# THE TROPOSPHERIC AEROSOL- MEASUREMENTS AND MODELLING

## CASE STUDIES IN TANZANIA AND SOUTHEAST ASIA AND DEVELOPMENT OF MODELS FOR SIZE RESOLVED AEROSOL SIMULATIONS ON THE REGIONAL SCALE

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# ABSTRACT

The tropospheric aerosol is a complex constituent of the atmosphere that has impacts on health and the climate. This thesis presents five different studies from Tanzania, Southeast Asia and Europe dealing with urban measurements of particle mass and elemental composition, regional scale modelling of ozone and particle mass of inorganic aerosols and development of modules for sea salt emissions and size resolved aerosol particles with aerosol dynamical mechanisms implemented in a regional scale chemistry and transport model (CTM).

The first research task, which was measurements in Dar es Salaam, Tanzania, uses information on elemental composition and temporal behaviour to find sources of particulate mass with a simple statistical model. The second research task used available monitored species in Asia to set up and evaluate a regional chemical transport model developed and used for European conditions. This model was then compared to other models in the Asian region. The regional scale model was also set up for Europe to test new parameterisations of sea salt emissions and size distributed aerosols.

A conclusion drawn from measurements in Dar es Salaam is that there is an enhanced concentration of small particles of anthropogenic origin in the city.
In Southeast Asia, the evaluation of the CTM with respect to ozone was found to be difficult as a result of unrepresentative monitoring data. The study does indicate that the model performance is representative, but more comparisons should be made before concluding that the model is as valid as it is in Europe.
An ensemble of models set up for East and Southeast Asia was able to reproduce the temporal variation for monitored particulate nitrate and sulphate. For simulations of the annual mean of nitrate, most models underestimated the measured values. All models in the ensemble either underestimated or overestimated total ammonium at five different stations.
The new sea salt emission module overestimated the value of monitored sodium, but the correlation was good. Introducing aerosol dynamics in the model made the bias smaller, but also the correlation decreased.
An aerosol dynamics module was successfully implemented in a regional scale CTM and can produce size distributed number and mass of several species. The introduction of aerosol dynamics did not degrade the performance of the model with respect to total inorganic particle mass in Europe.



Keywords: Aerosol, PM, Source assignment, Chemical Transport Modelling, Model inter-comparison, Sea salt emissions and Aerosol dynamics.