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Aerosol Optical Depth over Africa retrieved from AATSR

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Aerosols produced over the African continent have important consequences for climate. In particular, large amounts of desert dust are produced over the Sahara and transported across the North Atlantic where desert dust deposition influences the eco system by iron fertilization, and further North over Europe with outbreaks as far as Scandinavia. Biomass burning occurs in most of the African continent south of the Sahara and causes a net positive radiating forcing resulting in local warming of the atmosphere layers. These effects have been studied during large field campaigns. Satellites can systematically provide information on aerosols over a large area such as Africa and beyond. To this end, we retrieved the Aerosol Optical Depth (AOD) at three wavelengths (555nm, 670nm, and 1600nm) over Africa from the reflectance measured at the top of the atmosphere by the AATSR (Advances Along Track Scanning Radiometer) flying on ENVISAT, for one year (1 May 2008 to 30 April 2009) to obtain information on the seasonal and spatial behaviour of the AOD, episodes of high AOD events and connect the retrieved AOD with the ground-based aerosol measurements.

The AOD retrieval algorithm, which is applied to cloud-free pixels over land, is based on the comparison of the measured and modeled reflectance at the top of the atmosphere (TOA). The algorithm uses look-up-tables (LUTs) to compute the modeled TOA reflectance. For AOD retrieval, an aerosol in the atmosphere is assumed to be an external mixture of fine and coarse mode particles. The two aerosol types are mixed such that the spectral behavior of the reflectance due to aerosol best fits the measurements.

Comparison with AERONET (Aerosol Roboric NETwork), which is a network of ground-based sun photometers which measure atmospheric aerosol properties, shows good agreement but with some overestimation of the AATSR retrieved AOD. Different aerosol models have been used to improve the comparison. The lack of AERONET stations in Africa, its location in similar-type environments, while Africa is a continent with desert-to-rainforest lands with steppe, savanna, woodlands in between, makes it difficult to select the most appropriate aerosol types in the retrieval. We aim to find the connection of the aerosol types used in retrieval with the seasonality (rainy season, dry season, biomass burning season) and air mass transport (e.g., transport of Sahara dust).