Absorbing aerosols monitoring over remote regions

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Abstract: Although the Earth's atmosphere consists primarily of gases, aerosols and clouds play important roles in the Earth's energy balance and climate. Aerosols alter the Earth's energy budget directly by scattering and absorbing radiation and indirectly by modifying cloud microphysical and radiative properties. Evaluation of aerosol effects on climate must take into account high spatial and temporal variation of aerosol amounts and properties as well as the aerosol interactions with clouds and precipitation. Combustion of carbonaceous fuels for the production of energy inevitably results in the emission of gas and particulate air pollutants. A large fraction of the emitted particles are light absorbing carbonaceous aerosols that exhibit very large optical absorption across the spectrum. The most measured light absorbing carbonaceous aerosol is black carbon (BC), a unique primary tracer for combustion emissions as it is not emitted by any other sources. In the project "Absorbing aerosols monitoring over remote regions", we have used a lightweight aircraft to obtain information on the BC and other light absorbing carbonaceous aerosols concentrations. Thus, we have determined the regional heterogeneity and vertical distribution in the atmosphere of carbonaceous aerosols with a minor payload and for a fraction of the costs associated with large airborne platforms. The aircraft has been equipped with an aethalometer to measure aerosol absorption at different wavelengths. The wavelength dependence of absorption will enable us to apportion BC concentrations to two major sources: biomass and fossil fuel combustion. Measurements have been performed throughout the flight including regions where no or very little measurements have been performed in the past, such as the Arctic, Africa, South America and over the Atlantic Ocean. Along the flight special spiral flights over lidar stations operated in the frame of the global network GALION were carried out and were analyzed in this work. Plumes of pollution and mineral dust were detected and by the use of back trajectories the possible source regions were identified.

Keywords: absorbing aerosols; aircraft measurements; remote regions.

IXWLMLA Topic: Lidar networking