

# Airborne measurements of the vertical distribution of several trace gases during the POLARCAT spring 2008 campaign - Preliminary results



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## 1. Context

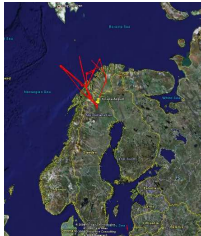


Fig. 1. Flight tracks during the POLARCAT-CNRS campaign in Kiruna

The CNRS-spring campaign took place in Kiruna, Sweden, between March the 27th and April the 14th of 2008. It was dedicated to microphysics and satellite validation. The ATR-42 from SAFIRE performed 12 flights above the Norway Sea from Kiruna and Enna airport.



## 2. Scientific objective

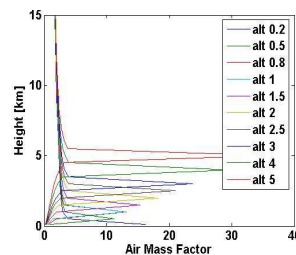


Fig. 2. Air mass factor simulations for BrO at 352 nm in the limb geometry

BIRA-IASB participated to this campaign with a new instrument, namely the Airborne Limb Scattering Differential Optical Absorption Spectrometer (ALS-DOAS). Our objective is to retrieve vertical distributions of several trace gases playing a key-role in the troposphere, N<sub>2</sub>O, O<sub>3</sub>, H<sub>2</sub>CO and BrO.

Simulations with a radiative transfer model, UV-SPEC/DISORT were performed for both BrO and NO<sub>2</sub> and shows that limb geometry is well suited to retrieve profile of small absorbers like BrO thanks to large air mass factors.

## 3. The Airborne Limb Scattering DOAS (ALS-DOAS)

Wavelength range : 332-450 nm  
Spectral resolution: 0.4 to 0.6 nm  
Field of View : 1.2°  
Scanning from +5° to -5° around the horizontal of the plane with a stepper motor and a JDT card

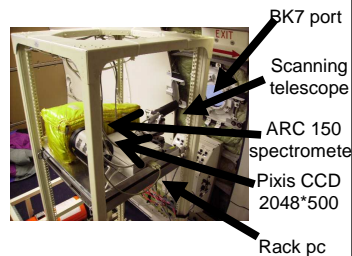


Fig 3. The ALS-DOAS onboard the ATR-42

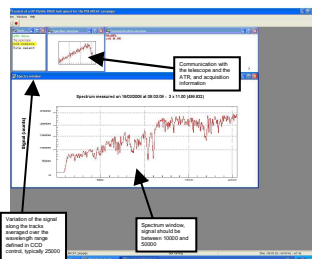


Fig. 4. The acquisition software interface

The acquisition software controls the telescope and the CCD, calculating the integration time and saving the spectra. Based on the programme of previous instruments from our group, the program is very stable and thus can run automatically once started. An operator is practically not needed during the flight for the ALS-DOAS.

## 4. Data Analysis, preliminary results(a)

The major steps of the data processing are:

1. Retrieval of the slant columns of the different species compared to a reference spectra (DOAS method)
2. Optimization of the forward model settings using O<sub>4</sub> (known profile). Change in light intensity during the sounding and aerosols taken into account.

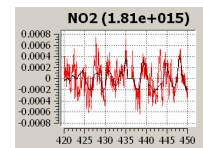


Fig 5. DOAS fit of the NO<sub>2</sub>

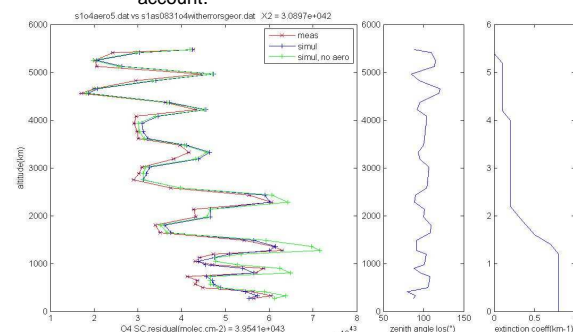


Fig 6. Effect of line of sight direction and aerosols on the observed O<sub>4</sub> slant column

## 4. Data Analysis, preliminary results(b)

### 3. Profile inversion for the different species with an external input for the stratospheric contribution

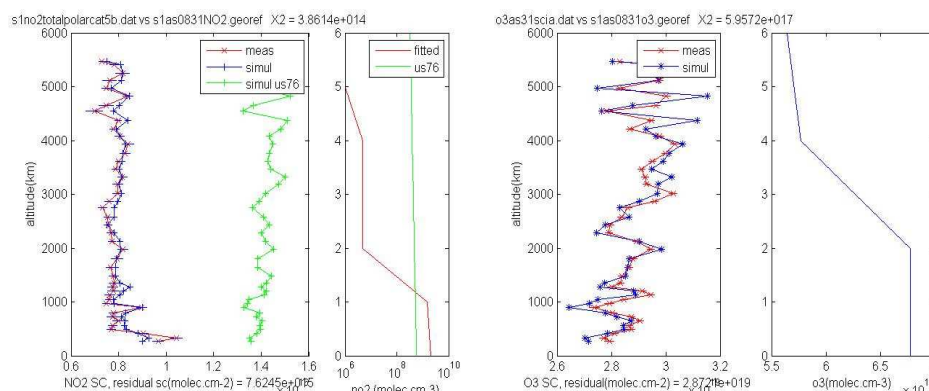


Fig 7. Preliminary results of NO<sub>2</sub> and O<sub>3</sub> profiles during sounding 1 in flight as0831. OMI and SCIAMACHY data were used to assume the stratospheric columns

## 5. Future work

1. Optimize inversion method for the NO<sub>2</sub> and Ozone
2. Check the possibility to retrieve information on BrO and H<sub>2</sub>CO
3. Error analysis
4. Validation

## Acknowledgements

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