Geophysical Research Abstracts
Vol. 16, EGU2014-4551-1, 2014
EGU General Assembly 2014

A Reexamination of Latitudinal Limits of Substorm-Produced Energetic Electron Precipitation

Kathy Cresswell-Moorcock (1), Craig Rodger (1), Antti Kero (2), Andrew Collier (3), Mark Clilverd (4), Ingemar Häggström (5), Timo Pitkänen (6), and Ian Whittaker (1)

(1) University of Otago, Department of Physics, Dunedin, New Zealand (creal158@student.otago.ac.nz), (2) Sodankylä Geophysical Observatory, University of Oulu, Sodankylä, Finland, (3) SANSA Space Science, Hermanus, South Africa, (4) British Antarctic Survey (NERC), Cambridge, United Kingdom, (5) EISCAT Scientific Association, Kiruna, Sweden, (6) Department of Physics, University of Oulu, Oulu, Finland

The primary sources of energetic electron precipitation (EEP) which affect altitudes $<$100 km ($>$30 keV) are expected to be from the radiation belts, and during substorms. EEP from the radiation belts should be restricted to locations between L=1.5-8, while substorm produced EEP is expected to range from L=4-9.5 during quiet geomagnetic conditions. Therefore, one would not expect any significant D-region impact due to electron precipitation at geomagnetic latitudes beyond about L=10. In this study we report on large unexpectedly high latitude D-region ionization enhancements, detected by an incoherent scatter radar at L$\approx$16, which appear to be caused by electron precipitation from substorms. We go on to reexamine the latitudinal limits of substorm produced EEP using data from multiple low-Earth orbiting spacecraft, and demonstrate that the precipitation stretches many hundreds of kilometers polewards of the previously suggested limits. We find that a typical substorm will produce significant EEP over the IGRF L-shell range L=4.6($\pm$0.2)-14.5($\pm$1.2), peaking at L=6-7. However, there is significant variability from event to event; in contrast to the median case, the strongest 25% of substorms have significant EEP in the range spaning L=4.1($\pm$0.1)-20.7($\pm$2.2), while the weakest 25% of substorms have significant EEP in the range spaning L=5.5($\pm$0.1)-10.1($\pm$0.7).