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Siberian and European pollution transport to the Arctic region: aircraft studies during the POLARCAT-FRANCE spring experiment

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As part of POLARCAT-FRANCE, an aircraft campaign took place in Kiruna (North Sweden) in March-April 2008. The major objective was to study the impact of transport processes on ozone and aerosol distributions and cloud microphysics in the Arctic region. An ATR-42 equipped with remote sensing instrument (3 wavelength backscatter lidar, radar) and in-situ measurements of gases (O3, CO), aerosol and cloud properties has been used in addition to satellite observation (Aqua-Train, IASI). The 12 aircraft flights occurred during a period characterized by frequent northward transport of European pollution and even the sampling of a Siberian forest fire event across the pole.

We will report on 2 case studies: (i) sampling with the aircraft of European outflow with clear signature of the mid-latitude pollution (aerosol, CO), (ii) sampling of an aged forest fire plume which was transported during more than 3 days over the pole. The analysis is based on the vertical lidar meridional cross section between 68N and 72N showing layers of increased aerosol backscatter at 3 wavelengths and correlation with gas (CO) and aerosol in-situ measurements. We have used ECMWF analysis and domain filling backward trajectories using the FLEXPART model in order to characterize the position of the layer with respect to the Arctic front and the origin of the air masses. The time evolution of the polluted layers, i.e. mixing with the background troposphere and the aerosol transformation will be studied by combining the aircraft lidar data with similar measurements made either by other aircraft or by the Calipso lidar. Lagrangian connections between the ATR-42 data and the Calipso lidar have been already established for the Siberian fire forest plume observed on April 11th. The aerosol in-situ measurements will be used to assess the analysis of aerosol properties based on the 3 wavelength and polarized lidar data. This is required for the interpretation of the relative between Calipso and the airborne lidar data.