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MERIS albedo climatology and its effect on the FRESCO+ O2 A-band cloud retrieval from SCIAMACHY data

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Accurate cloud information is an important prerequisite for the retrieval of atmospheric trace gases from space-borne UV/VIS sensors. Errors in the estimated cloud fraction and cloud height (pressure) result in an erroneous air mass factor and thus can lead to inaccuracies in the vertical column densities of the retrieved trace gas. In ESA's TEMIS (Tropospheric Emission Monitoring Internet Service) project, the FRESCO+ (Fast Retrieval Scheme for Clouds from the Oxygen A-band) cloud retrieval is applied to, amongst others, SCIAMACHY (SCanning Imaging Absorption SpectroMeter for Atmospheric CartograpHY) data to determine these quantities. Effective cloud fraction and pressure are inverted by (i) radiative transfer simulations of top-of-atmosphere reflectance based on O2 absorption, single Rayleigh scattering, surface and cloud albedo in three spectral windows covering the O2 A-band and (ii) a subsequent fitting of the simulated to the measured spectrum. However, FRESCO+ relies on a relatively coarse resolution surface albedo climatology (1° x 1°) compiled from GOME (Global Ozone Monitoring Experiment) measurements in the 1990's which introduces several artifacts, e.g. an overestimation of cloud fraction at coastlines or over some mountainous regions. Therefore, we test the substitution of the GOME climatology with a new land surface albedo climatology compiled for every month from MEdium Resolution Imaging Spectrometer (MERIS) Albedomap data (0.05° x 0.05°) covering the period January 2003 to October 2006. The MERIS channels at 754nm and 775nm are located spectrally close to the corresponding GOME channels (758nm and 772nm) on both sides of the O2 A-band. Further, the increased spatial resolution of the MERIS product allows to better account for SCIAMACHY's pixel size of approximately 30x60km.

The aim of this study is to describe and assess (i) the compilation and quality of the MERIS climatology (ii) the differences to the GOME climatology, and (iii) possible enhancements of the SCIAMACHY cloud retrieval after integrating the MERIS climatology into FRESCO+. First results indicate that in areas where FRESCO+ is overestimating cloud fraction using the GOME climatology, MERIS generally reveals higher albedo values which in turn will lead to lower cloud fractions, e.g. at coastlines, some arid or mountainous areas. The differences between the two data sets are also higher in winter than in summer. It can therefore be expected that the new data base with increased spatial resolution improves SCIAMACHY cloud retrieval with FRESCO+. The most limiting factors for the compilation of the MERIS climatology can be assigned to inappropriate snow cover masking and occasionally unfavorable illumination conditions in high northern latitudes during winter.