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MIPAS level 2 operational analysis

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Abstract. The MIPAS (Michelson Interferometer for Passive Atmospheric Sounding) instrument has been operating on-board the ENVISAT satellite since March 2002. In the first two years, it acquired in a nearly continuous manner high resolution (0.025 cm^{-1} unapodized) emission spectra of the Earth's atmosphere at limb in the middle infrared region. This paper describes the level 2 near real-time (NRT) and off-line (OL) ESA processors that have been used to derive level 2 geophysical products from the calibrated and geolocated level 1b spectra. The design of the code and the analysis methodology have been driven by the requirements for NRT processing. This paper reviews the performance of the optimized retrieval strategy that has been implemented to achieve these requirements and provides estimated error budgets for the target products: pressure, temperature, O_3, H_2O, CH_4, HNO_3, N_2O and NO_2, in the altitude measurement range from 6 to 68 km.

From application to real MIPAS data, it was found that no change was needed in the developed code although an external algorithm was introduced to identify clouds with high opacity and to exclude affected spectra from the analysis. In addition, a number of updates were made to the set-up parameters and to auxiliary data. In particular, a new version of the MIPAS dedicated spectroscopic database was used and, in the OL analysis, the retrieval range was extended to reduce errors due to uncertainties in extrapolation of the profile outside the retrieval range and more stringent convergence criteria were implemented.

A statistical analysis on the χ^2 values obtained in one year of

measurements shows good agreement with the a priori estimate of the forward model errors. On the basis of the first two years of MIPAS measurements the estimates of the forward model and instrument errors are in general found to be conservative with excellent performance demonstrated for frequency calibration. It is noted that the total retrieval error is limited by forward model errors which make effectless a further reduction of random errors. However, such a reduction is within the capabilities of MIPAS measurements, which contain many more spectral signatures of the target species than what has currently been used. Further work is needed to reduce the amplitude of the forward model errors, so that the random error and the total error budget can be reduced accordingly.

The importance of the Averaging kernels for a full characterization of the target products is underlined and the equations are provided for their practical applications.

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