Single particle chemical composition and state of mixing of aged Saharan dust

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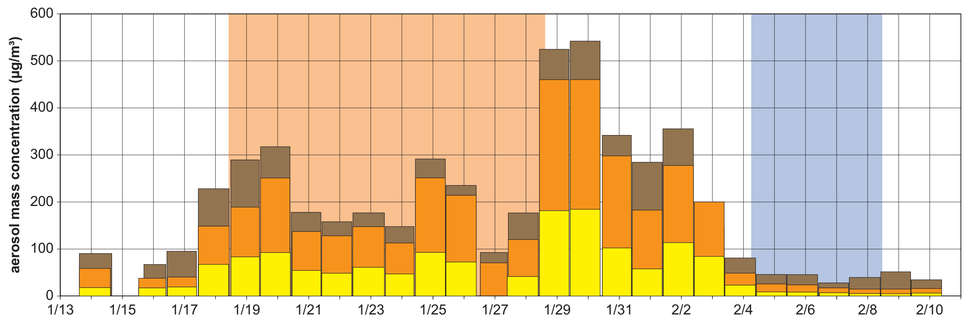
Introduction

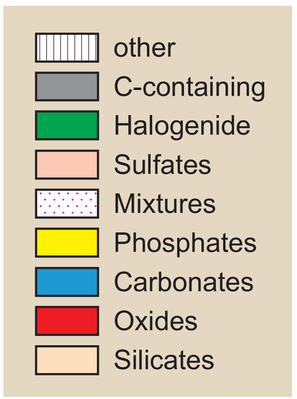
The Saharan Mineral Dust Experiment (SAMUM) is focussed to the understanding of the radiative effects of mineral dust.
The winter campaign of Saharan Mineral Dust Experiment II in 2008 was based in Praia, Island of Santiago, Cape Verde. It was dedicated to the investigation of transported Saharan Mineral Dust. For this work, samples were collected ground-based with a miniature impactor system, a sedimentation trap, and a free-wing impactor. The size-resolved chemical composition was determined by scanning electron microscopy and energy-dispersive X-ray microanalysis of single particles.

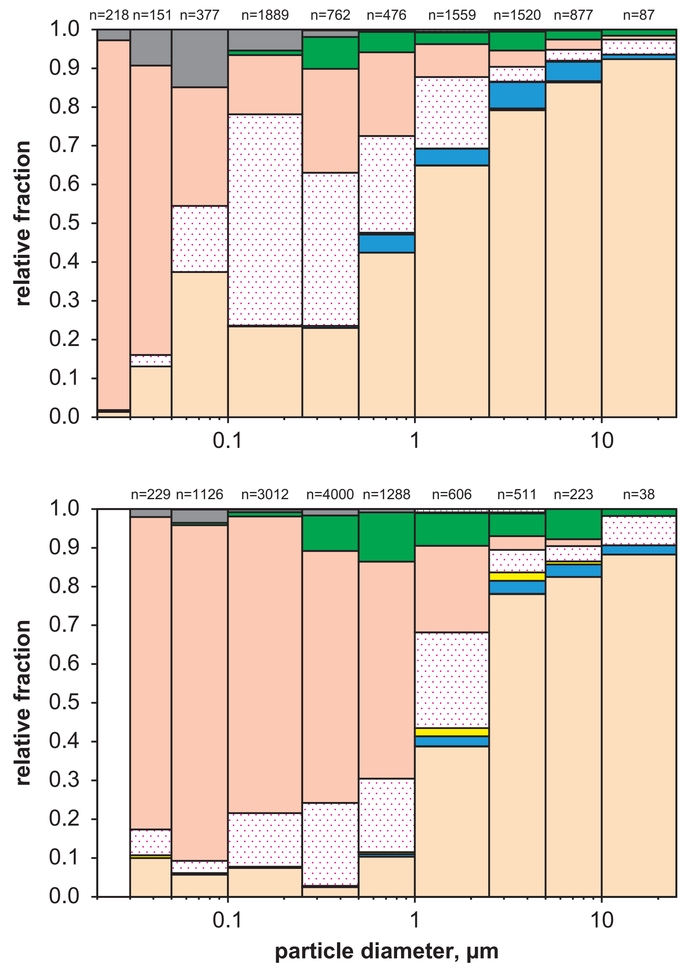
Composition

- superposition of mainly mineral dust, marine aerosol and sulfates
- at Praia always a large amount of mineral dust is present
- during dust events more mixed dust/sulfate particles are found than during low-dust situations
- during dust events submicron particles (larger than 100 nm) consist of a significant fraction of mineral dust
- particles smaller than 100 nm are always dominated by ammonium sulfate and soot

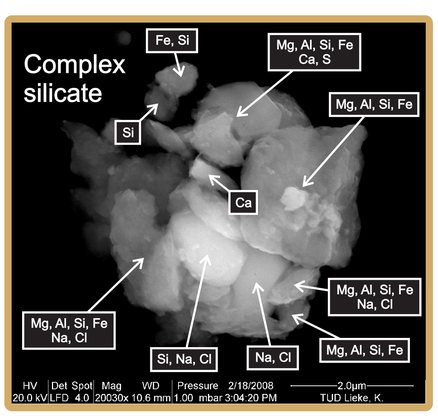


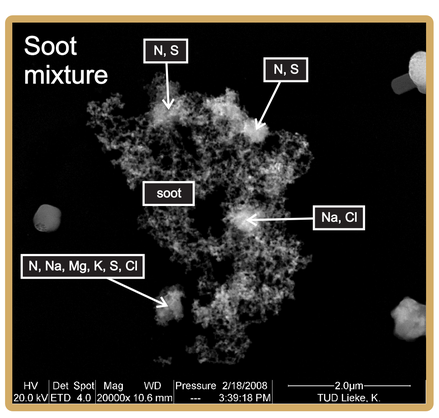
Mass concentrations at Praia for TSP (brown), PM_{10} (orange) and $PM_{2.5}$ (yellow); the dust event period is marked in orange, the low-dust situation in blue

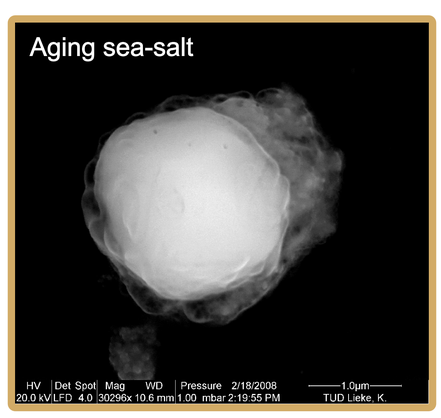


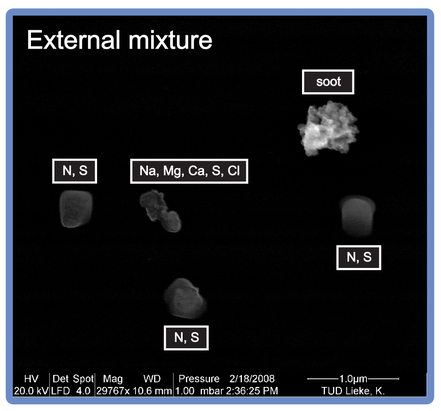


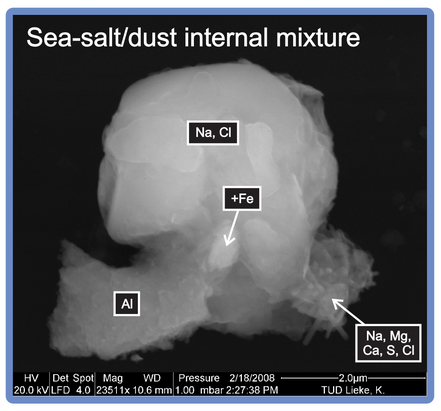
Average relative abundance of particle types in Praia for dust events (upper graph) and low-dust situations (lower graph)











Mixing state

Dust events
- large particles consist of dust with small amounts of sulfate and sea-salt particles
- small particles are composed of a wide range of dust and sulfate fractions

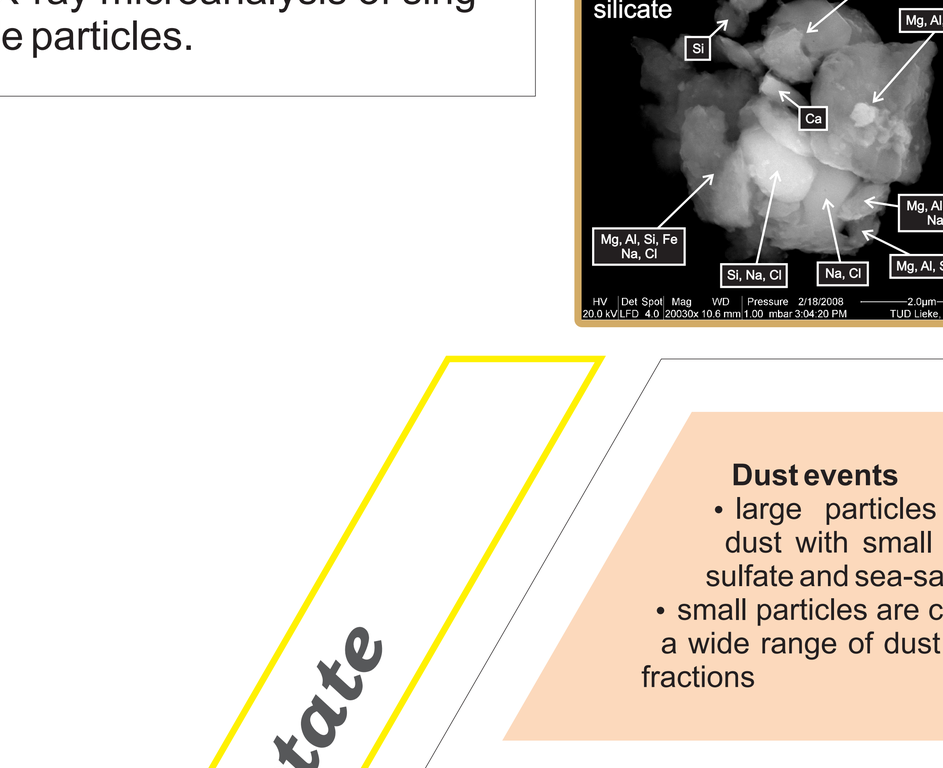
Low-dust situation
- fewer large dust particles, mixed with small amount of sulfate
- aged sea-salt particles
- high amount of small sulfate-dominated particles

Ternary diagrams of Si, Cl and S indices

The index value is defined as the ratio of the atomic element content of the particular element to all elements found in the particles with Z > 8. Element index is given in %. Only particles with a dominant contribution of Si, Cl and S (Si+Cl+S-index > 40 %) are displayed.

Legend

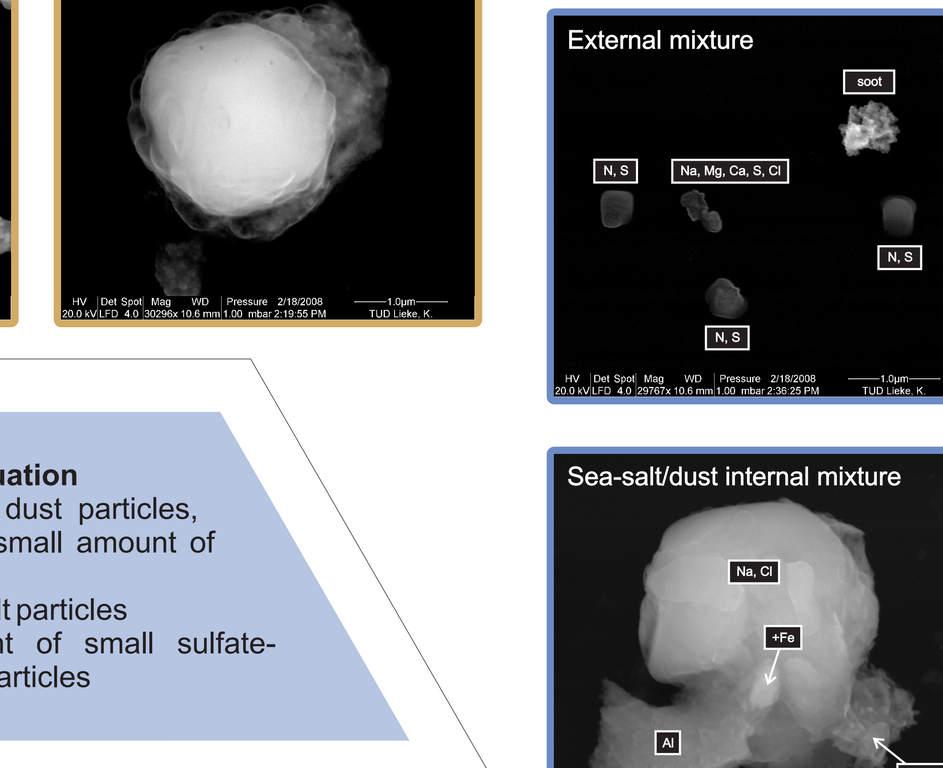
- d > 2.5 µm
- 0.7 µm < d < 2.5 µm
- 0.3 µm < d < 0.7 µm



4115 of 7916 total particles are displayed in this graph

Scheme of the ternary diagrams

The bottom axis represents aging of mineral dust by sulfate deposition. The right axis stands for mechanical mixing of dust with sea-salt or for gaseous chlorine deposition. The left axis shows potential ageing of sea-salt particles.



4262 of 11043 total particles are displayed in this graph

Dust advection | **Low-dust situation**