



NDACC Workshop Water Vapour

Bern, July 3rd – 5th, 2006

Microwave Activities at Bremen

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Outline

- IUP/UB microwave radiometers
- WaRAM @ Ny Ålesund (78N, 12E)
- WaRAM2 @ Mérida (8N, 71W)
- Summary



IUP/UB microwave radiometers

ASUR

Airborne SUBmillimetre Radiometer

- first operated in 1991 („SUMAS“)
- tunable receiver
624 – 632 GHz, 646 – 654 GHz
- SIS mixer since 1994
 $T_{\text{Rec}} = \text{O}(1000 \text{ K})$
- O_3 , ClO, HCl, N_2O , HNO_3



IUP/UB microwave radiometers

BreRAM (53° N, 8° E, sea level)

Bremen Radiometer for Atmospheric Measurements

- first operated in 2000
- monitors 110 GHz O₃ emission
- uncooled Schottky mixer

$$T_{\text{Rec}} = 3000 \text{ K}$$

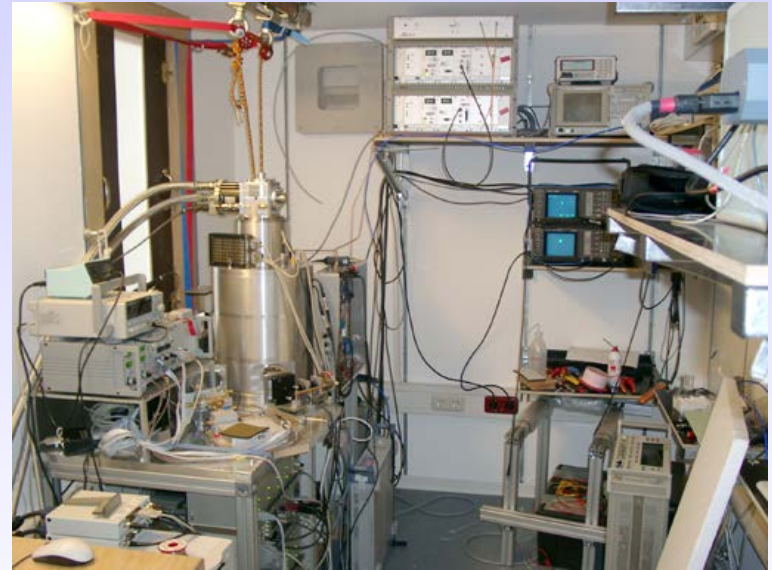


IUP/UB microwave radiometers

RAMAS

Radiometer for Atmospheric Measurements at Summit

- first operated in 2003
- tunable receiver
265 – 280 GHz
- SIS mixer
 $T_{\text{Rec}} = 360 \text{ K}$
- O_3 , ClO , HNO_3 , N_2O



IUP/UB microwave radiometers

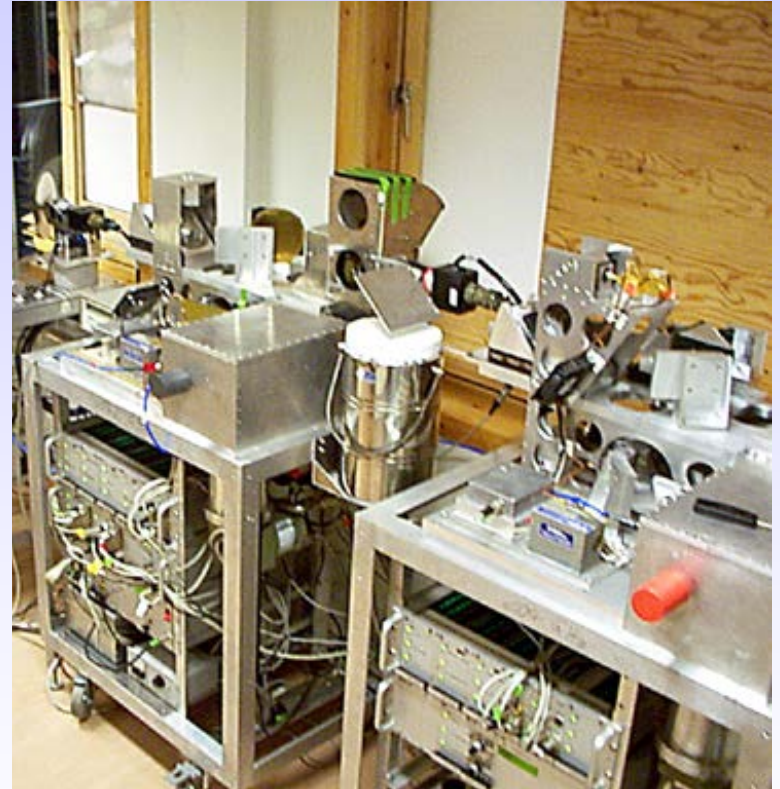
RAM (79° N, 12° E, sea level)

Radiometer for Atmospheric Measurements

- first operated in 1993
- monitors 142 GHz O₃ emission
- cooled Schottky, $T_{\text{Rec}} = 1000$ K

CIORAM

- first operated in 1996
- monitors 204 GHz ClO emission
- cooled Schottky, $T_{\text{Rec}} = 1000$ K



Outline

- Site
- Instrument
- Existing Data
- Retrieval
- Problems



WaRAM: Site

Koldewey-Station, Ny Ålesund

79° N, 12° E, sea level

NDACC Primary Arctic Station

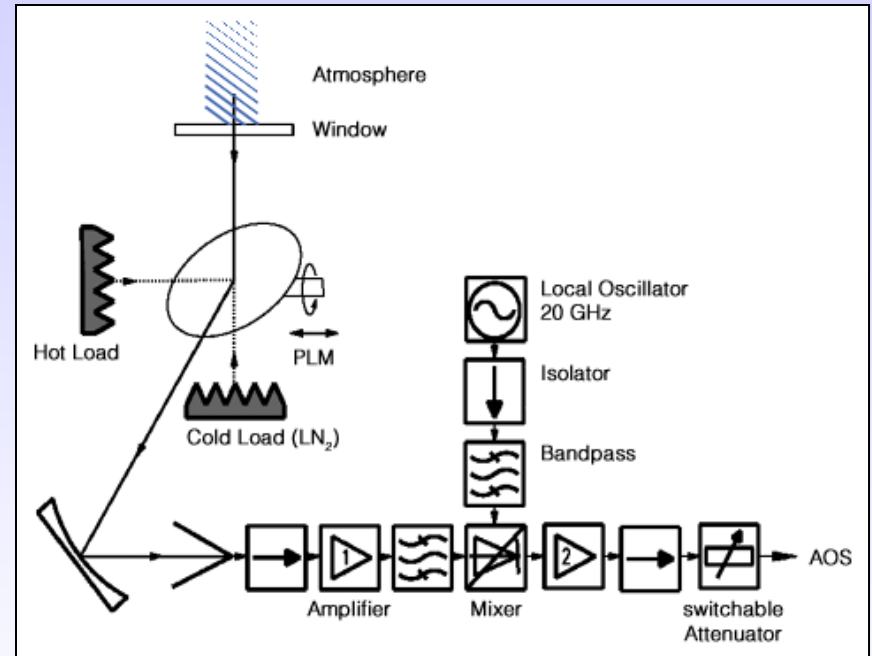
Large synergy of measurements

- Daily Balloon sondes
- FTS
- DOAS
- UV/B Spectrometer
- LIDAR
- Sun/Moon/Star Photometers

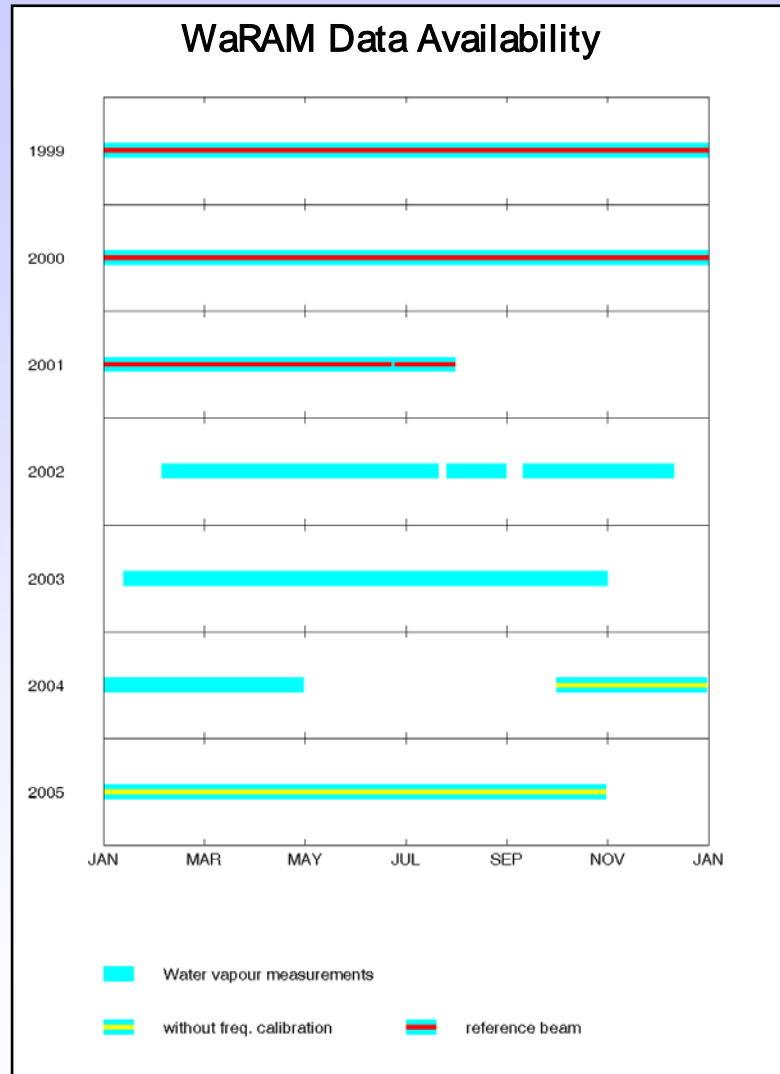


WaRAM: Instrument

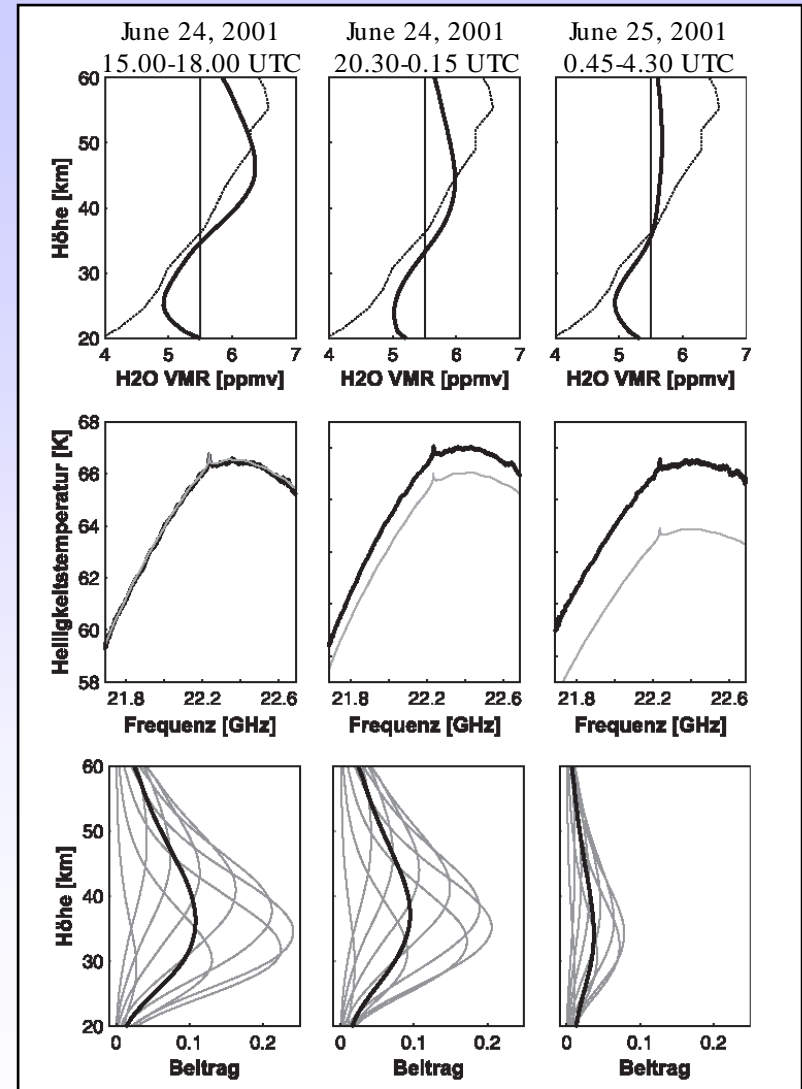
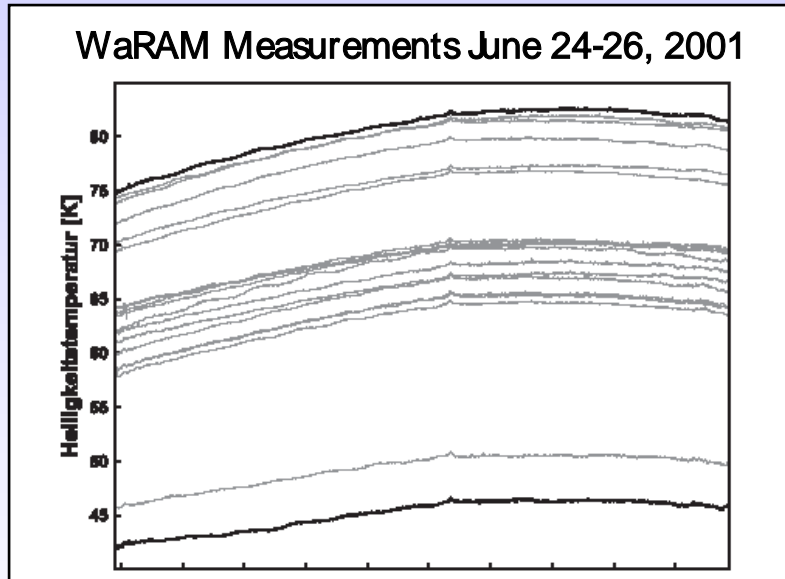
- Total Power calibration
- all parts inside laboratory
- elevation angles $12^\circ - 60^\circ$
- AOS ($\Delta\nu = 1.4$ MHz)
- Filter Bank ($\Delta\nu = 0.1$ MHz)
- CTS ($\Delta\nu = ***$ MHz)



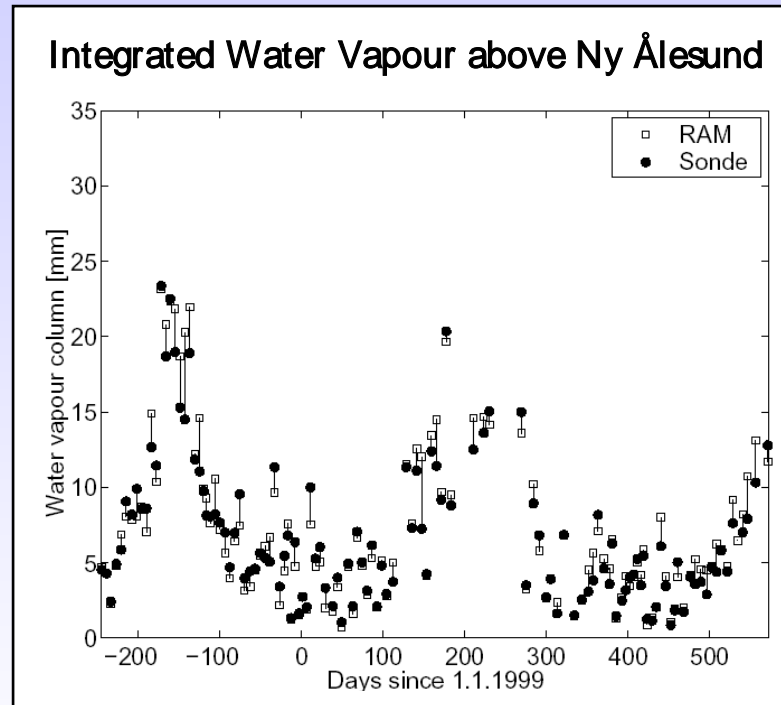
WaRAM: Existing Data



WaRAM: Profile Retrieval



WaRAM: Previous Retrievals



I Wohltmann (2002)

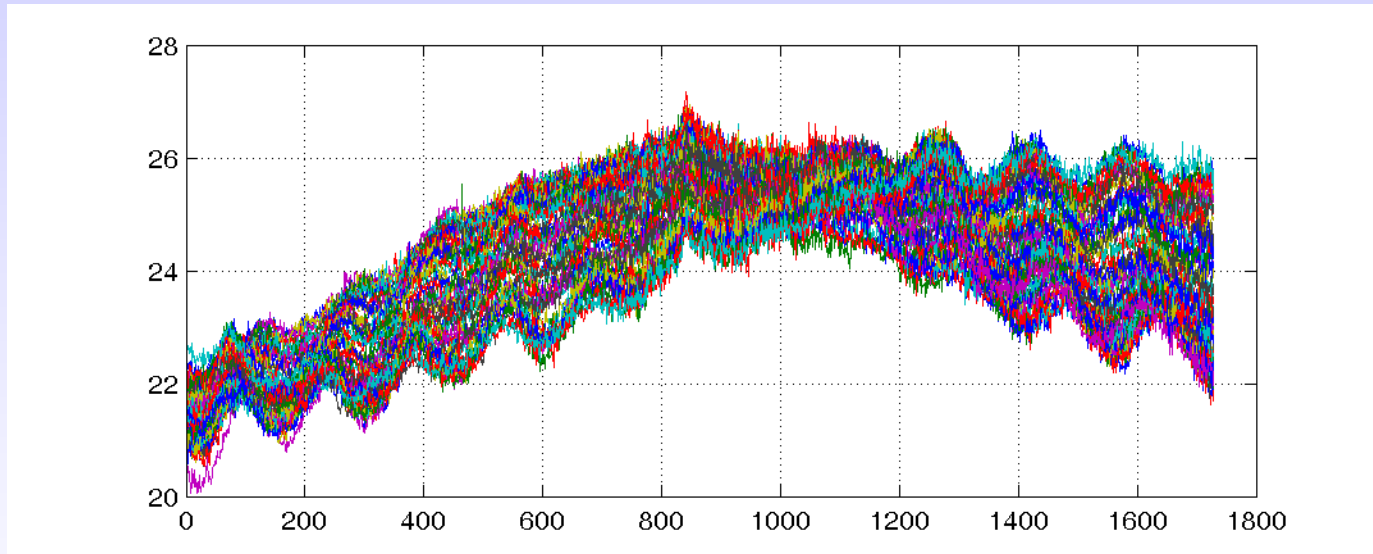
WaRAM: Retrieval Ideas

- balloon soundings -> better a-priori
- joint retrieval of tropospheric background
 - other microwave data
 - FTIR
 - further sensors as applicable

WaRAM: Problems

- Standing Waves

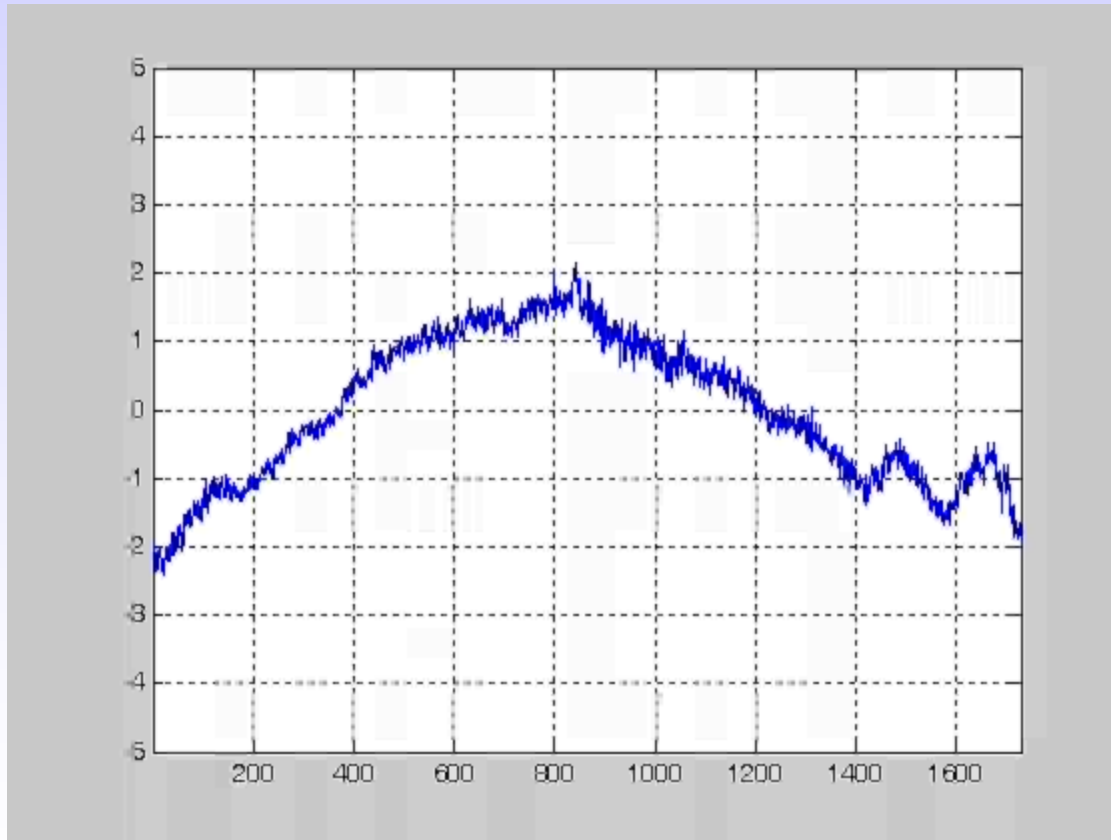
WaRAM power calibrated spectra, 13/May/02, 0:20-1:00 UTC



WaRAM: Problems

- Standing Waves

WaRAM power calibrated spectra, 13/May/02, 0:20-1:00 UTC



WaRAM: Problems

Cold Calibration Load

- No temperature monitoring
- Liquid nitrogen is oxygen contaminated

Outline

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- Existing Data
- Retrieval



WaRAM2: Site

MARS Station, Mérida

8° N, 71° W, 4760 m a.s.l.

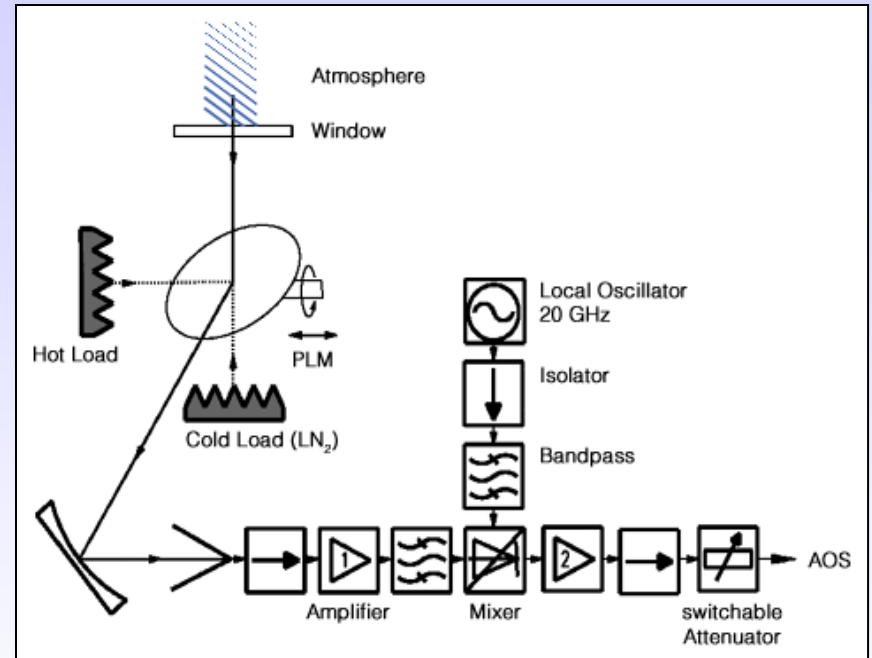
- Two microwave sensors
- Sun Photometer

- FTS?
- LIDAR??

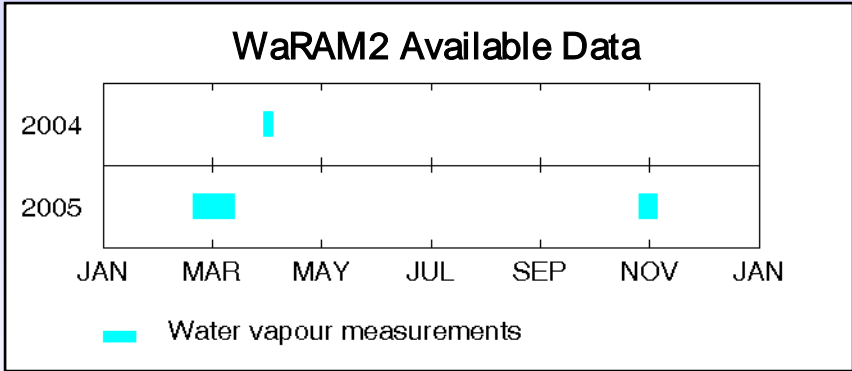


WaRAM2: Instrument

- Total Power calibration
- all parts inside laboratory
- elevation angles $12^\circ - 60^\circ$
- AOS spectrometer ($\Delta\nu = 1.4 \text{ MHz}$)

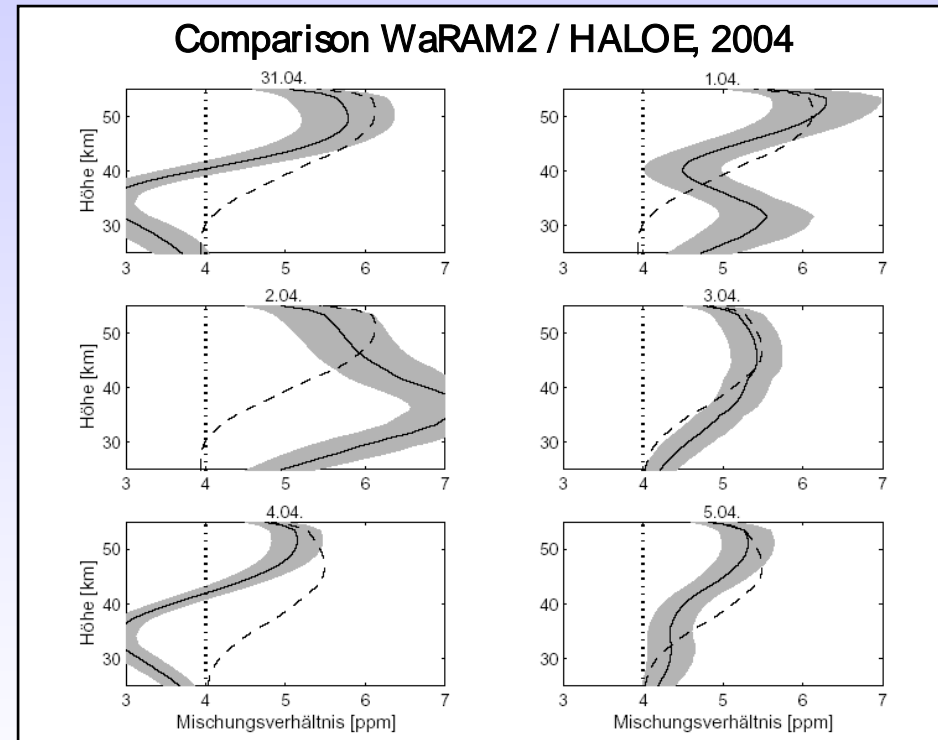


WaRAM2: Existing Data



WaRAM2: Retrieval

- use 300 Mhz bandwidth only
- calc. stratospheric contribution (two layer model)
- manually correct for standing waves



M Quack (2004)

Summary

- IUP/UB operates two water vapour profiling radiometers one in the Arctic, one in the Tropics
- Further investigation necessary to yield reliable profile retrieval

