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3.1.1 A MODEL FOR GRAVITY-WAVE SPECTRA OBSERVED BY DOPPLER SOUNDING SYSTEMS

T. E. VanZandt

Aeronomy Laboratory
National Oceanic and Atmospheric Administration
Boulder, Colorado 80303

It has been proposed that mesoscale fluctuations of wind and temperature in the free atmosphere are due to internal gravity (buoyancy) waves (VANZANDT, 1982). Critical tests of this hypothesis must involve the comparison of models based on the theory of gravity waves with suitable measurements. The MST radar technique is particularly attractive for this purpose, because it can measure several independent power spectra simultaneously. However, because of the complexities of the geometry of the MST radar experiment, which measures the radial velocity as a function of radial range and time, and the particular geometry of buoyancy waves, the relation between the observed spectra and the usual description of buoyancy wave spectra is not simple.

In this paper a model for MST radar spectra is developed following the formalism presented by PINKEL (1981). Expressions for the one-dimensional spectra of radial velocity versus frequency and versus radial wave number are presented. Their dependence on the parameters of the gravity-wave spectrum and on the experimental parameters, radar zenith angle χ and averaging time T_{av}, are described and the conditions for critical tests of the gravity-wave hypothesis are discussed (VANZANDT, 1985). SMITH et al. (1985) compare the model spectra with spectra observed in the Arctic summer mesosphere by the Poker Flat radar.

This model applies to any monostatic Doppler sounding system, including MST radar, Doppler lidar and Doppler sonar in the atmosphere, and Doppler sonar in the ocean.

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