

Radiation Monitoring at Mars Using the Odyssey Instrument Payload

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Although the MARIE instrument aboard 2001 Mars Odyssey failed in the large solar proton events of Halloween 2003, other instruments on the spacecraft have allowed us to continue monitoring both GCR and Solar Particle Events at Mars. The original concept of the Odyssey mission was to look for water at Mars, and the instrument suite designed for that purpose includes a Gamma-Ray Spectrometer (GRS), a Neutron Spectrometer (NS), and a High-Energy Neutron Detector (HEND). In addition to mapping the planet in gamma rays and neutrons, all of these instruments are also sensitive (to varying degrees) to energetic charged particles. The GRS provides a particularly useful channel for measuring the GCR and moderate solar events. In more intense solar events, the HEND counters – which record “background” neutrons produced in the spacecraft by incident charged particles – become useful as a substantial neutron flux is induced. Although no spectral data can be obtained from these instruments, total fluxes can be accurately determined using a simple normalization constant to convert GRS counts to flux. These data clearly show an increase in the GCR flux starting in 2004, consistent with data from near-Earth satellites showing the expected effect of solar modulation as solar minimum approaches. Using the latest version of the Badhwar-O’Neill GCR model, the average LET and quality factor can be obtained and the total measured flux can be expressed as a dose rate and a dose-equivalent rate. It will be of considerable interest to compare these results with the similar results obtained from instruments both inside and outside the ISS.