DREAM tool increases space weather predictions

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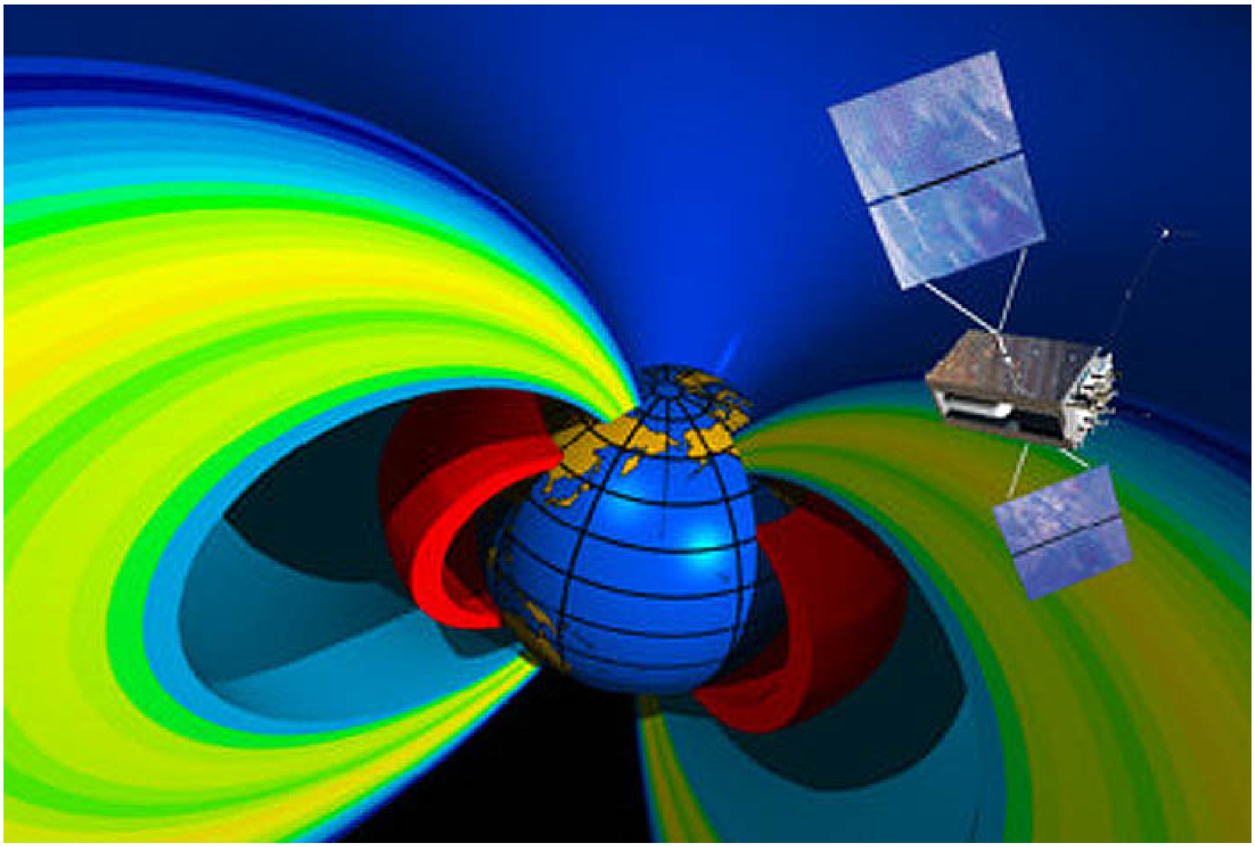

Predicting space weather improved by new DREAM modeling tool

Earth's radiation belts can now be studied with a new modeling tool called Dynamic Radiation Environment Assimilation Model (DREAM).

Researchers in LANL's Space Science and Applications (ISR-1) group are developing DREAM and described its current capabilities and applications in an article published in Space Weather, a journal of the American Geophysical Union.

Space environment and its hazards

The space environment poses a number of radiation hazards to space systems and their occupants. Relativistic electrons, the dominant source of the radiation dose to spacecraft traveling in the outer radiation belts (3-7 Earth radii), have an electron flux that varies by more than three orders of magnitude on time scales ranging from minutes to years.

This complex variation occurs in response to solar, interplanetary and geomagnetic conditions. Accurately modeling this population is complicated, which is where DREAM comes into play.

Radiation belt structure and dynamics revealed

DREAM is a modeling tool that improves the understanding of the physical processes that control Earth's radiation belt structure and dynamics. DREAM uses a modular software approach that is extremely flexible and adaptable to new developments, new data sources, and new physical understanding.

It starts with a very simple physical model to which researchers can add more complex physical processes when their effects can be tested against observations and their uncertainties can be calculated. The tool incorporates observational measurements in the model to simulate the global, time-dependent space environment out to beyond geosynchronous orbit.

DREAM to determine radiation environment

The most common application envisioned is to use DREAM to determine the radiation environment at a particular satellite that does not have its own environmental measurements and therefore might be vulnerable to unforeseen events.

In addition to its basic research applications, a DREAM implementation in development will run on workstation-level platforms using real-time space weather observations and an interactive user interface to support satellite operators and space weather forecasters. For national security applications, DREAM could include a module to calculate the injection and trapping of artificial radiation belts from a high-altitude nuclear explosion.

Los Alamos National Laboratory **www.lanl.gov** **(505) 667-7000** **Los Alamos, NM**

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