



Significant North – South and East – West Asymmetries in the ionospheric Effects of the intense geomagnetic Storms and Superstorms

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Recent series of the intense geomagnetic storms and superstorms revealed rather unexpected temporal/spatial distributions of the zones of precipitation of energetic charged particles such as protons and electrons. The most reliable proxy of geoeffectiveness of precipitation of these particles are the strength and duration of ionospheric disturbances produced during these events. The effects in the lower ionosphere are of a special interest since this part of the ionosphere is inadequately covered by the satellite instruments. In this paper ionospheric effects produced by precipitating protons and electrons are analyzed by means of data of ground-based instruments (riometers and VLF phase measurements) as well as by satellite

(Sampex and Coronas-F) observations. If the temporal/spatial features of distribution of solar proton fluxes are more or less known the same features of electrons of relativistic and subrelativistic energies are poorly investigated so far. We will analyze several storms and superstorms with a special emphasis on very unusual event of November, 1997. During this event the zone of relativistic electron precipitation protruded deeply inside the polar caps and the East-West asymmetry was demonstrated extremely clear. The correspondent ground-based and satellite observations during this event will be analyzed carefully. A suggestion is made that observed asymmetry of energetic electron precipitation could be able to explain even some anomalies of the Earth's climate.