

Spectral width of F-region Syowa East SuperDARN echoes

A.V. Koustov^{1,2}, N. Nishitani¹, D. Mori², and A.S. Yukimatu³

¹*Solar Terrestrial Environment Laboratory, Nagoya University, Nagoya, Japan*

²*Institute of Space and Atmospheric Studies, U of Saskatchewan, Saskatoon, Canada*

³*National Institute of Polar Research, Tokyo, Japan*

Spectral width (SpW) of the Antarctica SuperDARN radars has been investigated in a number of publications, e.g. Hosokawa et al. (2002) and Nishitani et al. (2004). It has been established later (e.g., Ponomarenko et al., 2006) that the SpW of F-region echoes must be considered in units of inverse seconds rather than the traditional consideration in units of meters per second. In addition, the processing technique had been changed in ~2008 so that fewer spectra are now qualified as a reliable measurement. These changes warrant a full-scale statistical study of the SpW of the F-region echoes. This is more urgent in view of recent preliminary reports that the polar cap echoes (in the northern hemisphere) show unusual properties such as a strong latitudinal (or range) variation, dependence on the electric field magnitude and virtually no flow angle variation. This prompts a question as to whether F-region echoes at the auroral zone latitudes show similar features. In this report, we investigate spectral width data of the Syowa East SuperDARN radar in beams 0-1, oriented almost perpendicular to the magnetic L-shells as illustrated in Fig. 1a by color. We show that, statistically speaking, the width increases with range (Magnetic Latitude, MLAT), Fig. 1b, with stronger effect winter time, Fig. 1b. We also compare SYE and McMurdo (MCM) SpW histogram distributions for observations at MLATs~80° in radar beams 0-1, Figs. 1c,d. Although the radar geometry of observations is comparable, SYE (MCM) radar waves travel through more turbulent (uniform) media (auroral oval vs polar cap) so that one might expect larger widths for SYE. The SpW distributions are shown to be very comparable, Figs. 1c,d although SYE has more narrow echoes. Other features of the SYE SpW will be discussed.

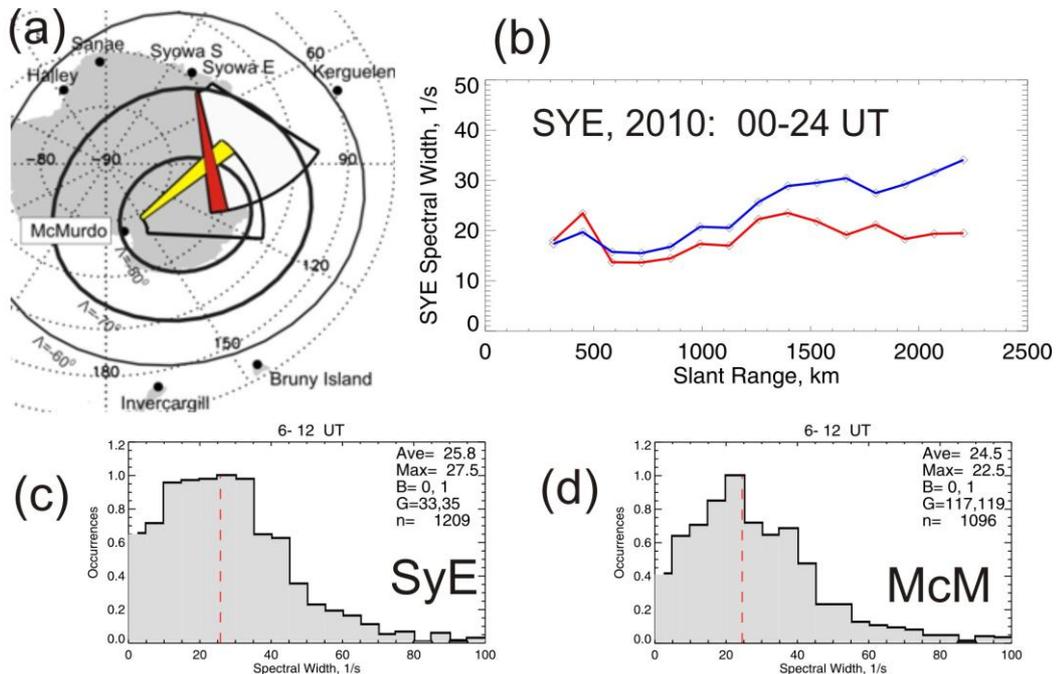


Figure 1. (a) Fields of view of the Syowa East (SYE) and McMurdo (MCM) radars, colored are locations of beams 0-1, (b) range variations of a typical SYE spectral width for observations in June (blue, winter) and December (red, summer) 2010 and (c) SYE and (d) MCM histogram distributions of the spectral width for observations between 06 and 12 UT in December 2010 at magnetic latitudes of ~80°.

References

- Hosokawa et al., Statistical characteristics of Doppler spectral width as observed by the conjugate SuperDARN radars, *Ann. Geophys.*, 20,1-11, 2002.
- Nishitani, N. et al., Unusual ionospheric echoes with high velocity and very low spectral width observed by the SuperDARN radars in the polar cap during high geomagnetic activity, *J. Geophys. Res.*, 109, A02311, doi:10.1029/2003JA010048, 2004.
- Ponomarenko, P.V. and C.L. Waters, Spectral width of SuperDARN echoes, *Ann. Geophys.*, 24, 115-128, 2006.