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Retrieval of Aerosol Absorption over Ocean using AATSR/MERIS

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Aerosols have a significant influence on the earth climate but are still one of the least understood variables in the earth radiation budget. On average aerosol particles scatter solar radiation back to space which leads to an offset in the global warming process to due greenhouse gases. Some types of atmospheric aerosols like black carbon or dessert dust absorb solar radiation and lead to local atmospheric warming. Even if this warming effect is overwhelmed by the cooling effect is it necessary to improve our knowledge on the global distribution of absorbing aerosols if we want to understand and predict local climate variations. Within the ESA CCI-Aerosol project we developed an innovative retrieval method to quantify aerosol absorption quantified by the Single Scattering Albedo (SSA) over the ocean in the sun glint contaminated region of a wind roughed sea surface.
From satellite measurement commonly retrieved Aerosol Optical Depth (AOD), which is the vertical integrated aerosol volume extinction, gives no information on the absorbing or scattering quantities of the observed aerosol. To distinct absorption from scattering independent measurements at different viewing geometries are needed. Furthermore the reflection properties of the underlying surface has to be known and therewith distinct absorption from scattering. The dual view sensor Advanced Along-Track Scanning Radiometer (AATSR) provides such information in regions where either of the two views is sun glint effected the other is not.
Hence, the sun glint is used as a lower boundary condition in the presented method an accurate determination of the ocean surface is needed. Therefore we use the 3 thermal channels from to estimate the amount of reflected sunlight to due glint in measured signal at 3.7 micrometer. The determined sun glint at the 3.7 micrometer channel is further used to derive an effective wind speed based on full radiative transfer calculations where optical properties for a wind roughed sea surface are based on Cox and Munk. Here the glint can be described as a poor function of observing geometry, refractive index, and effective wind speed, which is true as we assume a black water body in the analysed spectral range. Hence, the calculated glint can be transferred to any other observing geometry and spectral channel of the instrument.
The derivation of the optical properties of an observed aerosol layer is done by utilizing the different effects of aerosols on the signal over a highly and poorly reflecting surface. A non absorbing aerosol layer leads here to a brightening effect in the off glint and to a dimming in the glint region. Whereby a layer with the same AOD but containing an absorbing aerosol has a lower brightening effect on the off glint region and higher dimming effect on the glint area.