

Development of correlation technique aimed to reveal the ionospheric precursors of earthquakes using the data of GPS TEC and vertical sounding.

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Abstract

We demonstrate the development of correlation technique based on the discovered special case of the local ionospheric variability associated with earthquake preparation process. It permitted to develop the special index of the local ionospheric variability which reveals the ionospheric precursors even in the presence of geomagnetic disturbances. It is important for high latitude regions where the ionospheric disturbances associated with geomagnetic storms are more pronounced. New technique dealing with deviation of critical frequencies clearly demonstrates the earthquake related ionospheric disturbance at Petropavlovsk in comparison with Magadan data what happens in magnetically disturbed conditions.

1. Introduction

The correlation technique developed recently [1] has demonstrated the drop of the cross-correlation coefficient calculated for two stations (GPS TEC or vertical ionosonde) situated within the earthquake preparation zone few days before the seismic event. Further investigations have demonstrated the existence of the special case of the local ionospheric variability associated with earthquake preparation process. It permitted to develop the special index of the local ionospheric variability [2] which reveals the ionospheric precursors even in the presence of geomagnetic disturbances. The nature of the discovered phenomena is based on the fact that during magnetic storms the correlation radius of the ionosphere is much higher, and the variations are almost coherent at stations separated by more than 700 km. The nature of the ionospheric variability before earthquakes is completely different what is reflected in the loss of coherence in variations at stations situated very closely.

2. $\Delta foF2$ Correlation Technique

Variations of the critical frequency of F2-layer have been considered at two ionospheric stations Petropavlovsk and Magadan around the time of several earthquakes at Kamchatka peninsula. The series of $\Delta foF2$ - deviations of critical frequencies from its half-monthly moving average values are calculated for both stations. Then it has been obtained the difference of $\Delta foF2$ variations between stations Petropavlovsk and Magadan in order to exclude the identical changes, connected with geomagnetic disturbances, and to reveal the particularity, caused by location of stations in different seismic zones.

The previous statistic analysis of series of $foF2$ at two given ionospheric stations has shown that the correlation between them often was broken a few days before earthquake [3]. Now we considered the changes of critical frequencies more in details.

Our calculations show that independently on geomagnetic conditions before earthquakes the positive values of variations are predominated at Petropavlovsk station as compared with Magadan station. Usually the variations of $\Delta foF2$ follow the statistic distribution of random values. However 10-12 days before earthquakes the distribution becomes asymmetrical one with the displacement to positive values.

7. References

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