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Impacts and geo-effects of multiple coronal mass ejections around 2010 August 1 in the inner heliosphere

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We present multi-point in situ observations of a complex sequence of coronal mass ejections which may serve as a benchmark event for numerical and empirical space weather prediction models. On 2010 August 1, instruments on various space missions (SDO/SOHO/STEREO) monitored repeated coronal mass ejections originating within tens of degrees from solar disk center. We compare and contrast their imprints on four widely separated locations, covering 120° in heliospheric longitude, with radial distances from the Sun ranging from MESSENGER (0.38 AU) to Venus Express (VEX, at 0.72 AU) to Wind, ACE and ARTEMIS near Earth and both STEREO probes close to 1 AU. Calculating shock and flux rope parameters at each location lets us derive the global shape of the shock surface and gives us hints at the global ICME configuration. VEX and STEREO-B observed similar flux ropes, in contrast to the structures at Wind, where among others elevated alpha particles near the front boundary of a magnetic cloud were detected, indicating possible filament material. The geomagnetic storm was moderate to major, reaching two minima in the Dst index. MESSENGER received a glancing blow of the ICMEs, and the events missed STEREO-A entirely. The observations demonstrate how sympathetic solar eruptions may immerse at least 1/3 of the heliosphere in the ecliptic with their distinct plasma and magnetic field signatures and emphasize the difficulties in linking the local views derived from single-spacecraft observations to a consistent global picture.