MIPAS Summary

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General Remarks

- MIPAS switched-off since March 26, 2004
  - Problem with moving the retroreflectors
  - Investigations ongoing
  - Instrument will be operated at reduced spectral resolution (by about 41% of the previous one)
  - Regular data release planned until end of summer

- MIPAS operational data products generally in good shape
  - V4.61 data improved vs. old (v4.5x) versions
  - Some problem areas (e.g. at lower altitudes, sometimes biases, oscillations, …) have been identified
  - Further improvements possible and necessary

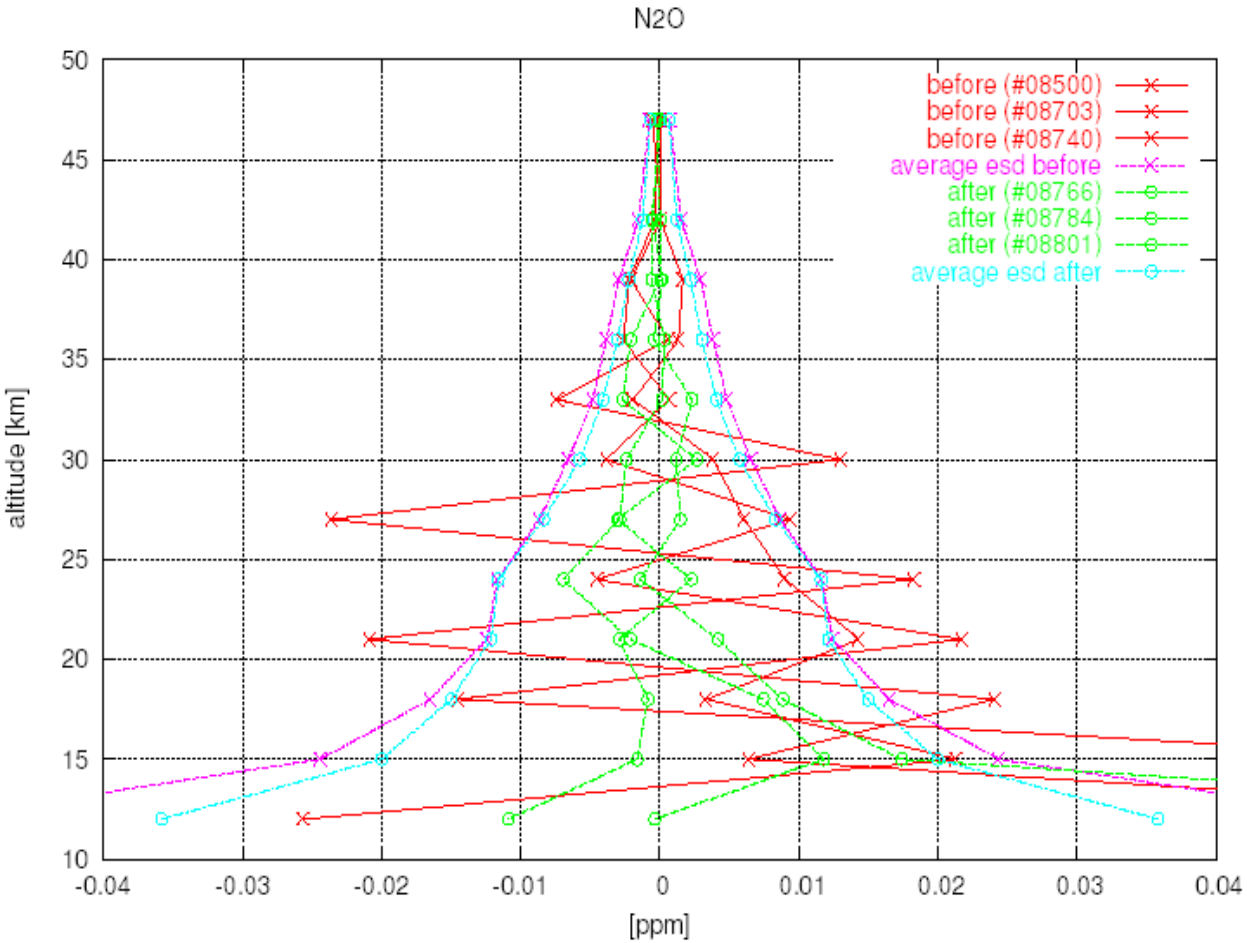
General Remarks (cont.)

- Only operational products have been discussed during ACVE-2 (P, T, O_3, H_2O, CH_4, N_2O, NO_2, HNO_3)
- Enormous scientific potential of MIPAS (>25 products)
  - Other products that have been validated partly: ClONO2, N2O5, NO, CO, PSC properties
  - Additional scientific products of which first results are available: HNO4, CFC-11, CFC-12, SF6, as well as upper atmosphere CO, NO, NO2, H2O, O3, non-LTE parameters

L1B Summary

- Processing Software (IPF) Changes
  - Versions: 4.57, 4.59 and 4.61.
  - v4.61: for Near Real Time (NRT) (Activation Date Mid-March 2004) and used for Off-line reprocessing
  - Main Improvements: Correct Spectra Oscillation Anomalies, Improve NESRT Reporting, Suppression of Aliasing Spike, ADC Saturation Flag
- Auxiliary Data File (ADF) Changes
  - Versions: 3.0, 3.1 and 3.2
  - v3.2: for NRT (Activation Date End-March 2004) and used for Off-line reprocessing
  - Main Improvements: Significant Reduction of Forward/Reverse Oscillations in Non-Linear Channels, Reduction of Spectral Calibration Variation along the Orbit

Oscillation Forward/Reverse Anomaly



- Solved with ADFs Version 3.0.

N2O retrieval in band B, difference between mean odd and even scans, mean esd (plot from IFAC-CNR)

L1B Summary

- **Monitoring**
  - Reduction of Ice Accumulation Rate (Max Gain Change 0.9%/week).
  - Laser Frequency Very Stable (Drift over Last Year 6ppm).
  - Since December 2003, LOS More Stable.
    - Residual Bias (-30mdeg) Corrected in Processing and Commanding
- **Future Changes**
  - IPF: Correction of Open Anomalies (Offset Validation, ILS Retrieval), Improve ILS Retrieval, Spectral Calibration.
    Investigate Residual Phase after Calibration vs Forward/Reverse.
  - ADF: Improve Non-Linearity Characterization and ILS Parameters.
    Review Calibration Scenario
  - Data: Report Pointing Angles in Topocentric Coordinates and Instrument Temperatures

L2 Summary

General consideration

- No major modifications to L2 code, all relevant updates have been made with changes to Auxiliary Data Files (ADF).
- 23.07.2003 update of spectroscopic database (on the basis of MIPAS observed spectra) and implementation of cloud filter.

Three improvements identified.

- Cloud filter makes possible extension of retrieval altitude range (extrapolation error that affects edge points can be moved away from relevant altitude range)
- more stringent convergence criteria (more iterations allowed) reduce the fitting error
- better non linearity correction of detector reduces oscillation in retrieved profiles.

Off-line processor starts operation on 4.11.2003

- The three improvements are applied. Time constraints prevent the implementation of the first two improvements to NRT processor

L2 pending issues

- Improvements possible for temperature retrieval (CO_2 climatology and pointing VCM)
- Problems identified with H_2O at high altitudes
- No a-priori information and no regularisation is used presently leading to residual oscillations in e.g. CH4, N2O, H2O (possible improvements need to be investigated, e.g. by increasing the no. of microwindows).
- The future operation of the interferometer at reduced spectral resolution is not expected to reduce the overall quality of measurements of most target species.
- The extension of NRT and OL operation to some special modes and to additional species is possible.

Validation of operational products

- Conditions for Intercomparison
  - Coincidence criteria: differences in space and time need to be restricted dependent on atmospheric situation
    (horizontal gradients, diurnal variations)
    Standard criteria: ~ 300km, ~ few hours
    (Larger difference acceptable if atmosphere is homogeneous
    or transformations with numerical models performed)
  - Vertical resolution: application of averaging kernels required in case of larger differences in vertical resolution
  - Calculation of partial columns needs to be standardized among GroundBased teams

Validation of operational products (cont.)

- Quality checks of MIPAS data sets necessary
  - Removal of spurious (unphysical) data, as e.g. identified in the case of p,T, H2O
  - Consistency checks, e.g. wrt hydrogen budget, tracer correlations

- Reprocessing needs to be done quicker and more frequently for validation measurements incl. delivery of L1B data
  (e.g. a considerable number of validation measurements is available for which no comparisons could be made so far)

- Method for the determination of precision and accuracy of satellite measurements ??

Assessment of product quality:

Temperature

- Generally good quality:
  - systematic deviations: Table by A. Dethof
  - Precison: 2-4 K in stratosphere, but how much influenced by atmospheric variability and precision of validation data ?
- Quality checks necessary (few unphysical data)
- Zig-zag in VMR profiles caused by oscillations in Temp. profiles ?

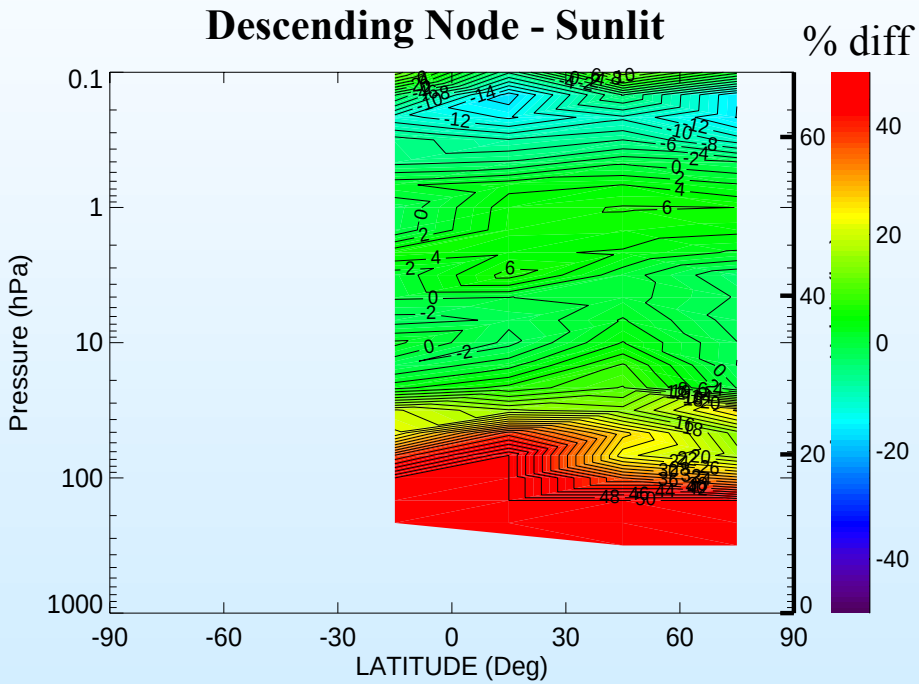
Summary of mean differences

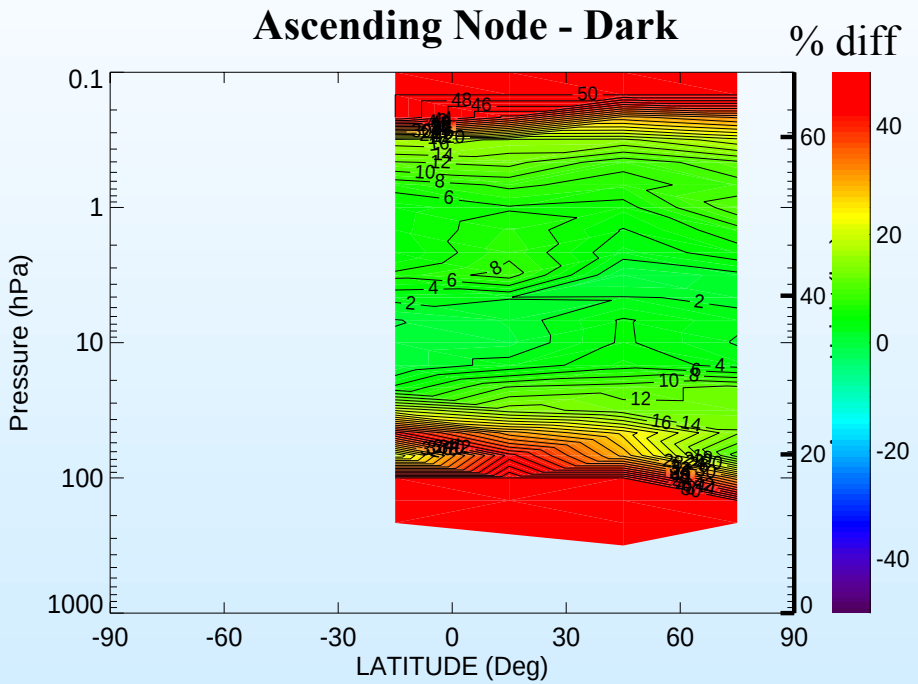
	MIPAS-IMK	MIPAS-HALOE	MIPAS-CHAMPS	MIPAS-METO	MIPAS-ECMWF	MIPAS-POAMIII (NMC)
Mesosphere/ stratopause	-1/-3 K	-6 K	N.A.	-13 K (METO problem)	-3 K (-13 K at 0.1 hPa, EC problem)	+4 K
Upper stratosphere (<10 hPa)	+0.5 K	-3/+1 K	N.A.	-2 K	+4 K (ECMWF problem)	+4 K
Lower stratosphere	+0.5 K	N.A.	+0.5K	2.5 K	+2 K	+/- 2.5 K

Ozone

- Good quality between ~ 20 and 55km
  - No obvious biases
  - Precision ~ 10-15%
- Degraded quality below, tendency of high bias
- Mesospheric systematic difference vs. HALOE (Fig. by B. Kerridge)

Comparison with HALOE (IMK)





Zonal mean for 18/09/02 – 28/09/02

Co-location: <5°lat, <10° long, <12hrs

- <0.4hPa: +ve bias in ascending node
- 0.4 – 40hPa: bias <10%
- >40hPa: increasing bias (nb tropics)

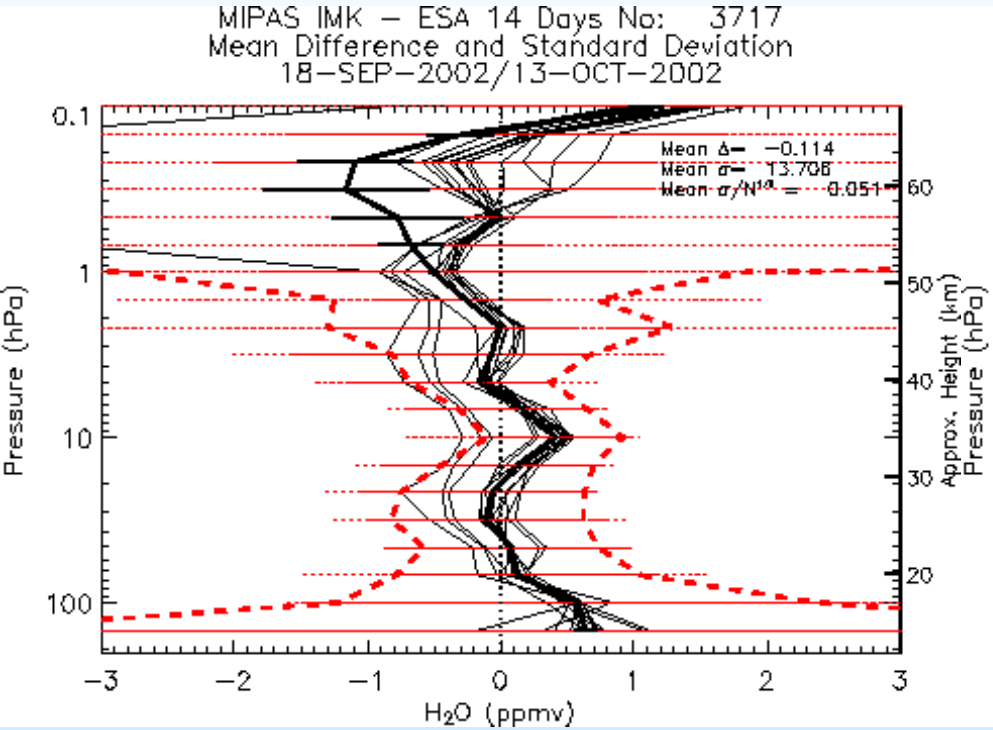
H2O

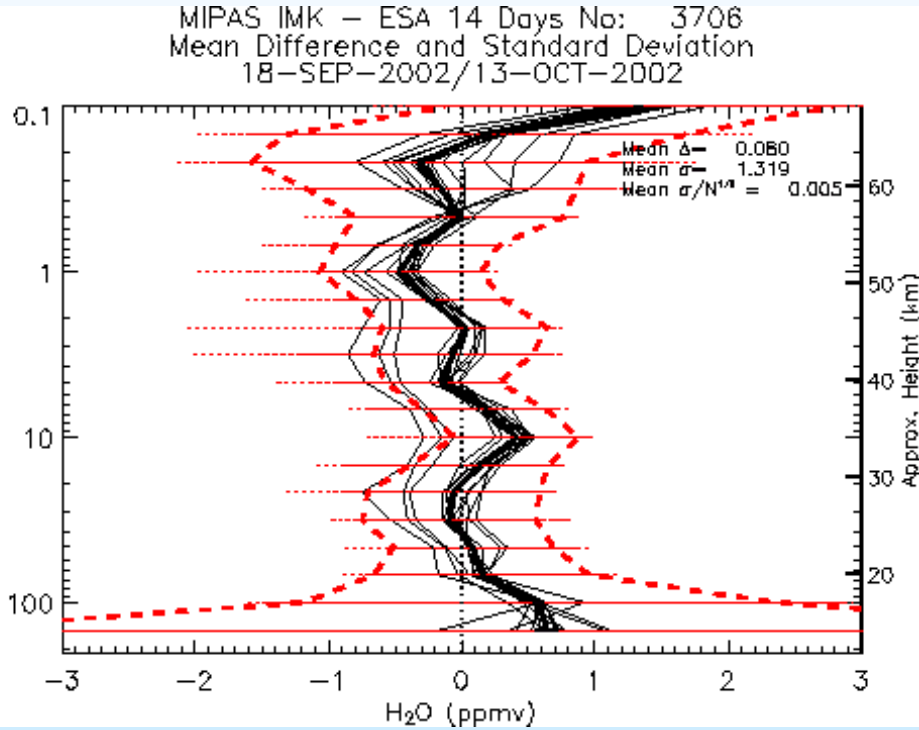
- Good quality between 15 and 30 km (within combined error bars)
- Low bias in the lowermost stratosphere
- Tends to high bias above 30 km,
  in particular wrt the hydrogen budget
- Oscillations in upper stratosphere
- Some unphysical profiles in data set

Plausibility Tests and Processor Intercomparison

IMK-Processor vs. ESA Oper. Processor

Statistics covering 18 Sept. to 13 Oct. 2002



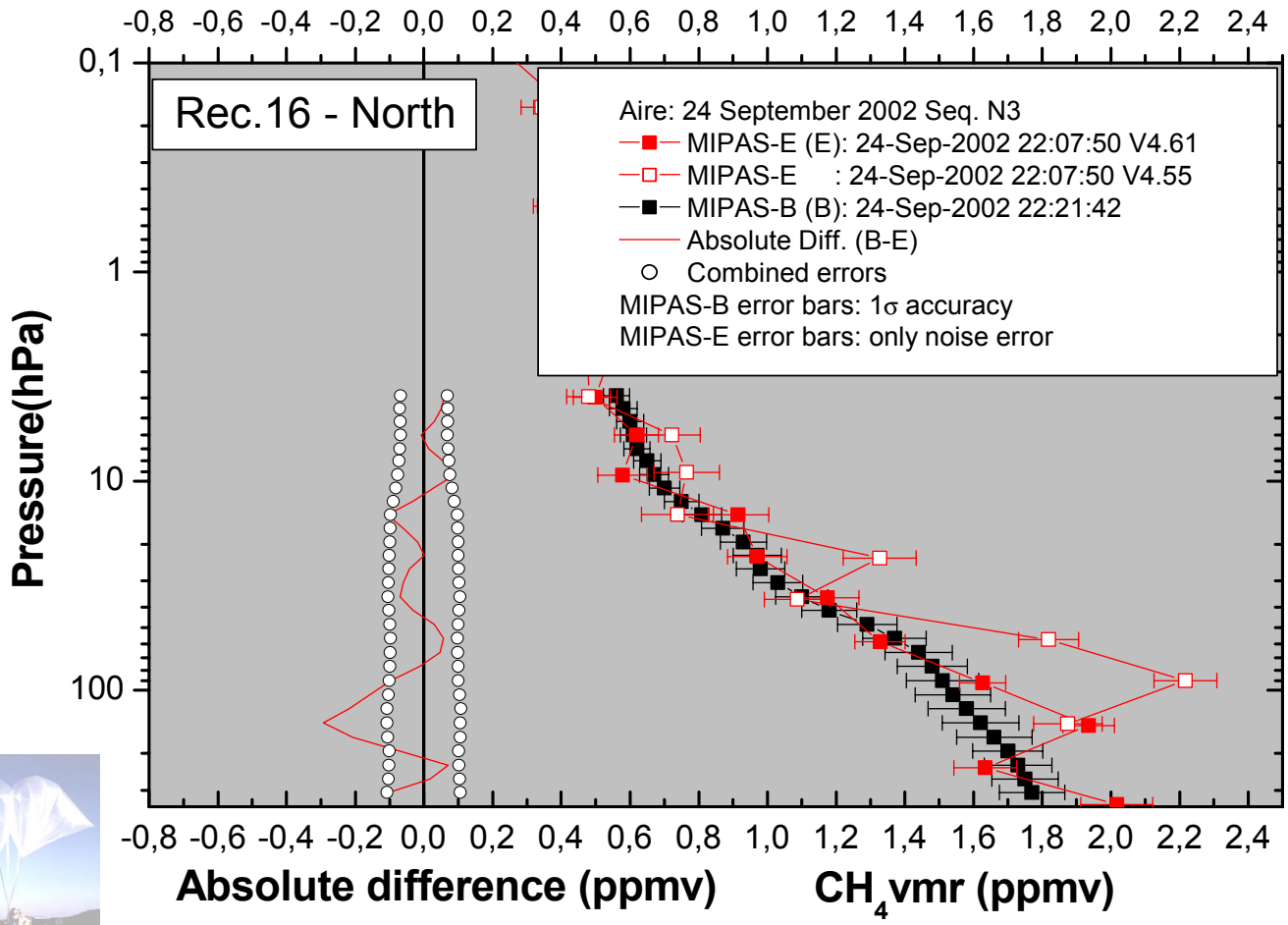


M. Milz and IMK-AME Team, cf. Poster by M. Milz

CH4 and N2O

- Small number of comparisons available up to now
- High bias in the lower stratosphere (mid latitudes)
- Oscillation reduced in v4.61 comp. to older versions but amplitudes still too high
- Outliers in the N2O-CH4 correlation

CH4: MIPAS-B vs. MIPAS-E



HNO3

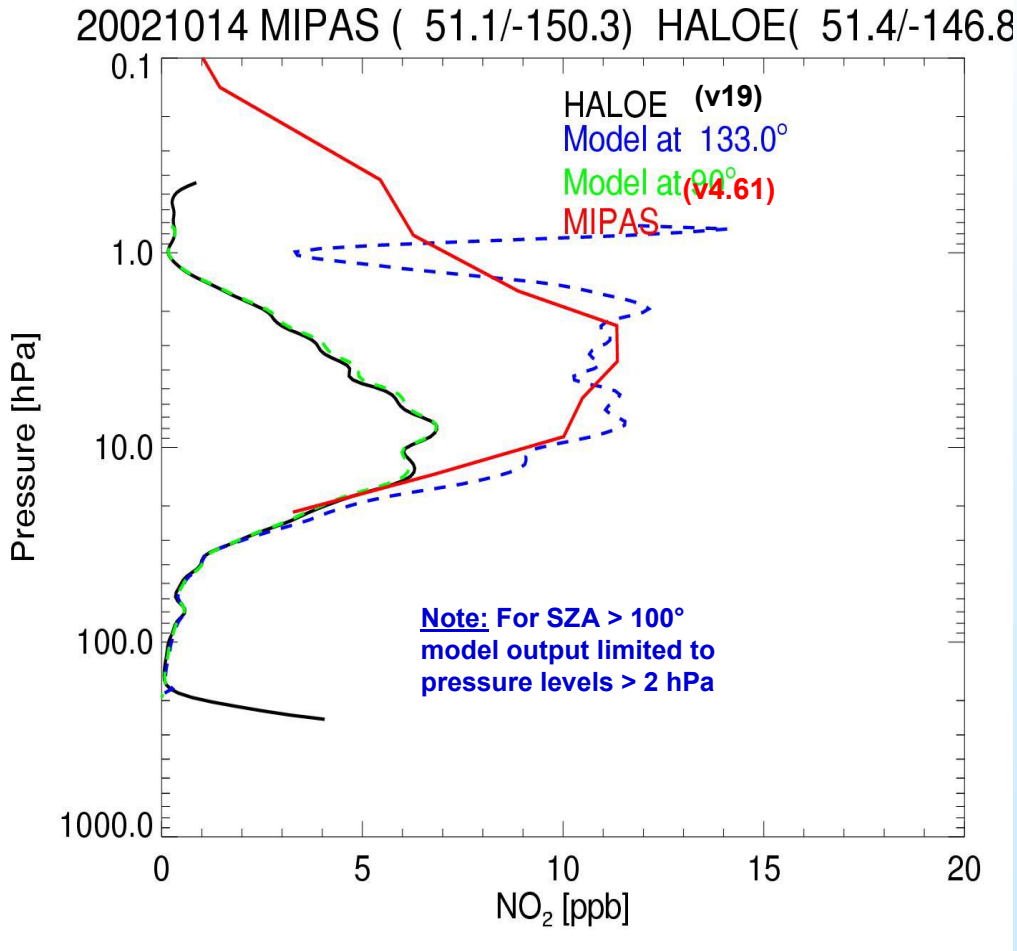
- Very good agreement (within combined error bars) in cases of good coincidences
- MIPAS peak values tend to be higher
- High biases vs. FTIR Ground-Based (column) measurements and large scatter need to be clarified (differences in spectroscopic data, …)

NO2

- Diurnal variations aggravate intercomparisons
- Reasonable agreement in 25-45 km, but based on limited No. of comparisons
- Oscillations in the VMR profile
- Seasonal variation of NO2 columns as measured by ground-based instruments is captured fairly well by MIPAS
- High bias in lower mesosphere
- Retrievals below 20 hPa desired
- UV/Vis and IR ground-based measurements not consistent to each other

HALOE (solar occ., v19 data) – UARS satellite

(courtesy: A. Bracher, M. Sinnhuber, M. Weber, K. Bramstedt



General Recommendations

- A MIPAS-SAG type group needs urgently to be establised in order to
  - define the future nominal mode at reduced spectral resolution
  - decide on the operation scenario for special modes
  - recommend future validation needs
  - ....
- In order to achieve progress in validation on a product by product basis dedicated small groups need to be formed and financially supported