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

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ESTIMATES OF CARRINGTON-CLASS SOLAR PARTICLE EVENT RADIATION EXPOSURES AS A FUNCTION OF ALTITUDE IN THE ATMOSPHERE OF MARS

Abstract

Radiation exposure estimates for crew members on the surface of Mars may vary widely due to large variations in terrain altitude. The maximum altitude difference between the highest (top of Olympus Mons) and the lowest (bottom of the Hellas impact basin) points on Mars is 31 km. In this work, estimates of radiation exposures as a function of altitude, from the Hellas impact basin to Olympus Mons, are made for a solar particle event proton radiation environment comparable to the Carrington event of 1859. We assume that the proton energy distribution for this Carrington-type event is similar to that of the Band Function fit of the February 1956 event. The HZETRN 2010 radiation transport code, originally developed at NASA Langley Research Center, and the Computerized Anatomical Male and Female human geometry models are used to estimate exposures for aluminum shield areal densities similar to those provided by a spacesuit, surface lander, and permanent habitat as a function of altitude in the Mars atmosphere. Comparisons of the predicted organ exposures are made with current NASA Permissible Exposure Limits (PELs).