POES SEM-2 OBSERVATIONS OF RADIATION BELT DYNAMICS AND ENERGETIC ELECTRON PRECIPITATION IN TO THE ATMOSPHERE

CRAIG J. RODGER[1], Mark A. Clilverd[2], Janet C. Green[3] and Mai Mai Lam[2]

[1]Department of Physics, University of Otago, Dunedin, New Zealand.
[2]Physical Sciences Division, British Antarctic Survey (NERC), Cambridge, United Kingdom.
[3]Space Weather Prediction Center, NOAA, Boulder, Colorado.

The coupling of the Van Allen radiation belts to the Earth's atmosphere through the effects of precipitating particles is an area of intense scientific interest. Currently, there are significant uncertainties surrounding the precipitating characteristics of medium energy electrons (>20 keV), and even more uncertainties for relativistic electrons. In this paper we examine roughly ten-years of measurements of trapped and precipitating electrons available from the Polar Orbiting Environmental Satellites (POES)/Space Environment Monitor (SEM-2) which has provided long-term global data in this energy range. Relativistic electron increases are associated with both interplanetary Coronal Mass Ejections (ICMEs) and periodic high speed solar wind streams (HSSWS). The processes triggered by ICMEs are roughly twice as effective at enhancing POES-observed electrons to relativistic energies as the processes triggered by HSSWS. We find that ICME-associated increases can extend down to L~2, while other enhancements are generally limited to L>3.5. Finally, during HSSWS conditions there is an energy-dependent time delay observed in the POES/SEM-2 observations, with the >800 keV relativistic electron enhancement delayed by ~1-week relative to the >30 keV electron enhancement, probably due to the timescales of the acceleration processes. One possible interpretation of this is a two-stage process, where relatively rapid acceleration initially takes place near the geomagnetic equator as predicted by theory and observed experimentally. This is followed by a much slower process, where the relativistic electrons scatter towards the atmosphere loss cone at a rate which is energy dependent. Such large delays should have consequences for the timing of the atmospheric impact of HSSWS-triggered geomagnetic storms.

radiation belts, relativistic electron precipitation

Craig J. Rodger, Department of Physics, University of Otago, P.O. Box 56, Dunedin, New Zealand.