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Validation of nitric acid retrieved by the IMK-IAA processor from MIPAS/ENVISAT measurements

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Abstract. The Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) onboard the ENVISAT satellite provides profiles of temperature and various trace-gases from limb-viewing mid-infrared emission measurements. The stratospheric nitric acid (HNO₃) from September 2002 to March 2004 was retrieved from the MIPAS observations using the science-oriented data processor developed at the Institut für Meteorologie und Klimaforschung (IMK), which is complemented by the component of non-local thermodynamic equilibrium (non-LTE) treatment from the Instituto de Astrofísica de Andalucía (IAA). The IMK-IAA research product, different from the ESA operational product, is validated in this paper by comparison with a number of reference data sets. Individual HNO₃ profiles of the IMK-IAA MIPAS show good agreement with those of the balloon-borne version of MIPAS (MIPAS-B) and the infrared spectrometer MkIV, with small differences of less than 0.5 ppbv throughout the entire altitude range up to about 38 km, and below 0.2 ppbv above 30 km. However, the degree of consistency is largely affected by their temporal and spatial coincidence, and differences of 1 to 2 ppbv may be observed between 22 and 26 km at high latitudes near the vortex boundary, due to large horizontal inhomogeneity of HNO₃. Statistical comparisons of MIPAS IMK-IAA HNO₃ VMRs with respect to those of satellite measurements of Odin/SMR, ILAS-II, ACE-FTS, as well as the MIPAS ESA product show good consistency. The mean differences are generally ±0.5 ppbv and standard deviations of the differences are of 0.5 to 1.5 ppbv. The maximum differences are 2.0 ppbv

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around 20 to 25 km. This gives confidence in the general reliability of MIPAS HNO₃ VMR data and the other three satellite data sets.

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