# Response of the equatorial and low latitude ionosphere to September 2017 solar flares and their likely role in storm-time electrodynamics

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**Abstract.**

We investigate the ionospheric response to recent geomagnetic storm that occurred during September 2017 where many solar flares having order of M, C and X-class are impacted the equatorial and low latitude ionosphere in addition to geomagnetic storm effect. It may be noted that this storm produced several major solar flares (C-class: 40; M-class: 15; X-class: 04) on different days during this storm period for the first time in the solar cycle-24 as this storm submerged with two CME's occurring side-by-side to radiation and particle effects. While 1st CME reduced the Dst to -144 nT at 01:05 UT on 08th September 2017, the 2nd CME produced the Dst effect of -111nT at 17:05 UT on 8th September 2017. Accordingly, the quiet time electrodynamics is believed to be modified due to enhanced production of ionization due to solar flares in addition to storm modified electron densities and electric fields. We investigate this storm using ground based ionosondes located at Tirunelveli and Allahabad and GPS/GNSS receivers located at Tirunelveli/Mumbai/Nagpur along with other IGS stations that measure ionospheric TEC/scintillations and ground geomagnetic field variations that measure magnetic signatures of the ionosphere. Recently it has been reported that this storm produced significant modifications in the mid-to-low latitude ionosphere at nearby longitudes. While many solar flares in the past have been observed to produce CEJ effects, the solar flare in the present investigation has produced eastward electric field in the daytime. In addition, the storm produced TIDs in the mid-latitude ionosphere that caused mid-latitude plasma bubbles in the Chinese longitude in addition to simultaneous equatorial plasma bubbles in the evening to post-sunset sector. However, we observe equatorial type plasma bubbles over Indian longitude. It is known that quiet-time electrodynamics is modified through eastward electric field that is promptly penetrated to equator during daytime due to southward IMF Bz while westward electric field penetration due to the southward IMF Bz during nighttime. Several observational reports have been made in the past in this aspect during geomagnetic storms. It may be noted that until now solar flare effects are seen as an independent process due to the fact that they occur well before storm onset but modification of the equatorial electrodynamics due to simultaneous presence of solar flares is a new concept and it needs to be investigated thoroughly using multi-instruments. Accordingly, using these ground based multi-instruments, we will investigate the response of the equatorial and low latitude ionosphere to different solar flares during the onset of the storm and their modifications in the electrodynamics of the low latitude ionosphere. We also examine the previous results to compare our observations and these results will be discussed.