Geophysical Research Abstracts
Vol. 13, EGU2011-4201, 2011
EGU General Assembly 2011

Comparison of regional pollution and background air characteristics in coastal Southern Spain

Jovana-Maria Diesch (1), Sören Rasmus Zorn (1,3), Sarah-Lena von der Weiden (1,2), Frank Drewnick (1), Stephan Borrmann (1,2)

(1) Max-Planck-Institute for Chemistry, Particle Chemistry Department, Mainz, Germany (j.diesch@mpic.de), (2) Institute for Atmospheric Physics, J. Gutenberg University, Mainz, Germany, (3) now at: School of Engineering and Applied Sciences, Harvard University, Cambridge, U.S.A.

Measurements of the ambient aerosol, various trace gases and meteorological parameters were performed during the DOMINO (Diel Oxidant Mechanisms In relation to Nitrogen Oxides) campaign at the Southern coast of Spain. The campaign took place from mid-November to mid-December 2008 at the atmospheric research station "El Arenosillo" located between a natural park, industrial cities (Huelva, Seville) and the Atlantic Ocean. Therefore, the study presented here provides the opportunity to investigate the influence of continental, urban and marine source regions on the local air composition associated with wind patterns of the air arriving at the measurement station. We also focus on particle formation and growth events as they have been frequently observed in different source regions, connected with characteristic features.
To study the variability of the air composition chemical and physical particle properties, trace gases and meteorology have been measured with high temporal resolution. Size distribution instruments (OPC, FMPS, APS, ELPI) covering a size range from 5.6 nm up to 32 μm were used and the chemical composition of the non-refractory aerosol in the submicron range was measured by means of an Aerosol Mass Spectrometer (Aerodyne HR-ToF-AMS). Furthermore, number and mass concentrations as well as PAH and black carbon concentrations were registered in PM1. Gas phase species analyzers monitored various trace gases in the air and a weather station provided meteorological parameters.
The particle mass and number concentration and composition as well as the size distributions observed during this campaign were highly variable. Locally measured wind directions and back trajectory analysis indicate that the variability of the different air masses affecting "El Arenosillo" depends to a high degree on local and regional sources and processes but also the distance from sources plays a major role. The lowest average mass and number concentrations (2 μg m^{-3}, 1000 cm^{-3}) were found in marine air masses. While these mass concentrations are about two to four times lower than those observed in continental and urban influenced air masses, in the same air masses the highest sulfate PM1-fraction (54%, 0.91 μg m^{-3}) was identified. The major submicron aerosol fraction in continental (64%, 2.5 μg m^{-3}) and urban (61%, 4.2 μg m^{-3}) source regions consists of organic species. This aerosol component was further divided into four organic classes, a highly-oxygenated-, a semi-volatile-, a hydrocarbon-like- and a wood burning-related organic aerosol using Positive Matrix Factorization.
The variability of the air composition associated with different source regions affects the emergence and temporal evolution of nucleation events. Therefore, nucleation events, occurring in continental and the so-called pollution events originating in urban source regions exhibit different characteristics. While during the start of the nucleation events low mass concentrations were measured, pollution events are characterized by enhanced aerosol mass concentrations with especially sulfate concentrations being substantially higher. Ultrafine mode particles are more acidic during the particle growth period in both cases. While larger particle growth rates of about 4 nm/h were registered during nucleation events, smaller rates (3 nm/h) were observed in pollution events.

In addition to a detailed investigation of the variability of aerosols and trace gases depending on continental, urban and marine air mass origins, we present an investigation of the characteristics of particle nucleation and pollution events and discuss the differences of the measured parameters during nucleation, coagulation and growth periods.