

SCI AMACHY Validation with the DLR Falcon

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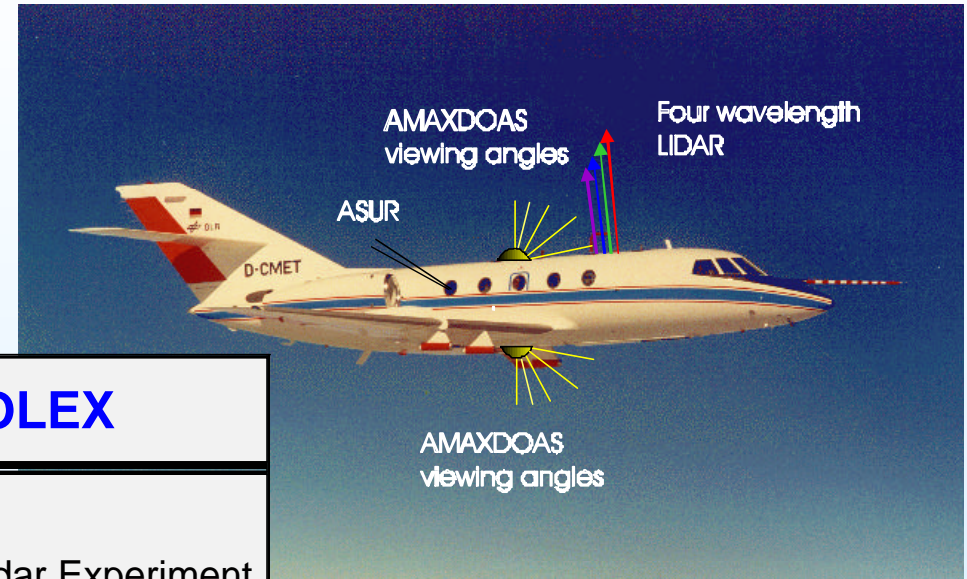
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Overview

- ✍ The Scientific payload
- ✍ The SCIA VALUE campaigns
- ✍ Results
- ✍ Conclusion



The scientific payload



AMAXDOAS	ASUR	OLEX
Airborne MultiAxis Differential Optical Absorption Spectrometer	Airborne SUBmillimeter wave Radiometer (604-662 GHz)	Ozone Lidar Experiment
U of Bremen U of Heidelberg	U of Bremen	DLR
stratospheric and tropospheric columns of O₃ , NO₂ , BrO, and OCIO	profiles of O₃ , N₂O , H ₂ O, ClO, BrO, (HNO ₃ , ...)	profiles of O₃ , stratospheric aerosol extinction, aerosol/molecular backscatter ratios , particle depolarisation

The Flight Pattern: September 2002



✍ Northern Part (03-07/09/2002)

Munich - Spitsbergen - Kiruna - Greenland - Munich



✍ Southern Part (15-28/09/2002)

Munich - Yaoundé - Nairobi - Mahé and back



Flight Schedule September 2002: 30 SCIA pixels, + 1 Occultation

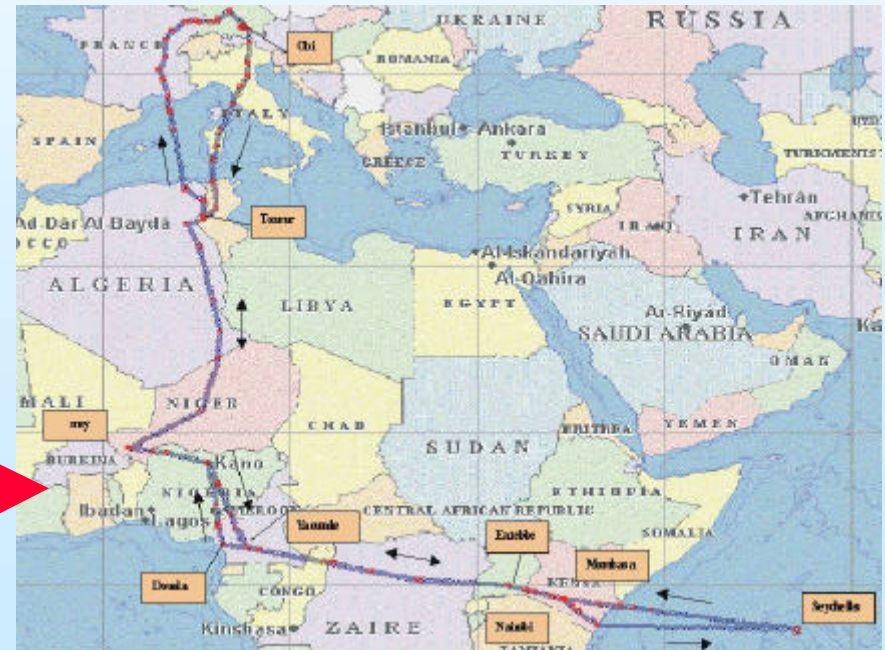
Date	Orbit	Crossed Orbit Index	Flight Leg
Northern Route			
02/09/03	2667	10, 11,12	Munich - Kiruna
02/09/04	2685, 2686	7, 5	Kiruna - Kiruna via Longyear
02/09/05	2696,2697	10, 11	Kiruna - Keflavik
02/09/06	2712, 2713	10, 11	Keflavik - 65W - Kangerlussuaq
02/09/07	2726, 2727	10	Kangerlussuaq - Keflavik
02/09/07	2730	Occultation, 61.8° N 351.9°E	Keflavik - Munich
Southern Route			
02/09/15	2839	12	Munich - Palma de Mallorca
02/09/17	2867	13-17	Palma de Mallorca –Yaoundé
02/09/18	2880, 2881	17, 18	Yaoundé - Nairobi
02/09/19	2894	18, 19	Nairobi - Seychelles
02/09/24	2966	17, 18	Seychelles - Nairobi
02/09/25	2981	17, 18	Nairobi – Yaoundé
02/09/26	2996	13-16	Yaoundé - Palma de Mallorca
02/09/28	3025	11, 12	Palma de Mallorca - Munich

The Flight Pattern: February-March 2003



✈ Northern Part (10-19/03/2003)

Munich - Spitsbergen - Kiruna - Greenland - Munich



✈ Southern Part (19/02-03/03/2002)

Munich - Yaoundé - Nairobi - Mahé and back

Flight Schedule Feb-March 2003 : 19 SCIA pixels

Date	Orbit	Crossed Orbit Index	Flight Leg
Southern Route			
19/02/03	5086	11	Basel – Tozeur
20/02/03	5100	xx	Tozeur – Niamey-Yaoundé
23/02/03	5141	16	Yaoundé – Entebbe-Nairobi
24/02/03	5156	17	Nairobi – Mombasa-Seychelles
26/02/03	5184	17	Seychelles - Nairobi
28/02/03	5214	16	Nairobi – Douala
01/03/03	5229	13-16	Douala – Niamey - Tozeur
03/03/03	5258	11	Tozeur - Oberpfaffenhofen
Northern Route			
10/03/03	5358	9, 10	Oberpfaffenhofen - Kiruna
12/03/03	5387	7, 8	Kiruna - Ny-Ålesund - Kiruna
13/03/03	5402	9	Kiruna – Keflavik
14/03/03	5417	9	Keflavik - Kangerlussuaq
	5418	9	
15/03/03	5433	xx	Kangerlussuaq - Keflavik
17/03/03	5459	xx	Keflavik - Oberpfaffenhofen
19/03/03	5487	10, 11	Oberpfaffenhofen - Oberpfaffenhofen

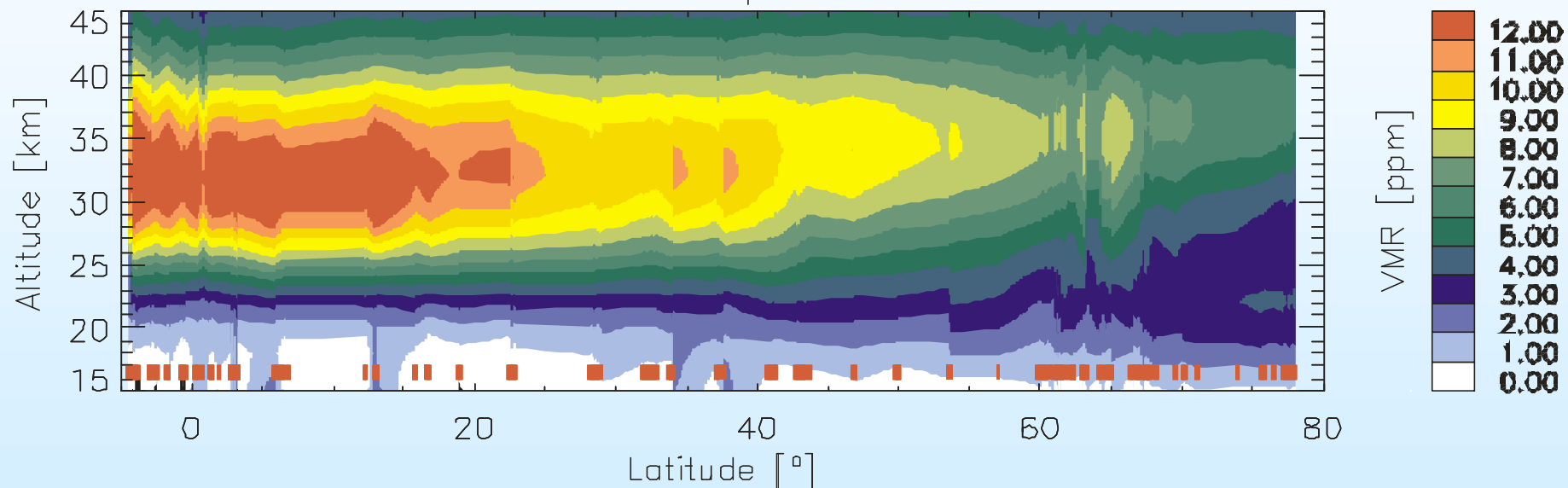
xx: SCIA not
operational

ASUR measurements during SCIA VALUE 2002 onboard the FALCON aircraft

- ✍ Validation of **SCIAMACHY** profiles (**limb** and solar occultation)
- ✍ Using the Airborne Submillimeter Radiometer **ASUR** (604 - 662 GHz)
- ✍ **O₃**, **N₂O**, H₂O, ClO, NO, (plus **HNO₃**, **HCl** and others)
- ✍ **Vertical profiles** of volume-mixing-ratios at 15 - 50 km altitude
- ✍ **Resolution** is 12-40 km (horizontally) and 5-12 km (vertically)
- ✍ High data quality at September 2002 and February/March 2003 campaigns

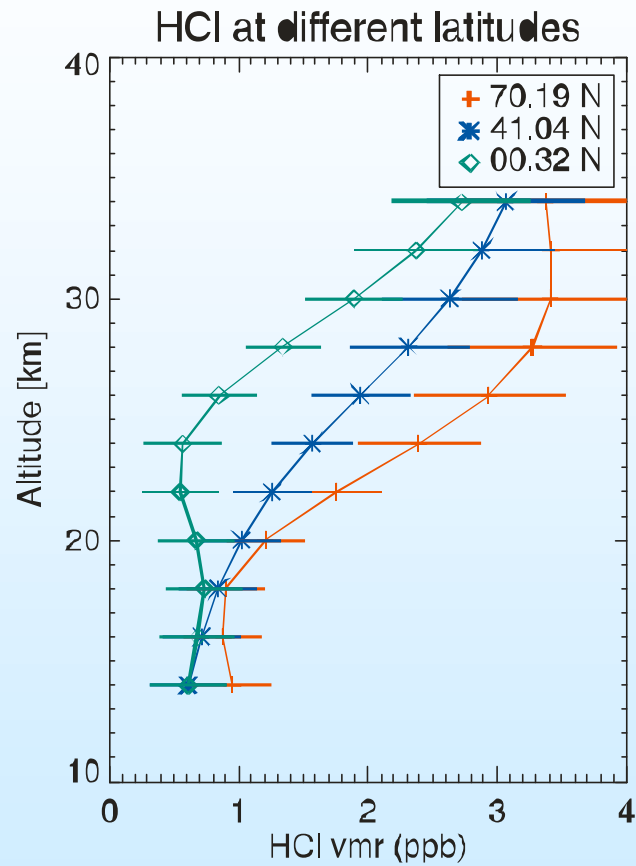
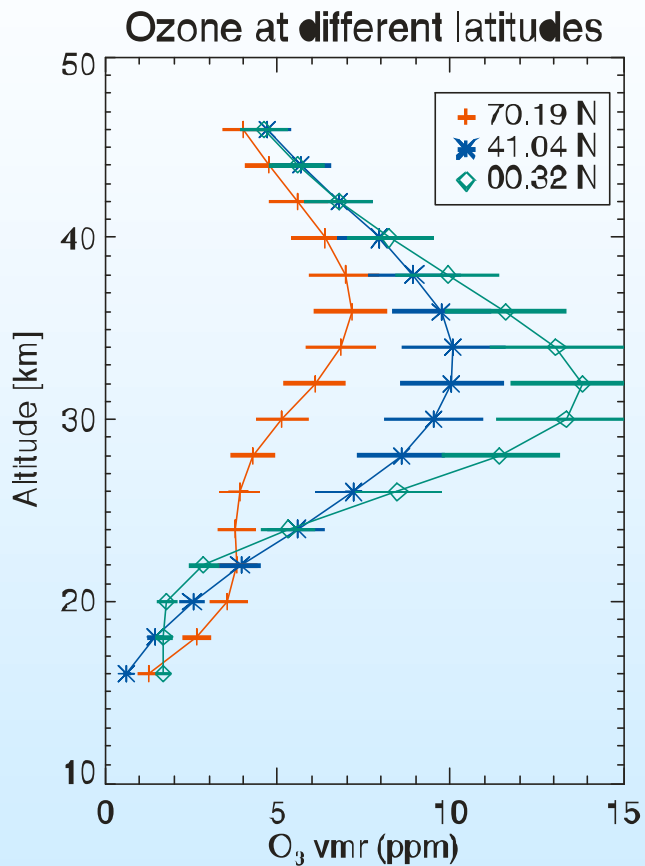
Ozone latitudinal cross-section

ASUR Ozone, September 2002



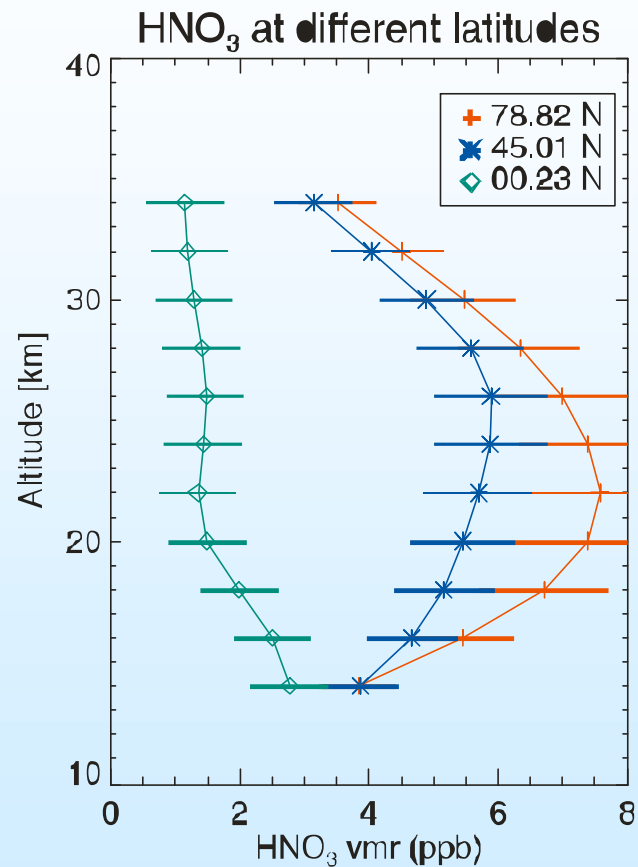
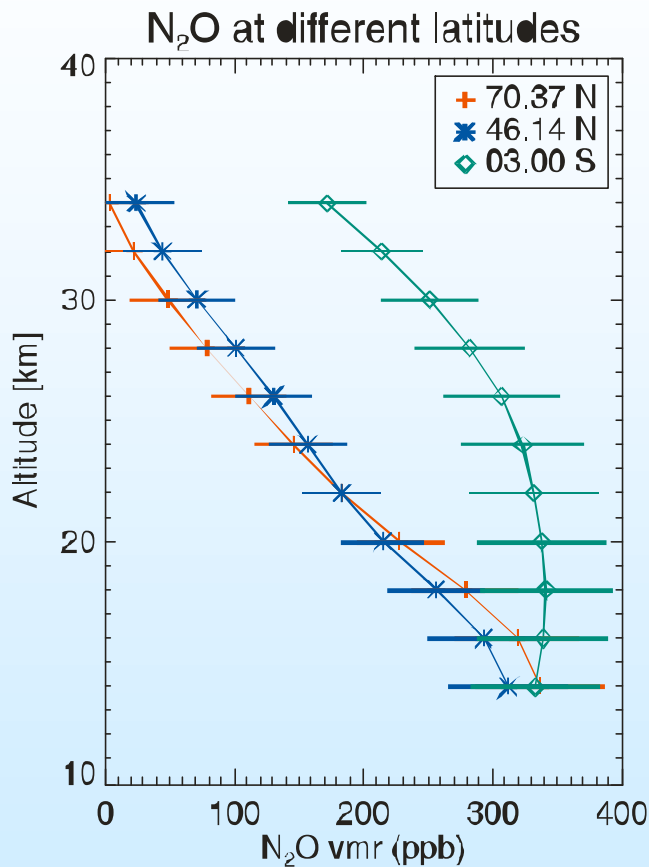
- ✍ Contour plot of ASUR ozone vertical profiles as a function of latitude.
- ✍ Red dots indicate latitudinal location of the aircraft during measurements.

**ASUR
vertical
profiles
(Sep 2002)
(1)**



Volume-mixing-ratios of Ozone and HCl at **high**, **mid** and **low** latitudes.
(The horizontal bars indicate the estimated accuracies)

**ASUR
vertical
profiles
(Sep 2002)
(2)**

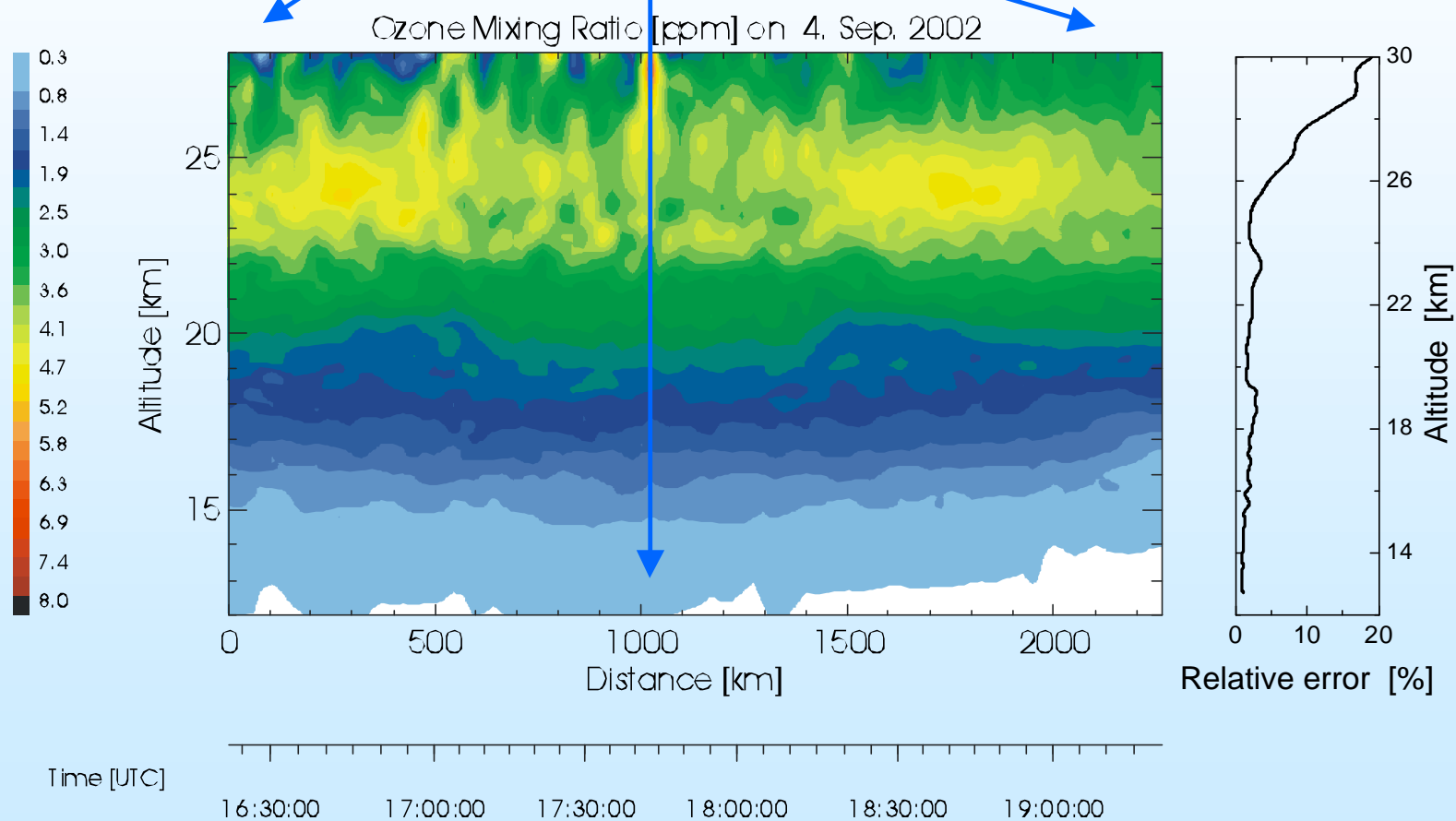


Volume-mixing-ratios of N₂O and HNO₃ at **high**, **mid** and **low** latitudes.
(The horizontal bars indicate the estimated accuracies)

OLEX Ozone: Arctic

 DLR OLEX

Kiruna -Spitsbergen-Kiruna (04/09/02)



OLEX Ozone

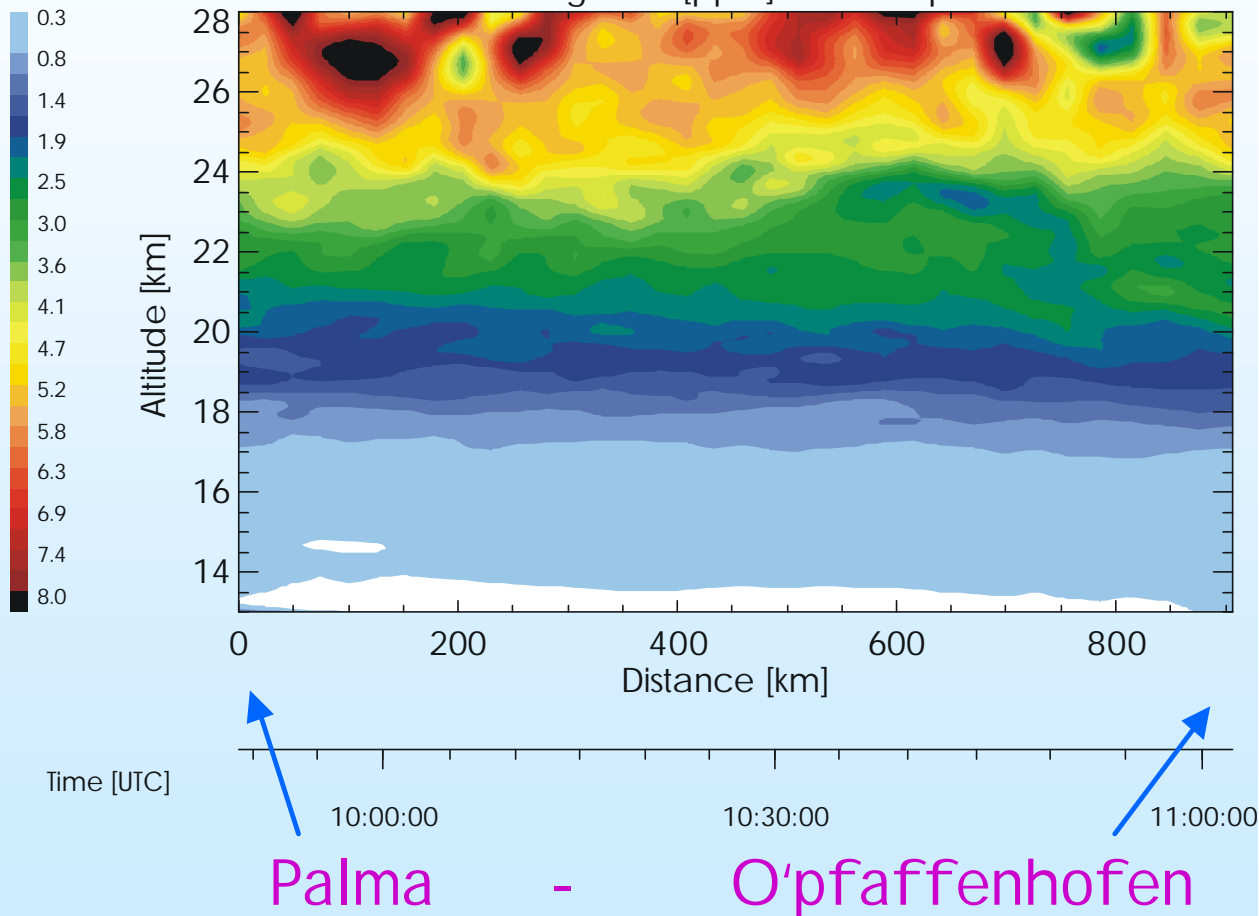
28/09/2002

Mid-Latitudes

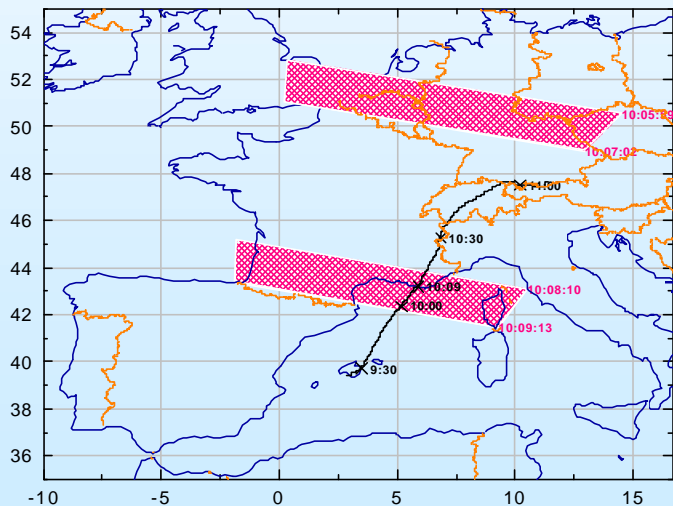
(Palma - O'pfaffenhofen)

OLEX

Ozone Mixing Ratio [ppm] on 28. Sep. 2002



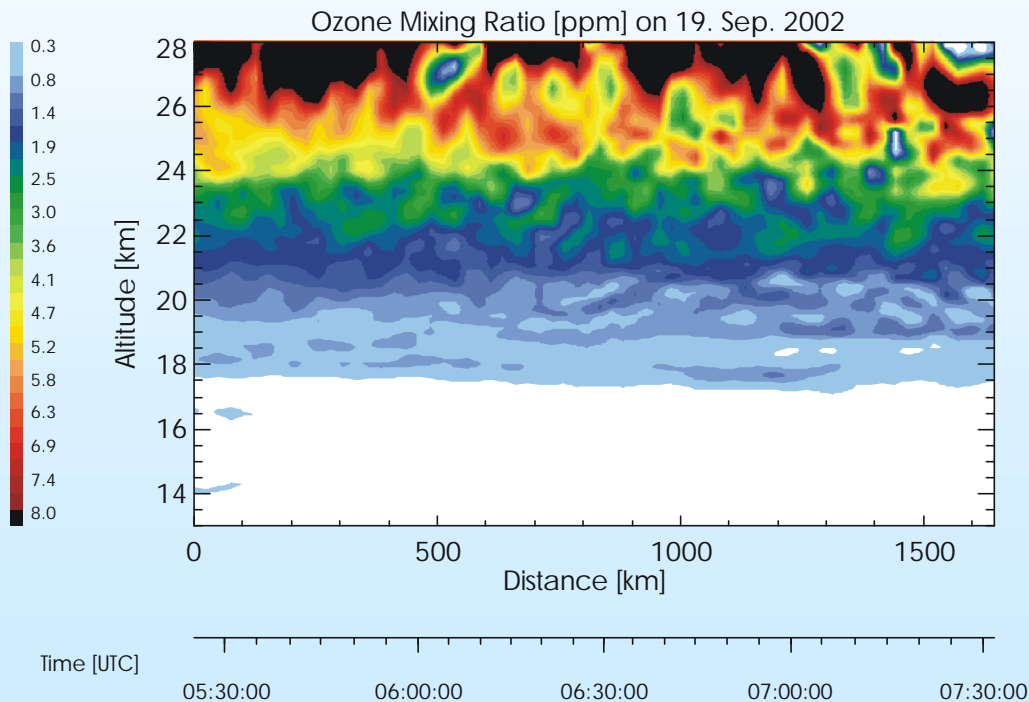
SCIA VALUE 02/09/28 Orbit 3025 Index 11/12 Limb



OLEX: Tropics

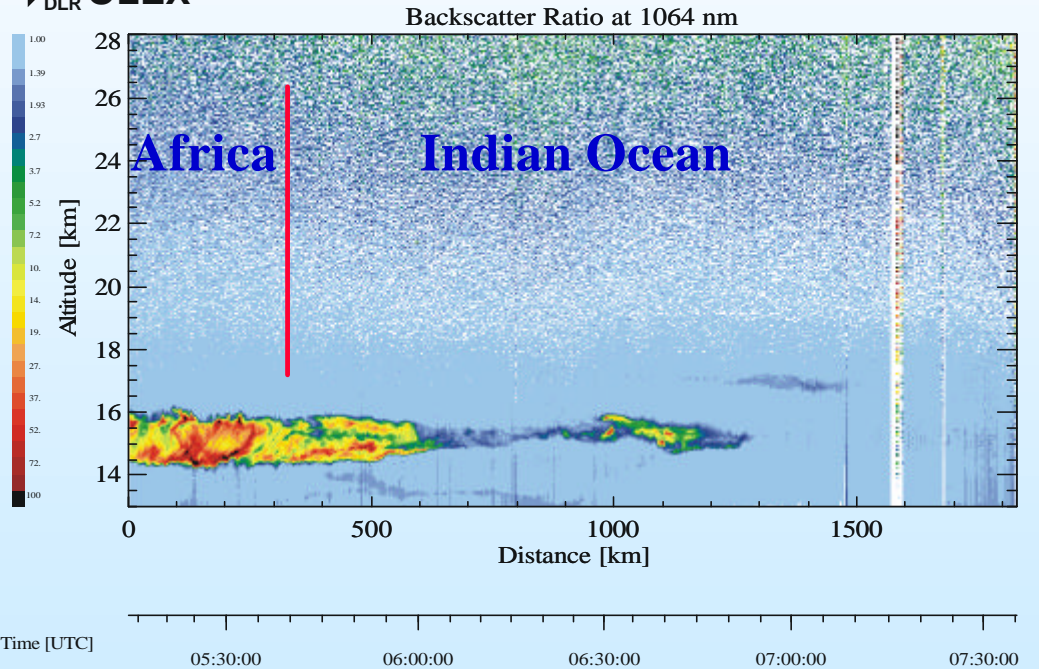
Ozone

DLR OLEX



Backscatter Ratio

DLR OLEX

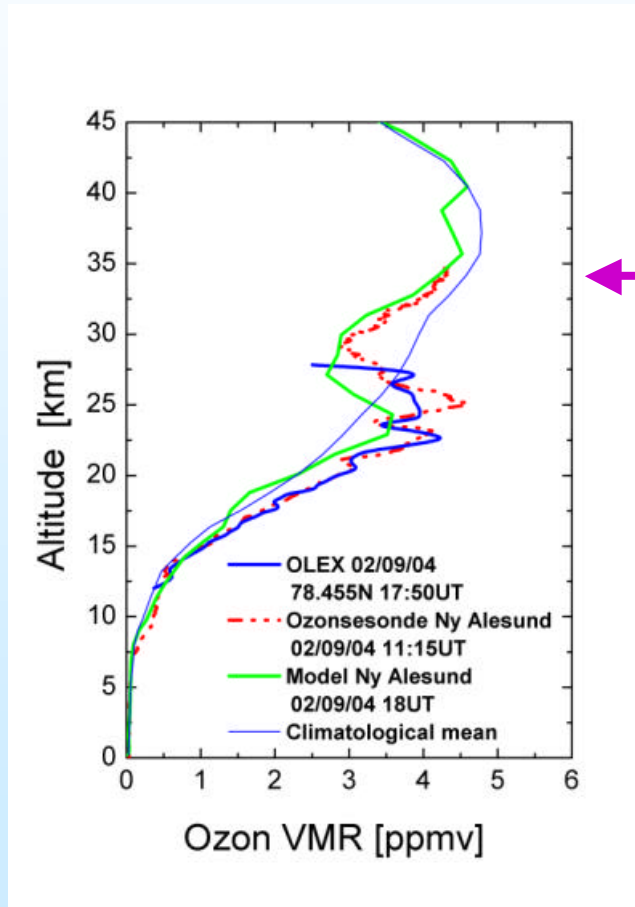


Nairobi

-

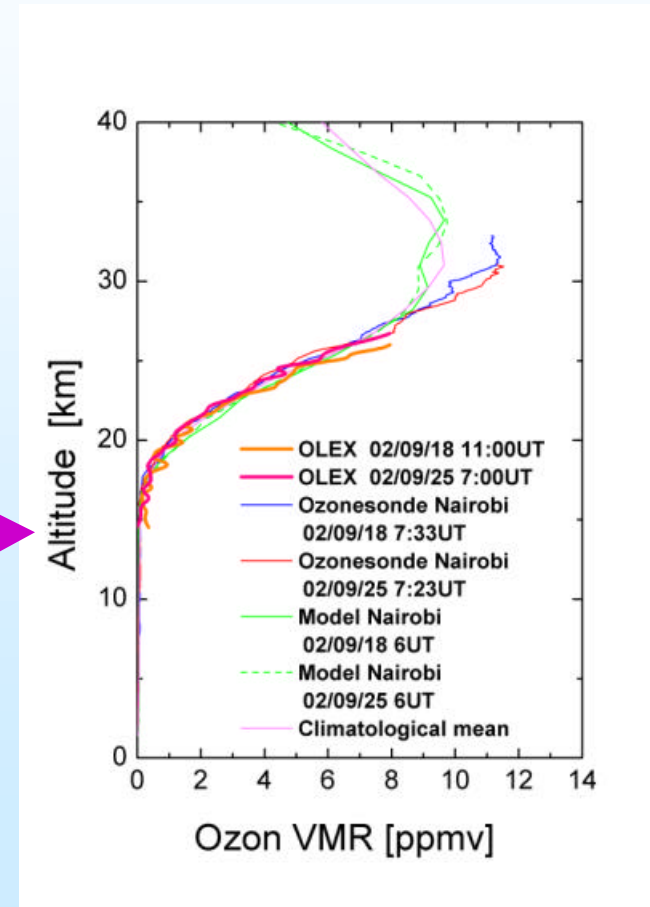
Mahé

OLEX Ozone: Comparison to ozonesondes

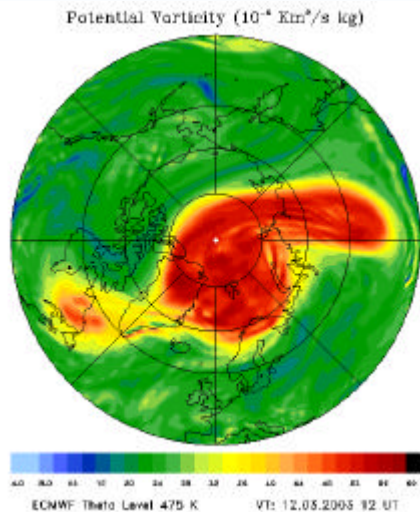


← Ny Ålesund
(courtesy: AWI)

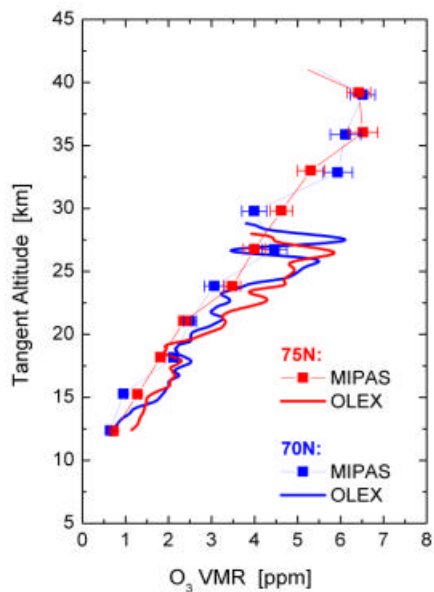
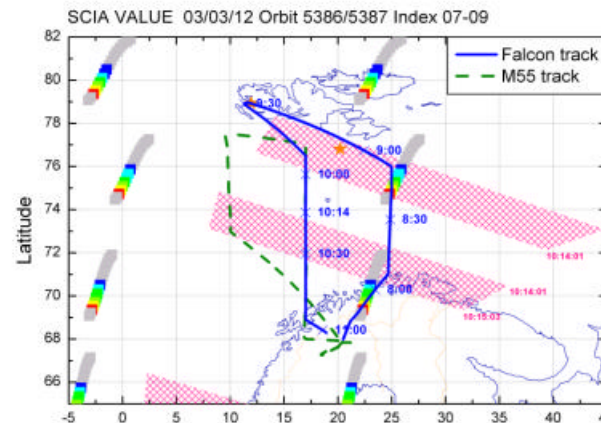
Nairobi →
(courtesy:
KMI /MeteoSuisse)



OLEX: Kiruna 2003



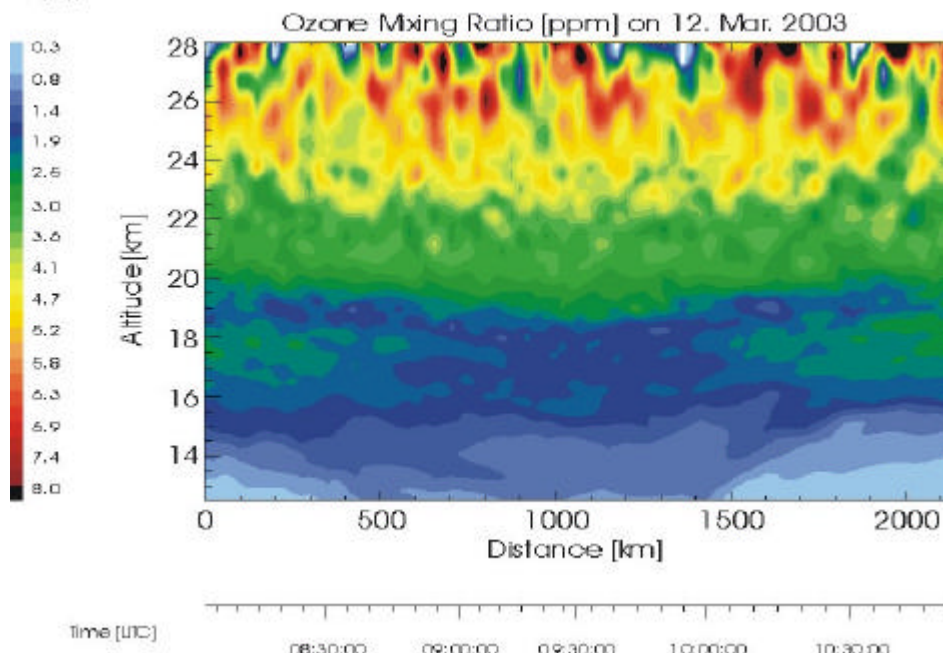
Flight inside polar vortex



← Comparison to MIPAS

Deviation
[(MIPAS-OLEX)/OLEX]:
70N: $-(19 \pm 14)\%$
75N: $-(17 \pm 11)\%$

DLR OLEX



Conclusion

- ✍ both campaigns: 113 flight hours, 49 SCIA pixels, 1 occultation
- ✍ synergistic payload; attractive candidate also for the long term validation activities of ENVISAT
- ✍ high latitudes to equator
- ✍ excellent measurements under various conditions
- ✍ unprecedented data set for validation