

ABSTRACT

This thesis describes the investigations carried out to establish the feasibility of measuring the concentration of atomic potassium, a minor metallic constituent of the upper atmosphere, and the height at which the layer exists over Jamaica. The previous two methods of measuring this constituent are reviewed and their limitations discussed. The present method is based on the technique already established for sodium and its advantages over the previous techniques are pointed out.

The dye laser developed for operation at 770 nm is described in detail, emphasising wherever necessary the alterations made to the Mark 11 lidar system, into which this new system was incorporated. Results of computations to determine expected system performance are also presented.

From preliminary results, the column density of potassium was estimated at $0.9 \times 10^{12} \text{ m}^{-2}$ for the 27 January 1973, and this measurement is consistent with twilight photometric data. The height of the layer is also consistent with twilight data but a large fraction of the potassium that was obtained below 84 km is different from sodium in the profiles obtained at other latitudes. Two peaks were observed in the potassium height profiles, near 82 km and 94 km. The excess signal received over the background noise was attributed to resonance scattering, establishing the suitability of the lidar technique for measuring potassium in the upper atmosphere by resonance scattering.