Ionospheric Effects of Geomagnetic Storms on 26–30 September 2011 in the Different Longitudinal Sectors and Their Impact on the HF Radio Wave Propagation

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Ionospheric storm is associated with the chain of events and phenomena in space environment, beginning at the Sun transmitted through the magnetosphere into the thermosphere-ionosphere system. The Earth's ionosphere plays a key role in the space radio communication, radiolocation, navigation, and operation of the satellite navigation systems GLONASS/GPS. In this study, the parameters of the ionosphere-plasmasphere system during geomagnetic storms on 26–30 September 2011 were calculated using Global Self-consistent Model of the Thermosphere, Ionosphere and Protonosphere (GSM TIP).

Use the GSM TIP model provides opportunity to allocate a global response of total, ionospheric and plasmaspheric electron content and ionospheric *F*2 layer peak parameters on geomagnetic disturbances. The comparison of storm-time ionospheric disturbances obtained in model results with GPS TEC and ionosondes observational data globally and in two longitudinal sectors (West American and Siberian) shows a good agreement. Fig.1 presents one example of this model/data comparison. In this study we consider in detail the formation mechanism of the positive and negative ionospheric disturbances at low-, mid- and high-latitudes during different phases of geomagnetic storms.

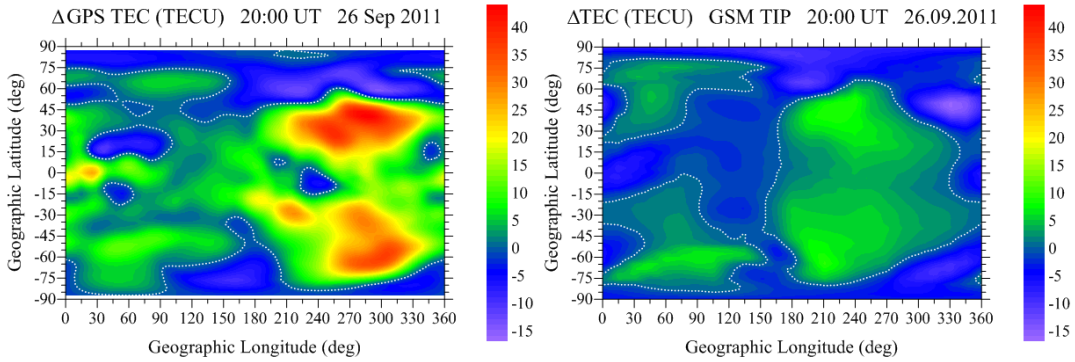

Fig. 1. Global maps of *TEC* perturbations in the main phase of geomagnetic storm on September 26, 2011 at 20:00 UT, obtained according to the data of the network of ground GPS receivers (left) and model calculation results (right).

The another purpose of this report is to present the joint use of the GSM TIP model and radio wave propagation model for studies of the geomagnetic storm impact to radio communication. It is shown that the presence of the *F*1 layer in the high-latitude ionosphere and *F*3 layer in the low-latitude ionosphere leads to the changes in the character of radio wave propagation. There is a significant increase in the range of radio wave propagating through the interlayer wave channel (the valley between *F*1 and *F*2 or *F*2 and *F*3 layers).