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Characterization and quantification of bioaerosols in Saharan dust transported across the Atlantic

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Primary biological aerosols (bioaerosols), forming a subset of atmospheric particles, are directly released from the biosphere into the atmosphere. They comprise living and dead organisms (e.g., algae, bacteria, archaea), reproduction units (e.g., pollen, seeds, spores) as well as organism fragments and excretions. They play a key role in the dispersal of otherwise mostly sessile organisms (e.g. plants), but also in the spread of pathogens and diseases. Recently, also soil dust has been described to frequently occur in a close connection with biological particles (Conen et al., 2011). Bioaerosols can serve as nuclei for cloud droplets and ice crystals and may influence the radiative properties of the atmosphere, thus influencing the hydrological cycle and climate (Fröhlich-Nowoisky et al., 2016). It has been well described that dust masses are transported across the Atlantic comprising a large variety of bacteria and fungi, but the origin of the biological material remained largely unknown (Prospero et al., 2005). In the present study we aim to accomplish three major tasks, i.e., 1) Thorough identification and quantification of bioaerosol particles, 2) Characterization of ice nucleating (IN) properties of bioaerosols, and 3) Evaluation of similarities between bioaerosols and biological material in source regions of dust.

For our field work we utilized filter techniques to collect aerosol samples of transatlantically transported dust at the easternmost site (Ragged Point) on the Caribbean island Barbados. Sampling took place from July to August 2016, when dust transport volumes were expected to reach peak amounts. Total suspended particles were collected ~30 m above sea level using a high volume sampler (~ 500 L min^{-1}) and a micro-orifice uniform deposit impactor (MOUDI™) to obtain size-resolved samples. Directly after sampling at different time intervals (i.e. 24-hour, 48-hour, and 7-day samples) the filters were frozen until further analyses. In a complementary approach, soil material was collected in dust source regions in the African Sahel.

These filter and soil samples are currently being used to investigate the microbial composition of the aerosols by means of genetic techniques (NGS-sequencing). We also investigate and characterize the IN properties of the filter samples utilizing filtration, thermal, chemical and enzyme treatments. Immersion freezing experiments are performed at relatively high subzero temperatures (-1 to -15˚C) using the mono ice nucleation array (MINA). Utilizing microscopy, we want to understand the connection between biological organisms and dust particles.

Cited literature:

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