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Slot Region Radiation Environment Models

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Herein we present the main characteristics and first results of the Slot Region Radiation Environment Models (SRREMs) project. The statistical models developed in SRREMs aim to address the variability of trapped electron and proton fluxes in the region between the inner and the outer electron radiation belt. The energetic charged particle fluxes in the slot region are highly dynamic and are known to vary by several orders of magnitude on both short and long timescales. During quiet times, the particle fluxes are much lower than those found at the peak of the inner and outer belts and the region is considered benign. During geospace magnetic storms, though, this region can fill with energetic particles as the peak of the outer belt is pushed Earthwards and the fluxes can increase drastically. There has been a renewed interest in the potential operation of commercial satellites in orbits that are at least partially contained within the Slot Region. Hence, there is a need to improve the current radiation belt models, most of which do not model the extreme variability of the slot region and instead provide long-term averages between the better-known low and medium Earth orbits (LEO and MEO). The statistical models developed in the SRREMs project are based on the analysis of a large volume of available data and on the construction of a virtual database of slot region particle fluxes. The analysis that we have followed retains the long-term temporal, spatial and spectral variations in electron and proton fluxes as well as the short-term enhancement events at altitudes and inclinations relevant for satellites in the slot region. A large number of datasets have been used for the construction, evaluation and inter-calibration of the SRREMs virtual dataset. Special emphasis has been given on the use and analysis of ESA Standard Radiation Environment Monitor (SREM) data from the units on-board PROBA-1, INTEGRAL, and GIOVE-B due to the sufficient spatial and long temporal coverage of the slot region. In addition, other datasets such as EI/AZUR, MEA/CRRES, ERMD/XMM also have been considered and processed. The output of the models provides mean and peak energetic particle fluxes for a given mission duration as determined by confidence levels for different time scales. Validation studies and comparison with standard radiation belt models, such as AE8-AP8 have been also performed.

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