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Stratospheric Trace Gases from SCIAMACHY Limb Measurements using 3D full spherical Monte Carlo Radiative Transfer Model Tracy-II

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A two step method for the retrieval of stratospheric trace gases (NO2, BrO, OClO) from SCIAMACHY limb observations in the UV/VIS spectral region is presented. In the limb observation mode the instrument is measuring scattered light with a non-trivial distribution of light paths. By means of spectroscopy and radiative transfer modeling the measurements can be inverted to retrieve the vertical distribution of stratospheric trace gases. For that purpose, Differential Optical Absorption spectroscopy (DOAS) is applied on the spectra in the UV/VIS region, yielding slant column densities (SCDs) of the respective trace gases in the first step. Second, the trace gases SCDs are converted into vertical concentration profiles applying radiative transfer modeling. The Monte Carlo method benefits from conceptual simplicity and allows realizing the concept of full spherical geometry of the atmosphere and also its 3D properties, which are important issues for a realistic description of the limb geometry. The implementation of a 3D box air mass factor concept allows accounting for horizontal gradients of trace gases. Moreover the model is assuming every light path in terms of probability to take place, allowing to estimate the statistical error of the RTM calculations. An important point is the effect of horizontal gradients on the profile inversion. This is of special interest in Polar Regions, where the sun elevation is typically low and photochemistry can highly vary along the long absorption paths. We investigate the influence of horizontal gradients by applying 3-dimensional radiative transfer modelling.