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Periodicities of earthquakes at the Garm test site

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1 Introduction

Semidiurnal, diurnal, annual and some other periods are reliably revealed in the catalog of the earthquakes at the Garm test site (Tadjikistan). A complete catalog of earthquakes including 92597 events for the whole period of the test site existence from 1955 to 1992 was used. The Fourier spectra and periodograms obtained by a modified method of epochs' superposition were analyzed.

1.1 Diurnal periodicity

It is established that throughout the whole year significantly more earthquakes were registered at night than during the day. This effect is particularly strongly revealed for small earthquakes. The catalog contained almost 1.5 times more nighttime earthquakes with M$<$1.1 than the daytime ones. The corresponding ratio for earthquakes of all magnitudes is approximately equal to 1.17. In addition to the 24 hours component, a component with a period of 12 h has large amplitude, and components with 6 and 4 h periods have somewhat smaller amplitudes. Components with the periods of the lunar tides (the waves O_1, M_2 etc.) are completely absent. The relation with the Sun is supported by the analysis results for earthquakes selected by individual months. The most characteristic features of diurnal variations in the number of registered earthquakes are discussed.

1.2 Seasonal and intraseasonal periodicities

The analysis of the distribution of the number of earthquakes by months of a year has shown that approximately 2 times fewer small earthquakes with $M<1.1$ were recorded in summer than in winter. A dominating role of components with the periods of 30-32 and 41 days that also dominate in the spectra of the global atmosphere oscillations (Madden-Julian oscillations) has been exposed in intraseasonal variations of seismicity. A possible role of variations in a wind load and pressure on the territory of a studied area and variations of the Earth's rotation velocity effected by Madden-Julian oscillations is discussed.

Conclusions

The majority of the obtained results agree well with a model suggesting detection capability variation of the observation network due to noise level variations as the main reason for the revealed periodicities. However some facts also lead us to suggest some yet unknown mechanism of real seismicity variations due to the solar effect.