Ionospheric anomalies instantly before three large earthquakes in Chile detected with GPS observations

*Liming He[1,2], Kosuke Heki[2]

1.Institute for Geo-informatics & Digital Mine Research, College of Resources and Civil Engineering, Northeastern Univ., China, 2.Department of Earth and Planetary Sciences, Hokkaido Univ., Japan

In this work, the ground-based permanent GPS stations were used to study ionospheric total electron content (TEC) response to three large earthquakes in Chile: the Mw8.3 Illapel earthquake of 16 September 2015, the Mw8.2 Iquique earthquake of 01 April 2014, and the Mw8.8 Maule earthquake of 27 February 2010. The GPS arrays around the epicenters provide rare opportunities to investigate the comprehensive near-field preseismic TEC responses to three huge earthquakes in South America. Based on the GPS absolute VTEC technique and Akaike's information criterion (AIC) method, the spatial distribution of ionospheric anomalies have been analyzed for the first time, especially in the height direction. The results showed that the positive anomalies occurred at an altitude of ~200 km, while the negative anomalies occurred at an altitude of ~350 km for the large earthquakes in the south hemisphere. The negative anomalies have a lager distribution than positive anomalies. A well consistency exists between the observation and the simulation result from C.L. Kou *et al*. (2014). The distribution of both positive and negative anomalies were mainly controlled by the geomagnetic field and magnetic latitude of epicenter. Moreover, we analyzed the VTEC variations during non-seismic activity period, and compared the VTEC changes originated form strong seismic activity with the VTEC changes induced by geomagnetic storm.
Acknowledgements: This study was funded by China Scholarship Council (CSC) and partially funded by the National Natural Science Foundation of China (grant no. 41104104). We thank C. Vigny (ENS) for providing GNSS data in Chile of his group. We thank the Argentine national geographic institute (IGNA) for providing GPS data of RAMSAC network, and the Brazilian Institute for Geography and Statistics (IBGE) for providing GPS data of RBMC network. We thank IGS (www.igs.org) and UNAVCO (www.unavco.org) for making GNSS data available.

Keywords: GPS TEC, large earthquake, preseismic anomaly, spatial distribution

