



## **Horizontal gradients and rate of changes in ionospheric F2 layer during November 2004 and 2003 and their application**

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The paper presents results of calculating ionospheric horizontal gradients and the rate of change in ionospheric plasma distribution represented by critical frequency of F2 layer  $f_{0F2}$  during two large geomagnetic storms in November 2003 and 2004. The aim of this analysis is to obtain enough knowledge for a future development of a suitable ionospheric index based on these parameters that enable users to quantify ionospheric disturbances affecting telecommunication and space based navigation services. For this purpose the vertical incidence sounding  $f_{0F2}$  data at four locations in Europe are used to calculate: (1) the horizontal gradients between all possible pairs of stations; and (2) the rate of change at individual station as a possible measure of horizontal plasma disturbances. The analysis is confined to two months of manually and automatically scaled  $f_{0F2}$  data (November 2003 and 2004) during a range of geomagnetic activity that offered an opportunity to reveal the characteristics of these plasma parameters during quiet and disturbed geomagnetic conditions. As it is clearly shown in this paper that the geomagnetic storm effect on the F region is visible within these parameters, a work is in progress to improve obtained results by recalculating the raw ionograms with an advanced auto scaling software relevant for real-time ionospheric specifications.