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Properties of submicron particles in Atmospheric Brown Clouds

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The Atmospheric Brown Clouds (ABC) is an important problem of this century. Investigations of last years and satellite data show that the ABC (or brown gas, smog, fog) cover extensive territories including the whole continents and oceans. The brown gas consists of a mixture of particles of anthropogenic sulfates, nitrates, organic origin, black carbon, dust, ashes, and also natural aerosols such as sea salt and mineral dust. The brown color is a result of absorption and scattering of solar radiation by the anthropogenic black carbon, ashes, the particles of salt dust, and nitrogen dioxide. The investigation of the ABC is a fundamental problem for prevention of degradation of the environment. At present in the CIS in-situ investigations of the ABC are carried out on Lidar Station Teplokluchenka (Kyrgyz Republic). Here, we present the results of experimental investigation of submicron (nanoscale) particles originating from the ABC and the properties of the particles. Samples of dust precipitating from the ABC were obtained at the area of Lidar Station Teplokluchenka as well as scientific station of the Russian Academy of Sciences near Bishkek. The data for determination of the grain composition were obtained with the aid of the scanning electron microscopes JEOL 6460 LV and Philips XL 30 FEG. Analysis of the properties of the particles was performed by means of the X-ray diffraction using diffractometer Siemens D5000. The images of the grains were mapped. The investigation allows us to get (after the image processing) the grain composition within the dust particle size range of 60 nm to 700 μm. Distributions of nano- and microscale particles in sizes were constructed using Rozin-Rammler coordinates. Analysis of the distributions shows that the ABC contain submicron (nanoscale) particles; 2) at higher altitudes the concentration of the submicron (nanoscale) particles in the ABC is higher than at lower altitudes. The chemical compositions of the particles are shown to be close to those typical for the ABC. We present also the results of the study of morphology and mineralogical composition of the obtained particles as well as their magnetic properties. This study was supported by the Division of Earth Sciences, Russian Academy of Sciences (research program “Nanoscale particles in nature and technogenic products: conditions of existence, physical and chemical properties, and mechanisms of formation”) and by ISTC (project No. KR–1522).