

# **EISCAT observation of wave-like fluctuations in vertical velocities and polar mesospheric summer echoes (PMSE) associated**

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In the summer polar mesosphere (~80-90 km) the high-energy electron precipitation plays an important role in producing polar mesospheric summer echoes (PMSE). PMSE is usually observed in wave-like feature at periodicities of 5-30 min. The wave-like feature has been mostly attributed to propagating gravity waves from the lower atmosphere. However, in this study we present an alternative explanation for the wave-like feature of PMSE.

From the EISCAT VHF radar dataset of Tromsø, simultaneous increases of both radar reflectivity of PMSE and upward velocity of ions were observed for the first time at the commencement of local geomagnetic disturbance on July 9-10, 2013. The synchronous onset of upward velocities occurred in the altitude range of 70-105 km, followed by periodic repetition of ~5 min during the initial 30 min period. At the same time both PMSE (85-90 km) and electron densities (75-105 km) varied at ~12 min periodicity. For the next 60 min, PMSE and electron densities showed the primary periodicity of ~13 min with the secondary periodicity of 18 min close to that of vertical velocity (20 min). The periodic vertical oscillation of ~5 min during the initial phase may be due to buoyancy waves that were triggered by the effects of high-energy electron precipitation. The periodicities of 12-13 min and 18 min in PMSE and electron densities are close to pulsating periods of geomagnetic field. We discuss the possibility that precipitating high-energy electrons are modulated by the geomagnetic pulsation and thus cause the vertical velocity and PMSE oscillations at longer periodicities of 18-20 min.