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Sensitivity studies of SREM instrument response and spectral unfolding to particle environment anisotropy

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The Standard Radiation Environment Monitor (SREM) is installed on several ESA satellites to monitor space radiation environment of protons and electrons [1]. With its 15 spectroscopy channels the monitor can distinguish between particle species and provide information on their energy spectra. Measurements are based on three sensors located behind different shielding materials. Two of them are arranged into a telescope. All SREM instruments have been carefully calibrated and modelled during laboratory preparation phase. Space data are unfolded using a wide range of methods ranging from simple fit functions to response matrix inversions [2]. Cross comparisons often show discrepancies reaching even an order of magnitude. They are usually attributed to the particle environment anisotropy. Due to various thicknesses of the shielding given by SREM itself and the spacecraft mass distributions the response functions show directional sensitivity. Knowing the spacecraft orientation with respect to the magnetic field allows for more accurate spectral measurements [3]. It is not always possible as only some spacecraft with SREM on board provide such information. This study utilizes pitch angle distributions of particles in the radiation belts for improved unfolding of the SREM energy spectra. Both, random and known SREM orientations with respect to the magnetic field are investigated. Results are given for wide range of numerical studies and for space measurements based on the PROBA1 mission [4]. They contribute to improved accuracy of SREM spectral measurements and give valuable inputs to design of new spacecraft radiation instruments.

Literature

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