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Transport of North American pollution plumes towards the Arctic detected by aircraft based aerosol composition measurements in the Arctic 2008 summer season during the POLARCAT-France campaign

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Mass spectrometric aerosol measurements were performed on board the French research aircraft "ATR42" within the POLARCAT-France project in July 2008 from Kangerlussuaq, Greenland. The objective of the project was to study the influence of European, North American and Siberian pollution on the clean Arctic air. An Aerodyne C-ToF-AMS was operated during 8 research flights near Kangerlussuaq, Greenland. The flights covered low altitudes (400 m above sea surface and 1300 m above the ice cap) as well as the free troposphere up to 7000 m. Additional instrumentation included aerosol and cloud microphysics (particle number concentration and size distribution), CO and O_3 measurements, as well as aerosol and ozone lidars. Here we present vertical profiles of the submicron sulfate and organic aerosol as well as mass size distributions of these species. While generally the Arctic air in the free troposphere was found to contain very small submicron aerosol mass concentrations (typically 0.1 – 0.5 μg m^{-3}), several distinct particle layers were identified that contained sulfate aerosol. Backward trajectories indicate that the air masses containing these sulfate aerosol particles arrived from the North American continent (eastern Canada and the north-eastern US). Furthermore, a positive correlation of sulfate aerosol and ozone was observed in the mid troposphere, most likely explained by the fact that sulfate aerosol originates from aircraft emissions that are emitted in the tropopause region while ozone is dominated by stratospheric sources.