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P.2 SEASONAL VARIATION OF TURBULENCE INTENSITIES IN THE UPPER MESOSPHERE AND LOWER THERMOSPHERE MEASURED BY RADAR TECHNIQUES

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Since February 1985, the 2-MHz narrow beam radar operated by the University of Adelaide in Australia has been used to measure the short-term root-mean-square fluctuating velocities of radio wave scatterers in the upper middle atmosphere (80 - 100 km). These measured fluctuations are caused by a mixture of turbulence and gravity waves, and under certain reasonable assumptions the turbulent contribution can be extracted. The results of these measurements were discussed in detail by Hocking [1988]. This paper summarizes these results and extends the data set to include 1987.

Hocking, W. K., *J. Geophys. Res.*, *93*, 2475, 1988.

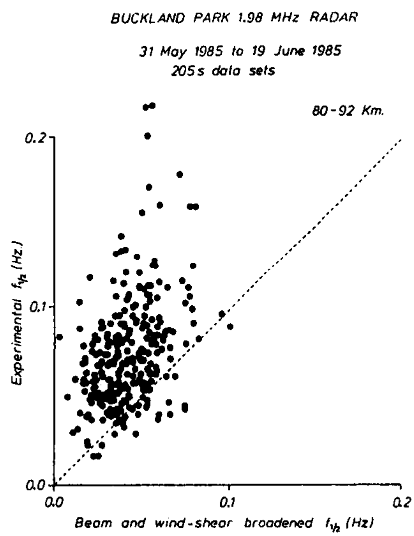

Figure 1. Scatter plot of experimental spectral half-power half width, compared to the half-power half width expected for isotropic scatterers in the absence of any fluctuating motions of the scatterers.

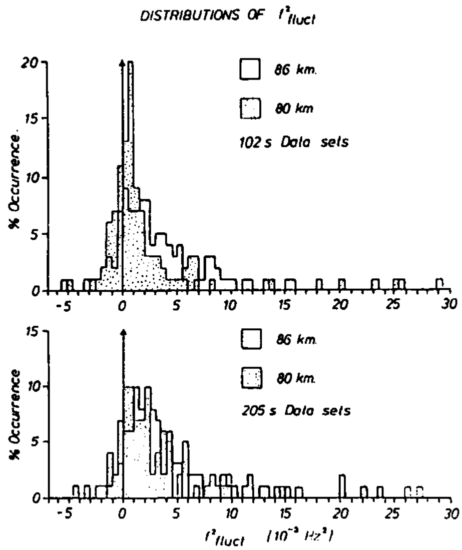

Figure 2. Histograms of frequency of occurrence of various classes of spectral width, $f_{(fluct)}$ being the spectral width measured after the removal of beam and wind-shear broadening. Values for $f_{(fluct)}$ greater than about 0.010 - 0.015 clearly lie in the "tail" of the distribution, and may arise due to effects unrelated to turbulence. For statistical reasons, some values were negative, but by far the majority were positive (generally > 85%) indicating real contributions due to turbulence and wave effects.

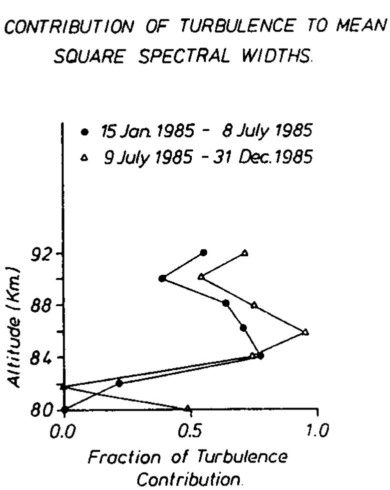

Figure 3. Fraction of experimentally observed spectral widths due to the turbulence for spectral widths deduced from 102 s data set. The remaining contribution was due to gravity waves of short period.

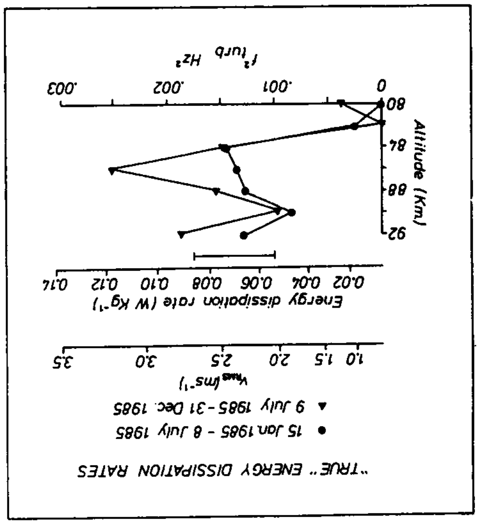

Figure 4. Height profiles of energy dissipation rates deduced for the periods January to June 1985, and July to December 1985, after removal of contamination due to gravity waves. The typical "standard error" is also given, although again it must be noted that a large part of this is due to natural fluctuation.

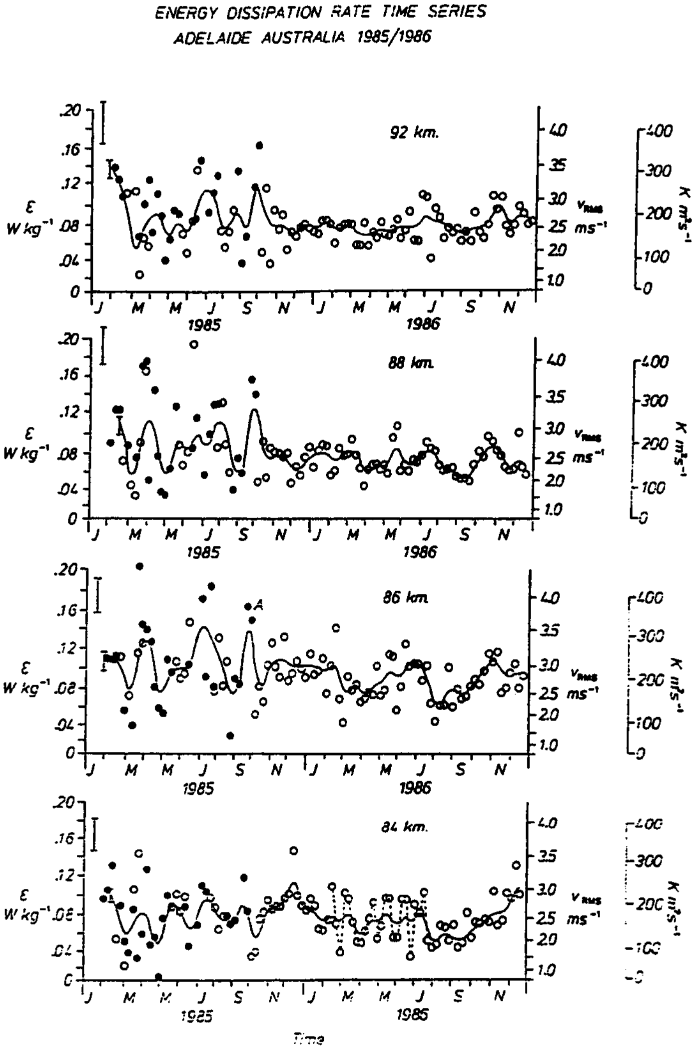

Figure 5. One-week averages of turbulent energy dissipation rates as a function of time for altitudes of 84, 86, 88 and 92 km. The 90-km plot is fairly similar to 92 km. Solid dots represent data collected using 102 s data lengths, and the open circles represent data collected using 205 s data lengths. The solid lines represent five point running means of the weekly averages. Error bars for individual means are shown (top left) and error bars for the running mean are also given. Note that the vertical spacing of the axis is not uniform, because $f^2_{(fluct)}$ was actually plotted, and then the axis rescaled. RMS fluctuating velocities are also shown to the right. The energy dissipation rates have also been plotted as "eddy diffusion coefficients", K, where $K - c\varepsilon/N^2$, N being the Brunt-Väisälä frequency and c being taken as 1.0.

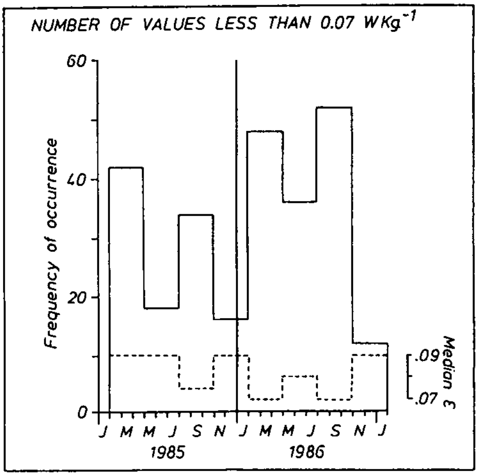

Figure 6. Histograms of the frequency of occurrence of values of less than 0.07 W kg^{-1}, in 3-month intervals (solid line). The dashed line shows the medians of the 1985 and 1986 data in the same 3-month groups for all data at the heights 84, 86, and 88 km.

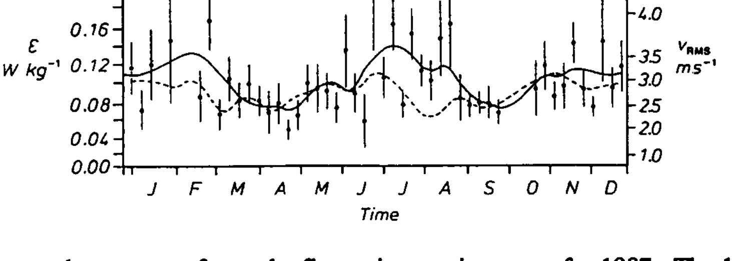

Figure 7. One week averages of ε, and a five-point running mean for 1987. The 1986 five-point running mean is also superimposed. These data show the clearest evidence of any of the three years 1985=1987 for a semiannual oscillation. (In 1987, all data were recorded using 102 s data blocks.)