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AEROSOL OPTICAL DEPTH RETRIEVAL OVER LAND FROM TWO ANGLE VIEW SATELLITE RADIOMETRY

J.Pepijn Veefkind[1], Gerrit de Leeuw[1], and Phillip A. Durkee[2]

1) TNO Physics and Electronics Laboratory (TNO/FEL), PO-Box 96864, 2509 JG The Hague, The Netherlands, e-mail veefkind@fel.tno.nl
2) Naval Postgraduate School, Department of Meteorology, 589 Dyer Road, CA 93943-5113, USA.

Atmospheric aerosol particles play an important role in the Earth's radiation balance. They are considered one of the largest uncertainties in today's climate modelling. To a large extent, these uncertainties are caused by the lack of aerosol data on a global scale. Due to the short lifetimes of aerosols in the troposphere (hours to a week), and the many different sources with different spatial extents and emissions, the aerosol is highly variable in both space and time. Satellite remote sensing only can provide the global coverage and the spatial and temporal resolution to measure the inhomogeneous aerosol fields.

Satellite remote sensing can provide measurements of the column integrated aerosol optical properties on scales ranging from a few kilometres to global. Retrieval of the aerosol optical depth from satellite measured radiances is best possible when the albedo of the underlying surface is low and preferably constant, as is the case for ocean surfaces. Therefore, most studies have focused on retrieval of aerosol optical depth over the ocean. The albedo of land surfaces is much higher and less homogeneous, and there is usually no *a priori* knowledge of the reflective properties.

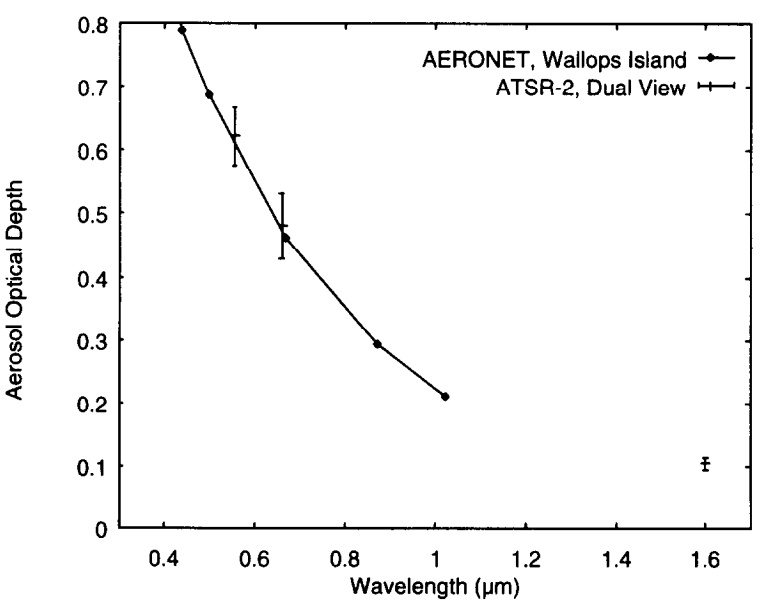

Figure 1. Acrosol optical depth measured with the NASA GSFC AERONET Sun/sky radiometer at Wallops Island (37.93 N, 74.47W) and co-allocated retrieval from ATSR-2 data using the dual view algorithm over land. Error bars indicate the standard deviation.

At TNO/FEL an algorithm is developed to retrieve the spectral optical depth over land and over water. This algorithm uses the two-view capability of the Along Track Scanning Radiometer 2 (ATSR-2) on the European ERS-2 satellite, and will therefore be referred to as the dual view algorithm. The ATSR-2 measures the top of the atmosphere radiance in seven wavelength bands, four of these bands are in the visible and near-infrared and potentially useful for aerosol retrieval. The spatial resolution of the ATSR-2 is 1x1 km^2 at nadir. The ATSR-2 has a conical scanning mechanism, thus producing two views of each region: first a forward view (zenith angle approximately 55 degrees) and about two minutes later a nadir view. By combining the two-angle view and the spectral information, it is possible to separate between aerosol and surface contributions to the top of the atmosphere radiance. From the aerosol contribution the spectral aerosol optical depth is computed, using a mixture of aerosol models that fits the spectral measurements best.

First validation of the dual view algorithm was performed during the Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX). TARFOX was an intensive field campaign conducted at the mid-Atlantic coast of the United States in July 1996 (Russell et al., 1998). Validation of the dual view algorithm was possible during several column closure experiments. Comparison of satellite retrieved aerosol optical depth to Sunphotometer measurements, permits both the assessment of measurement uncertainty and, perhaps more importantly, can establish credibility for satellite remote sensing of aerosol properties.
Figure 1 shows a comparison of the spectral aerosol optical depth as measured with a Sun/sky radiometer and the co-allocated retrieval from ATSR-2 data with the dual view algorithm. The retrieval over land and the Sun/sky radiometer data are in excellent agreement. Not only the aerosol optical depth at a single wavelength can be retrieved accurately, but also the spectral behaviour of the aerosol optical depth, which contains important information on the aerosol size distribution. Several closure analyses, similar to the one shown in Figure 1, were performed for TARFOX. For all these cases, the aerosol optical depth of the Sunphotometer and the dual view retrieval over land agreed within 0.1 .

First results from aerosol optical depth retrieval over land using two-view satellite radiometry, shows very promising results. In the near future additional validation of the dual view algorithm will be performed for different regions.

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