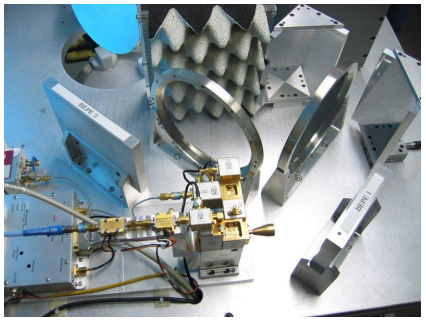
Groundbased Microwave Activities in Bern



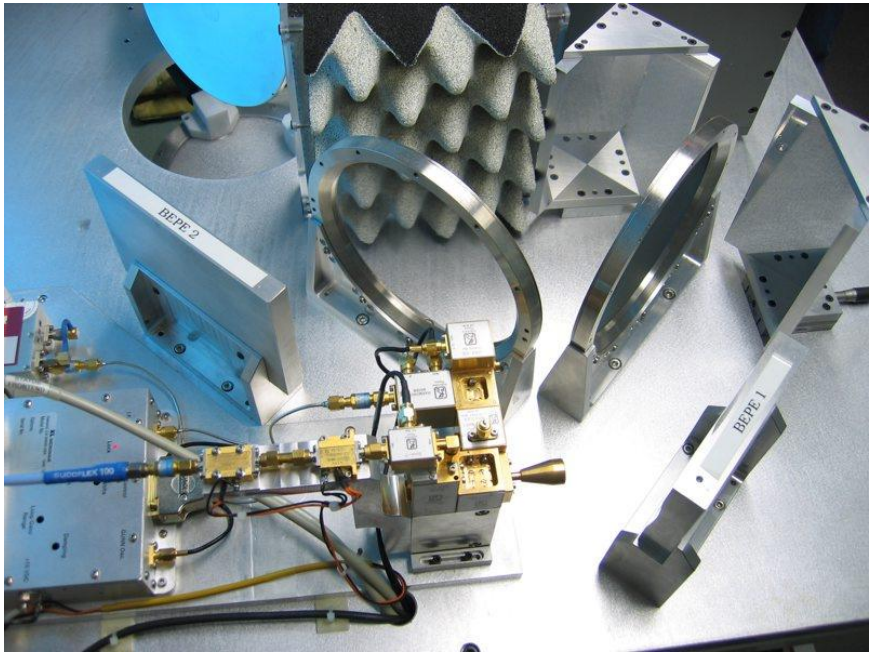
Alexander Haefele, Klemens Hocke, and Niklaus Kämpfer
University of Bern

Outline

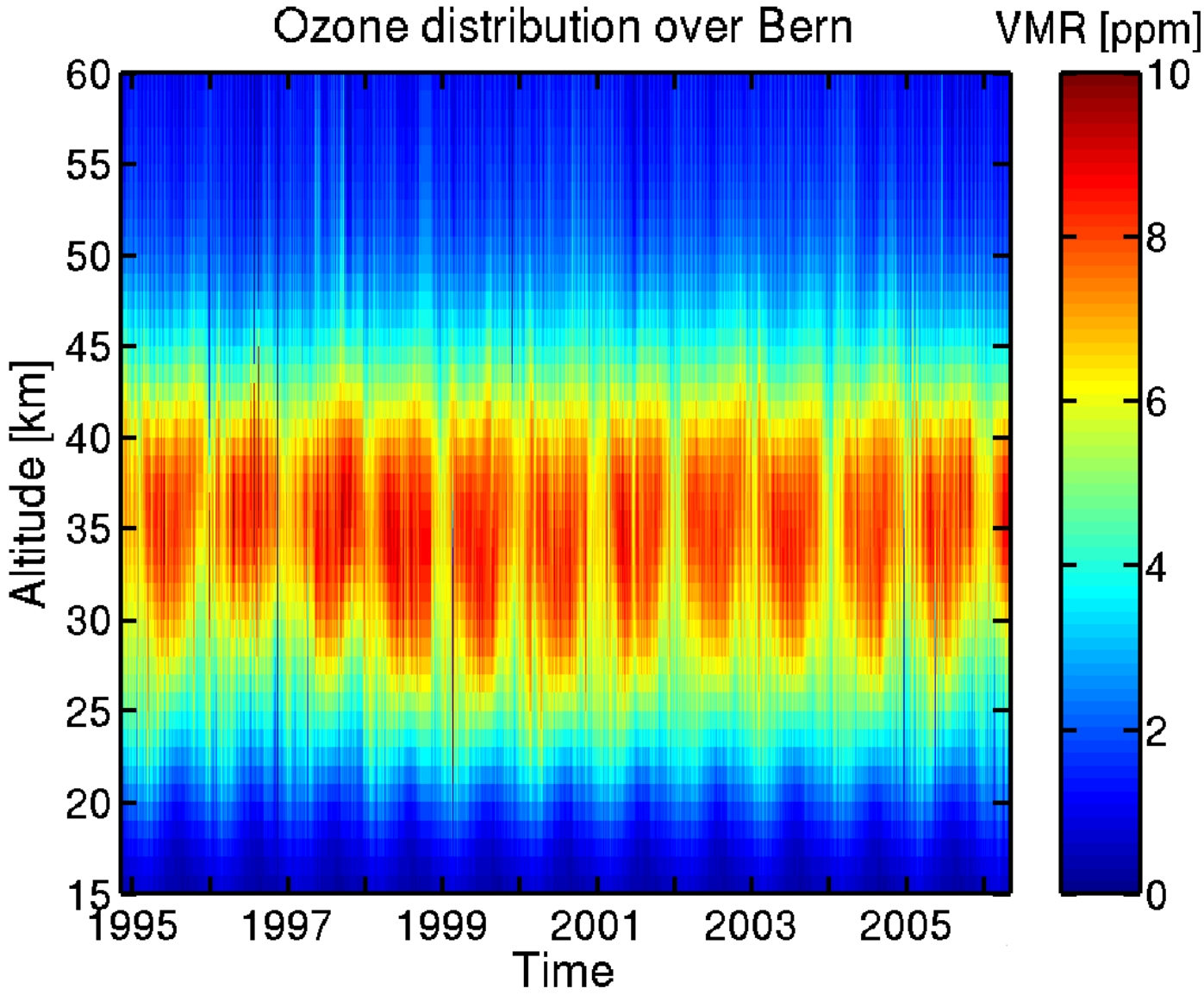
- GROMOS
  - Key Parameters
  - Dataset
- MIAWARA
  - The Instrument
  - Calibration
  - Spectral detection
  - Inversion
  - Datasets
  - Validation
- Diurnal Cycles in stratospheric O_3 and H_2O
- SWARA: A new Instrument

GROMOS: Ground Based Millimetre Wave Ozone Spectrometer

- In operation since 1994
- Total power spectrometer:
  Hot Load $\Rightarrow$ ambient temperature,
  cold load $\Rightarrow$ liquid N_2
- Single sideband:
  Martin-Puplett interferometer
- Altitude range: 20-70 km,
  vertical resolution: 5-10 km
- Temporal resolution: 2 h



GROMOS Dataset



MIAWARA: Middle Atmospheric Water Vapour Radiometer

Concept: As simple as possible $\Rightarrow$ no focussing optics.

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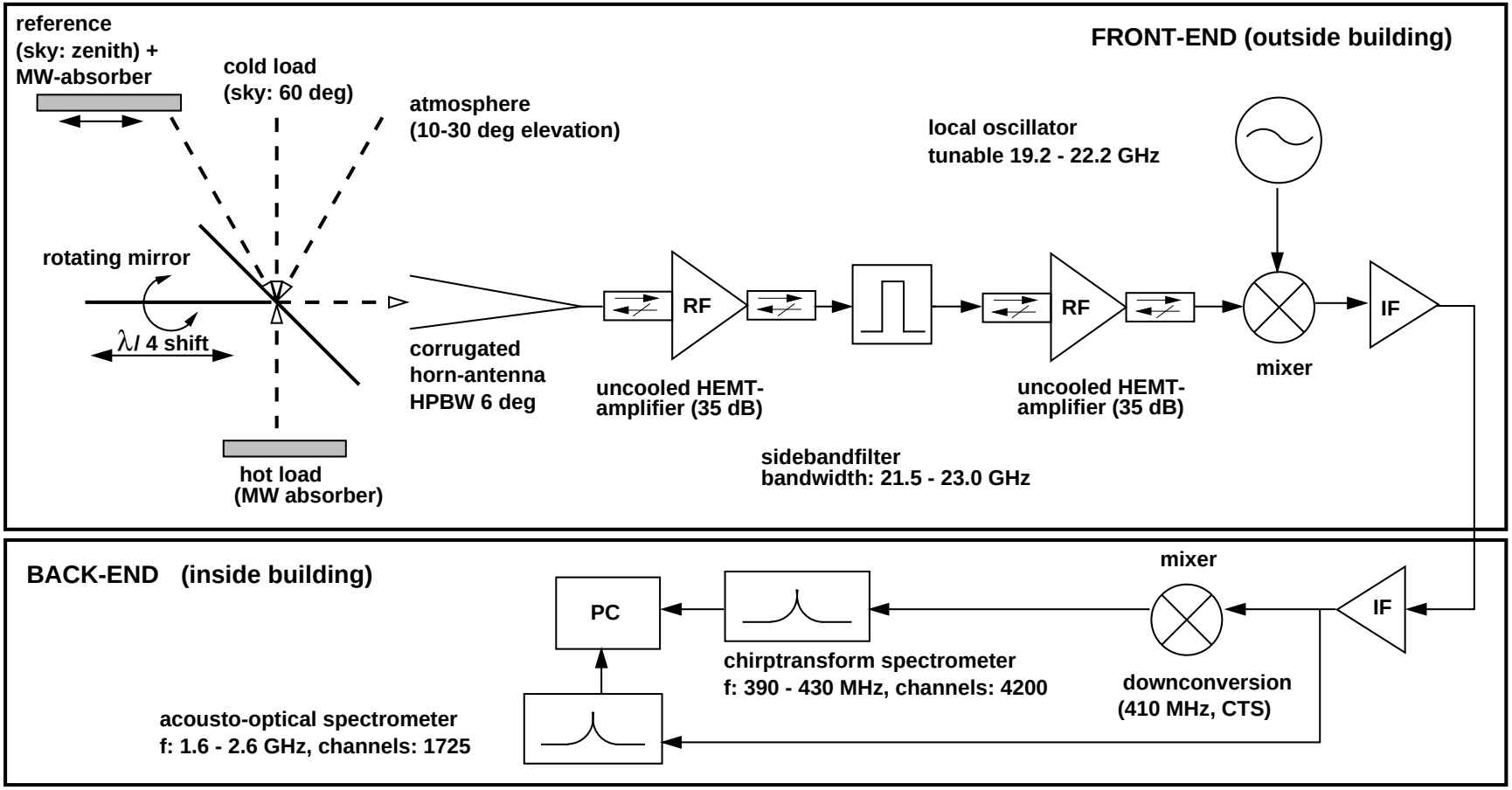
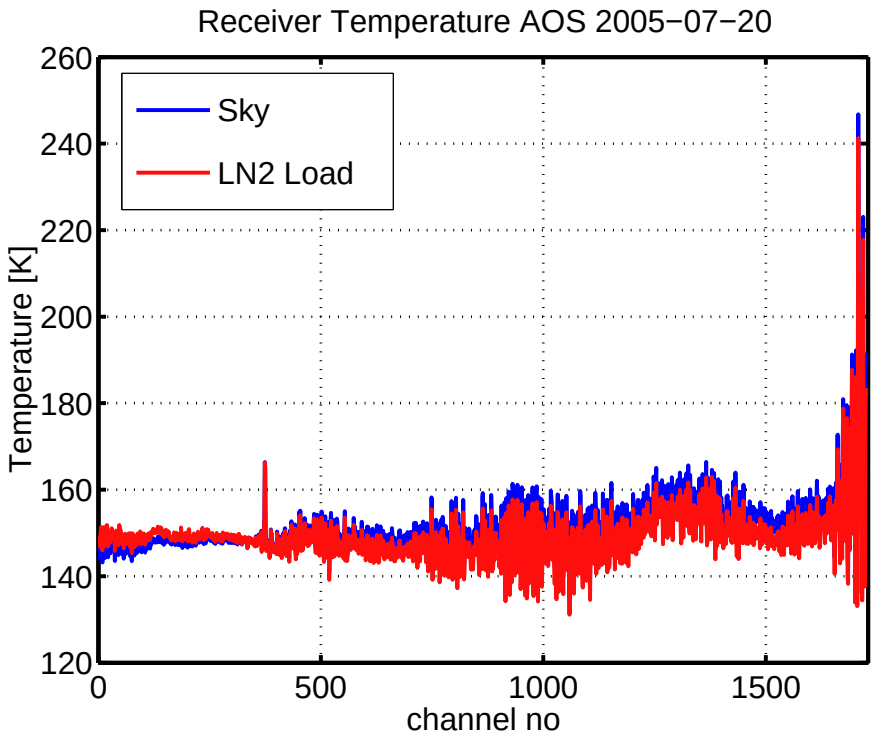


Calibration

- Hot Load: MW absorber at ambient temperature.
  Cold Load: Sky (tipping curve $\Rightarrow$ opacity $\Rightarrow$ sky brightness temperature)
- Balancing scheme: $\Delta T_b = \frac{S_{line} - S_{ref}}{S_{hot} - S_{cold}}(T_{hot} - T_{cold})$
- Validation of the calibration is performed once a month:



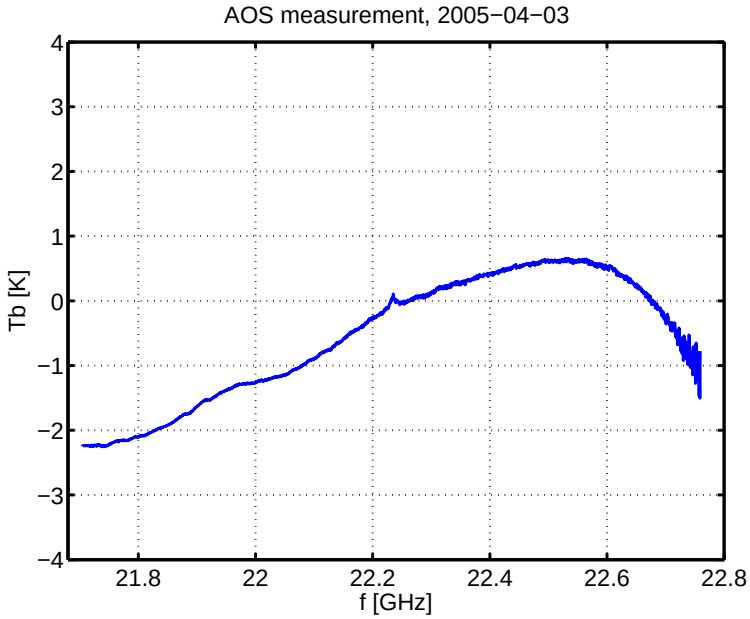
Spectral Detection

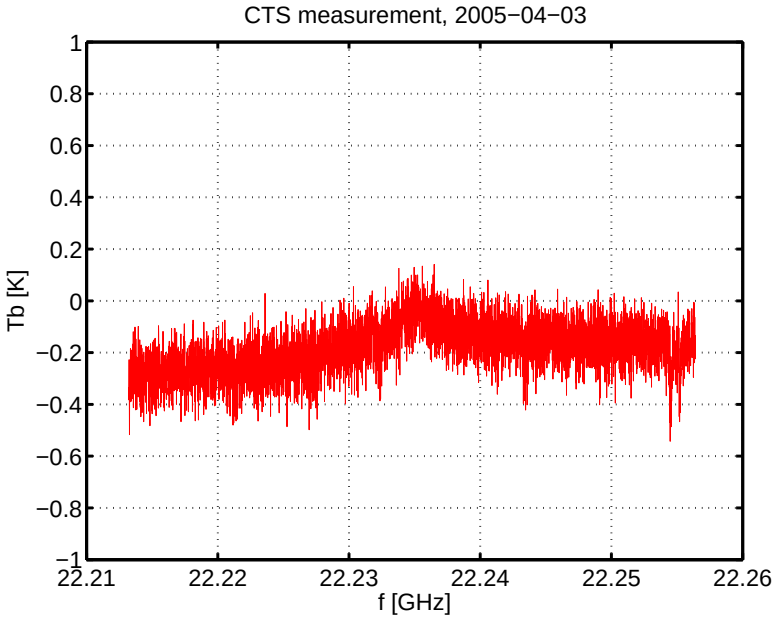
AOS: Acousto-Optical-Spectrometer

channels:	1725
f :	$1.6 - 2.6$ GHz
Δf_{FWHM} :	1.2 MHz

CTS: Chirp-Transform-Spectrometer

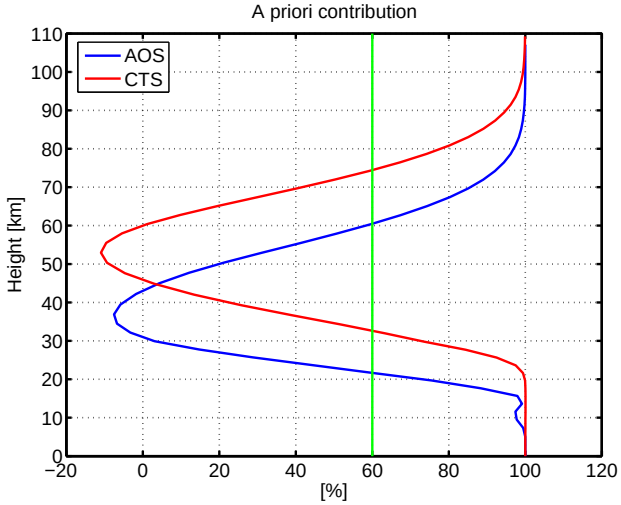
channels:	4200
f :	$390 - 430$ MHz
Δf_{FWHM} :	14.07 kHz

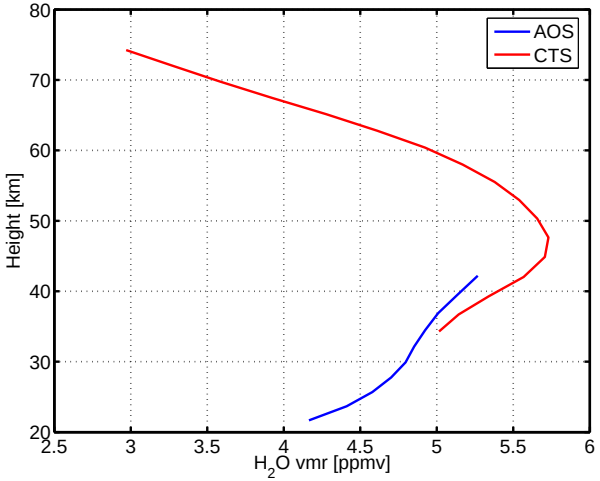


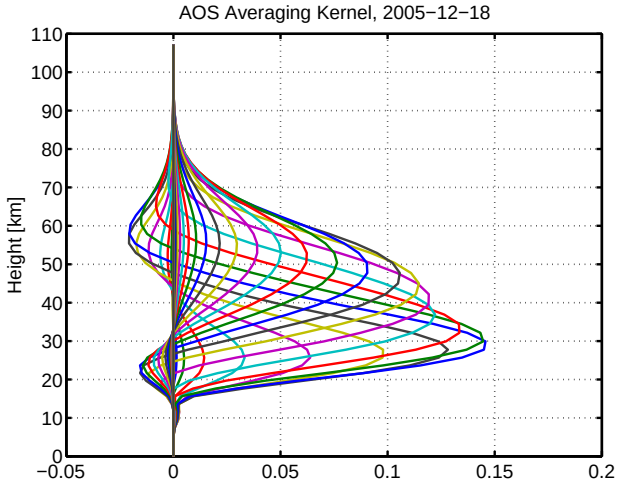


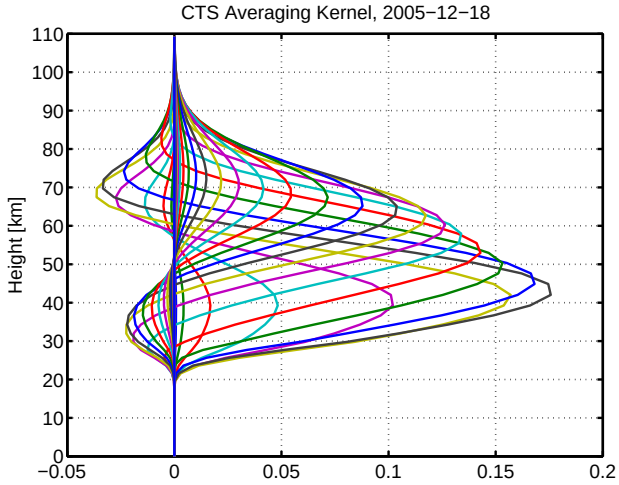
Inversion

- Radiative transfer: ARTS
- Sensor Modelling: QPack
- Rodger's OEM algorithm: QPack
- A priori H_2O profile: US standard
- pTz - profiles: ECMWF
- Observation time: AOS 4 h, CTS 24 h

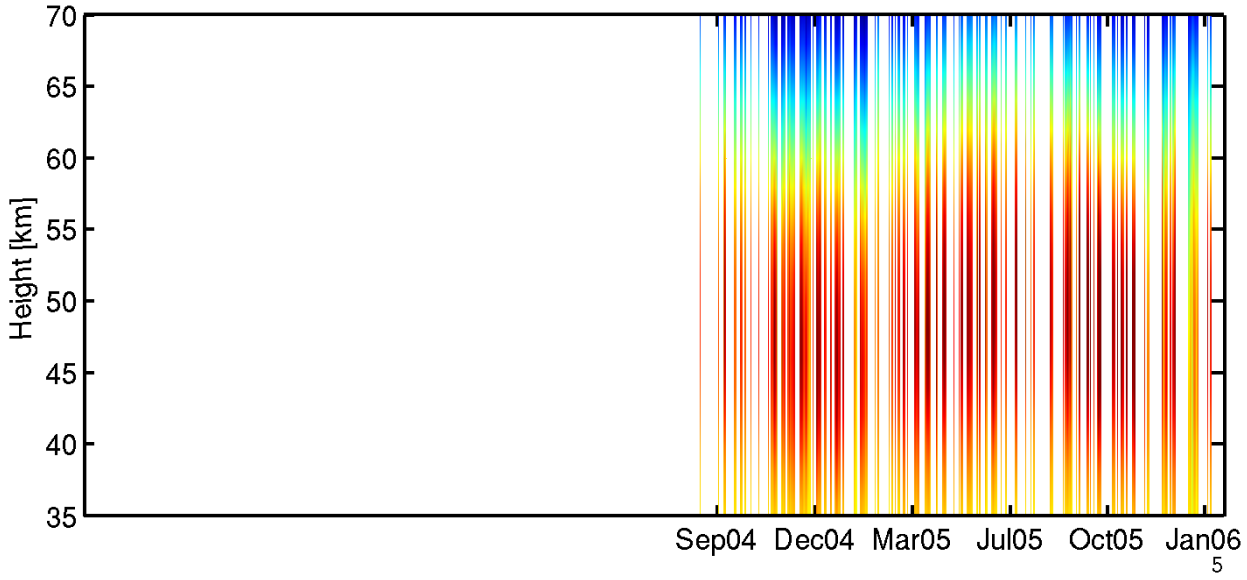


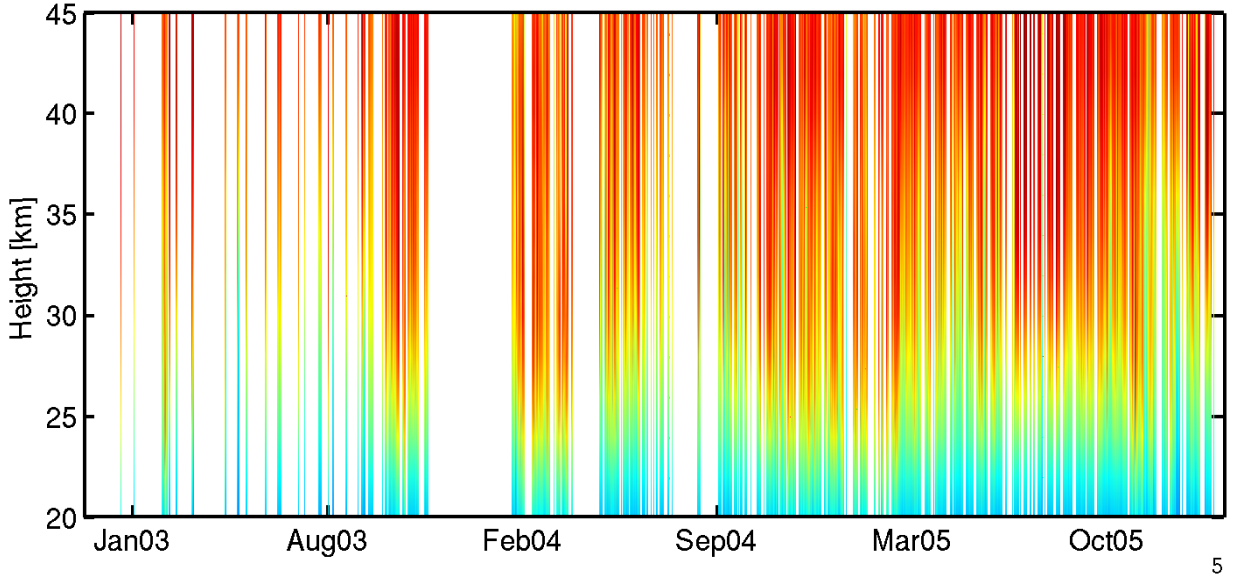






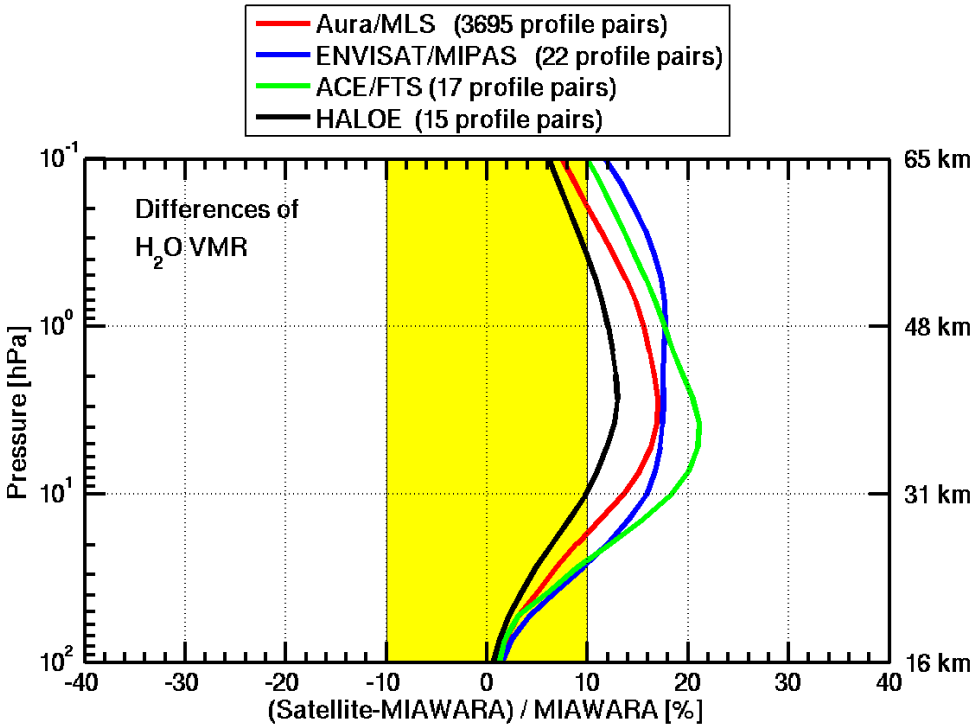
Datasets


70
65
60
55
50
45
40
35
Height [km]
Sep04
Dec04
Mar05
Jul05
Oct05
Jan06
5


45
40
35
30
25
20
Height [km]
Jan03
Aug03
Feb04
Sep04
Mar05
Oct05
5

Validation

- averaging kernel taken into account
- $\Delta r < 800$km
- $\Delta t < 3$h



$\Rightarrow$ good agreement of all satellite instruments (within 10%)

$\Rightarrow$ a constant, systematic bias of the ground station

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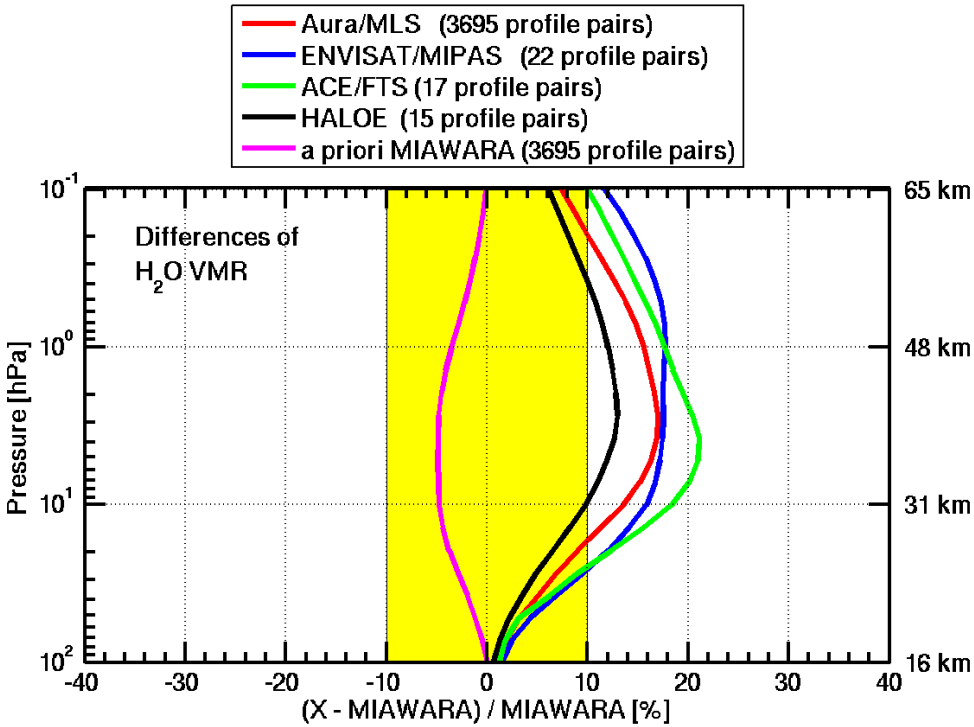
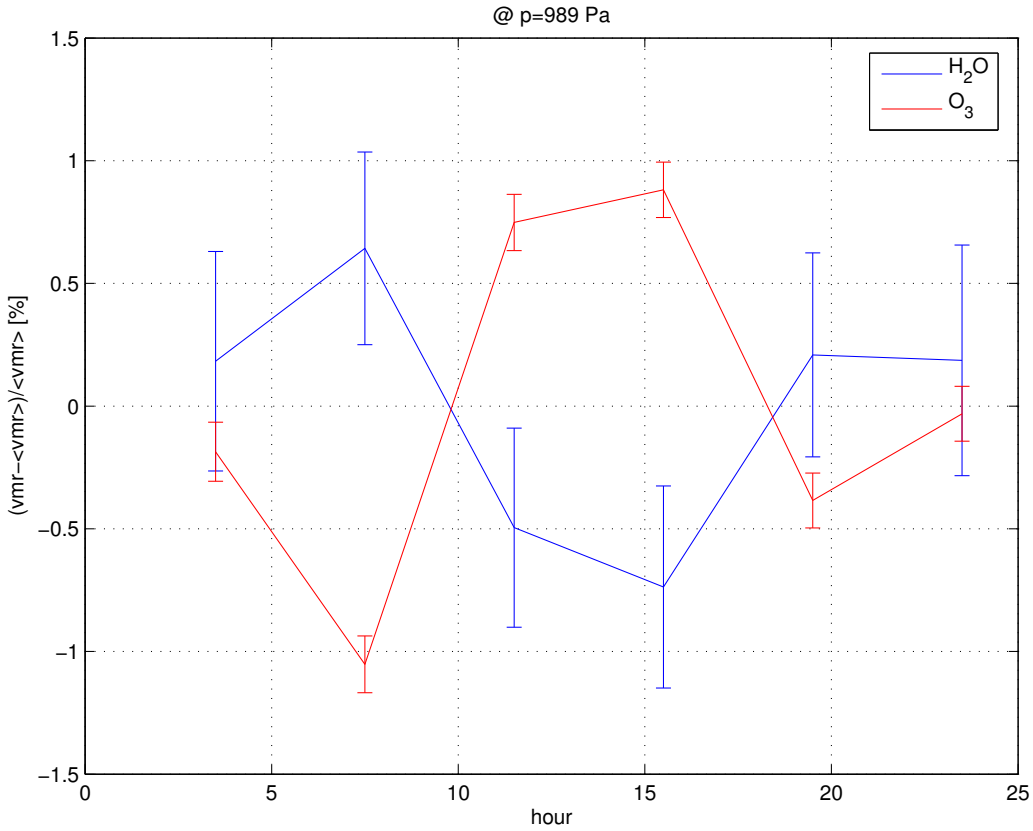


$\Rightarrow$ good agreement of all satellite instruments (within 10%)

$\Rightarrow$ a constant, systematic bias of the ground station

- quality assurance of level 1 data not sufficient
- a priori profile induces a dry bias

Diurnal Cycle in Stratospheric Water Vapour and Ozone



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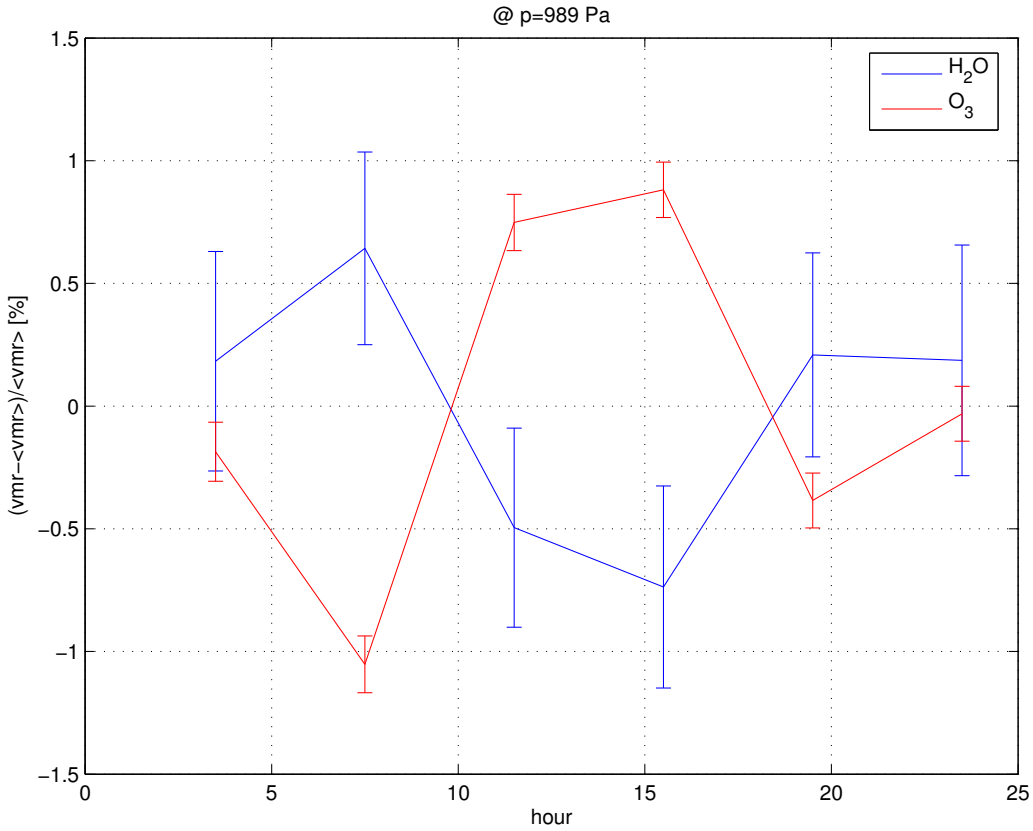
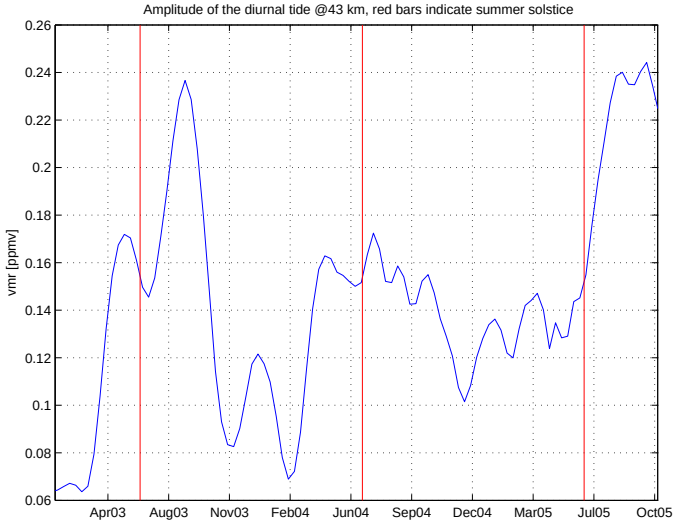
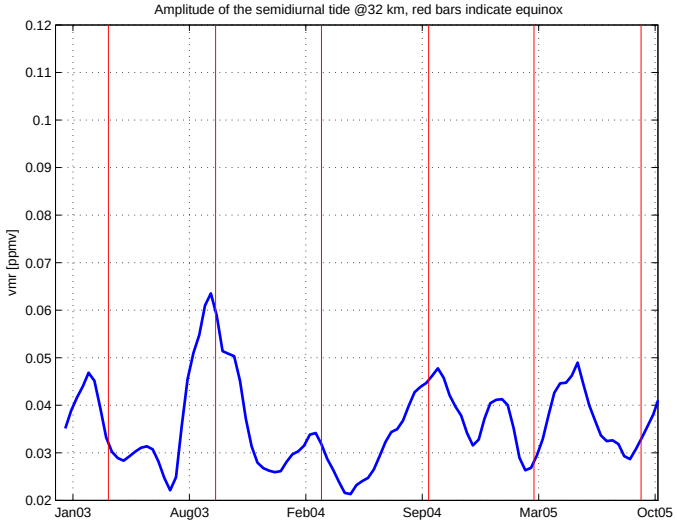


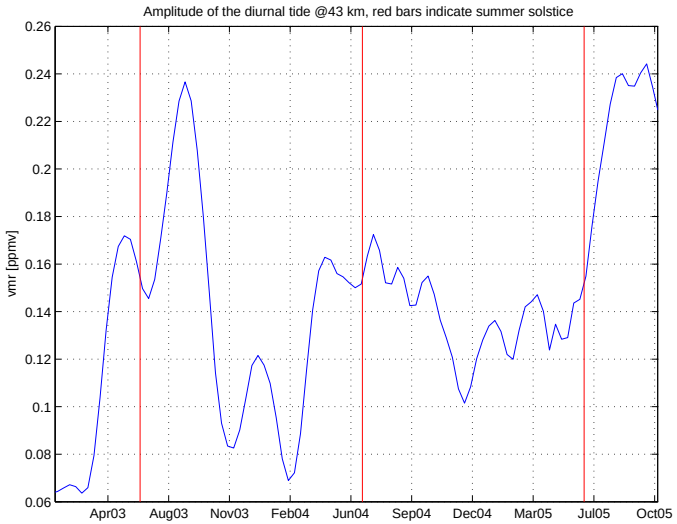
Could this be related to atmospheric tides?

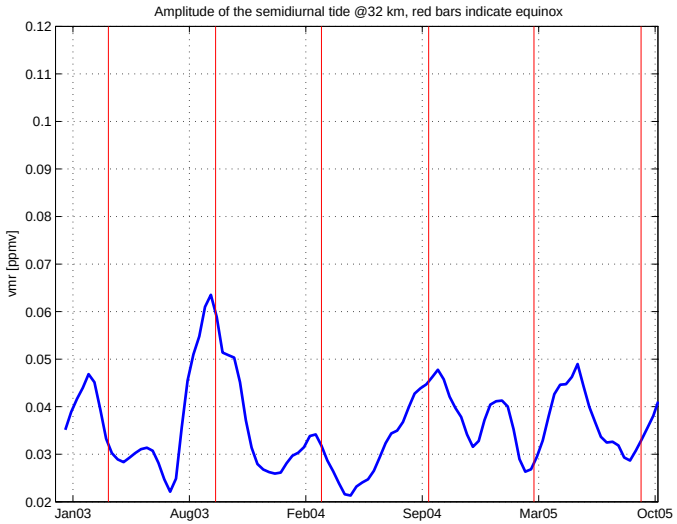
Diurnal and Semidiurnal Components in Ozone



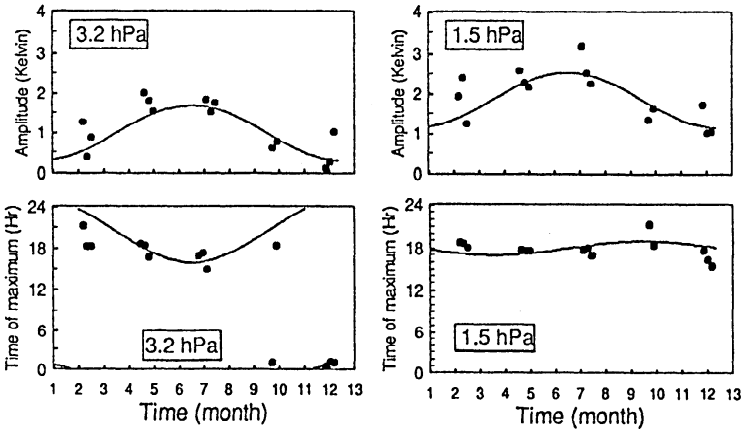


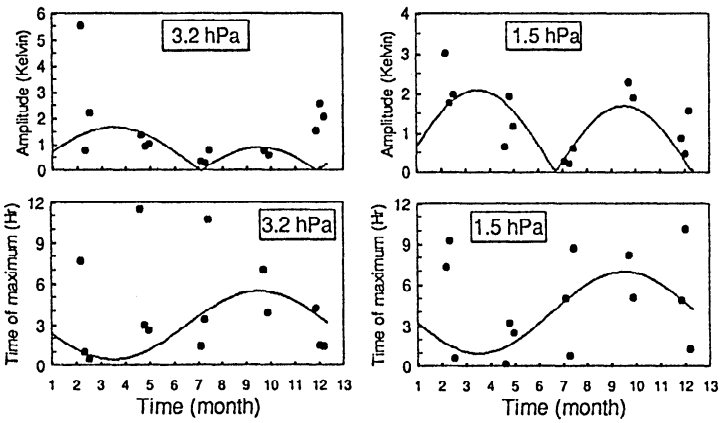
Diurnal and Semidiurnal Components in Ozone and Temperature





Temperatures:





[Keckhut et al.]

SWARA: A new Instrument

- A collaboration of the Uni Bern and the Sookmyung Women's University, Seoul
- Frontend: The same as MIAWARA
- Backend: FFT spectrometer
  - channels: 16400
  - f: $0 - 1$ GHz
  - Δf_{FWHM}: 60 kHz
- Destination: Seoul, 37N/126E

Thank you ...