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A SATELLITE MISSION FOR AN EXTENSIVE SAMPLING OF TERRESTRIAL RADIATION ENVIRONMENT

Abstract

Radiations are a major obstacle to space activities, limiting functionality of electronic devices and possibly be a show-stopper for human missions. Countermeasures, as shielding or, as far as it concerns the hardware, adoption of radiation hardened parts are available and largely employed. However all of these countermeasures are based on the results of simulation models, which are nowadays largely available for the different components, as protons and electrons of the Van Allen Belts, emissions from the Sun, cosmic/galactic rays. These models are incorporated in software tools (example is SPENVIS, supported by ESA) and allow engineers to design a mission, and the relevant spacecraft, on the basis of an educated knowledge of the expected environment. The limit of this approach is that the scenario represented by available models is far form being stationary. Solar activity has a huge influence, modifying the shape of the Earth belts, as well as affecting the possible entry of cosmic rays in the solar system. As a result, studies on the radiation environment, even in the close space volume relevant for Earth missions are clearly an ongoing activity. This paper intends to detail a space mission aimed to measure – by means of dosimeters – the radiation doses in Earth orbits for a set of altitudes, inclinations, and orbital plane orientations with respect to the Sun. The characteristic is that such an extensive sampling will be obtained by locating the monitoring satellite in an elliptic orbit, and by exploiting gravitational perturbations, namely the flattening of the Earth or J2. In such a way, the volume corresponding to a shell surrounding the Earth will be, in time, carefully sampled in terms of amount of radiations' input, providing consistent (generated by the very same instrument) and indeed quite useful data for an update of the models. The strong advantage of the design stays in the passive (i.e. not requiring any propulsion) strategy for sampling a very large volume, making such a mission a suitable opportunity. A full analysis of the expected radiation environment in the sampled regions is included, in order to allow for a first, very preliminary analysis of the instruments – dosimeters - to be usefully accommodated onboard.