Bi-directional electrons and their ionization in the ionosphere: ERG-EISCAT simultaneous observations

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We report the first direct comparison between bi-directional electrons in the magnetosphere at L=~7 and their effects on ionization in the ionosphere, based on coordinated ERG and EISCAT observations. The simultaneous observations show electron density enhancements prior to the bi-directional electrons and a small electric field spike accompanied by the bi-directional electrons, implying that this bi-directional electron event was generated through auroral acceleration processes near/in the plasma sheet boundary layer. The comparison also reveals that precipitating electron fluxes were quantitatively consistent with field-aligned fluxes of electrons estimated with the EISCAT data. The anti-parallel electron fluxes were smaller than the parallel fluxes at energies below ~3 keV and above ~14 keV, suggesting that the former was caused by a potential drop of ~3 kV below the satellite and the latter by a reflection process of secondary electrons in the ionosphere.