On the stability of the seismic mode parameters in time by the example of the east of the central part of Northern Caucasus

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Abstract The parameters of the seismic regime of the eastern zone of the Central Caucasus are determined based on the new catalog data. A similar study is being carried out for the third time: in 1996, 2015 and 2021. The basis for work in the area surrounding Grozny was laid in 1996 by a comprehensive study of geological, geomorphological, geophysical and seismological materials. When comparing the results, the stability of the seismic regime parameters was established: the repetition schedule b and seismic activity $A_{3.3}$ near Grozny, the capital of the Chechen Republic and a large industrial center in 2015 and 2021. In both cases, the estimates were performed on the same the same territory bounded by coordinates: 41.1-45.6°N and 42.6-48.8°E. The same basic earthquake catalog was used for the calculations. The difference was in the number of events that took place in this territory from 2015 to 2020 inclusive.

Keywords PEE zone, seismic mode, earthquake catalog, recurrence schedule, seismic activity.

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References

Babayan, T.O., Kuliev, F.T., Papalashvili, V.G., Shebalin, N.V., & Vandysheva, N.V. (Resp. comp.). (1977). [II b. Caucasus (50-1974, M≥4.0, I_0≥5)]. In *Novyi katalog sil'nykh zemletriasenii na territorii SSSR s drevneishikh vremen do 1975 g.* [New catalog of strong earthquakes on the territory of the USSR from ancient times to 1975] (pp. 69-170). Moscow, Russia: Nauka Publ. (In Russ.).

Bune, V.I., & Gorshkov, G.P. (Exec. eds.). (1980). *Seysmicheskoye rayonirovaniye territorii SSSR* [Seismic zoning of the territory of the USSR]. Moscow, Russia: Nauka Publ., 308 p. (In Russ.).

Earthquake Early Alert Service (EEAS). (2021). GS RAS [site]. Available at: http://www.gsras.ru/new/eng/ssd.htm

Gabsatarova, I.P., Mekhryushev, D.Yu., Koroletski, L.N., Adilov, A.Z., Magomedov, Kh.D., Sayapina, A.A., Bagaeva, S.S., Yankov, A.Yu., & Ivanova, L.E. (2021). [I. Results of seismic monitoring of various regions of Russia. North Caucasus]. In *Zemletryaseniya Rossii v 2019 godu* [Earthquakes in Russia in 2019] (pp. 35-60). Obninsk, Russia: GS RAS Publ. (In Russ.).

Global CMT Web Page. (2020). Global CMT Catalog Search. Retrieved from http://www.globalcmt.org

GOST R 57546-2017 [State Standard 57546-2017. Earthquakes. Seismic intensity scale]. (2017). Moscow, Russia: Standartinform Publ., 28 p. (In Russ.).

Information message on felt earthquakes in Chechnya on December 12 and 13, 2020. (2020). GS RAS [site]. Available at: http://mseism.gsras.ru/EqInfo/faces/imdetails.xhtml

Kondorskaya, N.V., & Ulomov, V.I. (Eds.). (2021). Special catalogue of earthquakes of the Northern Eurasia (to 1995). Global Seismic Hazard Assessment Program. Global Seismic Hazard Map. Retrieved from http://www.seismo.ethz.ch/static/gshap/neurasia/nordasiacat.txt

Levkovich, R.A., Kramynin, P.I., Deynega, A.G., & Aref'yev, S.S. (1979). [Some results of epicentral observations of the Chernogorskoye earthquake on July 28, 1976]. In *Geodinamika i seysmichnost' territorii Dagestana* [Geodynamics and seismicity of Dagestan] (pp. 63-86). *3*(21). Makhachkala, Russia: DB AS USSR, Institute of Geology Publ. (In Russ.).

Lutikov, A.I. (1996). [Seismic regime of the North-East Caucasus]. In *Kompleksnaya otsenka seysmicheskoy opasnosti territorii g. Groznogo (Utochneniye iskhodnoy seysmichnosti. Seysmicheskoye mikrorayonirovaniye. Seysmicheskiy risk). Nauch. red. S.I. Poltavtsev* [Comprehensive assessment of the seismic hazard of the territory of Grozny (Clarification of the initial seismicity. Seismic microzoning. Seismic risk). Sci. ed. S.I. Poltavtsev] (pp. 23-38). Moscow, Russia: Ministry of Construction of Russia Publ. (In Russ.).

Malovichko, A.A., Gabsatarova, I.P., Dyaghilev, R.A., Mekhryushev, D.Yu., & Zvereva, A.S. (2021). Evaluation

of the detection and location capability of the seismic network in the western part of the North Caucasus using network layout and local microseismic noise level. *Seismic instruments*, *57*(2), 209-230. doi: 10.3103/S0747923921020274

Nesmeyanov, S.A., Lutikov, A.I., Shchukin, Yu.K., & Dontsova, G.Yu. (1996). [Seismogenic structures]. In *Kompleksnaya otsenka seysmicheskoy opasnosti territorii g. Groznogo (Utochneniye iskhodnoy seysmichnosti. Seysmicheskoye mikrorayonirovaniye. Seysmicheskiy risk). Nauch. red. S.I. Poltavtsev* [Comprehensive assessment of the seismic hazard of the territory of Grozny (Clarification of the initial seismicity. Seismic microzoning. Seismic risk). Sci. ed. S.I. Poltavtsev] (pp. 38-47). Moscow, Russia: Ministry of Construction of Russia Publ. (In Russ.).

Poltavtsev, S.I. (Sci. ed.). (1996). *Kompleksnaya otsenka seysmicheskoy opasnosti territorii g. Groznogo* (*Utochneniye iskhodnoy seysmichnosti. Seysmicheskoye mikrorayonirovaniye. Seysmicheskiy risk*) [Comprehensive assessment of the seismic hazard of the territory of Grozny (Clarification of the initial seismicity. Seismic microzoning. Seismic risk)]. Moscow, Russia: Ministry of Construction of Russia Publ., 107 p. (In Russ.).

Rautian, T.G. (1960). [Energy of the Earthquakes]. In *Metody detalnogo izucheniya seismichnosti. Trudy IFZ ANSSSR*, 9(176). [Methods of Detailed Study of the Seismicity. Proceedings of the IPE AS USSR № 9(176)] (pp. 75-114). Moscow, Russia: IPE AS USSR Publ. (In Russ.).

Riznichenko, Yu.V. (1958). [On the study of the seismic regime]. *Izvestiya AN SSSR. Seriya geofizicheskay*a [Izvestia of the AS USSR. Geophysical series], 9, 1057-1074. (In Russ.).

Riznichenko, Yu.V. (Exec. ed.). (1979). *Seysmicheskaya sotryasayemost' territorii SSS*R [Seismic shaking of the territory of the USSR]. Moscow, Russia: Nauka Publ., 190 p. (In Russ.).

Ulomov, V.I., Danilova, T.I., Medvedeva, N.S., Polyakova, T.P., & Shumilina, L.S. (2007). Assessment of seismic hazard in the North Caucasus. *Izvestiya*, *Physics of the Solid Earth*, *43*, 559-572.

USGS. Search Earthquake Catalog. Earthquakes. (2021). U.S. Geological Survey National Earthquake Information Center, Federal Center Denver, Colorado. Retrieved from https://earthquake.usgs.gov/earthquakes/search/

Yakovlev, F.L., Gabsatarova, I.P., & Stakhovskaya, R.Yu. (2021). [Quasi-cyclical frequency of seismicity of the eastern part of the Greater Caucasus over the past 200 years and the mid-term forecast of seismic activity in the region]. In *Razlomoobrazovaniye v litosfere i soputstvuyushchiye protsessy: tektonofizicheskiy analiz: tezisy dokladov Vserossiyskogo soveshchaniya, posvyashchennogo pamyati professora S.I. Shermana. Irkutsk*, *26-30 aprelya 2021 g. FGBUN IZK SO RAN*; *FGBOU VO "IGU"*; *otv. red. K. ZH. Seminskiy* [Fault Formation in the Lithosphere and Associated Processes: Tectonophysical Analysis: Abstracts of the All-Russian Meeting dedicated to the memory of Professor S.I. Sherman. Irkutsk, April 26-30, 2021. FGBUN IZK SB RAS, FGBOU VO "ISU", resp. ed. K.Zh. Seminsky] (pp. 232-233). Irkutsk, Russia: IGU Publ. (In Russ.).

Zakharova, A.I., Starovoit, O.E., & Yakovlev, F.L. (1989). [Block seismicity of the North Caucasus]. In *Diskretnye svoistva geofizicheskoi sredy* [Discrete properties of the geophysical environment] (pp. 137-148). Moscow, Russia: Nauka Publ. (In Russ.).

Zemletriaseniia Rossii v 2003-2018 gg. (2020). [Earthquakes in Russia in 2003-2018]. Obninsk, Russia: GS RAS Publ. (In Russ.).

Zemletryaseniia Severnoi Evrazii, 1997-2013. (2003-2019). [Earthquakes of the Northern Eurasia, 1997-2013]. Obninsk, Russia: GS RAS Publ. (In Russ.).

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