GROUND–BASED MICROWAVE RADIOMETER FOR STRATOSPHERIC AND MESOSPHERIC WATER VAPOR PROFILES

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Atmospheric water vapor is a major field of the research activities at the Institute of Applied Physics (IAP) at the University of Berne (see also posters 7-19, 5-29 and 4-07). In order to enhance these activities we developed a new ground-based radiometer called MIAWARA (MIddle Atmospheric WAter Vapor RAdiometer) which provides stratospheric and mesospheric water vapor profiles in the range of 30-70 km by measuring the microwave emission line of $H_2{}^{16}O$ at 22.235 GHz. We determine the water vapor spectrum by performing a balancing-calibration using the sky in zenith direction as the reference signal. The tropospheric properties, required for the use of the sky as reference load, were measured by taking a tipping curve with the same instrument. With this calibration technique it is not necessary to use an external liquid-nitrogen-filled cold-load, so the instrument can run unattended for a long period.
The instrument has started operation in May 2001 and is currently in a first testing period operating from the roof of our Institute. After this testing period we are planning to operate MIAWARA in the frame of NDSC.

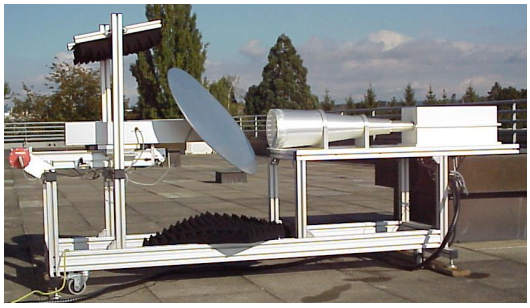

Figure 1 The Radiometer MIAWARA on the roof of the Institute of Applied Physics at Berne, Switzerland (46.95 N / 7.45 E, 550 m. above sea level).

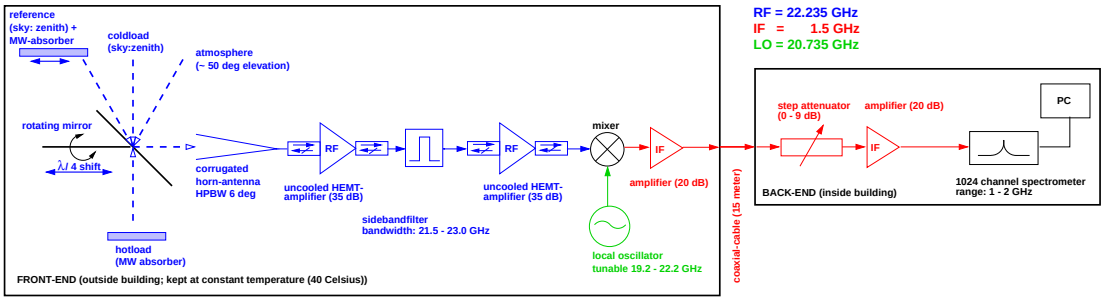

Figure 2 The setup of the instrument consists of the frontend (outside building) and the backend (inside building) connected by a 15 m coaxial cable. The atmospheric and calibrational (reference, hot, cold) signals are fed into the corrugated horn-antenna by a large plane mirror, which is shifted by a quater of the wavelength between two sucessive measurements to minimize artefacts of standing waves. The instrument is operating in the single-sideband mode. The radio-frequency (RF) signal at 22.235 GHz is directly amplified by 2 low-noise amplifiers before being downconverted to the intermediate-frequency (IF) at 1.5 GHz. The spectral analysis is currently achieved by an acusto-optical spectrometer (Bandwidth 1 GHz, Resolution 1 MHz).

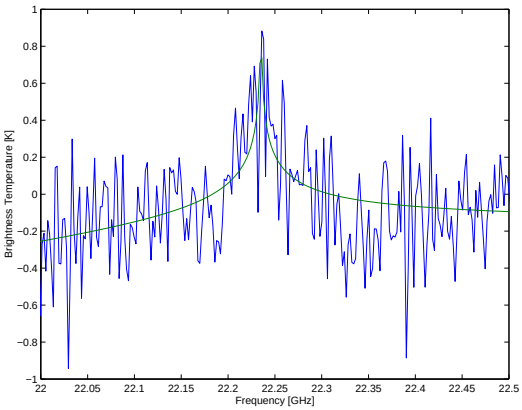

Figure 3 Measured balanced spectrum from 9^{th} to 11^{th} May 2001 with a integration-time of 0.84 hours.

Calibration technique	Balanced calibration
Antenna	Corrugated horn HPBW 6 deg
Receiver noise-temperature	160 K SSB
Radio-frequency	21.735 – 22.735 GHz
Radio-frequency amplifiers	uncooled HEMT
Total RF amplification	74 dB
Intermediate-frequency	1 – 2 GHz
Spectral analysis	Acusto-optical spectrometer Resolution 1 MHz
Sideband suppression	50 dB
Current place of operation	Berne, Switzerland 46.95 N / 7.45 E 550 m. asl

Table 1 Key-paramters of the instrument.

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