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CME impact at Earth with low and typical Mach number plasma characteristics

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We study the response of the Earth's magnetosphere to the solar wind conditions caused by interplanetary coronal mass ejection (ICME) events by using the Grand Unified Magnetosphere-Ionosphere Coupling Simulation (GUMICS-4). Such events typically drive the strongest geomagnetic disturbances and thus generate conditions that e.g. lead to saturation of the cross-polar cap potential (CPCP).

We use solar wind data from two ICME events that occurred on 15–16 July 2012 and 29–30 April 2014. During the 2012 event, the solar wind upstream values reached up to 35 particles/cc, speed of 694 km/s and interplanetary magnetic field of 22 nT. The event of 2014 was more moderate, with the corresponding upstream values of 30 particles/cc, 320 km/s and 10 nT. The mean upstream Alfvén Mach number was 2.3 for the 2012 event, while it was 5.8 for the 2014 event.

In this presentation, we show an overview of the Earth's space environment dynamics during both ICME events by covering both global and local perspectives. We study how the size of the magnetosphere changes and how the polar cap region evolves as a response to the two events. To validate the accuracy of the GUMICS-4 simulation we use satellite data from several missions located in different parts of the magnetosphere.