THE TEMPERATURE AT 120 KM ALTITUDE IN APRIL–MAY 1965*

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Grenade glow clouds were observed at Woomera in April–May 1965 following the firing of five Skylark sounding rockets. The glow cloud experiments formed part of the British programme for upper atmosphere wind measurement. Special observations of the glow clouds were made by the Baker–Nunn camera station at Woomera.

This paper gives new data on the variability of temperature near 120 km altitude using results obtained from observations of 10 grenade glow clouds between 118 and 174 km altitude. Molecular diffusion coefficients are calculated and the atmospheric temperature and density determined using the methods described by Lloyd and Sheppard (1966). The results are compared with those given in the CIRA (1965) model atmosphere. Details of the calculations are given by Sheppard (1968).

TABLE 1

ATMOSPHERIC TEMPERATURE

Altitude (km)	T (°K) October 1963*	T (°K) April–May 1965	T (°K) CIRA (1965)†
120	—	463	355
130	—	558	477
140	600	605	573
150	670	626	652
160	728	638	721
170	768	647	784
180	795	653	840
190	816	—	890
200	832	—	934

* Lloyd and Sheppard (1966). † Mean model.

The variation of molecular diffusion coefficient with altitude is described by a diffusion scale height H_D. The method given by Lloyd and Sheppard (1966) enables temperature to be calculated over the altitude range for which H_D is known. For the present results, this method was modified because the temperature at the altitude of the highest glow cloud had been determined by Low (1967) from observations of aluminium monoxide spectra. Consequently an ordinary first-order differential equation for the temperature T was integrated downwards from $T = 650 \pm 50$°K at 175 km altitude.

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Errors in the temperature result arise from two main sources. The error in Low's (1967) measurement is $\pm 50°K$ and there are errors in the measurement of H_D, arising from errors in the molecular diffusion coefficients. It is found that the latter source of error dominates at 120 km altitude, where the maximum error is $\pm 50°K$. The results are given in Table 1.

The table shows that the temperature at 120 km altitude was $460 \pm 50°K$, much greater than the value of 355°K predicted by CIRA (1965). It seems that conditions at 120 km altitude are variable, not constant as was assumed in constructing the CIRA (1965) model atmospheres.

The density was calculated using the temperature results given above; near 170 km altitude it was found to be higher than that predicted by the CIRA (1965) model atmosphere but very similar to that measured previously at Woomera in October 1963. The density at 120 km altitude was a little less than that predicted by the CIRA (1965) model atmosphere.

References

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