

Bioaerosols: Sources, transport, transformation and effects

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Biogenic aerosols are ubiquitous in the Earth's atmosphere, influencing atmospheric chemistry and physics, the biosphere, climate, and public health. They play an important role in the spread of biological organisms, and they can cause or enhance human, animal, and plant diseases. Moreover, they can initiate the formation of clouds and precipitation as cloud condensation and ice nuclei (CCN, IN)[1].

Primary biogenic aerosol (PBA) particles and components like pollen, fungal spores, bacteria, carbohydrates, and proteins are emitted directly from the biosphere to the atmosphere. They account for up to ~30% of fine and up to ~70% of coarse particulate matter in rural and rainforest air, and the estimates of PBA emissions range from ~60 Tg a⁻¹ of fine particles up to ~1000 Tg a⁻¹ of total particulate matter. Fungal spores account for a large proportion of PBA with typical number and mass concentrations of ~10⁴ m⁻³ and ~1 µg m⁻³ in continental boundary layer air and estimated global emissions of the order of ~50 Tg a⁻¹ and 200 m⁻² s⁻¹, respectively [1-3].

Recent advances in the DNA analysis and molecular genetic characterisation of aerosol filter samples yield new information about the sources and composition of PBA and provide new insight into regional and global biodiversity [4,5]. Moreover, numerical simulations with state-of-the-art atmospheric chemistry and climate models help unravelling the regional and global distribution and transport of PBA [6].

The atmospheric abundance and environmental effects of PBA particles are particularly pronounced in tropical regions, where both the biological activity at the Earth's surface and the physicochemical processes in the atmosphere are particularly intense and important for the Earth system and global climate. If climate change and human activities lead to changes in the abundance and properties of PBA, this might influence the hydrological cycle and provide a feedback to climate change [1-3].

- [1] Pöschl (2005) *Angew. Chem. Int. Ed.*, **44**, 7520–7540.
[2] Fuzzi *et al.* (2006) *Atmos. Chem. Phys.*, **6**, 2017–2038.
[3] Elbert *et al.* (2007) *Atmos. Chem. Phys.*, **7**, 4569–4588.
[4] Després *et al.* (2007) *Biogeosciences*, **4**, 1127–1141.
[5] Fröhlich-Nowoisky *et al.* (2009) submitted. [6] Burrows *et al.* (2009) submitted.

Individual particles in atmospheric dust from Saudi Arabia

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Aerosol particles from desert dust interact with clouds and influence climate on a regional and global scale. The Riyadh aerosol campaign was initiated to study the effects of dust particles on cloud droplet nucleation and cloud properties. Here we report the results of individual-particle studies of samples that were collected from an aircraft in April 2007. We used analytical transmission electron microscopy, including energy-dispersive X-ray spectrometry, electron diffraction, and imaging techniques for the morphological, chemical, and structural characterization of the particles.

The coarse fraction resembles freshly crushed rock. The particles are almost exclusively mineral dust grains and include common rock-forming minerals, among which sheet silicates are the most abundant. Unaltered calcite grains also occur, indicating no significant atmospheric processing. The particles have no visible coatings and may contain only traces of sulfur. The amount of dust was likely overwhelming compared to other, more reactive atmospheric constituents, and even the carbonate particles survived the atmospheric transport.

The fine fraction consists of ammonium sulfate (with variable organic coating and with or without soot inclusions) and combustion-derived particles (mostly soot) in addition to mineral dust. The majority of mineral particles in the fine fraction are internally mixed with ammonium sulfate or soot or both.

Concerning the cloud nucleating ability of the observed particles, almost any type is likely to be effective as CCN. Giant mineral aggregates, particularly those that include clay minerals, are likely to be excellent cloud condensation nuclei. In the fine fraction, minerals partly reacted and coagulated with ammonium sulfate and pollution particles, forming mixtures that are likely to be hygroscopic. The ammonium sulfate particles (and their internal mixtures with soot and mineral particles) are in the size range where they can be CCN even at low supersaturations.