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Extreme Energetic Electron Fluxes in Low Earth Orbit: Analysis of POES E > 30, E > 100 and E > 300 keV Electrons

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Energetic electrons are an important space weather hazard. Electrons with energies less than about 100 keV cause surface charging while higher energy electrons can penetrate materials and cause deep dielectric charging. In this study we conduct an extreme value analysis of the maximum 3-hourly flux of $E > 30$ keV, $E > 100$ keV and $E > 300$ keV electrons in low Earth orbit as a function of L^*, using data from the National Oceanic and Atmospheric Administration (NOAA) Polar Operational Environmental Satellites (POES) from July 1998 to June 2014. The 1 in 10 year flux of $E > 30$ keV electrons shows a general increasing trend with distance ranging from 1.8×10^7 $cm^{-2}s^{-1}sr^{-1}$ at L^* = 3.0 to 6.6×10^7 $cm^{-2}s^{-1}sr^{-1}$ at L^* = 8.0. The 1 in 10 year flux of $E > 100$ keV electrons peaks at L^* = 4.5 - 5.0 at 1.9×10^7 $cm^{-2}s^{-1}sr^{-1}$ decreasing to minima of 7.1×10^6 and 8.7×10^6 $cm^{-2}s^{-1}sr^{-1}$ at L^* = 3.0 and 8.0 respectively. In contrast to the $E > 30$ keV electrons, the 1 in 10 year flux of $E > 300$ keV electrons shows a general decreasing trend with distance, ranging from 2.4×10^6 $cm^{-2}s^{-1}sr^{-1}$ at L^* = 3.0 to 1.2×10^5 $cm^{-2}s^{-1}sr^{-1}$ at L^* =8.0. Our analysis suggests that there is a limit to the $E > 30$ keV electrons with an upper bound in the range 5.1 - 8.8×10^7 $cm^{-2}s^{-1}sr^{-1}$. However, the results suggest that there is no upper bound for the $E > 100$ keV and $E > 300$ keV electrons.