

DLR FKZ 50 EE 0009

SCIAMACHY-ENVISAT-Validierung:

**LIDAR-Messungen zur Bestimmung von Temperaturprofilen, der
Aerosolbeladung und von Wolken in der polaren Atmosphäre im
Höhenbereich von 5 bis 95 km auf der ESRANGE bei Kiruna
(Schweden)**

ESA AO-ID 222

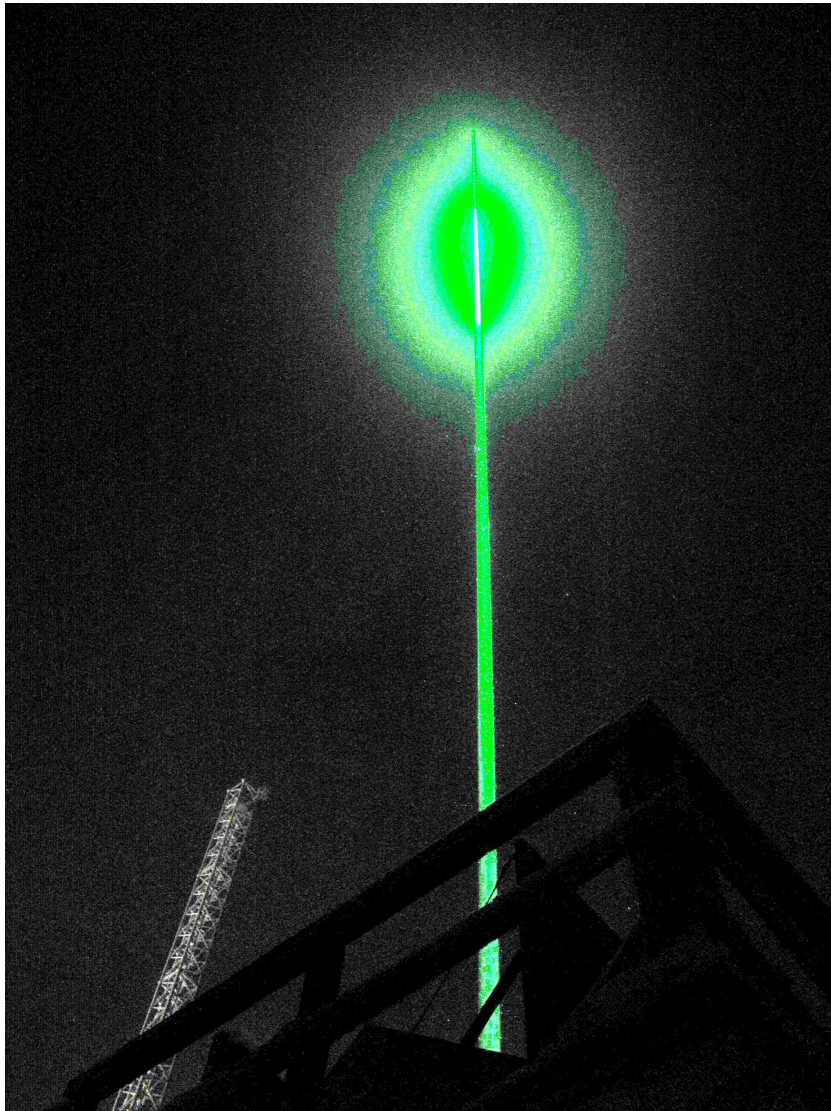
**Lidar Measurements at the Arctic Circle from Esrangle near Kiruna
(Sweden) for the Validation of ENVISAT Measurements of
Temperature Profiles, Aerosol Load, and Clouds in the Mesosphere,
Stratosphere and Troposphere**

**Physikalisches Institut der Universität Bonn
Nußallee 12, D-53115 Bonn, Germany**

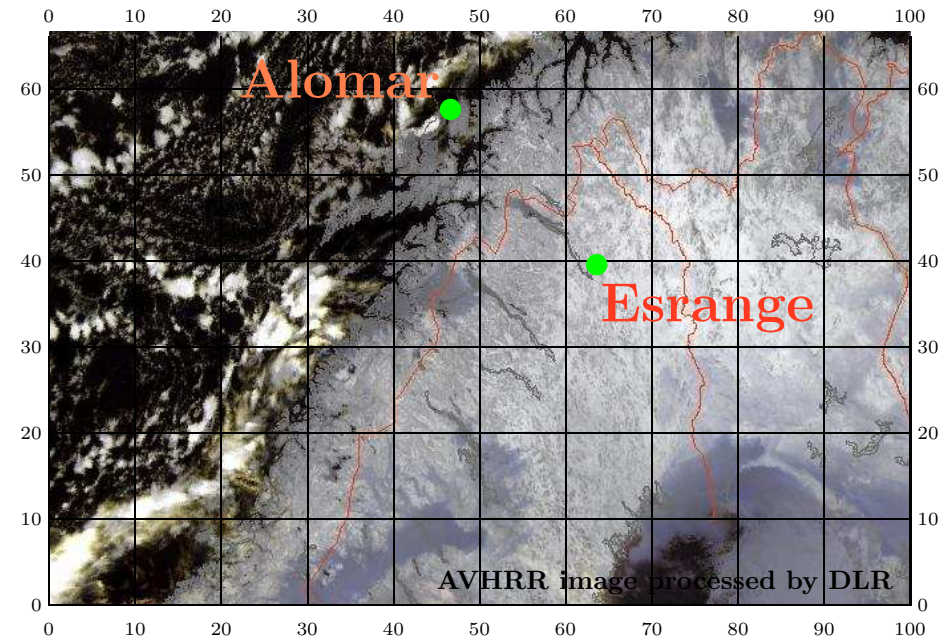
K. H. Fricke and U. Blum

The U. Bonn Lidar at the Esrange (68 N, 21 E)

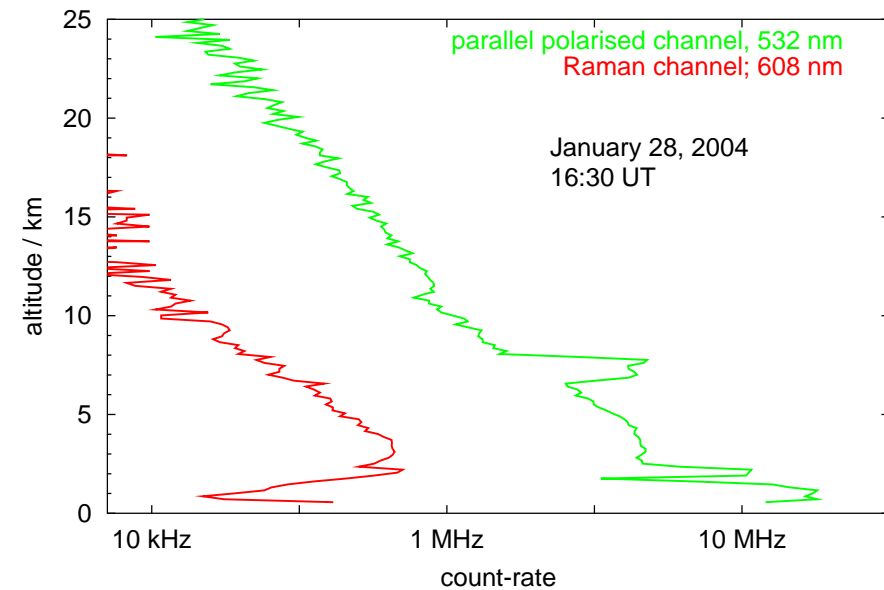
Multiple scattering of lidar beam
on “roof cloud” ($z \approx 10$ m)



January 28, 2004, 17h43m CET, contrast enhanced



U. Bonn Lidar at the Esrange - raw data



Overview of U. Bonn Activities for Envisat Validation

ESA AO-ID 222 and DLR FKZ 50 EE 0009

1. Available data set

10 measurement campaigns
(3 preparation-, 7 validation-campaigns)
39 coincident data sets deposited at NILU

2. Activity Reporting

validation reports to ESA
semi-annual reports to DLR

3. Publications

Conference proceedings
12 dealing with Envisat validation
6 dealing with science
Peer reviewed journals
none dealing with Envisat validation
5 dealing with science
(4 published, 1 submitted)

preparation campaigns

	date	# days	# hours
1	11. Jan – 08. Feb 2001	21	214
2	24. Jul – 14. Aug 2001	7	38
3	12. Jan – 18. Feb 2002	17	282
	total:	45	534

validation campaigns

	date	# days	# hours
1	16. Jul – 30. Aug 2002	31	342
2	16. Jan – 19. Feb 2003	28	291
3	03. Dec – 18. Dec 2003	10	90
4	07. Jan – 06. Feb 2004	14	140
5	08. Jul – 29. Jul 2004	13	105
6	17. Aug – 13. Sep 2004	12	68
7	22. Oct – 31. Oct 2004	3	47
	total:	111	1083

days with measurements

#hours of accumulated integration time

Results

Validation of ESA operational level 2 products

Temperature profiles in limb products

- **Sciamachy:** offline processed limb data **products** with temperature are **not available** (Dec. 2004)
- **Gomos:** temperatures not reliable (ACVE-2, May 2004)
- **Mipas:** temperatures ok (ACVE-2, May 2004)
accuracy < 1 K and precision < 5 K

Cloud top pressure in nadir products

1. values **recognized** to be taken from **climatology** in software version SCIA/3.51 in September 2002
2. values **confirmed** to be taken from **climatology** in software version SCIA/5.04 in November 2004
3. provides cloud top pressures in darkness, when Sciamachy does not measure

Results from Scientific Products

FRESCO Cloud Top Heights

FRESCO Fast Retrieval Scheme for Cloud Observations

Method Measured reflectivity in and around oxygen A-band

A priori Surface height, surface albedo, cloud albedo

critical: cloud albedo = 0.8 \Leftrightarrow $\tau \sim 33$

References Piters et al., Tech. Rep. GOFAP-KNMI-ASD-01, 1999

Koelemeijer et al., *J. Geophys. Res.* 106 (D4), 3475 (2001)

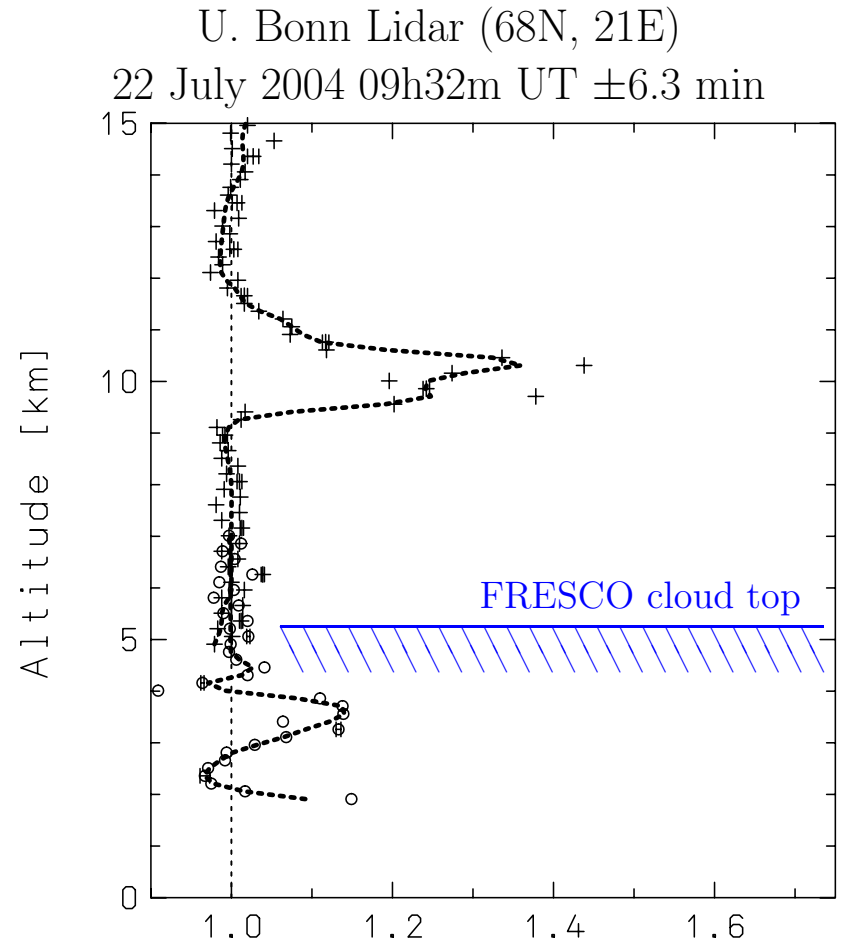
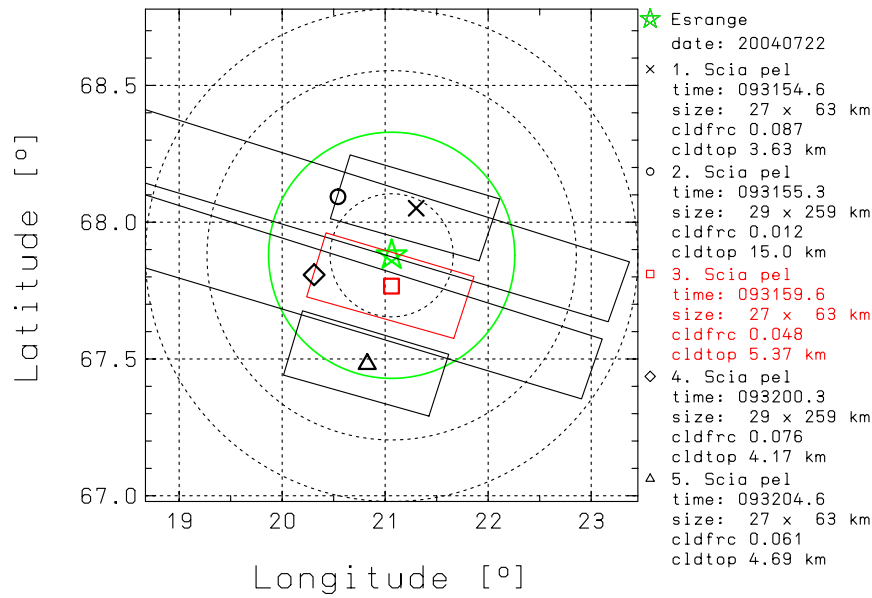
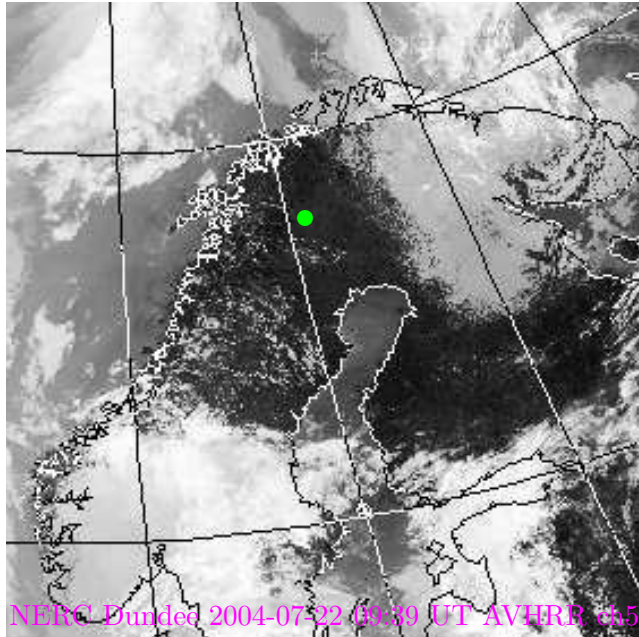
Koelemeijer et al., *J. Geophys. Res.* 107 (D12), 4151 (2002)

Availability <http://www.temis.nl/fresco/>

Validation with Lidar

- clouds are highly variable: strict coincidence required
- criteria were: range center of pixel < 50 km
lidar and scimachy measurement time within 10 minutes
- found nothing in 2003, 4 cases in 2004

Validation of FRESCO Cloud Top Height



Backscatter ratio 532 nm
FRESCO 22 July 2004 09h31m59.6s
Cloud top 5.4 km
Distance to Lidar 12.6 km
Pixel size 27 x 63 km

Results from Scientific Products

Cloud Top and Bottom Heights

FRESCO Fast Retrieval Scheme for Cloud Observations
provided by KNMI/TEMIS (R.J. van der A et al.)

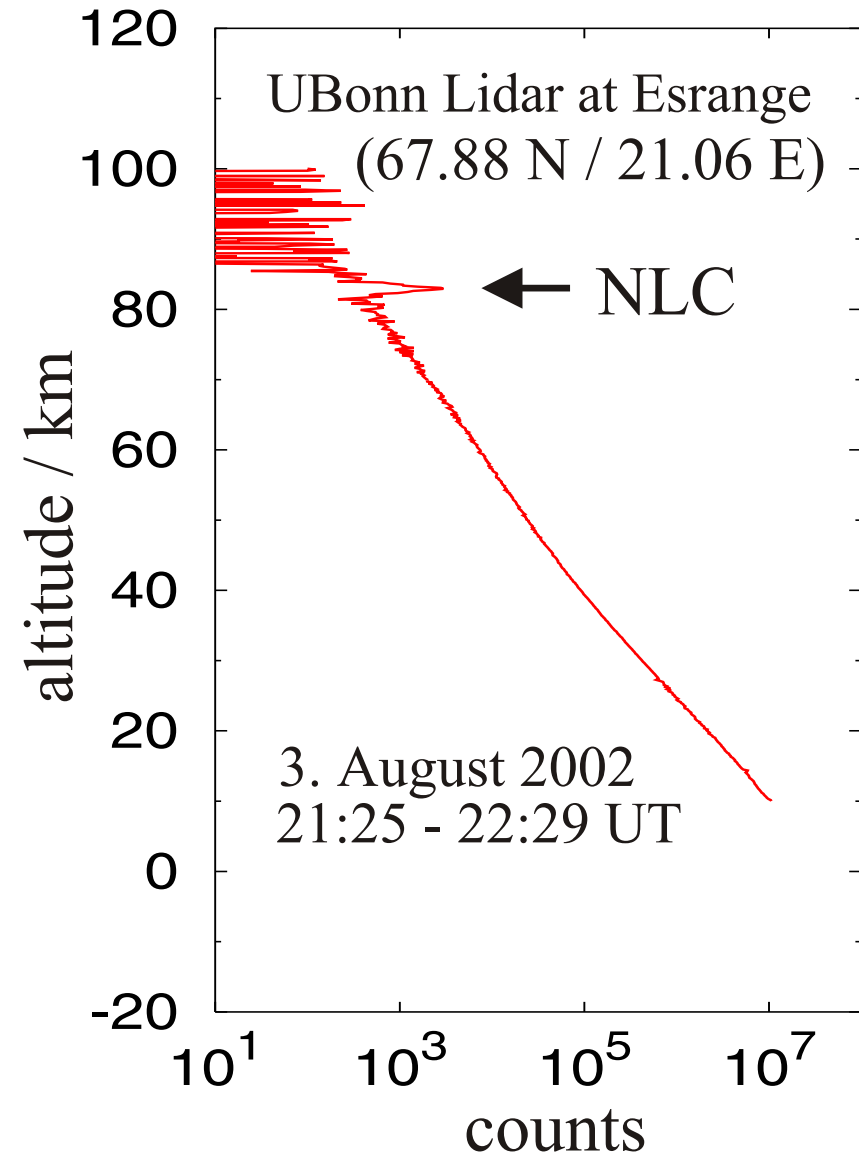
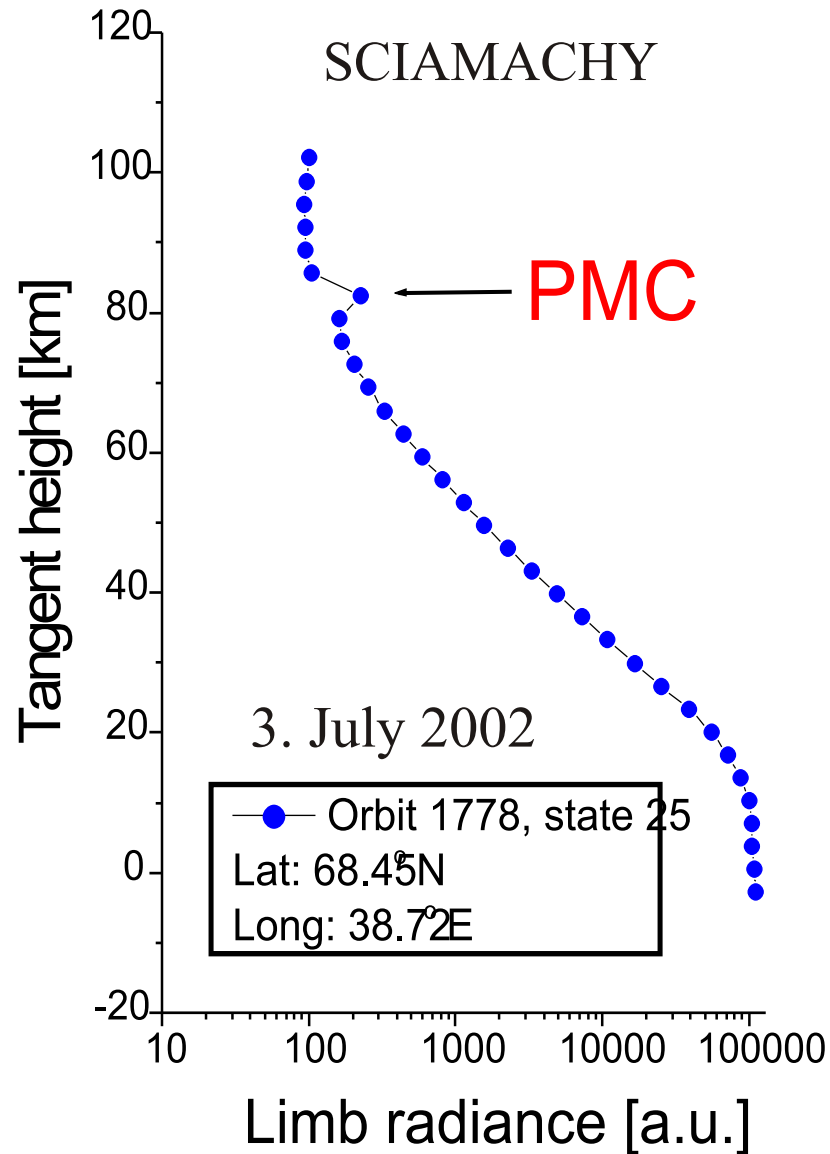
- assumes optical thickness ~ 33
- “negative” validation by lidar only, i.e. cases for which FRESCO reports a cloud top altitude for (semi-)clear skies
- suggest to introduce “cloud optical thickness flag”

SACURA Semi-Analytical Cloud Retrieval Algorithm
provided by IUP Bremen (A. Kokhanovsky)

- requires optical thickness > 5
- Cloud bottom in addition to cloud top
cloud *bottom* verifiable by lidar even for optically thick clouds
- Present data set codes **time of measurement** as orbit, suborbit, state, readout. Need tools for converting to universal time with an accuracy of about 1 minute.

Potential for further Scientific Products from Sciamachy

Noctilucent Clouds



Validation of Sciamachy Products with U. Bonn Lidar at the Esrange

ESA operational products

- **temperature** profiles: Sciamachy data not available
- **cloud top** pressure: climatological values rather than Sciamachy data
- U. Bonn Lidar team validated **Gomos/Mipas temperatures** instead

Scientific cloud products

- **FRESCO**: “negative” validation of cloud top heights for optically thin clouds
- **SACURA**: potential for cloud bottom height for optically thick clouds

Potential products

- **noctilucent clouds**
- **temperature profiles** from Rayleigh scattering