SCIAMACHY Validation by AMAXDOAS

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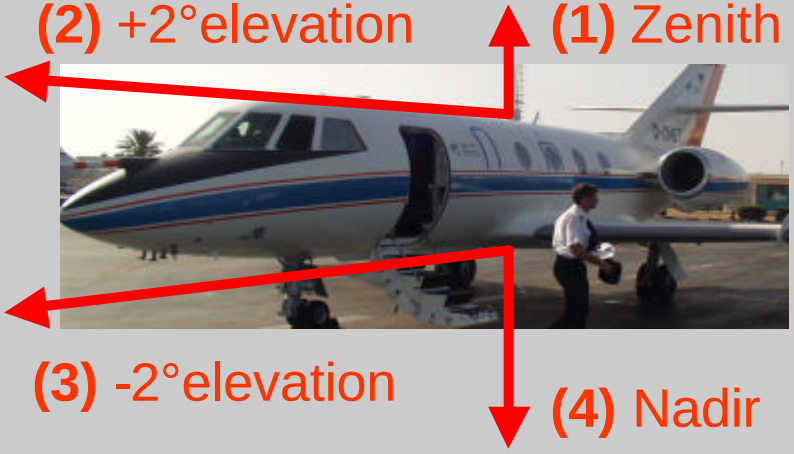
Overview

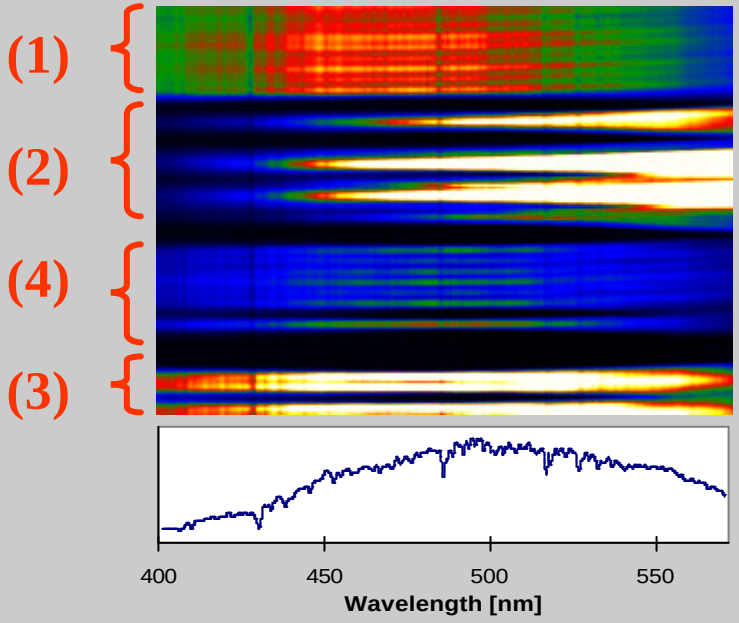
- The AMAXDOAS instrumental setup
- NO_2 and O_3 measured on the North flight September 4th 2002
- NO_2 over the Sahara desert - South flight September 17th 2002
- OClO inside the Polar Vortex
- Cloud effects in the Tropics
- Validation of radiometric data

AMAXDOAS Instrumental Setup



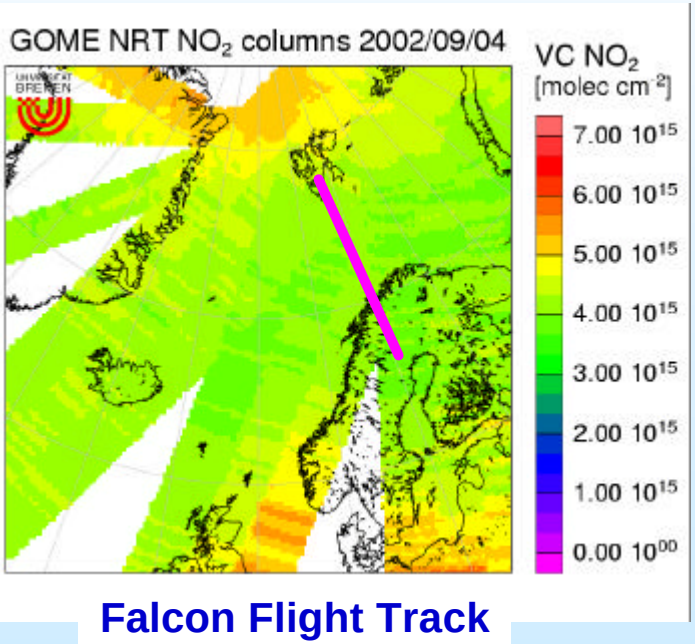
- **Different viewing angles**
- **Separation of tropospheric and stratospheric column**
- **UV and VIS instrument**
- **High temporal resolution**

Typical CCD Image, VIS Instrument

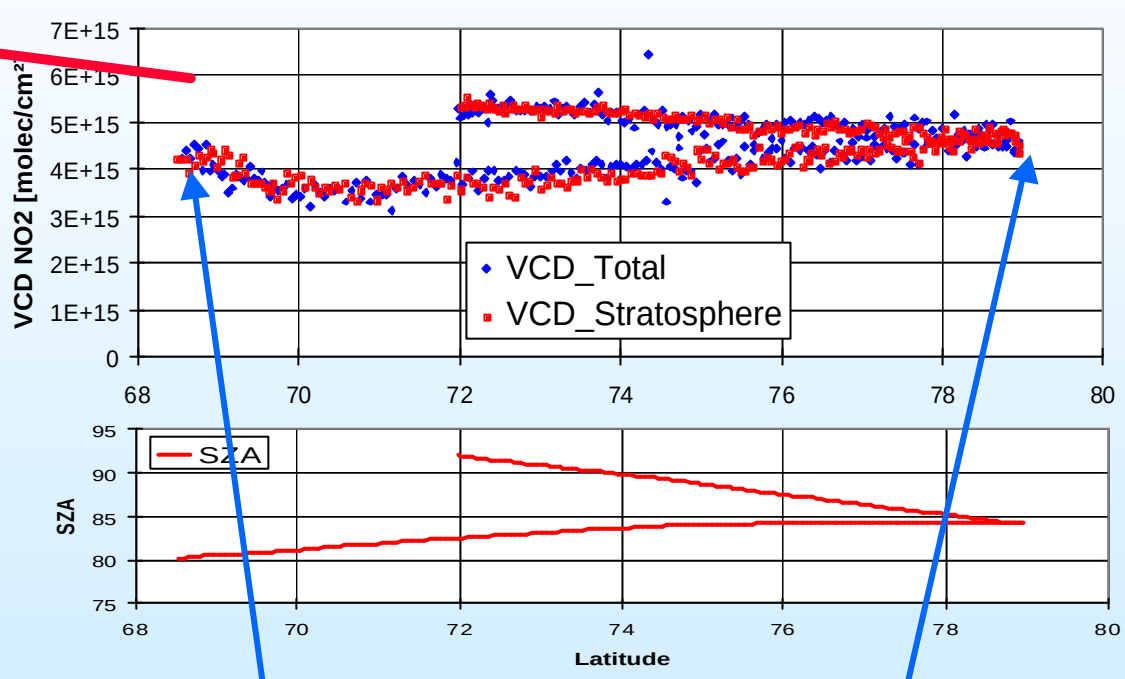


AMAXDOAS NO_2: GOME and Groundbased Comparisons

No significant NO2 in the troposphere



Falcon Flight Track 04.09.2002



Ground Based: →

Kiruna, 67°N, (06.09.):

Morning: 3.5e15 cm^{-2}

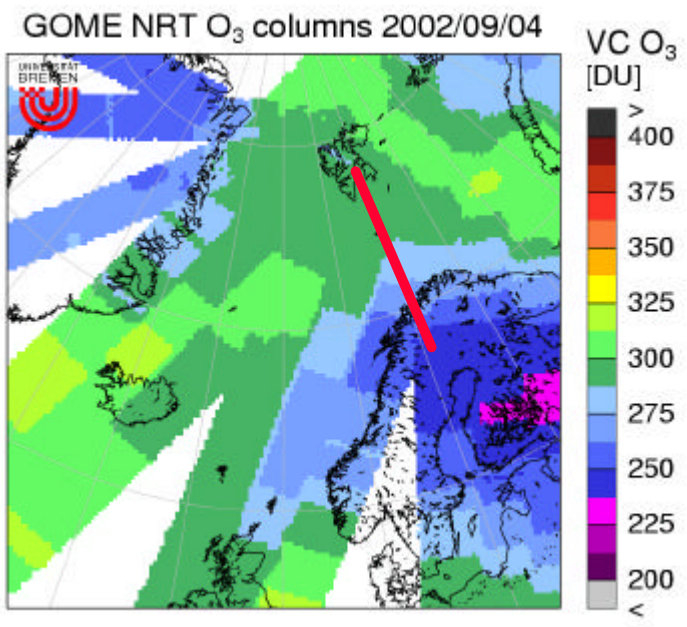
Afternoon: 5.0e15 cm^{-2}

Ny-Ålesund, 79°N,

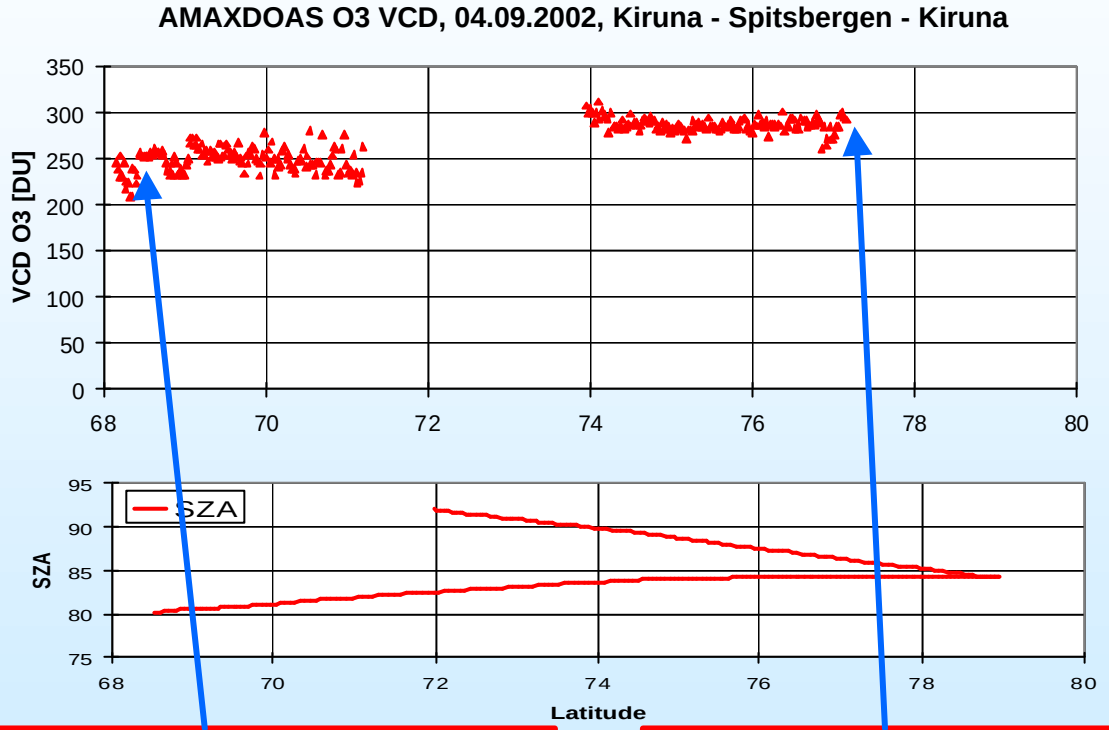
Morning: 4.3e15 cm^{-2}

Afternoon: 4.8e15 cm^{-2}

AMAXDOAS O_3: GOME and Groundbased Comparisons



Falcon Flight Track 04.09.2002



Ground Based: →

Kiruna, 67°N, (06.09.):

Morning: 264 DU

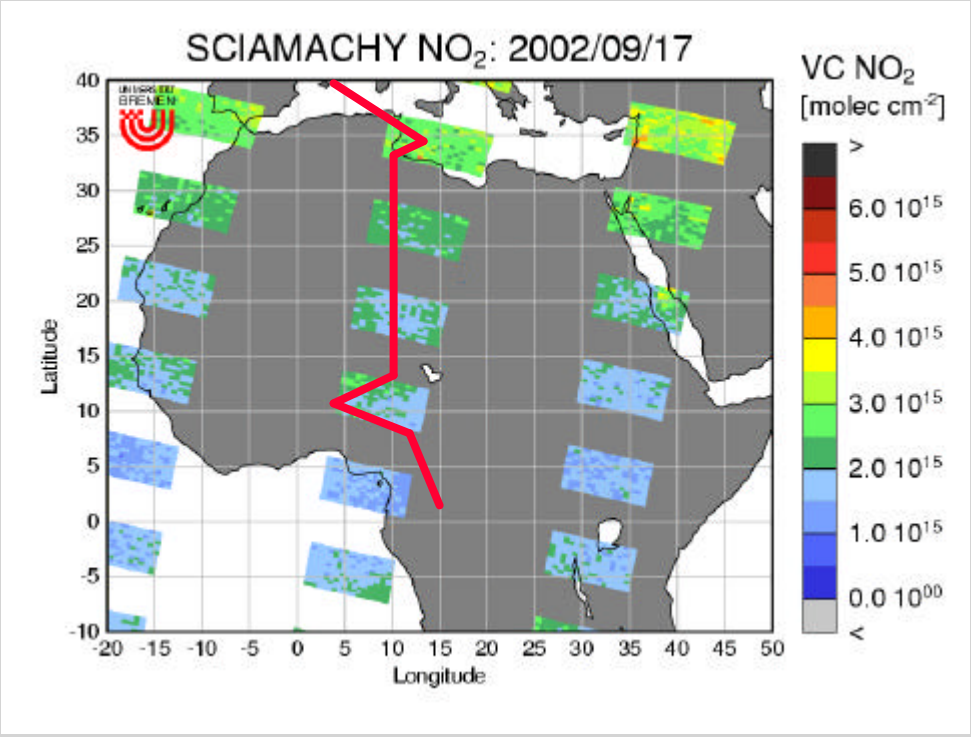
Afternoon: 271 DU

Ny-Ålesund, 79°N,

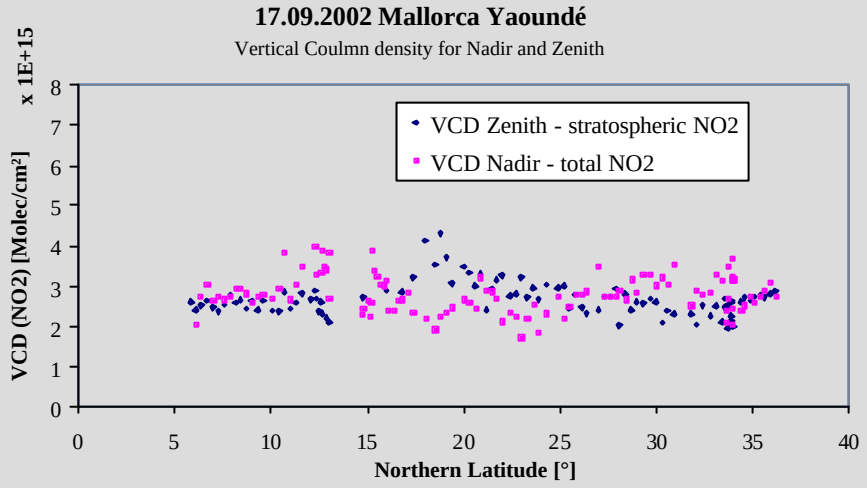
Morning: 305 DU

Afternoon: 305 DU

Vertical NO_2 Columns 17th Sep. 2002 - SCIAMACHY comparison

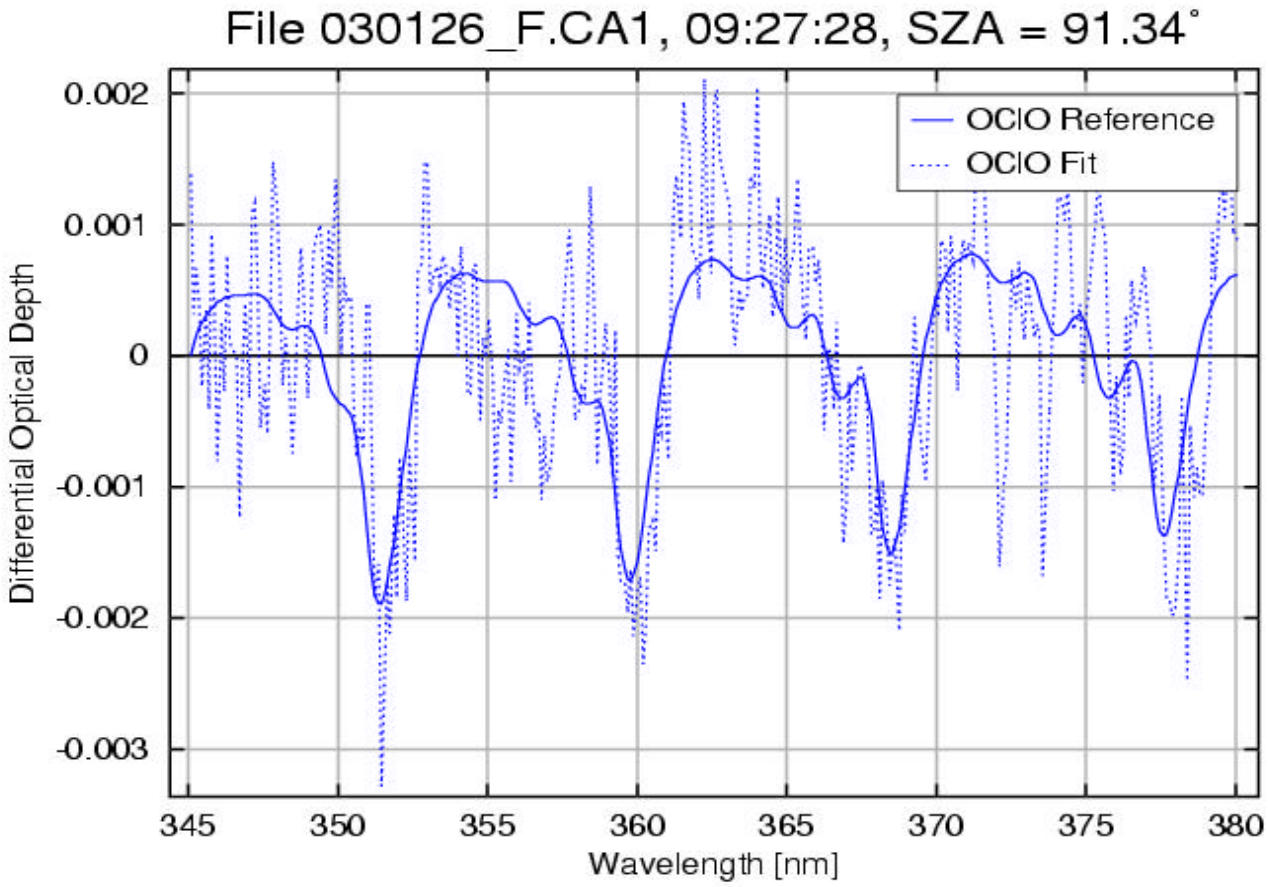


Falcon flight track on 17th Sep



Mean value Nadir: 2.8 * 10^{15} Molec/cm²
mean value Zenith: 2.6*10^{15}Molec/cm²
Almost no tropospheric NO_2

OClO measured during EUPLEX campaign – 26.01.2003

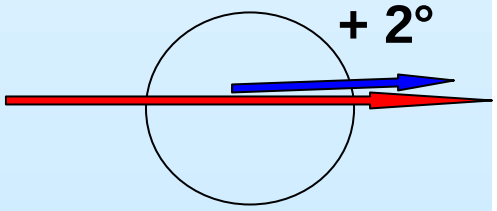


a **nice** OClO fit

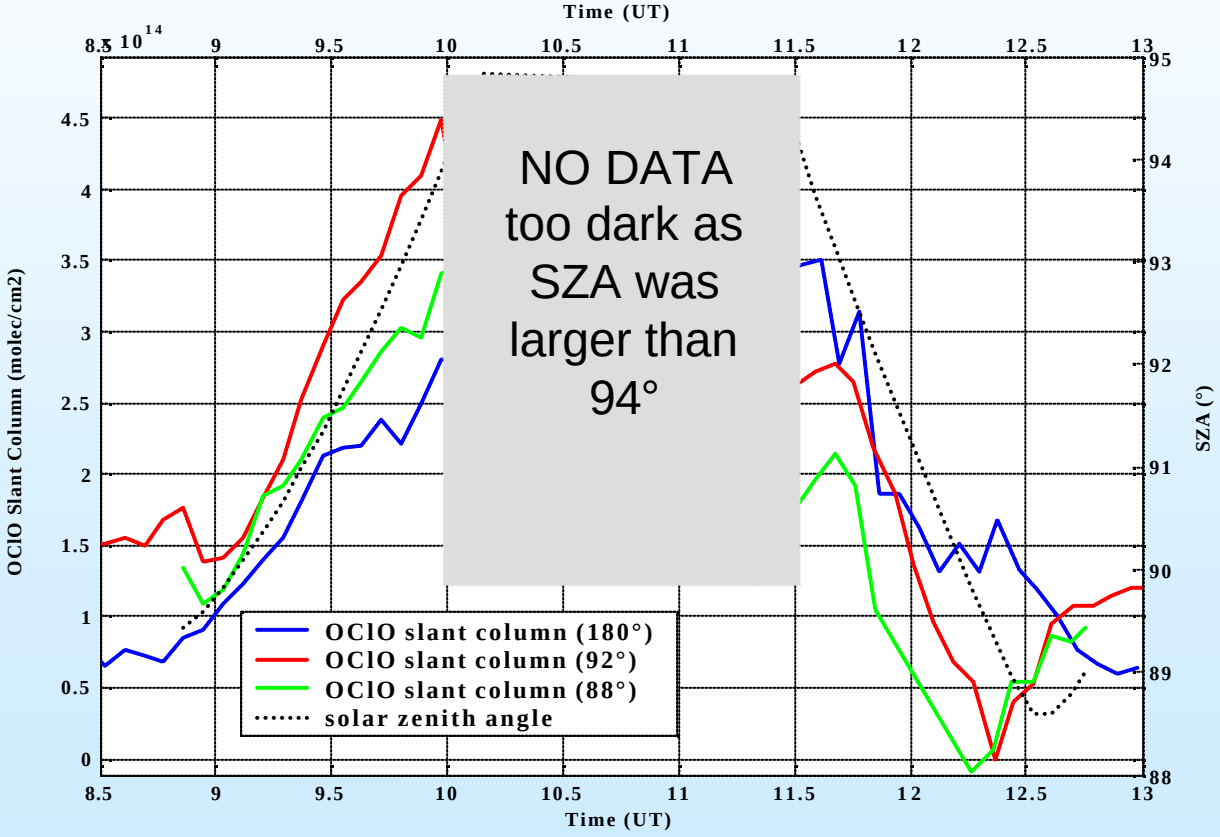
background spectra

SZA = 89.6°

Viewing angle: + 2° elevation

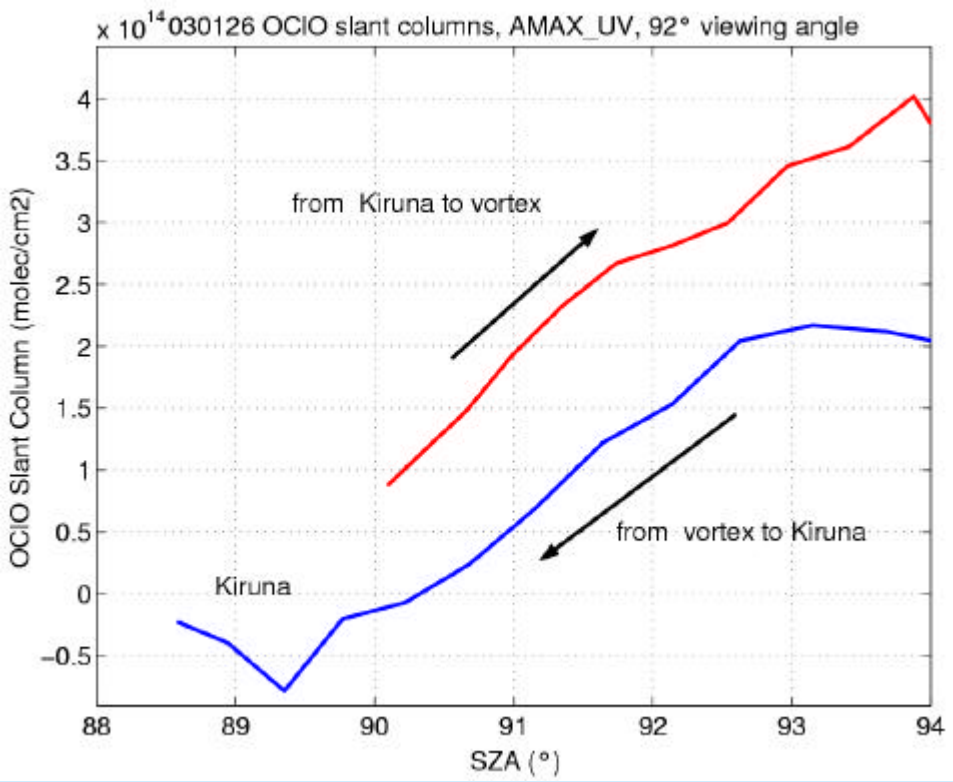


OClO slant column 030126



- OClO slant columns increase with solar zenith angle
- On return flight OClO slant columns smaller than during first part of flight
- Flying north:
  OClO SC zenith >
  OClO SC +/- 2° elevation
- Flying south:
  OClO SC +/- 2° elevation >
  OClO SC zenith

OClO slant column +2°elevation

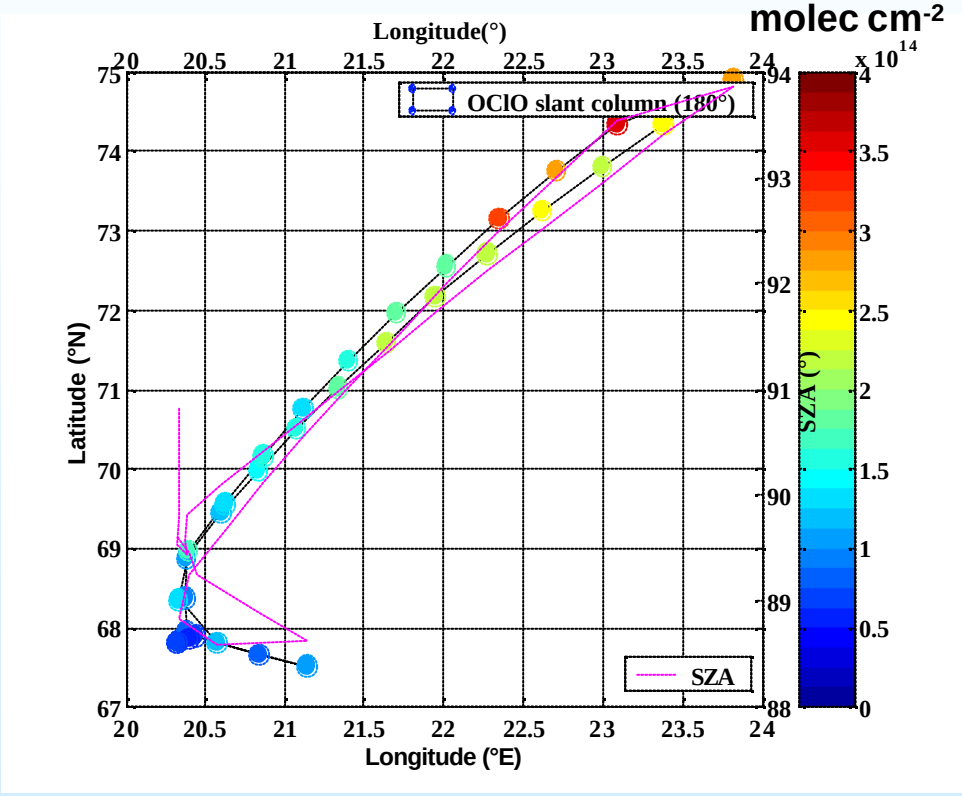


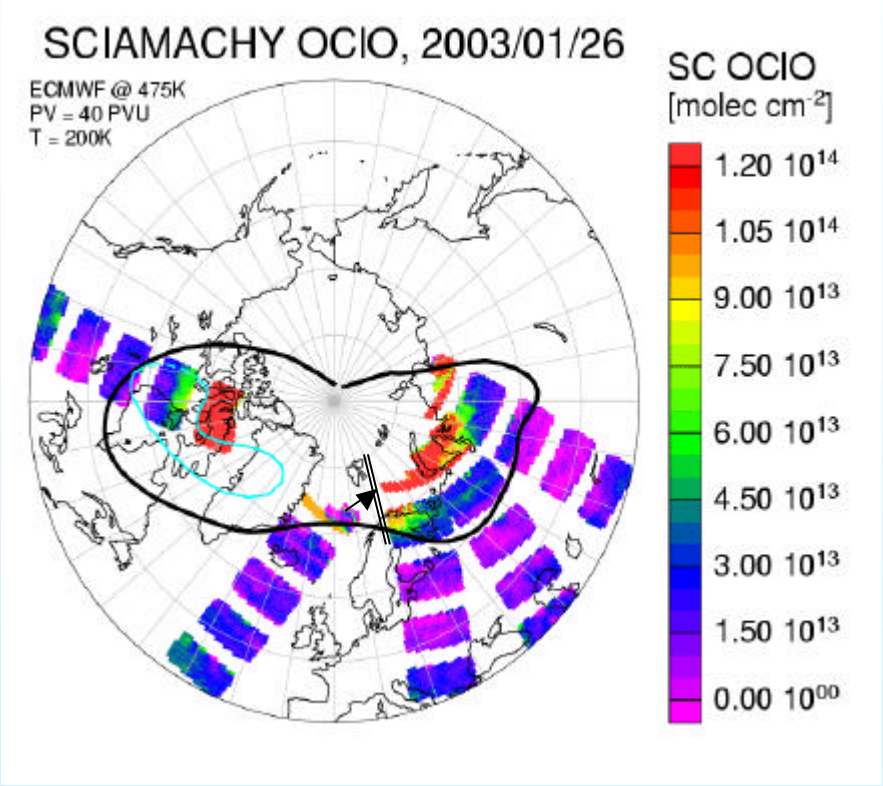
Return flight OClO slant columns smaller than during first part of the flight?

Possible reasons:

- **Different solar zenith angle**
- **Different solar azimuth**
- **OClO photolysis**
- **Go into / leave vortex**

OClO slant column AMAXDOAS - SCIAMACHY



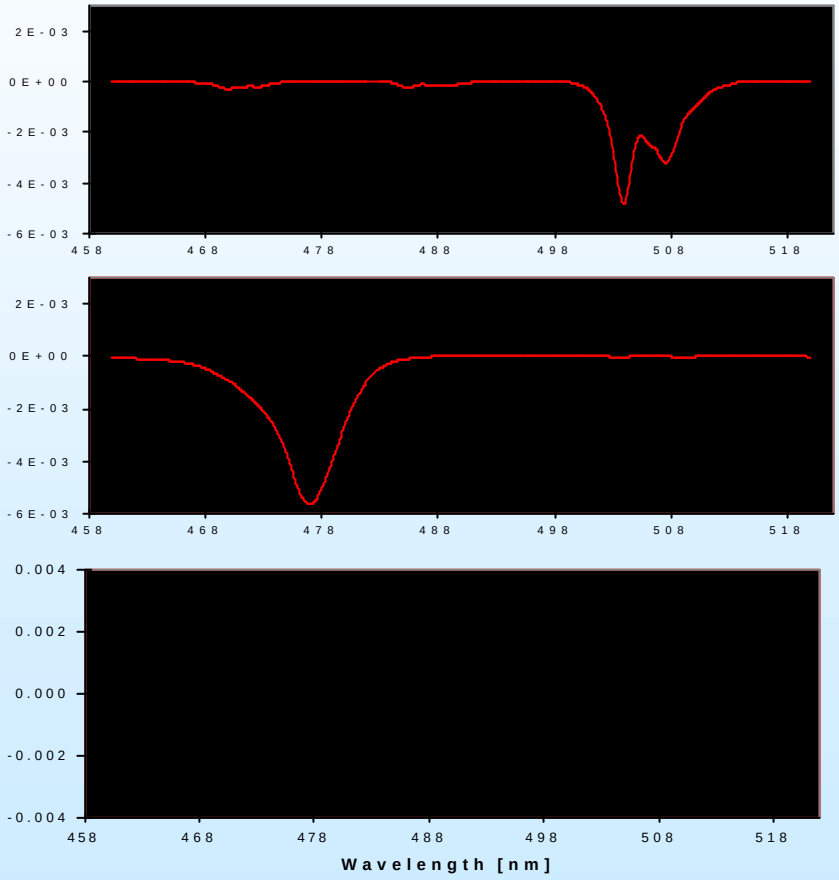


SZA: 90°, 70°N, 21.8°E,
OClO SC: 1.2~1.4 ? 10^{14} molec cm^{-2}

SZA: 90°, 71.5°N,
OClO SC: 1.2 ? 10^{14} molec cm^{-2}

H_2O and O_4 variations caused by clouds

DOAS fitting result for a spectrum from the zenith viewing direction (6:24 UTC). The laboratory spectra of H_2O and O_4 (thick lines) are scaled to the absorptions found in the AMAXDOAS measurement.



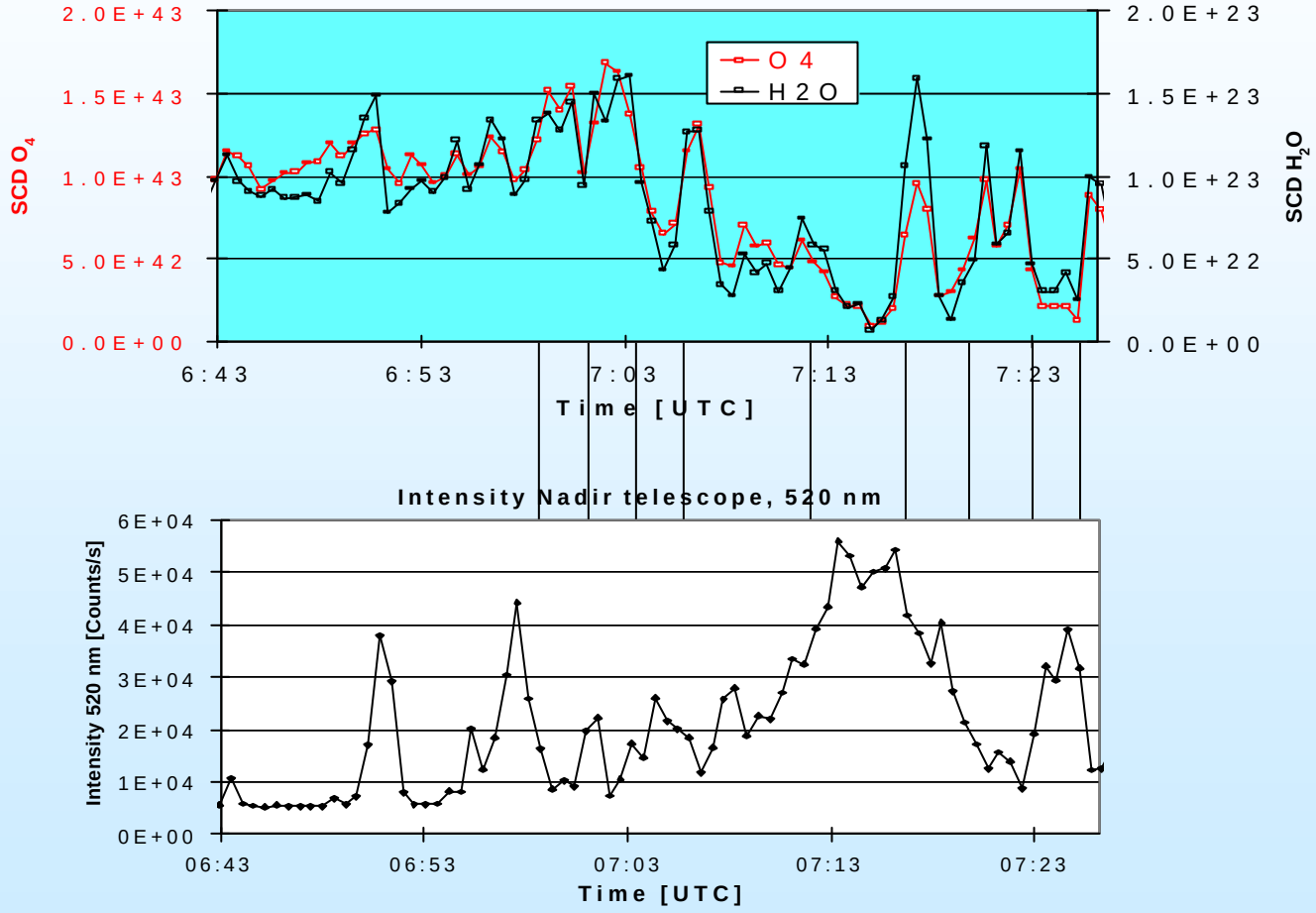
Cloud influence on tropospheric trace gases

High intensities indicate clouds below the aircraft and the tropospheric trace gases are shielded

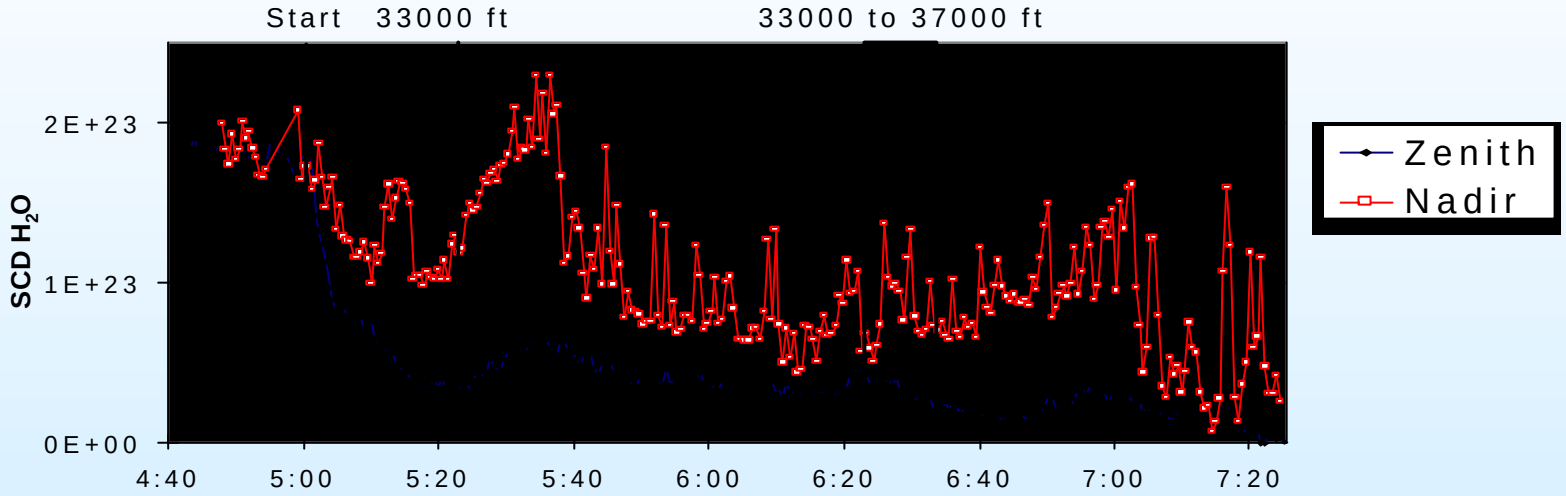
(yellow areas)

Low intensities indicate clear sky and the trace gas absorptions are high

(blue areas)



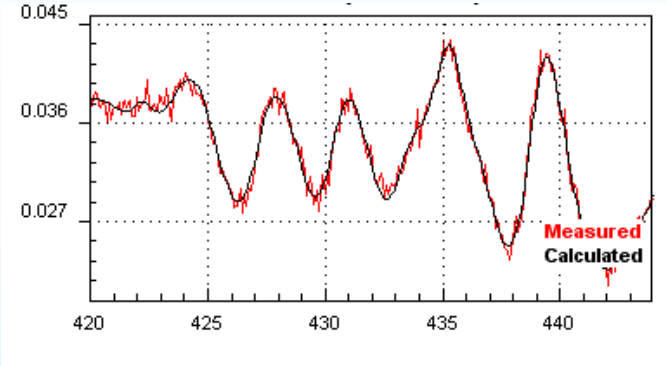
AMAX-GOME Comparison for H_2O

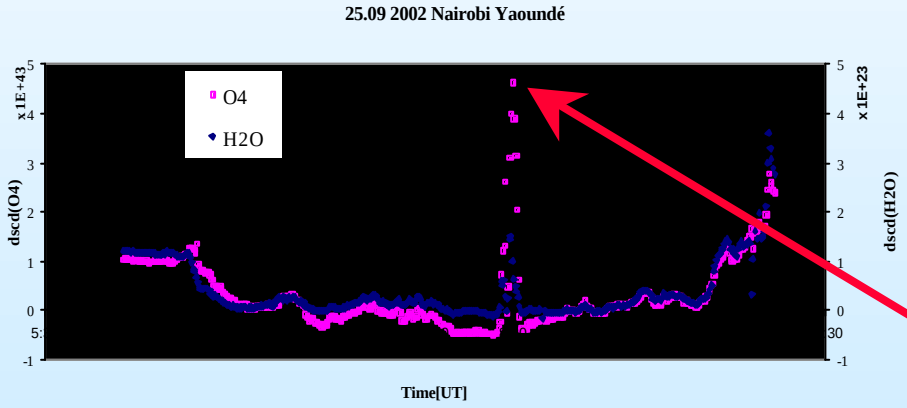


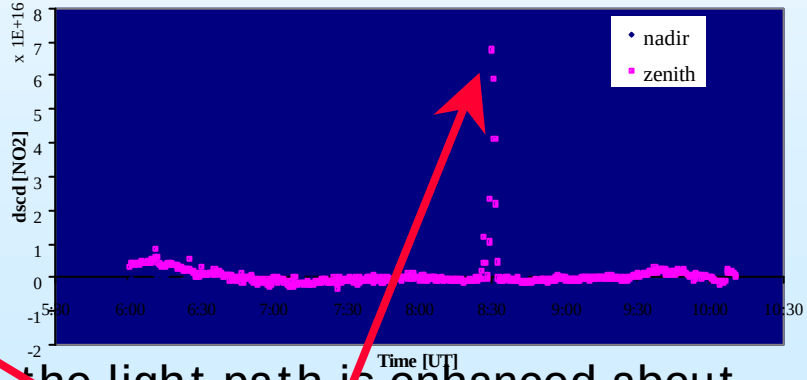
H_2O SCDs measured by GOME over the flight track over the ocean (from 44° to 49° longitude) at 7:19 UTC are between 1 ? 10^{23} molec/cm² and 1.4 ? 10^{23} molec/cm², which is in good agreement with the nadir H_2O SCDs measured by AMAXDOAS in the same area.

Inside a large cloud

Log book at 8:13: “between two thick layers of clouds”
at 8:26: “turbulent air” - “inside a cloud”







Due to multiple scattering inside the clouds the light path is enhanced about 100km, therefore the absorption for all absorbers O_4, H_2O,NO_2 increased in all viewing directions.

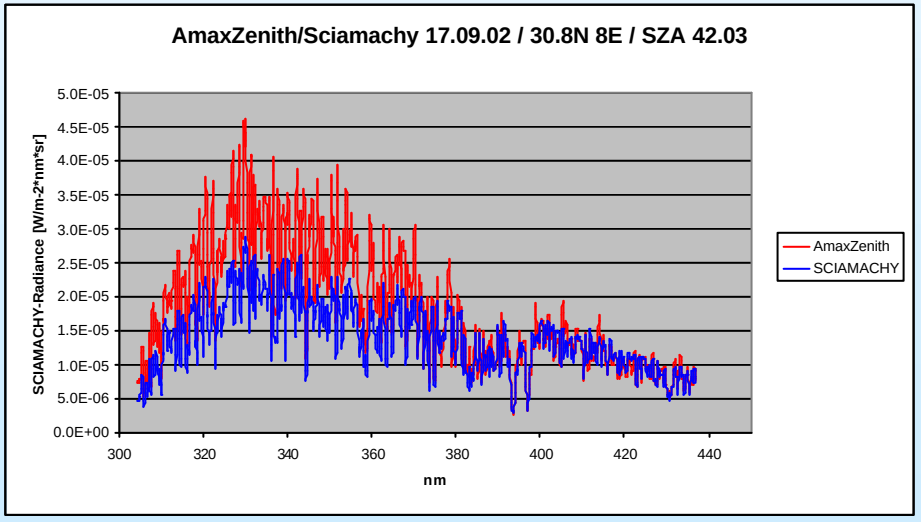
Radiometric Validation

Concept:

- Radiometric calibration of AMAXDOAS on campaigns
- Use of radiative transfer model (SCIATRAN) to calculate top of atmosphere radiance

First Results:

- Good Agreement in the interval between 380nm and 440 nm
- Larger deviations in the UV, due to aerosol load?



Conclusions and outlook

- The vertical NO_2 column densities are in fair agreement with those from GOME and SCIAMACHY data
- During the EUPLEX campaign, the AMAXDOAS detected enhanced OClO columns, in good agreement with SCIA
- The influence of clouds and spatial variability (strength of airborne instruments) has to studied in more detail
- The absolute calibration of SCIAMACHI is in fair agreement with the calibrated AMAXDOAS
- There are still some data not analysed by now, which might show some more interesting effects