A statistical analysis of the turbulent kinetic energy dissipation rate estimated from the PMWE spectral width in the Antarctic

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The radar volume reflectivity and turbulent kinetic energy dissipation rate in the Antarctic mesosphere have been estimated from the polar mesosphere winter echoes (PMWE) using a vertical beam of the PANSY radar, which is a Mesosphere-Stratosphere-Troposphere radar, at Syowa Station (69˚S, 40˚E) over four years. The radar volume reflectivity exhibits a lognormal distribution in the range of 2×10^{-18}–5×10^{-15} m^{-1} for a height region of 55–82 km. The turbulent energy dissipation rate estimated from the spectral width of the PMWE ranges from 3×10^{-5}–3×10^{-1} m^2s^{-3}. From monthly histograms of the turbulent energy dissipation rate for a fixed solar zenith angle and altitude, it is revealed that the summer-to-winter transition of the turbulent energy dissipation rate occurs in March, while the winter-to-summer transition occurs in September. This seasonal variation accords well with that of gravity wave activity, suggesting that the turbulence in the mesosphere is likely caused by the gravity wave breaking.

Keywords: Mesosphere, Turbulent energy dissipation rate, Polar Mesosphere Winter Echoes, MST radar

