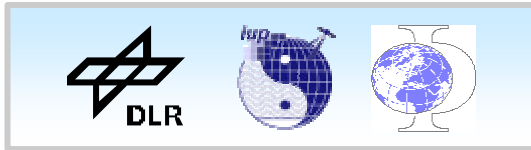


SCIAMACHY Validation by Measurements from Aircraft Platforms: "Status of the SCIA-VALUE Campaign"

Authors: **Gerhard Ehret, Andreas Fix, Harald Flentje**
(Institut für Physik der Atmosphäre, DLR Oberpfaffenhofen, Germany)

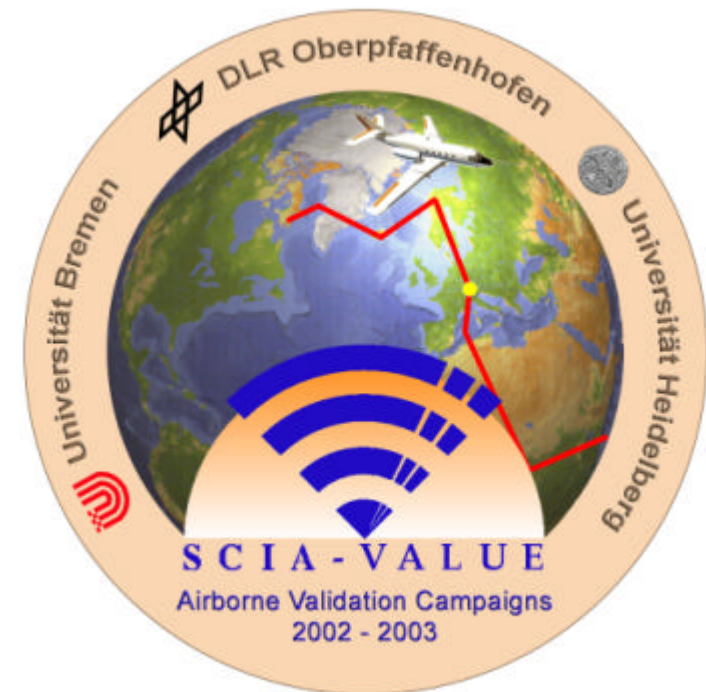
Klaus-Peter Heue, Ulrich Platt, Irene Pundt, Thomas Wagner,
(IUP, University of Heidelberg, Germany)

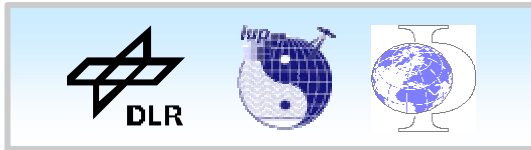
**Harry Küllmann, Holger Bremer, Armin Kleinböhl, Jayanarayanan Kuttipurath,
Justus Notholt, Klaus Künzi**
Marco Bruns, Ping Wang, Andreas Richter, John P. Burrows
(IFE, University of Bremen, Germany)



Overview

- ✍ Aircraft and validation payload
- ✍ The September 2002 campaign
- ✍ The March 2003 campaign
- ✍ Summary of campaign activities
- ✍ Conclusion

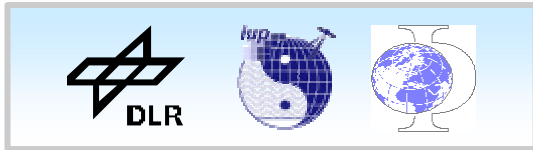




Satellite Validation from Aircraft

Advantages

- ▶ Extended 2-dim cross-sections in different climates
- ▶ Optimum spatial and temporal coincidence with ENVI SAT overpasses
- ▶ Atmospheric snapshot
- ▶ Complements ground-based and balloon-borne validation efforts
- ▶ Not affected by weather conditions



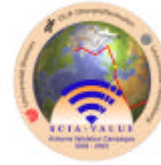
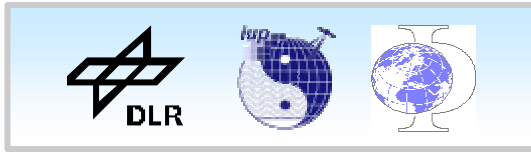
DLR Falcon 20

Meteorological Research Aircraft



Overall length	17.2 m
Wingspan	16.3 m
Maximum takeoff weight (MTOW)	13.2 t
Engines	Garret TFE 731-5BR-2C
Maximum Altitude	45000 ft (13.7km)
Maximum Range	3700 km (2000 nm)
Maximum Endurance	5:30 h
Maximum Payload (with max fuel)	1.1 t
Maximum Speed (TAS)	917 km/h (0.865 Mach)

Falcon:
← Technical Data

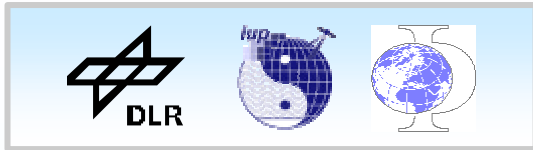


Falcon Validation Payload

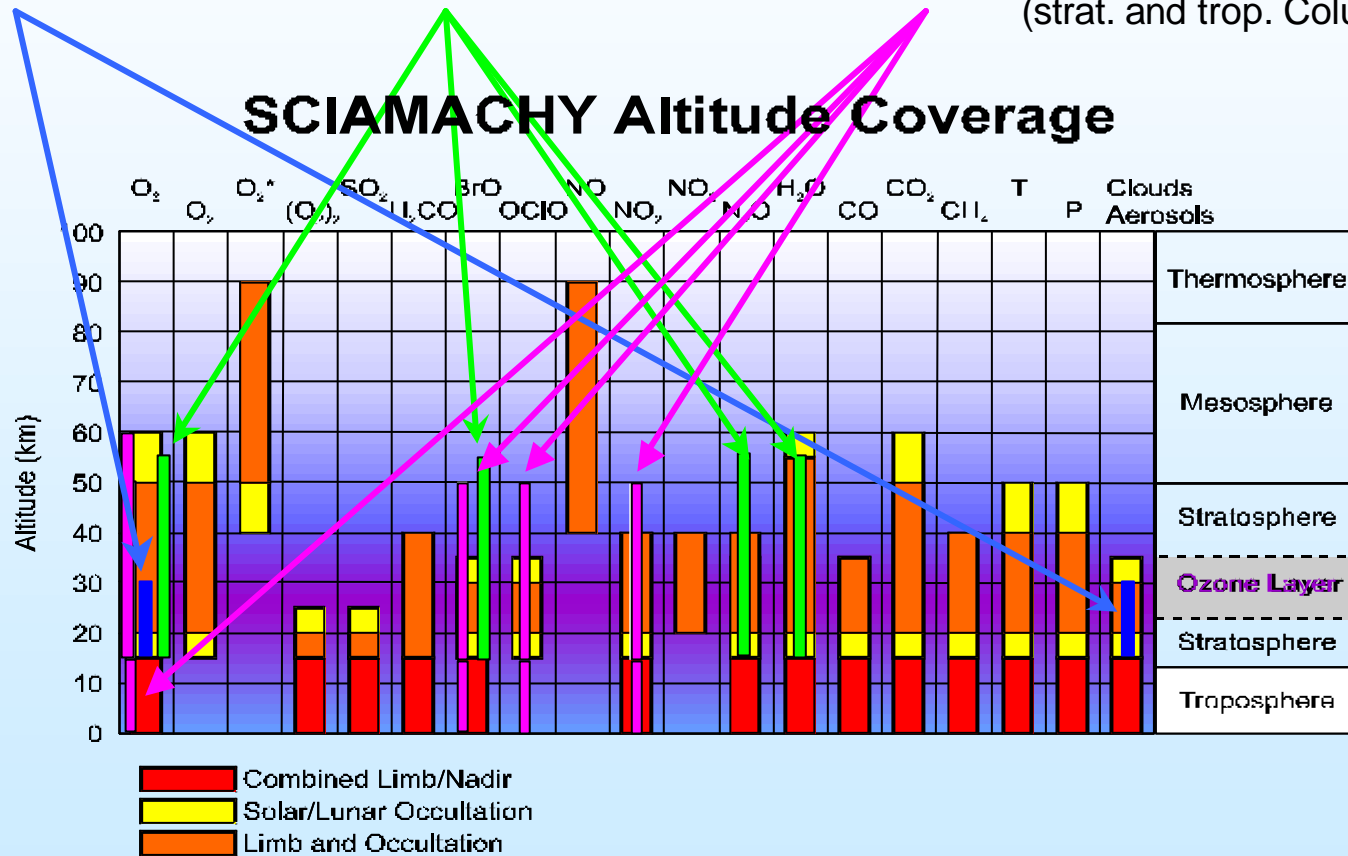
Advantage

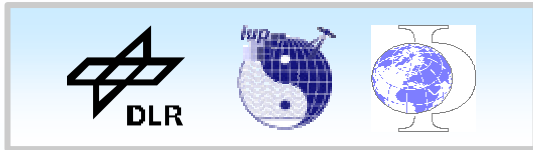
- address large number of SCIAMACHY data products
- provision of complementary information
- strong experience from previous airborne campaigns

ASUR	AMAXDOAS	OLEX
Airborne SUBmillimeter wave Radiometer	Airborne MultiAxis Differential Optical Absorption Spectrometer	Ozone Lidar Experiment
U of Bremen	U of Bremen U of Heidelberg	DLR
profiles of O ₃ , H ₂ O, N ₂ O, ClO, and BrO	stratospheric and tropospheric columns of O ₃ , NO ₂ , BrO, and OClO	profiles of O ₃ , stratospheric aerosol extinction, aerosol/molecular backscatter ratios, particle depolarisation

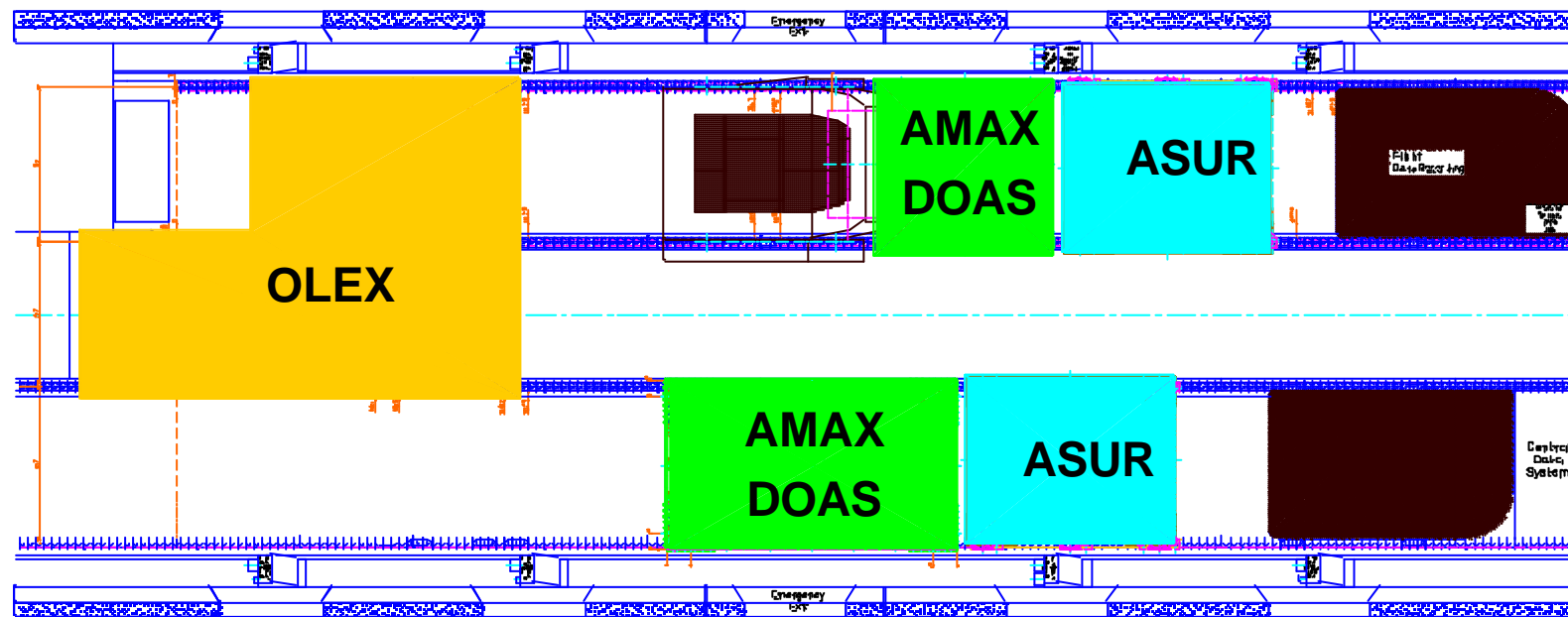


OLEX (profiles)
 ASUR (profiles)
 AMAXDOAS (strat. and trop. Columns)

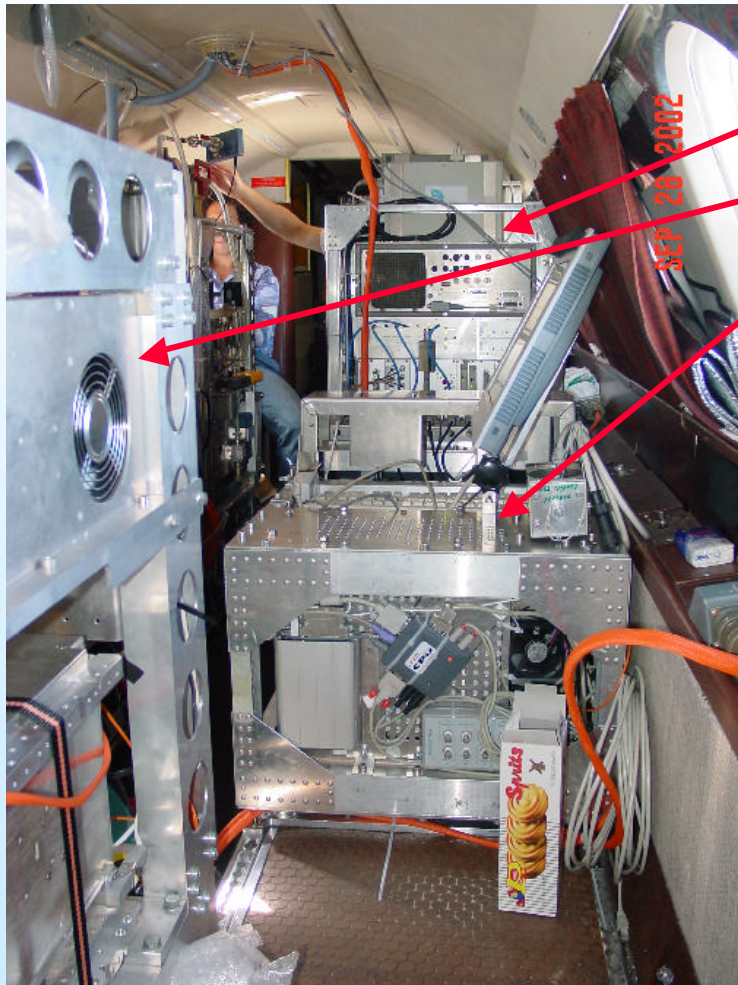
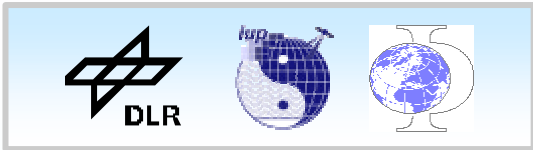




Layout of Validation Payload on Falcon 20 Aircraft



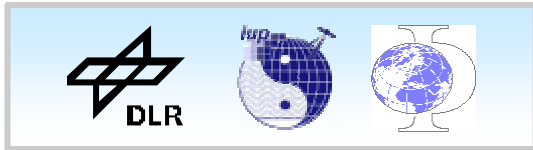
Aircraft flight direction



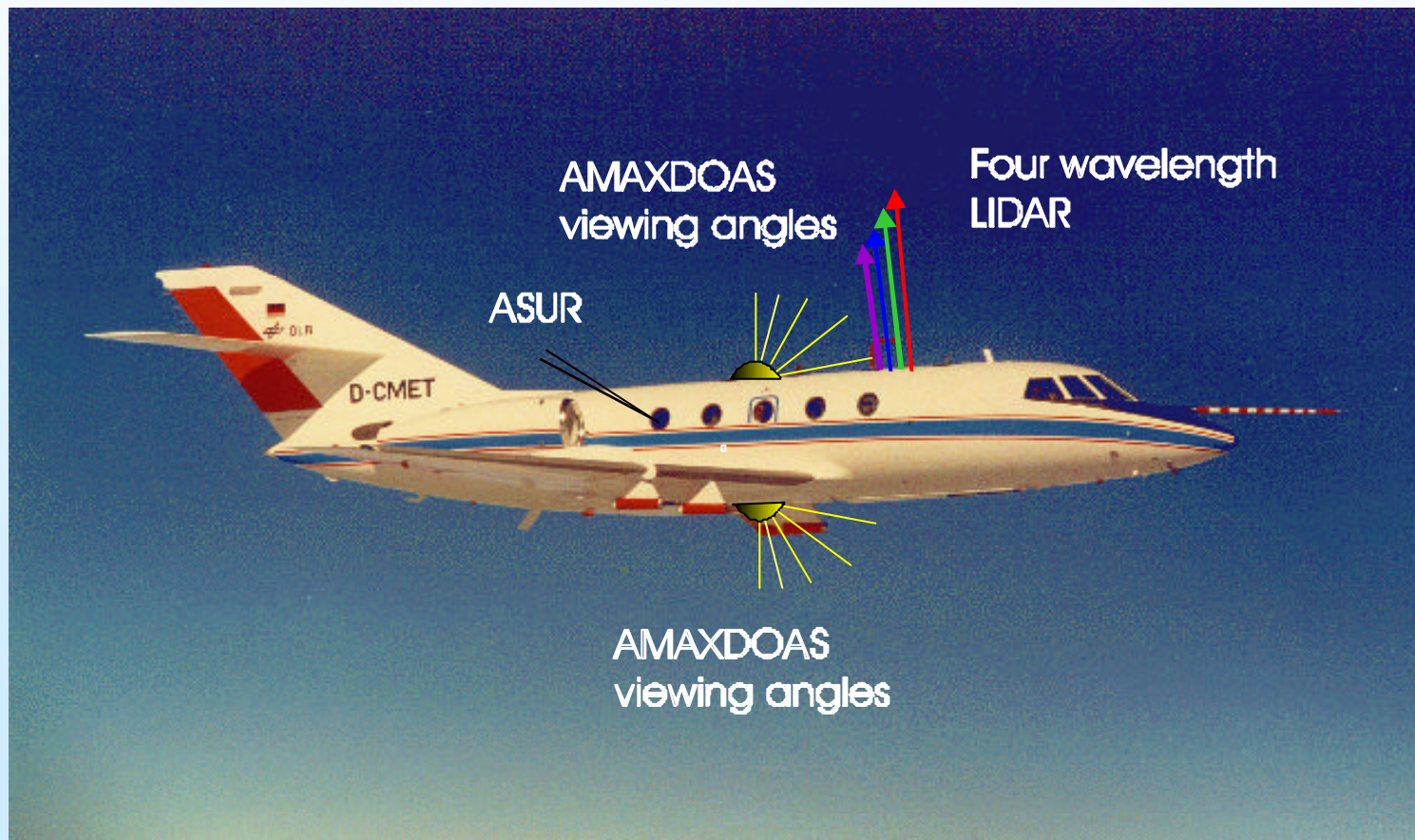
**ASUR,
OLEX,
AMAXDOAS
on the Falcon**

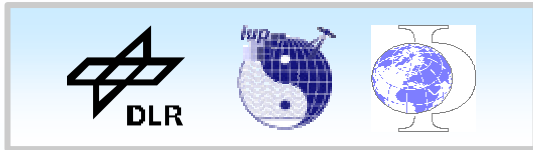


**AMAXDOAS
viewing ports
on the Falcon
aircraft**



Instrument Viewing Geometry





The Flight Pattern: September 2002



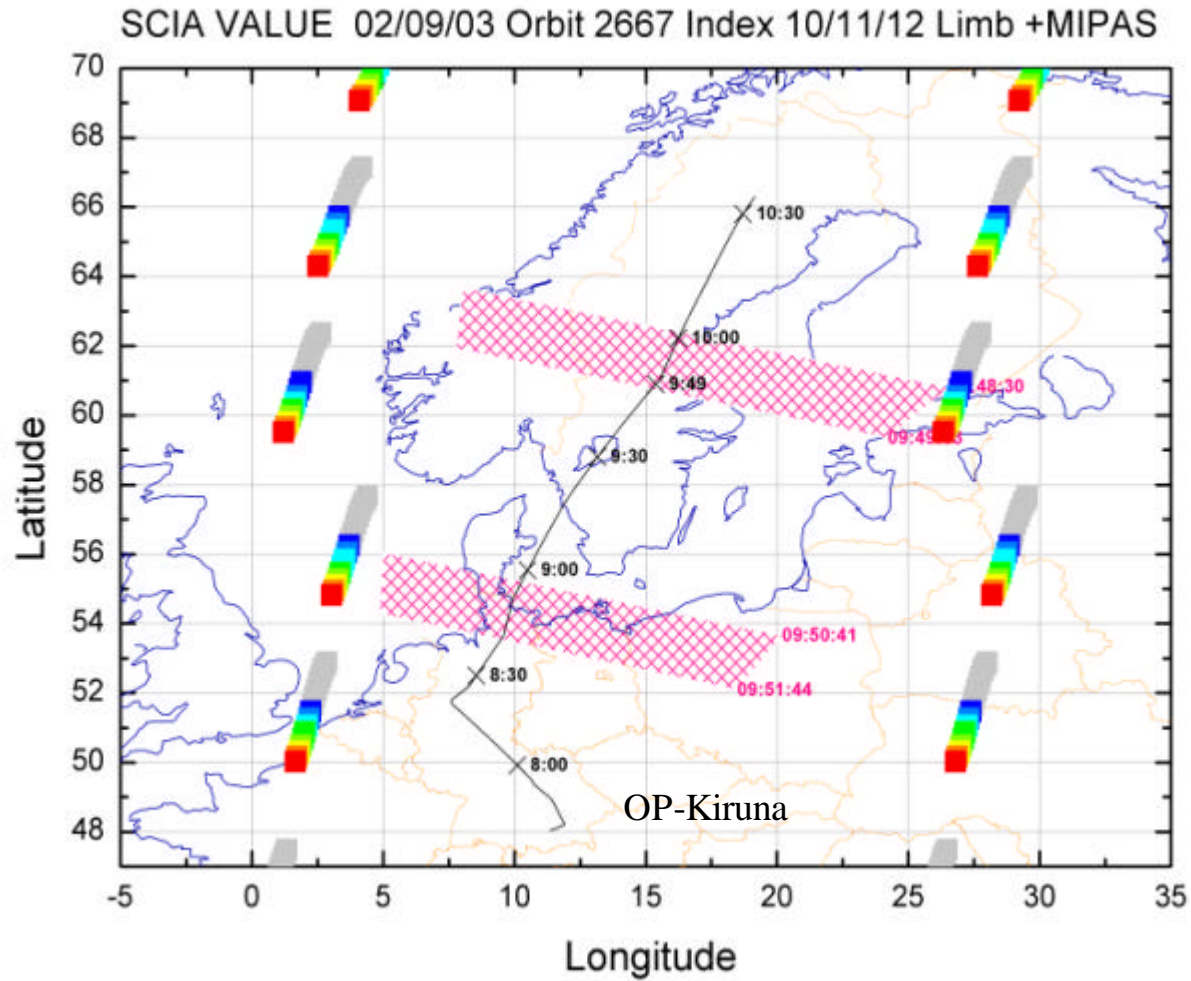
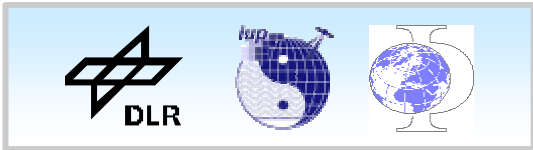
✈ Northern Part (03-07/09/2002)

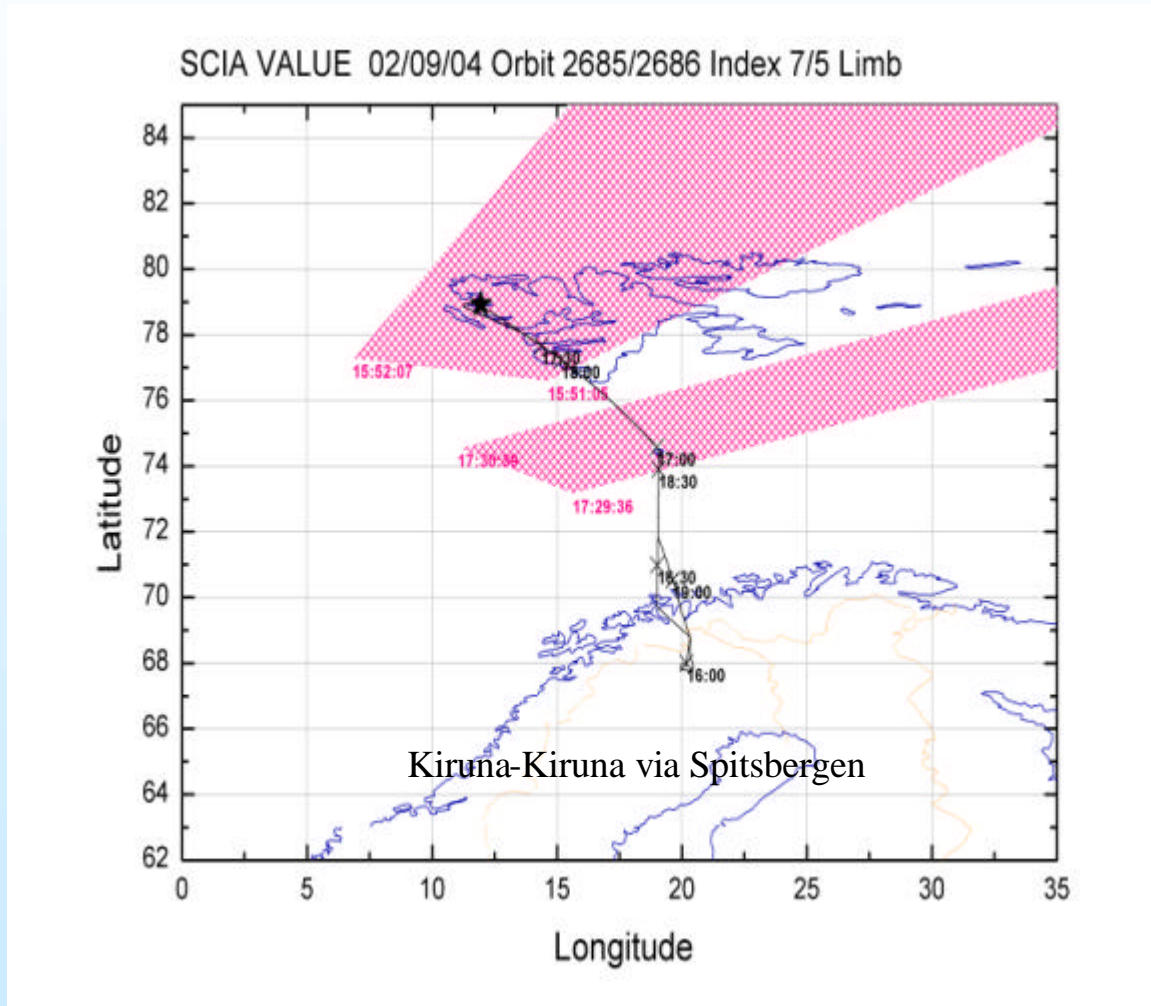
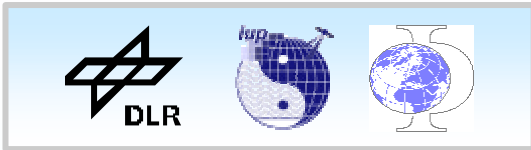
Munich - Spitsbergen - Kiruna - Greenland - Munich

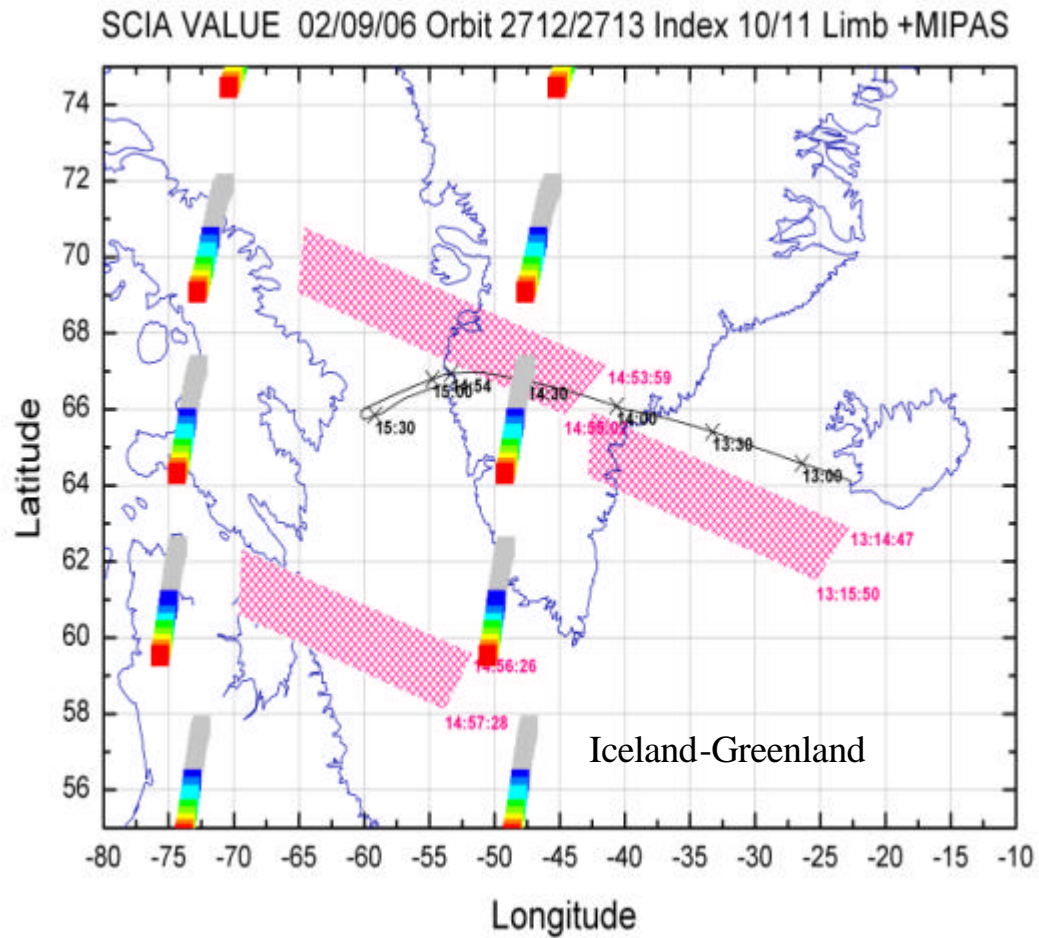
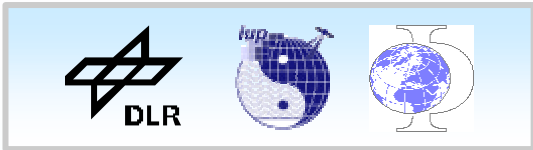
✈ Southern Part (15-28/09/2002)

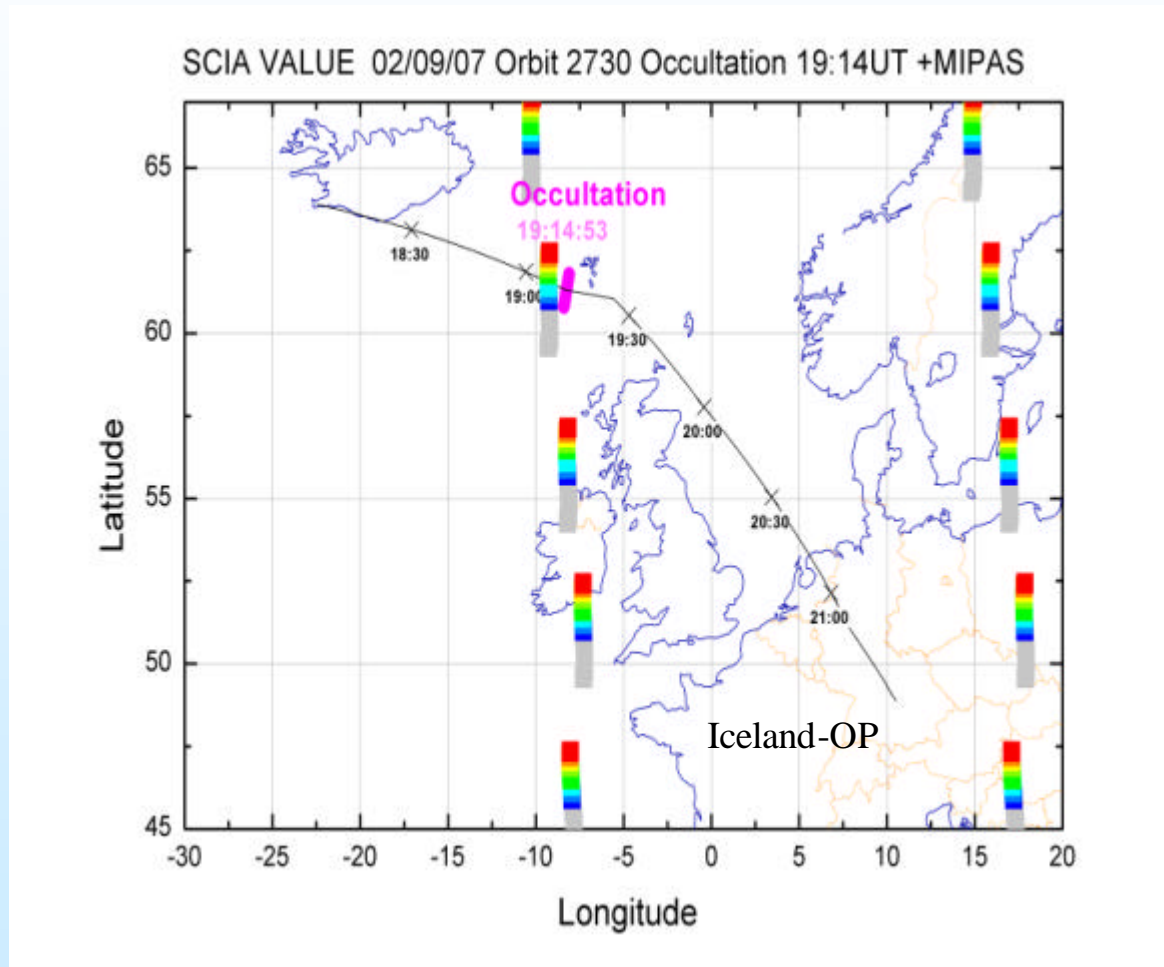
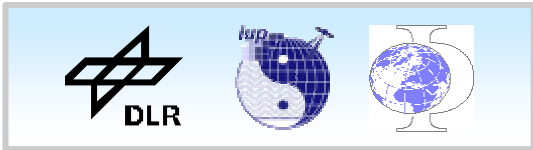
Munich - Yaoundé - Nairobi - Mahé and back

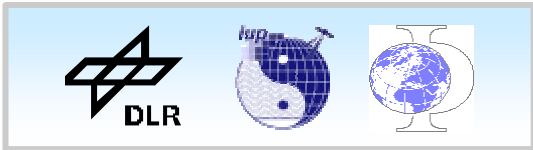




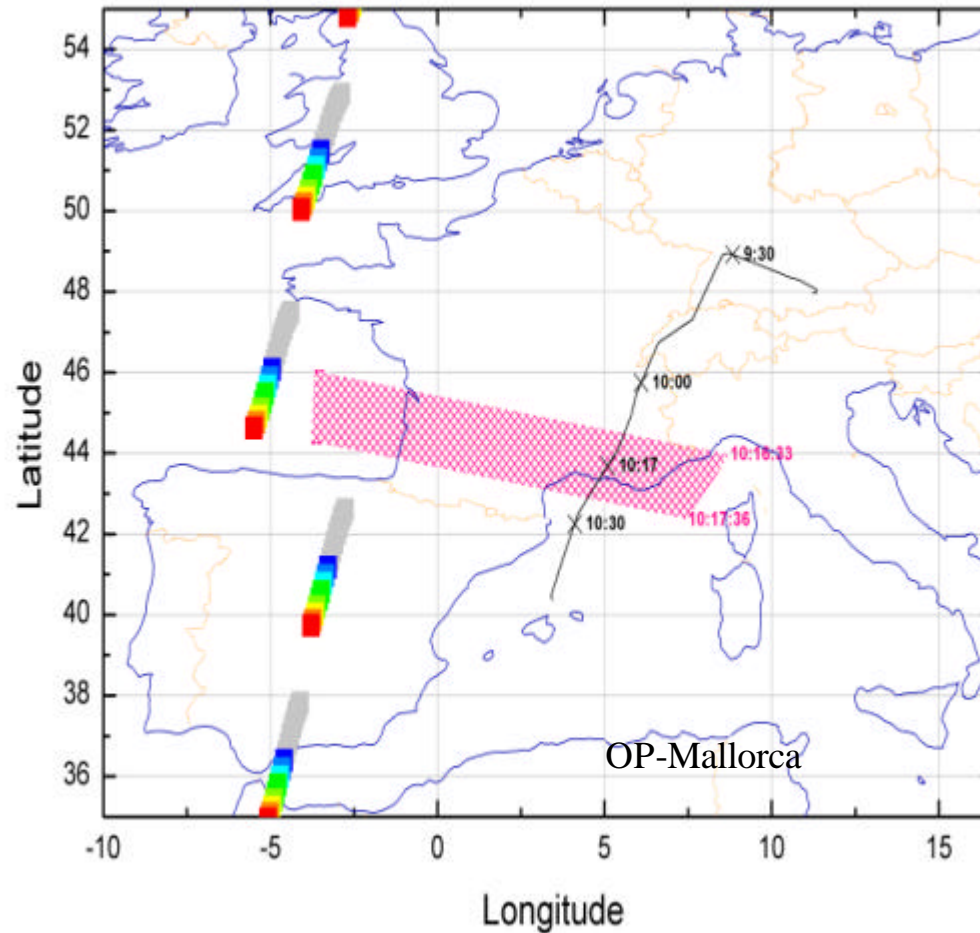


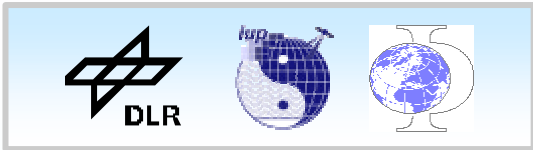




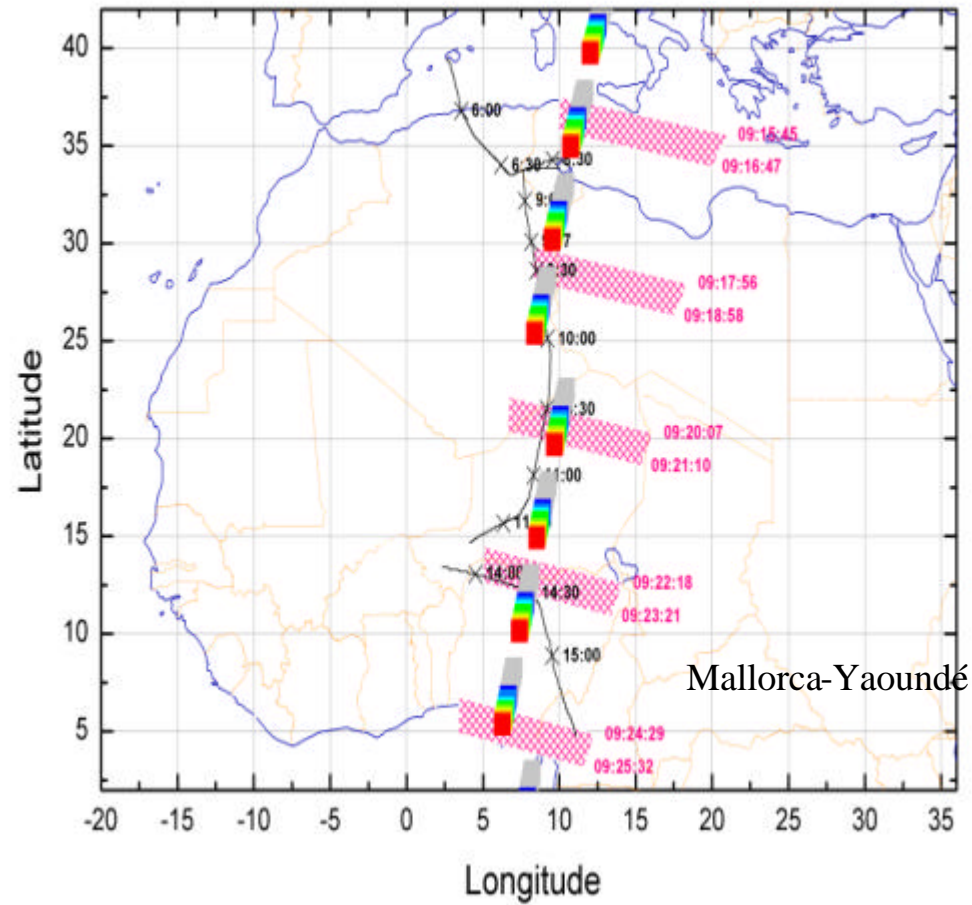


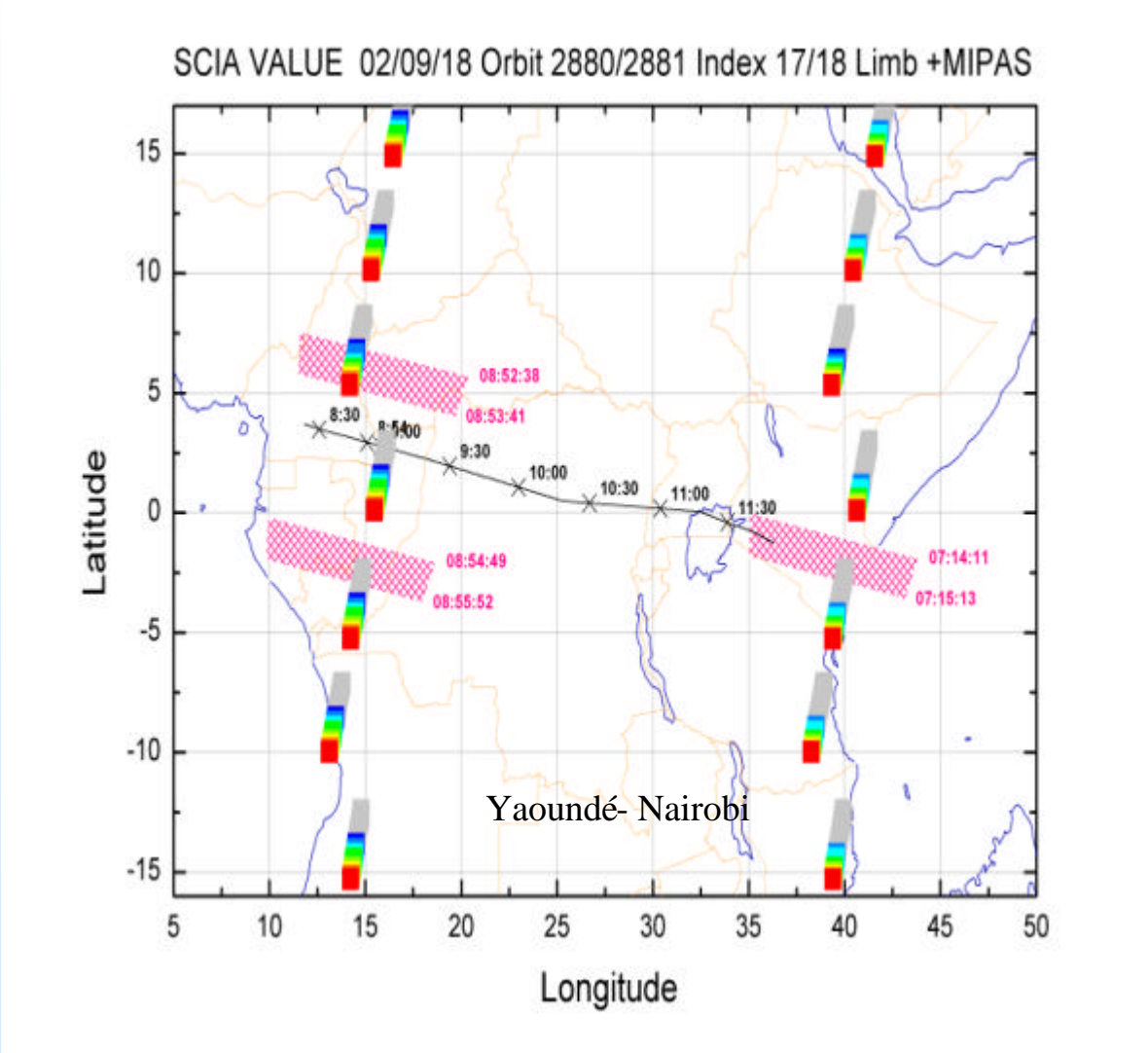
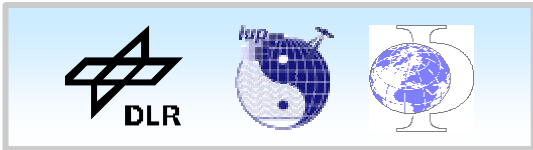
SCIA VALUE 02/09/15 Orbit 2839 Index 12 Limb +MIPAS

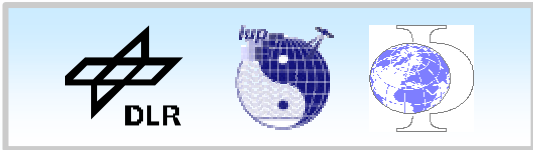




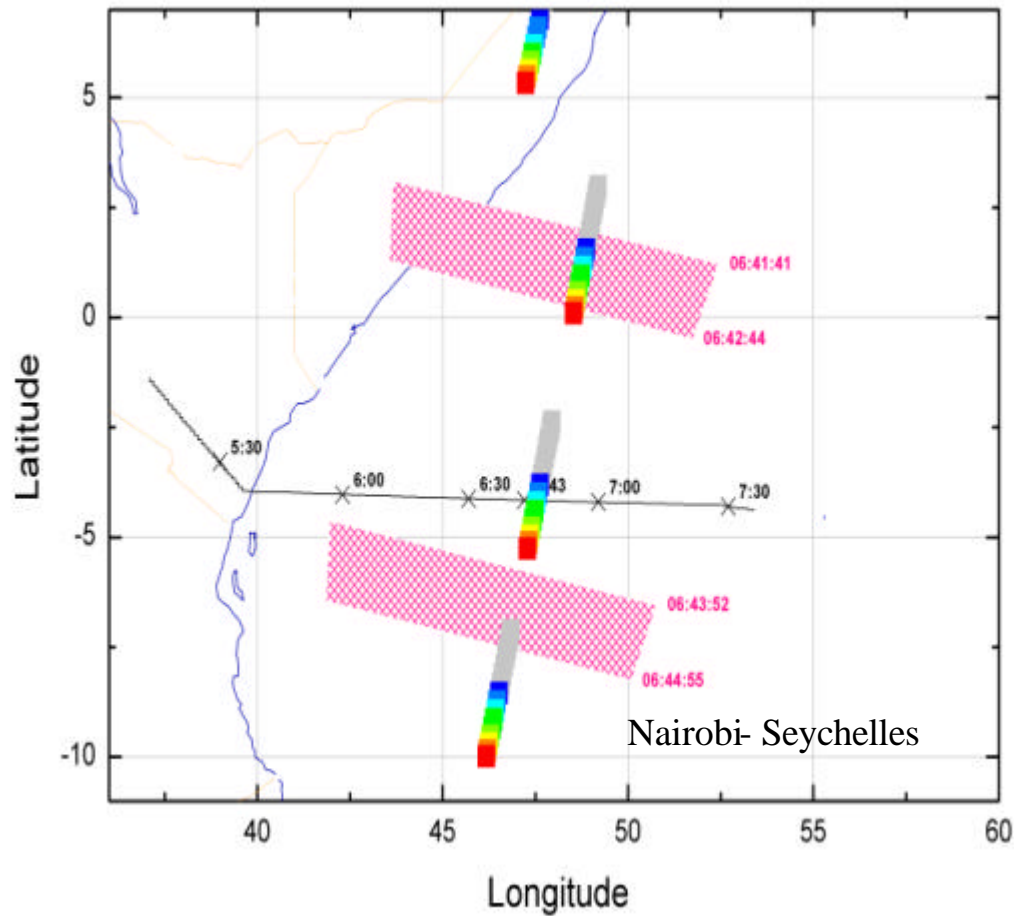
SCIA VALUE 02/09/17 Orbit 2867 Index 13-17 Limb

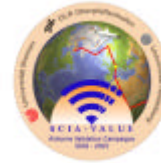
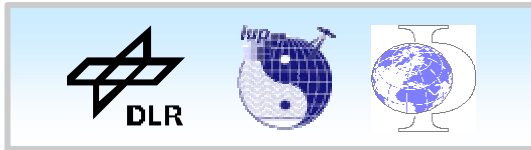






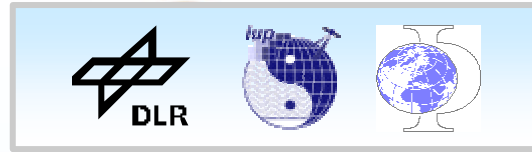
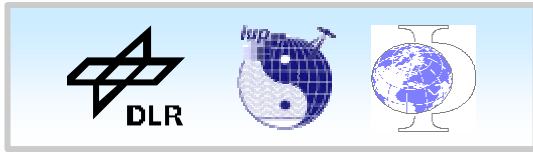
SCIA VALUE 02/09/19 Orbit 2894 Index 18/19 Limb +MIPAS





Flight Schedule September 2002: 30 SCIA states, + 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

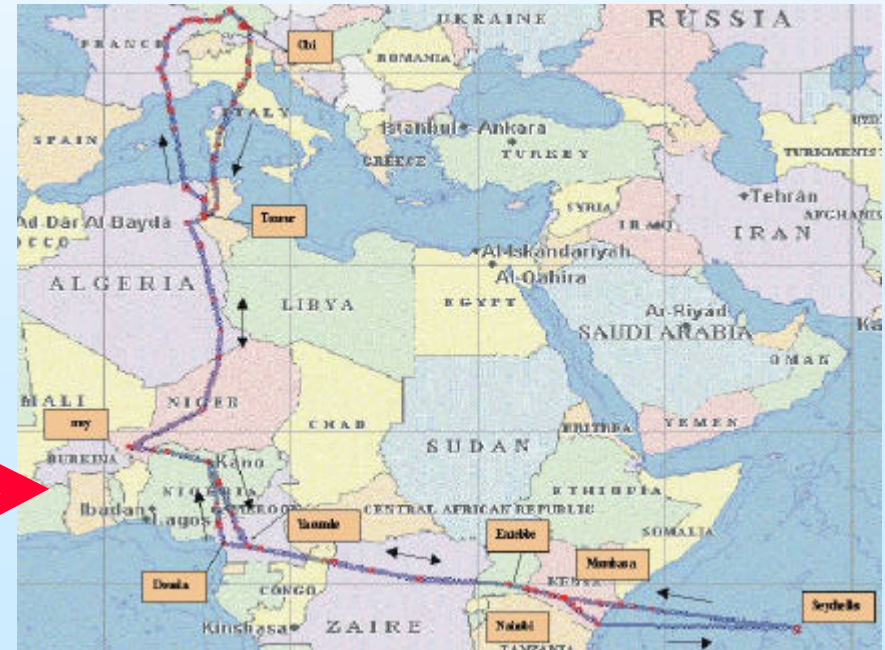


The Flight Pattern: February-March 2003



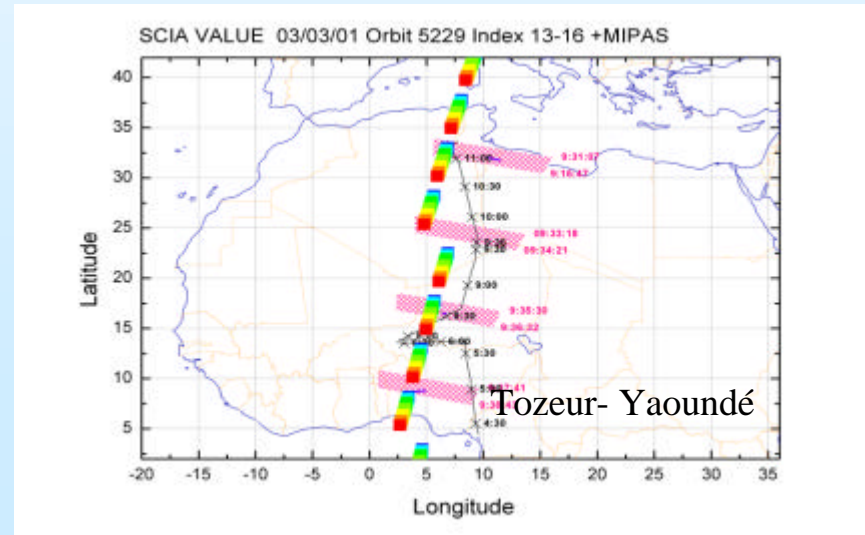
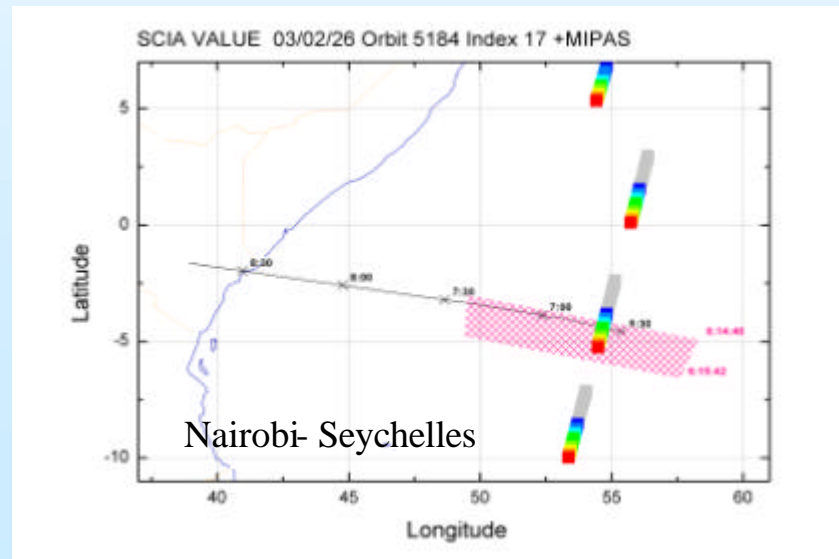
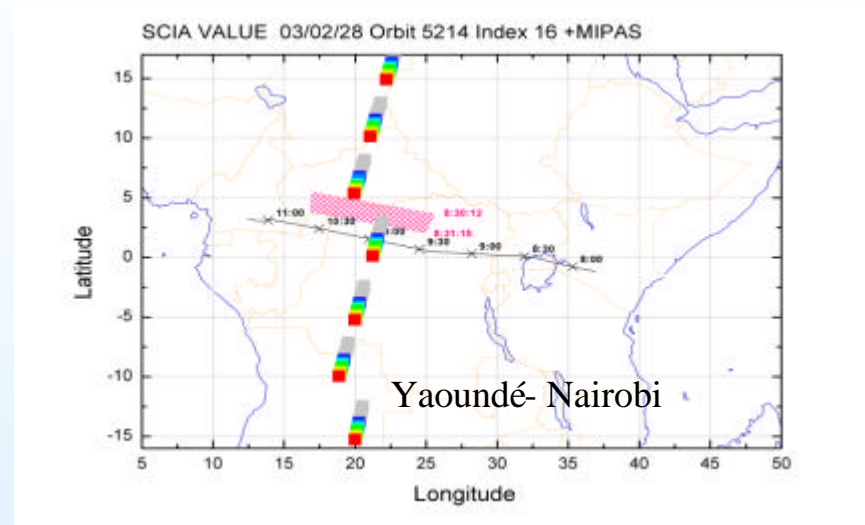
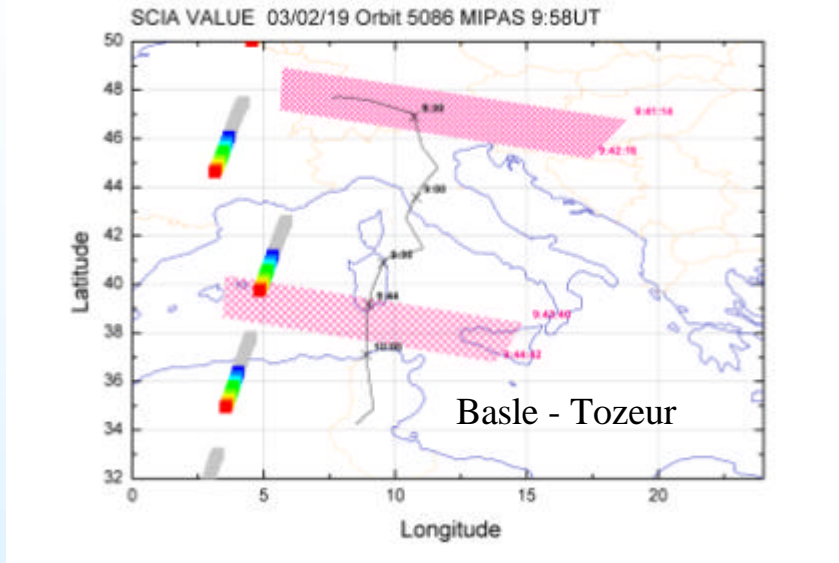
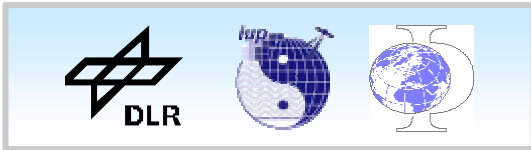
✈ Northern Part (10-19/03/2003)

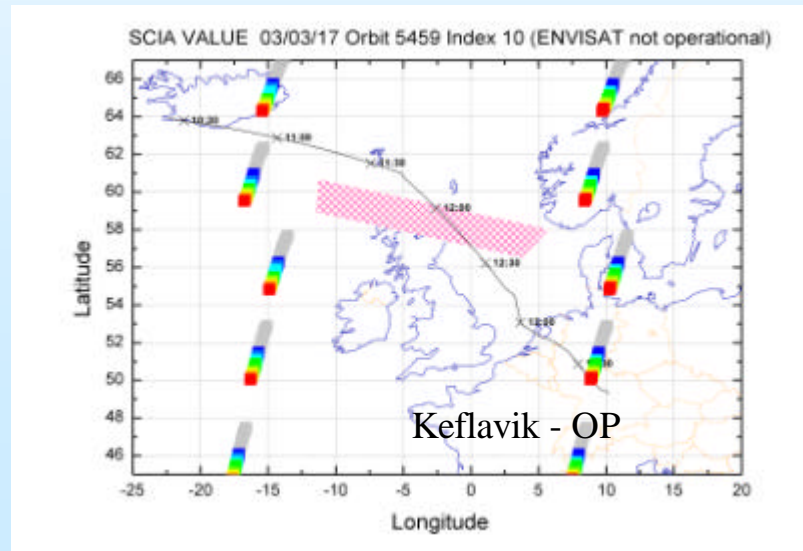
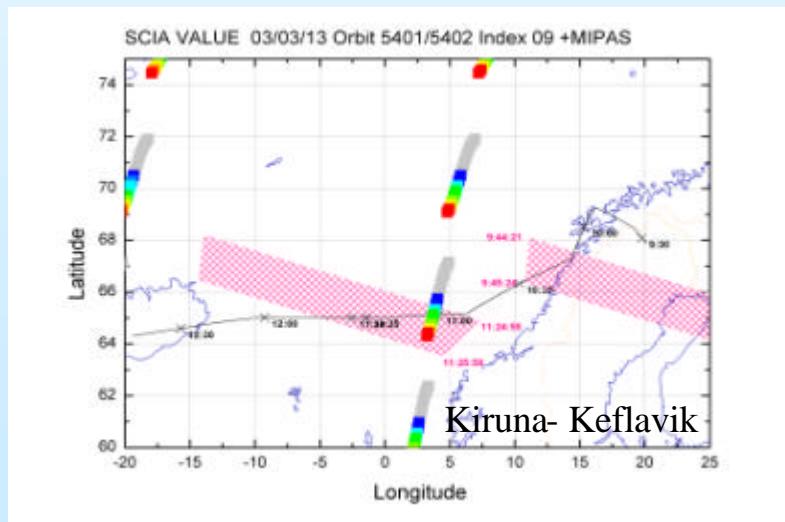
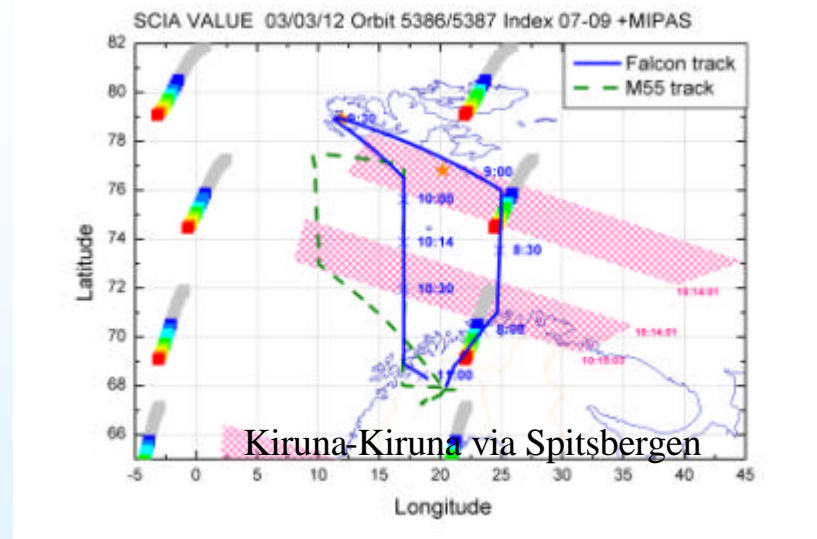
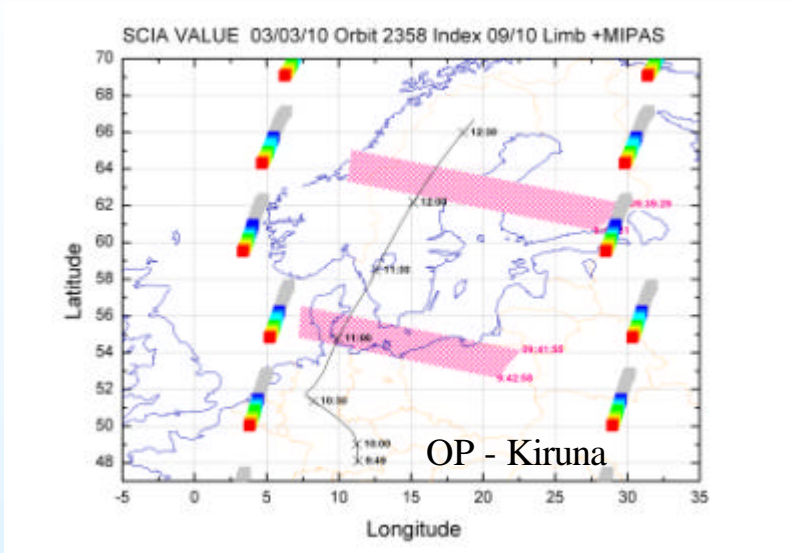
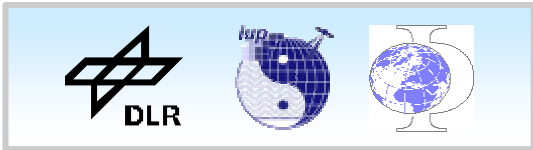
Munich - Spitsbergen - Kiruna - Greenland - Munich

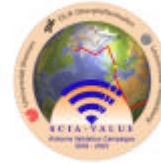
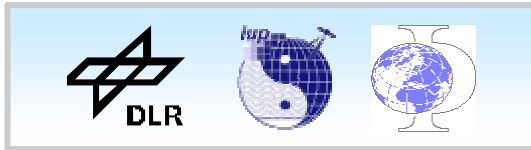


✈ Southern Part (19/02-03/03/2002)

Munich - Yaoundé - Nairobi - Mahé and back



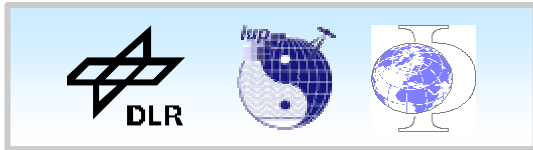




Flight Schedule Feb-March 2003 : 19 SCIA states

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



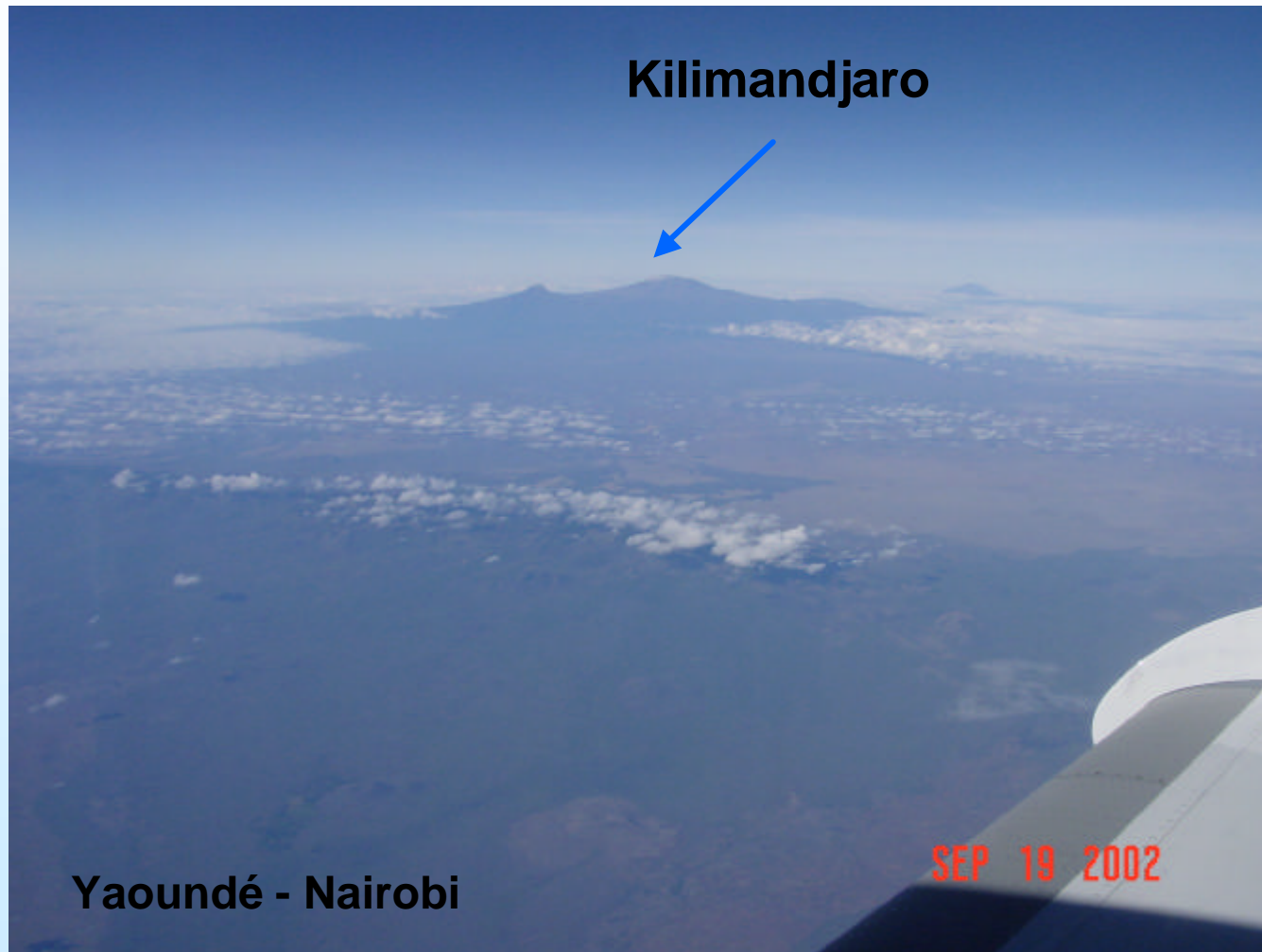
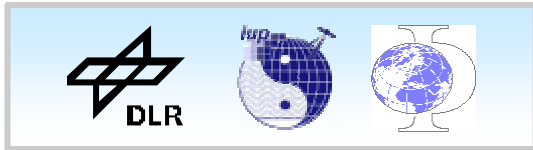
Tozeur

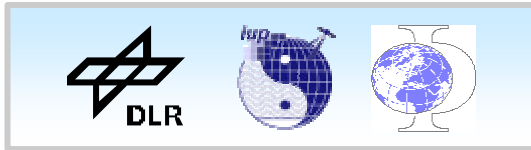
Falcon crew and scientists are waiting for spare parts ?



Mombasa

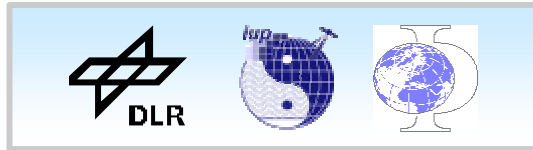
Refill of liquid nitrogen and helium for the ASUR instrument at various places was a big challenge





Conclusion

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



Acknowledgement

H. Finkenzeller, S. Grillenbeck, R. Welser, H. Brockstieger (DLR, FB, Oberpfaffenhofen) for their great support during both campaigns (flight planning, liquid N₂/He transport, logistics and instrument certification issues)

Manfred Gottwald (DLR, DFD, Oberpfaffenhofen) for provision of SCIA footprints (timing, coverage)

DLR Bonn and U. Heidelberg (BmbF, AFO 2000) for funding support