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ASSESSING THE SPACE ENVIRONMENT AND ITS EFFECTS ON SPACE MISSIONS WITH SPENVIS

Abstract

The SPace ENVironment Information System (SPENVIS) is an ESA operational software that has been developed and maintained by BIRA-IASB since 1996. It provides free access to an integrated set of space environment and effect models through a user-friendly Web interface (http://www.spenvis.oma.be/). The system is also accessible through ESA' s space weather portal (https://spenvis.ssa-swe.eu/) where it is a key product in several space weather services. Although initially designed to help spacecraft engineers perform rapid analysis of environmental problems, SPENVIS has become over the years a multi-purpose tool that is used by a worldwide user community, including spacecraft designers and operators, component designers, teachers and scientists (e.g. model developers). The radiation environment models in SPENVIS cover the radiation belts (around Earth and Jupiter), galactic cosmic rays and solar energetic particles. Fluxes and fluences derived from these models are used to calculate ionising and non-ionising dose, degradation of solar cells and single event effects for simple shielding configurations or in combination with a sectoring analysis. Some Geant4-based Monte Carlo tools (e.g. MULASSIS, GRAS) for performing fluence, dose, LET, charging and pulse height analyses are available as well. Due to radiation or plasma interactions, risk estimates for electrostatic discharges can be calculated with simple 1D engineering charging codes. Next to the radiation environment, SPENVIS also includes atmosphere and ionosphere models to evaluate e.g. the impact of atomic oxygen on spacecraft surfaces. The meteoroid/debris tools implemented in SPENVIS allow an estimation of the meteoroid and debris particle fluxes on randomly oriented surfaces in a user-defined orbit. The resulting fluxes can be fed into particle/wall interaction models to estimate the number of punctures over a given time interval.

In this presentation we give an overview of the SPENVIS integrated models and how they will operate together in a new SPENVIS framework that is in development under ESA contract and sponsored by the Belgian Space Policy. The new SPENVIS system will incorporate additional models for the space environment and make use of ESA' s Network of Models (NoM). The latter is a lightweight framework that provides access to the models and data via a common web API allowing to run also models available in other external frameworks and vice versa. Finally, we illustrate how SPENVIS is exploited in ESA' s Network of Space weather services.