Geophysical Research Abstracts
Vol. 20, EGU2018-2853, 2018
EGU General Assembly 2018

Current state of the art and understanding for forecasting relativistic electrons in Earth's radiation belts

Drew Turner (1), T. Paul O'Brien (1), Joseph Fennell (1), Seth Claudepierre (1), J. Bernard Blake (1), Emilia Kilpua (2), Heli Hietala (3), Allison Jaynes (4), Shrikanth Kanekal (5), Daniel Baker (6), Harlan Spence (7), Jean-Francois Ripoll (8), and Geoff Reeves (9)

(1) The Aerospace Corporation, Space Sciences, Los Angeles, United States (drew.lawson.turner@gmail.com), (2) University of Helsinki, Helsinki, Finland, (3) Department of Earth, Planetary, and Space Sciences, University of California, Los Angeles, CA, USA, (4) Department of Physics and Astronomy, University of Iowa, Iowa City, IA, USA, (5) NASA Goddard Space Flight Center, Greenbelt, MD, USA, (6) Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, USA, (7) Institute For the Study of Earth, Oceans, and Space, University of New Hampshire, Durham, NH, USA, (8) CEA, DAM, DIF, Arpajon, France, (9) Los Alamos National Laboratory, Los Alamos, NM, USA

Since the launch of NASA's Van Allen Probes in August 2012, scientists have been afforded near-continuous, multipoint observations of Earth's radiation belts at unprecedented temporal, angular, and energy resolution. The Van Allen Probes mission promised to deliver a dataset and refined understanding of the radiation belts system that would enable new and improved forecast models for use in spaceflight operations, and it has delivered just that. Now, the burden falls upon the space weather community to develop those improved forecast models to best serve the requirements of spaceflight operators. This presentation will focus on three main areas: 1) our current forecasting capabilities and how those fit in to the specific needs of the spaceflight operations communities; 2) our latest scientific understanding of the extreme dynamics of Earth's electron radiation belts; and 3) improvements in forecasting/predicting that we can achieve in the near-future. We begin by introducing the specific needs and challenges of the spaceflight community concerning operations in Earth's electron radiation belts. We then highlight several models representing our current state of the art in forecasting and predicting relativistic electrons in Earth's radiation belts. Next, we discuss our latest advances in understanding the dynamics of the system. In particular, we will outline recent results of a statistical study of 110 geomagnetic storms during the Van Allen Probes era and how different storm drivers result in markedly different effects for electrons at different energies and locations within the belts. That study showcases how Van Allen Probes data and continued observations of the radiation belts can be used to provide forecast capabilities throughout the entire radiation belt system. We finish by bringing those pieces together with a vision of forecasting the radiation belts in the near-future. We focus on: 1) the need to take advantage of existing machine learning algorithms to better ingest our growing data sets into improved forecasts; 2) the need for continued multipoint observations throughout the system to ensure data availability for real-time, data assimilative nowcasting of the radiation belts system.