## The Abnormal Perturbations of Ionospheric TED Prior to the Earthquakes in the Qinghai-Tibet Region

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The existence of seismic precursors is still a question widely studied by the signals of electricity, magnetism, electromagnetism and others. In this study, tens of the earthquakes occurred in the Qinghai-Tibet region from year 1999 to 2008 were chosen and the GPS TEC (total electron content) during the earthquakes was used as one of the important ionospheric parameters to find the pre-earthquake ionospheric anomalies. The similar anomalies of TEC were found before most earthquakes and the main character of the temporal and spatial TEC abnormal variations was extracted. We discussed the relationship between the occurrence of these anomalies and the earthquakes. The cases we studied include which the earthquake occurred within days after ionospheric TEC anomalies happened and those that no earthquakes happened after similar anomalies. There is an unusual TEC enhancement or decrement in the afternoon several days before most of the earthquakes (85% of the M>5.0 earthquakes). Compared to close numbers of the earthquakes happened on the west coast of the United States, the spacial anomalies of TEC before earthquakes in the Qinghai-Tibet region would mainly affect the equatorial ionization anomaly crest region and have some differences from the variations caused by geomagnetic storms. The result suggests that these anomalies of TEC may be a seismo-ionospheric signature.

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