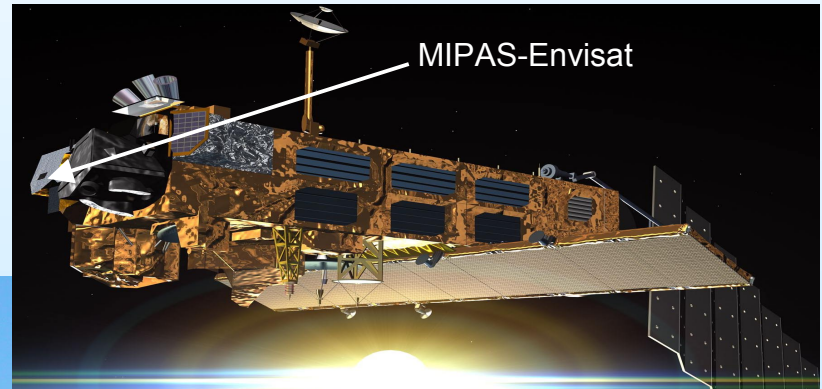


MIPAS HNO₃ ACVT

Hermann Oelhaf
Forschungszentrum Karlsruhe - IMK/ASF



Contributions

ACVT-GB:

- T. Blumenstock, FZK-IMK, Karlsruhe, Germany (FTIR)
- M. De Maziere, BIRA-IASB, Brussels, Belgium (FTIR's-Network)
- Stephen Wood, NIWA, Lauder, New Zealand (FTIR)

AVCT-ESABC/Aircraft:

- C. Blom, FZK-IMK, Karlsruhe, Germany (MIPAS-Aircraft)
- H. Schlager, DLR-IPA, O'hofen, Germany (SIOUX)
- U. Cortesi, IFAC-CNR, Firenze/Bologna (SAFIRE)

AVCT-ESABC/Balloons:

- C. Camy-Peyret, LPMA, Paris, France (LPMA Occultation FTIR)
- M. Pirre, LPCE, Orleans, France (SPIRALE)
- K. Strong, Univ. Toronto (MANTRA HNO₃ Radiometer)
- H. Oelhaf, FZK-IMK, Germany (MIPAS-B)

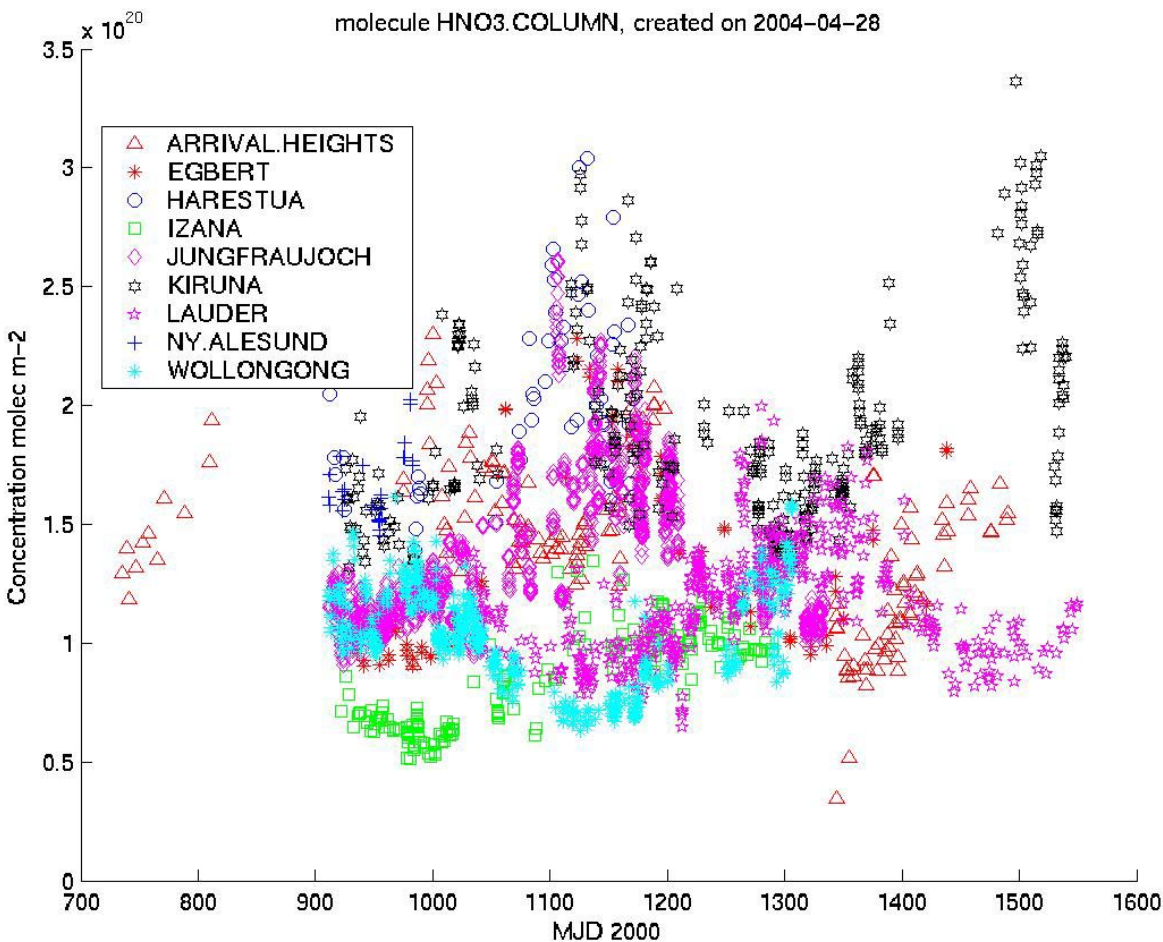
Others:

- D.Y. Wang, FZK-IMK, Germany (IMK-Proc. vs. ESA Oper. Proc.)

Nota bene:

- Examples restricted to V4.61 data in general
- Exceptions demonstrate improvement from 4.59 to 4.61
- Rather disappointingly small number of validation cases available so far, due to
 - V4.61 data only available until early 2003 for a limited set of orbits
 - Late delivery of V4.61 data
 - Other commitments by validation experimenters
 - Restricted capability/willingness of some validation experimenters to perform validation exercises themselves (in addition to data delivery)
- No statistics possible/useful so far
- Evaluation cannot yet be regarded as representative and conclusive (missing geophysical conditions etc.)

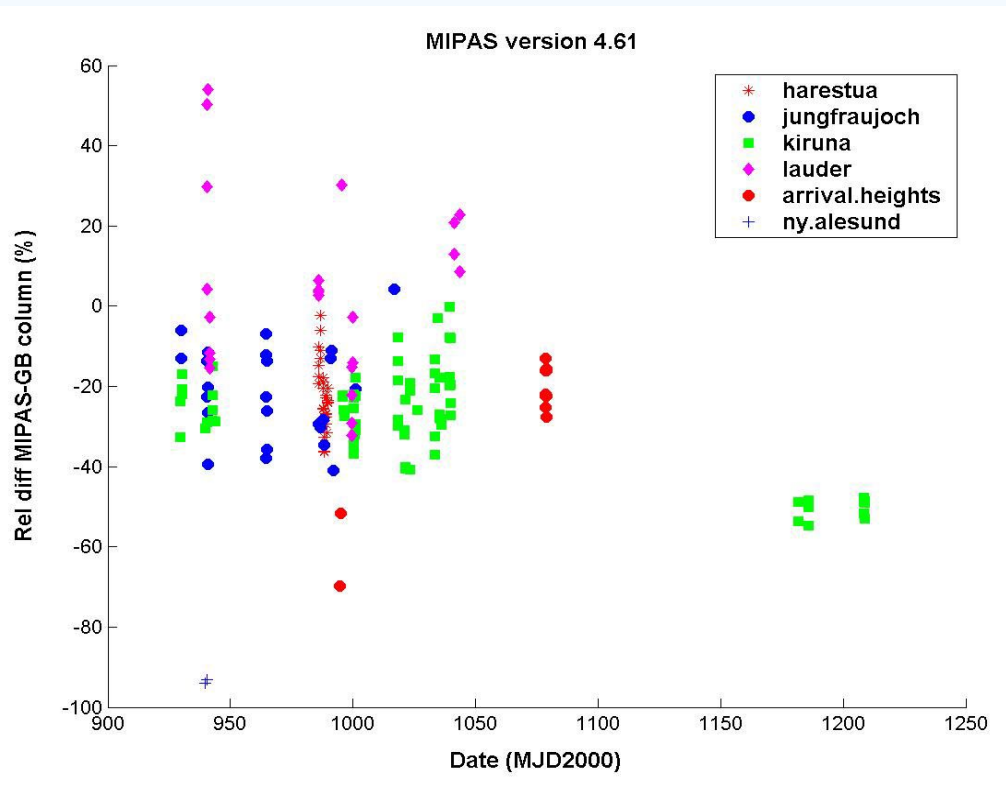
GB correlative data set for HNO_3 - M. DeMaziere/BIRA-IASB



Station name	Lat N	Lon E
Egbert	44.23	-79.78
Ny Alesund	78.91	11.88
Kiruna	67.84	20.41
Harestua	60.22	10.75
Zugspitze	47.5	11.1
Jungfrauoch	46.55	7.98
Kitt Peak	31.9	-111.6
Izana	28.3	-16.48
Wollongong	-34.4	150.9
Lauder	-45.05	169.68
Arrival Heights	-77.83	166.66

- Large data set
- Uncertainty associated with GB data \sim 4- 6% (columns)
- Limited profile information

GB total columns vs. v4.61 integr. profiles (> 12 km) - M. DeMaziere/BIRA-IASB & GB Network data providers



Collocation criterion:

- MIPAS-E TP within a circle of 1000 km radius around the GB station
- Measurements within 12 hrs

→ Offset of ~ 20 % on average
→ Large scatter

Explanation:

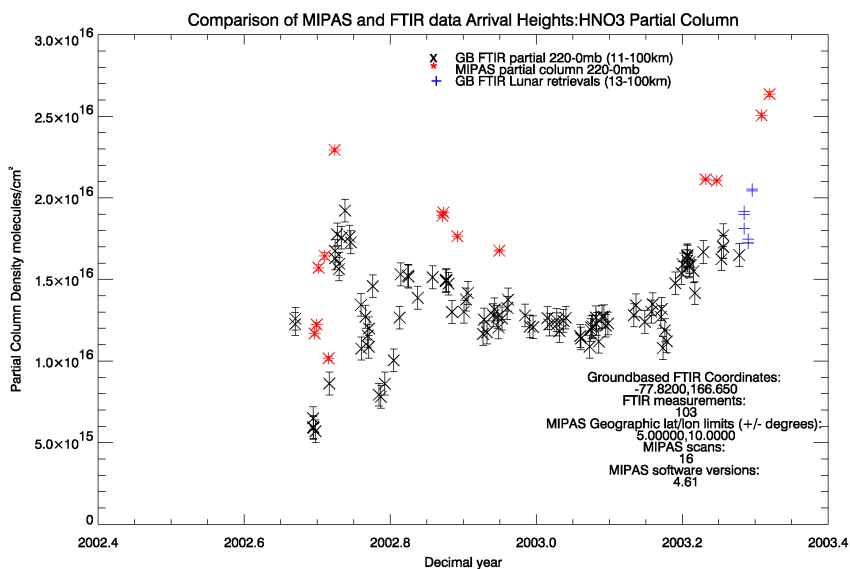
- Missing tropospheric amount in MIPAS accounts for ~ 10 %
- Diff. spectroscopic data account for ~12 %

GB stratospheric columns vs. v4.61 integr. profiles

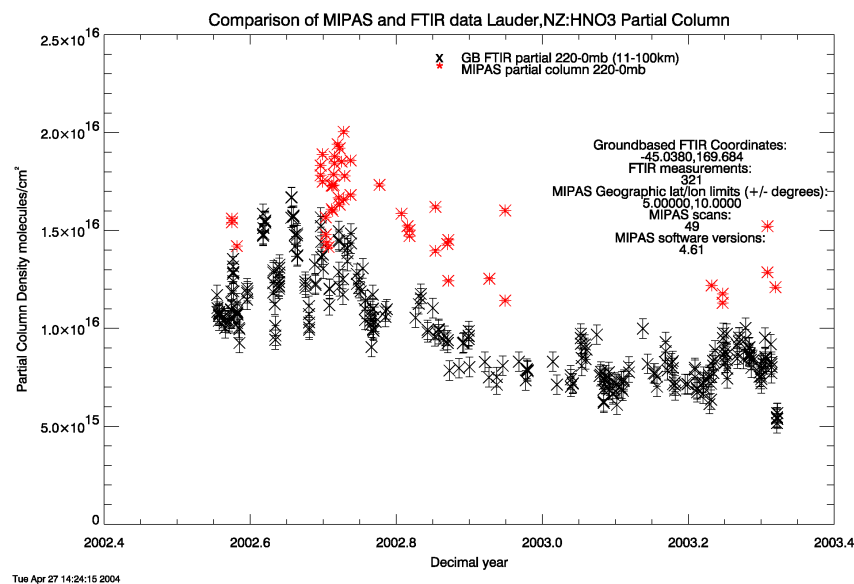
Lauder and Arrival heights - Sept. 2002 till March 2003

S. W. Wood/NIWA

Arrival heights (Antarctica)



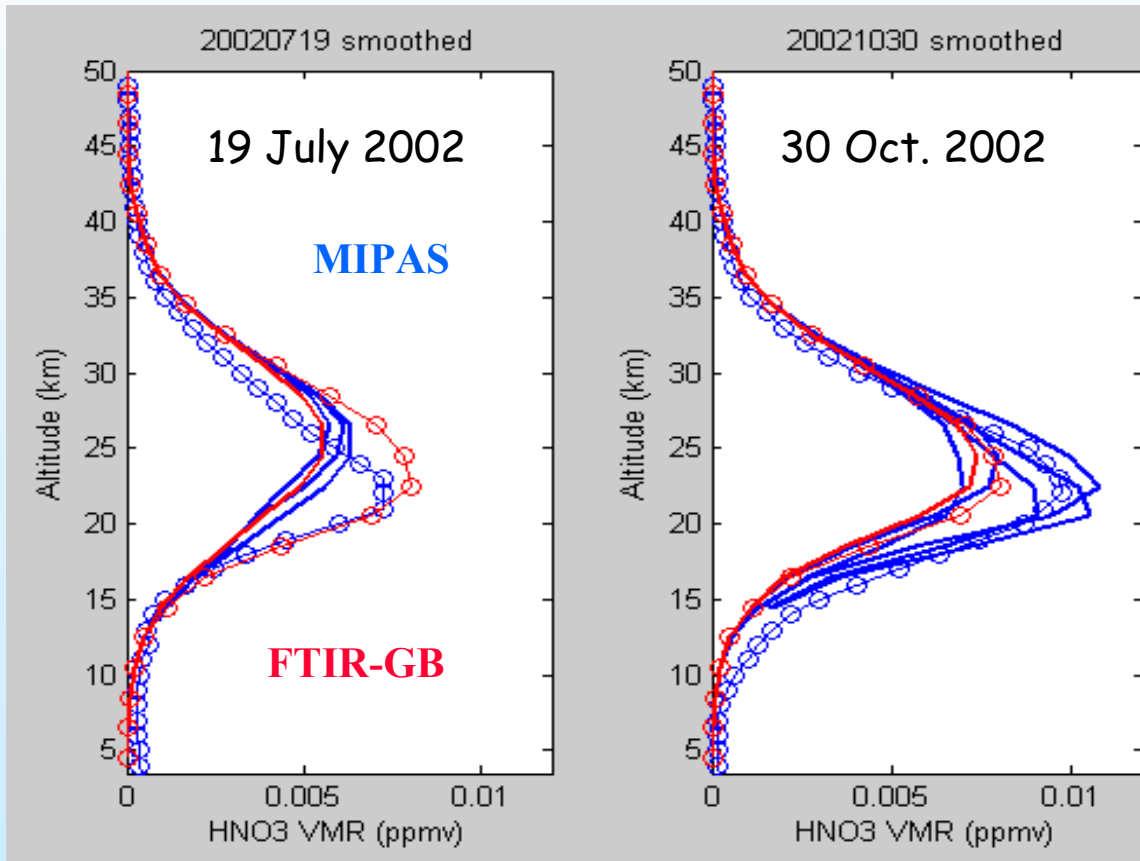
Lauder - NZ (mid-lat.)



→ MIPAS-E: High bias of ~ 10 - 20 % vs. GB data

Typical FTIR-HNO₃ profile intercomparisons - V4.61

Jungfrauoch - M. DeMaziere & C. Vigouroux/BIRA-IASB



Collocation criterion:

MIPAS-E TP

- within 1000 km of GB
- within +/- 12 hrs of GB

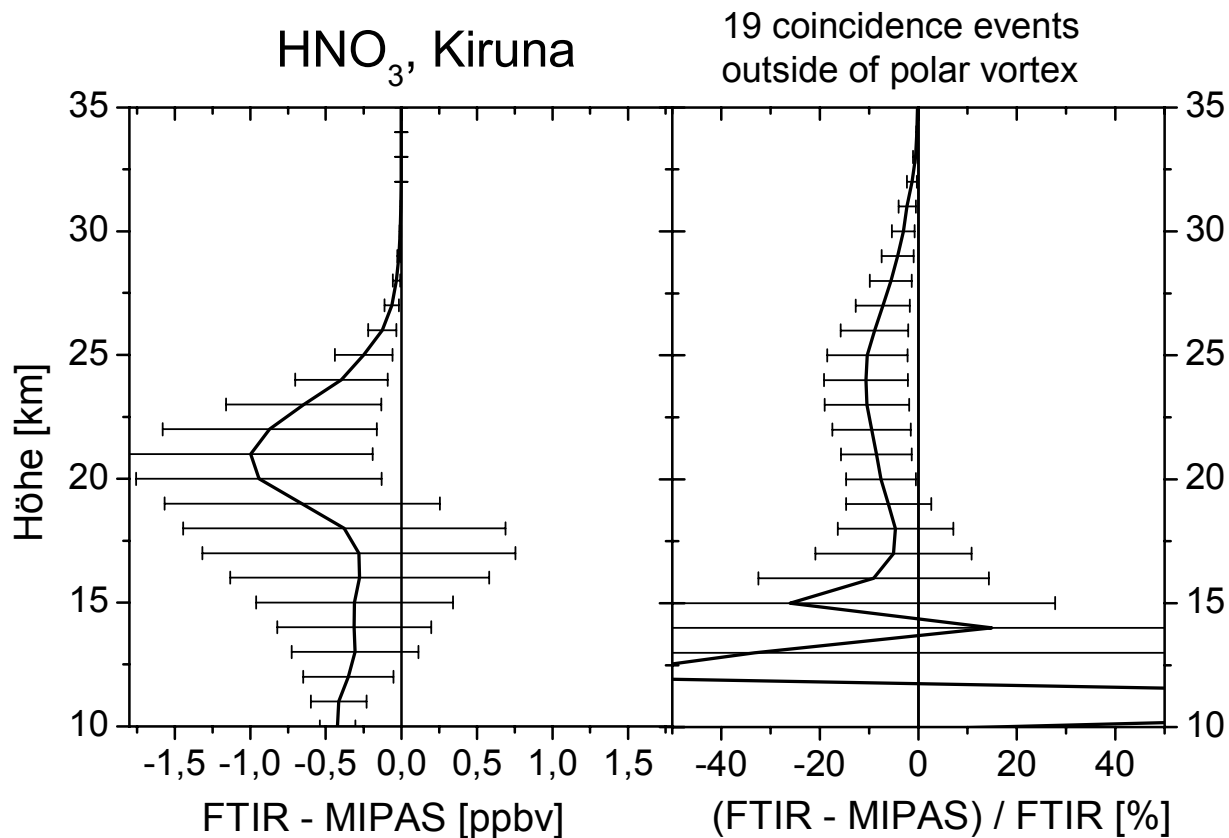
Averaging kernel of FTIR applied to MIPAS-E

→ Good agreement for 19/07/02

→ Large scatter on 30/10/02

IMK-GB-FTIR Kiruna - T. Blumenstock/FZK

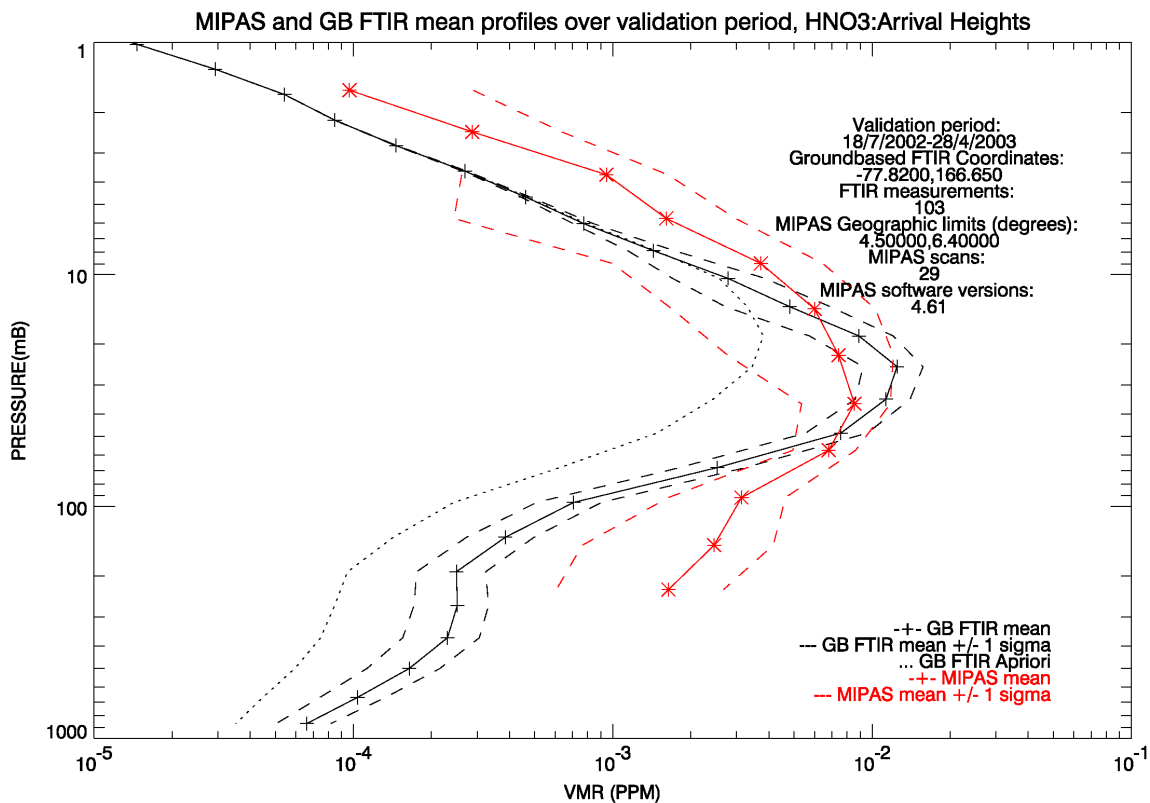
Statistics: 19 coincidence events outside vortex (v4.61)



- 19 coincidence events
- ➔ Fair agreement in terms of mean and 1- σ SD
- ➔ High bias of MIPAS (~ 10%) vs. GB data

Statistics for profile comparisons - FTIR-GB vs. V4.61

Arrival heights - July 2002 till April 2003 - S.W. Wood



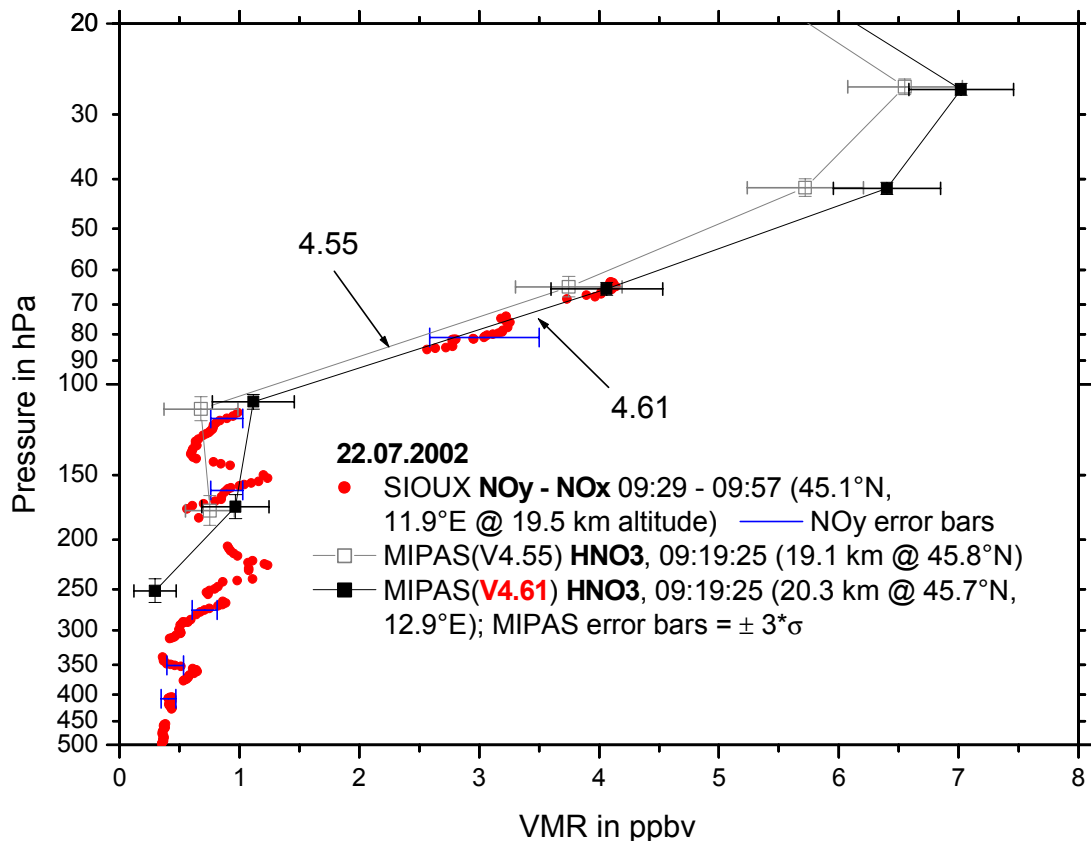
Mon Apr 26 15:56:17 2004

- 29 MIPAS-E scans
- 103 FTIR measurements

- ➔ Fair agreement in terms of mean and 1- σ SD
- ➔ High bias of MIPAS vs. GB in lowermost stratopshere

SIOUX (in situ) - Falcon - H. Schlager/DLR

22 July 2002, Forli, mid-lat

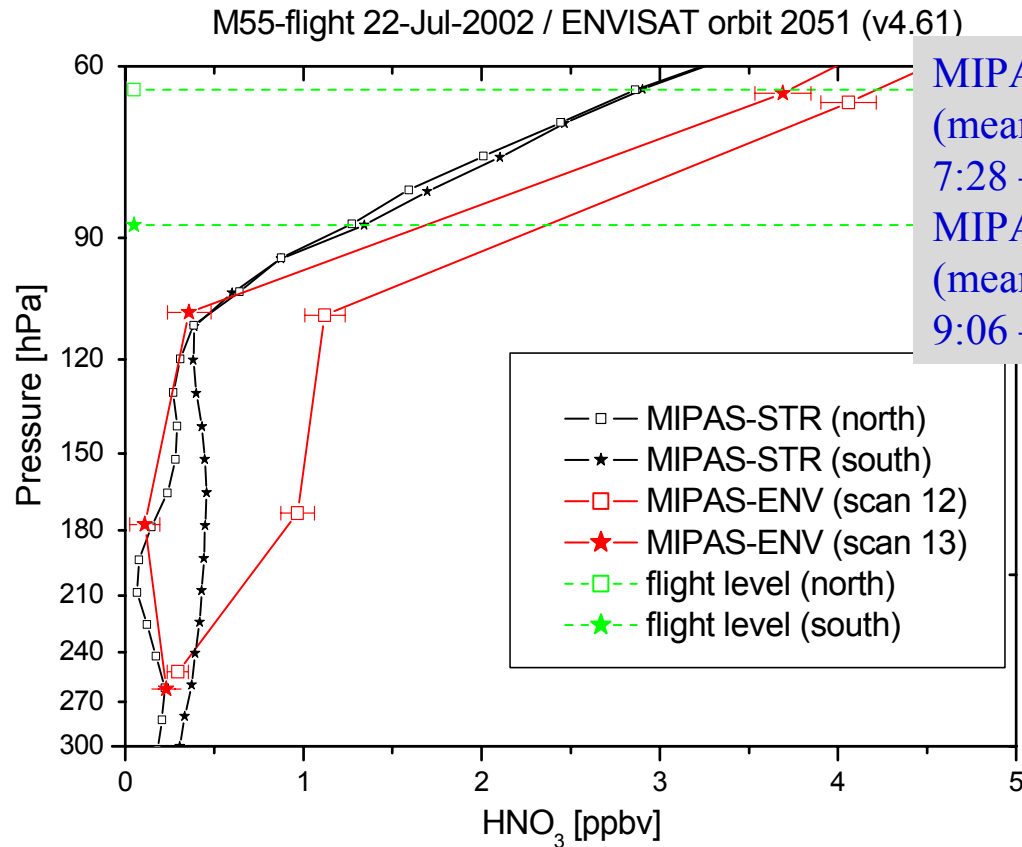


- 14 Geophysica flights with coincidences available
- But just one with V4.61 data so far
- Excellent coincidence

- ➔ Excellent agreement above ~120 hPa
- ➔ Good agreement lower down

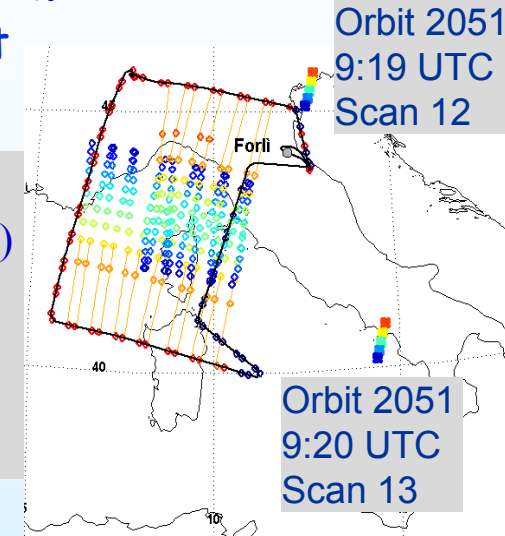
MIPAS-STR - C. Blom, FZK-IMK

Orbit 2051, 22 July 2002, Forli, mid-lat



MIPAS-STR south
(mean of 12 profiles)
7:28 – 7:59 UTC

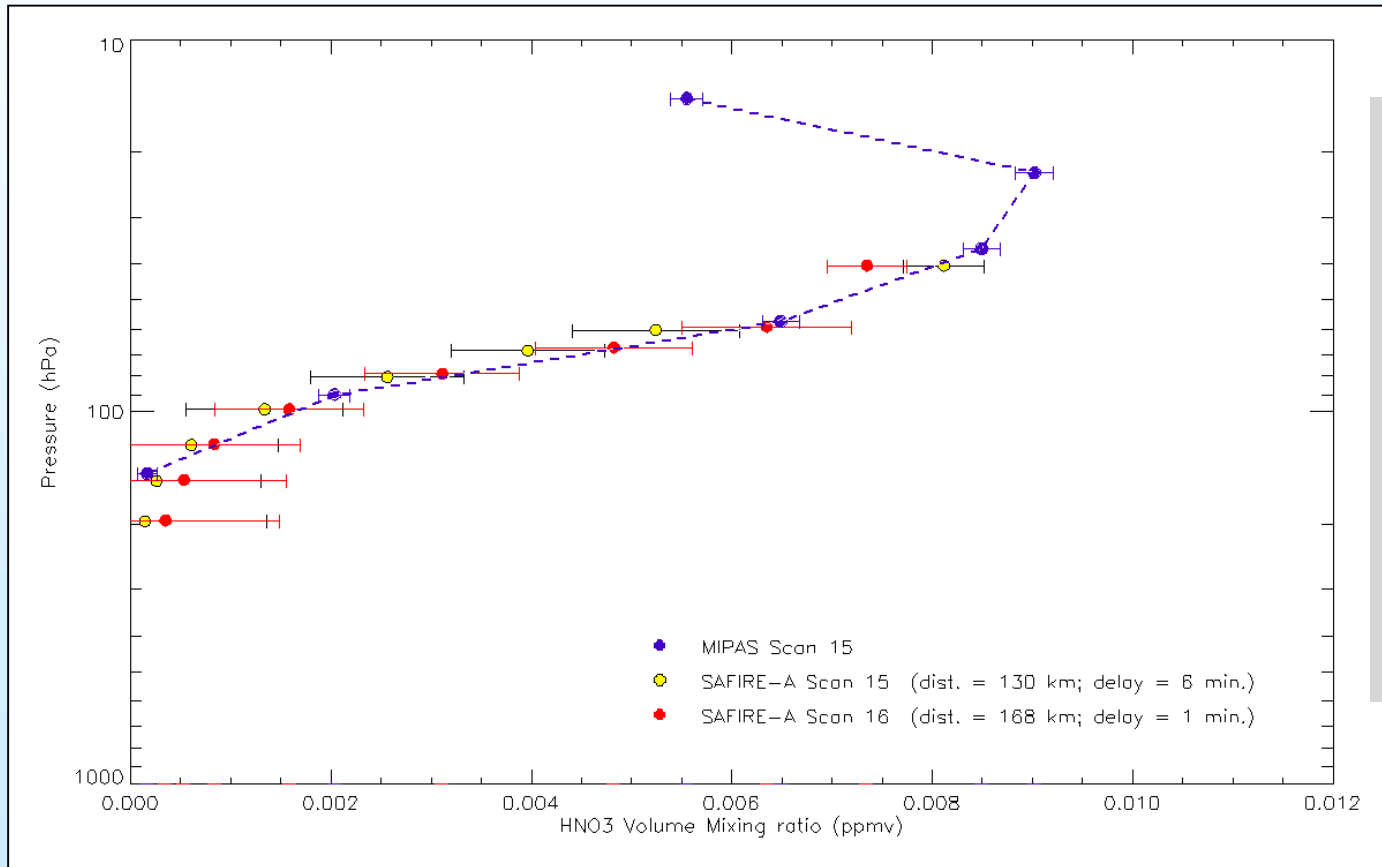
MIPAS-STR north
(mean of 7 profiles)
9:06 – 9:27 UTC



- Strong inhomogeneity in MIPAS-E HNO₃ field
- Difficult to interpret
- ➔ Good agreement of MIPAS-STR north scan with MIPAS-E scan 12

SAFIRE-Geophysica (sub-mm FTS), U. Cortesi, IFAC-CNR

October 24th, 2002 - ENVISAT orbit 3403, MIPAS scan 15



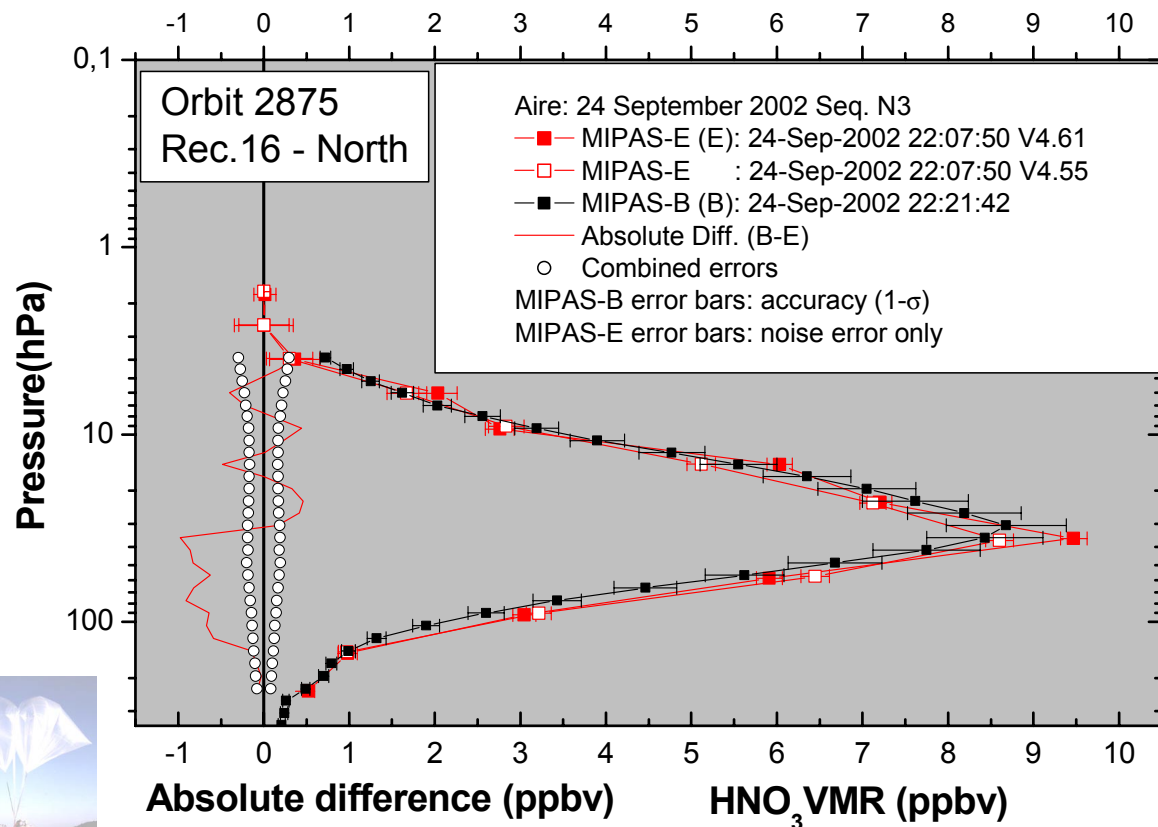
Excellent coincidence:

< 200 km
< 10 min

→ Agreement well within combined error bars

MIPAS-B - H. Oelhaf, FZK-IMK

24 Sept. 2002, ASA, mid-lat



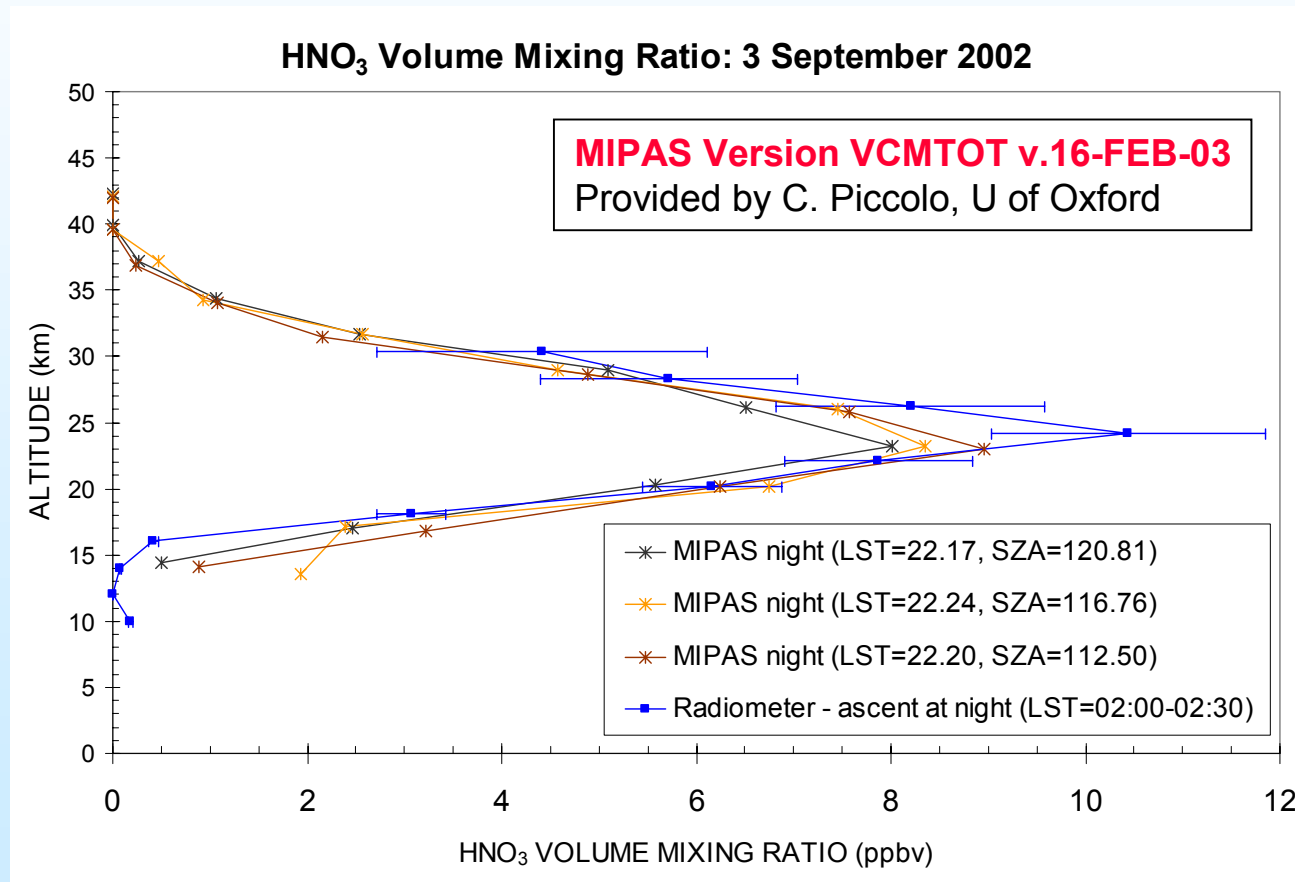
Quality of
coincidence:
excellent:

< 100km
< 20 min.

→ Excellent
agreement, but
slight low bias
between ~ 40
and 150 hPa

MANTRA Balloon-Radiometer HNO_3 - Kim Strong, Univ. Toronto

3 Sept. 2002, Vanscoy, Canada, mid-lat. night



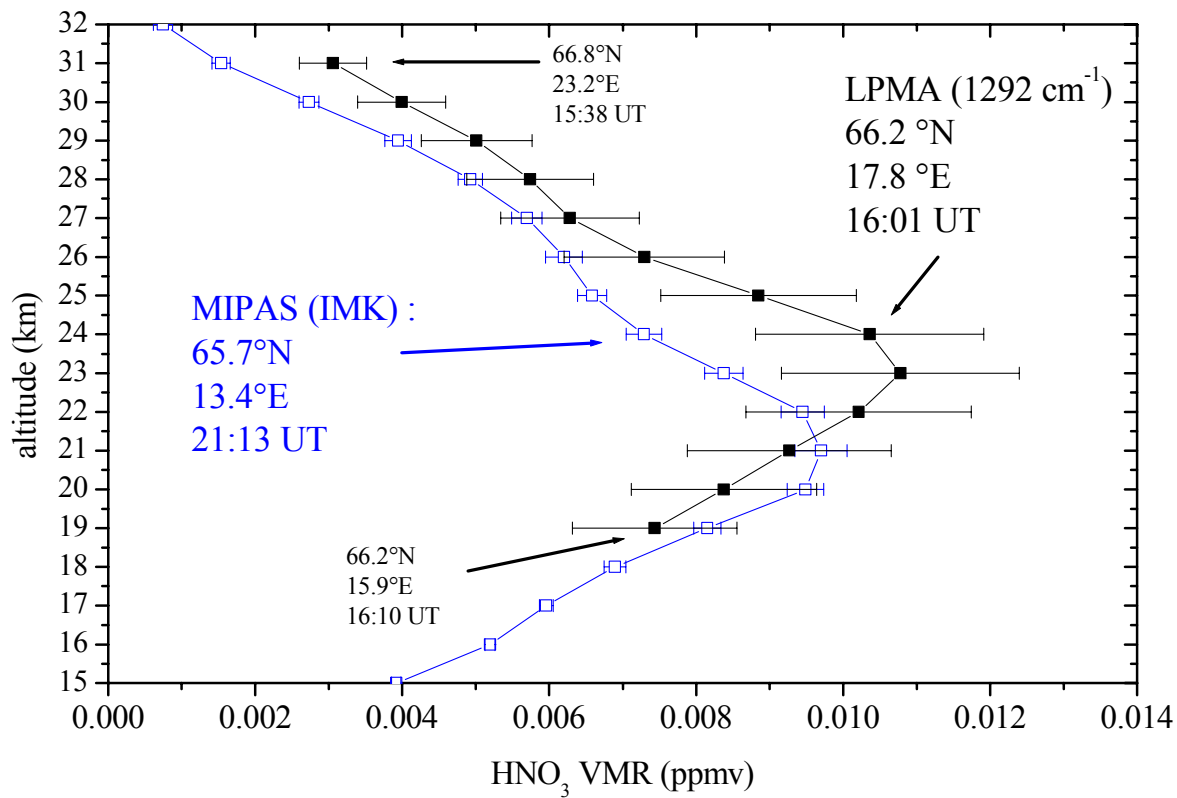
➤ Quality of Coincidence:
~ 1000 km wrt distance
~ 4 hrs wrt time

➤ N.b. peak magnitude and position

➔ MIPAS within radiometer error bars from 18 to 30 km except at the HNO_3 peak

LPMA-Balloon FTIR occultation - C. Camy-Peyret & S. Payan

3 March 2003, Orbit 5279



IMK-Processor data,
ESA-V4.61 data not
yet available!

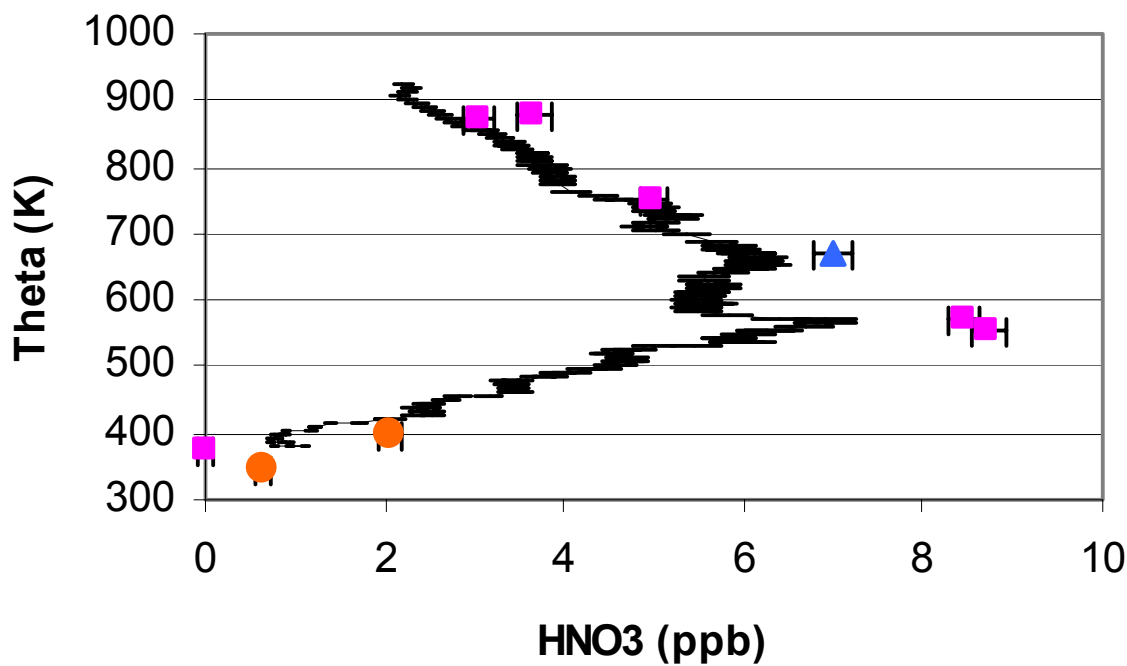
- Quality of coincidence:
fair
- N.b. peak magnitude and position

→ Altitude offset ?

SPIRALE-Balloon (TDLS in-situ) - Michel Pirre, LPCE

2 Oct. 2002, Aire sur l'Adour, trajectory matches

SPIRALE/MIPAS_200209



No direct coincidence !

Black line with 5% error bar:

SPIRALE on October 2, 2002 (0920-1040UT)

MIPAS on trajectories ending at the SPIRALE location:

Circle: MIPAS on Sept. 28

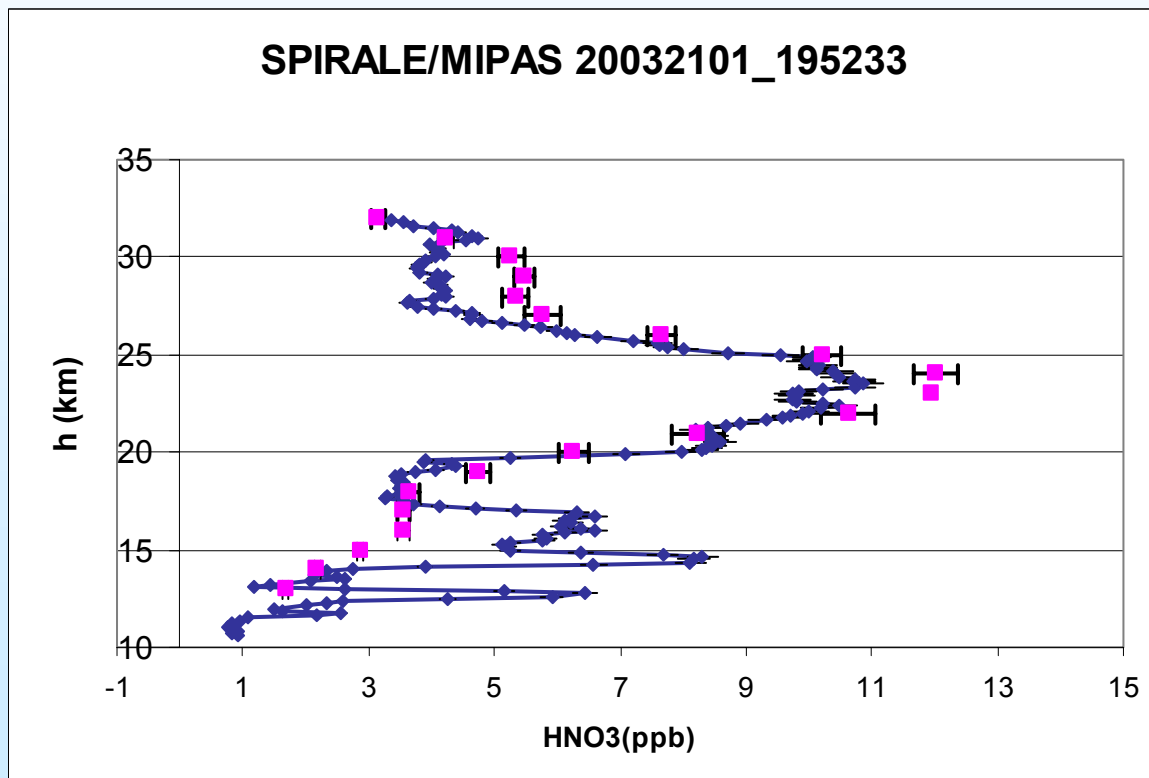
Square: MIPAS on Sept. 27

Triangle: MIPAS on Sept. 25

→ Good agreement, except in peak region

SPIRALE-Balloon (TDLs in-situ) - Michel Pirre, LPCE

21 Jan. 2003, Kiruna 68 N, 20E



IMK-AME Processor V1
Level 1b-Version: 4.55

Good coincidence:
< 1° in Lat.,
5-8° in Long.,
+/- 1 h in time

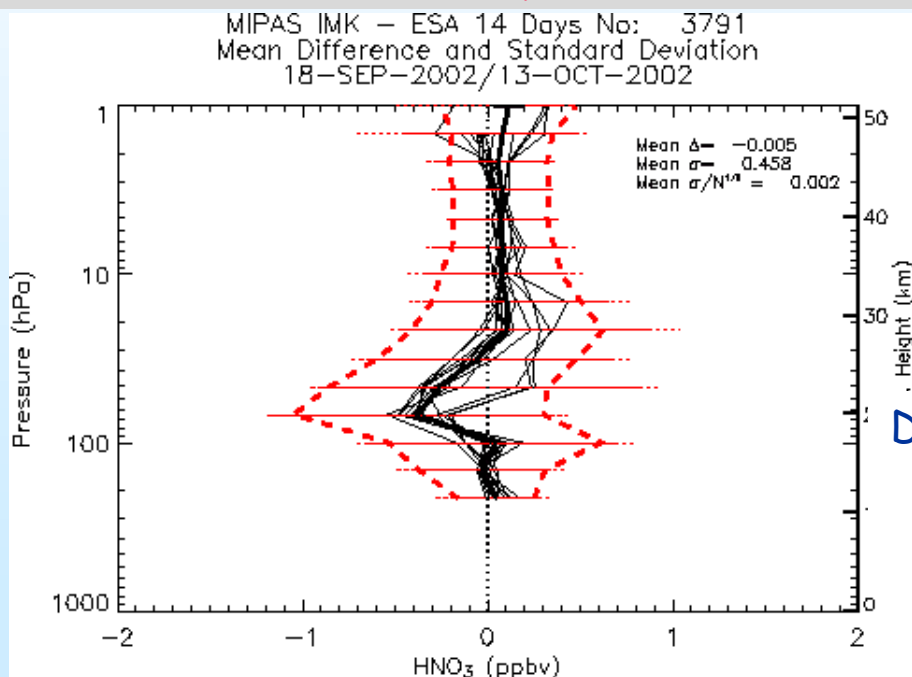
→ Generally good agreement, but different vertical resolution needs to be taken into account

Plausibility Tests and Processor Intercomparison

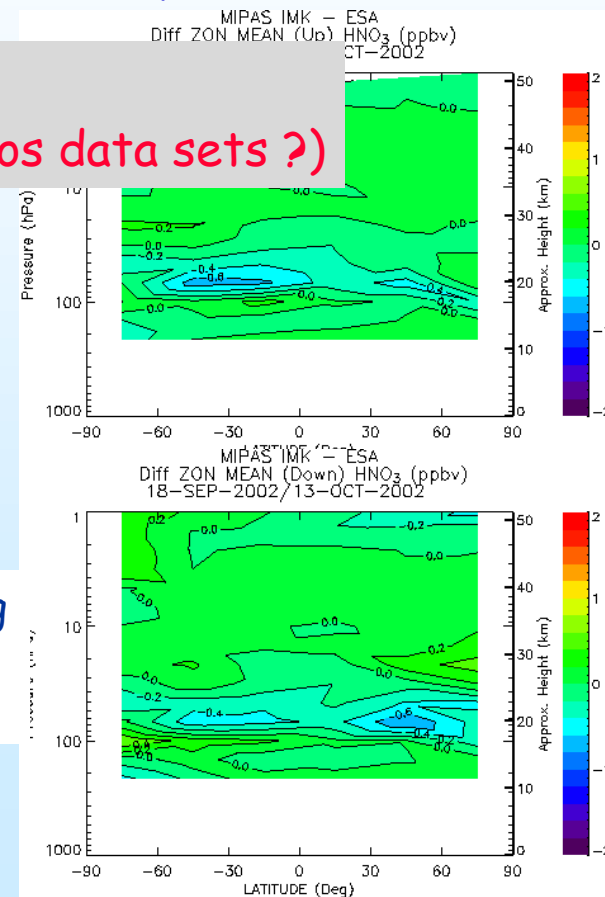
IMK-Processor vs. ESA Oper. Processor

Statistics covering 18 Sept. to 13 Oct. 2002

- Generally good agreement apart from 30-100 hPa
- Profiles of certain days behave differently (spurious data sets ?)



Ding-Yi Wang
and IMK-
AME Team



Conclusions

- Precision of INSTRUMENT species: too early
- Accuracy of INSTRUMENT species: too early

Inter-comparison aggravated by

- Lack of reprocessed v4.61 data for 2003
- Statistics still to come

Validation results obtained so far (quality rating: ++ very good, + good, o fair, ? unclear)

- Balloon
 - SPIRALE 09/10 2002 mid-latitudes + from trajectory matches, peak region ?
 - MIPAS-B Sep. 2002 mid-latitudes ++ excellent coincidence
 - MANTRA Sep. 2002 mid/high-lat. + except of peak region
 - LPMA Mar. 2003 high latitudes ? no coincidences with V4.61 available
- Aircraft
 - Sioux July 2002 mid-latitudes ++ below 120 hPa unclear, excellent coincidence
 - MIPAS-STR July 2002 mid-latitudes + ? inhomogeneity ?
 - SAFIRE-A Oct. 2002 mid-latitudes ++ excellent coincidence
- Ground-based
 - FTIR Kir. 07-11 2002 high latitudes + high bias in MIPAS profiles (~ 10%)
 - FTIR-Net 02+Jan 04 mid/high lat. ? high bias in MIPAS columns (large scatter)
 - FTIRs NI 9/02-03/03 mid/high lat o high bias in MIPAS columns (~ 15%)
 - FTIRs NI 9/02-03/03 high lat. S + but high bias in MIPAS profile < 18 km
 - FTIR J'jo 07+10/02 mid latitudes ? Coincidence criterion ?
- Processor Intercomparison (ESA V4.61 vs. IMK processor with level 1-b V4.55)
 - V4.61vs.IMK 18/09-13/10/02 global + except of 30-100 hPa and spurious data

Very good agreement with V4.61 when excell. coincidence (but limited statistics)

Peak in MIPAS tends to be sharper (?)

High biases (MIPAS) in FTIR GB comp. need to be clarified (spectroscopy, ...)

Recommendations and To Do List

- ESA to provide **all** reprocessed OL data **asap**
- ESA to provide full error budget for MIPAS products
- Validation teams to provide full error budget
- GB teams to harmonize validation techniques for (partial) columns
- Validation teams to provide statistics where applicable
- Validation teams to enhance statistics with trajectory match techniques where useful
- ESA+SAG to nominate scientists in charge for product validation

Acknowledgments

- ESA
- CNES
- SSC Esrange
- FU Berlin
- Teams behind the PIs (> 100 individuals)