Geophysical Research Abstracts
Vol. 13, EGU2011-9316, 2011
EGU General Assembly 2011

White-light observations of a forming wave ahead of a coronal mass ejection

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Images of the solar corona obtained by the *Solar-Terrestrial Relations Observatory* (STEREO) and the *Solar and Heliospheric Observatory* provide high-cadence, high-resolution observations of a large-scale density wave forming ahead of a fast Coronal Mass Ejection (CME) (> 700 km s^{-1}) which erupted on 2010 April 03. The passage of this wave at 1 AU is detected in situ by the *Advanced Composition Explorer* and *Wind* spacecraft at 08:00UT on April 05 as a shock followed by a turbulent and heated sheath. These unprecedented and complimentary observations of a shock-sheath region from the Sun to 1AU are used to investigate the onset of a Solar Energetic Particle Event (SEP) measured near Earth and at STEREO-B. The spatial extent, radial coordinates of the central axis and speed of the driver ejecta are measured from SECCHI observations and used as inputs to a numerical simulation of the CME propagation in the background solar wind. The simulated magneto-plasma properties of the shock and sheath near 1AU agree very well with those measured in situ near Earth. These simulation results reveal that Earth and STEREO-B are magnetically connected to the Eastern and Western edges of the bow shock. The simulation shows that the nine hour delay of the SEP onset at Earth relative to the eruption time is consistent with the time required by the shock to reach the magnetic field line connected with the Earth. The shock compression ratio is found to grow along the magnetic field line until the maximum flux of high-energy particles is reached and then levels off.