Revealing of anomaly in ionosphereic TEC for mid-latitude earthquakes

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Earthquakes are one of the outrageous upshots of nature. The question of earthquake prognosis is still irrefutable. The changes in the ionosphere can be employed to attain initial facts about an impending seismic activity. Variations in the ionospheric parameters Total Electron Content (TEC) have been examined by many research works (Wolcott et al., 1969; Calais and Minster, 1995; Parrot, 1989; Blaunstein, 1999; Devi et al., 2001; Kon et al., 2011; Le et al., 2013; Parrot, 2012). A drop in TEC retrieved from GPS was noted a few days ahead to certain strong earthquakes (Liu et al., 2001; Zhao, 2009; Xia et al., 2010).

But Ionospheric alteration triggered by geomagnetic storm commotion can promote intensification, or fading of the expression of Seismo-ionospheric effects (Zakharenkova, 2007). Many statistical methods adapted by the researchers such as the moving interquartile range method or the moving time window method, examined the relative enrichment or ruination of the ionospheric parameters to find precursors (Zhao et al., 2008; Liu et al., 2009), nevertheless these approaches are insufficient to reveal some characteristics of signal like frequency domain analysis. Since TEC is non-stationary and there exists a nonlinear relationship between time and frequency, but the Wavelet Transform Technology extracts the frequency, magnitude, phase and other characteristics of a non-stationary TEC signal much more quickly and accurately. This study aims at recognizing the perturbation in GNSS TEC drive from Jet Propulsion Laboratory (JPL) and Center for Orbit Determination in Europe (CODE) at mid latitude before the earthquakes of Turkey, Russia, China having more than 6 M_w.

As, in numerous circumstances, ionospheric irregularity signals prompted by seismic commotion can straightforwardly be tangled with background instabilities attributable to solar commotion. To get rid from this effect and study the inconsistency variation, we compute the Difference of TEC (DTEC), which is calculated by the formula, given below. DTEC = TEC obs –TECref where the TECobs are the observed TEC and the TECref are calculated from the preceding 15 days' moving median TEC. To rule-out the prospect of anomaly finding throughout high as well as moderate geomagnetic activity, the DTEC values with Dst<-20nT, ap>20 and -3<Kp. Then CWT was applied to expose the perturbations. We have also study the variation in DTEC at different longitude by taking value latitude constant. The anomalies for Turkey and Russia earthquake were witnessed within 7 days of pre shock activity. For China event the anomalies were seen on earthquake happening day as well as 13 and 14 days before the tremor happening day. But we have not find any anomalous behavior of DTEC other than earthquake zone for all three earthquake. The cause of all these perturbations can be understood, by the fact that during the preparatory stage of an earthquake the tectonic movement of the plates give rise this stress within the Earth's crust leads to mechanical deformations and crust estrangement. The key source of atmosphere ionosphere coupling atop the epicenter zone is the emanation of diverse chemical constituents like radon, light gases, and submicron gases from Earth (Aleksee and Alekseeva, 1992). If the aggregation of these arising gases is moderately enormous they directly cause the production of an anomalous electric field. The manner this irregular electric field coupled with the ionosphere in turn causes large scale alteration in the electron density (Pulinets et al., 2011).After the observations, we can achieve that the ionosphere behavior alters a few days

afore and after the seismic tremor with inconsistency which can be understood as uncharacteristic pre-seismic signatures.

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