

Observations of ionospheric echoes with extreme Doppler spectral width in the nightside auroral and sub-auroral ionosphere

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Abstract. The Tasman International Geospace Environment Radar (TIGER) (43.4°S, 147.2°E; -54.5°Λ) records echoes from decametre-scale ionospheric irregularities in the nightside high-latitude ionosphere between -57°Λ and -88°Λ. Separate echo populations have been identified including: (1) echoes with low spectral width and a mode value of $\sim 9 \text{ m s}^{-1}$ (bin size of 2 m s^{-1}) concentrated in the auroral and sub-auroral ionosphere (population A), (2) echoes with high spectral width and a mode value of $\sim 70 \text{ m s}^{-1}$ concentrated in the polar cap ionosphere (population B), and (3) echoes with extremely large spectral widths and a mode value of $\sim 1300 \text{ m s}^{-1}$ concentrated in the auroral and sub-auroral ionosphere (population C). Some other characteristics of population C echoes include: (a) they occur intermittently throughout the year, but are sometimes concentrated in “bursts” during 1000 to 1400 UT (~ 2030 to 0030 MLT), (b) the bursts occur during quiet geomagnetic conditions, but they are more likely to occur during disturbed conditions, (c) they occur at ranges $\leq 1485 \text{ km}$ (range gate ≤ 29) (i.e. on closed field lines), (d) more of them occur on the zonal eastward beam numbers (15, 14, etc.) than on the meridional beam numbers < 8 , (e) the LOS Doppler velocities take on randomly large positive and negative values, and (f) the ACFs de-correlate very rapidly, usually within a single lag length of 2400 μsec , suggesting the corresponding irregularities have an extremely short lifetime (reminiscent of lightning). We do not understand the underlying physical cause of population C echoes, and they may be artefacts caused by interference.