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Large-Scale Travelling Ionospheric Disturbances occurrence during the Space Weather events of September 7-8th, 2017

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The ionospheric disturbances, often related to Space Weather (SWE) events, can degrade the performance of radio systems used for communication and navigation. Hence, a good understanding of ionosphere behavior during these events is necessary in order to mitigate these harmful effects. The Large Scale Travelling Ionospheric Disturbances (LSTIDs) are among the set of ionospheric perturbations associated with SWE. These disturbances are likely to occur during geomagnetic storms and correspond to ionospheric signatures of the atmospheric gravity waves originated in the auroral region due to thermosphere heating. Although some efforts have been made in order to fully depict the LSTIDs generation, the source mechanisms are still not completely understood. It is well known that SWE events can trigger the emergence of these structures and that its occurrence on mid-latitudes is well correlated with the presence of auroral substorms. In order to analyze the LSTIDs excitation mechanisms, this work investigates the presence of the LSTIDs in the European sector from 7-8th of September 2017. During this period, and in the previous days, several SWE events took place, leading to significant effects on the Magnetosphere-Ionosphere-Thermosphere system. A few solar flares have been detected, including the strongest solar flare of solar cycle 24 (X9.3 class registered on the 6th of September at 11:53 UT). In addition to the solar flares, the occurrence of coronal mass ejections also contributed to the manifestation of geomagnetic disturbances. Throughout the investigated period the geomagnetic conditions indicate the occurrence of auroral substorms and two geomagnetic storms in which the SYM-H reached values of -146 nT and -115 nT on the 8th of September (01:08 UT and 13:56 UT, respectively). To detect the presence of LSTIDs the Total Electron Content derived from Global Navigation Satellite Systems measurements has been adopted. By using the detrended TEC derived from a set of several GNSS stations it was possible to confirm the occurrence of some structures propagating toward the equator with typical wave parameters (mean wavelength $\sim$1900 $\pm$ 500 km, a mean period $\sim$ 70 min and a mean phase speed $\sim$ 490 m/s). Another uncommon structure presenting very large wave parameters (wavelength $\sim$4000 km, period $\sim$ 120 min, phase speed $\sim$ 600 m/s) has been identified during the period of analysis, too.