Argus CO and CH4 measurements in October 2004 and June 2005 AVE

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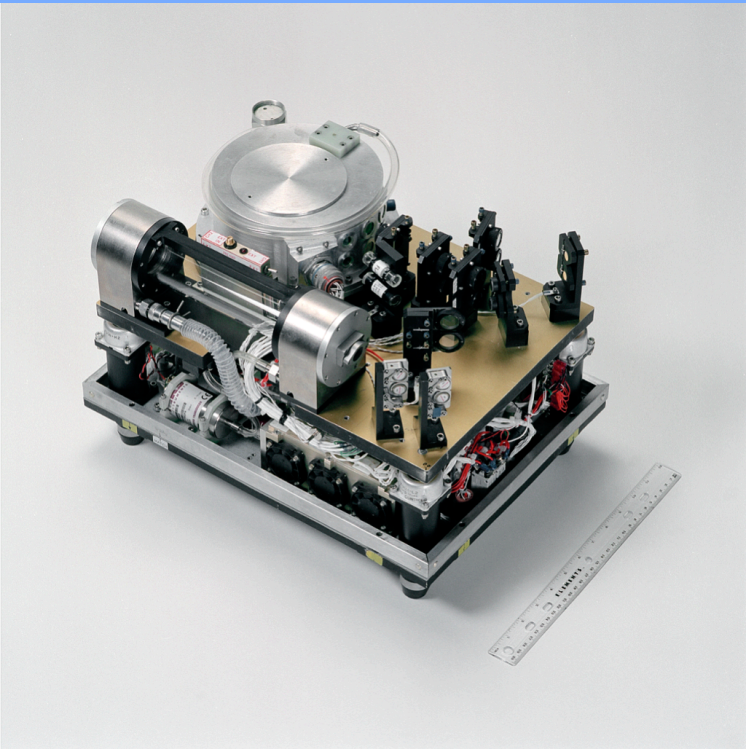
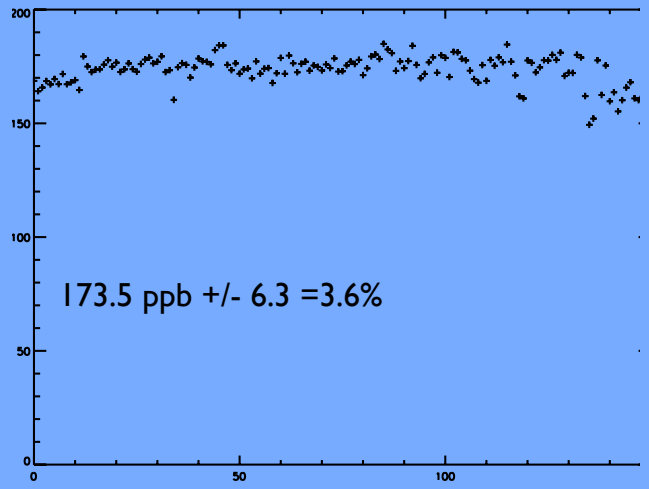
Argus



- small (40 cm x 30 cm x 30 cm), lightweight (21 kg) dual channel, fully automated instrument
- Tunable diode laser absorption spectroscopy in second harmonic mode
- Has been configured to measure CO, CH4 and N2O from 1 km to stratospheric altitudes
- Cold filters installed to isolate channels from each other
- Both lab and in-flight calibrations

In flight Calibration



- Completely re-designed in flight calibration system deployed for the first time in AVE-0506
- Pump integrated inside calibration system box allowing analysis of data below 900 mbar
- Calibrations tied to CMDL scale for CH4 and CO
- Frequency and duration of in-flight calibration adjustable

Performance Quality

Tracer	P(mb)/ Alt(km)	Data Rate (Hz)	Precision (ppb)	Accuracy (%) 1-sigma
CO	268/10 77/18	0.5 0.5	1.0 1.3	3 3
CH4	268/10 77/18	0.5 0.5	9.8 9.8	1.5 1.5
N2O (estimated)	268/10 77/18	0.5 0.5	3.0 3.9	

Accuracy and Precision in-flight versus laboratory calibrations are similar with in-flight calibrations being slightly worse

Argus Heritage

Airborne Campaigns	OMS Balloon Campaigns
SOLVE 2000	Fort Sumner, NM 1998, 2002, 2004
CRYSTAL-FACE 2002	Fairbanks, AK 1996
pre-AVE 2004	Brazil 1997
AVE 10-04 2004	
AVE 06-05 2005	

Problems and Progress

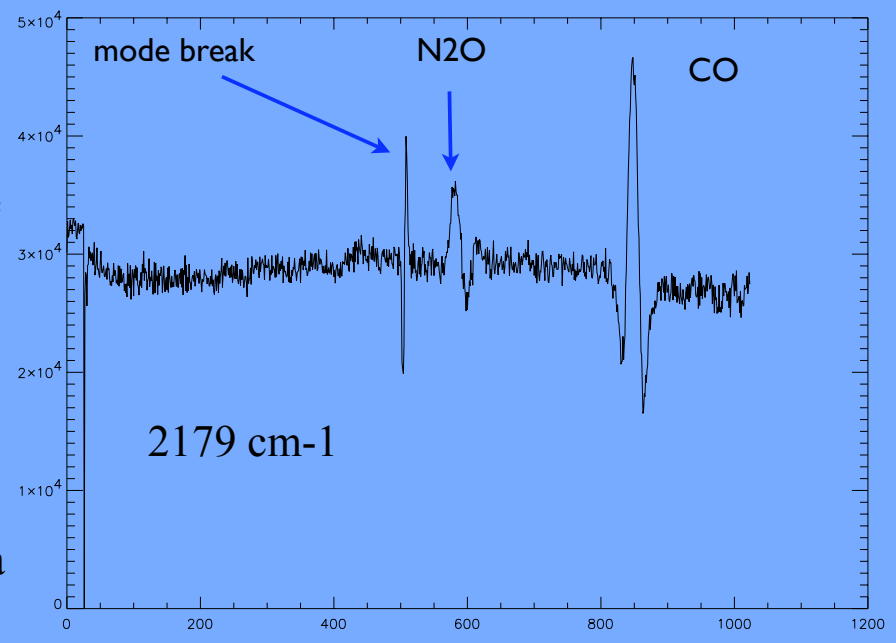
(during AVE 06-05)

Challenge

- Attempted to measure CO (R9) and N_2O (P45) simultaneously with one laser

Solution

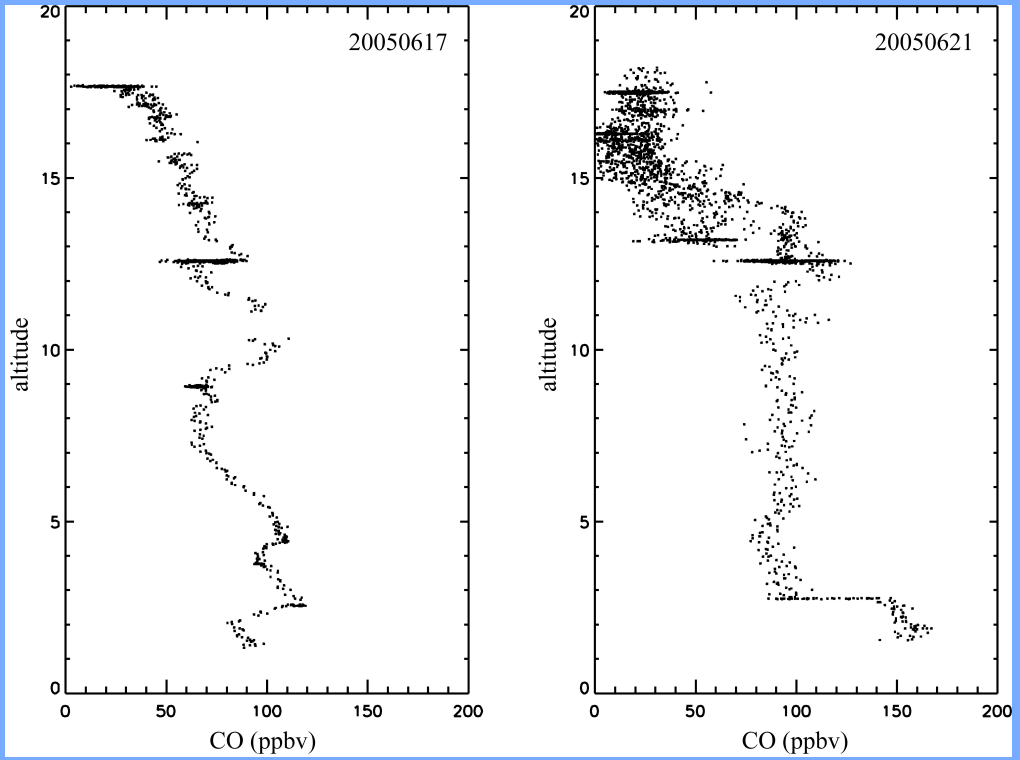
- New lasers! $8000/ea



Problems and Progress

(during AVE 06-05)

- Baseline noise of CO higher than previous campaigns
- Loss of laser power in CO/ N2O channel during portions of flights
- Full power upon return to lab



Problems and Progress

(during AVE 06-05)

Troubleshooting in the field

- Thermal shifts/thermal disequilibrium
- Optical Alignment

Problems and Progress

(during AVE 06-05)

Troubleshooting in the laboratory post-mission

- Complete and careful re-alignment of the optics
- Replacement of critical mirrors
- Inspection of table heaters - temperature control
- Removal of cold filters
- Herriott cell inspection

Problems and Progress

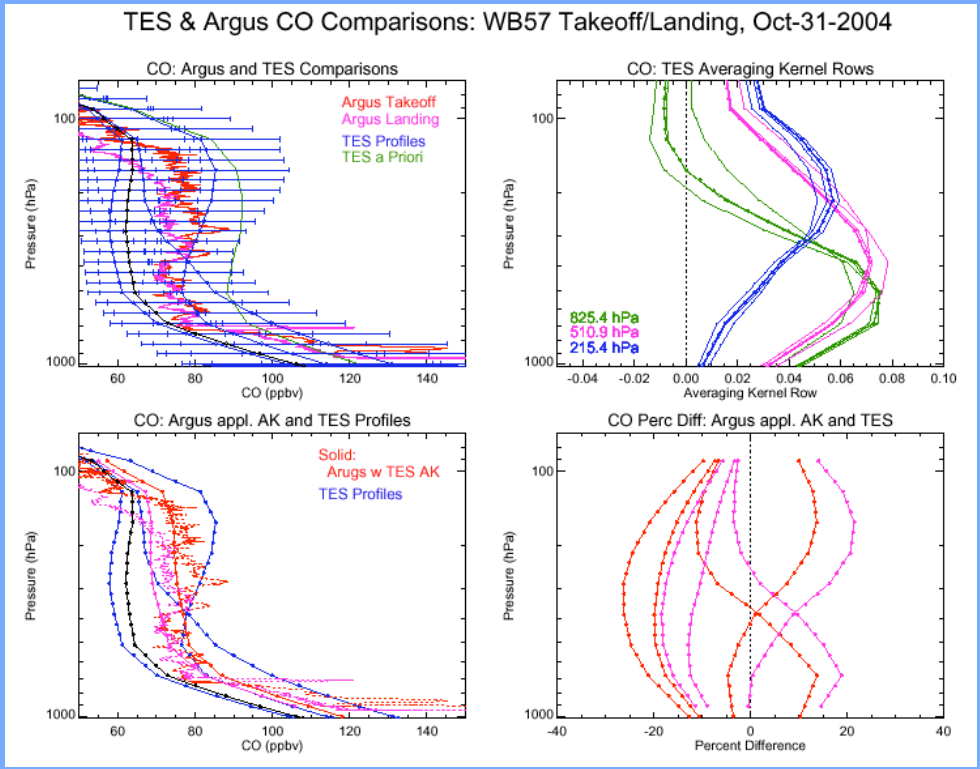
(during AVE 06-05)

Future studies

- AVIRIS flight series at NASA Ames Research Center-September 2005
- Replacement/cleaning of all optics
- Re-installation of cold filters
- Replacement of Herriott cell mirrors and mounts ($$$)
- New laser to properly measure CO and N2O simultaneously ($$$)

Status of Data

CO

- Investigating co-adding of spectra to recover data during low-power portions of flights during AVE-0506
- Recalibration of standards necessary
- Data will be re-archived upon re-analysis

Please see Ming Luo's talk Thursday 08:40 am, Room 2