



Solar cycle and geomagnetic effects in FORMOSAT-3 satellite anomalies

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An anomaly that occurs in a satellite can have an influence on the operation of the satellite and the instruments on board, possibly resulting in a disruption of the satellite operation and data acquisition. Therefore, understanding the causes of anomalies are very important to predicting potential anomalies and mitigating the impacts of the anomalies in future satellite missions. In this study, we first classified the FORMOSAT-3 (FS3) satellite anomalies, defined as computer resets, into the non-space weather related and space weather related anomalies. We then analyzed the latter anomalies along with solar and geomagnetic data. Surprisingly, we find that most FS3 anomalies occur at low geomagnetic activity monitored by the Kp index. A comparison of the anomalies with the solar cycle trend shows an anti-correlated relationship between the numbers of anomalies and sunspots. All these evidences imply that the sources of the anomalies are likely due to unmodulated low-energy galactic cosmic rays at low solar activity. A superposed epoch analysis enables us to conclude that the anomalies usually occur in a position where the disturbance degree of local geomagnetic fields are small. Under such a low geomagnetic condition, the unshielded cosmic rays can easily penetrate deeper into the magnetosphere, reaching the altitude where FS3 is located (~800 km) and affecting its operation.