Cite abstract as Author(s) (2009), Title, European Aerosol Conference 2009, Karlsruhe, Abstract T043A09

Air pollution by particulate matter in various heights, the example of Beijing

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Keywords: air quality, air pollution, mixing layer height, emissions, transport

Beijing is one of the Megacities showing the worst air quality conditions on the globe and additionally facing seasonal dust storms. The IMG is currently carrying out a DFG research project on the spatial distribution of urban aerosol pollution in Beijing. On the basis of these experiences, a KIT start-up project was launched in 2008/2009 to characterize the vertical composition of the Beijing atmosphere with special respect to the occurrence of particles.

Beijing air quality suffers frequently occurring air pollution events. Local and regional wind systems are able to refresh the air masses or stabilize air pollution over Beijing. One main local wind systems can be suggested to occur in Beijing, which is a mountain-valley wind system. This is induced by the more than 2000m high mountain ridge of the north-western Yundu and Xishan Mountains. On the other hand, this mountain ridge acts as barrier for air masses coming from southern directions with low velocities. During those meteorological conditions, air pollution can accumulate in the region of Beijing. The objective of this campaign is to investigate the strengths of wind systems during different weather situations by direct measurements and to assess their potential impacts on Beijing's atmosphere and air pollution.

Two field visits are carried out in end of winter 2008/2009 and beginning of spring 2009 to analyse the vertical distribution of atmospheric particles by various methods. Coarse geogenic, biogenic and anthropogenic particles were sampled by passive sampling methods on adhesive acceptor plates in various heights. PM2.5 is sampled by active samplers. The collected coarse particles will be analysed by automated optical microscopy at the DWD for size fraction distribution between 2.5 and 80µm. Under supervision of IMG, shape and major elemental composition of coarse particles will be documented by means of scanning electron microscopy at the Laboratory for Electron Microscopy (LEM) of the Universität Karlsruhe. Mass concentration and elemental composition of PM2.5 will be analysed by IMG. Furthermore, a ceilometer is used to analyse the actual development of the height of inversion and boundary layers and the distribution of aerosols and particles. The vertical distribution of atmosphere layers is additionally investigated with a weather zeppelin measuring air temperature, relative humidity, wind velocity and direction in various heights up to 300 m AGL. Additionally, similar data is available from meteorological masts in Beijing and around.

It is suggested that the results of these two field visits will exemplarily highlight the vertical distribution of atmospheric layers in combination with particulate concentrations at selected sites and for specific times. However, it is essential for the future development of the quality of Beijing's atmosphere to intensify research for a comprehensive understanding of the air mass movements throughout the year.