Source apportionment studies on particulate matter in Beijing/China

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Problem & Motivation

More than 15 million people in the greater area of Beijing are still suffering from severe air pollution levels caused by sources within the city itself but also from external impacts like severe dust storms and long range advection from the southern and central part of China.

Within this context particulate matter (PM) is the major air pollutant in the greater area of Beijing (Garland et al., 2009). PM did not serve only as lead substance for air quality levels and therefore for adverse health impact effects but also for a strong influence on the climate system by changing e.g. the radiative balance.

In order to discriminate the composition of the particulate matter levels, the different behavior of coarser and smaller particles investigations on source attribution, particle characteristics and external impacts on the PM levels of the city of Beijing by measurements and modeling are performed.

Methodology

Measurements

• PARTICULATE CONCENTRATIONS: Daily PM filter sampling on quartz fiber filters with 2 High-Volume Samplers DHA80 (Digielt)
• PARTICLE COMPOSITION: Main and trace elements analyzed by PEDXRF (Polarized energy dispersive X-ray fluorescence)
• PERIOD: One years episode from June 2010 to June 2011

Modeling

• METEOROLOGY: COSMO weather forecast model of the German Weather Service
• GASES & AEROSOLS: simulation in ART (developed at KIT) of 80 gaseous species, 5 anthropogenic aerosol modes, mineral dust, sea salt and pollen
• FEEDBACKS: meteorology, aerosols, gas phase, dynamics, clouds
• PERIOD: 9-days episode from April 23rd to May 2nd 2011

Model results

Source apportionment - Factor Analysis

Factor 1: Geogenic sources
Factor 2: Fossil fuel combustion (oil and coal combustion) and waste incineration
Factor 3: Brake wear

See also poster on “Chemical composition of PM in a residential area of Beijing, China” in P-2-082

Outlook

• Source apportionment on the basis of inorganic compounds, organic compounds, EC, OC, carbon isotope
• Integration of anthropogenic emissions in addition to the natural ones to quantify the contributions of each source category to PM10 and PM2.5 in Greater Beijing
• Consideration of interactions between dust, radiation and cloud processes

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