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Polar Mesosphere Winter Echoes: evidence for a turbulent process

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Polar Mesosphere Winter Echoes (PMWE) are relatively strong radar echoes from the mesosphere region during winter. PMWE is a rare phenomenon, with an occurrence rate of 1-3%, as opposed to the more well-known and frequently occurring Polar Mesosphere Summer Echoes (PMSE), which have an occurence rate of about 80%. Another difference between PMWE and PMSE is that PMWE occur in the lower and middle mesosphere (50-80 km), while PMSE occur in the mesopause region (80-85 km). In January 2005, two small, instrumented rockets were launched from Andøya Rocket Range (69.3°N, 16°E) in Norway during conditions with large solar proton fluxes and strong PMWE. The instrumented rockets were equipped with a Positive Ion Probe (PIP) with which we measured fluctuations in positive ion densities. A wavelet analysis of the data reveals turbulence with an inner scale of 10 m or less. Turbulent spectra were only found inside the altitude ranges with PMWE, but not outside, strongly suggesting that PMWE is caused by turbulence.