Model simulation of an asian dust storm event in April 2006 in Northern China with the model system COSMO-ART

S. Schrader1,2, B. Vogel3, H. Vogel3, S. Norra1, P. Suppan2, Y. Wang4, G. Tang4

1 Karlsruhe Institute of Technology, Institute of Geography and Geocology (KIT/IGG), Kaiserstraße 12, 76131 Karlsruhe, Germany. e-mail: stefanie.schrader@kit.edu
2 Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research, Atmospheric Environmental Division (KIT/IMK-IFU)
3 Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research, Troposphere Research (KIT/IMK-TRO)
4 Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China

Motivation

Sand- and dust storms occur frequently in spring in Northern China and lead to very high numbers and mass concentrations of particles in the atmosphere. These geogenic particles have effects on the state of the atmosphere and provide effective surfaces for heterogeneous chemical reactions (Huang et al., 2010). In combination with high loads of anthropogenic aerosol over urban areas dust storm events can be very harmful to human health.

Up to now, there is still a lack of information in understanding these processes (Zhang et al., 2008).

In this study COSMO-ART was used to investigate the effects of geogenic particles on the state of the atmosphere during a severe dust storm episode in Northern China in April 2006.

Method

The online coupled model system COSMO-ART has been developed to investigate the impact of natural and anthropogenic particles on the state of the atmosphere on regional to continental scales. COSMO-ART consists of the meteorological weather forecast model COSMO and the model add-on ART, which stands for Aerosols and Reactive Trace Gases (Vogel et al., 2009).

Two parameterization schemes for the calculation of dust fluxes are included:
1. Horizontal saltation fluxes & threshold friction velocity
2. Vertical particle fluxes for three dust modes with mean diameters of 1.5, 6.7 and 14.2 μm

Results

The comparison between model results and measurement data shows that the general behavior of the meteorological parameters during the dust event at April 6, 23h UTC can be reproduced by the model.

There is a good agreement between modeled and measured dust storm concentration variability at Beijing in the course of time.

Dust concentrations are overestimated within COSMO-ART.

The very first results of the application of COSMO-ART to the area of Northern China are promising but further modifications are needed.

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Outlook

Future Tasks are:
1. Modification of emission source parameters
2. Consideration of interactions between dust, radiation and cloud processes
3. Simulations of anthropogenic aerosols for Northern China and the greater area of Beijing to study interactions between geogenic and anthropogenic particles in an urban area

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