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IPSAT : Ionising Particle in Space Analysis Tool

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Abstract

Satellite engineers, operators, and radiation belt researchers share a common desire to understand and predict the structure and variability of Earth's radiation belts. In the radiation belt community, there is a need for improved scientific understanding of the radiation belts, more accurate dynamic and climatology models, and a mechanism for more efficient transfer of scientific understanding and models to the space technology and operational community. To allow for such advancements to take place, a virtual radiation belt observatory has been developed at ONERA/DESP under CNES funding. This Web based virtual observatory, called IPSAT (Ionising Particle in Space Analysis Tool), offers access to near-real-time measurements, historical data, analysis and visualization software.

The current IPSAT data base (about 400 Go) is composed of in-situ ionizing particle measurements covering a large range of orbits: interplanetary, geosynchronous (GEO), medium earth orbit (MEO), elliptical (HEO) and low altitude (LEO). Fig.1 represents the spatial and temporal coverage of all the measurements included in this data base. It has been developed through collaborations between ONERA/DESP and Los Alamos National Laboratory (LANL), Aerospace Corporation, JAXA (CNES-JAXA agreement), Moscow State University (MSU) and CONAE (CNES-CONAE agreement). The time coverage extends from 1976 (early for few missions) to present and the data time resolution ranges for 8 seconds to 5 minutes depending on the mission itself. This data base is updated everyday and therefore allows to perform radiation belt dynamics survey in near real time and in various regions of the radiation belts and interplanetary medium. When new data come in, associated magnetic coordinates are calculated and measurements are automatically filtered to ensure good quality of measurements. All the data are converted into CDF (Common Data Format) files to ensure a rapid and easy access to all information contained in them.

The particle species being measured are relativistic electrons, high energy protons and heavy ions (note that heavy ions measurements are only available in the interplanetary medium). The energy range for each specie depends on each instrument on-board each spacecraft but covers roughly 100 keV to few MeV for electrons, greater than 10 MeV for protons and greater than 10 MeV/nucleon for heavy ions.