

ENVISAT/SCIAMACHY validation by balloon-borne correlative measurements

Andreas Engel and the Bonbon team

Barbara Naujokat and the FU-Berlin team

Hermann Oelhaf and the MIPAS-B team

Klaus Pfeilsticker and the DOAS team

Cornelius Schiller and the FISH team

Fred Stroh and the HALOX team



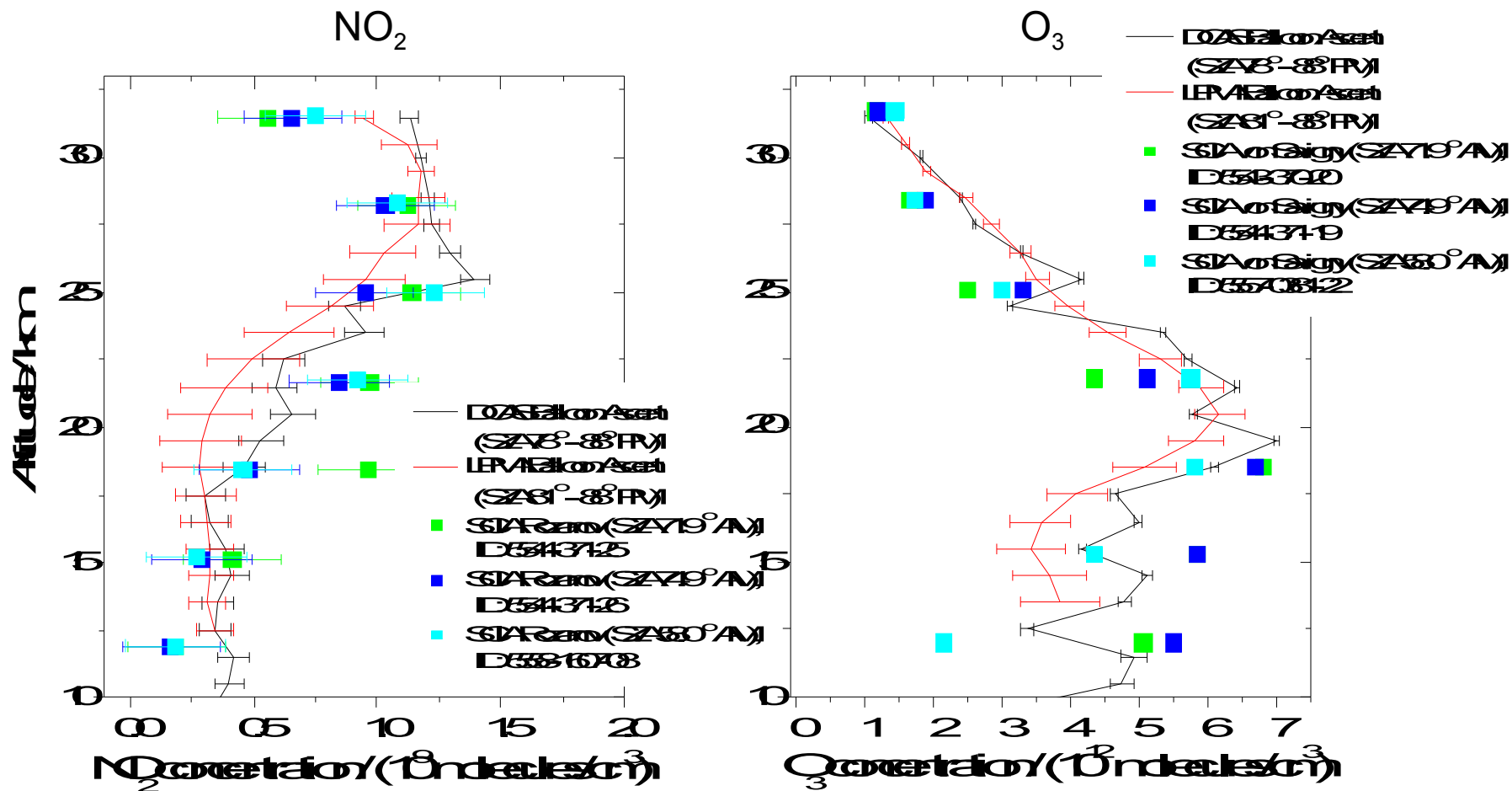
SCIAMACHY validation by LPMA/DOAS

1. March 23, 2003	Kiruna 67.9°N, 21.1° E	SZA: 80° to 95° pm		
Best SCIA matches:	5544	23-Mar-2003	09:28:09 UT	SZA: 71.82° am
	5544	23-Mar-2003	11:07:42 UT	SZA: 74.89° am
	5558	24-Mar-2003	09:01:18 UT	SZA: 57.88° am
2. October 9, 2003	Aire sur l'Adour 43.7° N, 0.25°E	SZA: 72° to 89° pm		
Best SCIA matches:	8394	08-Oct-2003	12:00:38 UT	SZA: 60.96° am
	8407	09-Oct-2003	09:51:44 UT	SZA: 51.73° am
	8408	09-Oct-2003	11:30:57 UT	SZA: 55.68° am
	8421	10-Oct-2003	09:20:14 UT	SZA: 51.72° am
14. March 24, 2004	Kiruna 67.9°N, 21.1° E	SZA: 72° to 96° pm		
Analysis and validation underway ...				
4. Upcoming	Teresina 5.1°S, 42.9° W			



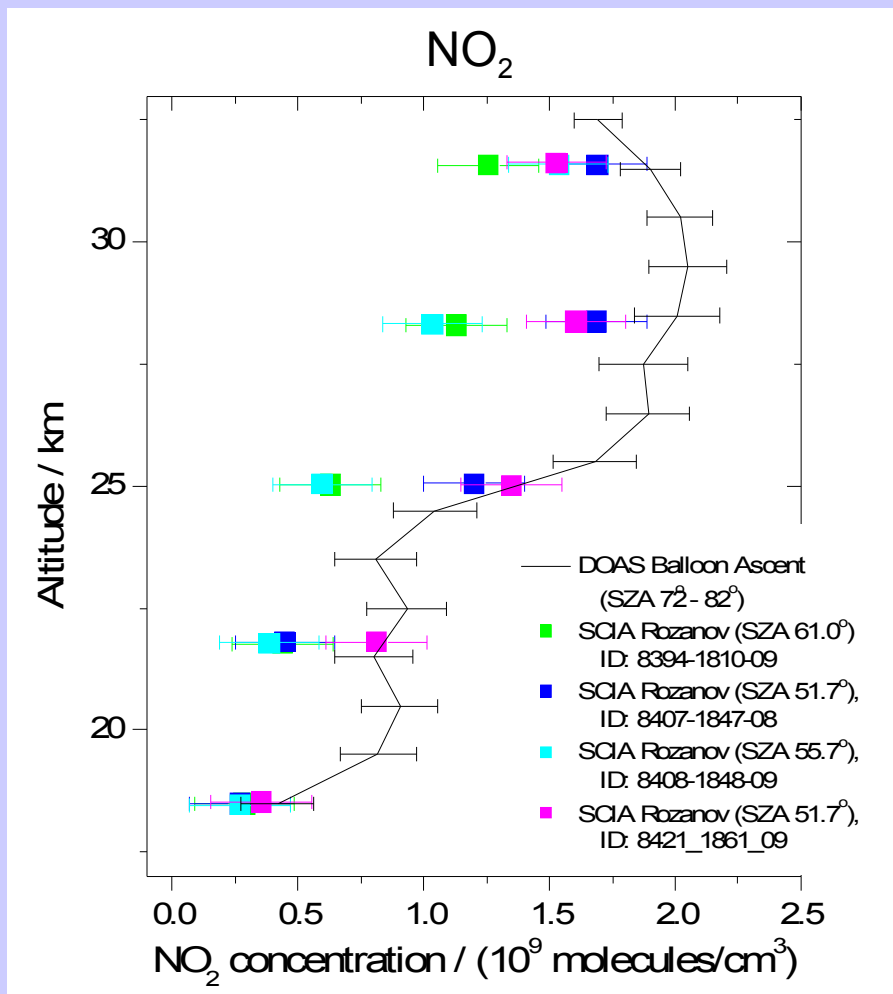
Preliminary SCIAMACHY validation results by LPMA/DOAS

Kiruna, March 23, 2003: Balloon ascent



Preliminary SCIAMACHY validation results by LPMA/DOAS

Aire sur l'Adour, Oct 09, 2003: Balloon ascent



O₃ validation in progress

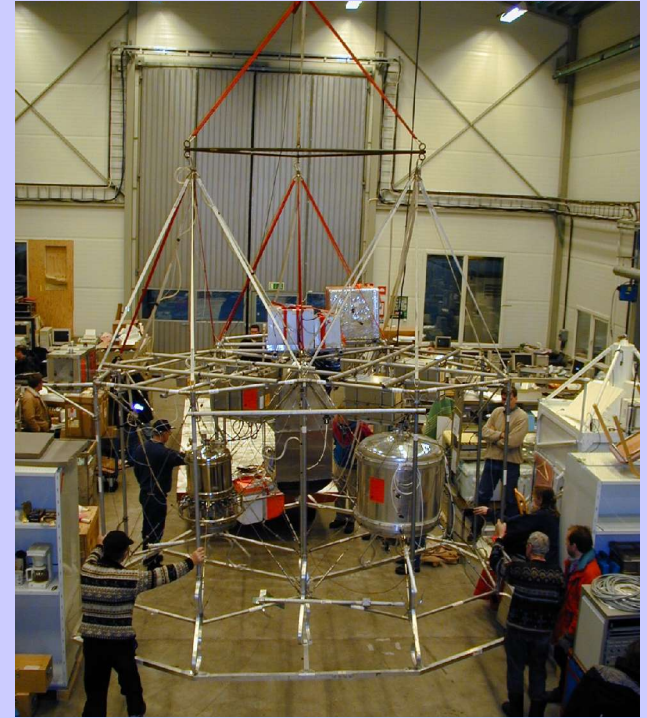
TRIPLE on air

24.09.2002 Aire sur l'Adour

06.03.2003 Kiruna

09.06.2003 Kiruna

??..12.2004 Teresina



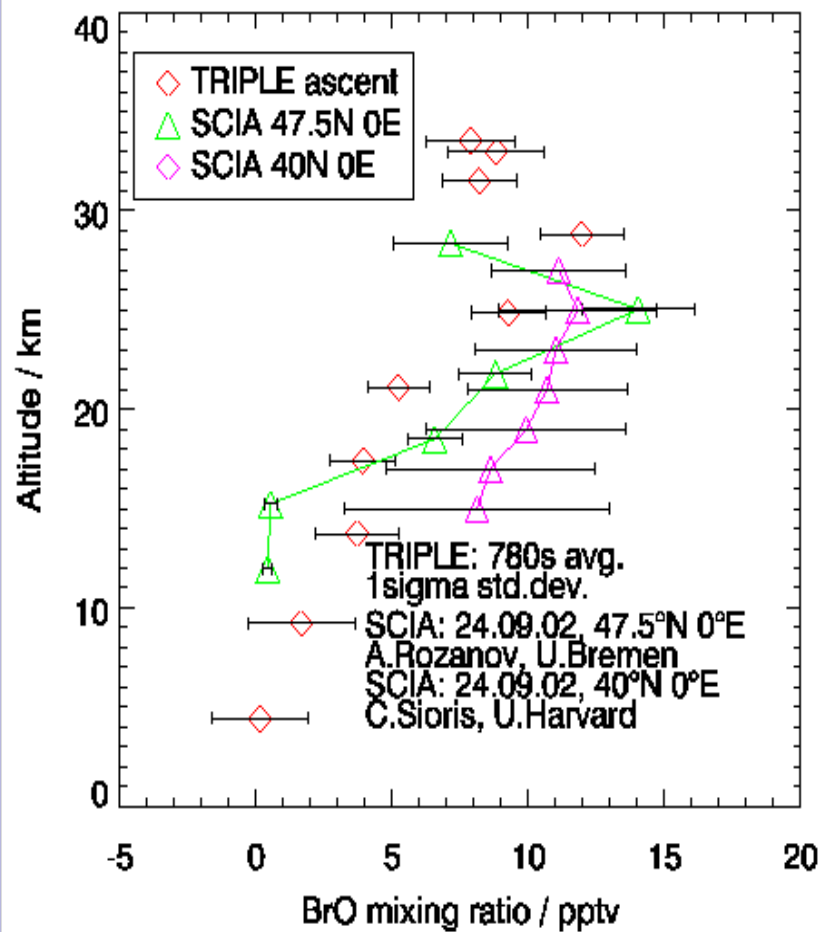
cryosampler (N_2O , CH_4 , other tracers): Andreas Engel, Ingeborg Levin

FISH (H_2O): Cornelius Schiller, Susanne Rohs

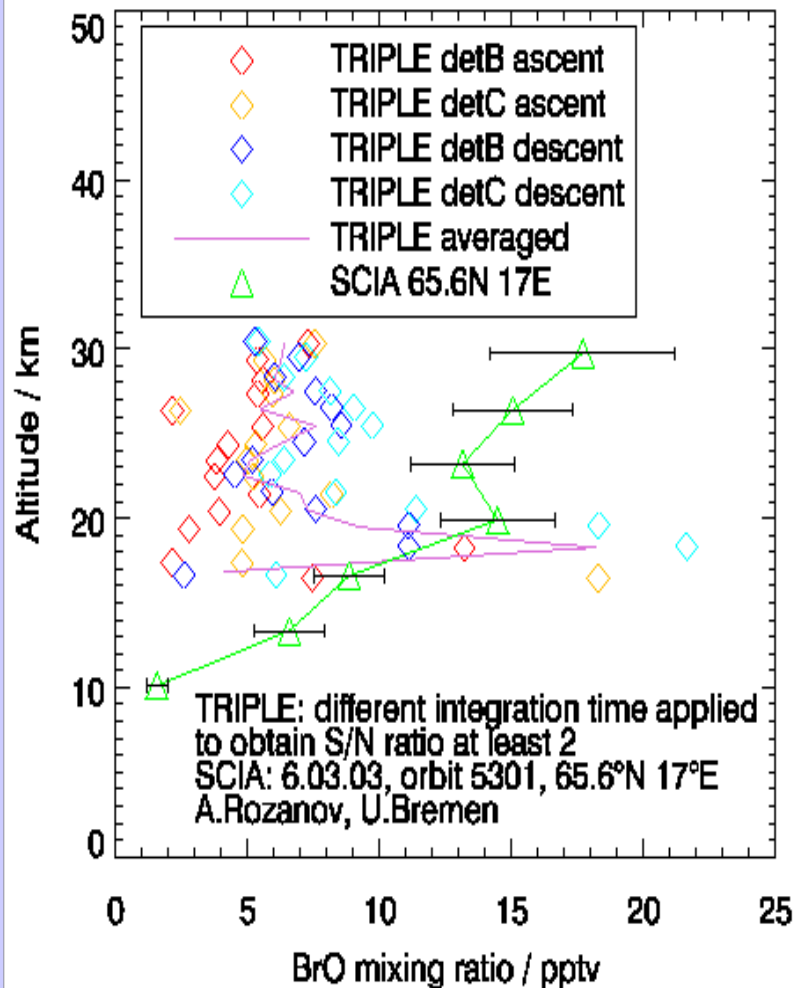
ClO/BrO monitor (ClO , BrO , ClONO_2): Fred Stroh



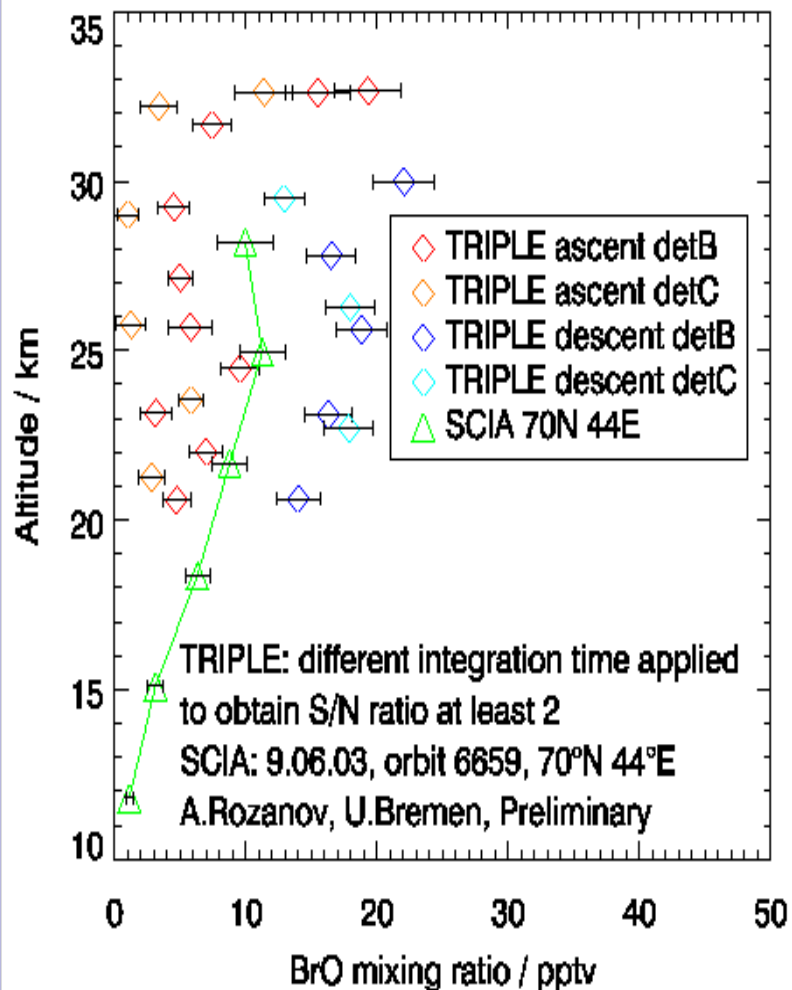
TRIPLE and SCIA BrO, Aire, 24.09.2002



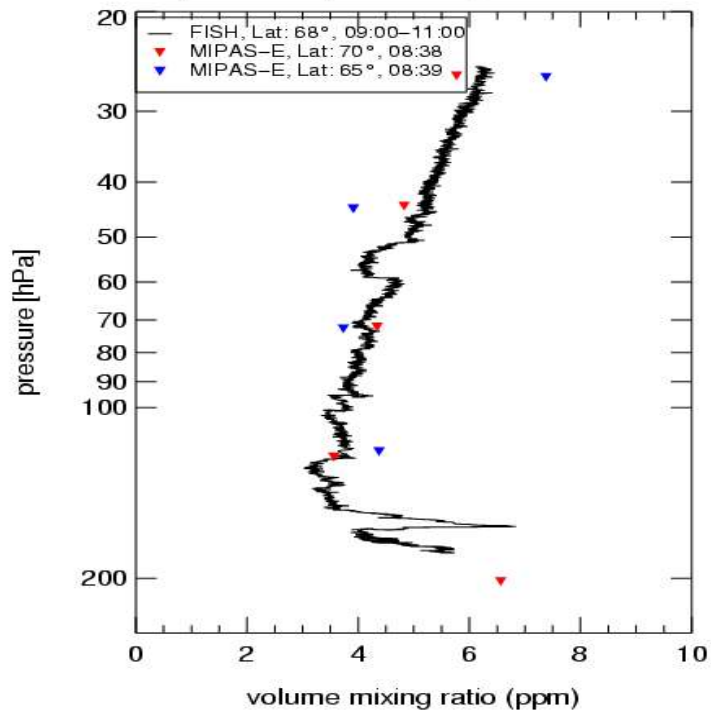
TRIPLE and SCIA BrO, KIRUNA, 06.03.2003



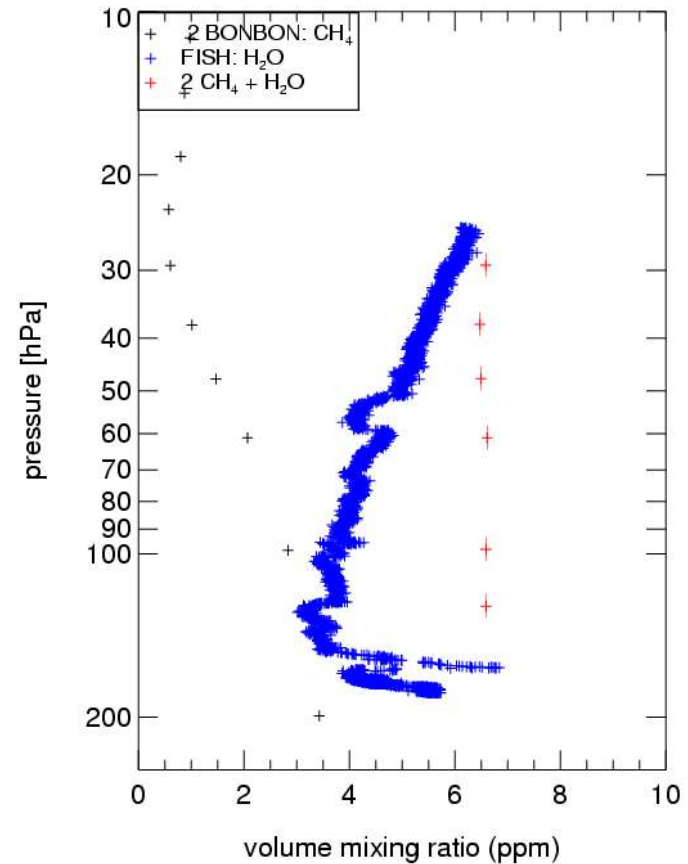
TRIPLE and SCIA BrO, KIRUNA, 09.06.2003



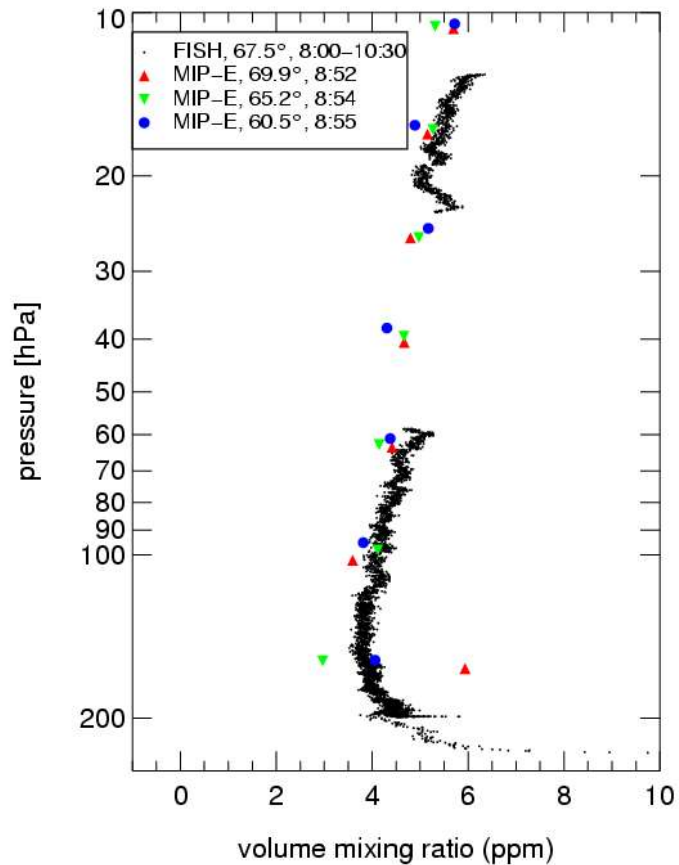
Balloon-FISH: Stratospheric H₂O profile
 Kiruna, 030306, descent, MIPAS-E: v4.61



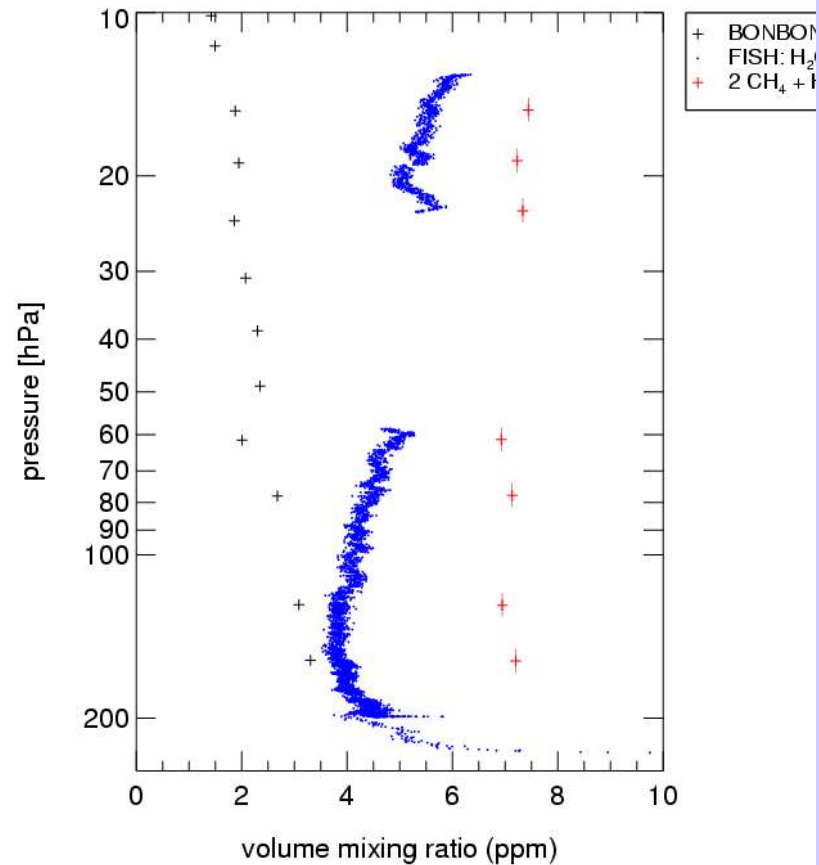
FISH and BONBON: Total Hydrogen Profile
 Kiruna 2003-03-06



Balloon-FISH: Stratospheric H₂O profile
 Kiruna, 030609, descent, MIPAS_E: v4.61



FISH and BONBON: Total Hydrogen Profile
 Kiruna 2003-06-09, descent

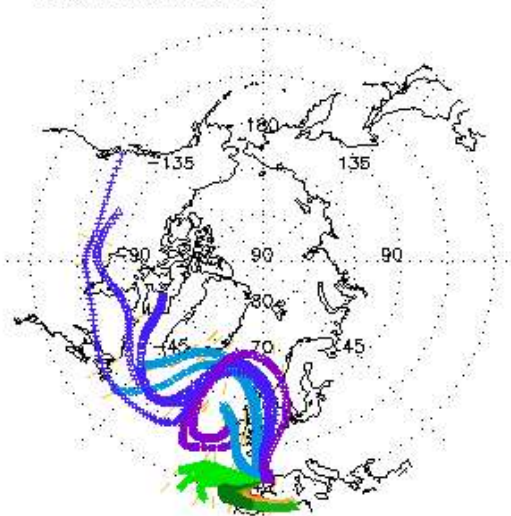


Cryosampler 24.9.2002 vs ESA Retrieval ver 4.61

- trajectory mapping for +/- 5 days: 125 matches with 49 orbits

Trajectories 5-day backward
file: 31020924.AAB, matches with MIPAS: 1 h, 500 km

Orbit: 2896, 2897, 2898, 2900, 2904, 2905, 2906, 2907, 2911
2912, 2918, 2919, 2920, 2925, 2926, 2933, 2939, 2940
2946, 2947, 2953, 2961

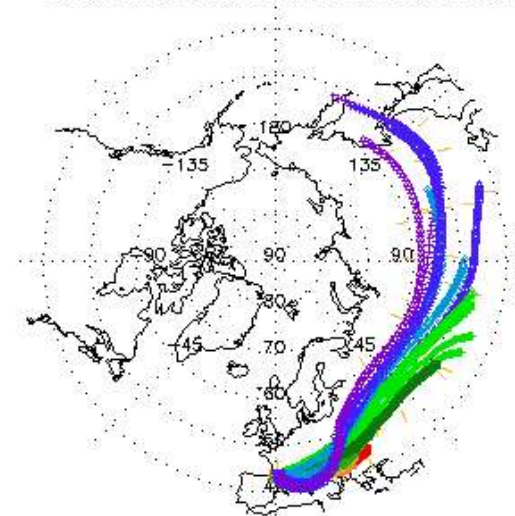


start time and altitude					
+	24.09.02	09:50 UT	32.0 km	▲	24.09.02 11:40 UT 6.0 km
■	24.09.02	09:40 UT	32.7 km	+	24.09.02 11:30 UT 11.1 km
×	24.09.02	08:50 UT	31.6 km	■	24.09.02 11:20 UT 12.8 km
◇	24.09.02	08:40 UT	29.7 km	×	24.09.02 11:10 UT 15.3 km
▲	24.09.02	08:30 UT	28.8 km	◇	24.09.02 11:00 UT 18.2 km
+	24.09.02	08:20 UT	23.8 km	▲	24.09.02 10:50 UT 20.3 km
■	24.09.02	08:10 UT	20.8 km	+	24.09.02 10:40 UT 22.6 km
×	24.09.02	08:00 UT	17.9 km	■	24.09.02 10:30 UT 25.2 km
◇	24.09.02	07:50 UT	15.1 km	×	24.09.02 10:20 UT 28.1 km
▲	24.09.02	07:40 UT	12.3 km	◇	24.09.02 10:10 UT 30.1 km
+	24.09.02	07:30 UT	8.4 km	▲	24.09.02 10:00 UT 31.5 km

trajectories calculated on 20030716, matches on 20030911, FU Berlin

Trajectories 5-day forward
file: 31020924.AAF, matches with MIPAS: 1 h, 500 km

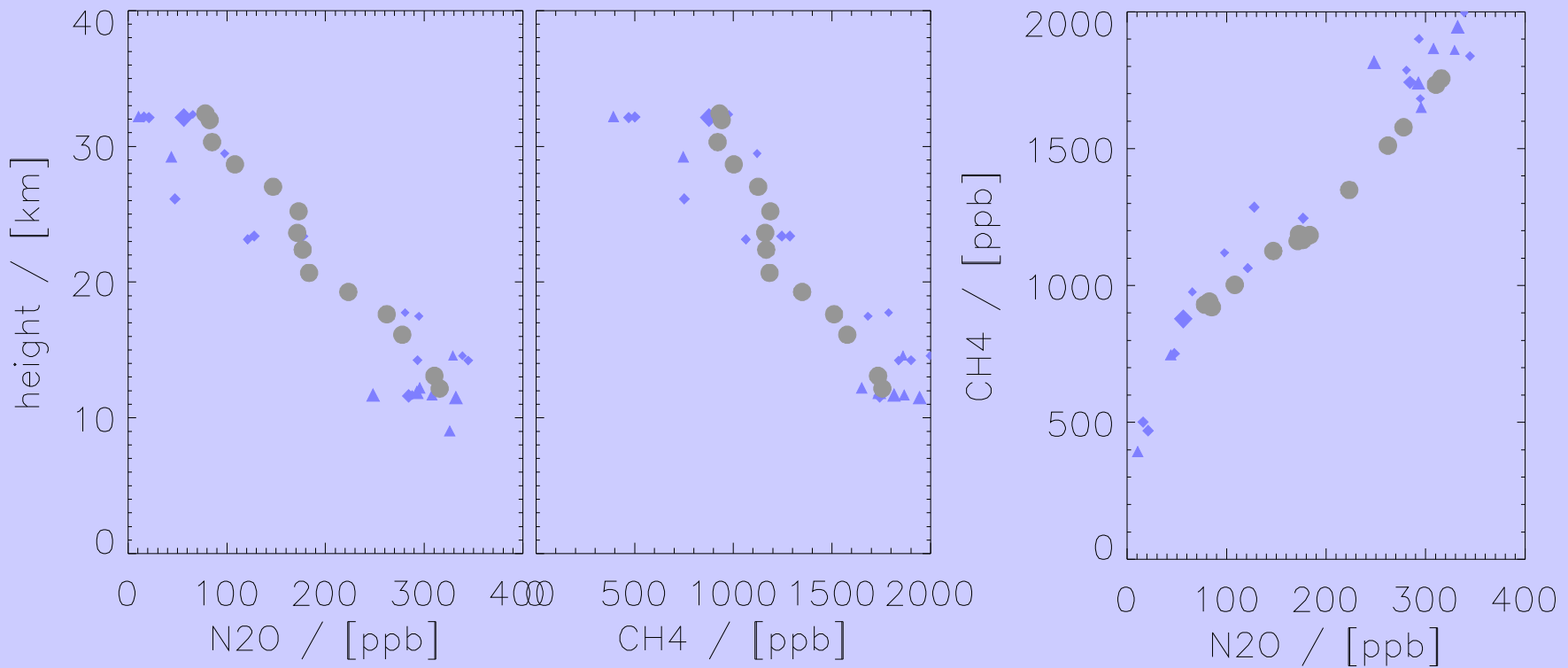
Orbit: 2975, 2981, 2988, 2989, 2995, 3001, 3002, 3003, 3007
3009, 3010, 3014, 3015, 3016, 3017, 3020, 3022, 3027
3028, 3030, 3031, 3034, 3035, 3036, 3037, 3038



start time and altitude					
+	24.09.02	09:50 UT	32.0 km	▲	24.09.02 11:40 UT 6.0 km
■	24.09.02	09:40 UT	32.6 km	+	24.09.02 11:30 UT 11.1 km
×	24.09.02	08:50 UT	31.6 km	■	24.09.02 11:20 UT 12.8 km
◇	24.09.02	08:40 UT	29.7 km	×	24.09.02 11:10 UT 15.3 km
▲	24.09.02	08:30 UT	28.7 km	◇	24.09.02 11:00 UT 18.1 km
+	24.09.02	08:20 UT	23.7 km	▲	24.09.02 10:50 UT 20.2 km
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×	24.09.02	08:00 UT	17.9 km	■	24.09.02 10:30 UT 25.1 km
◇	24.09.02	07:50 UT	15.1 km	×	24.09.02 10:20 UT 28.1 km
▲	24.09.02	07:40 UT	12.3 km	◇	24.09.02 10:10 UT 30.1 km
+	24.09.02	07:30 UT	8.4 km	▲	24.09.02 10:00 UT 31.5 km

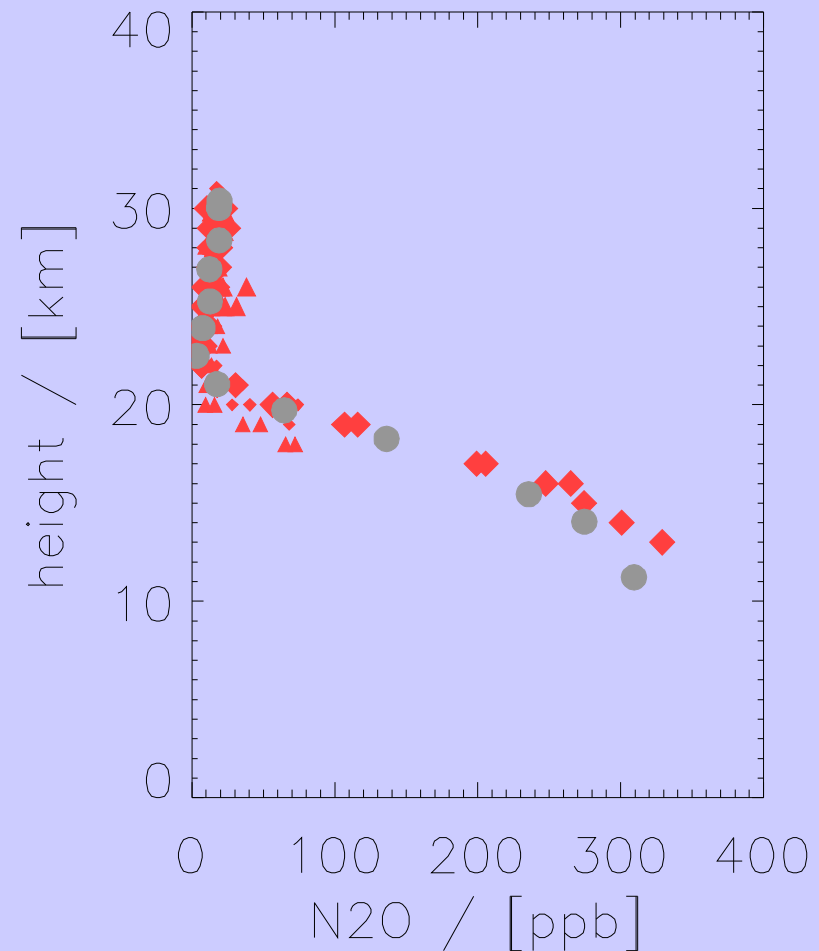
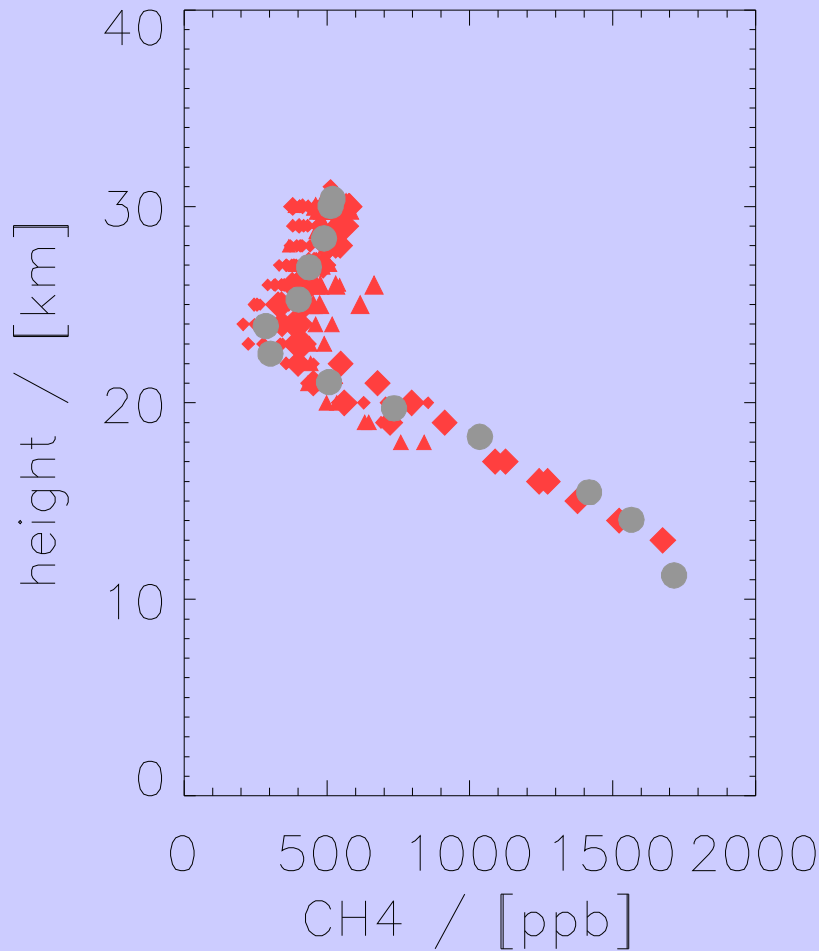
trajectories calculated on 20030716, matches on 20030911, FU Berlin

B39 24.9.2002, mid latitudes



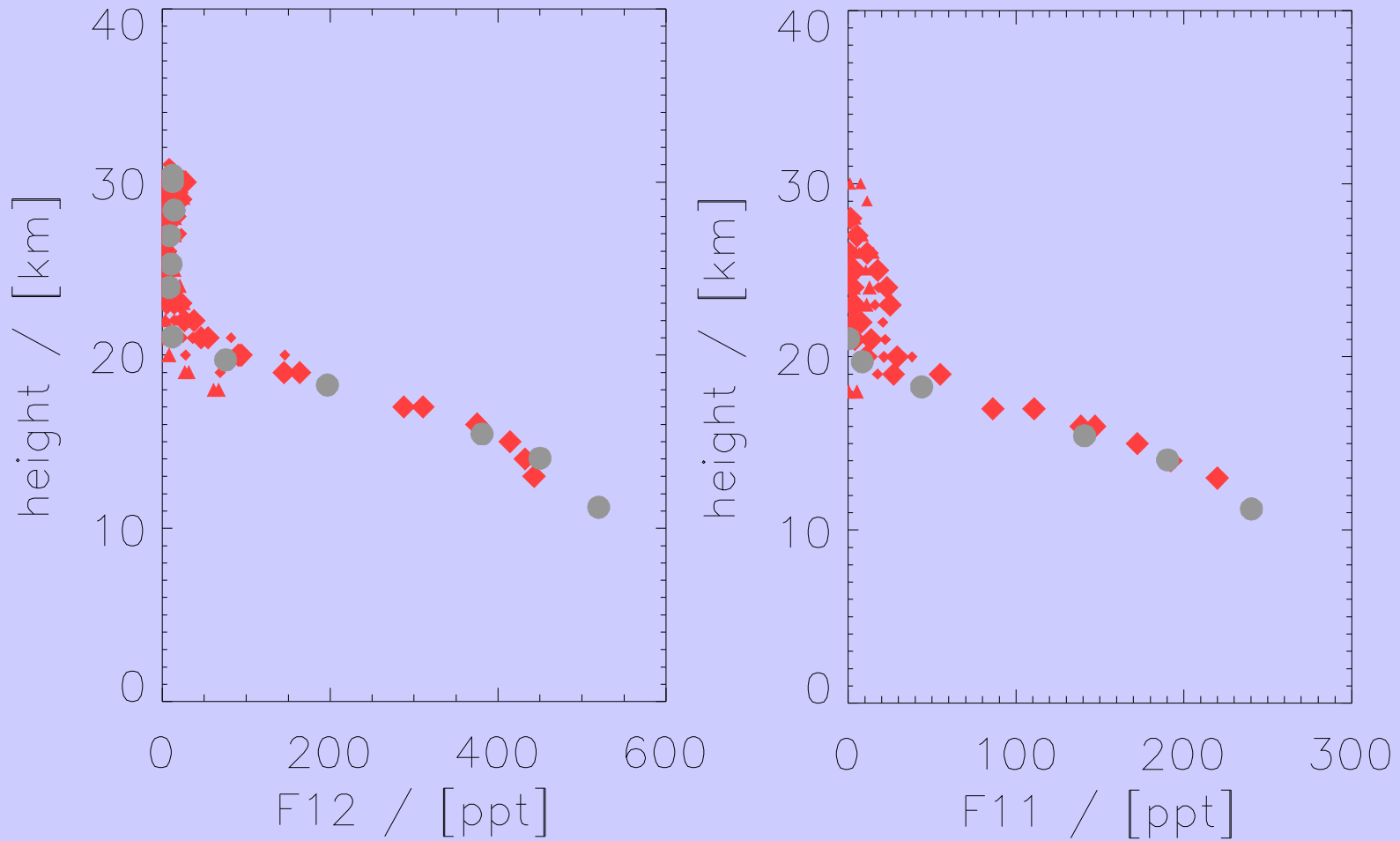
grey dots: cryosampler, blues diamonds: MIPAS-ENV, ESA vers. 4.6.1

B40, 6.3.2003, high latitudes



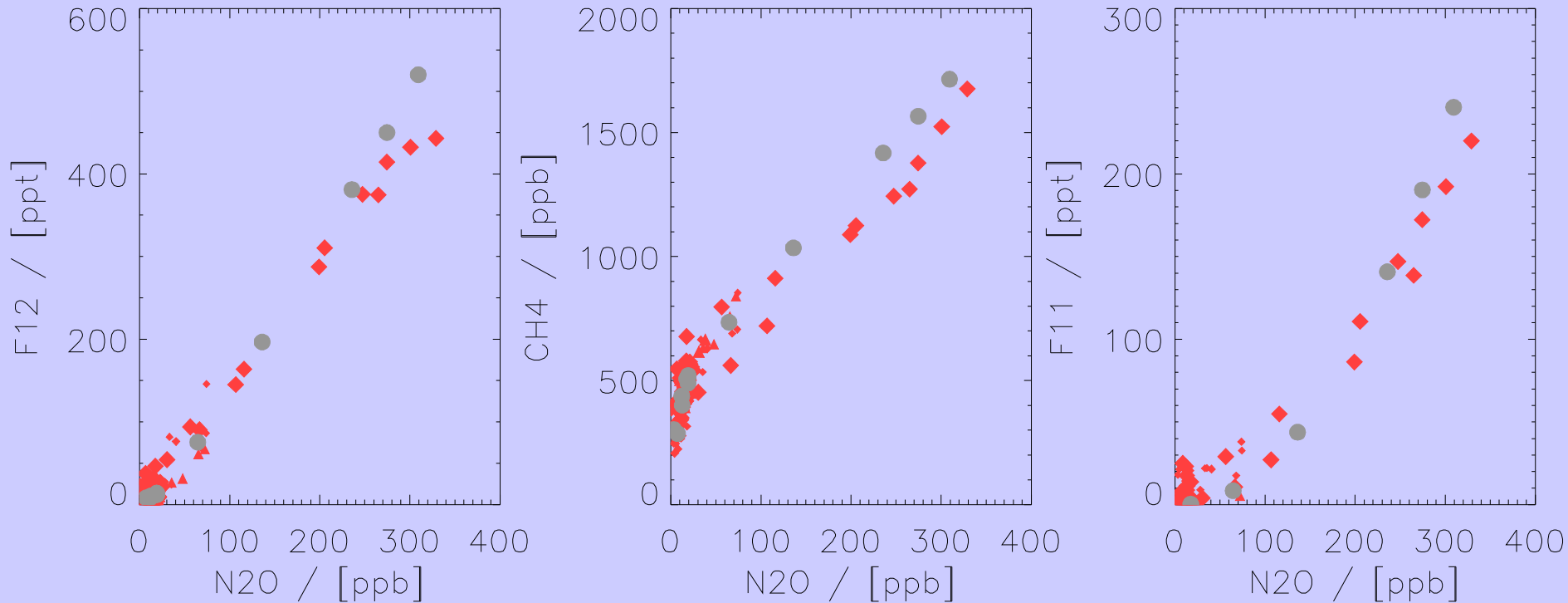
grey dots: cryosampler, red triangles: MIPAS-ENV, FZK

B40, 6.3.2003, high latitudes



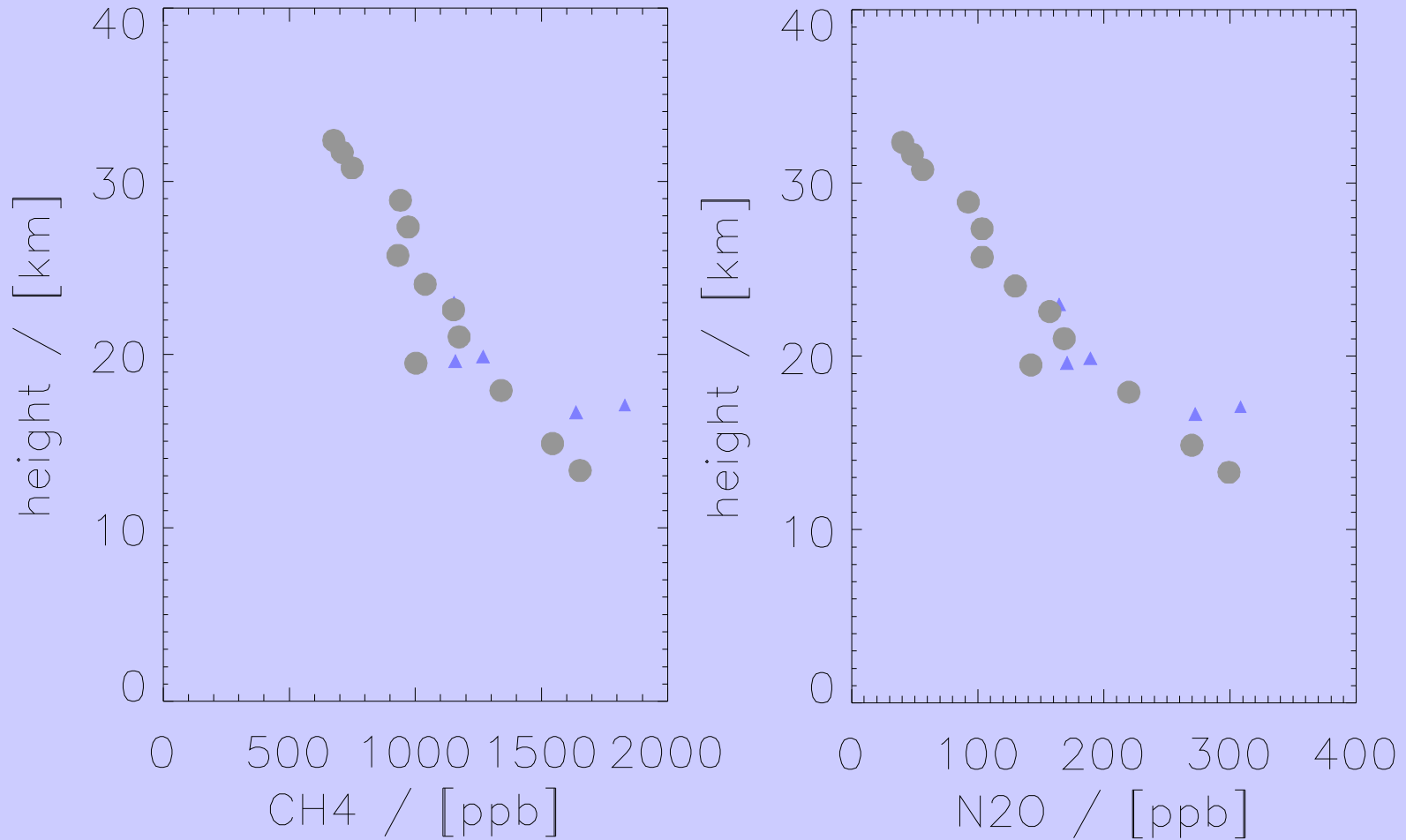
grey dots: cryosampler, red triangles: MIPAS-ENV, FZK

B40, 6.3.2003, high latitudes



grey dots: cryosampler, red triangles: MIPAS-ENV, FZK

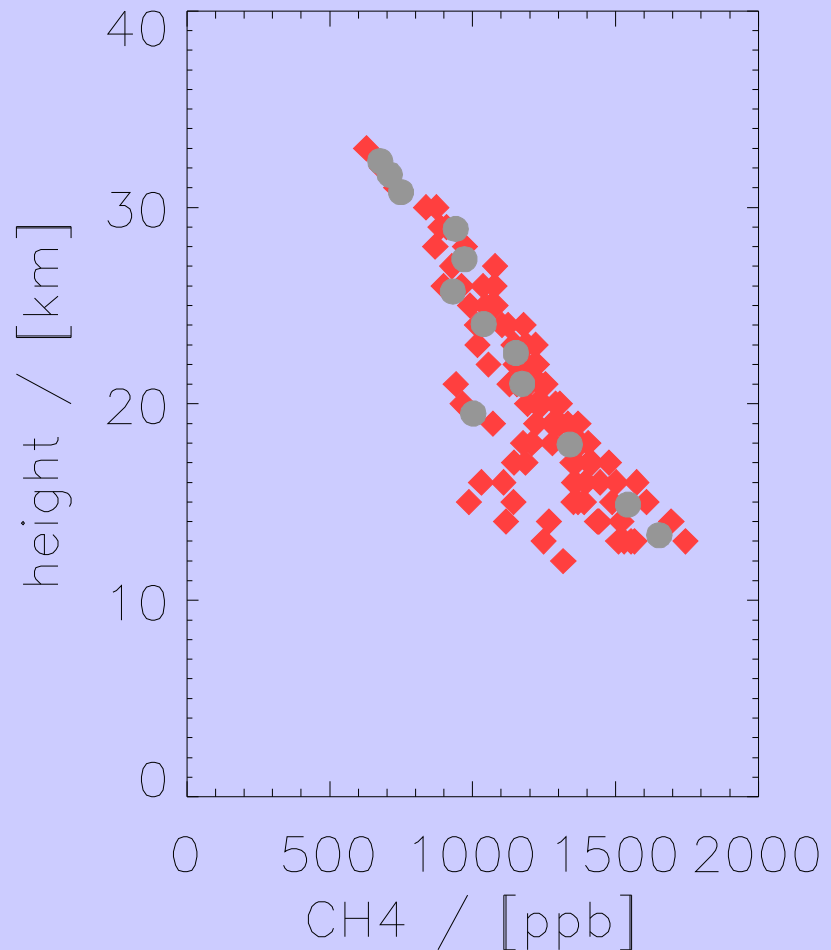
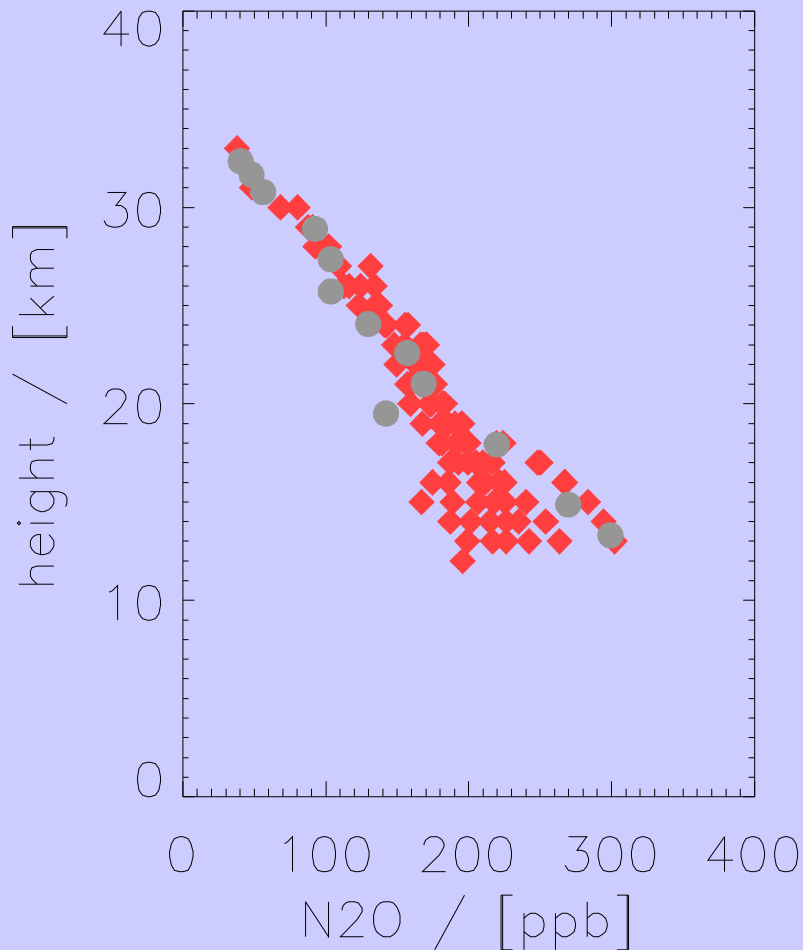
B41, 9.6.2003, high latitudes



grey dots: cryosampler, blues diamonds: MIPAS, ESA vers.

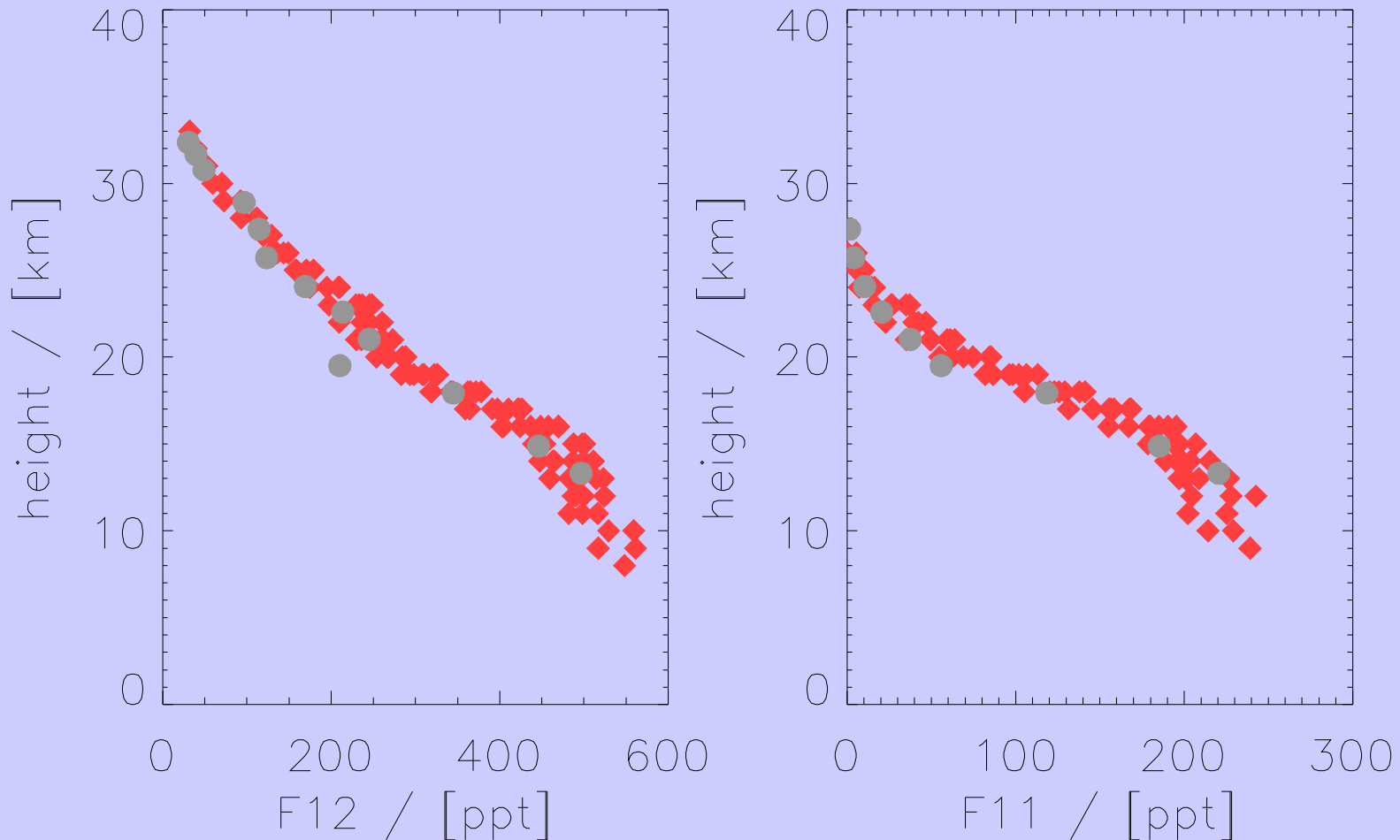
4.6.1

B41, 9.6.2003, high latitudes



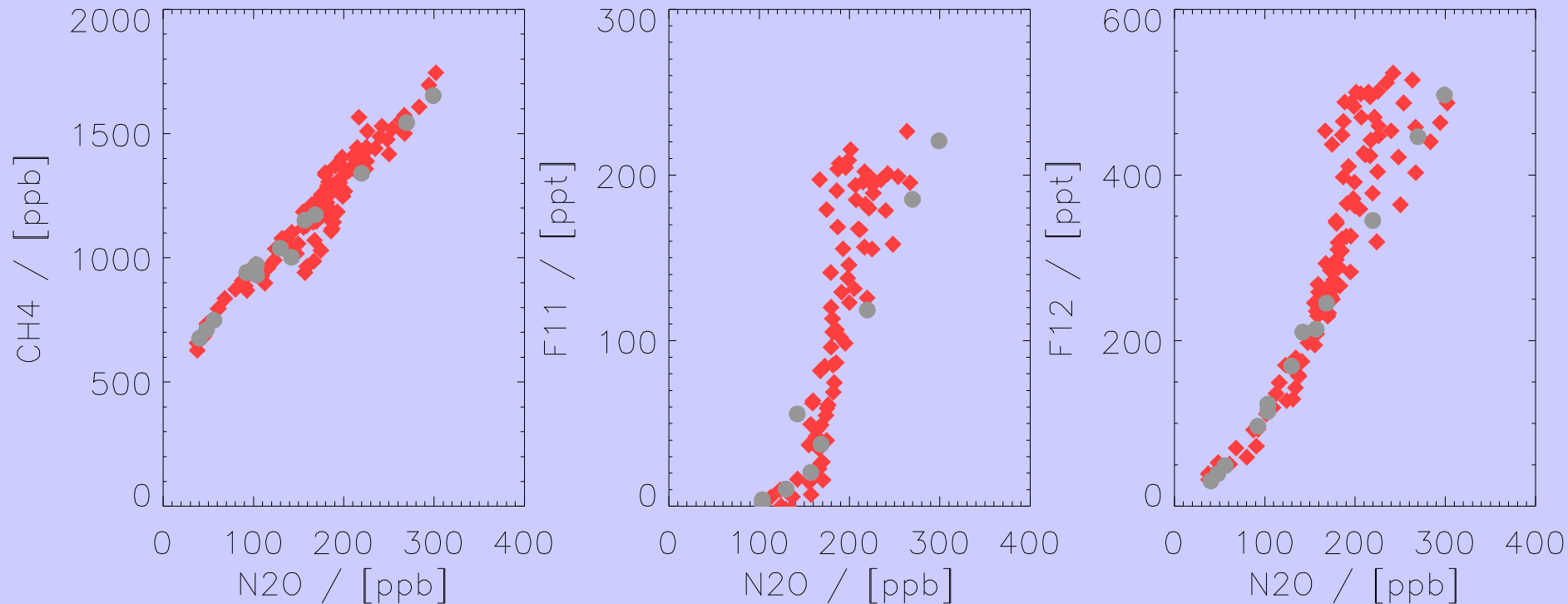
grey dots: cryosampler, red triangles: MIPAS-ENV, FZK

B41, 9.6.2003, high latitudes



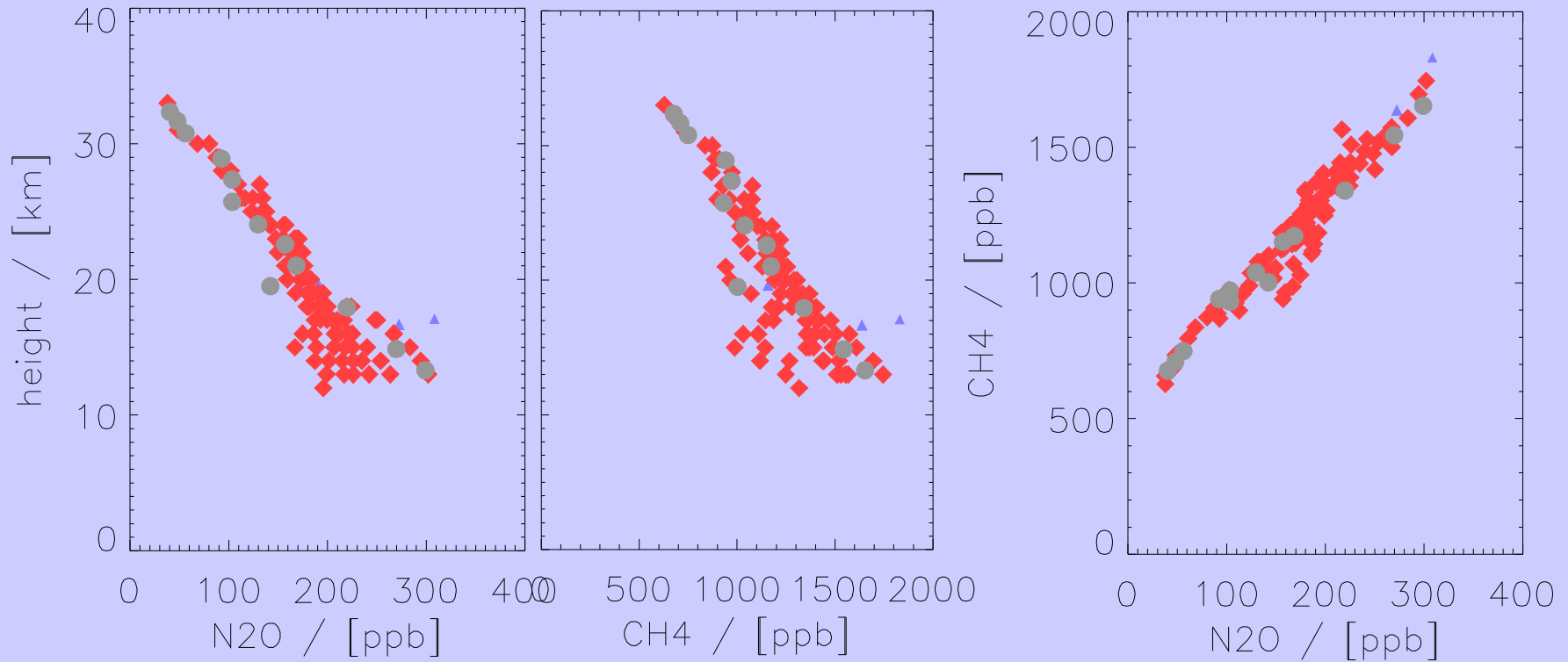
grey dots: cryosampler, red triangles: MIPAS-ENV, FZK

B41, 9.6.2003, high latitudes



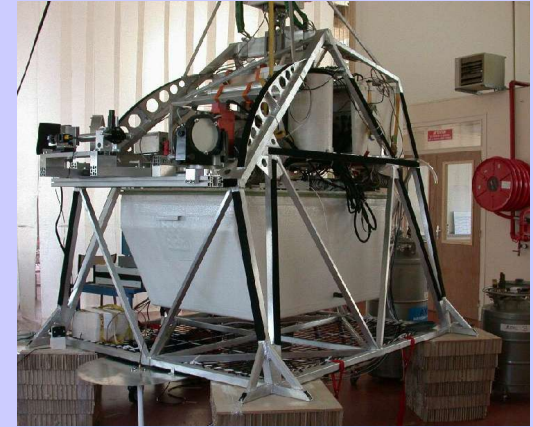
grey dots: cryosampler, red triangles: MIPAS-ENV, FZK

B41, 9.6.2003, high latitudes



grey dots: cryosampler, red triangles: MIPAS-ENV, FZK, blue triangles: ESA 4.6.1

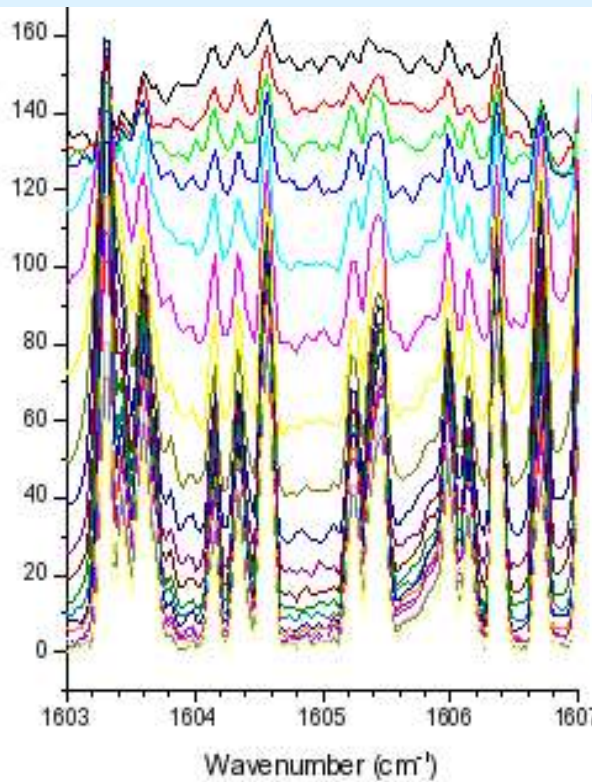
Validation Campaigns and Other Recent Flights of MIPAS-B



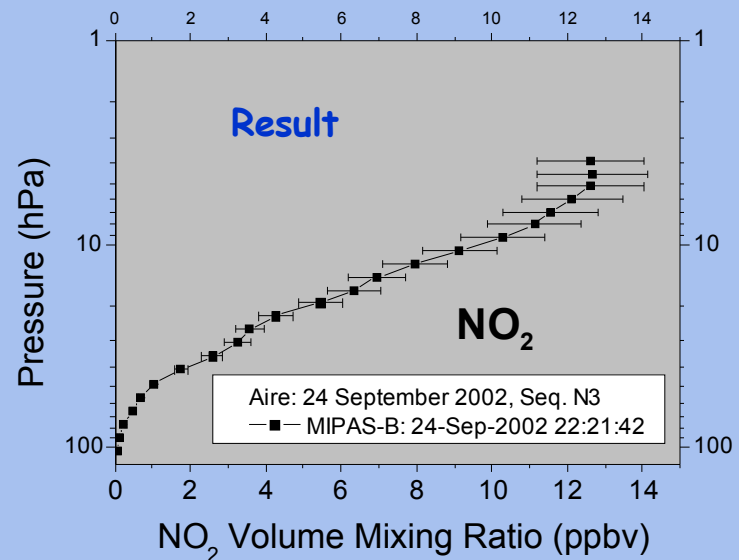
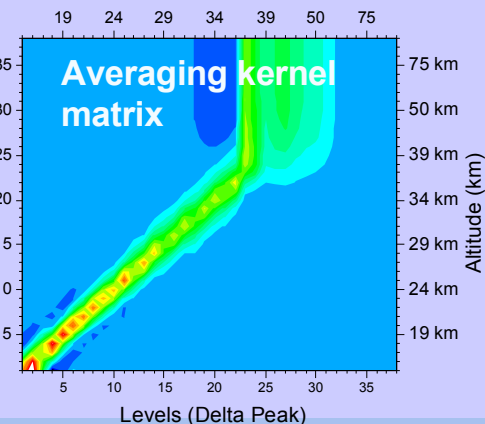
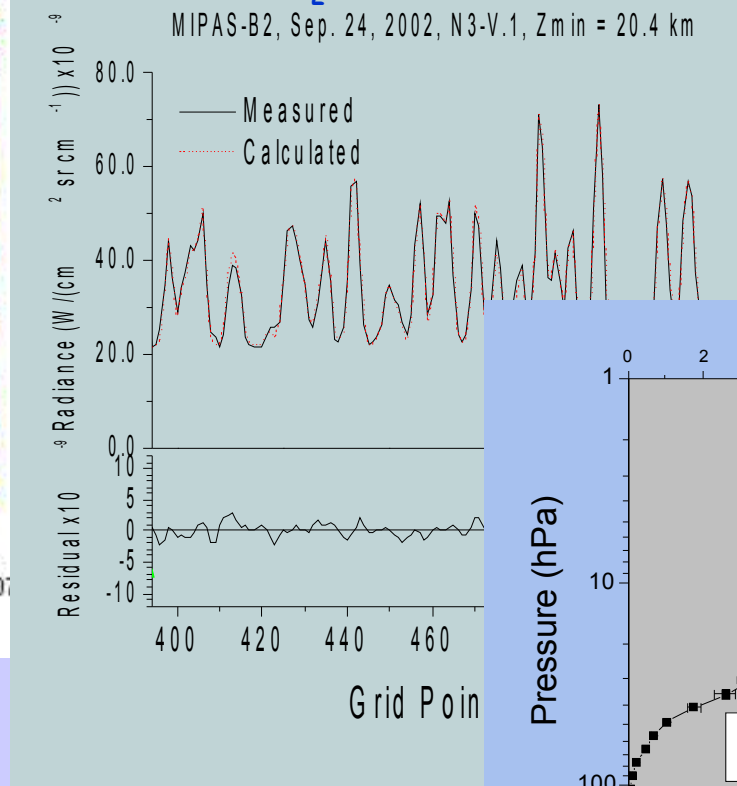
Date	Site	Primary Funding	Geoph. Condition		SCIA val type
11/09/2002	ASA	DLR-ESA-CNES	Midlat. refer.	Night	trajmap
07/12/2002	Kiruna	AFO2000-POSTA	Synopt. PSCs	Night+Day	(direct)
20-21/03/03	Kiruna	DLR-ESA-CNES	Arctic spring	Night+Day	direct
02-03/07/03	Kiruna	HGF	Arctic summer	Night	trajmap
??/12/04	Teresina	DLR-ESA-CNES	Tropics	SR+Day	direct

Measured spectra, tangent heights 8 - 38 km : NO₂ window

MIPAS-B retrieval example: NO₂



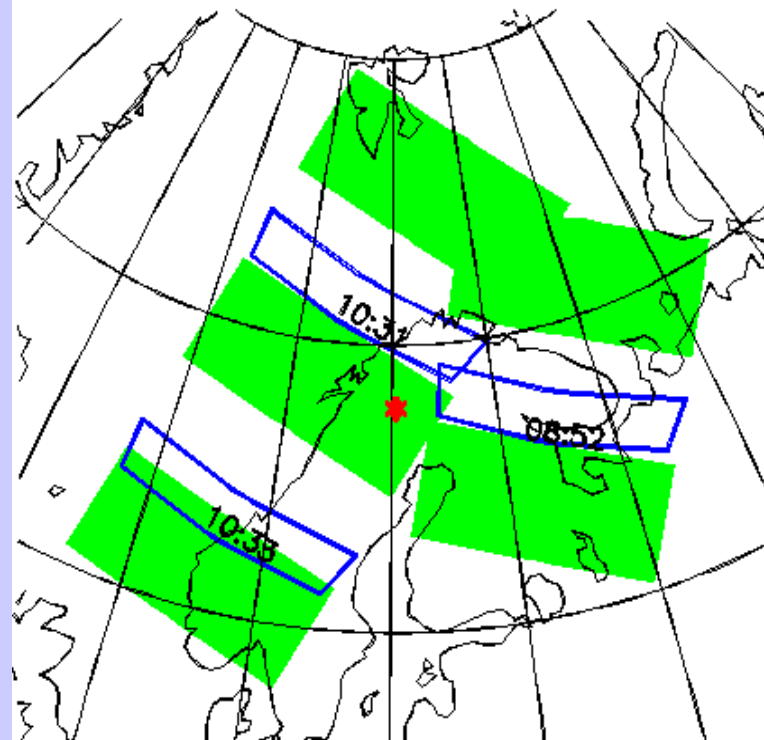
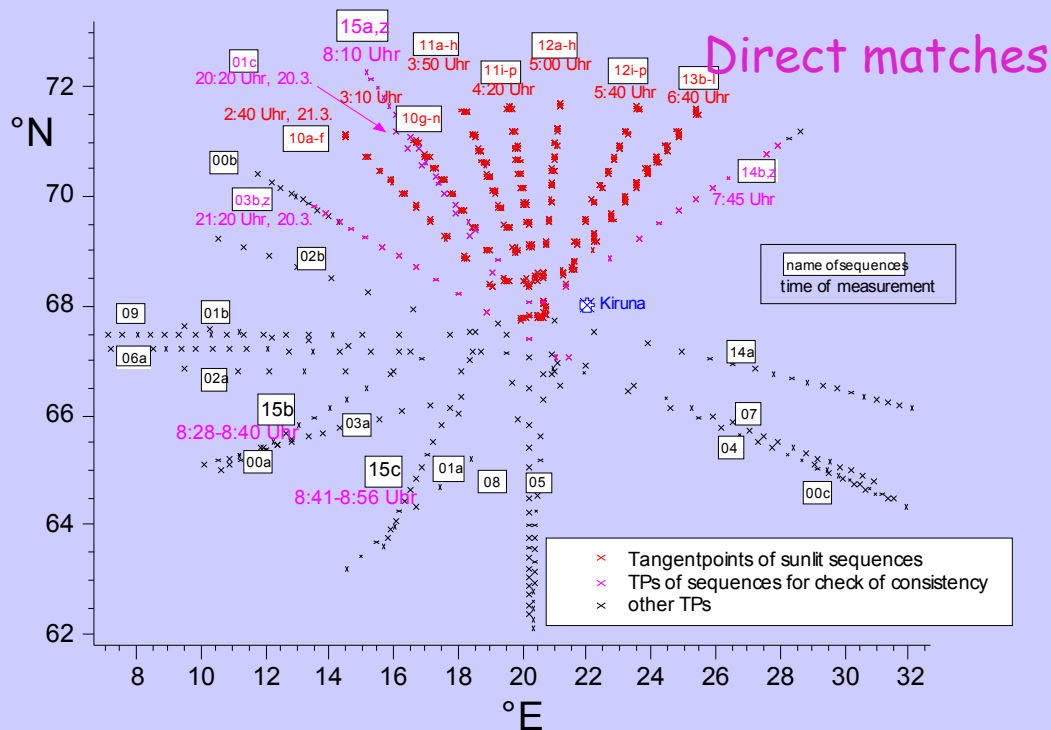
Best fit in NO₂ window @ 20.4 km



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

SCIAMACHY overpasses on 21-MAR-2003

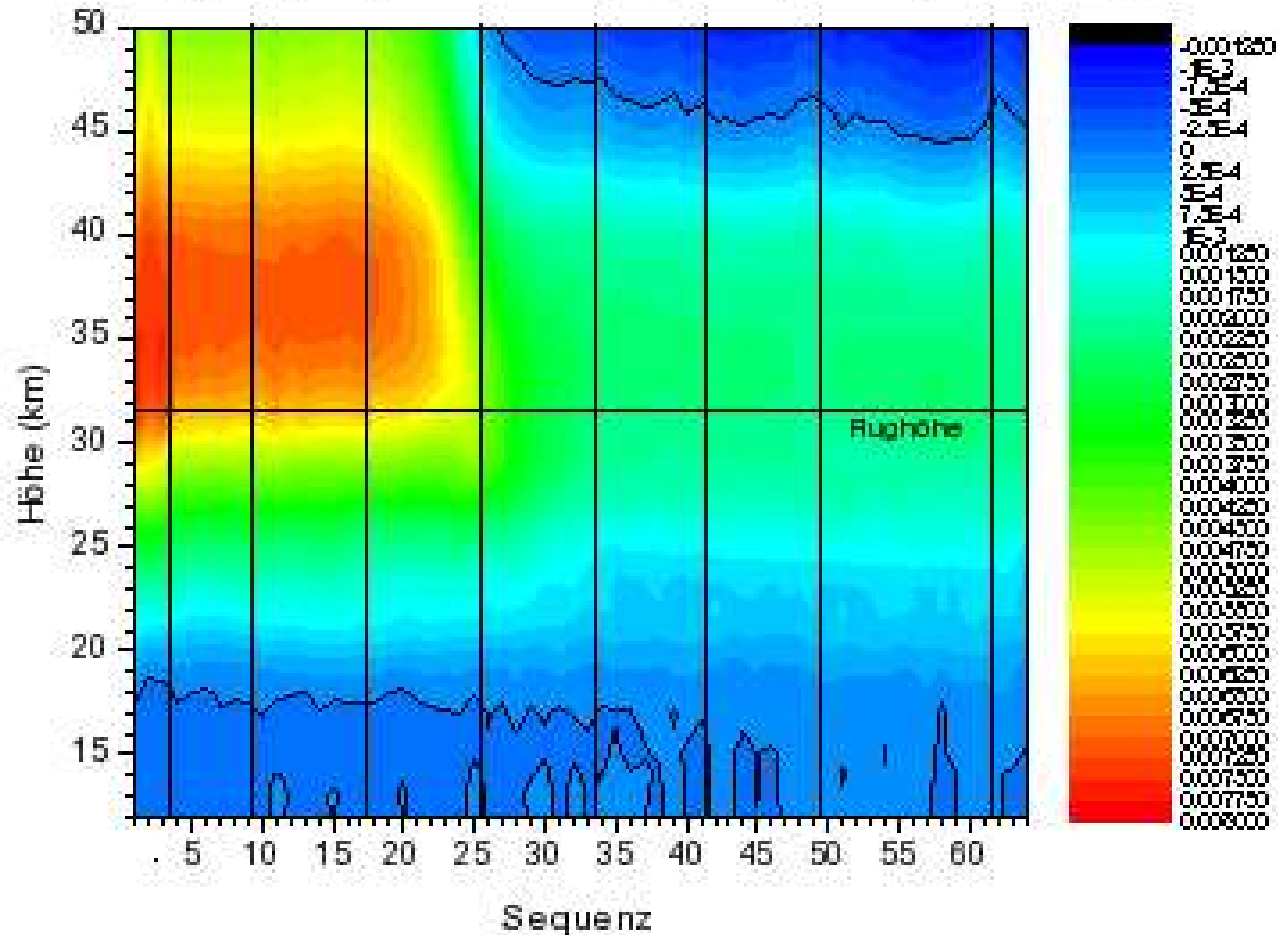
Measurement scheme for MIPAS-B2-Flight13, Kiruna, March 20/21 2003



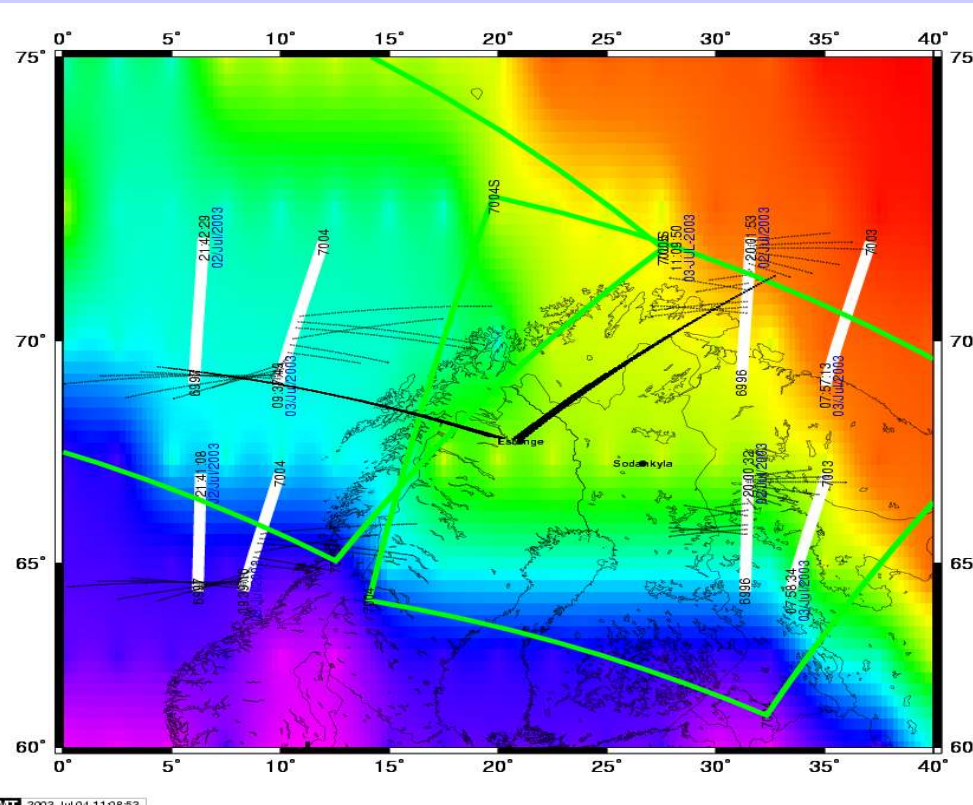
- high latitudes spring, tilted vortex
- long flight: 18:22 - 9:38
- from night to day
- from inside to outside

MIPAS-B2 flight #13: Measured evolution of NO₂ around sunrise

NO₂, Flug 13, Sonne naufgangssequenzen, Werte in ppmv



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



MIPAS-B
03-07-2003
T @ 5 hPa

■ 256.123

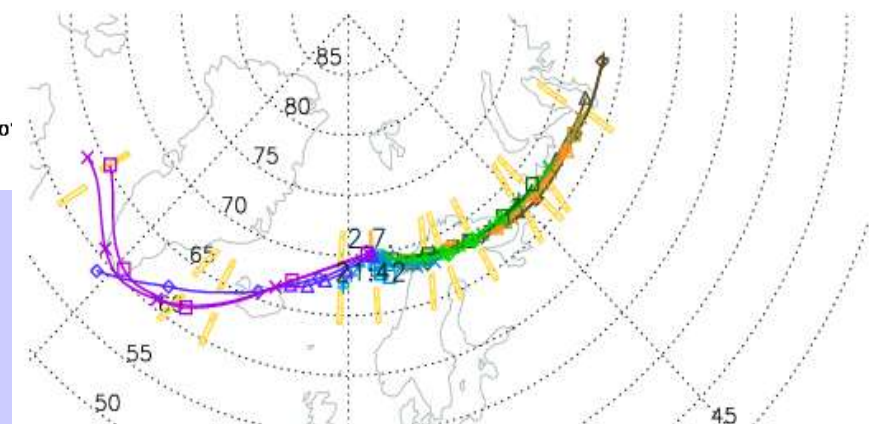
trajectory calculations
(FUB) show many good
matches with
SCIAMACHY limb
patterns

MIPAS-B sequenz 3, flight on 03.07.03
2-days backward trajectories

file: M3030703.C2B, matches with MIPAS: 1 h, 500 km

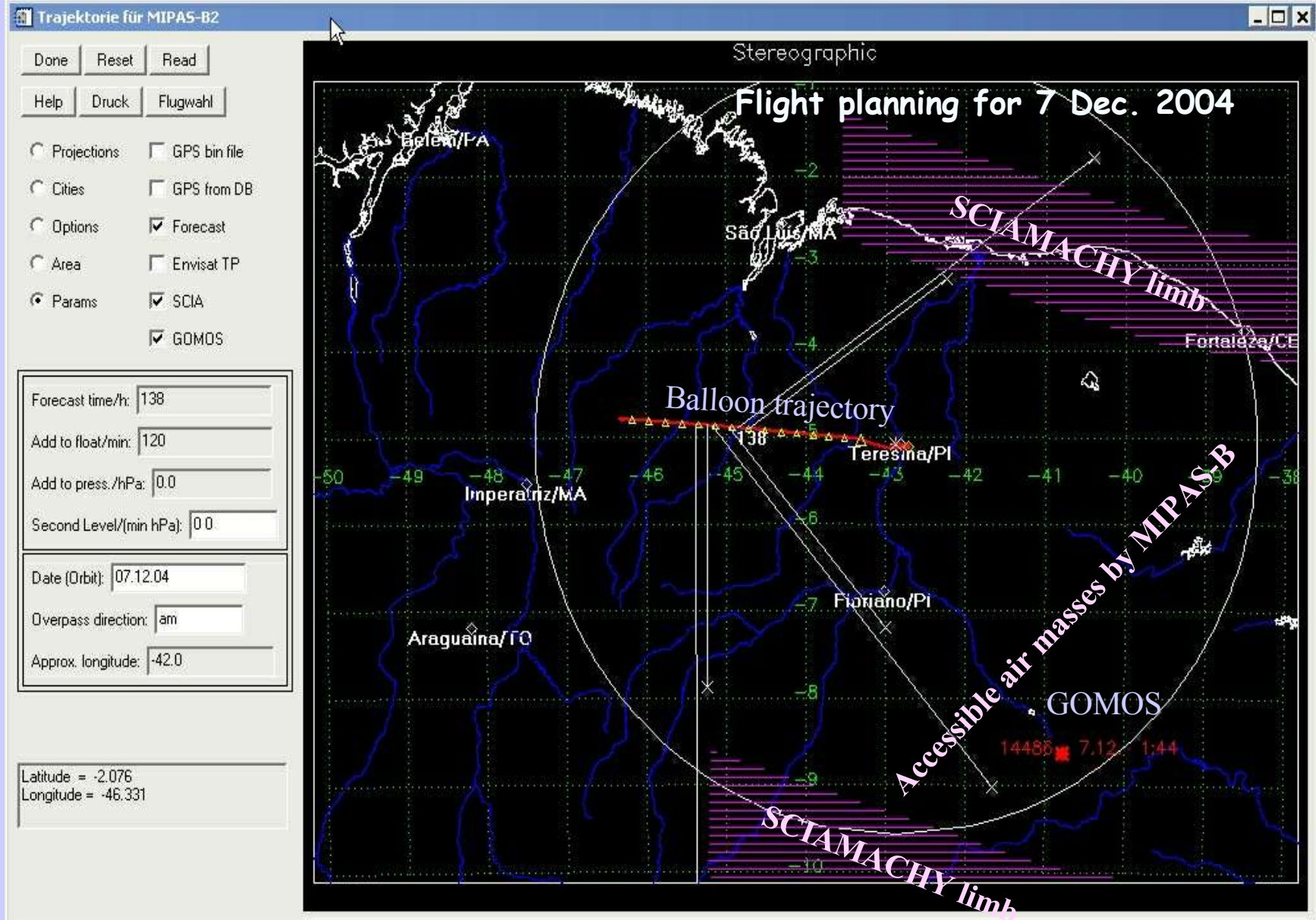
Orbit: 6971, 6973, 6974, 6975, 6977, 6981, 6982, 6983, 6984,
6988, 6996, 6997

2-days backward



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

MIPAS-B2 flight #15: Teresina (5°S), ?? Dec. 2004



Conclusions

3-4 successful flights of each payload LPMA/DOAS, MIPAS and TRIPLE
sophisticated flight planning strategies for ENVISAT matches
tropical measurements pending
long-term validation open

balloon data analysed

SCIAMACHY comparisons for O_3 , NO_2 , BrO (scientific retrievals)
pending: H_2O , tracers

MIPAS-ENV V6.1 and FZK comparisons available

trajectory mapping powerful tool to improve validation
photochemical mapping for NO_2 and BrO

