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Investigation of Effects of Geomagnetic Storms Produced by Different Solar Sources on the Total Electron Content (TEC)

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Abstract : The geomagnetic storm represents the most outstanding example of solar wind-magnetospheric interaction, which causes global disturbances in the geomagnetic field as well as the trigger ionospheric disturbances. We study the behaviour of ionospheric Total Electron Content (TEC) during the geomagnetic storms. For the present investigation we have selected 47 intense geomagnetic storms (Dst ≤ -100nT) that were observed during the solar cycle 23 i.e. during 1998-2006. We then categorized these storms into four categories depending upon their solar sources like Magnetic Cloud (MC), Co-rotating Interaction Region (CIR), SH+ICME and SH+MC. We then studied the behaviour of ionospheric TEC at a mid latitude station Usuda (36.13N, 138.36E), Japan during these storm events produced by four different solar sources. During our study we found that the smooth variations in TEC are replaced by rapid fluctuations and the value of TEC is strongly enhanced during the time of these storms belonging to all the four categories. However, the greatest enhancements in TEC are produced during those geomagnetic storms which are either caused by sheath driven magnetic cloud (SH+MC) or sheath driven ICME (SH+ICME). We also derived the correlation between the TEC enhancements produced during storms of each category with the minimum Dst. We found the strongest correlation exists for the SH+ICME category followed by SH+MC, MC and finally CIR. Since the most intense storms were either caused by SH+ICME or SH+MC while the least intense storms were caused by CIR, consequently the correlation was the strongest with SH+ICME and SH+MC and least with CIR.

Keywords : GPS, TEC, geomagnetic storm, sheath driven magnetic cloud
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