Radiation Risks for Future Manned and Robotic Missions: PREDICCS: Predictions of Radiation from REleASE, EMMREM, and Data Incorporating CRaTER, COSTEP, and other SEP Measurements – an Online Nowcasting and Forecasting System. J. F. Mislinski[1], N. A. Schwadron[1], L. Townsend[2], H. E. Spence[1], O. M. Rother[3], A. Posner[4], R. Squier[5], J. K. Wilson[1], A. P. Jordan[1], R. Anderson[1], T. Baker[1], K. A. Kozarev[6], C. Joyce[1]. [1]Institute for the Study of Earth, Oceans, and Space SCience (EOS), University of New Hampshire, Durham, NH, [2]Nuclear Engineering, University of Tennessee, Knoxville, Knoxville, TN, [3]Physics, University of Kiel, Kiel, Germany, [4]Heliophysics, NASA, Washington, D.C., [5]Computer Science, Georgetown University, Washington, D.C., [6]Astronomy, Boston University, Boston, Masschusetts.

Introduction: Future manned and robotic missions to the Moon, Mars, and beyond require accurate models for the radiation environment through the heliosphere. PREDICCS – Predictions of radiation from REleASE, EMMREM, and Data Incorporating CRaTER, COSTEP, and other SEP measurements – will be an on-line system to predict and forecast the radiation environment through interplanetary space. PREDICCS uses SEP (Solar Energetic Particle) measurements from the Cosmic Ray Telescope for the Effects of Radiation (CRaTER) [1] instrument currently on the Lunar Reconnaissance Orbiter (LRO) and data from the Comprehensive Suprathermal and Energetic Particle Analyzer (COSTEP) [2] and integrates two radiation environment models: The Earth-Moon-Mars Radiation Environment Module (EMMREM) [3] and the Relativistic Electron Alert System for Exploration (REleASE) [4]. REleASE very accurately forecasts SEP events up to one and a half hours ahead of the event. The EMMREM model predicts the real-time radiation environment using Energetic Particle Radiation Environment Module (EPREM) and the Baryon Transport Module (BRYNTRN). We combine these two models to nowcast and forecast the radiation environment at various observers – including the Earth, Moon, Mars, and at specific target observers such as comets and asteroids – and for future SEP events. Validation of these models requires data from CRaTER, COSTEP (EPHIN), and other SEP measurements. CRaTER characterizes the lunar radiation environment and its biological impacts with LET (Linear Energy Transfer) spectra of galactic and solar cosmic rays and COSTEP (EPHIN) measures relativistic electrons and deka-MeV protons and helium. Preliminary comparisons have been made of a recent, albeit small, SEP event from early June 2011 that has shown excellent agreement with EMMREM predictions. This event has been well observed by CRaTER and a number of other instruments. This has been the first “significant” event as we come out of the longest and deepest solar minimum in the space age. Additional observations of SEP events in the near future will help to fine tune the models in order to predict the radiation environment in interplanetary space with more confidence. This will be an invaluable resource for future manned and robotic missions.

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