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ALTITUDE PROFILES OF INFRARED RADIANCE
OF O₃(9.6 µm) AND CO₂(15 µm)

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Abstract. The infrared spectrum of the upper atmospheric emissions between 7 and 23 µm has been measured with two spectrometers carried to high altitude by sounding rockets. Radiance profiles of O₃(9.6 µm) and CO₂(15 µm) radiations have been obtained to nearly 100 and 750 km, respectively.

The emission spectrum of the upper atmospheric infrared emissions between 7 and 23 µm has been observed in the mesosphere and lower thermosphere by means of infrared spectrometers carried on sounding rockets. Two measurements were made in the auroral zone at the University of Alaska's Poker Flat Research Facility (65° N lat.) using Black Brant rockets. The first rocket (18.006-2) was launched at 0213 Alaska Standard Time (AST) [1972] from a balloon launched at nearby Ft. Wainwright. Since the ozone 9.6-µm radiation is optically thick, a detailed radiative transport computation must be accomplished in order to derive a volume emission rate profile. How-
ever, the slope of the radiance profile indicates the existence of a secondary ozone layer at about 86 km, well above the main ozone layer which would be below the lowest altitude of measurement (40 km). Apparently, this observation is the first reported wherein this upper ozone layer has been seen in infrared emission. It has previously been observed by solar ultraviolet absorption [Miller and Ryder, 1973].

The emission at 15 μm, which persists to an altitude of about 150 km, is thermal emission from the ν2 infrared fundamental bands of carbon dioxide (667.3 cm⁻¹) in the ground electronic state (1Σg). The zenith peak spectral radiance altitude profiles of the 15-μm band observed on each flight are shown in Figure 3. A computation of volume emission rate profiles requires a detailed radiative transfer analysis since CO₂ is optically thick at the lower altitudes. Analyses of this and the other infrared emission features observed in these experiments are being made by us and our co-workers and will be reported at a future date. Also being studied is the possible association of the observed emissions with auroral activity.

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Agency. The flights were part of the Defense Nuclear Agency's ICECAP infrared measurements program. The rocket payload was developed and flown under Ed McKenna, Ned Wheeler, and Dean Kimball of AFCRL. James Rogers materially assisted in the reduction and analysis of the data.

References


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