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Ground based measurements of aerosol properties using Microtops instruments

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Atmospheric aerosols originate from a wide variety of sources in both the marine and the continental environments. Aerosol properties vary significantly in space and time depending upon whether the air mass is anthropogenic or natural, marine or continental, rural or urban.
Aerosol particles influence the radiation field of the earth. Variations of aerosol properties in time and space are the dominating source of the variability of remote sensing signals in the optical spectral range. Consequently, the contribution of aerosols to the signals at top of the atmosphere must be accounted for remote sensing of the ocean and land surface, which is known as atmospheric correction. Validation of atmospheric correction procedures require ground based measurements of aerosol properties. Ground based measurements of aerosol properties give also a basis for validation of the aerosol models used by atmospheric correction algorithms. More, measurements of aerosol properties are useful for climate studies because aerosol particles have an impact on the radiation balance of the earth due to its influence on the radiation field.
Ground based measurements of aerosol properties have been performed in the coastal area of the southern Baltic Sea and near Berlin with a Microtops II Sunphotometer and a Microtops II ozone monitor. The data set at the Baltic Sea includes 7 observation periods at 4 different locations. The present paper reports some experience how to perform and analyze measurements with the Microtops instruments. Some advice is provided both for measurements at the land surface and onboard ships. Finally some results are presented.
Sunphotometer measurements over several years require a large effort to maintain accurate radiometric calibration of the instruments. Sensor calibration was found to be very stable. Sensor degradation per year is less than 0.1% with exception of the 1020 nm channel, where it is about 1% per year.
The dataset includes very clear and very turbid conditions. Situations with dominating large aerosol particles have been observed as well as situations with dominating small aerosol particles. Aerosol optical thickness at 550 nm varies from 0.04 to 0.7 and the Angstrœm exponent ranges from 0.25 to 1.8. Variations of the observed optical aerosol parameters in the coastal area show no clear relation to the related wind and humidity conditions, because the dataset is still too small for this kind of analysis.
Validation of atmospheric correction algorithms is demonstrated with a comparison of column aerosol optical thickness resulting from satellite data with aerosol optical thickness from ground based measurements at time of satellite overpass. The agreement is better than ± 0.03 at 750 nm. Another example uses the aerosol properties found from ground based measurements as input to radiative transfer modeling of the signals received at satellite. The agreement between modeled and measured signals is fine within the expectable uncertainty.