LETTERS TO THE EDITOR

A NOTE ON THE EQUATORIAL STRATOPAUSE

THE temporal variations of stratospheric parameters studied[1-3] revealed large variations in temperature and windspeeds at the stratopause. Schwentek[4] showed a good solar influence on the stratospheric temperatures of West Berlin for the winter atmosphere of the sunspot cycle, 1957–70. The recent studies of Ramakrishna and Seshamani[5] point out a strong correlation between mesospheric temperatures at Thumba and 10·7 cm solar flux 1970–71.

The diurnal variations in temperature of the stratopause is controversial. Beyers and Miers[1] observed *stratopause temperatures to be at minimum* at local midnight and maximum at local noon for whitesands (32° North). However, Theon *et al.*[3], reported for the stratospheric region 30 to 60 km a large increase of temperature during 2000–2400 hrs and abrupt cooling during 01:00–05:00 hrs Wallops island (38° North).

In view of these various controversies a study is attempted in the present paper to understand equatorial stratopause during day and night and to study the solar influence on its parameters. The stratopause is a level of maximum in the vertical temperature structure.

The data obtained from the M-100 type Meteorological rocket firings made regularly at 20:00 hrs at Thumba, beginning in January 1971, give the altitude profile of the wind, temperature, pressure and neutral density upto an altitude of about 90 km. The earlier flights of January 1971 give some data during daytime. These data are used for the day and nighttime studies and those of January 1972–December 1973 for correlative studies. The present study is mainly confined to temperature and density variations.

The average of the two daytime flight measurements of temperature at 10:00 hrs (20 January 1971) and 10:22 hrs (30 January 1971) is taken as the daytime representative profile and this is shown in Fig. 1. Another profile averaged from the three flight measurements made at 23:00 hrs (6 and 20 January 1971) and 23:05 hrs (13 January 1971) is also shown to represent the nighttime profile. The temperature profiles show a large increase, through a region of about 15 km from day to night conditions around the stratopause. The maximum temperature difference of 12·3° C was observed at 40 km altitude.

The large diurnal variations in temperature led to the examining of the solar influence on the stratopause. Hence, correlations between stratopause and solar parameters are studied, and the temperature and density data of the nighttime flights around 20:00 hrs over a two-year period are analysed. This period (January 1972–December 1973), during which 90 flights were made, also coincides with one biennial cycle[4] which is exhibited by most of the stratospheric parameters. The solar parameters of the corresponding day are taken to study the correlation. The correlative data are taken from *Solar Geophysical Data Bulletin published by the NOAA*. Choosing the solar data of the corresponding day is justified as it was already shown that the solar influence is felt in less than a day's period at mesospheric heights[5]. The solar influence will be felt with a lesser delay at decreasing altitudes.

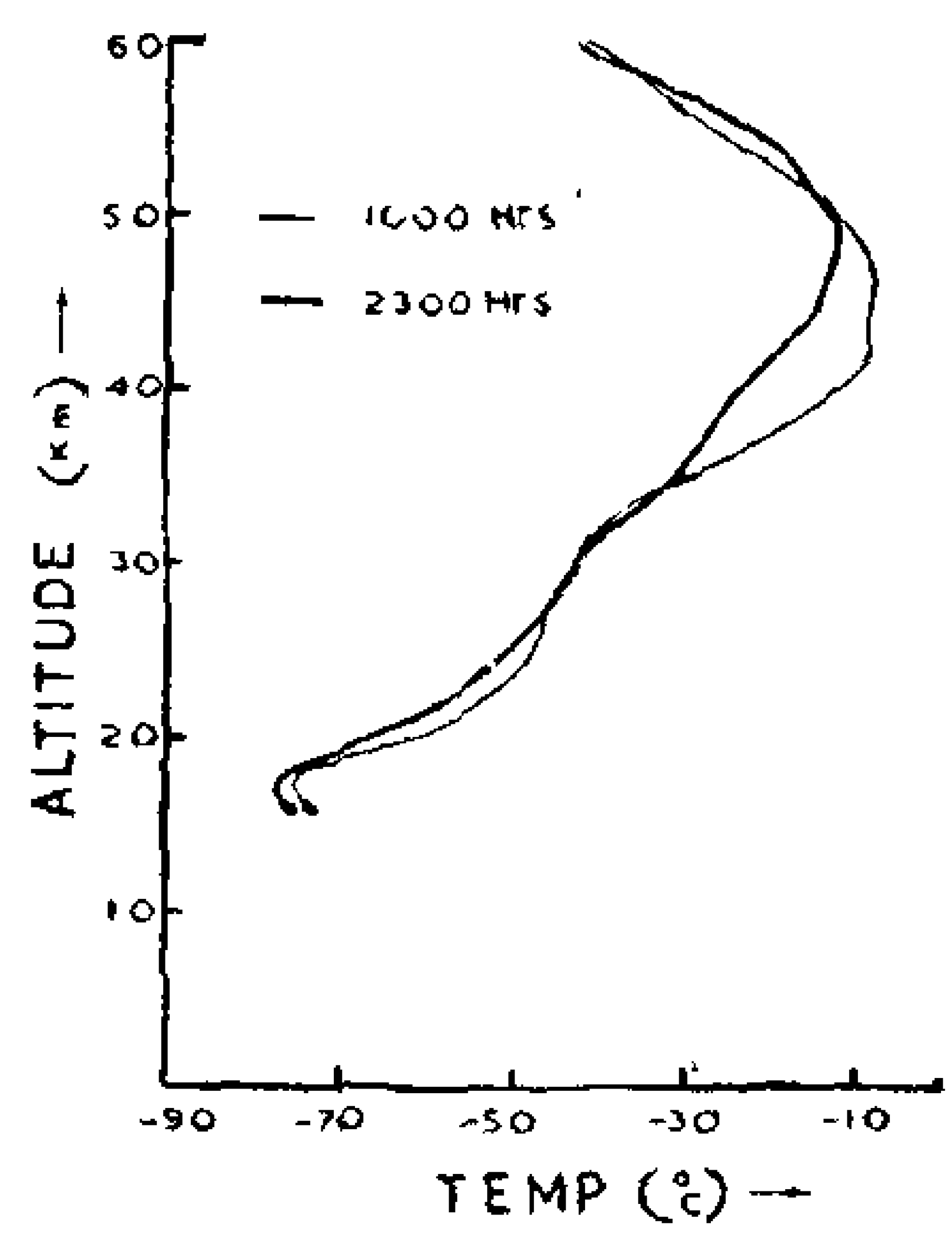

FIG. 1. Altitude profiles of temperature for Thumba averaged over two daytime and three nighttime flights of January, 1971.

The cross-correlations coefficients calculated with the Zurich sunspot number and 10·7 cm solar flux of Ottawa are given in Table I with their corresponding

TABLE I

Correlation coefficients evaluated between stratopause and solar parameters

Correlations between	No. of observations	Correlation coefficient	Significance level*
Temperature *vs.* Sunspot number	90	0·37	<0·01
Temperature *vs.* Solar radio flux	90	0·28	<0·01
Neutral density *vs.* Sunspot number	90	0·09	..
Neutral density *vs.* Solar radio flux	90	0·07	..

* < 0·01 indicates high correlation, .. poor correlation

significance levels. A significance level of 0·1 indicates a good correlation and a further decrease in the level indicates a higher correlation. During the period the stratopause height varied between 41-51 km, the temperature between 256–284° K and density between 0·81–3·45 gm/meter[3]. The corresponding variation in the sunspot number was between 0-140 and the solar flux was between 72–176 units.

The above correlation coefficients show a good positive correlation between stratopause temperature and solar parameters, this is clearly brought out in Fig. 2. The absence of such correlation with neutral

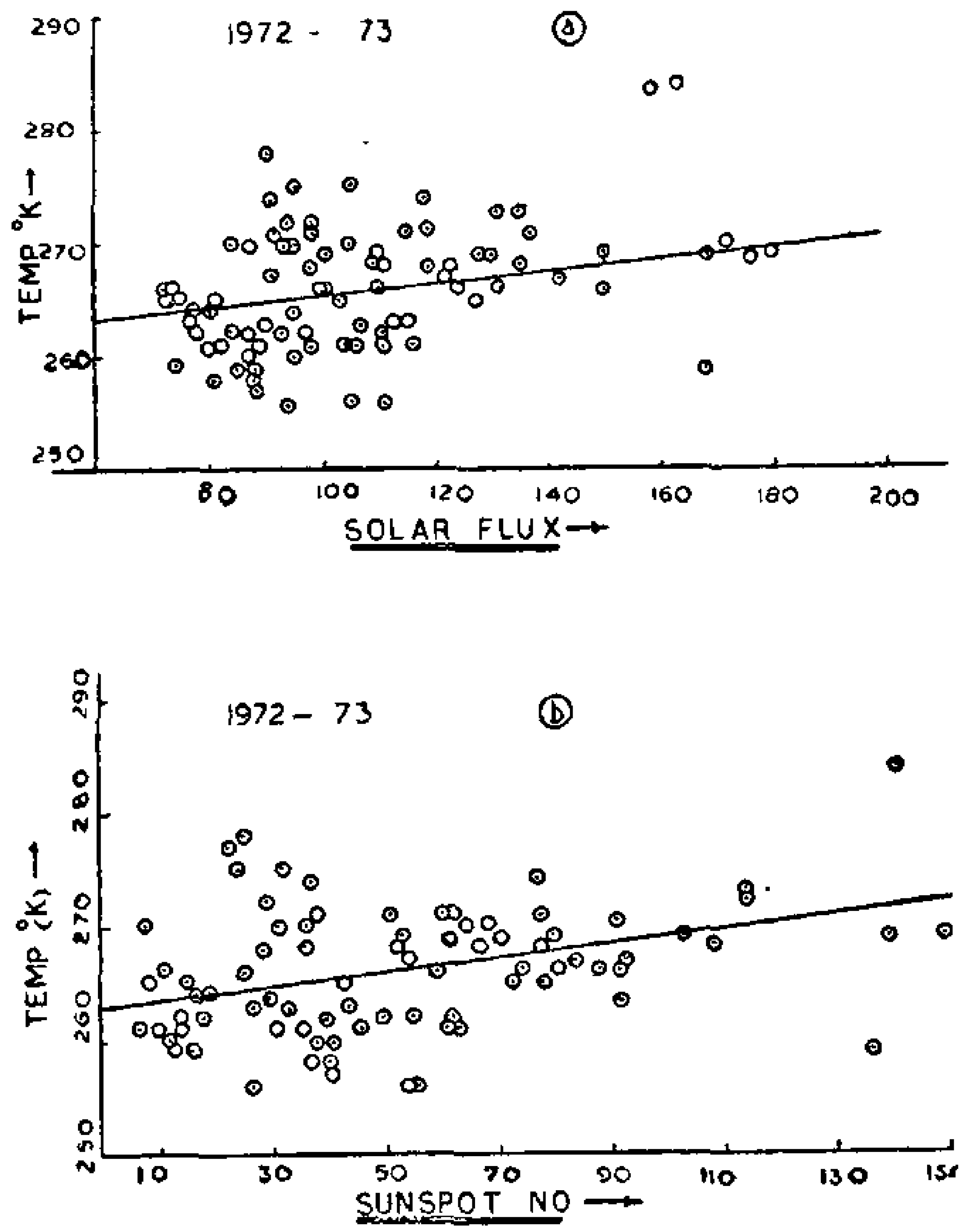

FIG. 2. Variations of temperature with (*a*) Solar Flux, (10·7 cm, Ottawa) and (*b*) Zurich Sunspot Numbers.

density is interesting as this is a function of temperature. The high correlation is, evidently because of the fact that the solar ultra-violet radiation of the range 2000-3000 Å is mainly absorbed by a minor constituent, ozone which is responsible for the large temperature in the entire stratosphere with a peak at the stratopause[4]. The same reason holds good for the higher daytime temperatures as compared to that of the nighttime (Fig. 1). Another observation that could be made from Fig. 1 is that the solar effect may be almost simultaneous, which results in large stratopause temperature around noon. The results of the earlier workers for whitesands[3] closely agree with our observations of higher daytime temperatures.

The observations that are made above, relating to the diurnal variations and the solar influence, will be confirmed by studying the daytime flights spread over a larger period. A detailed study taking into consideration the seasonal variations will be published elsewhere.

From the above studies the following conclusions are made. Higher daytime temperatures are observed compared to nighttime in the altitude region of 35–50 km for the winter atmosphere of Thumba. A good positive correlation is observed between the stratopause temperature and the solar parameters, and a poor correlation with the neutral density for, one biennial cycle, 1972–73.

Space Physics Laboratories, Department of Physics, Andhra University, Waltair, *March* 15, 1976.

J. V. M. NAIDU.
RAMA KOTESWARAM.
B. RAMACHANDRA RAO.

1. Beyers, N. J. and Miers, B. T., *J. Atmos. Sci.*, 1965, **22**, 262.
2. —, — and Reed, R. J., *Ibid.*, 1966, **23**, 325.
3. Theon, J. S., Nordverg, W., Katchen, L. B. and Horvath, J. J., *Ibid.*, 1967, **24**, 428.
4. Schewentek, H., *J. Atmos., Terr. Phys.*, 1971, **33**, 1839.
5. Ramakrishna, S. and Seshamani, R., *Ibid.*, 1973, **35**, 1631.
6. Gaigerov, S. S., Kalikhman, M. YA., Sedov, V. E., Shvidkovsky, E. G., Tarasenko, D. A. and Zaichikov, B. P., *Space Research*, 1971, **11**, 799.
7. Fisher, R. A., *Statistical Methods for Research Workers* (Oliver and Boyd), p. 209.

THE CRYSTAL STRUCTURE OF *n*-*p*-CYANOBENZILIDENE-*p*-*n*-OCTYLOXYANILINE

As part of programme of systematic X-ray investigations of mesogenic compounds[1], the crystal structure of *n*-*p*-cyanobenzilidne. *p*-*n*-octyloxyaniline (CBOOA) has been analysed in its stable solid phase. The compound is known to exhibit the following liquid crystalline phases on heating.

$$\text{Solid} \xrightarrow{73^\circ\,\text{C}} \text{Smectic A} \xrightarrow{82\cdot5^\circ\,\text{C}} \text{Nematic} \xrightarrow{106\cdot9^\circ\,\text{C}} \text{Isotropic}$$

Large, rectangular prismatic, yellow crystals of the compound were obtained by slow evaporation from a solution in *n*-heptane. Unit cell dimensions and space group were determined from conventional oscillation and Weissenberg photographs and are listed in Table I along with other relevant crystal data.

Three-dimensional intensity data were collected on multiple Weissenberg films using copper K_α radiation. The intensities were estimated visually and were corrected for Lorentz and polarisation factors, absorption and spot-shape effects.