

Identification of ionospheric plasma density changes due to solar flares and energetic particle precipitation using the SuperDARN radar data

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Watanabe and Nishitani (Adv. Polar Sci, 2013) showed that during solar flares the SuperDARN data show positive Doppler velocities in ground / sea scatter echoes, and that this velocity change can be interpreted mainly in terms of the abnormal ionization of the D-region ionosphere due to EUV / X-ray, leading to the shortening of the HF ray paths. They also showed that it is possible to identify the plasma density changes from the Doppler velocity distributions. These result suggests that it might be possible to identify the D-region plasma density changes due to energetic particle precipitation events such as substorms using the same technique.

Ionospheric convection around substorm expansion onset are characterized by reduction of sheared flow and enhancement of equatorward flows (e.g., Bristow et al., J. Geophys. Res., 2007). However, there have been no studies on the effect of D-region HF wave absorption due to particle precipitation, which could lead to positive Doppler shift, which is independent of beam number but could be positively (negatively) correlated with the range (elevation angle) Initial result of the quantitative estimation of Doppler velocities associated with particle precipitation will be presented.

Keywords: SuperDARN radars, ionospheric plasma density change, solar flare / energetic particle precipitation