MIPAS Level 2 Near Real Time processor performances

Piera Raspollini & the ORM team

ORM team

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Optimised Retrieval Model (ORM)

- Scientific code for the **near real time** Level 2 analysis of MIPAS measurements (basis of the code implemented in the ENVISAT Ground Segment)

- Starting from the calibrated and geolocated spectra of each scan, ORM retrieves vertical profiles of:
  - **Tangent altitude correction** and **temperature** (p,T retrieval)
  - VMR of minor constituents (**H_2O**, **O_3**, **HNO_3**, **CH_4**, **N_2O** and **NO_2**)

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Outline

- Latest improvements
  - Code improvements
    - ✓cloud filtering
  - Improvement in auxiliary data
    - ✓New spectroscopic database
    - ✓Retrievals on the whole MIPAS measurement range (6-68 km)
    - ✓New convergence criteria
    - ✓ILS correction
- Examples of results: Antarctic ozone hole (2002 vs 2003)
- Concluding remarks

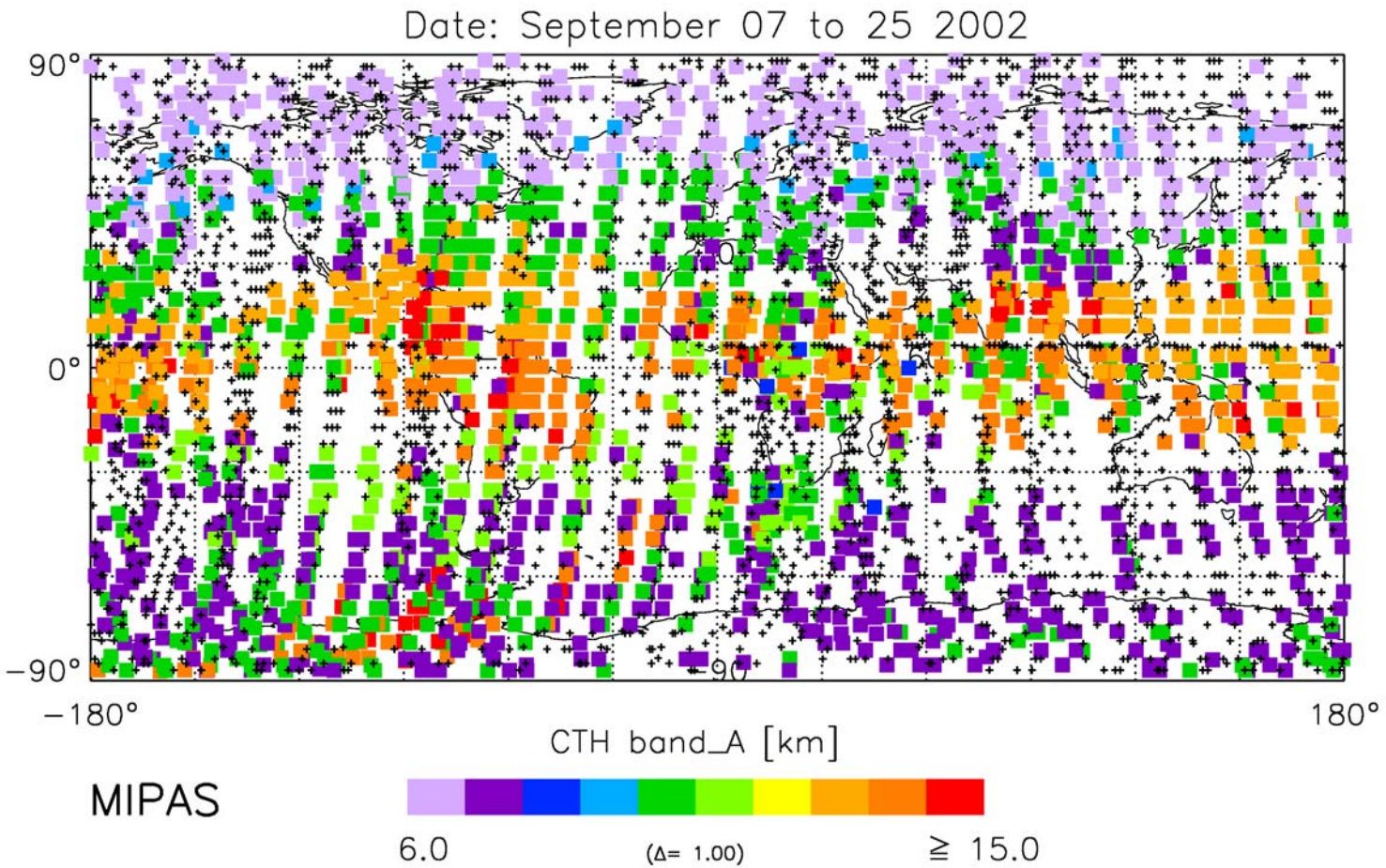
Code improvements

Cloud filtering

•A cloud detection algorithm has been implemented in MIPAS Level 2 pre-processor that detects the presence of clouds in the line of sights and excludes from the analysis the sweeps that are affected by clouds.

Code improvements

Cloud filtering



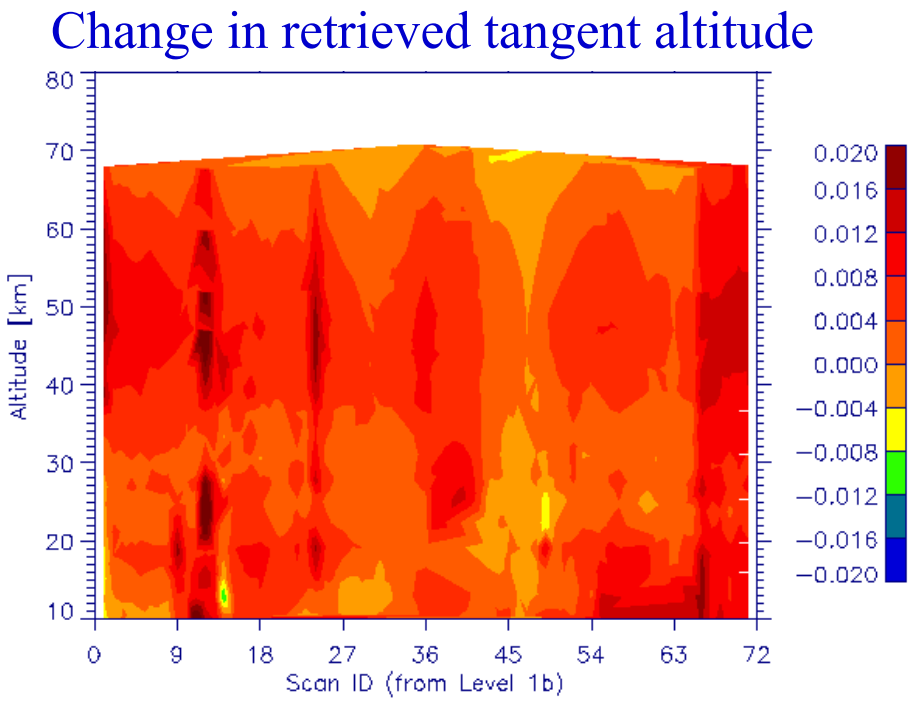
Operative since 23 July 2003

New spectroscopic database

- Version 3.0 of MIPAS spectroscopic database has been released
- Main modifications in HNO_3
- In use since 23 July 2003

ILS correction

An error in the computation of the ILS has been found. A code modification in Level 2 pre-processor is needed, but a short term solution involving only the auxiliary data has been successfully tested.



$$\Delta z[\mathrm{km}] = 7.3\,\Delta \ln P$$

The error in the ILS introduced a negative bias in the determination of the tangent altitude of the order of 50-100 metres.

Extension of the retrieval range

✓ Retrieved profiles are characterised by large systematic errors at the boundaries of the retrieval range due to the wrong assumption of the profile outside the retrieval range (H_2O at both low and high altitudes, CH_4 and N_2O at low altitudes, NO_2 at high altitudes are mostly affected).

✓ Use of the extended retrieval range reduces this error.

	Nominal range	Extended range
PT	12 - 68 km	6 – 68 km
H2O	12 – 60 km	6 – 68 km
O3	12 – 60 km	6 – 68 km
HNO3	12 – 42 km	9 – 42 km
CH4	12 – 60 km	6 – 68 km
N2O	12 – 47 km	6 – 60 km
NO2	24 – 47 km	24 – 68 km

Extension of the retrieval range

- Extension of the retrieval range improves the quality of the products in the nominal range, but does not extend the useful range.
- The extension of the retrieval range leads to an increase in computing time of the order of 50%

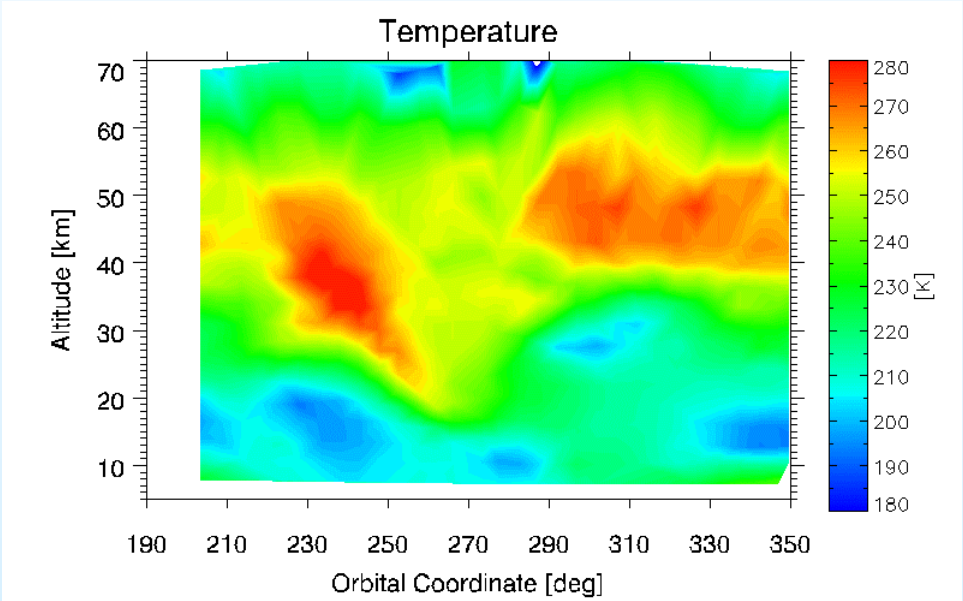
Convergence criteria

- Retrieved profiles are affected by an error due to the fact that the 'real convergence' has not been reached ('convergence error').
- With the current convergence criteria the convergence error is estimated to be 0.7-1.5 times the random error
- This error can be reduced using more stringent convergence criteria
- New thresholds for the convergence criteria have been optimised, that allow to reduce the convergence error to about 0.3-0.6 times the random error
- The new convergence criteria require about 35 % of extra computing time.

Example of results
ANTARCTIC OZONE HOLE
2002 vs 2003: Temperature

2994

26th September 2002



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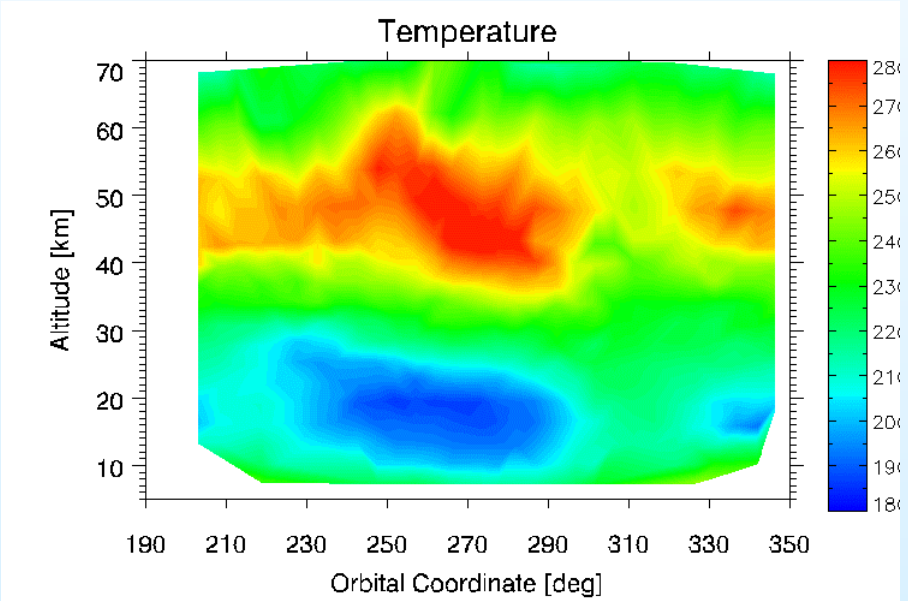
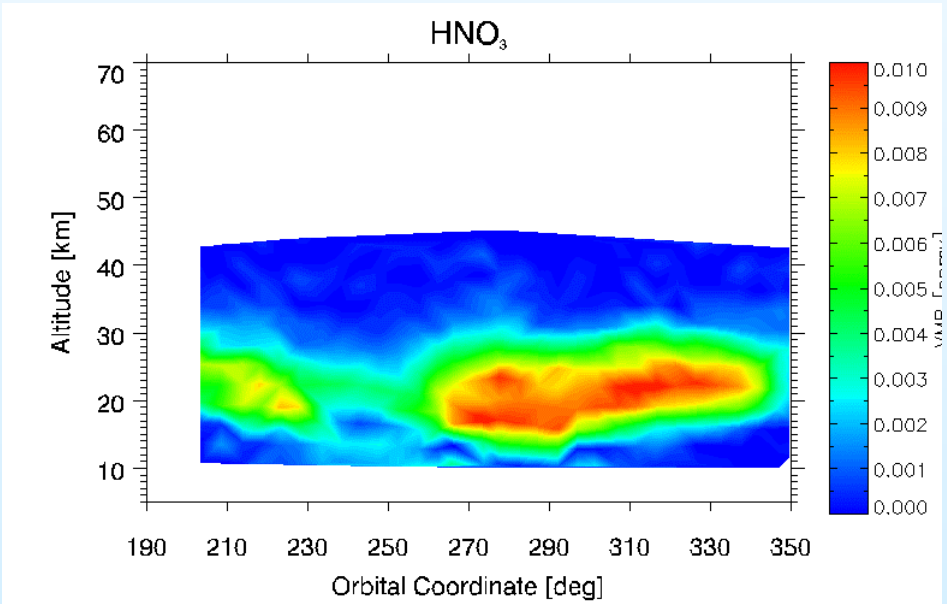
26th September 2003



Example of results: ANTARCTIC OZONE HOLE 2002 vs 2003: HNO_3

2994

26th September 2002



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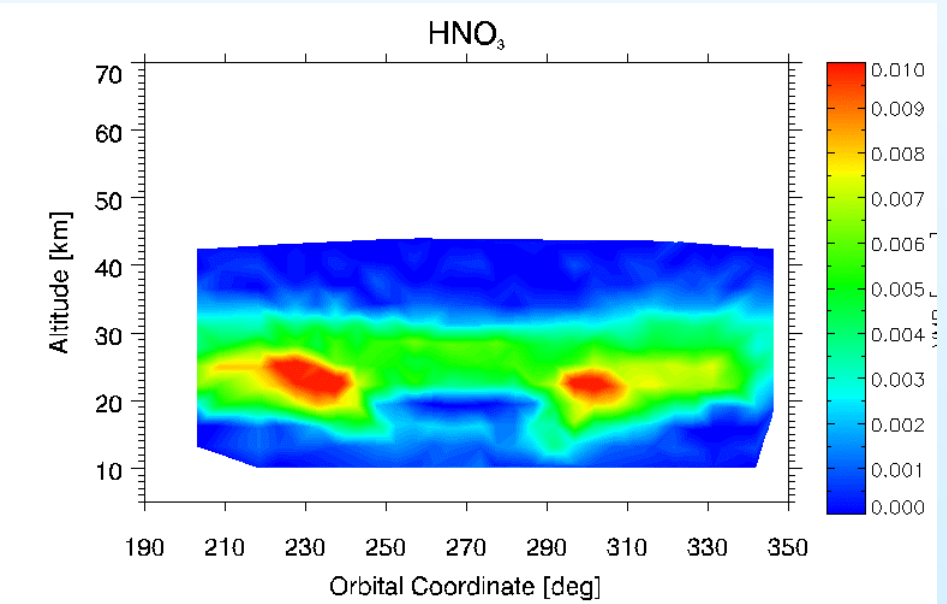
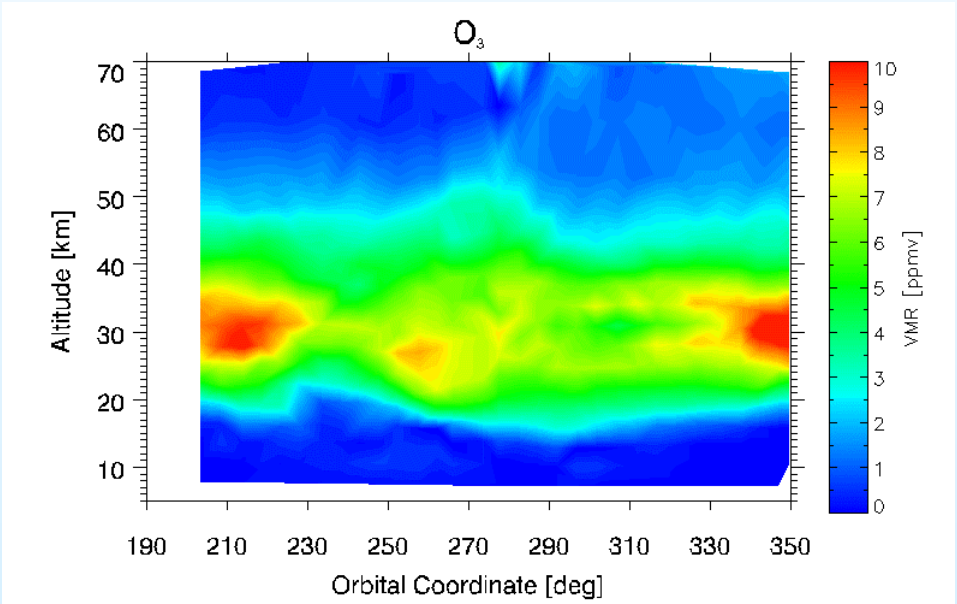


Example of results
ANTARCTIC OZONE HOLE
2002 vs 2003: O_3

2994

26th September 2002



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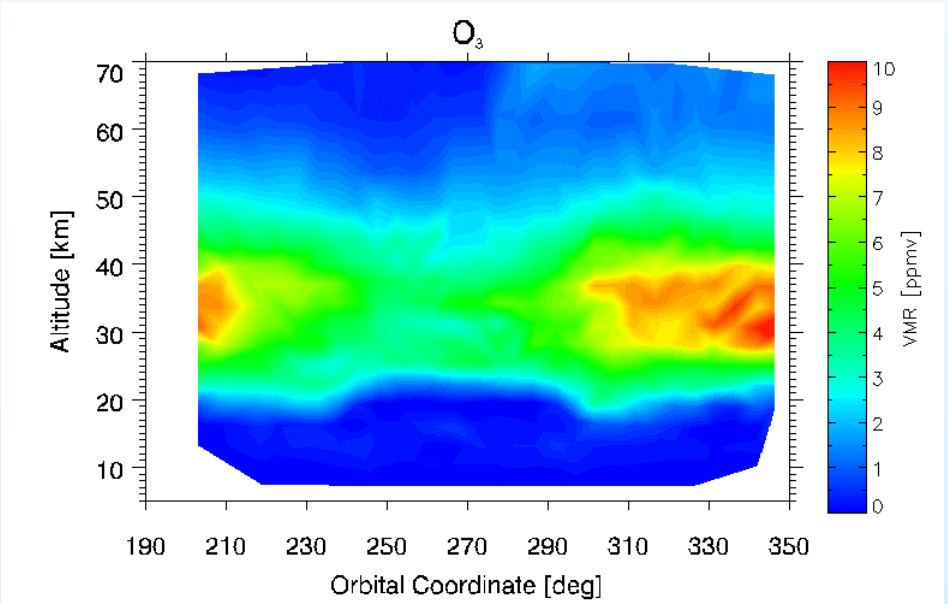
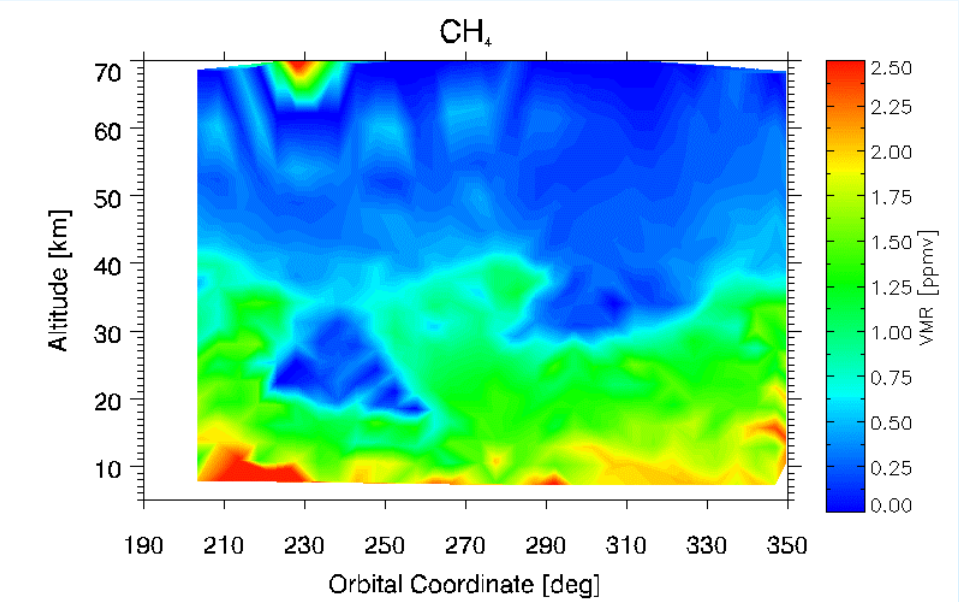


Example of results
ANTARCTIC OZONE HOLE
2002 vs 2003 : CH_4

2994

26th September 2002



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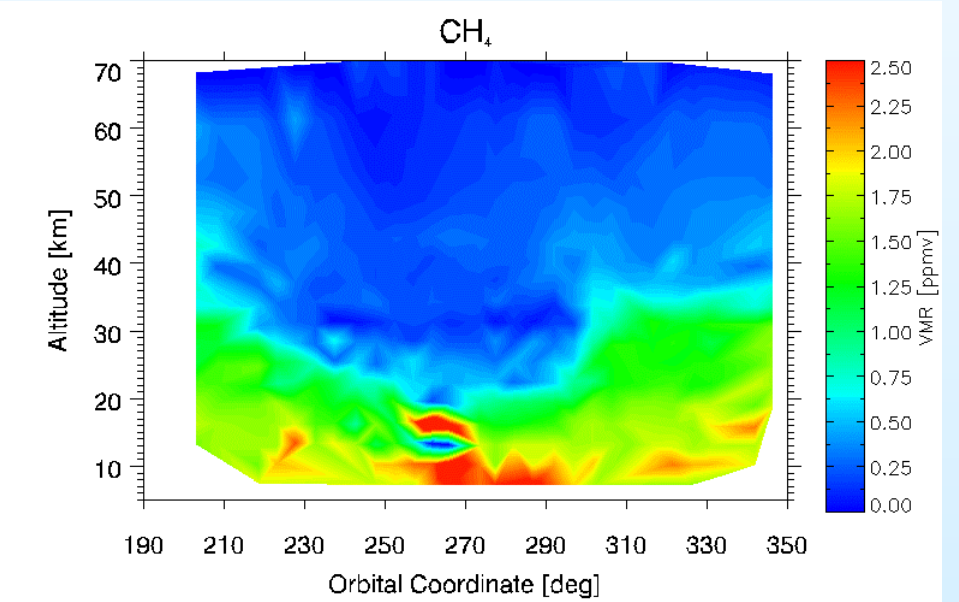

Example of results: ANTARCTIC OZONE HOLE 2002 vs 2003: N_2O

2994

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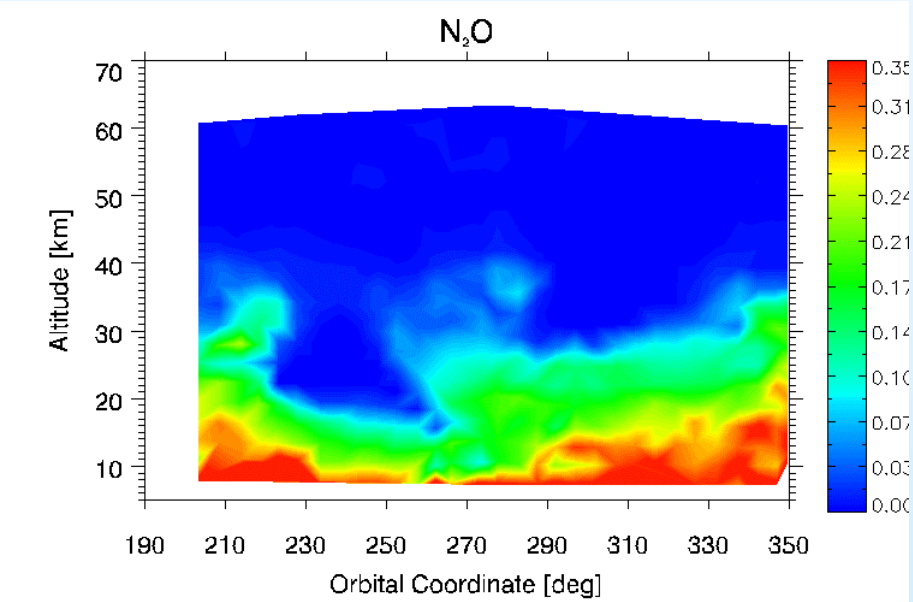

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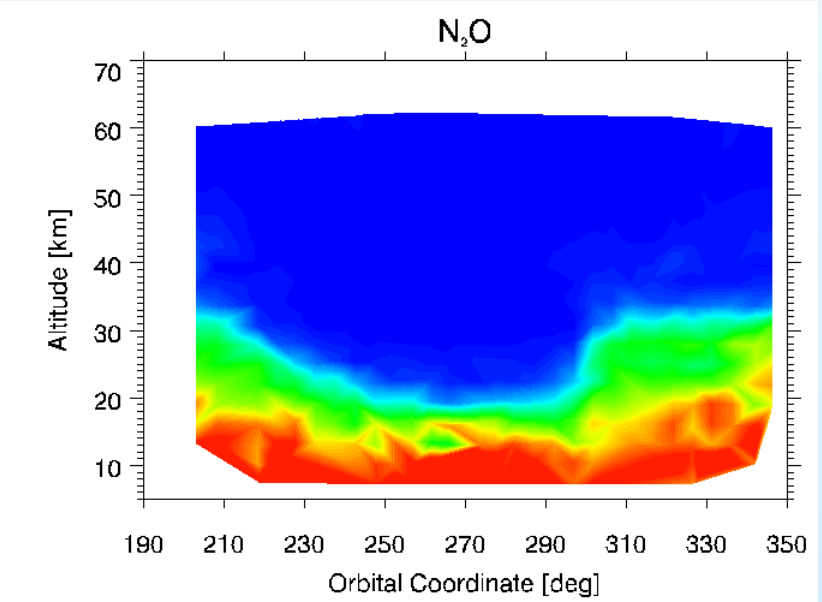

Example of results
ANTARCTIC OZONE HOLE
2002 vs 2003 : $ClONO_2$

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26th September 2002

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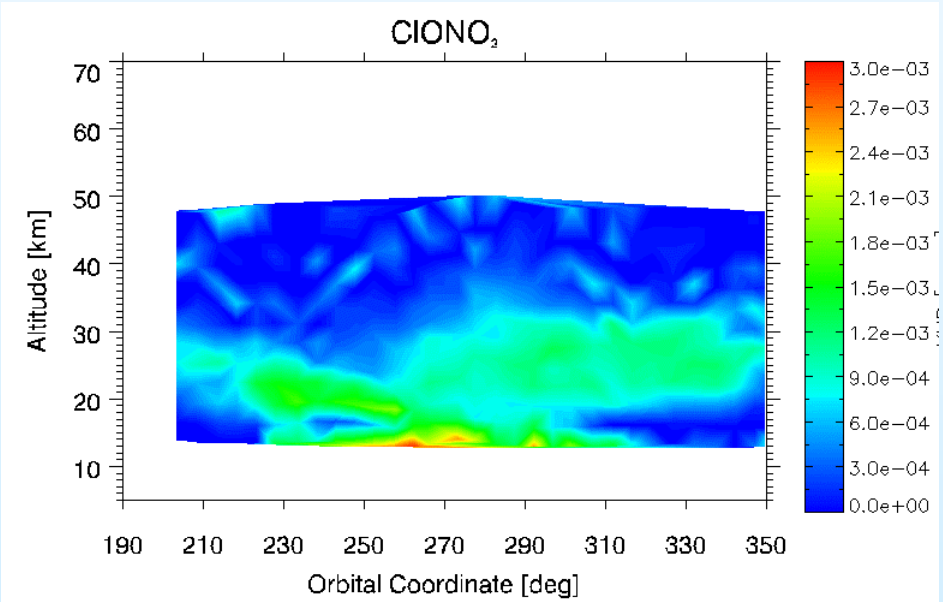
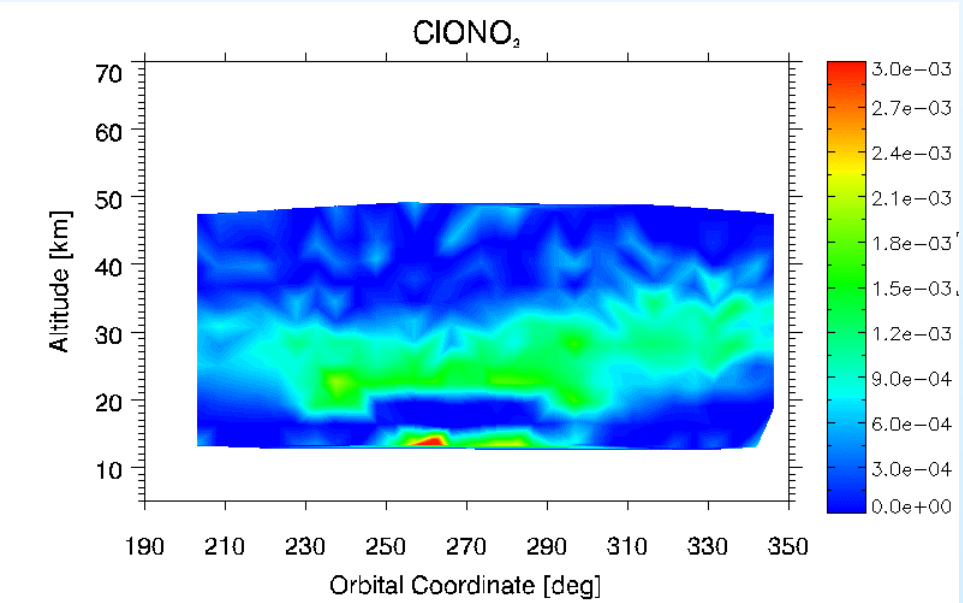
26th September 2003





Non-target species

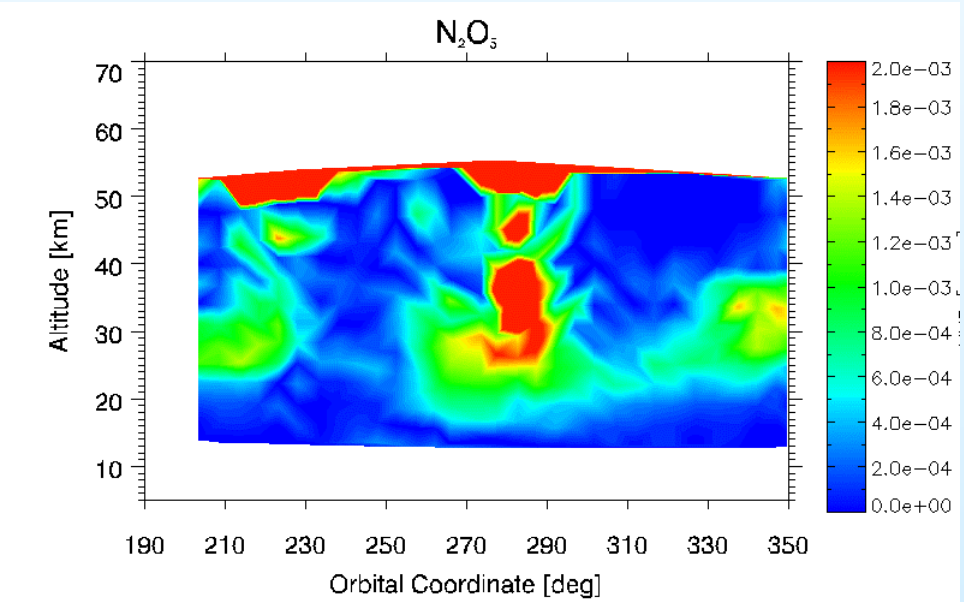
Example of results
ANTARCTIC OZONE HOLE
2002 vs 2003 : N_2O_5

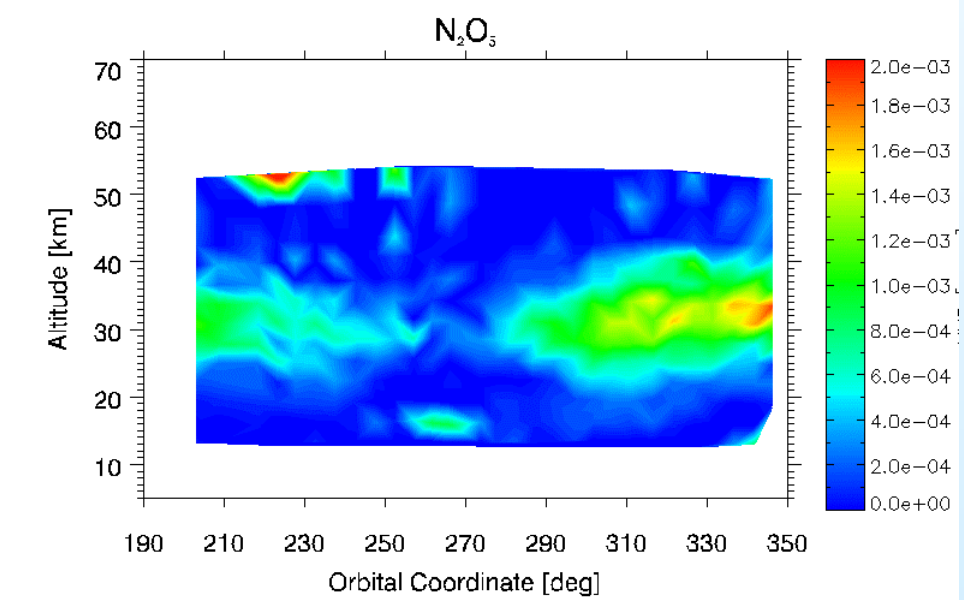
2994

26th September 2002

8225

26th September 2003





Non-target species

Concluding remarks

•Continuous monitoring of MIPAS products has been performing

•Investigations for improving the quality of MIPAS products are on-going

•A full validation of MIPAS products is in progress

•MIPAS provides a very complete and detailed description of the atmosphere that allows, for example, to visualise very well the differences of the Antarctic ozone hole between 2002 and 2003.

•Other species, other than the target species, can be retrieved from MIPAS measurements.

ORM team activity on the Web

IFAC: www.ifac.cnr.it/retrieval/Mipas.htm

University of Bologna: www2.fci.unibo.it/~ridolfi/

ISAC: www.isac.cnr.it/~rss/

Oxford University: www-atm.physics.ox.ac.uk/group/mipas/oxford.html

IMK: www-imk.fzk.de/asf/ame/

University of Leicester: www.leos.le.ac.uk/mipas/main.html

MIPAS ESA official page: envisat.esa.int/instruments/mipas/