Geophysical Research Abstracts
Vol. 17, EGU2015-5951, 2015
EGU General Assembly 2015

Pollution in the Summertime Canadian High Arctic observed during NETCARE 2014: Investigation of origin and composition

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The clean and sensitive Arctic atmosphere is influenced by transport of air masses from lower latitudes that bring pollution in the form of aerosol particles and trace gases into the Arctic regions. However, the transport processes causing such pollution events are yet not sufficiently well understood.
Here we report on results from the aircraft campaign NETCARE 2014 that took place in July 2014 in Resolute Bay, Nunavut (Canada) as part of the "Network on Climate and Aerosols: Addressing Key Uncertainties in Remote Canadian Environment" (NETCARE). These airborne measurements add to only a very few of such measurements conducted in the Arctic during the summertime. The instrumentation on board the research aircraft Polar 6 (operated by the Alfred Wegener Institute for Polar and Marine Research) included a large set of physico-chemical aerosol analysis instruments, several trace gas measurements and basic meteorological parameters.
Here we focus on observed pollution events that caused elevated trace gas and aerosol concentrations in the summertime Canadian High Arctic between 50 and 3500 m. In order to better understand the chemical composition and the origin of those polluted air masses, we use single particle aerosol composition obtained using the Aircraft-based Laser Ablation Aerosol Mass Spectrometer (ALABAMA), combined with aerosol size distributions and number concentrations from an Optical Particle Counter as well as trace gas measurements of CO and CO_2. CO and CO_2 are important tracers to study pollution events, which are connected to anthropogenic and non-anthropogenic combustion processes, respectively biomass burning and fossil fuel combustion. The ALABAMA provides a detailed single particle aerosol composition analysis from which we identify different particle types like soot-, biomass burning-, organics-, diesel exhaust- and metallic particles. The measurements were compared to Lagrangian models like FLEXPART and LAGRANTO to find the pollution sources and transport pathways of the respective plumes into the Arctic.
First results indicate a strong influence of biomass burning originating in the Northwest Territories several days before the measurements above Resolute Bay. This long range transport was associated with cyclonic activities of a prevailing low pressure system. Trace gas measurements as well as particle concentrations and sizes show an enhancement in the plume region around 2 km. The particles in this pollution plume were composed of soot, nitrate, cyanide and levoglucosan, confirming biomass burning as particle source.