Infrared Phys. Vol. 23, No. 2, pp. 119–120, 1983
Printed in Great Britain.

0020-0891/83$03.00 + .00

RESEARCH NOTE

HIGH ALTITUDE ATMOSPHERIC WATER VAPOUR MEASUREMENTS IN THE HIMALAYAN REGION

T. CHANDRASEKHAR, K. C. SAHU and J. N. DESAI
Physical Research Laboratory, Ahmedabad-380009, India

(*Received* 21 *October* 1982)

The transmission of the earth's atmosphere at infrared and millimeter wavelengths is greatly affec by the amount of precipitable water vapour along the path of propagation. Hence, a good index evaluating the suitability of a site for infrared and millimeter astronomy is the integrated zenithal water vapour measured at the site. Statistics of the amount and variation of zenithal water vapour (W) for sites in Western Europe have been published by Greve[1] and for American sites by Kuiper.[2] In this note, we present zenithal water vapour values obtained from infrared attenuation measurements made during a preliminary site survey for an infrared observatory. The measurements were carried out in the extremely arid Himalayan region near Leh, India (34°09′N., 77°35′E.) in September 1982. Of special interest are the measurements carried out at various points on a 'jeepable' dirt road rising steeply from Leh (altitude ~ 11000 ft) to the Kardung La pass (altitude ~ 17000 ft).

The observations were carried out with a water vapour meter (J. H. Ransom Laboratories Inc.). The meter essentially compares the transmission of sunlight at two closely spaced near-infrared wavelengths, one of which is in the water vapour absorption window and hence sensitive to the integrated water vapour in the line of sight. Measurement consists of adjusting a calibrated circularly variable optical wedge placed in the path of the unabsorbed wavelength until the intensities at the two wavelengths are equal.

Figure 1 shows the observations of zenithal water vapour taken on the single day when it was possible to go up to the pass. Each data point is the mean of several sets of actual observations. The dispersion in the data at each place is ±0.1 mm independent of the actual water vapour value in the range 1–3 mm. The altitude measurements were made with a suitably calibrated altimeter having a probable error of ±100 ft. Superimposed on the data, for comparison, is a curve derived from radiosonde measurements at Cologne during 1962–1965 (Greve[1]).

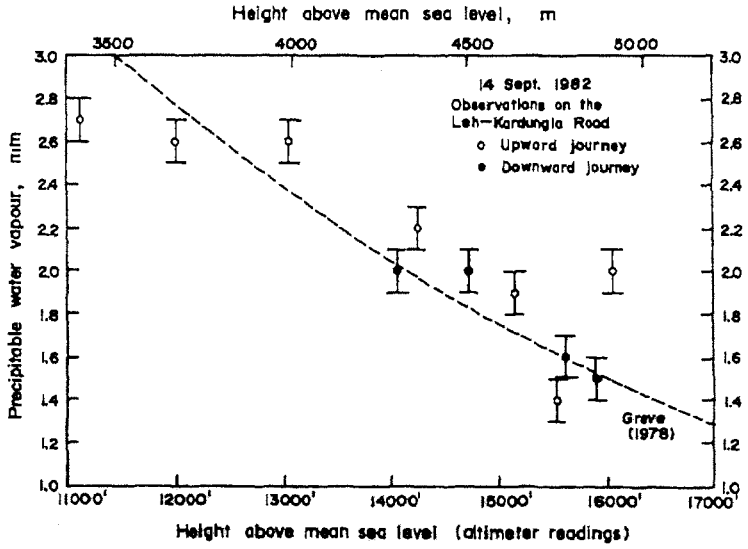

Fig. 1. Zenith precipitable water vapour on the Leh–Kardung La Road.

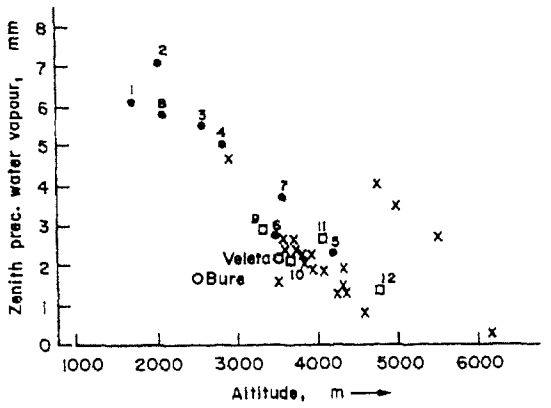

Fig. 2. Zenith precipitable water vapour of existing telescope sites (●), proposed American i.r./mm observatory sites (×) (Kuiper) and proposed European mm observatory sites (○). 1 = Mount Palomar (U.S.A.); 2 = Kitt Peak (U.S.A.); 3 = Catalina (U.S.A.); 4 = Mount Lemmon (U.S.A.); 5 = Mauna Kea (Hawaii); 6 = Jungfraujoch (Switzerland); 7 = Tenerife (Canary Isles); 8 = Zelenchukskaya (U.S.S.R.); 9 = Leh (India); 10 = Hemis (India); 11 = Mt Nimo (India); 12 = Kardung La Road (India). □ = Indian Sites.

An exponential decrease of W with altitude (h) is noticed. A least square fit to the data (ln W vs h) yields a scale height of 2619 m. The correlation coefficient of the fit is 0.86. The lowest value of water vapour recorded was 1.4 mm. As the observations were made just after the withdrawal of the monsoon in the Indian plains, it is expected that an even lower value of water vapour and correspondingly better transmission at i.r. wavelengths can be obtained in the long dry winter months.

Figure 2 is a curve from Greve[1] expanded to include our data. The different data points are all for the neighbourhood of Leh in the same arid region of Ladakh with an annual rain fall of less than 2 in. It is seen that sites in this region compare very well with other observatory sites around the world. Preliminary investigations suggest a large number of clear nights per year—in excess of 250—which would make the Leh region a good candidate site for a high altitude observatory devoted to infrared astronomy.

Acknowledgements—We are grateful to Professors Westphal, Bhatnagar and Kulkarni for providing the water vapour meter, to Mr N. S. Sandhu of the Indo–Tibetan border force and the Field Research Laboratory, Leh, for excellent logistical support. Financial support for the work came from the Department of Space, Government of India.

REFERENCES

1. A. Greve, *Infrared Phys.* **18**, 127 (1978).
2. C. P. Kuiper, *Comm. Lunar Planetary Lab.*, No. 142, 146. University of Arizona, Tucson (1970).