

Interplanetary Shock Detection and Geomagnetic Storm Evolution

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Geomagnetic storms driven by interplanetary coronal mass ejections threaten electric power distribution systems worldwide. Accurate predictions of CME arrival and subsequent storm initiation allow utility providers to minimize disruptions to the grid. While operational numerical models have reduced the error associated with CME arrival predictions, little guidance exists for forecasting geomagnetic storm in terms of three-hourly planetary K-index (Kp) values specified in the Space Weather Prediction Center's Three Day Forecast product. The aim of this work is to establish empirical guidelines for space weather forecasters based on an examination of previous shock-storm episodes. We compare data derived from the USGS Boulder Magnetometer readings and geomagnetic storm alerts issued by the Space Weather Prediction Center (SWPC), to lists of interplanetary shocks observed by the (ACE) spacecraft. We examine 90 cases, calculate delay times from shock arrival to specific Kp thresholds associated with minor to extreme geomagnetic storms, and obtain summary statistics.