

MODELLING OF TROPOSPHERIC SOOT AEROSOL IN THE REGIONAL SCALE

N. RIEMER, H. VOGEL, B. VOGEL and F. FIEDLER

Institut für Meteorologie und Klimaforschung, Forschungszentrum Karlsruhe/
Universität Karlsruhe, Postfach 3640, D-76021 Karlsruhe

Keywords: regional aerosols, aerosol dynamics and transport, chemical composition

INTRODUCTION

Atmospheric aerosol populations have to be characterized by several quantities. Besides the size distribution and the chemical composition of the aerosol population the composition of the individual particle is important. The latter characterizes the hygroscopic properties. The hygroscopic properties determine the size of the particle in response to ambient relative humidity, the ability of being activated to cloud condensation nuclei, and also affect the optical properties of the aerosol.

The composition can change as a consequence of chemical processes and physical processes such as coagulation and condensation. This study focusses on the transformation of externally mixed hydrophobic soot into an internal mixture as it happens in the regional scale.

METHODS

The Modal Aerosol Dynamics Model for Europe (MADE) (Ackermann *et al.*, 1998) has been included in the comprehensive mesoscale model system KAMM/DRAIS (Vogel *et al.*, 1995) in order to allow a treatment of the aerosol phase in the regional scale. The aerosol population is represented by two overlapping modes which are approximated by log-normal functions. The chemical composition of the aerosol phase includes sulfate, nitrate, ammonium and water in an internal mixture. As a source mechanism, the binary nucleation of sulfuric acid and water is implemented. Coagulation, condensation, advection, turbulent diffusion and deposition modify the aerosol population spatially and temporally.

We extended the concept of MADE and introduced a separate, externally mixed mode to represent soot. We allow the soot particles to coagulate with the soluble internally mixed particles of the Aitken mode and the accumulation mode. Hence, the formally externally mixed soot particles are transformed into an internal mixture and change from being hydrophobic to being hygroscopic. The individual mixed particle is assumed to consist of an insoluble core and a soluble shell.

The gas phase emissions and the emissions of the soot particles represent the conditions of a moderate polluted city in Europe. The whole model system is running in a fully coupled mode.

We investigate the individual aerosol processes as well as the interaction of the aerosol phase with transport processes for a city plume. First results will be presented.

REFERENCES

- Ackermann, I.J., H. Hass, M. Memmesheimer, A. Ebel, F.S. Binkowski, U. Shankar (1998). Modal aerosol dynamics model for Europe: development and first applications, *Atmospheric Env.*, **32**, 17, 2981-3000.
- Vogel, B., H. Vogel, F. Fiedler, (1995). Influence of topography and biogenic volatile organic compounds emission in the state of Baden-Württemberg on ozone concentrations during episodes of high air temperatures, *J. Geophys. Res.*, **100**, 11, 22907-22928.