

Use of multi-instrumental radiophysical measurements to study seismo-ionospheric effects

CHERNIAK, Iurii^{1*}, ZAKHARENKOVA, Irina¹, SHAGIMURATOV, Irk¹, Olga Suslova²

¹West Department of IZMIRAN, Kaliningrad, Russia, ²I. Kant Baltic Federal University, Kaliningrad, Russia

Though lithosphere-atmosphere-ionosphere coupling has been intensively discussed for several decades, it does not mean that the ionospheric morphology above seismically active regions is investigated sufficiently well. Investigation of seismo-ionospheric phenomena is a rather complicated task which consists of the identification and localization of weak anomaly pattern at the background of ionospheric changes under various space weather conditions. Analysis of the previous works on lithosphere-ionosphere interactions confirmed the necessity to use simultaneous observations from several independent diagnostics tools in order to raise the reliability of the observed seismo-ionospheric effects. For the given research we propose to use integrated processing of the ionospheric data from different sources: total electron content (TEC) data obtained on the basis of regular GPS observations of IGS stations located in Japan region, ionospheric E and F2 layers peak parameters, derived from data of Japan ionosonde network and electron density profiles, obtained by FORMOSAT-3/COSMIC radio occultation measurements. It allows us to estimate the contribution of different parts of the ionosphere into the GPS TEC values and to reveal the ionospheric regions that are affected to a greater extent by the possible influence from below. There is also estimated the cross-correlation between spaced measurements and data obtained by different techniques. The proposed approach was applied to the case-study of Japan earthquake occurred on May 7, 2008 with magnitude of 6.9. The obtained results and further testing of the method are discussed in the report.

We acknowledge the University Corporation for Atmospheric Research (UCAR) for providing the COSMIC data, IGS community for GPS permanent data and WDC for Ionosphere, Tokyo, National Institute of Information and Communications Technology (NICT) for ionosonde data. This work was supported by Russian Federation President grant MK-2058.2011.5.

Keywords: ionosphere, seismo-ionospheric phenomena, TEC, ionosonde, radio occultation