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## Rocket measurements of positive ions during polar mesosphere winter echo conditions

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**Abstract.** On 18 January 2005, two small, instrumented rockets were launched from Andøya Rocket Range (69.3° N, 16° E) during conditions with Polar Mesosphere Winter Echoes (PMWE). Each of the rockets was equipped with a Positive Ion Probe (PIP) and a Faraday rotation/differential absorption experiment, and was launched as part of a salvo of meteorological rockets measuring temperature and wind using falling spheres and chaff. Layers of PMWE were detected between 55 and 77 km by the 53.5 MHz ALWIN radar. The rockets were launched during a solar proton event, and measured extremely high ion densities, of order  $10^{10} \text{ m}^{-3}$ , in the region where PMWE were observed. The density measurements were analyzed with the wavelet transform technique. At large length scales,  $\sim 10^3 \text{ m}$ , the power spectral density can be fitted with a  $k^{-3}$  wave number dependence, consistent with saturated gravity waves. Outside the PMWE layers the  $k^{-3}$  spectrum extends down to approximately  $10^2 \text{ m}$  where the fluctuations are quickly damped and disappear into the instrumental noise. Inside the PMWE layers the spectrum at smaller length scales is well fitted with a  $k^{-5/3}$  dependence over two decades of scales. The PMWE are therefore clearly indicative of turbulence, and the data are consistent with the turbulent dissipation of breaking gravity waves. We estimate a lower limit for the turbulent energy dissipation rate of about  $10^{-2} \text{ W/kg}$  in the upper (72 km) layer.

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