N89-29921

P.3 A COMPARISON OF RADAR MEASUREMENTS OF ATMOSPHERIC TURBULENCE INTENSITIES BY BOTH C_n^2 AND SPECTRAL WIDTH METHODS

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There are two main techniques by which turbulence intensities in the atmosphere can be measured by radars. One is to utilize the absolute backscattered power received by the radar, and use this to deduce C_n^2. With appropriate assumptions, this parameter can then be converted to an energy dissipation rate. The second method utilizes the width of the spectrum of the signal received by the radar. Neither of these techniques have been used a great deal, and they have never been properly compared. Thus it has not been possible to determine the validity of the assumptions made in applying each technique, nor has it bee possible to determine the limitations of each method. This paper presents the first comparisons of the two techniques. Measurements were made with the Adelaide VHF ST radar, and the results of the comparisons will be discussed.

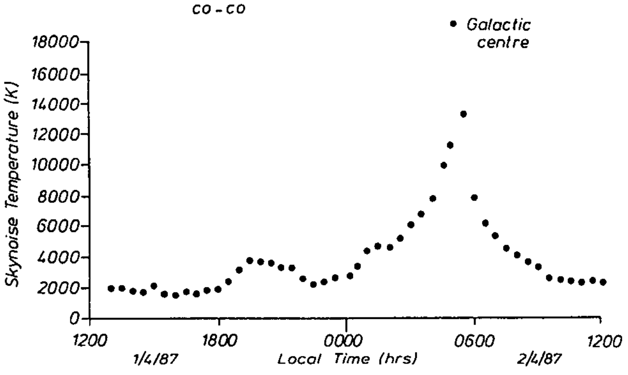

Figure 1. Sky noise temperature as a function of time of day.

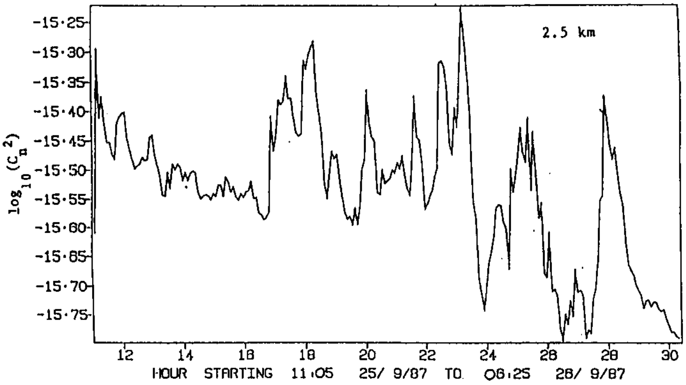

Figure 2. Typical C_n^2 values plotted over a 20-hour period in 1987.

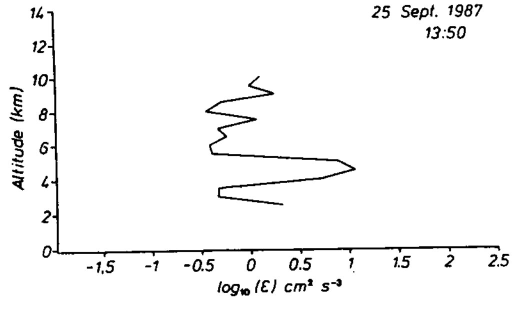

Figure 3. Typical height profile of energy dissipation rates determined by the C_n^2 method.

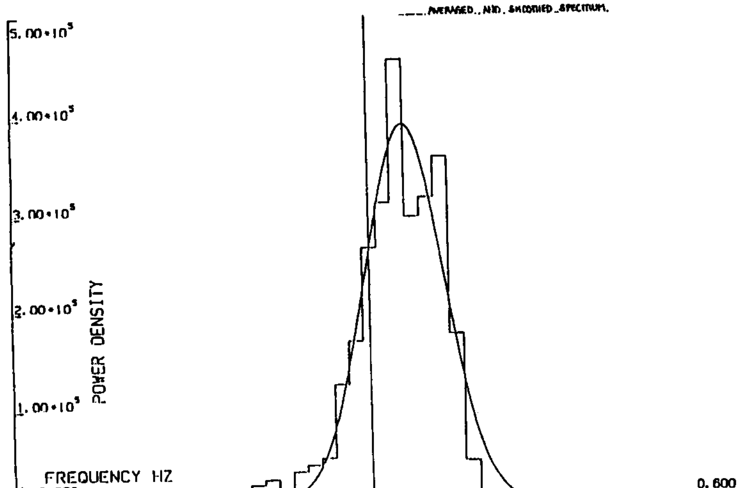

Figure 4. Typical spectrum recorded with the Adelaide VHF radar. The spectral points have been averaged into frequency bins and then a Gaussian function (plus constant offset) fitted to the spectrum.

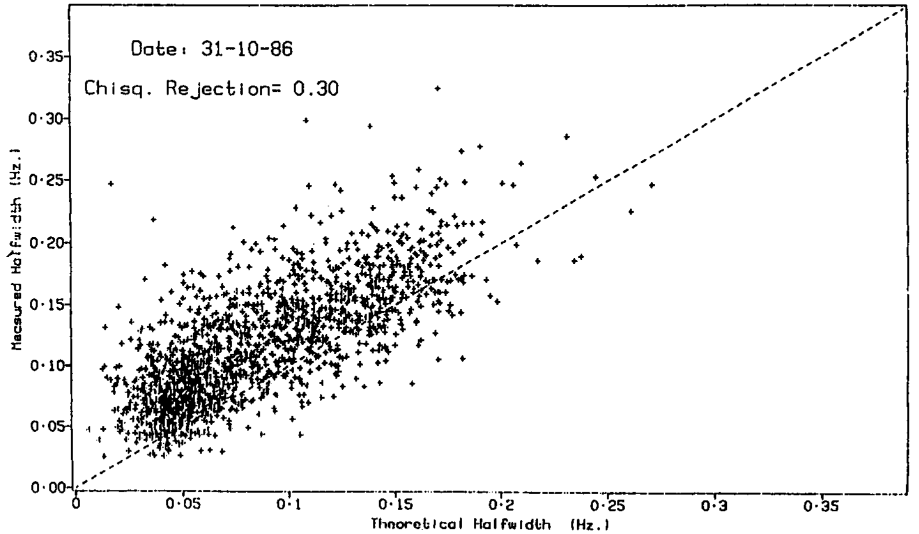

Figure 5. Scatter plot of experimental spectral half-power-half-widths versus the half width expected due to beam and wind-shear broadening ("instrumental"). If the only causes of the spectral widths were instrumental, the points should be scattered symmetrically about the broken line. Instead, they are predominantly above this line, indicating an extra contribution due to turbulence. There are points below the line, which arise due to statistical effects and also possibly due to the effects of specular reflectors, although attempts have been made to remove the latter contribution. By using sufficient averaging, these statistical fluctuations are reduced.

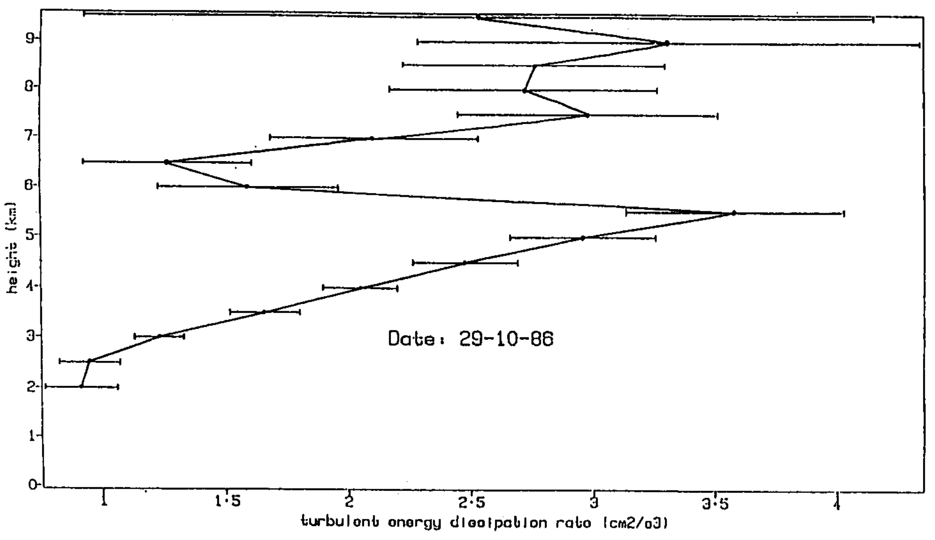

Figure 6. Typical height profile of mean energy dissipation rates, averaged over a 24-hour period.

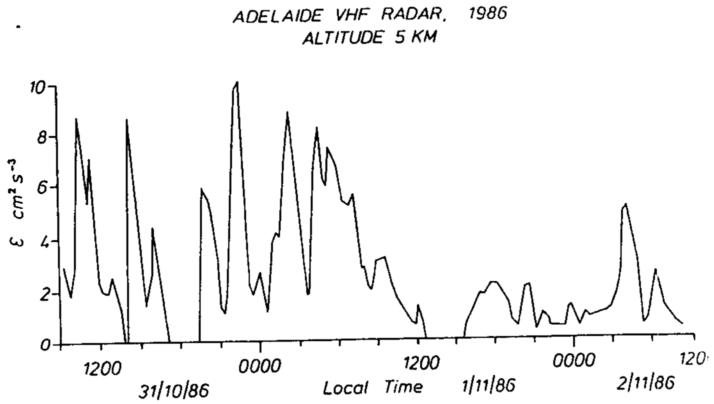

Figure 7. Time sequence of hourly mean turbulent energy dissipation rates for an altitude of 5 km in October and November 1986.

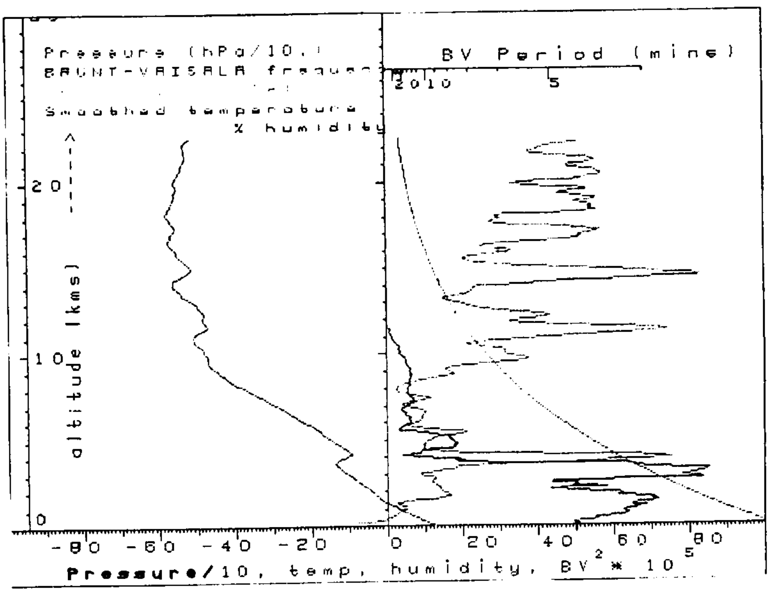

Figure 8. Height profiles of temperature, humidity and Brunt-Väisälä frequency for October 31, 1986 at 0730 local time (30 October 1986 at 2200 GMT). This radiosonde release was made just prior to the data runs shown in Figure 7.