3.5.2 CLIMATOLOGY OF TROPOSPHERIC VERTICAL VELOCITY SPECTRA

W. L. Ecklund, K. S. Gage, B. B. Balsley, and D. A. Carter

Aeronomy Laboratory
NOAA
Boulder, Colorado 80303

In this brief report, we show vertical velocity power spectra obtained from Poker Flat, Alaska; Platteville, Colorado; Rhone Delta, France; and Ponape, East Caroline Islands using 50-MHz clear-air radars with vertical beams. The spectra were obtained by analyzing the quietest periods from the one-minute-resolution time series for each site. The lengths of available vertical records ranged from as long as 6 months at Poker Flat to about 1 month at Platteville.

The quiet-time vertical velocity spectra are shown in Figure 1. Spectral period ranging from 2 minutes to 4 hours is shown on the abscissa and power spectral density is given on the ordinate. The Brunt-Vaisala (B-V) periods (determined from nearby sounding balloons) are indicated by the arrows. All spectra (except the one from Platteville) exhibit a peak at periods slightly longer than the B-V period, are flat at longer periods, and fall rapidly at periods less than the B-V period. This behavior is expected for a spectrum of internal waves and is very similar to what is observed in the ocean (ERIKSEN, 1978). The spectral amplitudes in Figure 1 vary by only a factor of 2 or 3 about the mean, and show that under quiet conditions vertical velocity spectra from the troposphere are very similar at widely different locations.

Preliminary spectra from Liberal, Kansas and Christmas Island, Kiribati are indicated by hatched areas in Figure 1. These spectra were obtained from time series covering only 1 or 2 days and cannot be taken as being representative of quiet periods. It should be noted, however, that the shapes and amplitudes of the spectra from these two sites are similar to the spectra from the four other sites displayed in Figure 1.

REFERENCE

Eriksen, C. C. (1978), Measurements and models of fine structure, internal gravity waves, and wave breaking in the deep ocean, J. Geophys. Res., 83, 2989-3009.

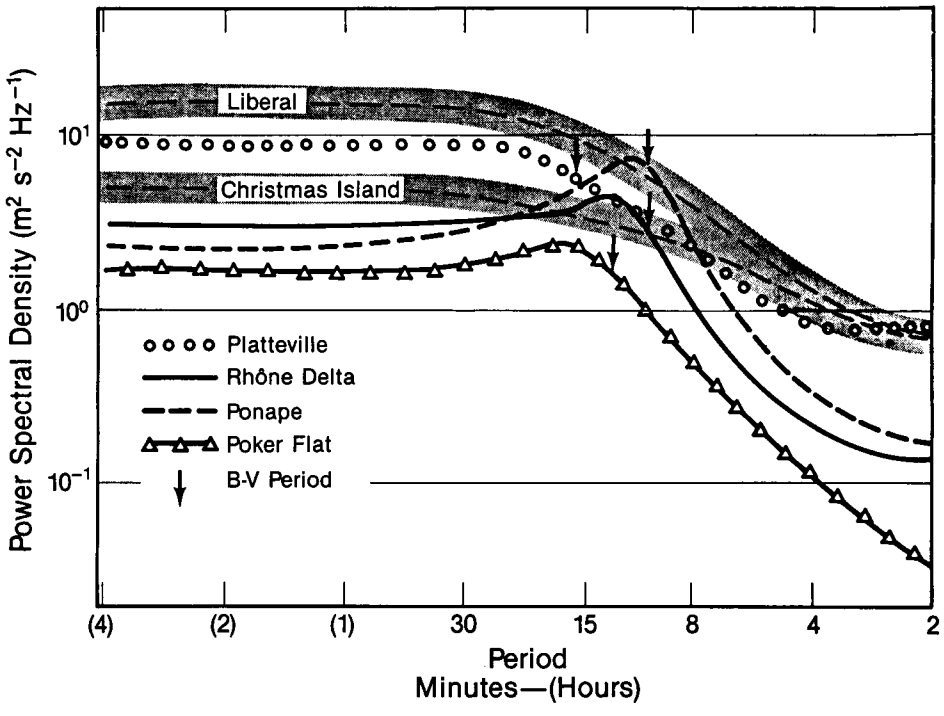
Liberal
Christmas Island
Platteville
Rhône Delta
Ponape
Poker Flat
B-V Period
Power Spectral Density (m² s⁻² Hz⁻¹)
10¹
10⁰
10⁻¹
(4)
(2)
(1)
30
15
8
4
2
Period
Minutes—(Hours)

Figure 1.