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On long-term variations of foF2 frequencies in the mid-latitude ionosphere before strong earthquakes

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In a series of works, the behaviour of characteristic parameters of the ionosphere during earthquake preparation times has been studied. There, by vertical sounding experiments, the critical f_oF2 frequency was one of the normally measured parameters. This frequency is a characteristic of the F-layer, that means of the most dynamic regular ionospheric layer which varies strongest by different reasons. First, one made a search for modifications of the mean values of f_oF2 to prove if they might be precursors of sufficiently strong earthquakes. But the results of the works by Pulinets, Hobara, Parrot, Singh etc. showed, that the problem turns out to be rather difficult as mean f_oF2 values seem to be considerably changed only by very strong earthquakes. So, it was unclear which are the magnitudes of the earthquakes yet connected with an observable modification of the mean f_oF2 parameters before an eruption. In the present work, nine very strong earthquakes with $M > 6.5$, which took place in Japan, are analysed. In such cases one expects that a decrease of f_oF2 may be observed about 5-10 days before the earthquake. Further, a group of less strong earthquakes with $6 < M < 6.5$ is studied, and it is found that the mean f_oF2-value does not decrease before the events. Thus, it is concluded that one has to use the changes of the values of the f_oF2 frequency - and not the changes of the mean values of F_oF2 - to make earthquake predictions. Further, it is shown, that at distances from the vertical sounding stations up to 1000 km, the f_oF2 frequencies decrease 1-10 days before core earthquakes with magnitudes $M > 5.5$. In the present statistical analysis more than

100 earthquakes are taken into account.