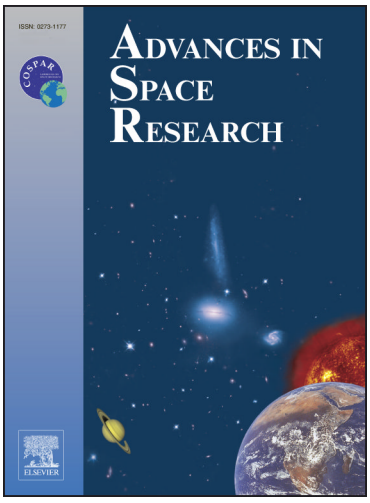


# On the Mid-latitude Ionospheric Storm Association with Intense Geomagnetic Storms

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**On the Mid-latitude Ionospheric Storm Association with Intense Geomagnetic Storms**

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**Abstract**

The bulk association between ionospheric storms and geomagnetic storms has been studied. Hemispheric features of seasonal variation of ionospheric storms in the mid-latitude were also investigated. 188 intense geomagnetic storms (Dst ≤100nT) that occurred during solar cycles 22 and 23 were considered, of which 143 were observed to be identified with an ionospheric storm. Individual ionospheric storms were identified as maximum deviations of the F2 layer peak electron density from quiet time values. Only ionospheric storms that could clearly be associated with the peak of a geomagnetic storm were considered. Data from two mid-latitude ionosonde stations; one in the northern hemisphere (i.e Moscow) and the other in the southern hemisphere (Grahamstown) were used to study ionospheric conditions at the time of the individual geomagnetic storms. Results show hemispheric and latitudinal differences in the intensity and nature of ionospheric storms association with different types of geomagnetic storms. These results are significant for our present understanding of the mechanisms which drive the changes in electron density during different types of ionospheric storms.

**Keywords**: Ionospheric storm, geomagnetic storm, electron density, solar quietest days, Disturbance storm time Index.

## 1.0 INTRODUCTION

### 1.1 Theory of electron Density Variability in the Ionosphere

Electron density variation in the ionosphere and especially in the F region is characterized by the peak plasma densities which result from an interplay of local perturbations, production and loss processes in addition to transport processes (Luhmann, 1995). This interplay is well represented in equation 1 (i.e the continuity equation).

$$\frac{\partial N}{\partial t} = q - l(N) - \nabla \cdot (Nv) \qquad 1$$

Where *N* is the electron density, q is the production rate of ionization, *l(N*) is the loss term. *v* is a net drift velocity resulting from transport processes. The production and loss processes (and consequently the electron density) in the F2 region of the ionosphere are dependent on the neutral composition of O, $O_2$ and $N_2$. Complexities in the temporal and spatial electron density variability in the ionosphere have been the subject of a number of notable researches in the past (e.g, Rishbeth and Garriot, 1969, Jones and Rishbeth, 1971, Prolss and Jung, 1978, Davis *et al*.,1997, Rakhee *et al.*, 2010, Byung-Kyu Choi *et al*.,