Turbulent kinetic energy dissipation rates depending on the polar vortex and on synoptic-scale disturbances in the UTLS region in the Antarctic

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The turbulence kinetic energy dissipation rate (TKEDR) is a fundamental parameter describing atmospheric turbulence. Our previous study reported the first estimation of the TKEDR in the free atmosphere in the Antarctic from atmospheric radar measurements at Syowa Station, and showed that the TKEDR in the 10–15 km height range became large in May through October. This fact suggests that the seasonal evolution of polar vortex has impact on the TKEDR in the upper troposphere and lower stratosphere (UTLS). The present study investigates the dependence of the TKEDR on the relative location to the polar vortex and on each phase of synoptic scale disturbances during austral winter in the UTLS region using the radar measurements at Syowa Station. First, the TKEDR is obtained as a function of the relative distance from the edge of the polar vortex. The edge of the polar vortex was determined from Ertel's potential vorticity on 475 K isentropic surface (Nash et al., 1996). The result showed that the TKEDR is significantly large near the polar vortex edge compared to that outside and deep inside the polar vortex. Furthermore, it is clarified that the TKEDR largely depends on synoptic-scale PV perturbation around the tropopause (300 K isentropic surface).