

Real-time LURR earthquake forecast in Sakhalin. Results of the monitoring in 2023–2025 and their assessment in connection with the megathrust earthquake in Kamchatka on July 30, 2025, M 8.8

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Abstract. The results of the ongoing study on the seismicity of Sakhalin using the LURR method (Load-Unload Response Ratio) of the medium-term earthquake forecast are presented. The results of the recent stage of the study included calculations of the LURR parameter based on seismic data from 2023 to 2025 (the first stage, from 2019 to 2022) in 36 calculated areas. These areas evenly cover the island with a grid with a step of 0.5 degrees in latitude and longitude. During the entire period, the information about new LURR anomalies and forecast zones was analyzed on a quarterly basis. From 2023 to 3Q 2024, 24 LURR anomalies were detected. Taking into account 11 anomalies registered in 2022, a total of 35 anomalies were identified in 2.5 years. Since no major earthquake occurred in Sakhalin, it was reasonable to assume that such a large number of anomalies could be due to unusual and significant factors outside Sakhalin. A hypothesis has been proposed regarding the possible impact of the megathrust earthquake in Kamchatka on July 30, 2025 ($M = 8.8$), on the LURR parameter in Sakhalin. To test it, we calculated the LURR parameter at the epicenter of the earthquake on July 30, 2025, as well as along the subduction zone in the direction of the aftershock cloud. It was shown that the hypothesis is valid due to the presence of the precursor several months prior to the event. Moreover, the analysis revealed that the LURR anomalies in the period from 2022 to 2024 coincide for the part of Kamchatka, where the earthquake occurred, and Sakhalin.

Keywords:

seismicity, seismic events, monitoring, LURR method, LURR anomalies, precursor of the earthquake

For citation: Zakupin A.S. Real-time LURR earthquake forecast in Sakhalin. Results of the monitoring in 2023–2025 and their assessment in connection with the megathrust earthquake in Kamchatka on July 30, 2025, M 8.8. *Geosistemy perehodnykh zon = Geosystems of Transition Zones*, 2025, vol. 9, No. 3, pp. 256–264. (In Russ.). <https://doi.org/10.30730/gtr.2025.9.3.256-264>; <https://www.elibrary.ru/eaazgl>

Для цитирования: Закупин А.С. Прогноз землетрясений методом LURR на Сахалине в режиме реального времени. Результаты мониторинга в 2023–2025 гг. и их оценка в связи с мегаземлетрясением на Камчатке 30.07.2025, M 8.8. *Геосистемы переходных зон*, 2025, т. 9, № 3, с. 256–264. <https://doi.org/10.30730/gtr.2025.9.3.256-264>; <https://www.elibrary.ru/eaazgl>

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