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Observations of spectra of polar mesospheric summer echoes at 224 MHz using EISCAT radar during particle precipitation events – Some case studies from July 2019

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We present the initial results from investigation of polar mesospheric summer echoes (PMSE) spectra at 224 MHz observed by EISCAT VHF radar operated from Ramfjordmoen near Tromsø during July 2019. Since EISCAT UHF measurements were not available, we used the sudden enhancements in electron densities derived from the VHF observations above 90 km as indicators of particle precipitation. We note that the altitude extent of the PMSE increased along with an enhancement of the strength of the pre-existing PMSE. However, a closer examination reveals that the PMSE strengths vary significantly between different heights in the region of 80 to 90 km. Interestingly, the spectral widths show well separated regimes between the top and the bottom part of the PMSE layers following particle precipitation. In the altitudes where the maximum enhancement in PMSE backscatter occurred, there is no corresponding enhancement in the spectral widths. The frequency Doppler shifts showed alternating upward and downward motions without much difference before and after the particle precipitation. This indicates that the moderate levels of particle precipitation observed herein did not affect the vertical winds considerably. Further, after the particle precipitation subsided, the PMSE intensities continued to be stronger for a while.