 2018, we participate in the intensive aircraft observation campaign as a part of Polar Airborne Measurements and Arctic Regional Climate Model Simulation Project (PAMARCMiP) 2018. The general goal of PAMARCMiP is to obtain a comprehensive data set of atmospheric and sea ice properties that will be used to understand and quantify the interaction between atmospheric aerosols, surface optical properties, and clouds in the central Arctic. A research aircraft will be operated by AWI in Germany (DC3 aircraft, call as POLAR 5) and a series of aircraft measurements are made from Station Nord (northern tip of Greenland). In this project, we measure horizontal and vertical distributions of aerosols including dark-colored aerosols such as black carbon (BC) and iron oxides (FeO_x), using in-situ instruments on board the Polar 5 aircraft. We also collect aerosol samples on the aircraft for analysis with a transmission electron microscope. BC and FeO_x aerosols transported from mid- and high-latitudes to the Arctic strongly absorbs the solar radiation and may accelerate the warming of the Arctic. We characterize the size distributions and mixing states of BC and FeO_x aerosols from near the ground to tropopause, and evaluate the relative importance of emission sources and transport processes that control spatial distributions of these aerosols. In addition, we also measure size distributions and cloud water content of low clouds in the Arctic. Although it has been reported that mixed-phase clouds persistently appear in the Arctic lower troposphere, the mechanism of their persistency is quite uncertain. We aim to characterize vertical structures of mixed-phase clouds and evaluate possible impacts of aerosols on these clouds.
In this presentation, we introduce the overview of the observation campaign and show some preliminary results.

Keywords: Aircraft observation, Arctic, Aerosol, Black carbon, Mixed-phase cloud

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