Real-time dose prediction for Artemis missions

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Abstract

As large solar energetic particle (SEP) events can add significant radiation dose to astronauts in a short period of time and even induce acute clinical responses during missions, they present a concern for manned space flight operation. To assist the operations team in modeling and monitoring organ doses and any possible acute radiation-induced risks to astronauts during SEP events in real time, ARRT (Acute Radiation Risks Tool) 1.0 has been developed and successfully tested for Artemis I mission. The ARRT 2.0 described in this work integrates an established SEP forecasting model – UMASEP-100, further enabling real-time dose prediction for the upcoming Artemis II and following missions. With the new module linking with UMASEP-100 outputs in real time, the total BFO doses of most significant events can be communicated at the time of onset and hours before the peak. This is based on a flux-dose formula identified from comparing UMASEP-100 results with transport calculation for the events during 1994-2013 and validated with events outside that period. ARRT 2.0 also shows capability to distinguish minor events from significant ones to screen false alarms that will cause disruptions for space activities. This improvement provides additional information for operational teams to make timely decisions in contingent scenarios of severe SEP events to mitigate radiation exposure.