Quantification of sources and removal mechanisms of atmospheric aerosol particles

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Abstract

The focus of this work has been to quantify important processes for climatically relevant aerosols, and to improve our understanding of, and ability to accurately model, aerosols in the atmosphere on a large scale. This thesis contains five papers focused on different parts of the life cycle of atmospheric aerosol particles. Two papers describe the physical process of emission of primary marine aerosols. The large uncertainties in these processes are demonstrated by examining the diversity of existing parameterizations for emissions. Building from laboratory experiments to validation of model results with observations, new parameterizations are suggested. These take into account also effects of water temperature on primary marine aerosol production. In the third paper the main focus was to develop a new aerosol wet removal scheme in the Lagrangian transport and dispersion model FLEXPART. Removal timescales and atmospheric concentrations are found to be close to observation based estimates. The final two papers focus on atmospheric black carbon aerosols at high latitudes. As an example of increased human activities in the Arctic, local emissions from cruise ships visiting the research base in Ny Ålesund had demonstrable effects on the level of pollutants measured there. In contrast, inland Antarctic air was shown to be clean compared to the Arctic, due to the extremely long transport time from any major aerosol sources. The work done in this thesis has addressed critical uncertainties regarding the aerosol lifecycle, by better constraining aerosol emissions and atmospheric lifetimes. The development of the new wet removal scheme has improved FLEXPART model accuracy, which will be beneficial in future applications of the model.

Keywords: *aerosol, aerosol removal, aerosol emission, aerosol sources, FLEXPART, Arctic aerosol.*

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