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Aerosol modelling for variational data assimilation

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Aerosols play an important role in atmospheric physics and chemistry through their impact on air pollution, actinic fluxes, visibility, acid rain, and climate. Numerous atmospheric models at the urban, regional or global scale include a representation of aerosols aimed at simulating their physical and chemical properties such as their concentration, size distribution, chemical composition and state of mixture. However the uncertainty about their emissions result in a wide range of uncertainties about their final impact. To estimate their source strength we are developing a variational data assimilation scheme. This scheme estimates the optimal parameters that fit both the satellite observations and an emissions climatology within specified errors. Our transport model is the general circulation model (GCM) of the Laboratoire de Météorologie Dynamique, also known as LMDZ. In order to make the iterative process of the assimilation scheme computationally efficient, we have developed a simplified aerosol chemistry model. The main simplification is the grouping of LMDZ's original 24 tracers into 4; namely gaseous precursors, fine particles, dust and sea salt. Despite these modifications, the simplified model shows good agreement with the original one in terms of aerosol burden. Validation of this simplified aerosol model conducted against AERONET data will be presented. In order to be used for variational data assimilation, the adjoint of the aerosol model has been coded. First results on the assimilation of satellite data using the full variational system will be shown.