

Effects of the September 2014 CMEs chain in the inner Solar System and the response of the Martian ionosphere.

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A chain of CME events, occurred on September 2014, led to strong perturbations in the interplanetary magnetic field and remarkable enhancements in the energetic particle fluxes measured at different heliospheric distances (see figure 1, panel a)). We conducted a multi-spacecraft and multi-parameter analysis of such intense events, using observations from a fleet of spacecraft distributed in the inner Solar System, such as STEREO B, MESSENGER , Mars Express, SOHO.

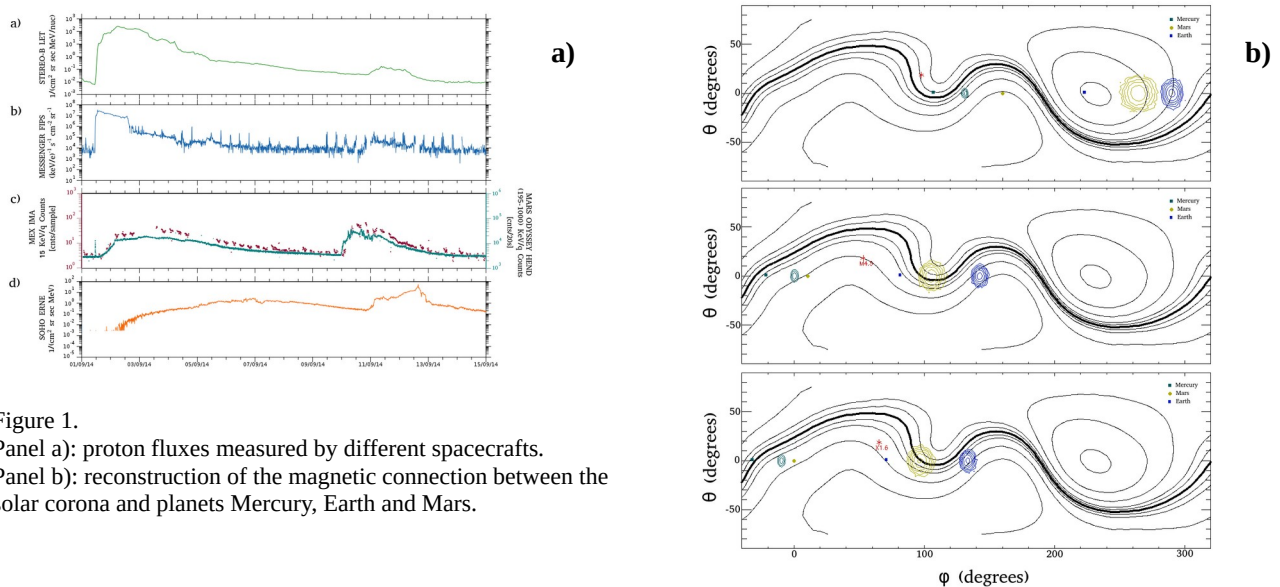


Figure 1.
Panel a): proton fluxes measured by different spacecraft.
Panel b): reconstruction of the magnetic connection between the solar corona and planets Mercury, Earth and Mars.

To better understand the propagation of the SEPs induced by such a strong solar events and their subsequent effects on different planetary bodies, we investigated the magnetic connectivity between the inner planets and the solar corona at the time when the CMEs occurred. We used a Monte Carlo simulation to trace the magnetic footpoints of the Parker spiral intersecting Mercury, Mars, and Earth. In panel b) of figure 1, we report the magnetic footpoints of the Earth (blue contour lines), Mars (green contour lines), and Mercury (petrol blue contour lines), traced back on the solar surface (4 Solar radii) for September 1, 9, and 10, 2014, respectively and projected on the solar magnetic configuration at the source surface ($r = 2.5R_s$) provided by the Wilcox Solar Observatory (WSO).

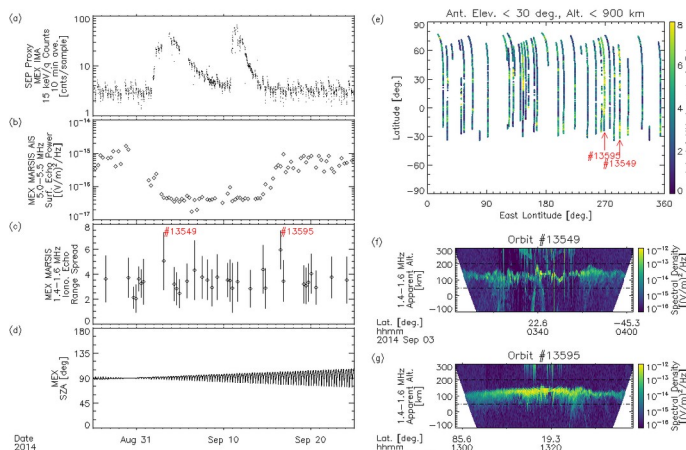


Figure 2.
Overview of Mars Express (MEX) observations of the Martian ionospheric response to the September 2014 space weather events.

Reference:

Ippolito A., Sanchez-Cano B. and Harada Y., Effects of the September 2014 CMEs chain in the inner Solar System and the response of the Martian ionosphere, 2025, Astronomy and Astrophysics, 695, A225 (2025), <https://doi.org/10.1051/0004-6361/202453169>.

A characterization of the interaction between Coronal Mass Ejections and the inner planets of the Solar System is presented, focusing on some of the main effects on each planetary environment, with particular emphasis on the Martian's ionosphere (see figure 2). The aim of the work we present is to offer a detailed cause-and-effect framework for studying space weather events in the Solar System, allowing us to obtain a more global picture of the related phenomena in action.