Assessment of MIPAS ESA V7 products and first verification of MIPAS ESA V8 products

INTRODUCTION
The Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) is a limb-viewing infrared Fourier transform spectrometer that operated from 2002 to 2012 onboard the ENVISAT satellite. MIPAS mission is divided in two phases: the full resolution (FR) phase, in the first two years of measurements, and the optimized resolution (OR) phase, characterized by a reduced spectral resolution but improved spatial resolution, for the rest of the years.

The maintenance and the upgrade of both L1 and L2 ESA processors are made in the frame of the Quality Working Group, where a fruitful collaboration among Level 1, Level 2 and validation teams can be exploited. This collaboration is essential to pursue improvements in the products and the quality of the retrieved species.

So far the full mission reanalysis has been performed with two versions of the ESA L2 processor, V6 [1] (using L1 V5 data) and, recently, V7 (using L1 V7 data), with data released in September 2016 [2]; furthermore, work is in progress to finalize a new version of the Level 2 processor (V8), that will be used for another MIPAS full mission reprocessing using the upgraded Level 1 data (V8). Each new release is characterized by improvements in the algorithms and in the auxiliary data, as well as an increased number of retrieved species.

This paper is meant to describe the additional species and the main improvements in V7 and V8 ESA L2 products with respect to previous dataset V6.

RETRIEVED SPECIES IN L2 V6 DATA [1]

August 2009 zonal means of VMR profiles of all species provided with V6 dataset. For diurnally varying species separated maps for day and night are shown.

RECENTLY RELEASED L2 V7 DATA [2]

ADDITIONAL SPECIES IN L2 V7 DATA

Preliminary L2 V8 data

ADDITIONAL SPECIES IN L2 V8 DATA

MAIN IMPROVEMENTS IN L2 V7 WRT L2 V6 DATA

The inclusion of COCl₂ among the interfering species allows to reduce the positive bias present in CFC-11 V6 measurements. A comparison between MIPAS-ENVISAT and MIPAS-bullion for both V6 and V7 is shown [2]. (Wijffels’s oral presentation and [3]).

The use of new microwindows for FR measurements allows to reduce the positive bias in the UT/LS present in V7 FR measurements for CH₄, N₂O and CFC-12. An example of the result of the comparison of CH₄ with MIPAS balloon is shown.

ECMWF corrected altitude are provided; those are within 200 m of nominal-s-mode altitudes.

CONCLUSIONS

Ten years of MIPAS measurements represent a very interesting dataset providing a global latitude coverage of the atmospheric composition and temperature in the upper troposphere, the stratosphere and the mesosphere. Vertical distributions of numerous species during both night and day have been derived. Significant improvements have been recently implemented in both L1 and L2 ESA processors, as well as in the auxiliary data. The recently released MIPAS ESA V7 products are characterized by an improved quality of the products of FR measurements, obtained using new microwindows with an increased information content and leading to a reduction of the detected bias in the FR measurements for CFC-12, CH₄ and N₂O improved CFC-11, and a reduced time dependent calibration error due to non-linearities (important for the study of trends with MIPAS products).

MIPAS ESA V8 products will take advantage of the new spectroscopic database and cross-sections for heavy molecules, it will properly handle horizontal gradients, it will further correct the instrumental drift due to the time dependent nonlinearities. A total of 22 species will be included in the L2 V8 products.

Bibliography

V8 – V7 delta-analysis (preliminary)

Tests are ongoing, but a clear indication on a positive temperature bias of V8 wrt V7 in the FR measurements that corrects for the negative bias of V7 (left plot) emerges. Furthermore the use of the new cross-sections for CFC-22 recently measured by J. Harrison [6] leads to a 5-15 % reduction in the retrieved CFC-22 (right plot). Other differences in the products have to be better investigated.

V8 – V7 differences for FR Temperature

V8 – V7 differences for HFC-22