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Aerosol chemical composition measurements from a ship campaign across the Mediterranean and Middle East during the summer of 2017

James Brooks (1), Eoghan Darbyshire (1), Frank Drewnick (2), Marcel Dorf (2), Jos Lelieveld (2), Hugh Coe (1,3), and Stephan Borrmann (2)

(1) University of Manchester, School of Earth and Environmental Sciences, Centre of Atmospheric Science, United Kingdom, (2) Max-Planck Institute for Chemistry, Mainz, Germany., (3) National Centre for Atmospheric Science, UK.

The Mediterranean basin is an area encompassing a variety of environments and climates, with the region susceptible to both long-range transport of atmospheric aerosol from Europe, Africa and the Middle East, as well as local sources such as ship emissions. There is a key relationship between aerosol and atmospheric chemistry. The reactive uptake of pollutant gases by mineral compounds can drastically change the particle properties, whereas the aerosols in turn influence the gas phase chemistry. Acidic pollutants can turn the particles from hydrophobic into hydrophylic, and convert them into efficient cloud condensation nuclei (CCN) (Karydis et al., 2011). This can alter the microstructure of clouds and increase removal of the particulates by deposition processes (Abdelkader et al., 2016). These processes have been found to be of key importance for Saharan dust that is transported over the Mediterranean basin.

Although the Middle East and Mediterranean regions are a global change hot spot, they have received only little attention, e.g., in reports of the Intergovernmental Panel on Climate Change (IPCC, 2013). One reason is that observational data are insufficient, unavailable or of limited quality. In the past, studies needed to rely on satellite observations and sparse meteorological data. Atmospheric chemistry data are essentially non-existent.

The Air Quality and climate change in the Arabian Basin (AQABA) study aims to alleviate these issues with unique field measurements, combined with satellite observations and high resolution atmospheric chemistry and climate modelling. A comprehensive ship-borne campaign took place from June-September 2017 measuring gases and particles in the Arabian Basin and the Mediterranean, studying the regional contrasts that occur in the atmospheric pollutants. The results presented here are collected from an aerosol instrument called a High-Resolution Time-of-Flight Aerosol Mass Spectrometer (HR-ToF-AMS), which collected aerosol chemical composition measurements. The presentation will summarise the key features in the regional aerosol burden for these regions, with an analysis into the sources of air masses.

Some preliminary results indicate the influence of long-range transportation from mainland Europe, bringing large mass concentrations of organic aerosol, with smaller-scale influences from ship emissions that are high in sulphate concentrations. Also, nearer the coast of Africa, there is long range aerosol transportation carrying dust and other aerosol chemical species from the Middle East into the Mediterranean. This presentation will expand on these early findings and seek to shed light on the chemical composition of aerosol across the Mediterranean.

References:
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