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Statistical analysis of geomagnetic storms, coronal mass ejections and solar energetic particle events in the framework of the COMESEP project

Olga Malandraki and the COMESEP Team
National Observatory of Athens, omaland@astro.noa.gr, Athens, Greece (omaland@astro.noa.gr)

Geomagnetic storms and Solar Energetic Particle (SEP) radiation storms are hazards in space. It is important to mitigate the effects space weather phenomena may have on technology and human life. The aim of the EU FP7 COMESEP (Coronal Mass Ejections and Solar Energetic Particles) project is to develop forecasting tools both for geomagnetic and SEP storms, and relies on both models and data. This includes a statistical analysis of geomagnetic storms and SEP events during the SOHO era. The goal is to connect the impact of these phenomena with the associated Coronal Mass Ejection (CME) and/or solar flare characteristics. Results of these analyses are being implemented into the COMESEP space weather alert system that is being built based on the produced tools.

For the analysis of geomagnetic storms, a representative subset of CMEs from the LASCO/SOHO catalog is selected, and includes associations with Dst index values. The main objective is to determine the probability distributions of Dst and other relationships depending on the CME and flare characteristics. The effect of multiple CME occurrences on the probability of large Dst index values and the treatment of semiannual variations of storms are also evaluated. The analysis of SEP events focuses on the quantification of SEP occurrence probabilities and on the identification of correlations between SEPs and solar events. Both quantities depend on the flare heliographic location, soft X-ray intensity, the CME speed and width. The SEP parameters studied include peak fluxes, fluences, spectral fit parameters and enhancements in heavy ion fluxes. A preliminary estimation of false alarms for our system based on the statistical analysis used is under progress to asses the validity of the alerts.
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