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Single particle chemical composition and shape of fresh and aged Saharan dust in Morocco and at Cape Verde Islands during SAMUM I and II

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The Saharan Mineral Dust Experiment (SAMUM) is focussed to the understanding of the radiative effects of mineral dust. During the SAMUM 2006 field campaign at Tinfou, southern Morocco, chemical and mineralogical properties of fresh desert aerosols were measured. The winter campaign of Saharan Mineral Dust Experiment II was based in Praia, Island of Santiago, Cape Verde. This second field campaign was dedicated to the investigation of transported Saharan Mineral Dust.

Aerosol particles between 100 nm and 500 μm (Morocco) respectively 50 μm (Cape Verde) in diameter were collected by nozzle and body impactors and in a sedimentation trap. The particles were investigated by electron microscopic single particle analysis and attached energy-dispersive X-ray analysis. Chemical properties as well as size and shape for each particle were recorded.

Three size regimes are identified in the aerosol at Tinfou: Smaller than 500 nm in diameter, the aerosol consists of sulfates and mineral dust. Larger than 500 nm up to 50 μm, mineral dust dominates, consisting mainly of silicates, and – to a lesser extent – carbonates and quartz. Larger than 50 μm, approximately half of the particles consist of quartz. Time series of the elemental composition show a moderate temporal variability of the major compounds. Calcium-dominated particles are enhanced during advection from a prominent dust source in Northern Africa (Chott El Djerid and surroundings). At Praia, the boundary layer aerosol consists of a superposition of mineral dust, marine aerosol and ammonium sulfate, soot, and other sulfates as well as mixtures thereof. During low-dust periods, the aerosol is dominated by sea salt. During dust events, mineral dust takes over the majority of the particle mass up to 90 %. Particles smaller 500 nm in diameter always show a significant abundance of ammonium sulfate.

The particle aspect ratio was measured for all analyzed particles. Its size dependence reflects that of the chemical composition. At Tinfou, larger than 500 nm particle diameter, a median aspect ratio of 1.6 is measured. Towards smaller particles, it decreases to about 1.3. Evaluation of the Cape Verde data will show whether a significant difference exists between fresh and aged Saharan dust in aspect ratio.