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Evaluation of modeled vertical aerosol distributions over east-Asia using in-situ and satellite data during summer 2008

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As part of the EU ECLIPSE project, which aims to quantify the climate impact of short lived climate forcers (SLCFs), including aerosols, black carbon and ozone, regional models are being used to evaluate global model performance for specific case studies. Here, we present results using regional WRF-Chem simulations over east-Asia. Results are compared to data from field campaigns which took place in summer 2008 and from long-term measurement stations.

This study will, in a first step, evaluate the ability of the model to simulate aerosol physical, chemical and optical properties, with a focus on pollution layers. In a second step, the radiative impact of such layers over east-Asia will be investigated as a function of their position relative to clouds. The WRF-Chem regional model was run using MOZART gas phase chemistry and the MOSAIC aerosol scheme and was evaluated against available measurements for the period August to September 2008. The model was run using ECLIPSE anthropogenic and GFEDv3.1 fire emissions for 2008, while initial and boundary conditions were specified from the TM4 global chemical transport model.

The radiative impact of pollution aerosol layers has already been investigated but less is known about the influence of vertical layering in the atmosphere. Such layers might have different radiative impacts whether they are below or above clouds and in that sense, a better understanding of their spatial extent is critical. Information about pollution aerosol layers and clouds optical properties and positions over East-Asia are determined using observations from CALIPSO. The radiative impact of these layers is simulated and compared to the observations.

In addition to satellite observations, model results are evaluated against trace gas and aerosol data from aircraft campaigns over eastern Asia in summer 2008 (e.g., CAREBEIJING and CAPMEX) and ground-based measurements (e.g., NIES and ABC). In this study, we assess aerosol total concentrations and size distributions simulated by the model. Aerosol aging is also evaluated with the ratio between elementary and organic carbon (EC:OC), while origins of plumes with enhanced aerosol and pollutants such as CO are investigated with Lagrangian back-trajectories.