TEC VARIATIONS FROM GPS DATA RECORDED DURING HECTOR MINE EARTHQUAKE ON OCTOBER, 16, 1999, CALIFORNIA

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Abstract:

We analyze GPS data in order to record the potential earthquake precursors of Hector Mine earthquake that occurred in California, USA, in October 16, 1999. This event was chosen because at the time of this strong earthquake (M=7.1) a dense network of ground-based GPS stations was operated, thus providing a fairly high spatial resolution. We analyzed the seismic, geomagnetic, and ionospheric data available for this region for period of October, 13–18, 1999 (286th to 291st Julian days of year), i.e. four days before and two days after the earthquake. The state of the ionosphere in the epicenter region was controlled using the data recorded by the GPS and the nearest Point Arguello ionospheric measurement station (32.17 N, 249.27 E). The main goal of this investigation is a detailed analysis of the total electron content (TEC) over a sufficiently long time interval including the time of the earthquake. The subject of this research is the potential revealing in the TEC data of the well-known seismo-ionospheric effects. They include both quasi-regular changes in the ionospheric parameters (e.g. plasma density) and internal gravity waves propagating through the ionospheric plasma after suspected generation in the epicenter region. Standard analysis showed, however, that the observed TEC variations in the range of 30-130 min seem to have been controlled by the local time and by fairly moderate geomagnetic activity instead of being associated with any expected processes that usually accompany the process of earthquake preparation. The dominant geomagnetic control of the entire spectrum of ionospheric disturbances can serve as a serious obstacle in revealing any seismo-ionospheric effects which occure even during moderate magnetic activity, if no specific means of recording ionospheric disturbances of seismic origin are found. Indeed, when we used a refined method of TEC analysis in the range of 10-20 min variations, it showed rather promising opportunity to extract information about an earthquake preparation. In particular, the method of an optimum detector allows one to get an additional information about the ionospheric disturbances which in this case corresponds to the earthquake time and do not correlate with the growth of geomagnetic activity. This subject calls for a further study however. At the same time there are definite prospects for recording the processes of earthquake preparation by detecting the small-scale ionospheric irregularities which are supposed to arise in the course of earthquake preparation. This possibility is also discussed in the present investigation.