Satellite and Rocket Measurements of Solar Ultraviolet Flux and Atmospheric Molecular Oxygen Density

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first winter measurement of molecular oxygen density in the southern hemisphere in the region of the atmosphere near 90 km.

A comparison of the HAD 309 and HAD 310 (summer) results with similar measurements by other workers has indicated that the average scale height of the density distribution, in the altitude range 80 km to 95 km, is greater in winter than in summer.

Australia's first satellite, WRESAT 1, carried lithium fluoride-nitric oxide, sapphire-xylene and quartz-triethylamine ion chambers. This experiment was designed to measure atmospheric molecular oxygen density at satellite sunrise and sunset, in the altitude range 90 km to 220 km. A method of analysis of the ion chamber data has been developed which allows for the effect of the finite size of the solar disk. All of the available WRESAT 1 data has been analysed using this method.

To within the experimental uncertainties, the WRESAT 1 density results show general agreement with the mean 1965 CIRA model atmosphere in the region near 100 km. However, in the height range 130 km to 220 km, the average density values are a factor of two below those of the mean 1965 CIRA model and show day-to-day variations greater than those predicted by the 1965 CIRA models.

The region of the solar temperature minimum, between the upper photosphere and lower chromosphere, is of considerable importance for the theory of the solar atmosphere. The solar flux data obtained from the sapphire-xylene and quartz-triethylamine ion chambers carried on WRESAT 1, indicate a value of (4870 ± 90)°K for the solar minimum brightness temperature. A comparison has been made between this value and the values obtained by workers using dispersive instruments.
This thesis describes experiments performed using rocket and satellite-borne ion chambers sensitive to vacuum ultraviolet radiation. The objectives of these experiments were:

(i) the measurement of molecular oxygen density by the technique of absorption spectroscopy, and

(ii) the measurement of absolute solar flux at the wavelength of hydrogen Lyman-α (1215.7Å) and in the wavelength bands 1420Å to 1480Å and 1550Å to 1690Å.

Ion chambers with both glass bodies and copper bodies have been designed and constructed for use in these experiments. The construction and testing of these detectors are fully discussed.

In the upper mesosphere (70 Km to 90 Km) and lower thermosphere (50 Km to 200 Km), seasonal, geographical and temporal variations in the atmospheric molecular oxygen density profile are still largely unknown. As a result, significant uncertainties still exist with regard to "model" or "standard" atmospheres used to represent the molecular oxygen distribution.

In the present work, five rockets carrying lithium fluoride-nitric oxide ion chambers (which respond mainly to hydrogen Lyman-α radiation) have been launched from Woomera, Australia. The main objective of these experiments was the determination of the nature of seasonal variations in the molecular oxygen density profile in the altitude range 80 Km to 95 Km. Only two of the rockets, RAD 300 and RAD 310, performed satisfactorily. The RAD 309 experiment gave the