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The determination of aerosol optical thickness over Germany using different satellite algorithms and instruments: an inter-comparison study based on spectral top-of-atmosphere measurements of AATSR, MERIS, MISR, MODIS, POLDER, and SCIAMACHY

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An intercomparison of the aerosol optical thickness (AOT) at 0.55 retrieved using different satellite instruments and algorithms based on the analysis of backscattered solar light is performed for a single scene over Germany (7-12E, 49-53N) on October 13th, 2005(10:00-13:30UTC depending on the instrument used). The scene covers a densely populated area of central Europe with Nurnberg at the southern and Bremen at the northern boarder of the scene. A large portion of the scene includes hills covered by forest (e.g., Harz). In addition, agricultural areas covered by vegetation and also bare soil are present in the scene studied. The scene is a characteristic one for the central and eastern Europe. It was found that on the scale of a single pixel there can be large differences in AOT retrieved over land using different retrieval techniques and instruments. However, these differences are not as pronounced for the average AOT over land. For instance, the average AOT at 0.55 for the area 7-12E, 49-53N was equal to 0.14 for MISR, NASA MODIS and POLDER algorithms. It is smaller by 0.01 for the ESA MERIS aerosol product and larger by 0.04 for the MERIS BAER algorithm. AOT as derived using AATSR gives on average larger values as compared to all other instruments, while SCIAMACHY retrievals underestimate the aerosol loading. These discrepancies are explained by uncertainties in a priori assumptions used in the different algorithms and differences in the sensor characteristics. MERIS retrievals gave AOTs closest to those measured by ground-based sunphotometers operating in the scene under study at the moment of satellite measurements.