Time variations of PMWE and turbulent energy dissipation rates after the stratospheric warming in the Southern Hemisphere in 2019

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The radar volume reflectivity and turbulent kinetic energy dissipation rate in the Antarctic mesosphere were estimated from the polar mesosphere winter echoes (PMWE) detected using a vertical beam of the PANSY radar, a Mesosphere-Stratosphere-Troposphere radar at Syowa Station (69°S, 40°E), over four years. In an earlier study, we showed that the summer-to-winter increase in energy dissipation rates occurs in March, while the winter-to-summer decrease occurs in September (Kohma et al., 2020).

In the present study, we examined the time variations of PMWE volume reflectivity and turbulent energy dissipation rates associated with the sudden stratospheric warming (SSW) in September 2019 in the Southern Hemisphere. We found a decrease in the frequency of PMWE occurrence from early September to October when the SSW occurred. We also found that the frequency of large turbulent energy dissipation rates ($>2\text{x}10^{-3}$ m^2s^{-3}) was reduced compared to the average for 2016-2018. This is likely due to the modulation of gravity wave propagation by the SSW, resulting in less gravity wave breaking, which is the main source of the turbulence. This result suggests that the decrease in turbulence intensity is at least partly responsible for the decrease in the frequency of PMWE.