CSES monitoring of the interplay between current-sheet and EMIC-wave driven scattering as a proxy of substorm activity

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Plasma injections from Earth's magnetotail to high-latitude ionosphere provided by substorm activity are known to play a key role in the MeV-electron acceleration mechanism by resonating interaction of very-low-frequency (VLF) chorus waves with seed electrons. On the other hand, non-adiabatic motion of plasma-sheet protons related to current sheet scattering (CSS) causes pitch-angle diffusion and precipitation to the ionosphere, inducing the formation of a characteristic energy-latitude dispersion pattern at the equatorward side of the auroral isotropy boundary (IB), which gets significantly altered during geomagnetic storms due to particle precipitation triggered by electromagnetic ion cyclotron (EMIC) waves.

For these last two years, a moderate geomagnetic storm activity has been affecting the Earth's environment, with the notable case of Aug 2018 G3-class storm. The effects of such disturbances - especially in case of prolonged substorm activity during the recovery phase - have been clearly spotted by the entire suite of detectors on board the China Seismo-Electromagnetic Satellite (CSES-01), a low-Earth-orbit (LEO) mission launched on Feb 2, 2018.

Here, we present long-term storm-time observations by particle, e.m.-field, and plasma instrumentation on board CSES-01, namely the High-Energy Particle Detector (HEPD), the Electric Field Detector (EFD), and the High Precision Magnetometer (HPM), either developed or data-validated by the Italian LIMADOU Collaboration. Thanks to magnetosphere-to-ionosphere mapping, results from HEPD, EFD, and HPM data analysis help track substorm plasma injections and consequent magnetosphere re-arrangement on a statistical basis. This further inscribes CSES-01 into the thematic area of space-weather and space-climate exploration and modeling, which is especially important in a period when many key space-weather instruments have been quit or operate well beyond the end of their scheduled lifetimes.