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2. CRs at Earth and planets (GEO)

Detecting upward-directed charged particle fluxes in MSL/RAD

Appel, JanKristoffer[0], Guo, Jingnan[0], Koehler, Jan[0], Wimmer-Schweingruber, Robert[0], Hassler, Don[1], Ehresmann, Bent[1], Zeitlin, Cary[2] and Science Team, RAD[0]
[0]Institute for Experimental and Applied Physics, Christian- Albrechts- University of Kiel, Germany
[1]Space Division, Southwest Research Institute, Boulder, CO, USA
[2]Southwest Research Institute, Earth, Oceans & Space Department, Durham, NH, USA

The goals of the Mars Science Laboratory (MSL) mission are searching for past and present biological life evidences, studying the geological and geochemical planetary processes, and characterizing the radiation environment on the Martian surface. The Radiation Assessment Detector (RAD) onboard the MSL rover is designed to measure the full spectrum of radiation. One of the science goals of RAD is to enable the verification of atmospheric radiation transport models. This can be done by comparing predicted upwards- and downwards-directed radiation fluxes at RAD with observations. The downwards-directed radiation flux consists of Galactic Cosmic Rays modified by the Martian atmosphere, and the upwards-directed radiation flux consists of secondary particles generated in the Martian soil. We investigate the upwards-directed radiation flux using a Geant4 simulation model of the MSL rover and the atmosphere below it. Through this, we obtain the resulting upwards-directed spectra as seen by the RAD instrument and compare it with the downwards-directed component. Then, we investigate the detector response signatures generated by the upwards- and downwards- directed flux components respectively. Lastly, we show the presence of both upwards- and downwards- directed fluxes in data collected by the RAD instrument.