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Satellite remote sensing of aerosol and cloud properties over Eurasia

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Satellite remote sensing provides the spatial distribution of aerosol and cloud properties over a wide area.
In our studies large data sets are used for statistical studies on aerosol and cloud interaction in an area over Fennoscandia, the Baltic Sea and adjacent regions over the European mainland. This area spans several regimes with different influences on aerosol cloud interaction such as a the transition from relative clean air over Fennoscandia to more anthropogenically polluted air further south, and the influence maritime air over the Baltic and oceanic air advected from the North Atlantic. Anthropogenic pollution occurs in several parts of the study area, and in particular near densely populated areas and megacities, but also in industrialized areas and areas with dense traffic. The aerosol in such areas is quite different from that produced over the boreal forest and has different effects on air quality and climate. Studies have been made on the effects of aerosols on air quality and on the radiation balance in China.
The aim of the study is to study the effect of these different regimes on aerosol-cloud interaction using a large aerosol and cloud data set retrieved with the (Advanced) Along Track Scanning Radiometer (A)ATSR Dual View algorithm (ADV) further developed at Finnish Meteorological Institute and aerosol and cloud data provided by MODIS.
Retrieval algorithms for aerosol and clouds have been developed for the (A)ATSR, consisting of a series of instruments of which we use the second and third one: ATSR-2 which flew on the ERS-2 satellite (1995-2003) and AATSR which flew on the ENVISAT satellite (2002-2012) (both from the European Space Agency, ESA).
The ADV algorithm provides aerosol data on a global scale with a default resolution of 10x10km2 (L2) and an aggregate product on 1x1 degree (L3). Optional, a 1x1 km2 retrieval products is available over smaller areas for specific studies. Since for the retrieval of AOD no prior knowledge is needed on surface properties, the surface reflectance can be independently retrieved using the AOD for atmospheric correction.
For the retrieval of cloud properties, the SACURA algorithm has been implemented in the ADV/ASV aerosol retrieval suite. Cloud properties retrieved from AATSR data are cloud fraction, cloud optical thickness, cloud top height, cloud droplet effective radius, liquid water path.
Aerosol and cloud properties are applied for different studies over the Eurasia area. Using the simultaneous retrieval of aerosol and cloud properties allows for study of the transition from the aerosol regime to the cloud regime, such as changes in effective radius or AOD (aerosol optical depth) to COT (cloud optical thickness).
The column- integrated aerosol extinction, aerosol optical depth or AOD, which is primarily reported from satellite observations, can be used as a proxy for cloud condensation nuclei (CCN) and hence contains information on the ability of aerosol particles to form clouds. Hence, connecting this information with direct observations of cloud properties provides information on aerosol-cloud interactions.