Geophysical Research Abstracts
Vol. 15, EGU2013-543, 2013
EGU General Assembly 2013

Detection of ionospheric foF2 variations before strong earthquakes

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Several studies have revealed the existence of seismo-ionospheric precursors based on the observation of disturbances of the ionospheric parameters before strong earthquakes, including the F2 layer critical frequency. Following these observations; we examine ionospheric anomalies by analyzing the F2 layer critical frequency (foF2) derived from ionosonde stations. The stations are located inside the earthquake preparation area, as evaluated using Dobrovolsky equation, to capture the ionospheric disturbances generated by the seismic event. The analyzed data cover a period of 50 days (day of the quake included) before the main shock. The deviation of F2 layer critical frequency (ΔfoF2) is calculated over this period to find meaningful changes of peak electron density in time. This duration is sufficient to distinguish seasonal events from séismo-ionospheric precursors. The solar activity conditions are taken into account. However, the ionosphere is directly influenced by solar activity. Thus, additional measures of foF2, obtained during non-seismic activity, are analyzed for a period of time identical to that taken in the previous study. As we know, seismo-ionospheric precursors are detectable 1 to 10 days before the main shock of powerful earthquakes; various solar activity conditions are, therefore, considered (quiet and intense) whether during the 10 days before the main shock (day of the quake included) or over the whole period of time analyzed (50 days). The statistical analysis of the F2 layer critical frequency (foF2) revealed a significant decrease of the deviation of foF2 (ΔfoF2) at some hours of the day during the first 10 days before the main shock (day of the quake included). This behavior is not systematically observed during periods of non-seismic activity regardless of the conditions of solar activity. On the other side, the statistical analysis has not shown any seasonal dependence of foF2 over the whole length of the signal whatever the conditions of seismic and solar activity. These results suggest extending this study to other earthquakes considering various conditions of solar activity over several periods of time.

Key words: Seismo-ionospheric precursors – ionosonde data – foF2 – Statistical analyses – Solar activity.