MIPAS HNO3
ACVT

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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

<table>
<thead>
<tr>
<th>Station name</th>
<th>Lat N</th>
<th>Lon E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egbert</td>
<td>44.23</td>
<td>-79.78</td>
</tr>
<tr>
<td>Ny Alesund</td>
<td>78.91</td>
<td>11.88</td>
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<tr>
<td>Kiruna</td>
<td>67.84</td>
<td>20.41</td>
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<td>Harestua</td>
<td>60.22</td>
<td>10.75</td>
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<td>Zugspitze</td>
<td>47.5</td>
<td>11.1</td>
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<td>Jungfraujoch</td>
<td>46.55</td>
<td>7.98</td>
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<td>Kitt Peak</td>
<td>31.9</td>
<td>-111.6</td>
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<td>Izana</td>
<td>28.3</td>
<td>-16.48</td>
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<td>Wollongong</td>
<td>-34.4</td>
<td>150.9</td>
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<td>Lauder</td>
<td>-45.05</td>
<td>169.68</td>
</tr>
<tr>
<td>Arrival Heights</td>
<td>-77.83</td>
<td>166.66</td>
</tr>
</tbody>
</table>

- Large data set
- Uncertainty associated with GB data ~ 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) 

\[ \text{MIPAS-E: High bias of } \sim 10 - 20\% \text{ vs. GB data} \]
Typical FTIR-HNO3 profile intercomparisons – V4.61
Jungfraujoch - 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 outside of polar vortex

- 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

- 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

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 stratopause
**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

*VMR in ppbv*
Strong inhomogeneity in MIPAS-E HNO₃ field
Difficult to interpret
Good agreement of MIPAS-STR north scan with MIPAS-E scan 12
Excellent coincidence:
< 200 km
< 10 min
→ Agreement well within combined error bars
Quality of coincidence: excellent:
- < 100km
- < 20 min.

→ Excellent agreement, but slight low bias between ~ 40 and 150 hPa
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 HNO₃ peak
LPMA-Balloon FTIR occultation - C. Camy-Peyret & S. Payan
3 March 2003, Orbit 5279

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

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

IMK-Pocessor 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

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

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

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

Ding-Yi Wang
and IMK-AME Team

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in der Helmholtz-Gemeinschaft
Conclusions

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

- 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)
    - V4.61 vs. 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 \textit{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)