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SEVIRI 4D-var assimilation analysing the April 2010 Eyjafjallajökull ash dispersion

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We present first results of four dimensional variational (4D-var) data assimilation analysis applying SEVIRI observations to the Eulerian regional chemistry and aerosol transport model EURAD-IM (European Air Pollution Dispersion – Inverse Model). Optimising atmospheric dispersion models in terms of volcanic ash transport predictions by observations is especially essential for the aviation industry and associated interests. Remote sensing satellite observations are instrumental for ash detection and monitoring. We choose volcanic ash column retrievals of the Spinning Enhanced Visible and Infrared Imager (SEVIRI) because as infrared instrument on the geostationary satellite Meteosat Second Generation it delivers measurements with high temporal resolution during day and night. The retrieval method relies on the reverse absorption effect.
In the framework of the national initiative ESKP (Earth System Knowledge Platform) and the European ACTRIS-2 (Aerosol, Clouds, and Trace gases Research InfraStructure) project, we developed new modules (forward and adjoint) within the EURAD-IM, which are able to process SEVIRI ash column data as observational input to the 4D-var system. The focus of the 4D-var analysis is on initial value optimisation of the volcanic ash clouds that were emitted during the explosive Eyjafjallajökull eruption in April 2010. This eruption caused high public interest because of air traffic closures and it was particularly well observed from many different observation systems all over Europe. Considering multiple observation periods simultaneously in one assimilation window generates a continuous trajectory in the phase space and ensures that past observations are considered within their uncertainties. Results are validated mainly by lidar (LIght Detection And Ranging) observations, both ground and satellite based.