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Single particle analysis of eastern Mediterranean aerosol particles: Influence of the source region on the chemical composition

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The Mediterranean region is one of the most climatically sensitive areas and is influenced by air masses of different origin. Aerosol particles are one important factor contributing to the Earth‘s radiative forcing, but knowledge about their composition and sources is still limited.

Here, we report on results from the INUIT-BACCHUS-ACTRIS campaign, which was conducted at the Cyprus Atmospheric Observatory (CAO, Agia Marina Xyliatou) in Cyprus in April 2016. Our results show that the chemical composition of the aerosol particles in the eastern Mediterranean is strongly dependent on their source region.

The composition of particles in a size range between 150 nm and 3 μm was measured using the **A**ircraft-based **L**aser **AB**lation **A**erosol **MA**ss spectrometer (ALABAMA), which is a single particle laser ablation instrument using a bipolar time-of-flight mass spectrometer. The mass spectral information on cations and anions allow for the analysis of different molecular fragments. The information about the source regions results from backward trajectories using HYSPLIT Trajectory Model (Trajectory Ensemble) on hourly basis. To assess the influence of certain source regions on the air masses arriving at CAO, we consider the number of trajectories that crossed the respective source region within defined time steps. For a more detailed picture also the height and the velocity of the air masses during their overpass above the source regions will be considered.

During the campaign at CAO in April 2016 three main air mass source regions were observed: 1) Northern Central Europe, likely with an enhanced anthropogenic influence (e.g. sulfate and black carbon from combustion processes, fly ash particles from power plants, characterized by Sr and Ba), 2) Southwest Europe, with a higher influence of the Mediterranean Sea including sea salt particles (characterized by, e.g., Na_xCl_y, $NaCl_xNO_y$), 3) Northern Africa/Sahara, with air masses that are expected to have a higher load of mineral dust particles (characterized by typical elements like Al, Si, Ca, Fe). To estimate the influence of the selected regions, we compare the time series of the dominating elements or molecular fragments to the times with trajectories from specific source regions. For differentiation between short and long-range transported particles, molecules that are typical for aging processes in the atmosphere, e.g., products from reaction with ozone, nitric and sulfuric acid will be considered. Additionally, modifications of the internal mixing state of the particles during the measurement period will be studied.

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