

Operational Prototype Development of a Global Aircraft Radiation Exposure Nowcast

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Galactic cosmic rays (GCR) and solar energetic particles (SEP) are the primary sources of human exposure to high linear energy transfer (LET) radiation in the atmosphere. High-LET radiation is effective at directly breaking DNA strands in biological tissue, or producing chemically active radicals in tissue that alter the cell function, both of which can lead to cancer or other adverse health effects. A prototype operational nowcast model of air-crew radiation exposure is currently under development and funded by NASA. The model predicts air-crew radiation exposure levels from both GCR and SEP that may accompany solar storms. The new air-crew radiation exposure model is called the Nowcast of Atmospheric Ionizing Radiation for Aviation Safety (NAIRAS) model. NAIRAS will provide global, data-driven, real-time exposure predictions of biologically harmful radiation at aviation altitudes. Observations are utilized from the ground (neutron monitors), from the atmosphere (the NCEP Global Forecast System), and from space (NASA/ACE and NOAA/GOES). Atmospheric observations characterize the overhead mass shielding and the ground- and space-based observations provide boundary conditions on the incident GCR and SEP particle flux distributions for transport and dosimetry calculations. Radiation exposure rates are calculated using the NASA physics-based HZETRN (High Charge (Z) and Energy TRaNsport) code. An overview of the NAIRAS model is given: the concept, design, prototype implementation status, data access, and example results. Issues encountered thus far and known and/or anticipated hurdles to research to operations transition are also discussed.