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4.2C HIGH RESOLUTION EVIDENCE FOR THE GARRETT-MUNK SPECTRUM OF STRATOSPHERIC GRAVITY WAVES

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Vertical profiles of scalar horizontal winds have been measured at high resolution (10 m) in the 13 to 37 km region of the stratosphere (DEWAN et al., 1984a,b). This resolution (at that range of altitude) represents the state-of-the-art, and is unique. The technique used smoke trails laid by rockets in the stratosphere, and were taken by AFGL at Wallops Island, VA, White Sands Missile Range, NM, and Ft. Churchill, Canada, in the 1977-78 time period. Two or three cameras were used to give the time-lapse photographs. Our goal was to ascertain whether or not the internal waves of the stratosphere behave consistently with the Garrett-Munk model which was originally created for oceanic internal waves. Five profiles of horizontal wind are presented in Figures 1 through 5; their power spectral densities (PSDs) are shown superposed on Figure 6, and their average is shown on Figure 7. It is found that (1) they closely fit a straight line on a log-log graph even to wavelengths as small as 40 m, and (2) the average slope is -2.7 .2 (standard error = 0.1). We conclude that (1) stratospheric internal waves obey the Garrett-Munk model for vertical wave numbers, (2) there is not statistically significant evidence for a break in the curve at high wave numbers when due allowance is made for aliasing effects, and (3) the power density level of the spectra are almost equal on a log-log scale in spite of the difference in time, season, and geographical location.

REFERENCES

Dewan, E. M., N. Grossbard, A. F. Quesada, and R. E. Good (1984a), Spectral analysis of 10 m resolution scalar velocity profiles in the stratosphere, Geophys. Res. Lett., 11, 80-83.

Dewan, E. M., N. Grossbard, A.F. Quesada, and R. E. Good (1984b), Correction, Geophys. Res. Lett., 11, 624.

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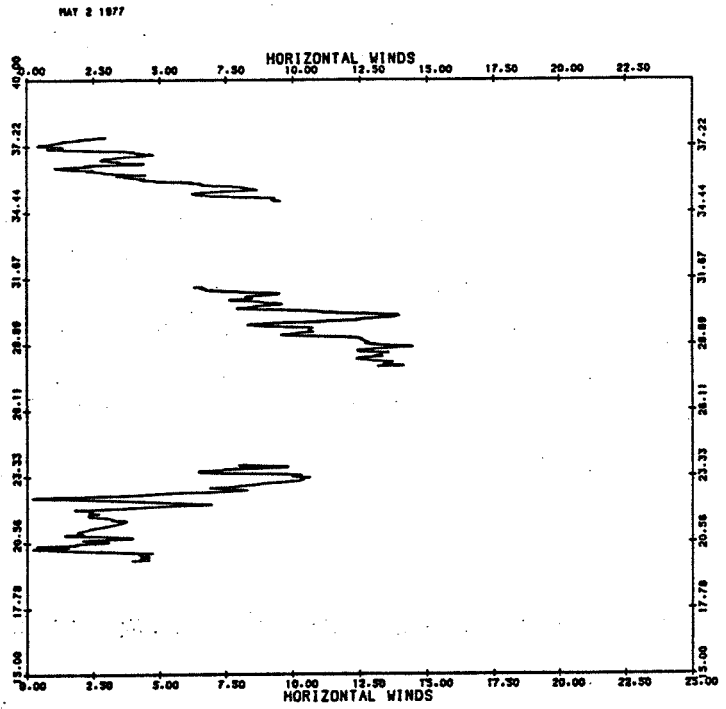

Figure 1. Profile of horizontal winds, May 2, 1977.

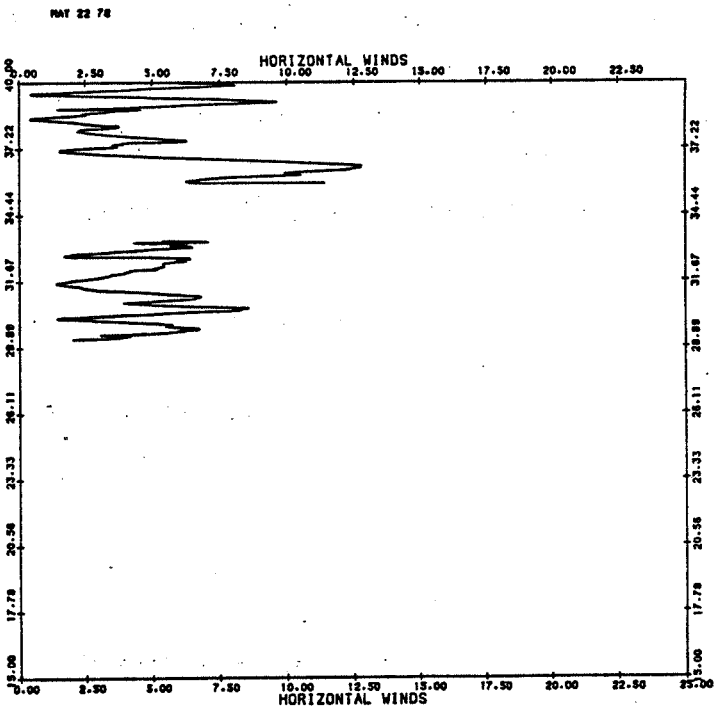

Figure 2. Profile of horizontal winds, May 22, 1978.

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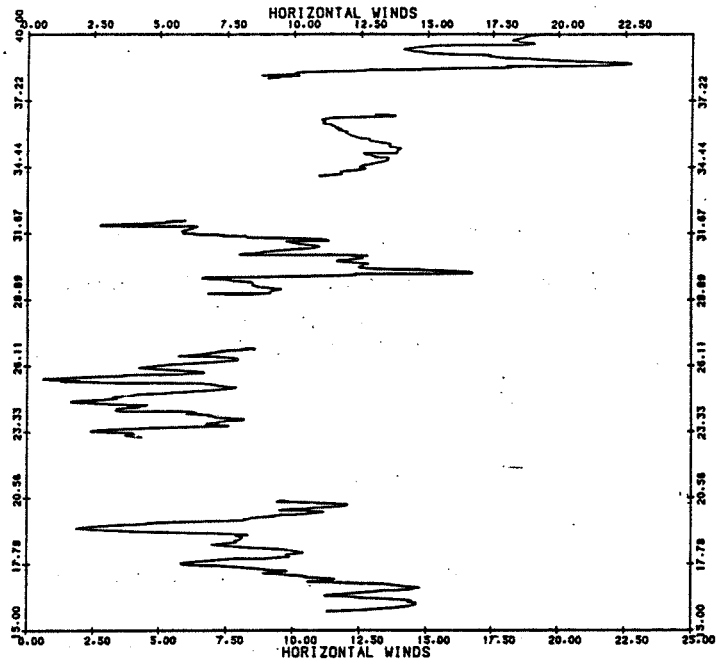

Figure 3. Profile of horizontal winds, September 12, 1978.

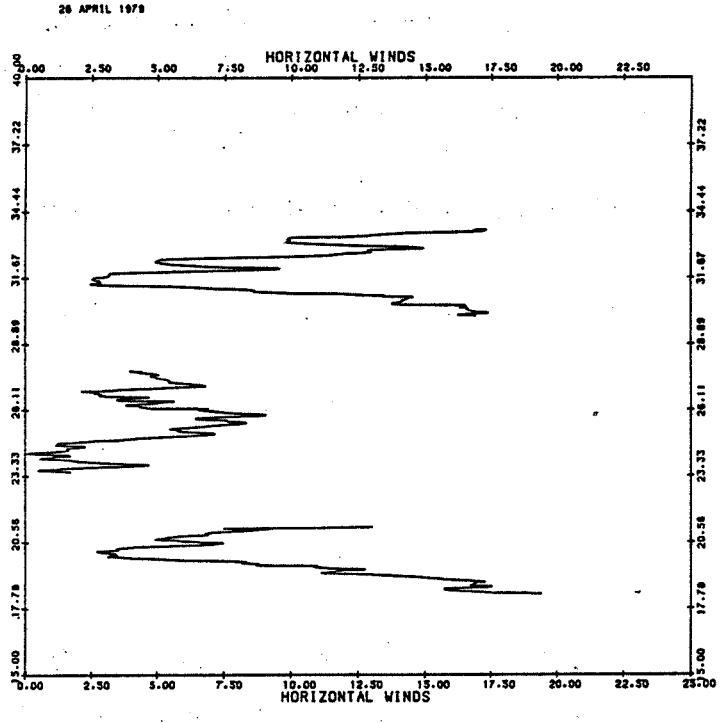

Figure 4. Profile of horizontal winds, April 26, 1979.

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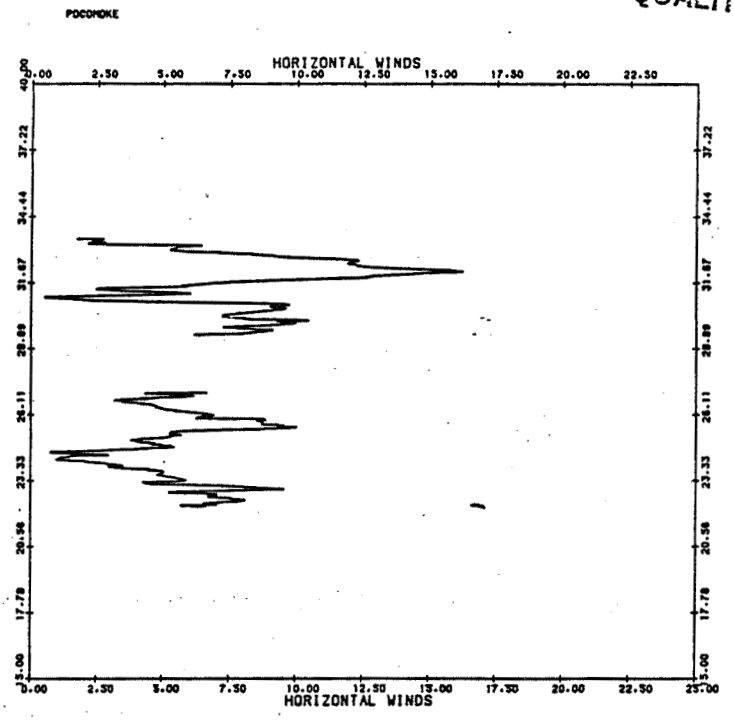
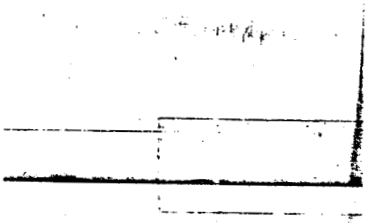


Figure 5. Profile of horizontal winds, Pocomoke.



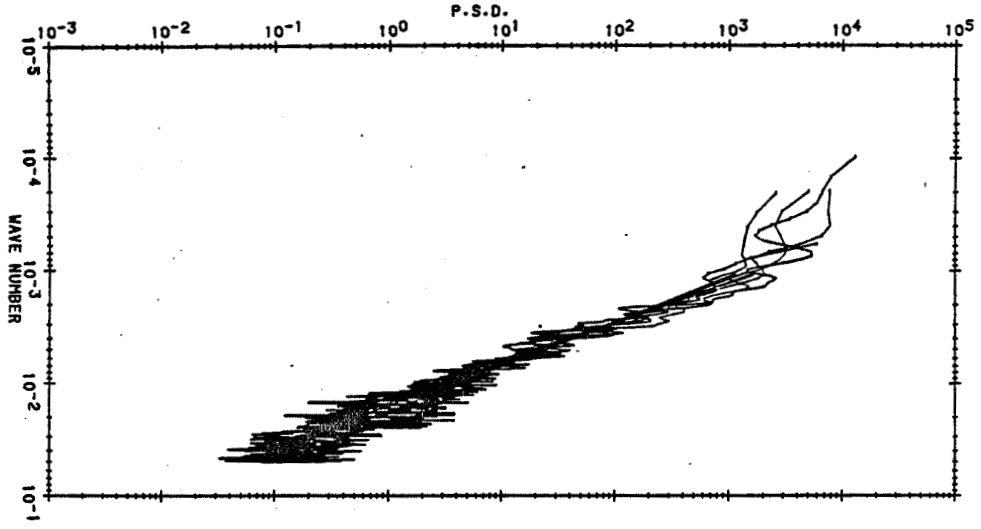


Figure 6. Superposed power spectral densities of all profiles.

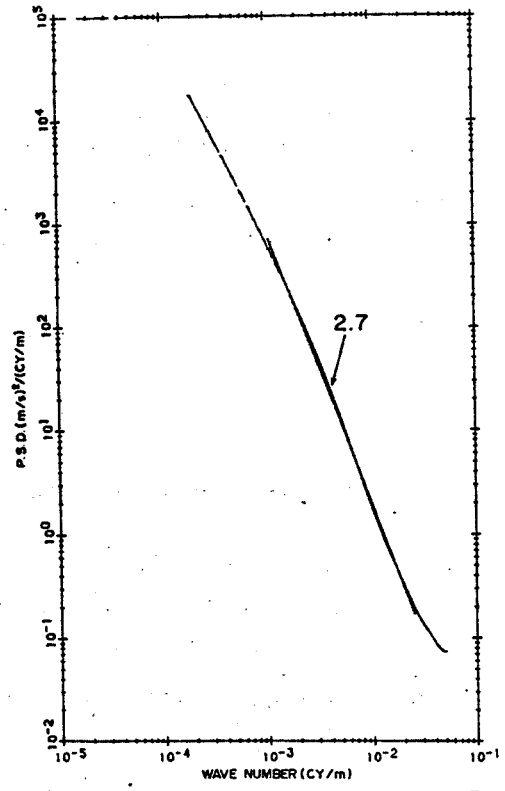


Figure 7. Averaged power spectral densities of all profiles.