

Experimental and theoretical studies of PMSE / PMWE incoherent scatter radar spectra

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Polar Mesosphere Summer/Winter Echoes, PMSE/PMWE, are layered phenomena in the mesosphere. PMSE are thought to be due to strong enhancement of the scattered signal due to the presence of small charged ice-aerosols of several nanometers radius. Low summer temperatures in the mesosphere provide favorable conditions to form ice particles. Meanwhile winter mesosphere temperatures are much too high for ice to form. There is no commonly accepted explanation for PMWE so far. Several possible sources for PMWE have been proposed such as strong turbulence due to wave-breaking or wind shear, thin layers of positively charged meteoric dust particles, highly-damped ion-acoustic waves and fluctuations in electron density due to chemical reactions.

Here we present an analysis of incoherent scatter spectra both for PMWE and PMSE observed by the 224 MHz EISCAT radar. We compare theoretical spectra of the incoherent scattered signal with experimental ones and try to explain spectral characteristics of layered phenomena in the mesosphere. Special attention is paid to the charged aerosol effect on PMWE and PMSE spectra. At the same time, we try to verify existing theories concerning incoherent scatter radar spectra in the D-region.