

MINI-DOAS

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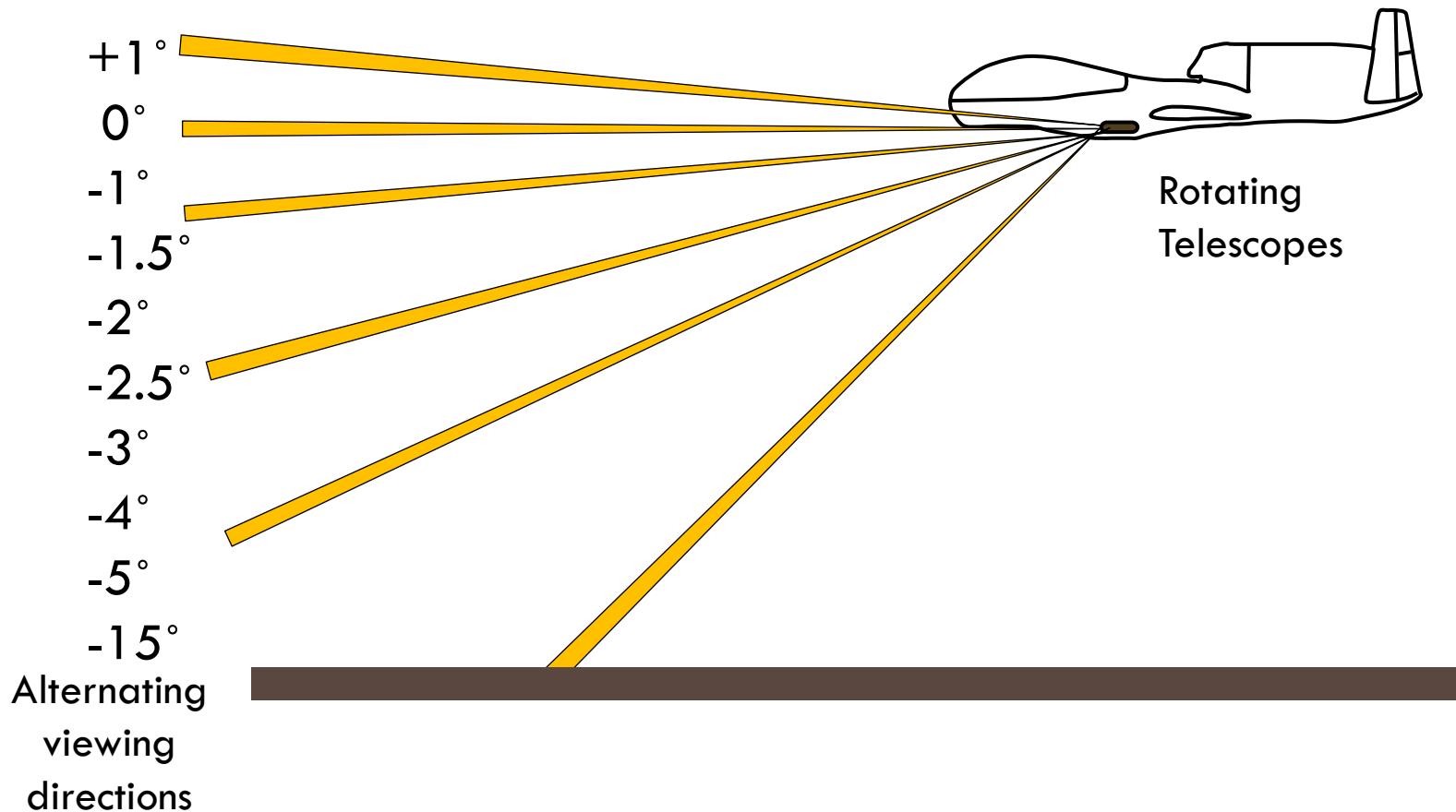


University of California Los Angeles

What is Mini-DOAS ?

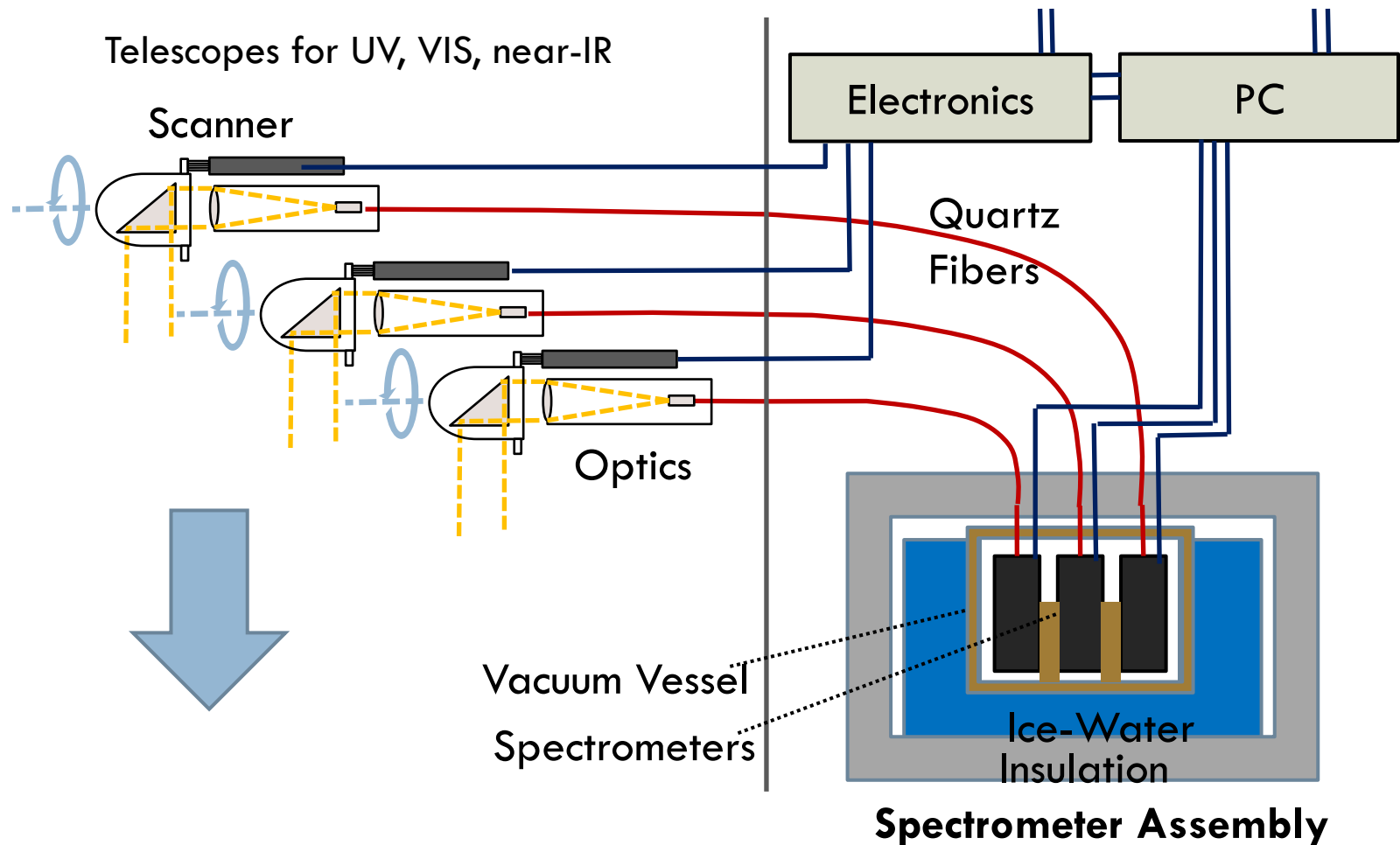
- Identify and quantify trace gases using their narrow band absorptions.
- Airborne remote sensing
- Slant Column Density (SCD)

$$SCD = \int_0^s c(s) ds$$

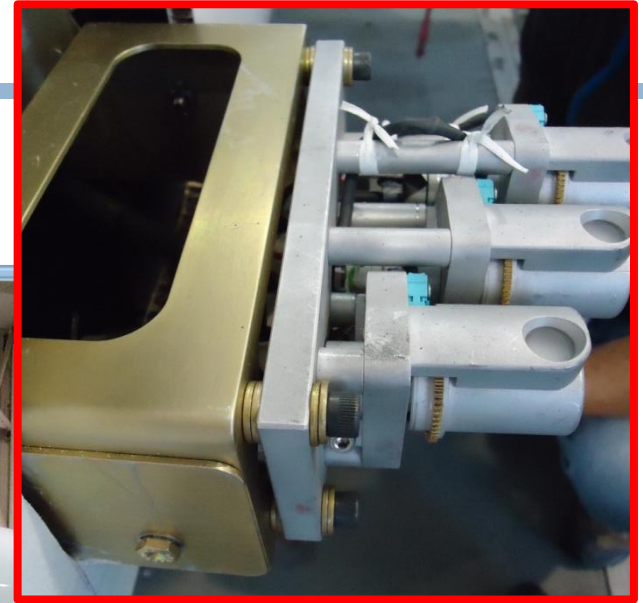
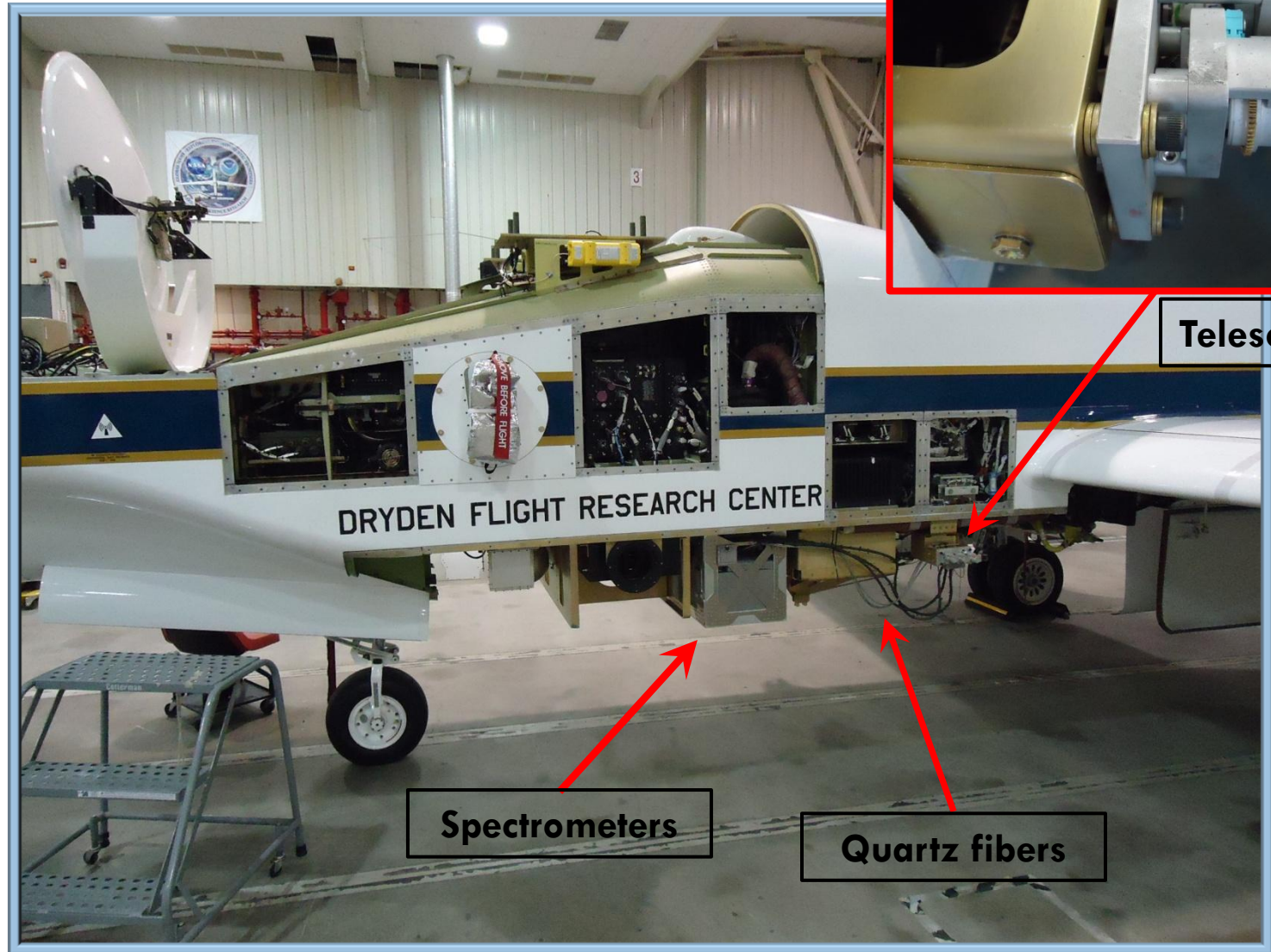


How does Mini-DOAS work?

- Power consumption: 29VDC at 1.4A = 41W
- Size and Weight: 11.8x9.84x8.0 inches; 75pounds including 9L ice-water



... on NASA's Global Hawk



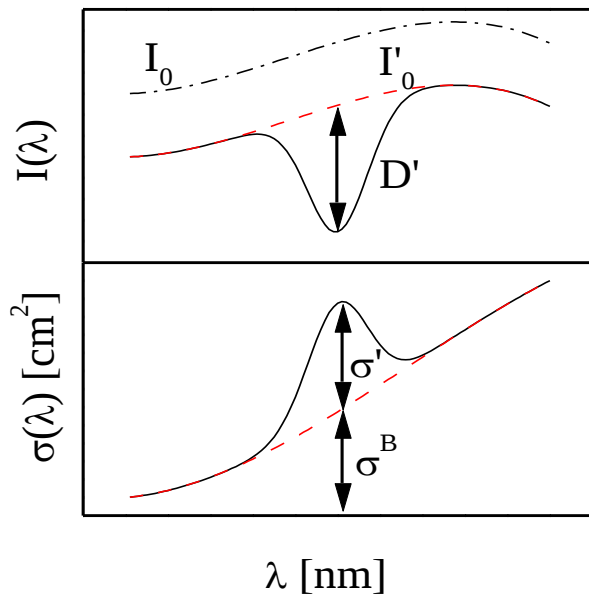
Telescopes

Spectrometers

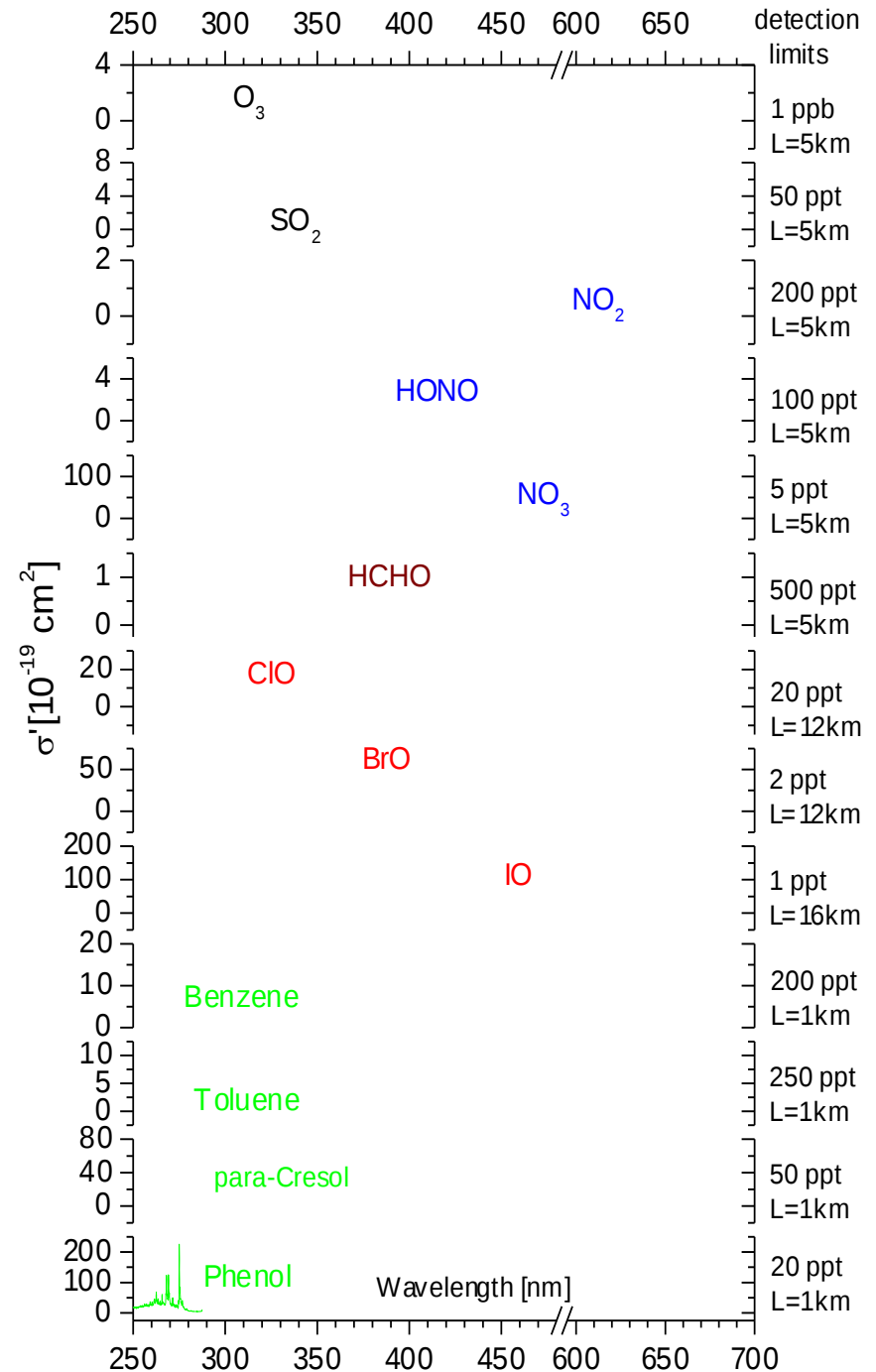
Quartz fibers

DOAS

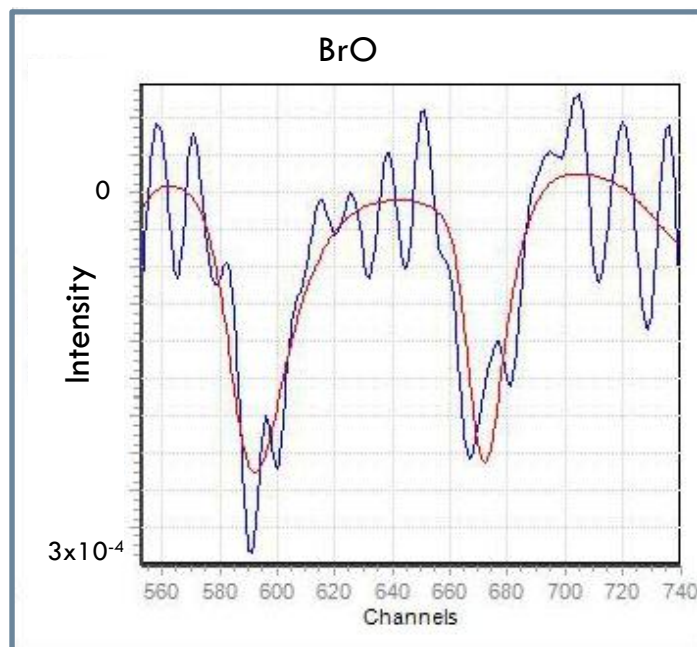
Differential Optical Absorption Spectroscopy



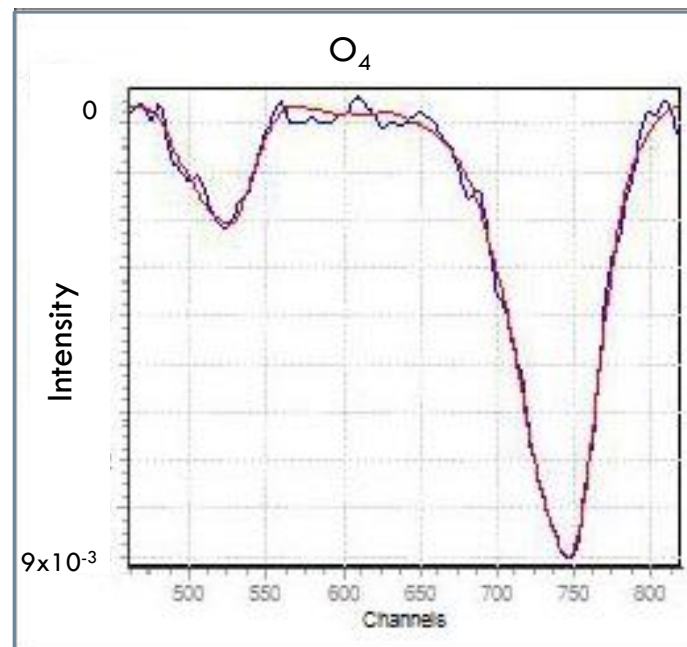
Identification and quantification of trace gases by their unique narrow band absorption in the open atmosphere



BrO and O₄ data analysis



BrO fit range: 345 – 360nm

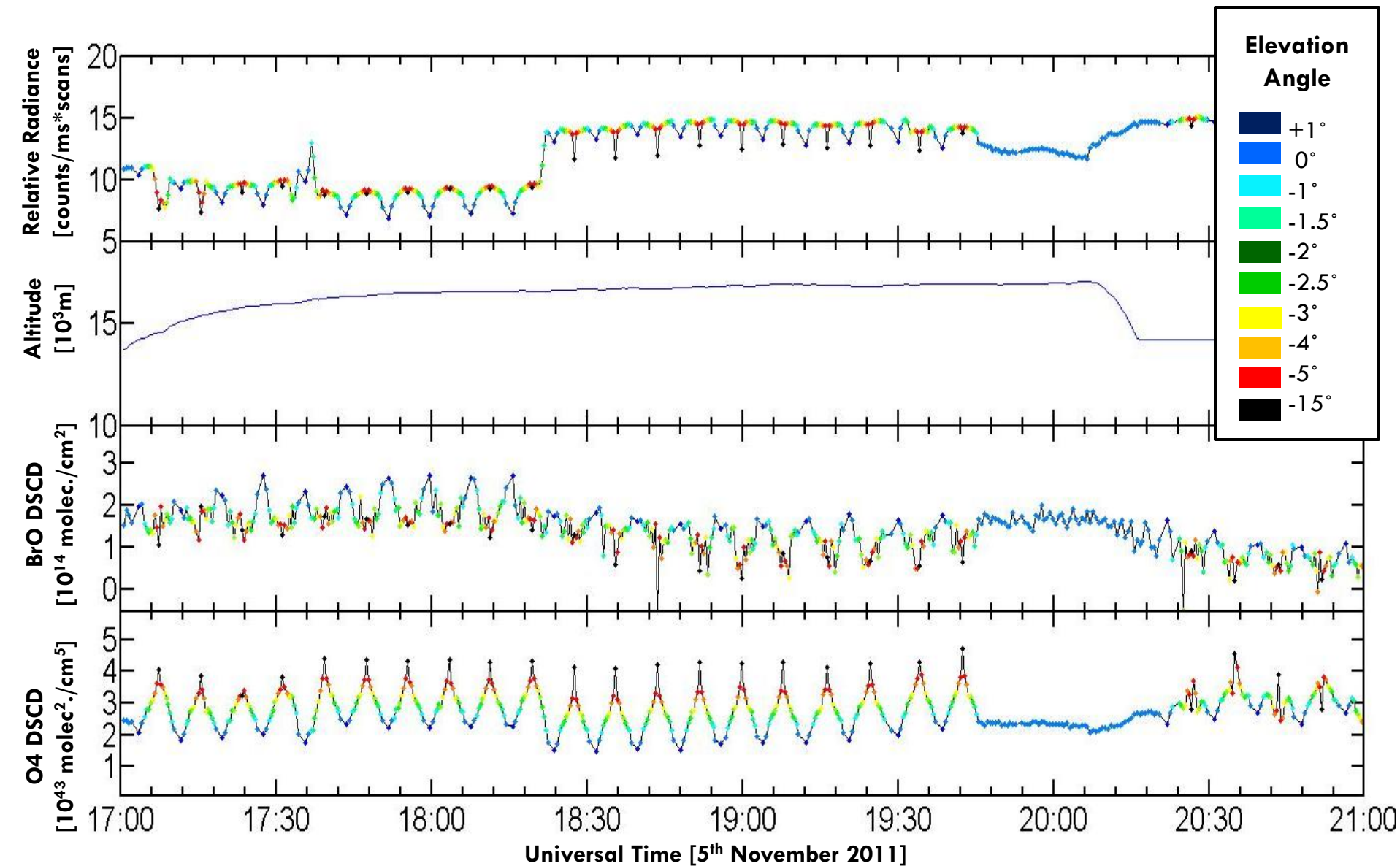


O₄ fit range: 338-347nm 352-360nm

Species to be measured & DL:

NO ₂	50 ppt
HONO	20 ppt
BrO	0.75 ppt
HCHO	150 ppt
SO ₂	200 ppt
glyoxal:	?
aerosol extinction (via O ₄)	

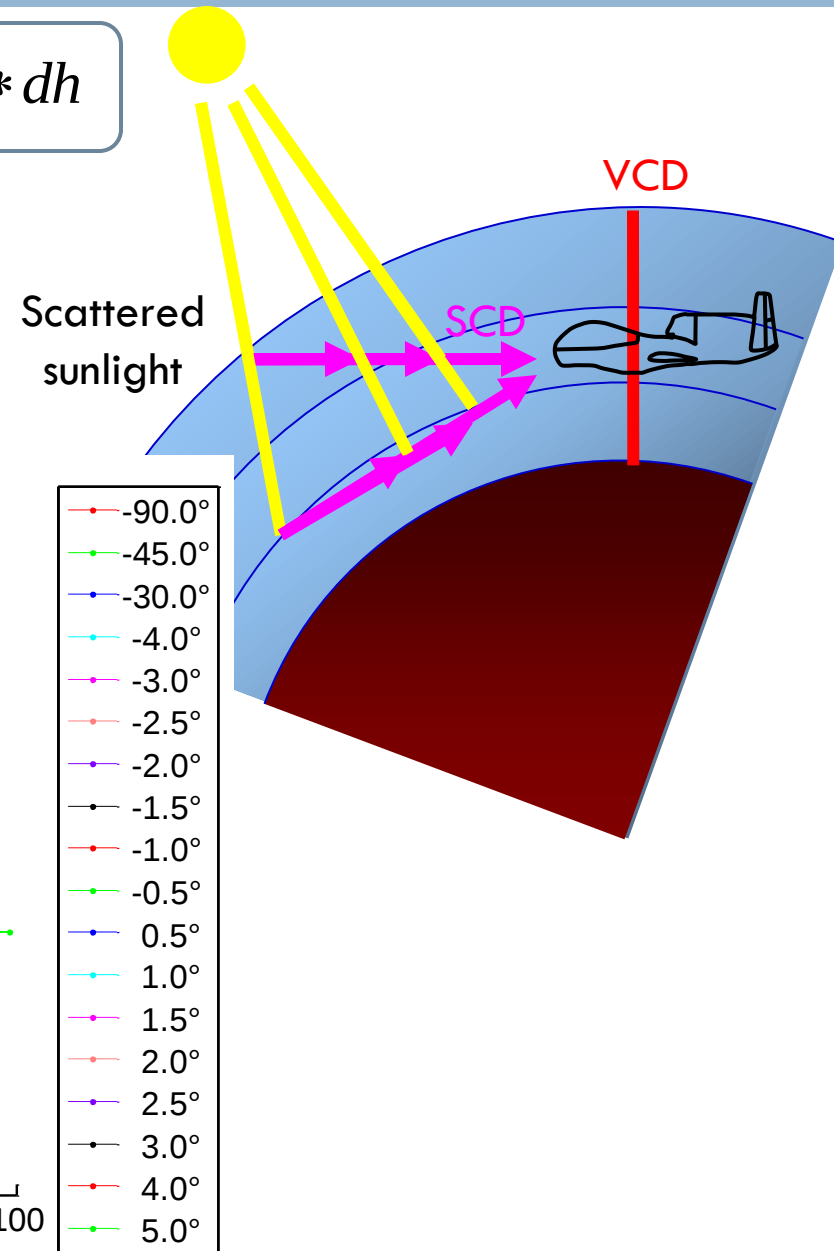
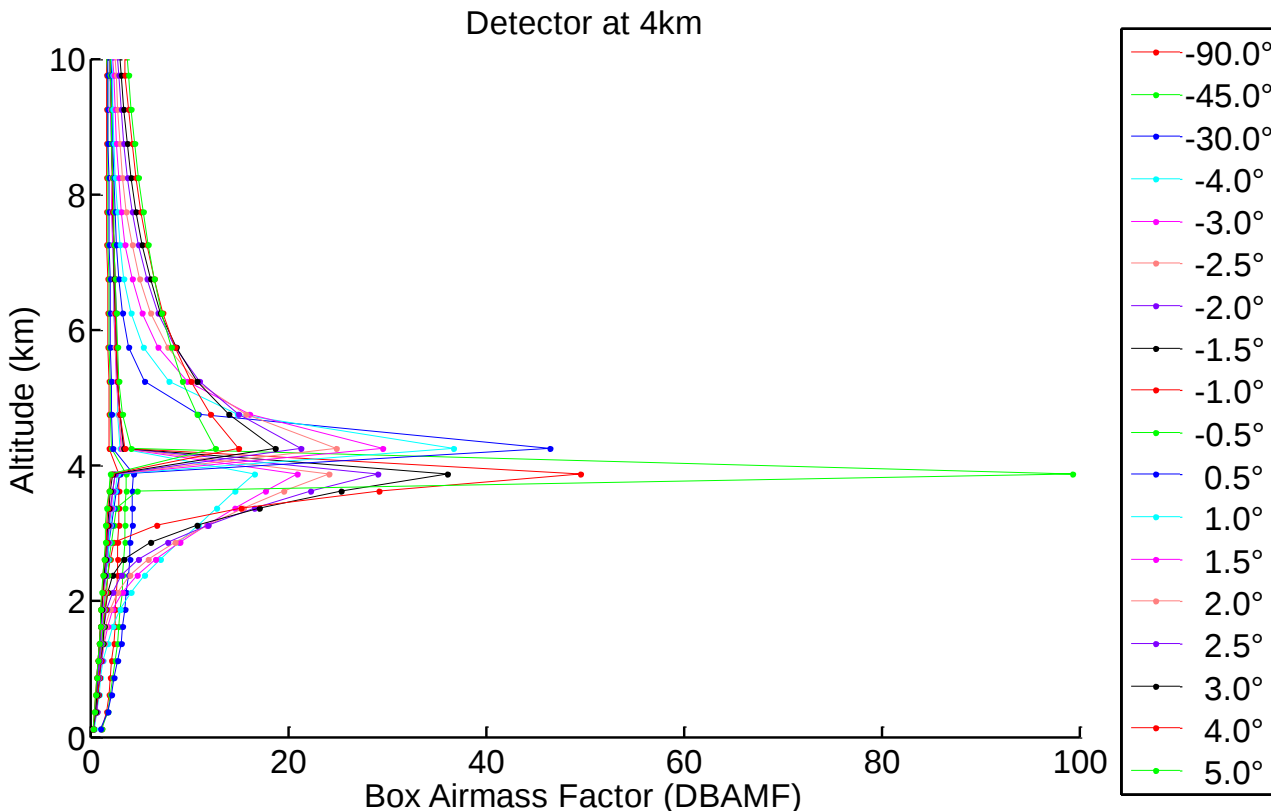
ATTREX Data Example



From SCDs to trace gas concentration

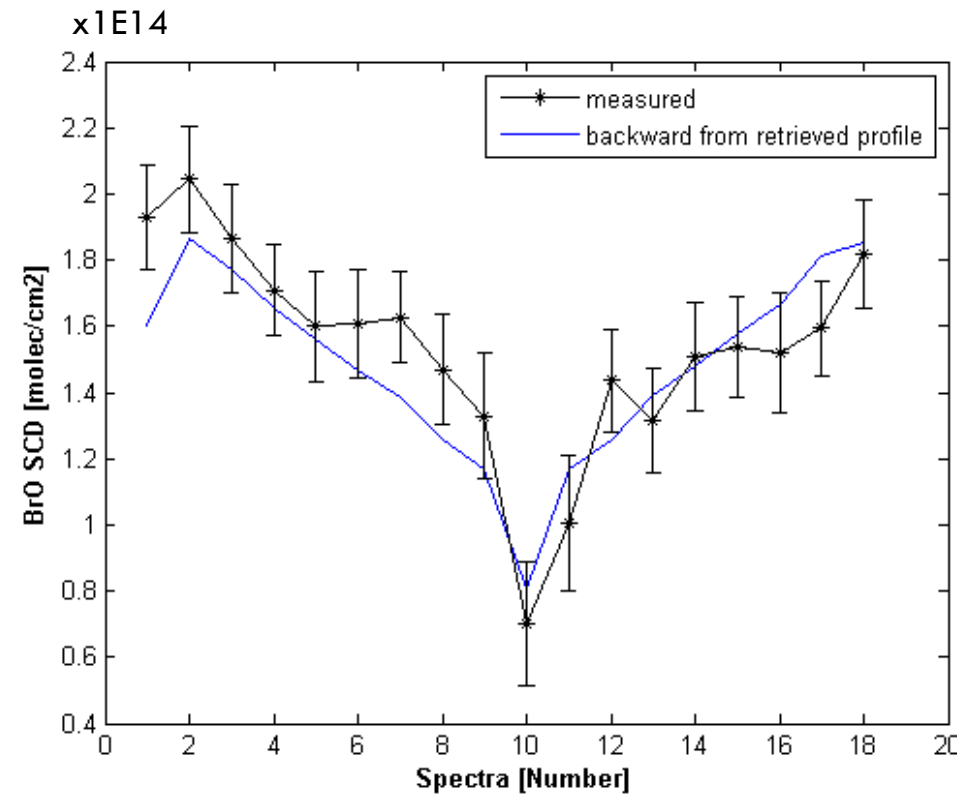
$$SCD(El.Ang.) = \sum BAMF(El.Ang.) * c(h) * dh$$

- BAMFs derived via radiative transfer calculations
- Optimal Estimation Inversion to derive concentration profile $c(h)$

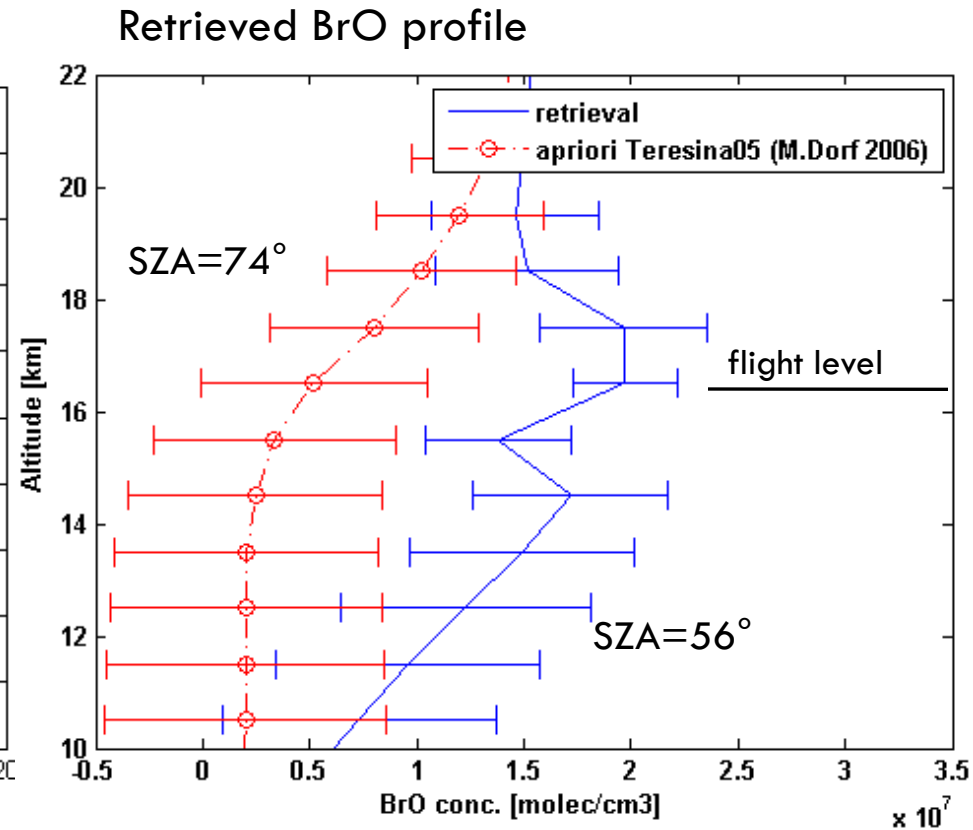


BrO vertical concentration profile retrieval

Science flight 2 on 11/05, 18:00 UTC



Modeled SCDs fit well



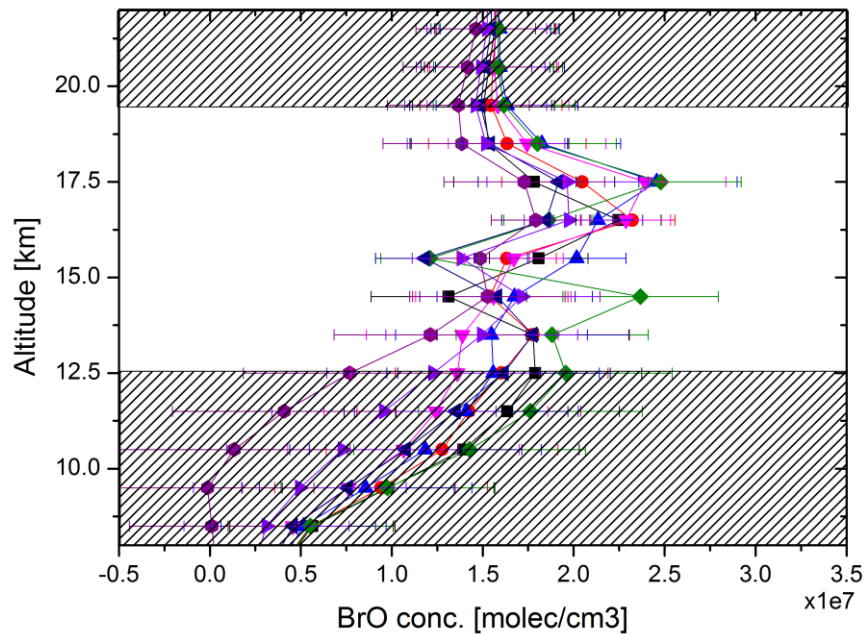
BrO at flight altitude:

$$\begin{aligned} &\sim (1.8 \pm 0.25) \times 10^7 \text{ molec/cm}^3 \\ &= (5.0 \pm 0.75) \text{ ppt} \end{aligned}$$

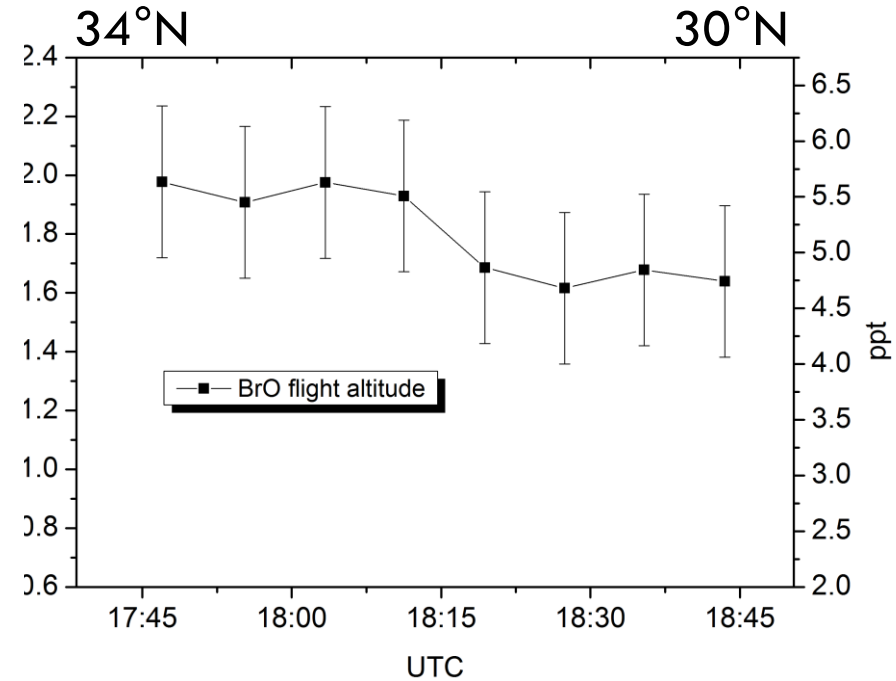
BrO vertical profiles

Science flight 2 on 11/05

Consecutively retrieved BrO profiles



BrO at flight altitude



Questions / Issues

- Telescope fairing (pressure seal).
 - ▣ Calibration of telescope geometry after installation
- Meeting NSF specs for instrument
 - ▣ Instrument has undergone environmental testing at NASA
- Fast information on pitch, roll, acceleration ?
 - ▣ Addition of sensor to instrument of from aircraft?
- Data archive on C130 server (~5000 spectra each 10kbyte)?
- Change of measurement strategy depending on flight status
 - ▣ Profiling through elevation scanning vs limb during ascent/decent