IONOSPHERIC PERTURBATION IN ASSOCIATION WITH SEISMIC ACTIVITY, A STATISTICAL STUDY

Yasuhide Hobara and Michel Parrot

LPCE/CNRS, 3A Avenue de la Recherche Scientifique 45071, Orleans, France
Tel: 238255291, Fax: 238631234, Email: hobara@cnrs-orleans.fr

ABSTRACT

Ionospheric perturbations in response to major seismic activities are derived either by case study or statistical approach. foF2 records from ionospheric stations all over the world between 1957 and 1990 are used. Two sharp decreases in dfoF2 are observed only at several ionospheric stations within 1500km from the epicenter of large seismic event (M=8.25) a couple of days before and after the shock. Statistical study of mid magnetic latitude range (20deg< mlat<40deg) based on the averaging over each station tend to have increase in dfoF2 around 5 and 15 days before earthquakes within a 160-day time period.

INTRODUCTION

Electromagnetic perturbations due to seismic activity are known since a long time [1]. Due to a lack of complete measurements, they have been the object of large debate in literature. The aim of this paper is to study statistically the ionospheric data record by the ground-based ionospheric sounders all over the world since the beginning of their activities.

DATA AND ANALYSIS

We used the World Data Center A Vertical Incidence Sounding CD-ROM, which includes ionospheric records from world wide ionospheric stations between 1957 and 1990. We take foF2 (F2 layer o-mode critical frequency indicating the peak electron density of F2 layer for our analysis. From this record we calculate the deviation of foF2 from its running mean value for different hour in UT. Our statistical study is performed by a station basis. For a given particular station, we derive the temporal variation of dfoF2 record around the earthquake time for each hour. Then , records from each seismic event are summed up and divided by the number of the data points available for each day.

RESULTS

Generally, significant change in dfoF2 records caused by earthquakes is difficult to find from case study basis because the ionospheric parameters strongly depend on solar activity. Nevertheless, we obtained one rather clear example of such an anomaly in association with powerful Hachinohe earthquake indicating two distinctive sharp drops in dfoF2. They occur –4 days and +2 days with respect to the main shock. Furthermore, this anomaly is observed only in several ionospheric stations with limited spatial extent. Recent results in [2] show precursory decreases of foF2 observed at single ionospheric station for powerful Chi-Chi earthquake in Taiwan at 1, 3 and 4 days before the main shock and found that the corresponding electron density decrease is about 51 % from its normal value. We have very similar results with for the case study. From statistical study we examine superposed epoch of the foF2 records for more than 1000 events occurring during 27 years close to different stations. Results from mid magnetic latitude stations tend to have increase in foF2 around 5 and 15 days before earthquakes within a 160-day time period, which indicate probable link between the ionosphere and the seismic activity. However rather large fluctuating characteristics prevent us to reveal a clear relation with earthquakes at low and high latitude stations.

REFERENCE

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