Earthquake Precursors in Low-Latitude Ionosphere: Investigation of Formation Mechanisms

MAXIM V. KLIMENKO[1,2], VLADIMIR V. KLIMENKO[2], BIQIANG ZHAO[3] AND VALERIJ V. BRYUKHANOV[1]

[1]*Kaliningrad State Technical University, 1 Sovetsky Av., Kaliningrad 236000, Russia, e-mail: maksim.klimenko@mail.ru*
[2]*West Department of N.V. Pushkov IZMIRAN, 41 Pobedy Av., Kaliningrad 236017, Russia*
[3]*Division of Geomagnetism and Space Physics, Institute of Geology and Geophysics, CAS, 19 Bei-Tu-Cheng-Xi-Lu Str., Beijing 100029, China*

In [1] it has been assumed, that the most probable formation mechanism of *TEC* disturbed areas, observable prior strong earthquakes, is the vertical transport of the *F2*-region ionospheric plasma under the zonal electric field action. The geomagnetic conjugacy of the earthquake ionospheric precursors and effects in equatorial anomaly which development is controlled by zonal electric field are strong arguments in favor of this hypothesis. Besides, the analysis of model calculation results with use of the Global Self-consistent Model of the Thermosphere, Ionosphere, Protonosphere (GSM TIP) in [1] testifies in favor of this hypothesis. There is a question, how such electric fields can arise in the ionosphere prior to earthquakes? Now it is not answer to this question. Therefore, for understanding of formation mechanisms of earthquake ionospheric precursors it is necessary to understand the physics of lithosphere-atmosphere-ionosphere coupling prior to earthquake. Until now there is not common opinion concerning to this coupling. The appearance of local large-scale seismo-ionospheric anomalies in *TEC* and *foF2* it is possible to explain only by two mechanisms: an atmospheric electric field and/or small-scale Internal Gravity Waves (IGWs) with small amplitude. In this study, we present the numerical calculation results for reproduction of observed changes in the ionosphere prior to earthquakes: Koyna on 11.12.1967; New Guinea on 16.07.1980; Philippines on 22.11.1981, 11.01.1982 and 24.01.1982; Sumatra on 26.12.2004; Peru on 25.09.2005 and Wenchuan on 12.05.2008. The calculations of ionospheric precursors were carried out with use of the GSM TIP model. In calculations, the small-scale IGWs and/or the penetration of vertical electric field are considered as the formation mechanisms of earthquake ionospheric precursors. It was carried out the comparison of calculation results of the different ionospheric parameters with experimental data. The obtained results confirm the proposed mechanisms of seismo-ionospheric effect formation by small-scale IGWs and the penetration of the seismogenic vertical electric field from the atmosphere into the ionosphere.

References

[1] A.A. Namgaladze, M.V. Klimenko, V.V. Klimenko and I.E. Zakharenkova, *Geomag. Aeron.* **49**, 252 (2009).