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Electron precipitation spectra; a global view using DEMETER and POES

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The Detection of Electromagnetic Emissions Transmitted from Earthquake Regions (DEMETER) microsatellite electron flux instrument is comparatively unusual in that it has very high energy resolution (128 channels with 17.9 keV widths in normal survey mode), which lends itself to spectral analysis of electron precipitation from the Earth's radiation belts. Here electron spectra from DEMETER have been analyzed from all 6 years of its operation. Global electron flux maps are produced and average spectral fit values are taken during geomagnetic storm and quiet times. The flux behaviour and spectral variation during geomagnetic storm time and the recovery period are also examined, showing differences between the two radiation belts and the slot region.

The high energy resolution of the DEMETER satellite also allows insightful comparisons with electron flux measurements from MEPED (Medium Energy Proton and Electron Detector) instrument onboard the POES constellation of satellites. Unlike the high-resolution observations, POES/MEPED provide only 3 integral electron telescopes. Our comparison allows a test of the MEPED geometric factor equations given by Yando et al., [JGR (116, A10231), 2011] which characterized proton contamination of the electron telescopes as well as a variation in detector efficiency with energy. Electron fluxes are compared when the MetOp-02 POES satellite is in similar locations to DEMETER (ΔL < 0.5, Δlongitude < 4 degrees) using the MEPED 90 degree telescope as both instruments observe essentially the same particle populations (drift loss cone or trapped particles depending on the L shell). Simplified equations are calculated to reverse the geomagnetic factor (for SEM-2 electron instruments only) and then tested, these equations allow the MEPED electron fluxes to be corrected quickly and easily based on the values from Yando et al. Differential fluxes from the integral POES data are also calculated in the comparison. This process is shown to work best during high flux daytime spectra, leading to differential flux fits which are comparable to those from DEMETER.