Solar cosmic ray dose rate assessments during GLE 72 using MIRA and PANDOCA

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Abstract

Exposure from cosmic radiation at aviation altitudes can be elevated during solar energetic particle events compared to the omnipresent galactic cosmic ray background. The largest of these events can be measured on ground as so-called Ground Level Enhancements (GLE). GLE 72, which occurred 10 Sept. 2017, was the more recent of the two solar particle induced ground level enhancements in solar cycle 24 in which GLEs have been unusually rare. Larger GLEs can significantly increase ionizing radiation dose rates at aviation altitudes for hours to days, leading to concern among crewmembers. One way to provide real time monitoring and preliminary evaluation of solar particle events, including GLEs, in regard to effective dose rates at aviation altitudes is to use real time measurements of the cosmic ray intensity, for instance GOES proton measurements, in combination with numerical models for the calculation of radiation exposure at aviation altitudes. In this work, the PANDOCA and MIRA models which have been developed for this purpose are compared. PANDOCA has been developed by the German Aerospace Center (DLR) and can be applied both to galactic cosmic radiation and solar energetic particle events. MIRA is based on CARI-7A and part of the latest Solar Radiation Alert System (SRAS) of the U.S. Federal Aviation Administration.
For GLE72, the models consistently predict increases in the radiation exposure at aviation altitudes, i.e. below 50000 ft, which were on the order of or below the galactic cosmic ray background. Increases in dose rate were limited to high latitudes as the primary solar particles were strongly suppressed by the geomagnetic shielding.

Space Weather Workshop, 16.-20.4.2018
Westminster, CO,
Poster, 17.4.2018