AMIL2DA

Advanced MIPAS level 2 data analysis [amil'tu:da]

An EU Framework V project within the GATO cluster

BACKGROUND

ESA's operational processing of MIPAS data generates profiles of atmospheric temperature, CH4, H2O, HNO3, N2O, NO2 and O3. Various scientific groups are also developing their own algorithms to retrieve these and additional species.

The AMIL2DA project aims to coordinate this work in order to guarantee consistent and reliable datasets.

INTRODUCTION

MIPAS retrieval schemes all contain the following components:

- A 'forward model' for the radiative transfer calculation
- A set microwindows, representing the subset of spectral measurements used
- An 'inverse model' which performs the actual retrieval

These inevitably include some trade-off between accuracy and cpu-time. Since differences in any of these components will result in differences in the retrieved profiles the AMIL2DA strategy is to investigate each of these components individually, and collectively via a `blind test' retrieval before comparing results from real MIPAS data.

Here we present some examples of results from these tests.

FORWARD MODEL

Retrieval schemes incorporate a forward model which contains the physics of the radiative transfer process. Although these are numerically optimised, the approximations used should not contribute a significant error to the retrieval.

To verify this, a series of 30 intercomparison tests of gradually increasing complexity.were performed and significant discrepancies investigated and corrections made where necessary.

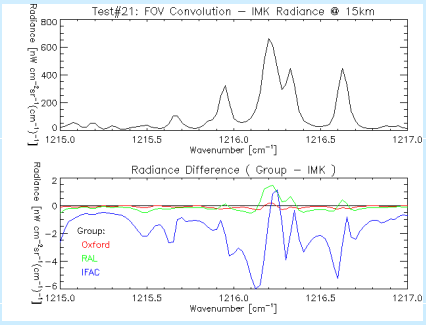

Figure 1: FOV Implementation test

MICROWINDOW ANALYSIS

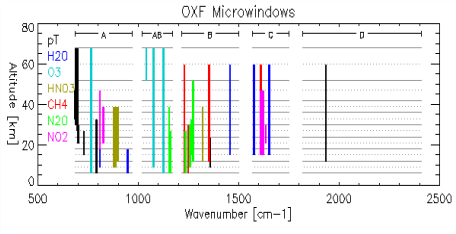

Figure 2: Oxford microwindows

Microwindows are subsets of the complete MIPAS spectra chosen to maximise the signal from the target species while minimising the contributions from foreign species and other potential sources of error. A common error analysis has been applied in order to estimate the systematic error budget for each retrieval.

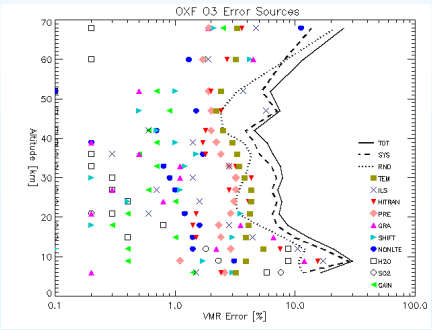

Figure 3: Oxford O3 error budget

INVERSE MODEL

Even with perfect measurements and forward model, a discrete retrieved profile can only represent the atmosphere at a finite resolution (typically 3 km for MIPAS). In addition, most retrieval schemes either use a priori information or some smoothing constraint which further reduces the resolution. Each group will provide an Averaging Kernel matrix **A** for their retrieval, which is the standard form for representing the mapping of a 'true' high resolution (=1km) profile **z** into the retrieved profile **x**:

$$\mathbf{x} = \mathbf{A}\,\mathbf{z}$$

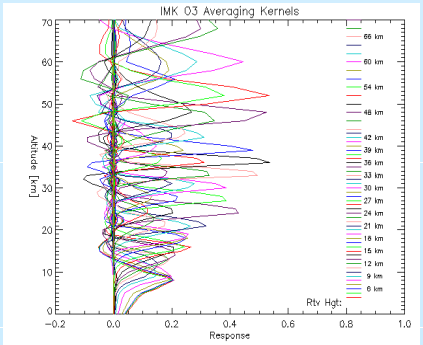

Figure 4: IMK O3 averaging kernels

BLIND TEST RETRIEVALS

As a final test prior to experience with actual MIPAS data, each group were given a set of realistic simulated spectra and attempted to retrieve their own profiles without prior knowledge of the reference atmosphere used in the simulations.

FUTURE WORK

Most of the groups are currently involved in Cal/Val activities for ESA's MIPAS retrievals.Once calibrated spectra become available plans are to

- Retrieve the ESA species to greater altitude range and/or with more sophisticated algorithms,
- Retrieve additional species with spectral signatures within the MIPAS bands

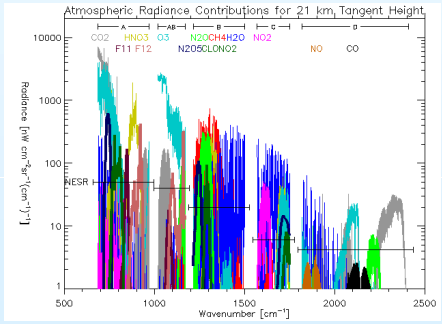

Figure 6: Species detectable by MIPAS

PARTICIPANTS

MIPAS Retrievals

- University of Karsruhe, Germany
- University of Oxford, UK
- Deutsches Zentrum für Luft und Raumfahrt, Germany
- Istituto di Fisica Applicata 'Nello Carrara' del C.N.R.. Italy
- Rutherford Appleton Laboratory, UK

Non-LTE Modelling

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Spectroscopy

- Laboratore de Photophysique Moleculaire, France

GOMOS Intercomparisons

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SCIAMACHY Intercomparisons

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