SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES (D5)
Space Weather Prediction and Effects on Space Missions (3)

Author: Mr. Tardelli Ronan Coelho Stekel
National Institute for Space Research - INPE , Brazil, tardellirs@gmail.com

Dr. Nelson Jorge Schuch
Southern Regional Space Research Center - CRS/CCR/INPE - MCT in collaboration with the Space Science Laboratory of Santa Maria - LACESM/CT - UFSM, Brazil, njschuch@gmail.com
Dr. Ezequiel Echer
National Institute for Space Research - INPE , Brazil, eecher@dge.inpe.br
Mr. Cassio Espindola Antunes
Southern Regional Space Research Center - CRS/CIE/INPE - MCT, Brazil, cassio@lacesm.ufsm.br
Mr. Lucas Lopes Costa
National Institute for Space Research - INPE , Brazil, lucas.matusalem@gmail.com

SPACE WEATHER EFFECTS IN SPACE MISSIONS MEASURED FROM SATELLITES AND GROUND-BASED INSTRUMENTS NEAR THE SOUTH ATLANTIC MAGNETIC ANOMALY CENTER

Abstract

The occurrence of large solar flares, coronal mass ejections and high velocity solar wind represents an adverse space weather conditions hazardous for manned and unmanned space missions. During the maximum solar activity, many elements of the natural space environment can damage space missions. Low energy plasmas charge spacecraft surfaces and cause arc discharges. High-energy electrons (>2MeV) penetrate the spacecraft and build high charges in insulation on coaxial lines and circuit boards. Protons (>50MeV) and other charged particles disrupt computer memories or even damage the semiconductors structure. Spacecraft damage also includes decreased power production by solar arrays, failure of sensitive electronics, increased background noise in sensors, until radiation exposure to the crew members. The geomagnetic field influences the particles motions within the Earth's orbital environment and deflects incoming high-energy particles associated with cosmic rays. In the South Atlantic Magnetic Anomaly (SAMA) the Van Allen radiation belt comes closest to the Earth's surface increasing these kind of space mission damage. When solar activity is high, ultraviolet radiation from the Sun heats and expands the Earth's ionosphere, increasing atmospheric drag and orbital decay rate of spacecraft. This work presents Space Weather phenomena measurements correlating the EUV and X-ray radiation, the ionospheric and magnetospheric perturbation and space mission failures for high-intensity solar events. For this purpose, analysis were performed for the riometer, to measure the ionosphere density, and magnetometers, to measure the SAMA geomagnetic intensity, installed at the Southern Space Observatory (SSO/CRS/CCR/INPE – MCT), (29.4 ^{o}S, 53.8 ^{o}W, 480m a.s.l), São Martinho da Serra, RS, Brazil, near the SAMA center. To identify and monitor the sudden radiation increase the X-ray data (0.1 to 0.8nm) from GOES Satellites and the EUV data (26.0 to 34.0nm and 0.1 to 50.0nm) from the Solar EUV Monitor (SEM) on the SOHO spacecraft were correlated. GOES electron flux >2MeV and GOES proton flux >50MeV were measured as the particle influences. The work also reviews space mission failures correlating Satellites and ground-based instruments dedicated to monitor and predict the Space Weather phenomena.