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A study of the global ionospheric phenomena during the very intense geomagnetic storm of November 20-21, 2003

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A study of the pre-storm and main phase ionospheric phenomena during November 20-21, 2003 is presented using heliophysical, interplanetary, geomagnetic and global ionospheric data. The results show ionospheric responses in the main phase do not indicate prompt penetration electric fields as the main ionospheric driver. Furthermore, the results show that pre-storm phenomena's origin doesn't derive from local time effect. The simultaneous occurrence of foF2 enhancements at two widely separated longitudinal zones appeared to suggest a role by the magnetospheric electric field. But the analysis of hmF2 at the stations could not confirm these fields as main drivers of pre-storm phenomena. An investigation of flare effects on the pre-storm phenomena also revealed that solar flares are not the main drivers. The present study stand up against recent suggestions that there are no convincing arguments that pre-storm phenomena bear a relation to magnetic storms, and suggests that pre-storm ionospheric phenomena could be the result of some underlying mechanisms that are working together with relative importance.

Keywords: Geomagnetic storm; Solar X-rays; Solar wind; Shock-driver gas; Ionosphere; Pre-storm phenomena