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Assimilation of satellite-based aerosol measurements in a chemical transport model using aerosol component information

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Aerosol monitoring is of growing interest due to the impact of aerosol particle concentration on human health and the global climate. The key question of this paper is how the assimilation of satellite atmospheric aerosol observations improves the capability of a chemical transport model in reproducing the distribution of tropospheric particles. The study is carried out using the Model for Atmospheric Transport and Chemistry (MATCH).
As measurement input vector for the assimilation procedure satellite data from GOME-2 and AVHRR instruments onboard MetOp was used. Synergetic Aerosol Retrieval (SYNAER) observational and model (MATCH) data can be coupled by means of data assimilation. MetOp-SYNAER measurements are able to distinguish between different aerosol components such as water-soluble, soot, sea salt and long-range transported mineral aerosols. Therefore, a component-wise assimilation approach is under development. During the assimilation procedure, the final analysis is highly dependent on the specification of the relative weights to both model and satellite source of information through the error covariance matrices. Since observation and background error covariance matrices are not perfectly known, a large potential for improvements of the analyses is offered by methods allowing their constructing and tuning. In this study, the method proposed by Desroziers and Ivanov (2001) is used to tune background and observational error statistics of the 3D-Var assimilation procedure.
The assimilation system with improved background and observation error covariance matrices was tested for the period of 1 month in 2007.