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Estimation of particle number size distributions from mass based model simulations and comparison to observations

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The atmospheric Chemistry Transport Model system COSMO-MUSCAT was used to determine the particle mass concentrations of dust and anthropogenically emitted aerosol particles over Europe. The model system consists of the online coupled code of the operational forecast model COSMO (Schättler et al., 2009) and the chemistry-transport model MUSCAT (Wolke et al., 2012).
For a four-months-period in 2008 (May to August), the dust and anthropogenic aerosol mass concentrations for six different species (sulfate, nitrate, ammonium, organic and elemental carbon and sea salt) were simulated. For the dust, five different size bins were used and a representative particle size and density were assumed for each size bin. Afterwards, the number concentration was calculated. For the anthropogenic aerosol, lognormal modes were assumed with a representative mode diameter, sigma and density for each component. These parameters were then used to convert the simulated mass concentrations to number concentrations and number size distributions for each component. Those individual size distributions can then be summed up to a total particle number size distribution.
A first comparison with measurement data from the Cape Verde Islands showed a good agreement between observed and simulated dust particle size distributions. Both, the shape of the number size distributions and the order of magnitude of the particle number concentrations compared well. Only for the smallest size bin, observed numbers were occasionally higher, which can be explained by anthropogenic or biomass burning aerosol, which is included in the measurements of the total particle size distributions but was not included in the model runs. Comparisons of measured and simulated size distributions of the anthropogenic aerosol will be available soon. In case the data are available, we will also present an estimation of the particle number concentrations with the aerosol microphysical aerosol module ext-M7 for the duration of a measurement campaign in spring 2013 (HOPE).