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CIR event multi-instrument analysis, and its ionospheric response: Low latitude study case

María Graciela Molina*[1,2], Sergio Dasso[3,4], Gustavo Mansilla[1,2], Jorge H. Namour[1] and Miguel A. Cabrera [1]
(1) Facultad de Ciencias Exactas y Tecnología, Universidad Nacional de Tucumán,
Av. Independencia 1800, Tucumán, Argentina, email:gmolina@herrera.unt.edu.ar
(2) CONICET, Universidad Nacional de Tucumán, Av. Independencia 1800, Tucumán, Argentina
(3)Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Departamento de Ciencias de la Atmósfera y los Océanos and Departamento de Física, Intendente Güiraldes 2160, Ciudad Universitaria, Ciudad Autónoma de Buenos Aires, Argentina.
(4) CONICET, Universidad de Buenos Aires, Instituto de Astronomía y Física del Espacio, Intendente Güiraldes 2160, Ciudad Universitaria, Ciudad Autónoma de Buenos Aires, Argentina, email: sdasso@iafe.uba.ar

On 7th October 2015 an intense geomagnetic storm (Kp=7) occurred. The mentioned geomagnetic storm triggered almost intermediately disturbances in the ionosphere. The ionospheric perturbations at Tucumán, Argentina, a low latitude station (26° 51' S, 65° 12' W), by analyzing the main ionospheric parameters using a AIS-INGV ionospheric sounder and TEC from GNSS receivers was observed. The solar wind impact on the Earth's environment was analyzed using geomagnetic data and proxies such as Dst index. We observed two ionospheric storms, first negative and the other one positive. Significant depletion in both parameters f0F2 and TEC where observed in agreement with a first main phase showed by Dst index. The geomagnetic storms starts its recovering phase late the same day when a second SSC is observed, which triggered the second (positive) ionospheric storm. We included for the analysis the virtual height of the F2 layer and a model for the electric field.

We concluded that the prompt penetration electric fields (PPEFs) originated by the solar wind-magnetophere-ionosphere coupling are playing the main role in the negative ionospheric storm. In the case of the positive ionospheric storm. We believe that a combination of mechanisms are responsible: PPEFs and disturbed dynamo electric fields (DDEFs).

We also investigated the solar and interplanetary drivers. Different solar sources candidates from possible CMEs, stealth CMEs and CHs, were explored. We find that the main responsible for this strong perturbation in the geospace was a Co-rotating Interaction Region (CIR) even, when typically Interplanetary Coronal Mass Ejections (ICMEs) are the most geo-effective transient interplanetary events.

This study analyzed the complete chain of events from the Sun to the ionosphere, with particular emphasis in a low latitude station. This multi-intrument approach has special interest for local and regional space weather monitoring.