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# Retrieval of aerosol optical thickness over snow using dual-view satellite observations

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Information about amount and distribution of aerosols in Earth atmosphere is important for understanding their possible influence on climate of the planet. Remote sensing can provide necessary information over rather dark surfaces - ocean and land, but there is no information about aerosols over bright surfaces such as snow and ice. The purpose of this work is to cover the gap in aerosol remote sensing over snow and ice. For this an algorithm for aerosol optical thickness (AOT) retrieval over snow using dual-view AATSR data has been established.

The algorithm solves the equation for top of atmosphere radiance $R_{TOA}$

$$R_{TOA} = R_{atm} + \frac{t_1 t_2 A_{surf}}{1 - r A_{surf}}$$

for both nadir (observation zenith angle 0˚) and forward (observation zenith angle 55˚) views to get AOT for each cloud free snow pixel of satellite image.

Here the atmospheric part $R_{atm}$is pre-calculated with radiative transfer model SCIATRAN for different AOT, geometries and aerosol types and formes a look-up table, snow surface reflectance in given direction $A_{surf}$ is calculated with approximate asymptotic theory (Kokhanovsky et al, 2005), diffuse transmittances $t_1$, $t_2$ and atmospheric spherical albedo $r$ are calculated using a parameterization from (Kokhanovsky et al, 2005). The algorithm has been tested on simulated data and shows reasonable accuracy of retrieved AOT values.

Described AOT retrieval was applied to AATSR data for Arctic smoke event in May 2006 at Spitsbergen and performed for 550nm AATSR channel. The retrieval shows strong dependence on aerosol type and the relief of the underlying snow surface. Retrieved AOTs were compared to ground based measurements at Spitsbergen for the same date and to AOT retrieval over ocean (BAER), performed in University of Bremen using MERIS data. The results of the AOT retrieval over snow achieved with haze aerosol phase function show good correspondence to BAER AOT over ocean.