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Radiation Fields, Effects and Risks in Human Space Missions (4)

Author: Prof. Tsvetan Dachev
Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria, tdachev@bas.bg

Dr. Nikolay Bankov
Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria, ngb43@abv.bg
Dr. Borislav Tomov
Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria, btomov@bas.bg
Mr. Plamen Dimitrov
Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria,
pdimitrov1957@abv.bg
Dr. Yuriy Matviichuk
Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria, ymat@bas.bg

EMPIRICAL MODEL FOR CALCULATION OF THE ABSORBED DOSE RATES DURING EVA

Abstract

The ionizing radiation has been recognized as a one of the main health concern to the International Space Station (ISS) crew. Estimating the effects of radiation on humans in ISS requires at first order accurate knowledge of the global distribution of absorbed dose rates. The R3DE (Radiation Risks Radiometer-Dosimeter (R3D) for the EXPOSE-E facility on the European Technological Exposure Facility (EuTEF) outside of the European Columbus module of ISS is a Liulin type Bulgarian build miniature spectrometer-dosimeter. R3DE worked successfully between February 2008 and September 2009 accumulating about 4 million measurements of the flux and absorbed dose rate with 10 seconds resolution behind less than 0.4 g cm-2 shielding. This large data base was used for development of an empirical model for calculation of the absorbed dose rates on the ISS at 359 km altitude. The model approximate the averaged in a grid empirical dose rate values to predict values at required from the user point, line or area in geographic coordinate system. Very preliminary comparisons with the existing AP-8 MIN model shows that the South Atlantic Anomaly (SAA) maximum is moved westward with at least 12 for the period after 1970. Also an intercomparison between predicted by the model dose rate values and data collected by the Bulgarian build R3DE/R instruments and NASA Tissue Equivalent Proportional Counter (TEPC) during astronauts/cosmonauts external vehicular activities (EVA). The model was used to be predicted the accumulated along the orbit of ISS galactic cosmic rays and inner radiation belt dose for 1 orbit (1.5 hours) and 4 consequences orbits (6 hours, which is the usual EVA continuation) in dependence by the longitude of the ascending node of ISS. These predictions and the model could be used by space agencies medical and other not specialized in the radio physics support staff for first approach to ISS EVA time and space planning.