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Multiparametric study of polar ionosphere on both hemispheres

Giulia D'Angelo (1), Lucilla Alfonsi (2), Luca Spogli (2), Claudio Cesaroni (2), and Vittorio Sgrigna (1)

(1) Università degli studi Roma Tre, Rome, Italy (sgrigna@fis.uniroma3.it), (2) Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy (claudio.cesaroni@ingv.it)

The polar ionosphere is a complex system in which several actors concur to establish the observed medium. Indeed the coupling between the interplanetary magnetic field and the earth magnetic field determines a high degree of complexity of the polar ionosphere, which is directly exposed to the variations of the solar wind. This configuration results in a strong sensitivity of the polar ionosphere to the perturbation phenomena caused by solar events which may result in a wide variety of spatial and temporal dimensions of the plasma electron density irregularities.
Polar ionospheric irregularities may seriously jeopardize performance and reliability level of the navigation and positioning technological systems, such as GPS or the nascent Galileo. Therefore, knowledge of the physical state of the upper atmosphere ionized layers becomes essential to predict and mitigate events that may affect the use of modern technology, causing economic damage and, in severe cases, even jeopardizing the safety of human beings. In this context, a careful and thorough investigation that covers a wide range of geospatial different disturbances, observed in circumterrestrial space and on the ground, can provide the necessary basis for a real advance of the current knowledge. In this frame, the aim of this work is to contribute to the study of the effects of perturbation induced by the Sun on the polar ionosphere of both the hemispheres, through the analysis and interpretation of the measures available before, during and after the occurrence of an event of disturbance. We propose a multiparametric approach, that combines the information derived from measurements acquired by ground-based and space-based stations, to have a broad spectrum of information necessary to characterize the ionospheric disturbances on different time scales (from milliseconds to days) and spatial scales (from millimetres to hundreds meters/kilometres).
The period chosen for this study is the entire month of March 2015 when a succession of numerous solar events caused magnetic varying intensity and different nature disturbances on the ground. The results provide interesting insights on the symmetry/asymmetry of the two caps and suggest a crucial role of the substorms in generating the observed ionospheric irregularities.