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Precursors of strong earthquakes in Kamchatka (according to data from 2005-2022)

Galina Kopylova[1] , Yulia Serafimova[1] , **Victoria Kasimova[1]**

[1] Geophysical Survey, Russian Academy of Sciences, Kamchatka Branch, Russia

gala@emsd.ru

The Kamchatka Peninsula is one of the most earthquake-prone regions of Russia. Here, earthquakes with magnitudes M_W up to 8–9 are possible, which accompanied by tsunamis and shaking up to 9–10 points on the MSK-64 scale in continental areas. Over the period of detailed seismological observations since 1962, the average frequency of earthquakes with $M_W \geq 6.8$ is 0.47 events per year (28 events in 60 years). The average frequency of earthquakes with MW ≥ 7.5 is 0.17 $year^{-1}$ (10 events in 60 years).

Seismological, geophysical, geochemical and hydrogeological observations in order to search for earthquake precursors have been carried out in the Kamchatka Peninsula area from the late 1970s to the present. Most of the stations for “non-seismological” observations of precursors are located in a small area of the Petropavlovsk-Kamchatsky geodynamic polygon (PKP).

The priority of the KB GS RAS activity is the development of observation networks for seismicity, geophysical and geochemical parameters in order to search for precursors and develop methods for predicting strong earthquakes. From 1998 to the present, the Kamchatka branch of the Russian Expert Council for Earthquake Forecasting (KB REC), whose competence includes the collection and analysis of all seismic forecast information, has been operates under the KB GS RAS. Seismic hazard assessment in the form of issuing long-term, medium-term and short-term earthquake forecasts is carried out through expert analysis of the results of comprehensive geophysical monitoring in the territory of the Kamchatka Peninsula [1].

This work is a continuation of the authors’ research on the manifestations of the precursors of strong earthquakes in the area of the Kamchatka Peninsula [2, 3]. The data on seismological, geophysical and geochemical precursors before seven earthquakes 2005–2022 with M_W = 6.6–7.7 at depths up to 180 km were examined taking into account their composition according to various types of observations and duration (time of manifestation before each earthquake). An increase in the number of precursors with increasing parameter M_W/lgd_h, where dh is the hypocentral distance of the earthquake to the center of the PKP (km) is detected, which is an indicator of the integrated manifestation of precursors before the strongest and closest earthquakes in the area under consideration.

It is discussed the need to study the phenomenon of integrated manifestation of precursors, diagnosed in real time, for use in predicting the time of a strong earthquake in the Petropavlovsk-

Yelizovo agglomeration area, where most of the population of the Kamchatka Kari lives. It is proposed to use materials from the archives of expert councils on earthquake forecasting operating in the Kamchatka Krai to create a database of regular forecast conclusions on individual observation methods, subsequent formalization and retrospective analysis of the properties of the complex manifestation of precursors in connection with earthquakes that have occurred. This direction of seismic prognostic research will contribute to obtaining more definite estimates regarding the parameters of earthquakes and the time of their occurrence when a complex of precursors is detected, diagnosed in real time.

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