MIPAS-B observations for the validation of target parameters of Envisat chemistry instruments

H. Oelhaf, F. Friedl-Vallon, A. Kleinert, A. Lengel, G. Maucher, H. Nordmeyer, G. Wetzel, G. Zhang, and H. Fischer

Institut für Meteorologie und Klimaforschung
Forschungszentrum Karlsruhe, Germany

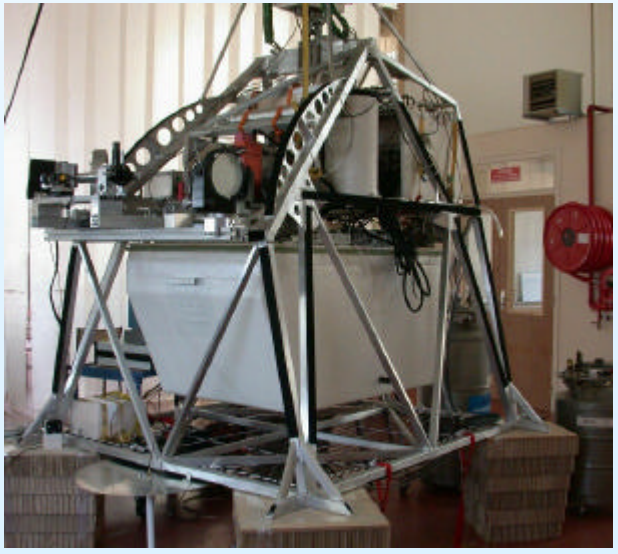
Special thanks to: CNES, SSC, ESTEC, FUB

Funding agencies: DLR, ESA

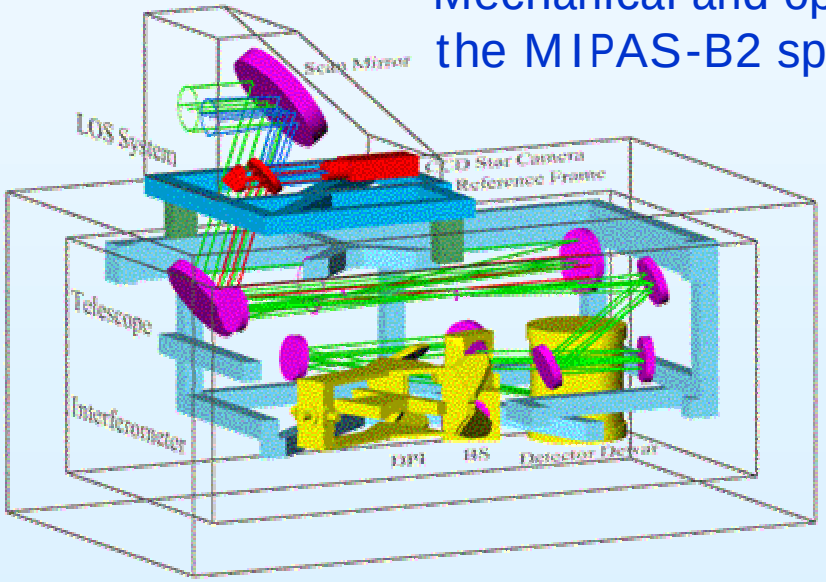
MIPAS-B2: Instrument

- cryogenic limb emission FTIR spectrometer
- spectral coverage 5 - 14 µm, spectral resolution 0.035 cm^{-1} (unapodized)
- profiles from 6 to 39 km, vertical resolution 1.5 - 3 km
- INS/GPS-based pointing system + star camera for absolute reference

New gondola during integration

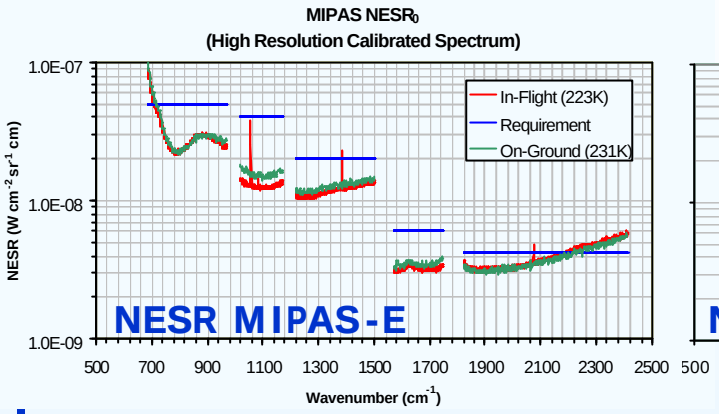


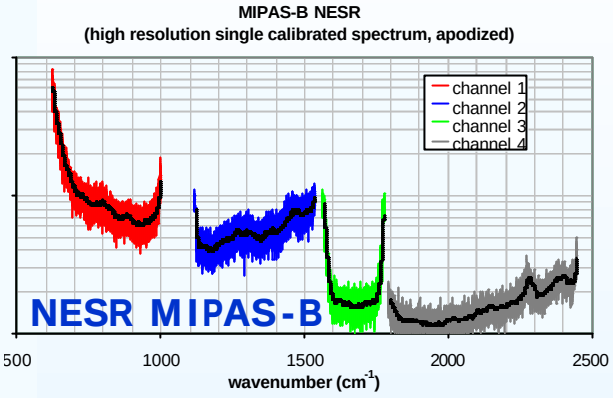
Mechanical and optical setup of the MIPAS-B2 spectrometer

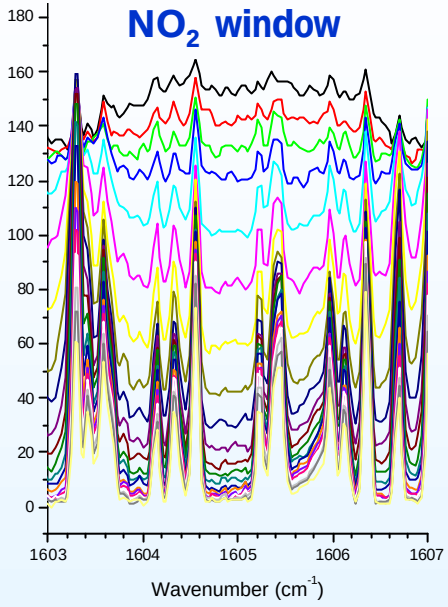


Instrument characterization:

- NESR
- ILS
- FOV
- LOS

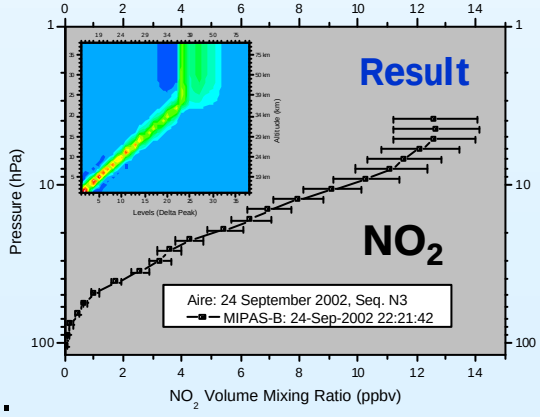


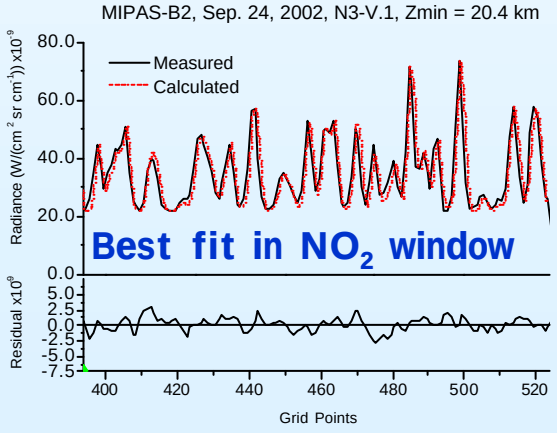




Retrievals:

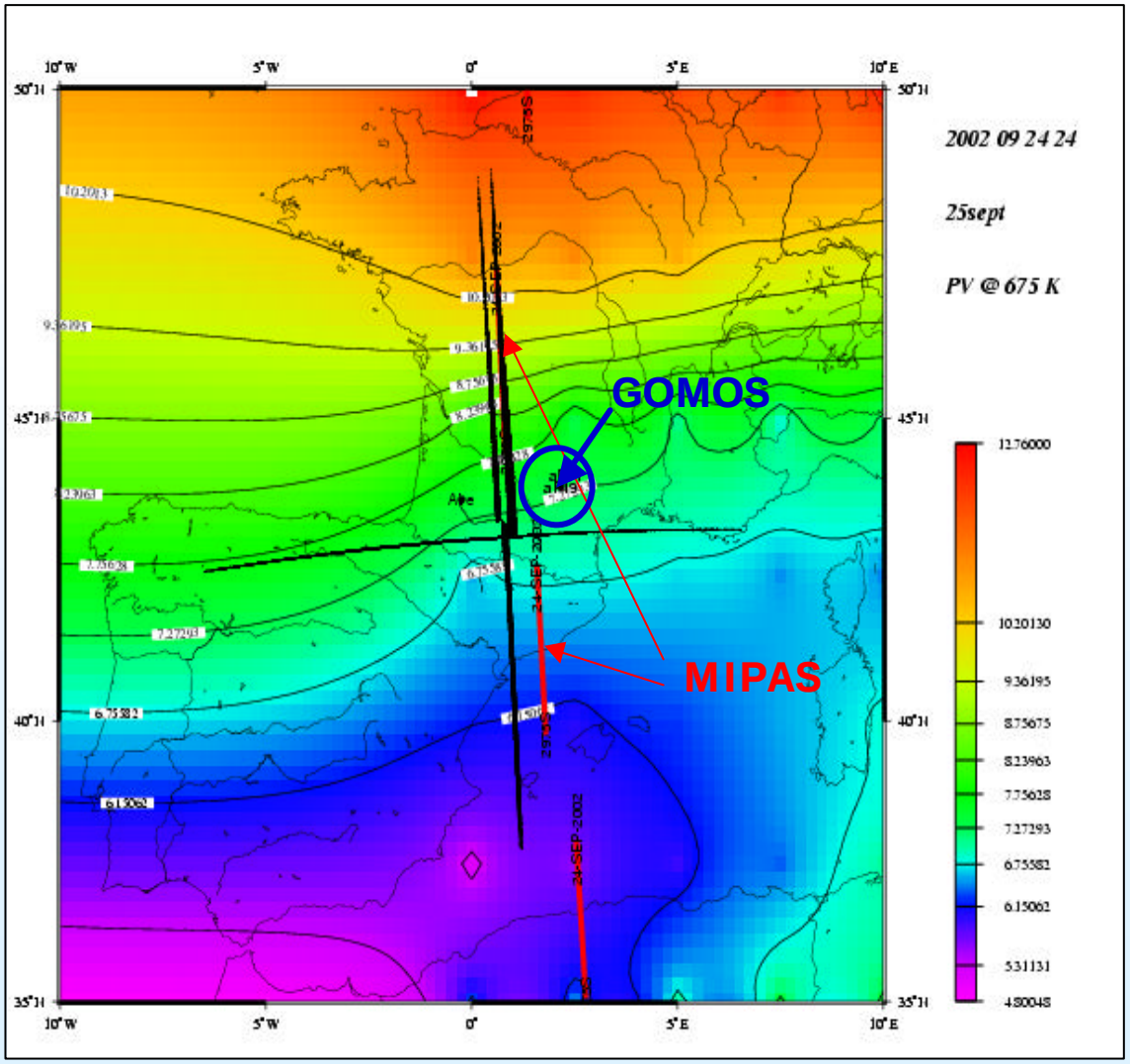
- KOPRA-INV (IMK-AME)
- retrieval grid: 1 km
- measurement grid: 1.5 km
- MIPAS-B proven µWs
- fit param.: T, VMRs, ??, ?L, cont.
- Tikhonov-Phillips regularization
- # degrees of freedom: 7-13
- Errors: Noise, T, LOS, spectrosc.
- A priori: Sonde + ECMWF + climat.





Validation Campaigns and other recent flights of MIPAS-B useful for validation

Date	Site	Primary Funding	Overpass	OP rating/n.b.	
11 09 2002	ASA	DLR-ESA-CNES #1	even. ovp	++/tm	
07 12 2002	Kiruna	AFO2000-POSTA	morn. ovp	++/++	PSC
20/21 0303	Kiruna	DLR-ESA-CNES #2	eve+mor ovps	++/++	SCIA ??
03 07 2003	Kiruna	HGF	‚night'	+/+	



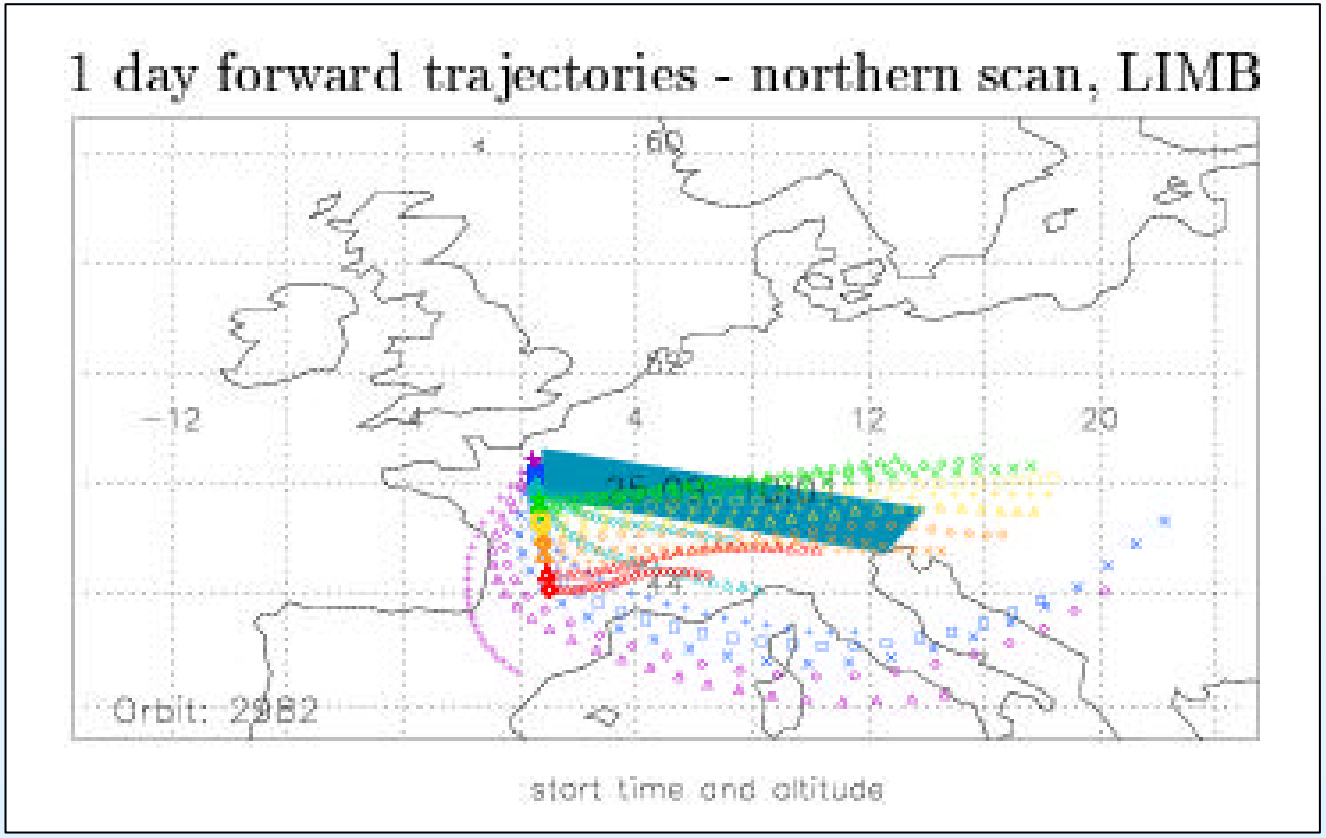
MIPAS-B2 flight #11:

- **Aire sur l'Adour (F)**
- **24 Sept. 2002**
- **mid-latitudes, late summer**
- **orbit 2975 (evening)**

Measurement strategy and quality of match

Colour-coded PV field at the 675 K (~26.5 km) level, MIPAS-B balloon trajectory with lines-of-sight (black), MIPAS-Envisat limb sequences (red) and nearest GOMOS occultation (blue); match of Envisat evening overpass (orbit: 2975).

MIPAS-B vs SCIAMACHY:

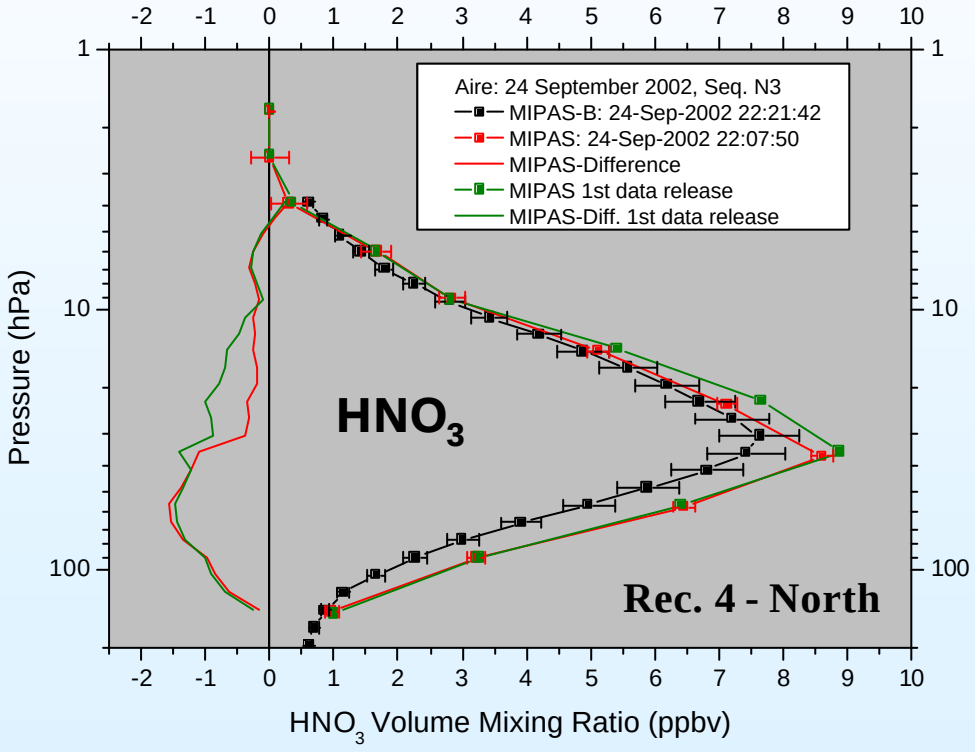


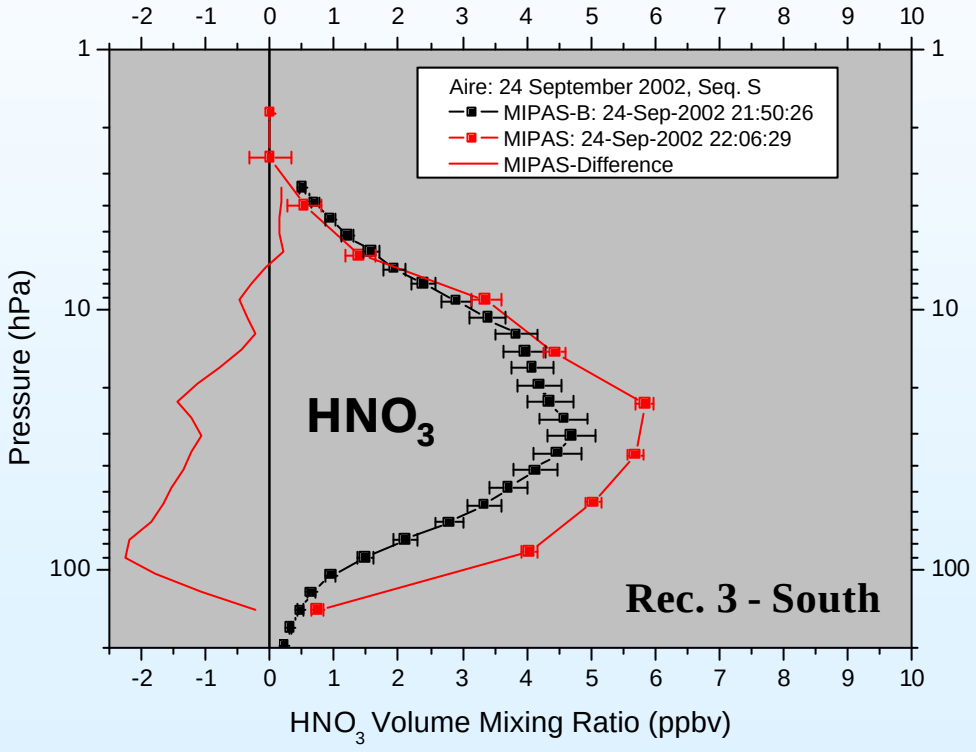
Trajectory calculations performed by Institute for Meteorology, Free University Berlin (sample).

Trajectories started at MIPAS-B tangent point locations (6 to 37 km altitude) to search for matches with nearest limb scans of SCIAMACHY (orbit: 2982).

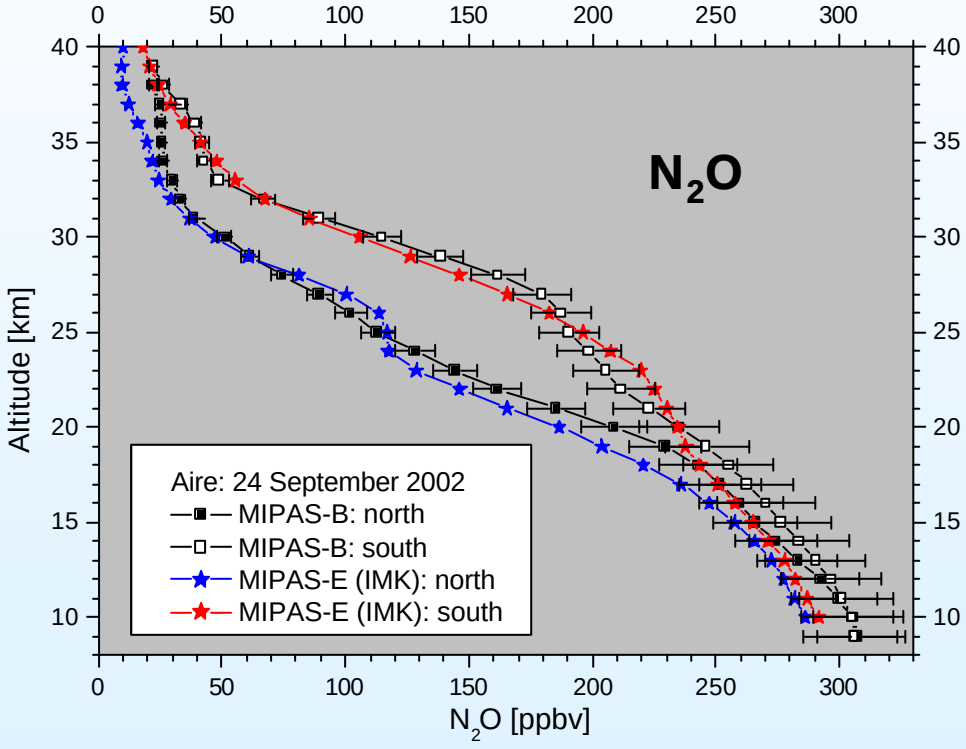
By courtesy of K. Grunow and B. Naujokat, FUB

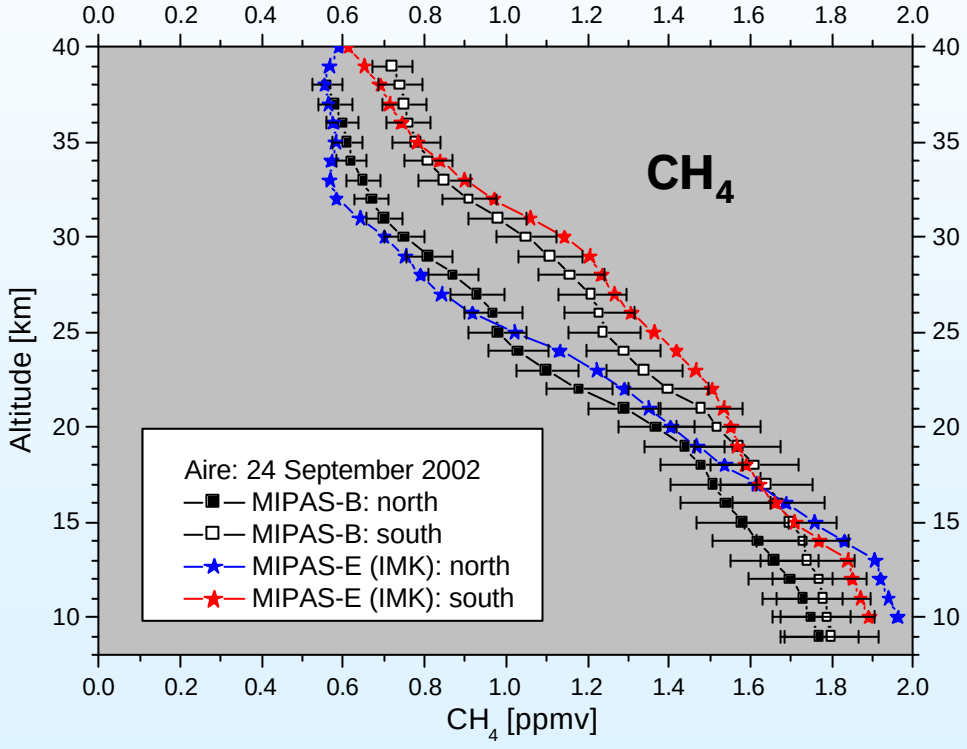
MIPAS-B vs. MIPAS-Envisat





MIPAS-B vs. MIPAS-E (IMK-AME processor)

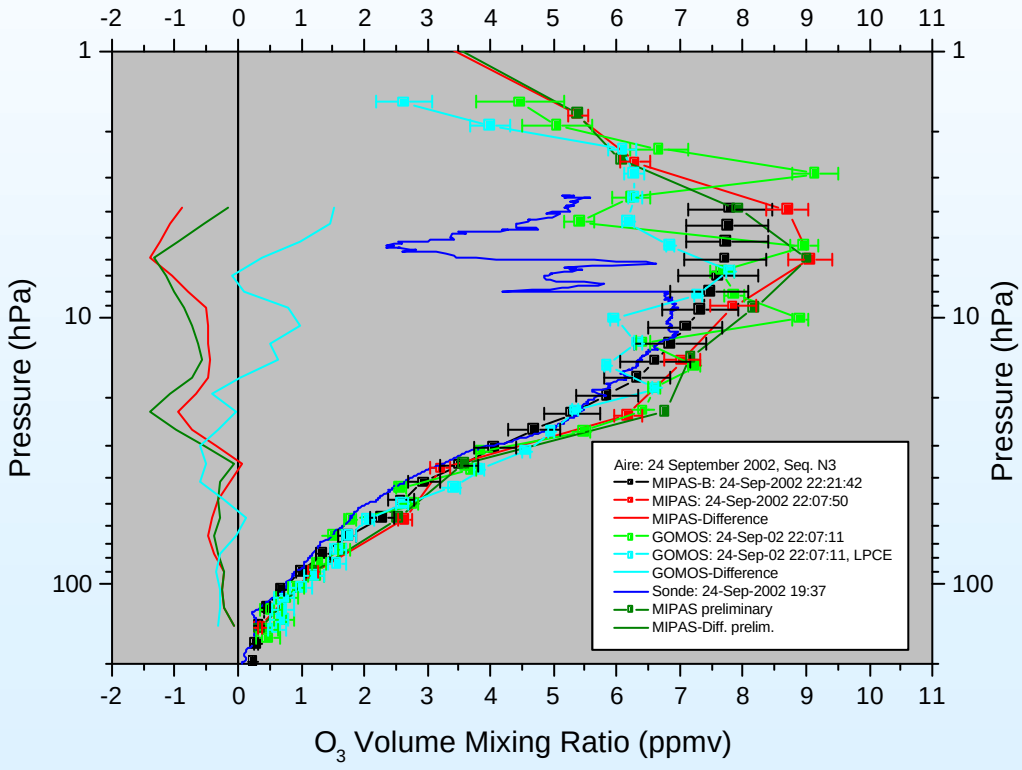


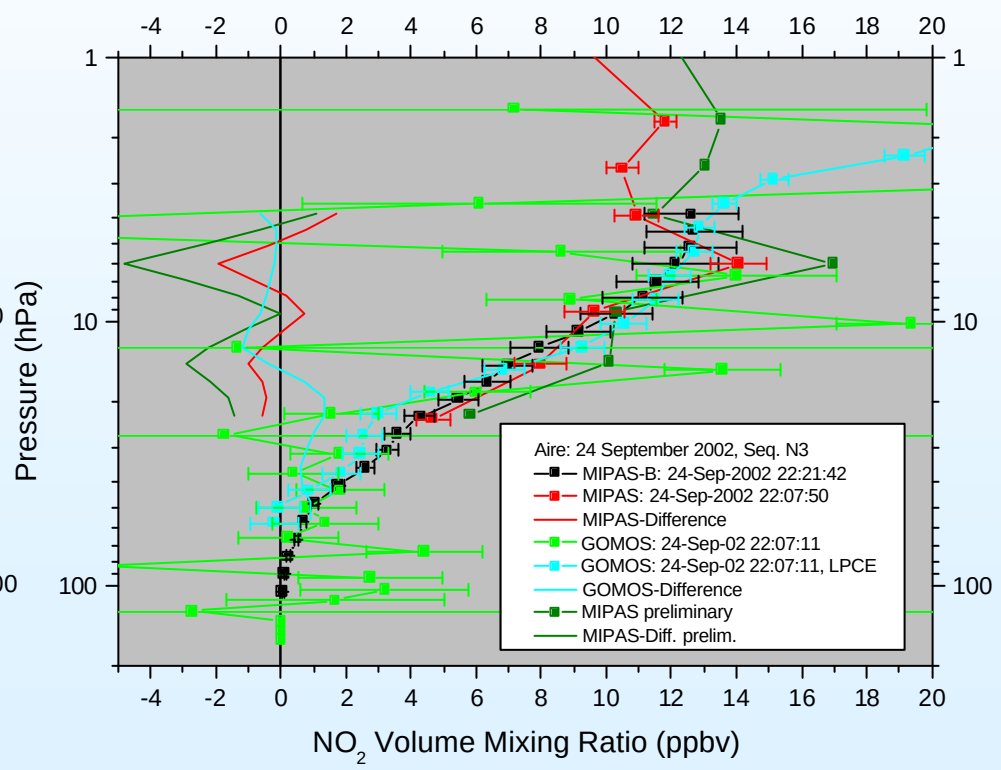


Courtesy: M. Höpfner for IMK-AME team

MIPAS-B vs GOMOS oper. and scient. SW:

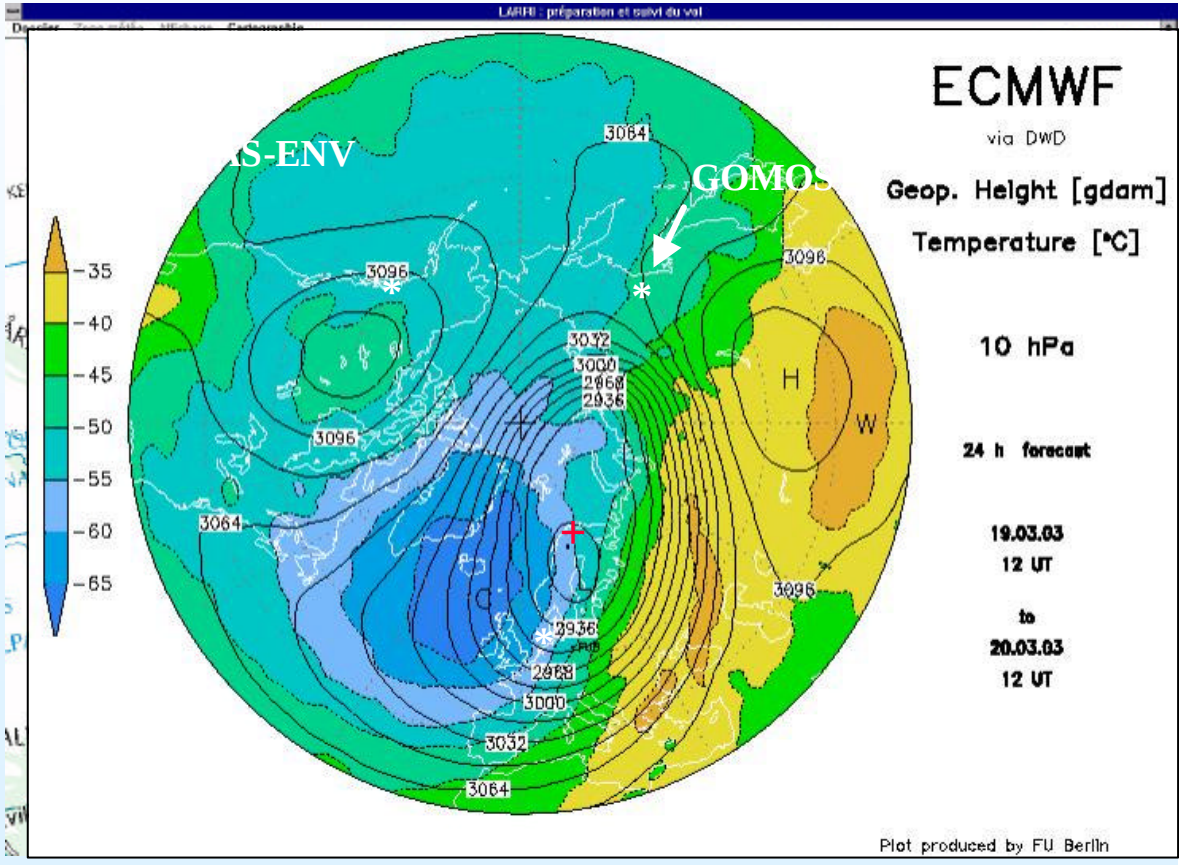
Courtesy: J.-B. Renard/LPCE



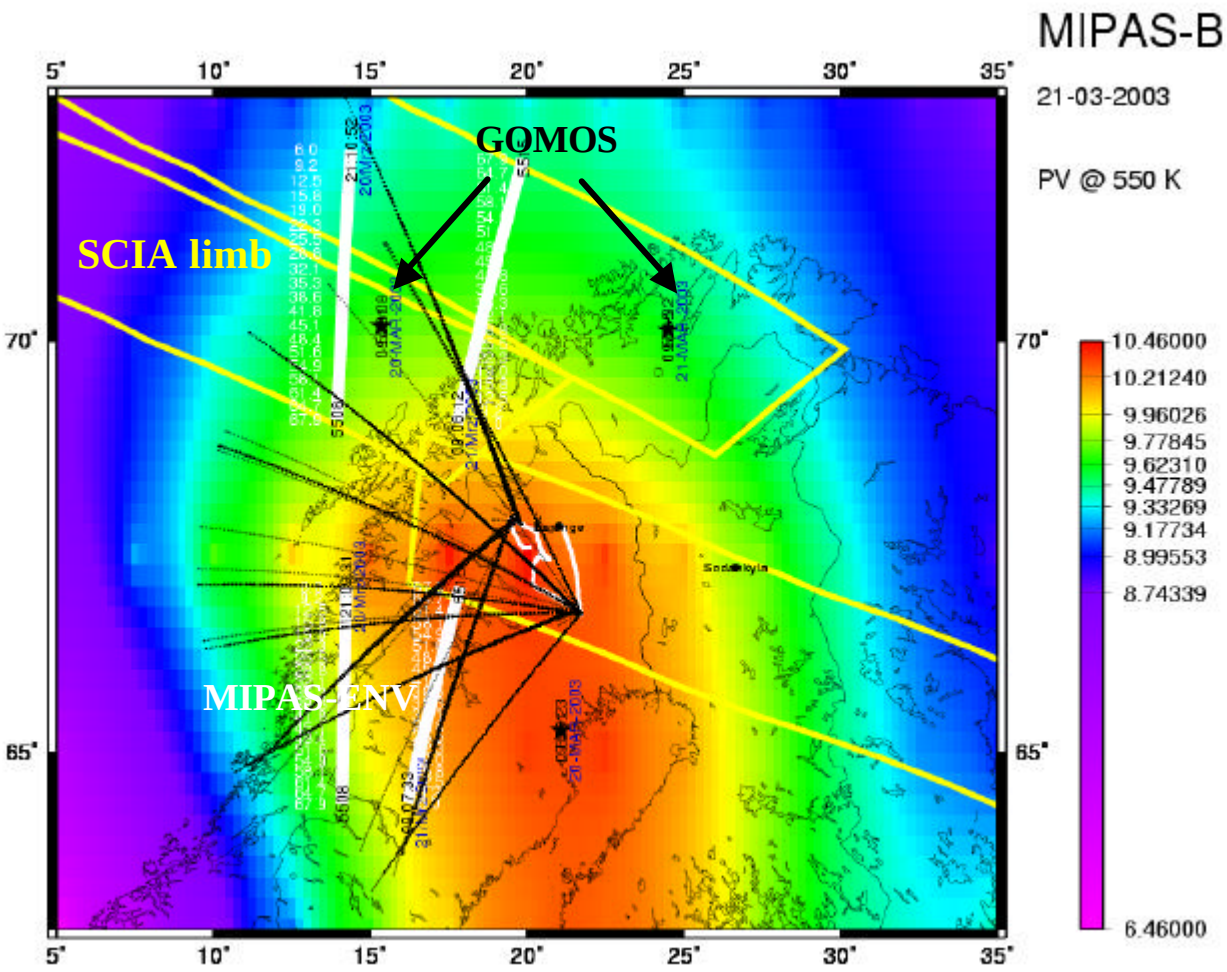


MIPAS-B2 flight #13: Kiruna (S), 20 – 21 March 2003

- high latitudes spring, well inside vortex (> ~20 km)
- long flight: 030320 18:22 to 030321 9:38
- match of evening and morning overpasses (orbits: 5508, 5515)



MIPAS-B2 flight #13: Kiruna (S), 20 – 21 March 2003



Colour-coded PV field at the 550 K (~23 km) level,

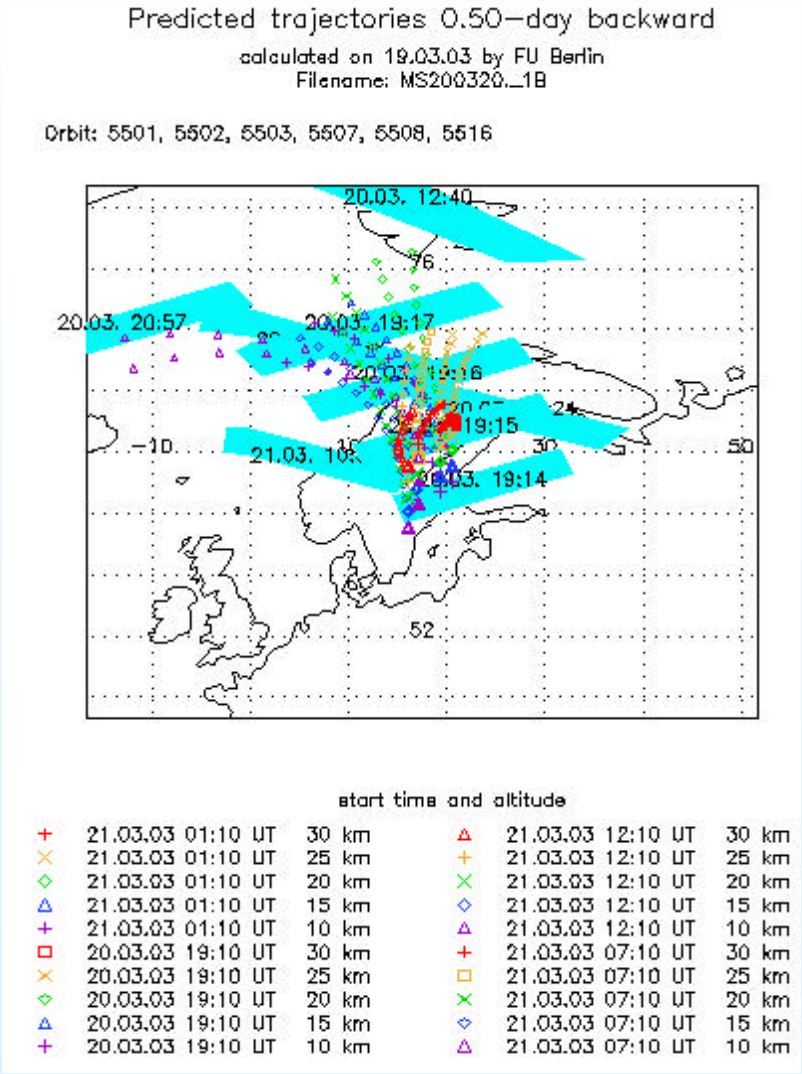
MIPAS-B balloon trajectory with selected lines-of-sight (black),

MIPAS-Envisat limb sequences (white bars),

nearest GOMOS occultations (black stars),

SCIAMACHY limb footprints (yellow);

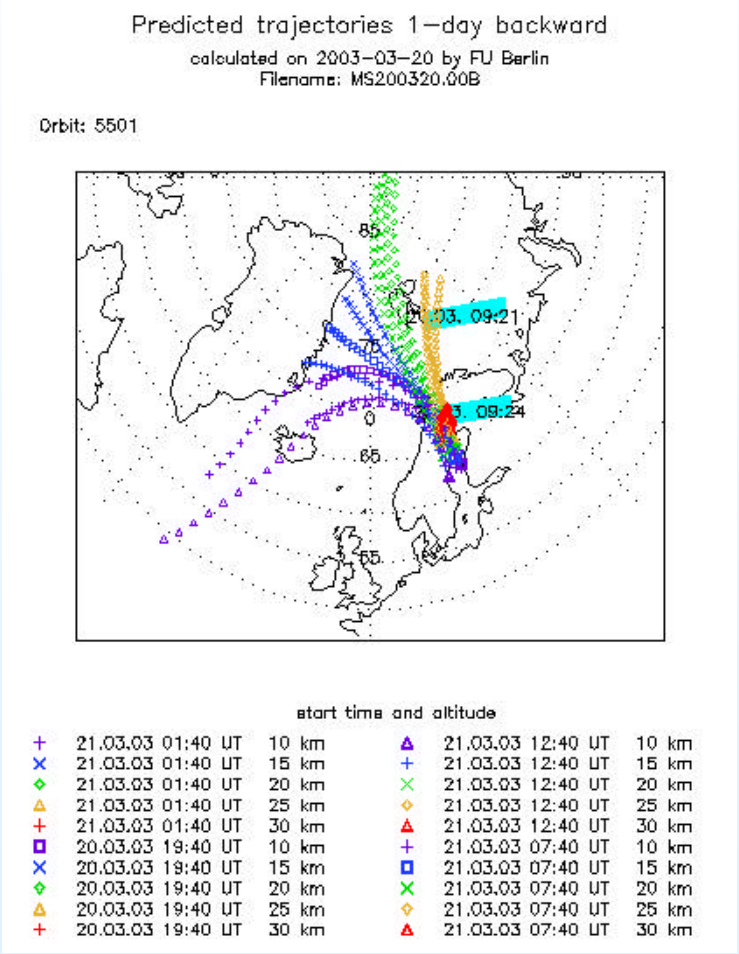
Envisat orbits 5508 & 5515

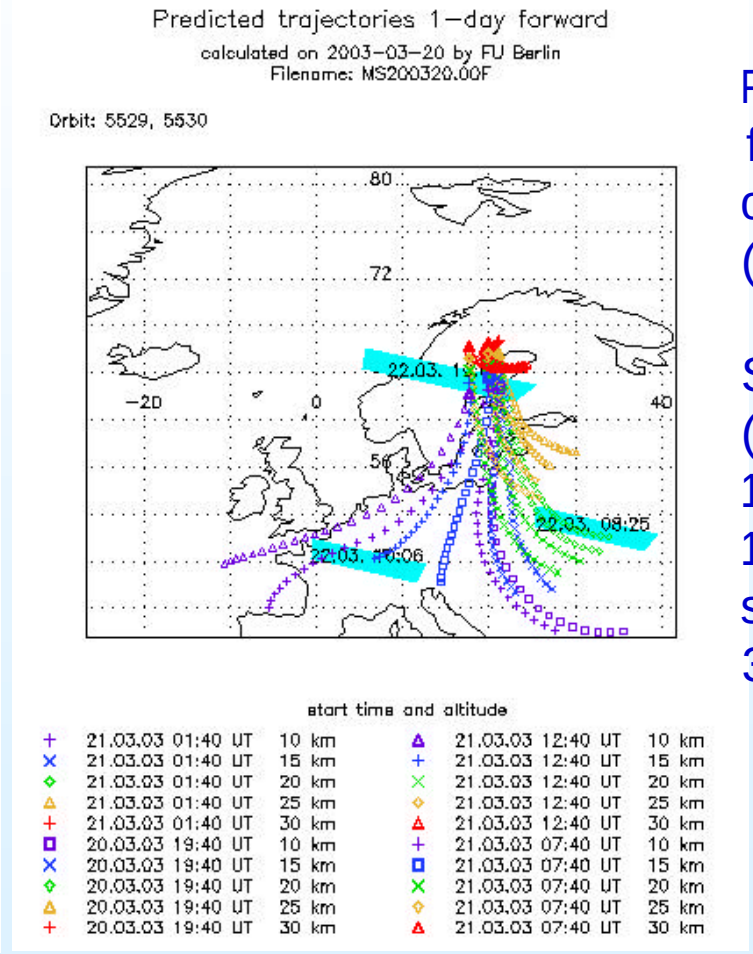


Trajectory calculations by FUB used for flight planning
(K. Grunow)

Questions:

- Health status of SCIA on 20/21 March
- Which trajectories to calculate (if any)



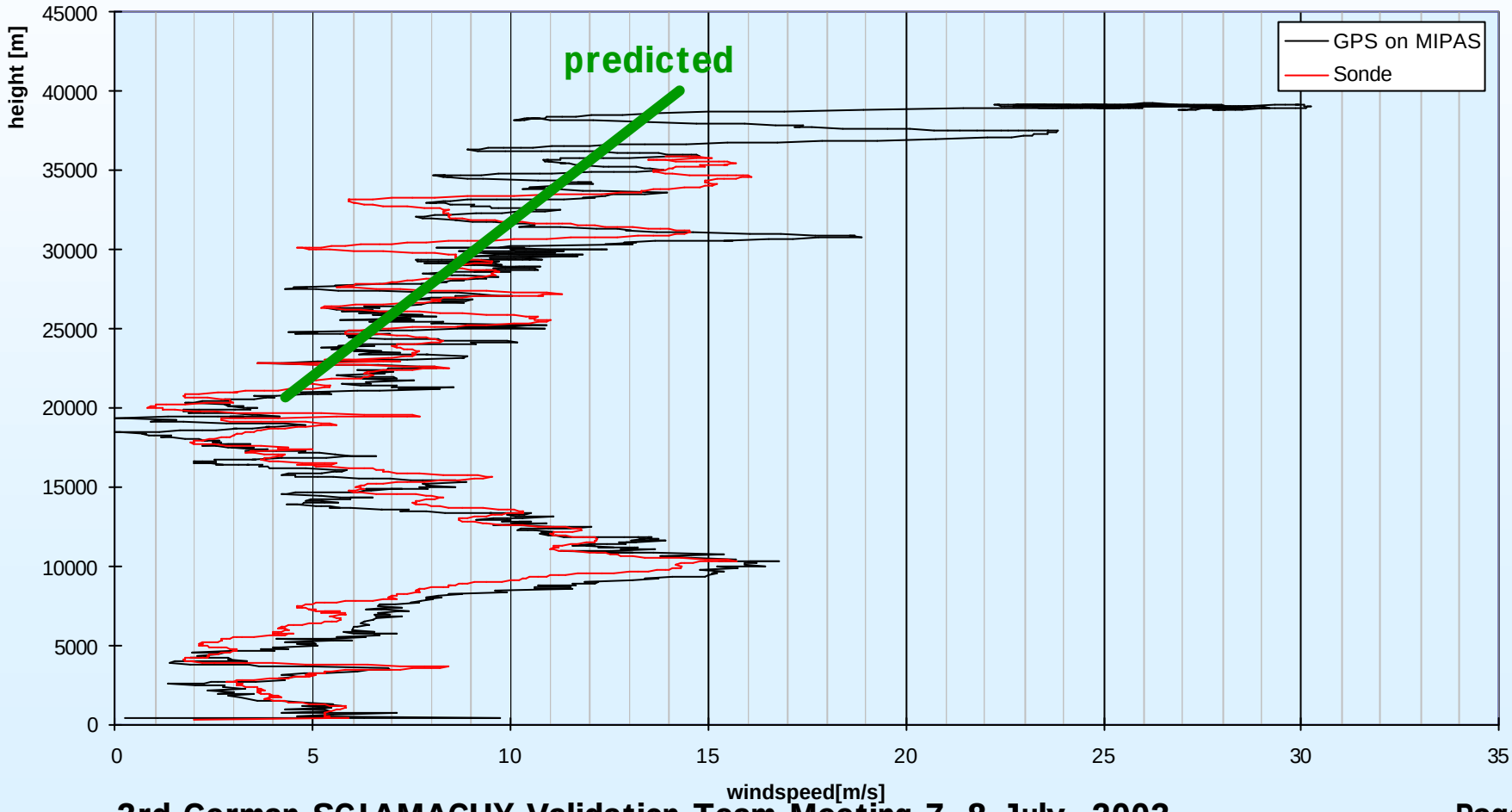


Predicted trajectories for MIPAS-B observation time (samples)

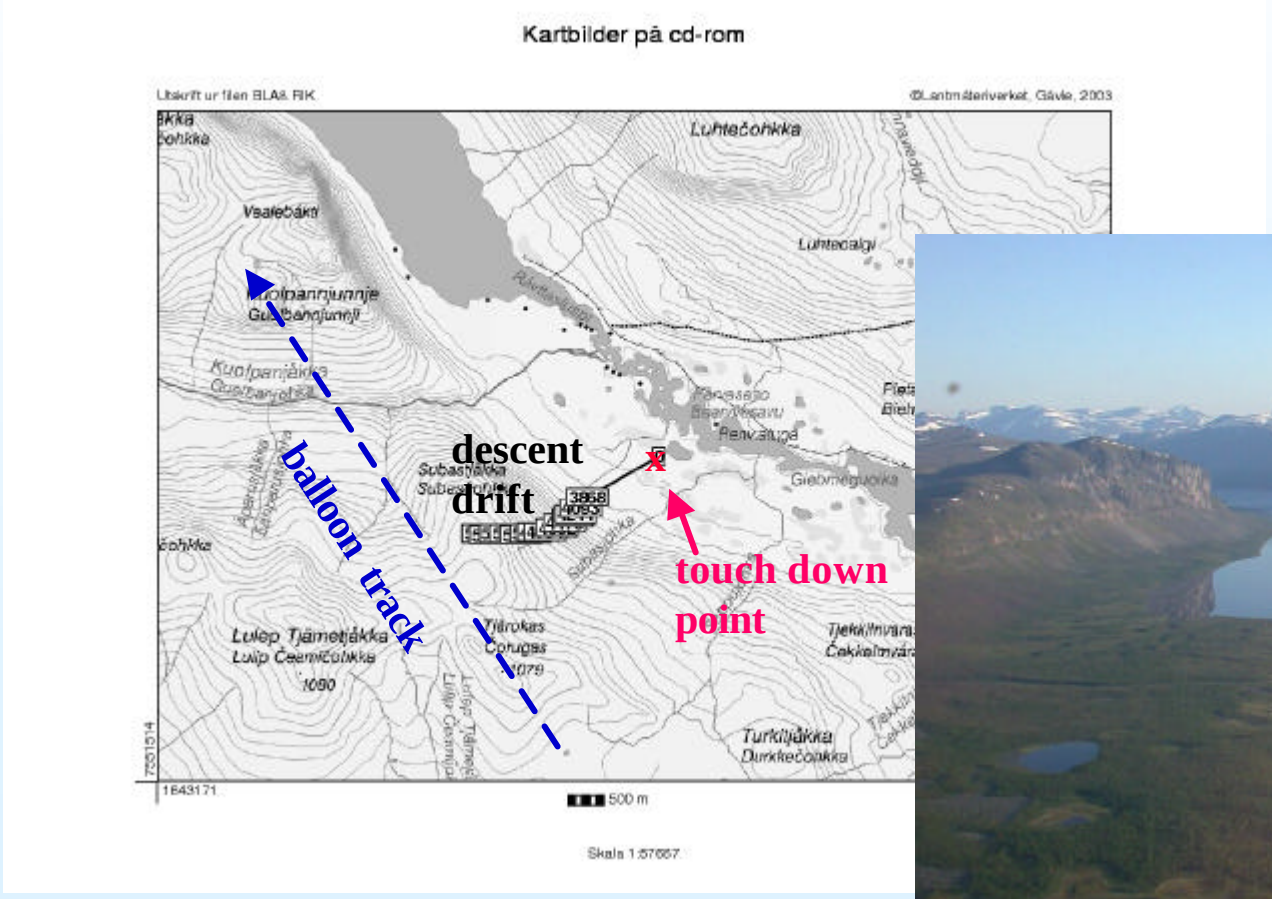
SCIA overpasses (NOT shown for 20.3. 10:57 UT - 21.03. 10:40 UT and SCIA state IDs 1, 9, 23, 28, 33, 34, 41)

MIPAS-B2 flight #14: Kiruna (S), 3 July 2003

MIPAS-B2 flight #14: Kiruna (S), 3 July 2003



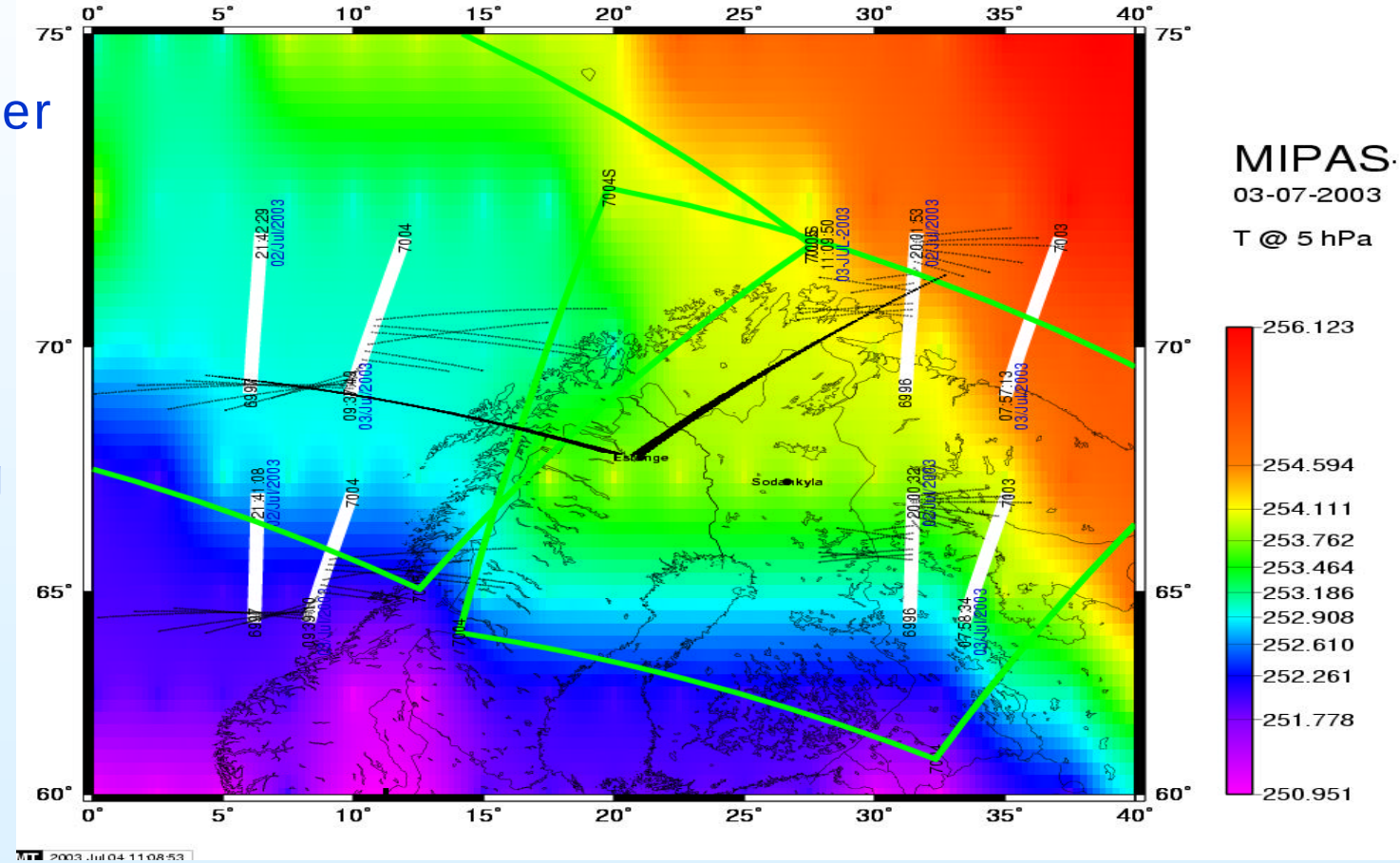
MIPAS-B2 flight #14: Kiruna (S), 3 July 2003



MIPAS-B2 flight #14: Kiruna (S), 3 July 2003

- high latitudes summer
- polar day
- solar zenith angles ~ 80°

- match of 'advected' evening and morning overpasses (orbits: 6996, 7004)



Conclusions and outlook

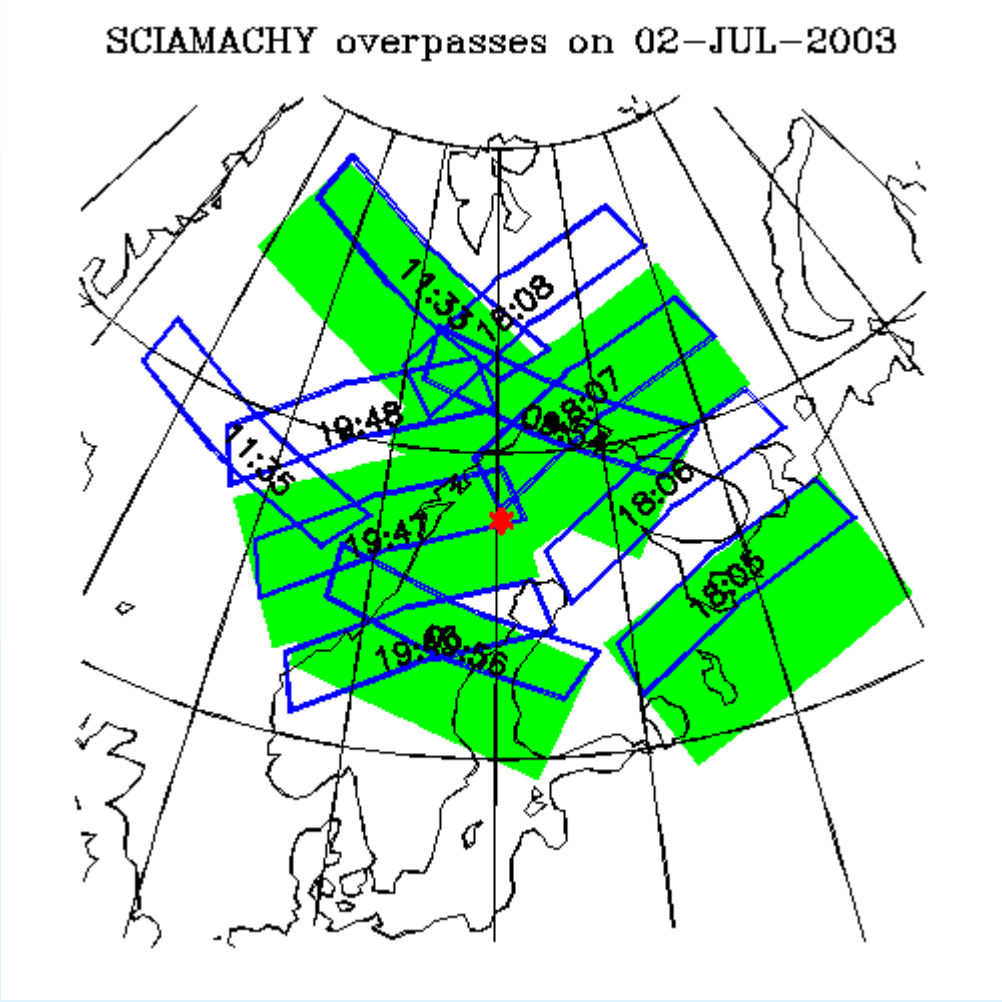
Status and current assessment:

- Good to excellent matches with MIPAS and GOMOS achieved
- SCIAMACHY: good matches in Dec. 2002, March and June 2003, trajectory calculations needed for Sept. 2002 and probably March 2003 flight to find good matches for SCIAMACHY footprints
- Usefulness of Dec. 2002 data set for SCIA validation?
- T- and VMR gradients in Sept.2002 (ASA flight) reveal necessity of good matches even at mid-latitudes
- Products for MIPAS-B flight #11 analyzed and uploaded to NILU, Data analysis for Dec. 2002 and March 2003 flights well in progress
- Comparisons to GOMOS: large oscillations (ver. GOPR_LV2_5.4a, Feb. 2003)
- Comparisons to MIPAS-ENV (operational products, ver. 4.55, Jan 2003): presented in Frascati and St. Gallen: generally already good quality except for CH4 and N2O; IMK processor appears superior to operational processor

Conclusions and outlook

Next steps:

- Further analysis of flight #13 data (Kiruna, winter) and comparison
- Analysis of flight #14 data (Kiruna, summer) and comparison
- Refine SCIAMACHY match analysis (in coop. with FUB) where necessary and compare to SCIAMACHY profile data (still to come)
- Decide on which SCIAMACHY data sets to concentrate
- Perform quantitative validation (total error budgets, averaging kernels, etc.)
- Synthesize with other validation measurements, like BONBON, FISH (AOID 240).
- Campaigns for missing geophysical situations to be prepared
- Long-term validation ?


SCIAMACHY overpasses on 02-JUL-2003
17:35
18:08
19:48
18:07
18:06
19:47
18:05
19:26