Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)


PEM07-13 Room:302 Time:May 25 11:00-11:30

# Progress in Understanding the Earth-affecting Coronal Mass Ejections

GOPALSWAMY, Nat[1*]

[1]NASA Goddard Space Flight Center

Coronal mass ejections (CMEs) producing solar energetic particle (SEP) events at Earth and causing geomagnetic storms are obviously the Earth-affecting CMEs. The occurrence of SEP events depends on the outer structure of CMEs, viz. the MHD shock, irrespective of the internal structure. On the other hand, geomagnetic storms occur when the internal magnetic structure of CMEs and/or the sheath behind the shock contain southward-pointing magnetic fields. The source locations of these two types of CMEs are also different: SEP events require magnetic connectivity to Earth, whereas storm-producing CMEs need to be directed toward Earth. Observations from the STEREO mission have contributed enormously to the study of Earth-affecting CMEs because of the expanded field of view and viewing angles away from the Sun-Earth line. The increased field of view closer to the Sun helped us understand that shocks can form as close as about 1.25 solar radii from the Sun center. The onset of type II radio bursts associated with CMEs has shown that shocks can form at large distances from the Sun (tens of solar radii). SEPs are energized as soon as the shock forms and can continue until the shock arrival at Earth and even afterwards. Therefore, predicting SEP events is generally very difficult (there is little lead time). There is definitely 1-4 days of lead time in predicting geomagnetic storms. There have been many attempts to predict the shock arrival using CME, Type II radio, and IPS observations. The CME trajectory can be severely affected by nearby coronal holes, non-radial ejection, and preceding CMEs resulting in large deviations in the predicted arrival times. We are far from predicting the orientation and strength of the CME magnetic field, which is crucial in predicting the occurrence and strength of geomagnetic storms. Then there are problems like the extremely mild space weather during solar cycle 24. Even though there are sufficiently large number of energetic CMEs ejected from the Sun, they do not seem to produce very many high-energy SEP events and large geomagnetic storms. It appears that this strange behavior can be attributed to a combination of weak solar activity and CME propagation in the altered heliosphere. This talk summarizes some of these issues related to Earth-affecting CMEs and how the issues will be tackled by the ISEST/MiniMax24 project of the SCOSTEP/VarSITI program.

Keywords: Coronal mass ejections, Solar Energetic Particle Events, Geomagnetic Storms, CME propagation, Solar Cycle, SCOSTEP/VarSITI