

ON THE POSSIBLE DRIVERS OF PRESTORM IONOSPHERIC PHENOMENA

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An investigation of the ionospheric pre-storm phenomena associated with the very intense geomagnetic storm of November 20-21, 2003 is presented using heliophysical, solar wind, geomagnetic and f_oF2 data. The f_oF2 data were obtained from ionosonde stations located in East Asian sector: Manzhouli, Chongqing, Guangzhou, Hainan; Australian sector: Darwin, Learmonth and Mundaring; the European/African sector: Juliusruh/Rugen, Rome, Athens and Grahamstone and the American sector: Goosebay, Milestone Hill, Wallops Island, Puerto Rico and Jicamarca. Our results show that the pre-storm ionospheric phenomena only occurred on November 20 at Hainan, Learmonth, Mundaring and Goosebay with respective 32%, 22%, 24% and 49% enhancement in f_oF2 at ~0800 UT and at Jicamarca with a strong f_oF2 depletion of ~ -33% between 0100 and 0600 UT. The present results show that the pre-storm phenomena did not indicate any longitudinal dependence, which means that their origin does not derive from local time effect. However, the fact that the enhancements occurred in simultaneity at two widely separated longitudinal zones suggest a role by the magnetospheric electric field, whereby a prompt penetrating electric field would cause dayside enhancement at Hainan, Learmonth and Mundaring and a disturbance dynamo electric field would cause nightside enhancement at Goosebay. But a 6% increase in $hmF2$ observed at Learmonth cannot account for enhancement in f_oF2 at that station. Also the positive storm observed at Goosebay at 0800 UT cannot be accounted for by the 8% downward movement of the F2-region here. These results suggest that both prompt penetrating electric field and disturbance dynamo electric field may not be the main drivers of pre-storm phenomena. The occurrence of flares at 0212 and 0747 UT on November 20 appeared to suggest that the flares could be responsible for the enhancements at Hainan, Learmonth and Mundaring. But these occurred in near simultaneity with the nighttime intense positive storm at Goosebay as well as the depletion of f_oF2 at the low latitude station of Jicamarca implying that solar flares are not the main drivers for the enhancements. The present results appear to suggest that pre-storm ionospheric phenomena could be the result of some underlying mechanisms that are working together.

Geomagnetic storm; Ionosphere; Pre-storm phenomena.

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