MODELING OF THE MARTIAN ENVIRONMENT FOR RADIATION ANALYSIS

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In view of manned missions targeted to Mars, for which radiation exposure is one of the greatest challenges to be tackled, it is of fundamental importance to have available a tool, which allows to knowing which are the particle flux and spectra at any time at any point of the Martian surface. With this goal in mind, a new model for the radiation environment to be found on the planet Mars due to Galactic Cosmic Rays (GCR) has been developed. Solar modulated primary particles rescaled for Mars conditions are transported within the Martian atmosphere, with temporal properties modeled with variable timescales, down to the surface, with altitude and backscattering patterns taken into account. The Martian atmosphere has been modeled by using the Mars Global Reference Atmospheric Model – version 2001. This model can provide at any time a profile of the Martian atmosphere in terms of density, pressure, and temperature vs. altitude, needed to compute the atmosphere thickness for the incoming particle flux. The atmospheric chemical and isotopic composition is taken as modeled over results from the in-situ Viking Lander measurements for both major and minor components. The surface altitude, or better the atmospheric depth for incoming particles, to compute the atmospheric thickness profile has been determined by using a model for the Martian topography based on the data provided by the Mars Orbiter Laser Altimeter (MOLA) instrument on board the Mars Global Surveyor (MGS) spacecraft. The surface itself has been modeled in both the dry ('regolith') and volatile components. Mars regolith composition has been modeled based on the measurements obtained with orbiter and lander spacecraft from which an average composition has been derived. The volatile inventory (e.g. CO₂ ice, H₂O ice) properties, both in the regolith and in the seasonal and perennial polar caps, has been taken into account by modeling the deposition of volatiles and its variations with geography and time all throughout the Martian year, from results from imaging data of orbiter spacecraft. Particle transport has been performed with the HZETRN heavy ion code with an adaptation for planetary surface geometry. The present Mars Radiation Environment Model will be tested by comparison with the data from the Mars Odyssey mission MARIE and HEND instruments.