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Remote sensing of aerosol irradiance and column concentration from MSG/SEVIRI and its application to the life cycle of mineral dust

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The radiative effect of mineral dust and its life cycle is a key aspect in the study of aerosols. Remote sensing from a geostationary platform offers the possibility of closely studying and monitoring the onset and transport of mineral dust outbreaks with very good spatial and temporal resolution. MSG/SEVIRI provides information of the Sahara desert, Earth's main dust source, with a temporal resolution of 15 minutes and a spatial resolution of 3 km x 3 km in the sub-satellite point.

We present an algorithm that performs the necessary narrowband-to-broadband conversion to derive outgoing irradiance for aerosol-covered pixels. It is based on an artificial neural network and has been validated with collocated Terra/CERES measurements. Additionally, the algorithm also provides an estimate of the column concentration. For the training of the neural network a setup of atmospheric conditions with different aerosol column concentrations have been created. Using the radiative transfer package libRadtran, the SEVIRI channel radiances and the corresponding broadband irradiances have been simulated. These simulations have been used to train the network.

Results show that the new algorithm is a powerful and quick tool to closely observe aerosol outbreaks and their life cycle. Irradiance measurements from dedicated instruments have either a poorer spatial and temporal resolution (Terra/CERES), or a poorer spatial resolution (MSG/GERB) than our algorithm. Our results have been compared with in-situ measurements carried out during the SALTRACE campaign(2013).