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Determining the optimal time window for detecting acoustic emission anomalies preceding major earthquakes on Kamchatka

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Abstract. Extensive empirical data have been accumulated during long-term monitoring on Kamchatka, which reflect the dynamics of the parameters of the acoustic emission (AE) of near-surface sedimentary rocks during the initiation of strong earthquakes. The article is devoted to the study of the characteristics of the acoustic signal in the frequency range of 10 Hz to 10 kHz, the source of which is near-surface sedimentary rocks. A hypothesis was formulated suggesting that fragments of the AE signal lasting from several hours to several days contain features indicating the initiation of seismic events preceding strong earthquakes in Kamchatka. To verify this hypothesis, a study was carried out to identify a specific class of anomalies in the parameters of AE signals correlated with the occurrence of strong seismic events. The key challenge in this task was determining the temporal boundaries of the intervals during which these anomalies occur. A significant diversity in the forms of anomalies and their temporal duration was discovered, caused by the nonlinearity of AE generation processes and the influence of a wide spectrum of external natural factors. Under such conditions, the successful identification of the desired features of the parametric relationship between the observed AE anomalies and subsequent earthquakes depends strongly on the proper selection of boundaries of the signal processing intervals. The study presents the solution to the problem of determining interval boundaries, provides evidence for the existence of a class of anomalies associated with the initiation of earthquakes, and introduces a method for finding the optimal time interval for identifying such anomalies using artificial intelligence.

Keywords:
acoustic emission, near-surface rocks, preseismic anomalies, neural networks

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