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Characteristics of mineral aerosol deposited on the glaciers of Mt. Elbrus, Caucasus, Russia.

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Records of mineral aerosol (desert dust) stored in glaciers provide data on frequency and intensity of deposition events, source regions and atmospheric pathways of mineral dust. We present and discuss a chronology of dust deposition events recorded in the shallow firn and ice cores extracted on the Western Plateau, Mt. Elbrus (5150 m a.s.l.), Caucasus Mountains, Russia and covering the period of 2009-2013. Particle size distribution and chemical analysis (major ions, trace elements) were peformed using Coulter Counter Multisizer III, Abacus particle counter, IC and ICPMS analysis. Sampling was performed using continuous flow analysis (CFA) system. Annual average dust flux (264 μg/cm2 a-1) and average mass concentration (1.7 mg/kg) over the period 2007-2013 were calculated for the first time for this region. A combination of satellite imagery (MSG SEVIRI), trajectory models (FLEXTA, HYSPLIT) and meteorological data were used to accurately date each of the dust layers observed in shallow cores and investigate provenance of the dust and its pathways. Desert dust originating from the Middle East and Sahara was deposited on the Caucasus glaciers 3-6 times a year. Although less frequent, Saharan events are characterized by considerably higher dust loads than the more frequent Middle Eastern events. The mass median diameter of dust particles ranged between 2 and 9 μm. The deposition of dust resulted in elevated concentrations of most ions, especially Ca2+, Mg2+, K+, and sulphates. Dust originated from or passing over the Middle East was characterised by the elevated concentrations of nitrates and ammonia. This may be related to dust emissions from agricultural fields which, if abandoned due to droughts, become important sources of dust. By contrast, samples of the Saharan dust originated from natural sources showed lower concentrations of ammonium. The mean values of crustal enrichment factors for the measured trace elements including metals were calculated. Overall, the enrichment factors were lower for such elements as V, Cr, Mn, Co, Ni, and Pb, indicating that these metals originated from rocks and soil. The enrichment factors for Cu, Zn and Cd were lower pointing at the contribution of anthropogenic sources.

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