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Validation of SCIAMACHY cloud top height

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SCIAMACHY is a spectrometer onboard ENVISAT. It performs measurements in the spectral range 214-2386 nm with the spectral resolution of 0.22-1.48nm depending on the channel (Gottwald et al., 2006). The task of this work is the validation of the SCIAMACHY cloud top height (CTH) measurements. In this work only measurements with the spatial resolution of 30km by 60km are used. The SCIAMACHY cloud top height is derived using various cloud retrieval algorithms. In this work only retrievals using semi-analytical cloud retrieval algorithm (SACURA) are considered. SACURA can be applied only to extended cloud fields with the cloud optical thickness larger than 5. The corresponding ATBD is located at www.iup.physik.uni-bremen.de/sacura. The algorithm is based on the fitting of SCIAMACHY-measured top-of-atmosphere reflectance in the spectral range of 758-777nm with the resolution of 0.48nm. In this spectral range the solar radiation is strongly absorbed by molecular oxygen. Therefore, the strength of the oxygen absorption band as seen in the SCIAMACHY reflectance spectra can be used to determine the cloud top height based on the screening effects of clouds. E.g., for thick high clouds, light hardly penetrates into lower troposphere, where the concentration of the oxygen is highest. Therefore, the oxygen absorption bands are not very pronounced in reflectance spectra then. The fit is performed using the semi-analytical radiative transfer theory valid for a single homogeneous water cloud layer. In reality, clouds can considerably deviate from the assumed

cloud model. Therefore, it is of importance to study the accuracy of retrievals using independent measurements. In this work we perform the comparison of SACURA-derived cloud top height with those derived from AATSR and MERIS measurements performed from the same satellite platform. MERIS uses the same physical principle as SCIAMACHY to determine the cloud top height (oxygen A-band absorption). AATSR measurements of CTH are based on the thermal infrared measurements and conversion of the measured brightness temperature to the cloud top height. In addition, we show some results of comparisons using space and airborne lidars and radars. We found that the average CTH error is in the range 0.5-1.0 km depending on the cloud system under study. Comparisons are performed for broken and extended cloud systems. This enables to study the impact of the cloud fraction (CF) on the retrieval procedure. The CF is derived using both the SCIAMACHY Polarization Measurement Devices algorithm (Loyola et al., 2007) and synergetic MERIS-SCIAMACHY CF algorithm developed in the framework of ESA G-POD (see, e.g., http://gpod.eo.esa.int/) Project (Kokhanovsky et al., 2008).

References

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