

Seismic activation on the northeastern coast of Honshu Island (November–December 2025) and its possible connection with geodeformation processes on Shikotan Island (the Lesser Kuril Ridge)

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Abstract

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Abstract. Two major seismic activations were observed on the northeastern coast of Honshu Island in November–December 2025. The first activation was localized in the area of the Japan Trench, and the second was located in the same area but closer to the border between the Japan and Kuril-Kamchatka Trenches. The largest event during this time was the Aomori earthquake on December 8, 2025 with $M = 7.6$. The seismic process in the subduction zone is primarily a consequence of the movement of tectonic plates, which causes excessive stress load at the sites of their collision. Therefore, these activations may be related to the deformation processes in the area of the Southern Kuril Islands, which are located about 400 km away. This paper presents the results of rock deformation measurements from August to December 2025 on Shikotan Island (the Lesser Kuril Ridge). Measurements were conducted using strainmeters installed in the underground pavilion (adit) of the Shikotan seismic station of the Sakhalin Branch of the GS RAS. Analysis of the data collected over five months of measurements revealed two characteristic periods in the deformation process. The first one began after a strong aftershock (September 18, 2025, $M = 7.8$) in the area of the Kamchatka earthquake on July 29(30), 2025, $M = 8.8$, and is associated with a change of sign and a high rate of deformation. The second period began in November 2025 and was associated with zero deformation rates. This period coincided with two powerful seismic activations in the Japan Trench area east of Honshu Island, with a characteristic northward migration toward the Hidaka collision zone. Previously obtained results on the influence of strong atmospheric cyclones (in the form of pulse variations) on rock deformation in the adit were also confirmed.

Keywords:

seismic activation, geodeformational process, strainmeter, impulse variations, strain rate

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References

1. Salko D.V., Bornyakov S.A. Automated instrumental system for monitoring geophysical parameters at geodynamic sites. *Pribory*. 2014, 168(6):24–28. (In Russ.).
2. Ostrovsky A.E. (ed.) *Study of Earth Tides: Collection*. (Results of the IGY). Moscow: USSR Academy of Sciences Publ., 1961, 76 p. (In Russ.).

3. Pustovitenko B.G., Pustovitenko A.N., Soloviev S.L. Tilt-measuring observations on Shikotan Island. *Doklady AN SSSR = Proceedings of the USSR Academy of Sciences*. 1971,200(1):94–96. (In Russ.).
4. Kostylev D.V., Zakupin A.S., Kostyleva N.V., Bornyakov S.A., Salko D.V., Stovbun N.S. Rock deformations deduced from adit-based measurements on the Shikotan Island (Lesser Kuril ridge) in 2024–2025. *Geodynamics & Tectonophysics*. 2025,16(6):0865. (In Russ.). <https://doi.org/10.5800/GT-2025-16-6-0865>
5. Kostylev D.V., Goev A.G., Kostyleva N.V. Seismic network of the southern segment of the Far Eastern zone of Russia and its potential for studying upper mantle heterogeneities. *Moscow University Bulletin. Series 4. Geology*. 2025,5:100–108. (In Russ.). <https://doi.org/10.55959/msu0579-9406-4-2025-64-5-100-108>
6. Ichiyanaagi M., Takahashi H., Mikhaylov V., Kostylev D., Levin Y. Evaluation for hypocenter estimation error in the southwestern Kuril trench using Japan and Russia joint seismic data. *Earth, Planets and Space*. 2020,72(1):86. doi:10.1186/s40623-020-01215-0
7. Kostylev D.V., Kostyleva N.V. The system of engineering seismometric observations on the Kuril Islands under conditions of constant intense seismic impacts. *Natural and man-made risks. Safety of Structures*. 2025,6(81):30–37. (In Russ.).
8. Medvedev S.V., Sponheuer W., Karnik V. *Seismic Intensity Scale MSK-64*. Moscow, Russia: Interdepartmental Geophysical Commission of the USSR Acad. Sci., 11 p. (In Russ.); Medvedev S., Sponheuer W., Karnik V. Neue seismische Skala Intensity scale of earthquakes. In: *7 Tagung der Europäischen Seismologischen Kommission in Jena*. Berlin: Akademie-Verlag, 1964, p. 69–76.
9. Takahashi N., Kodaira S., Tsuru T., Park Jin-Oh, Kaneda Y., Suyehiro K., Kinoshita H., Abe S., Nishino M., Hino R. Seismic structure and seismogenesis off Sanriku region, northeastern Japan. *Geophysical Journal International*. 2004,159(1):129–145. <https://doi.org/10.1111/j.1365-246X.2004.02350.x>
10. Iwasaki T., Sato H., Shinohara M., Ishiyama T., Hashima A. Fundamental structure model of island arcs and subducted plates in and around Japan. In: *2015 Fall Meeting, American Geophysical Union, San Francisco, Dec. 14–18*. 2015, T31B-2878.
11. Satake K. Geological and historical evidence of irregular recurrent earthquakes in Japan. *Philosophical Transactions: Mathematical, Physical and Engineering Sciences*. 2015,373(2053),20140375. <https://doi.org/10.1098/rsta.2014.0375>
12. Izumi N., Nishizawa A., Horiuchi D., Kido Y., Goto H., Nakata T. 3D bathymetric image of the southwestern part of the Kuril Trench and its vicinity. *Rep. Hydrogr. Oceanogr. Research*. 2017,54:133–155. (In Japan, with Engl. abstr.).
13. Mezentseva L.I., Kaptyug V.A. Meteorological conditions. September 2025. In: *Monthly hydrometeorological bulletin of DVNIGMI*. Available from: https://ferhri.ru/images/stories/FERHRI/Bulletins/Bul_2025/09/2025.09_ch1_meteo.pdf (accessed 19.02.2026).