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Retrieval of stratospheric ozone profiles from MIPAS/ENVISAT limb emission spectra: a sensitivity study

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Abstract. We report on the dependence of ozone volume mixing ratio profiles, retrieved from limb emission infrared spectra of the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS), on different retrieval setups such as the treatment of the background continuum, cloud filtering, spectral regions used for analysis and a series of further more technical parameter choices. The purpose of this investigation is to better understand the error sources of the ozone retrieval, to optimize the current retrieval setup and to document changes in the data versions. It was shown that the cloud clearing technique used so far (cloud index 1.8) does not reliably exclude all cloud-contaminated spectra from analysis. Through analysis of spectra calculated for cloudy atmospheres we found that the cloud index should be increased to a value of 3.0 or higher. Further, it was found that assignment of a common background continuum to adjacent microwindows within 5 cm^{-1} is advantageous, because it sufficiently represents the continuum emission by aerosols, clouds and gases as reported in the literature, and is computationally more efficient. For ozone retrieval we use ozone lines from MIPAS band A (685–970 cm^{-1}) and band AB (1020–1170 cm^{-1}) as well. Therefore we checked ozone retrievals with lines from bands A or AB only for a systematic difference. Such a difference was indeed found and could, to a major part, be attributed to the spectroscopic data used in these two bands, and to a minor part to neglection of modelling of non-local thermodynamic (non-LTE) emissions. Another potential explanation, a bias in the radiance calibration of level-1B spectra of bands A and AB, could largely be ruled out by correlation analysis and inspection of broadband spectra. Further upgrades in the ozone retrieval consist of application of an all-zero a-priori profile and a weaker regularization. Finally, the ozone distribution obtained with the new retrieval setup (data versions V3o_O3_7) was compared to the data version used before (V2_O3_2). Differences are smaller than $\pm$0.4 ppmv in the altitude region 15–50 km. Further, differences to ozone measured by the HALogen Occultation Experiment (HALOE) on the Upper Atmospheric Research Satellite (UARS) are partly reduced with the

new MIPAS data version.

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