OBSERVATIONS ON THE SODIUM AIRGLOW

P.A. Greet, B.Sc.(Hons)

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THE MAWSON INSTITUTE FOR ANTARCTIC RESEARCH

UNIVERSITY OF ADELAIDE

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Contents

Abstract

Observations on the sodium airglow using a Fabry-Perot spectrometer (FPS) at Mt. Torrens (35° S, 139° E) are described. Modifications to the instrument and assessment of two new etalons are described. Three years of observations of the sodium twilight emission using the high-resolution FPS have been made to obtain wind and temperature estimates from the 90 km altitude region. Attempted observations of the sodium dayglow emission with the dual FPS are discussed.

Analysis of the sodium emission line is complicated by its hyperfine structure. A hollow-cathode sodium lamp has been used to obtain the FPS instrument function, to define the hyperfine structure in the analysis, and to give a rest wavelength for wind determinations. Care must be exercised in analysis as contamination by both Rayleigh scattered sunlight and the photochemical excitation of the emission affect results obtained. The twilight- and day- glow are excited dominantly by resonant scattering of sunlight.

A summer mean temperature of 150 K and a winter mean temperature of 199 K have been determined from 2 years of data. A systematic difference between dusk and dawn temperatures of up to 37 K in March and April is ascribed to the diurnal tide. The FPS measurements of the dawn – dusk temperature difference are in reasonable agreement with those calculated using a recent theoretical model together with measurements of the amplitude and phase of the diurnal tide from the nearby Buckland Park, spaced-antenna, partial-reflection (SAPR) radar.

Comparisons of the FPS and SAPR radar horizontal wind measurements are presented. There is excellent agreement in some cases and, in general, agreement between the two methods is good when the wind field is uniform spatially. Short-term variability, some of which may be ascribed to gravity waves, is seen in both the temperature and wind measurements.

The project has shown that high-resolution Fabry-Perot spectrometer observations of the sodium airglow provide a useful means of studying the dynamics of the 85–90 km region.