<u>Atmospheric Water Vapour Column</u> <u>above Mt Saraswati, Hanle</u>

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Infrared radiation is absorbed mostly by water vapour, but also by  $CO_2, O_2, N_2O$ , and  $CH_4$ Water vapour, oxygen and ozone have absorption features also in the "optical" region

Ultraviolet radiation is absorbed by ozone high up in the atmosphere



## Effect of water vapour on the sub-mm band transmission

Scale height of water vapour is ~1.5 km Atmosphere holds less water vapour at lower temperatures



# Water vapour pressure and precipitable water vapour:

 $P_0 = 2.409 \times 10^{12} RH(300/T)^4 e^{-6792/T}$  microbars

 $pwv = P_0/(3T)$  mm for scaleheight = 1.5 km

RH = 80%; t = 27 CRH = 20%; t = -20 C $P_0$ 28350 microbars209 microbarspwv31.5 mm0.27 mmAbsorption  $\propto pwv$  $pwv \sim P_0$  in millibars

# Methods

- Radiosonde: Campaign Mode, not yet undertaken at Hanle provides information on vertical distribution
- Radiometer: Automated 220 GHz radiometer at Hanle
  Ananthasubramanian et al. 2002, 2004
- GPS: Hanle has a permanent station of DST network Jade et al. 2005,2006
- Sun photometer: Current report
- Satellite Imagery

#### Microtops II Sun Photometer

- Water Vapour Band: 936 nm
- Aerosol Band: 1020 nm
- Deployed in 2000: Early results gave PWV much lower than expected: Factory Calibration was not good enough at Hanle

Calibration observations were taken several times between 2000-2005. Better Calibration was obtained using Langley Plots (signal vs airmass)

#### Calibration of Aerosol Channel



#### Calibration of Water Vapour Channel



## Calibration of Aerosol Channel



## Calibration of Water Vapour Channel



#### Seasonal variation of AOD and Water Vapour





# Seasonal variation of AOD and Water Vapour

Month			PWV				
	Hanle	KPNO	VLA	СР	LaSilla	Atacama	
Jan	0.9	4.0	4.3	3.8	8.0	1.8	
Feb	0.9	5.0	4.6	4.7	8.1	8.1	
Mar	1.2	4.9	4.4	4.7	8.3	4.1	
Apr	1.7	4.5	4.9	3.4	6.1	0.8	
May	1.5	5.9	6.7	2.8	4.7	1.2	
Jun	2.8	6.1	8.7	2.3	4.2	0.9	
Jul	3.6	14.0	13.9	2.2	3.8	0.9	
Aug	2.9	17.0	14.2	2.0	4.0	1.4	
Sep	1.4	13.2	11.0	2.0	4.8	1.5	
Oct	1.2	6.7	6.2	2.2	5.5	1.7	
Nov	0.9	5.1	2.3	2.4	6.4	1.2	
Dec	1.0	4.1	4.1	2.9	7.2	1.9	

	MKO	Hanle
20%	1.0	0.7
50%	1.6	1.1
30%	3.0	1.8

## Scale height of water vapour



#### Cross-Calibration: 220GHz

