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Relativistic electron precipitations in association with diffuse aurora

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It has been widely thought that diffuse auroras are generated by electron precipitations in the energy range from a few keV to tens keV. Recent simulation results based on the quasi-linear theory showed that the scattering by whistler-mode waves plays an important role in the production of precipitating electrons responsible for diffuse auroras. A test particle simulation on electron-whistler interactions shows that relativistic electrons can be scattered into the loss cone simultaneously with the electrons in the energy range from a few keV to tens keV. Thus, it is expected that relativistic electrons precipitate into the atmosphere in association with diffuse auroras if whistler-mode waves contribute to generation of diffuse auroras. To examine this hypothesis, we investigated conjugate observations of SAMPEX and the all sky camera at Syowa Station on the dawn side, where diffuse auroras are frequently observed. In this study, we show a case study that relativistic electron ($>$1 MeV) precipitations observed by SAMPEX are associated with the diffuse aurora observed at Syowa Station. The SAMPEX observation shows that the enhancement of precipitating relativistic electrons are well correlated with that of precipitating $>$150 keV electrons, indicating that electrons in the energy range from a few keV to 1 MeV precipitate into the atmosphere simultaneously. It is observational evidence that whistler mode waves contribute to generation of diffuse auroras.

Keywords: diffuse aurora, whistler mode wave, relativistic electron, radiation belts, wave-particle interaction