

The Solar Energetic Particle environment: How to transition from science to International Standard Models

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Solar energetic particle events (SEPEs) and can have a significant impact on the design and operations of interplanetary and earth-orbiting spacecraft. The fluxes of high-energy protons and heavy ions, that they produce, can cause radiation degradation of electronic parts, sensor interference and single event effects. Current engineering models of these environments will be described with an attempt to address how accurate they are and how accurate they need to be from a user's point of view. The known inadequacies of existing models will be discussed and where there is more than one model, the various advantages and disadvantages highlighted. A brief description of the underlying physical processes will be given to try to identify where improvements in our understanding might aid the development of more accurate models. Key issues such as data fidelity (instrument cross-calibration) and the sparsity of data, solar activity modulation, geomagnetic shielding, heliocentric radial dependence and the choice of confidence level will also be addressed. It will be argued that currently there are no comprehensive science models for SEPEs, only fragmented models to explain certain key aspects such as initiation, acceleration and propagation, reflecting our incomplete understanding of the underlying physical mechanisms involved. Nonetheless, a methodology to incorporate the existing body of scientific knowledge with empirical data and current engineering models to develop an ISO model or models will be presented. Comments on the crucial importance of user guidance will also be given.