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«Central Asian Academic Research Center» LLP is pleased to announce that “News of NAS RK. Series of Geology and Technical sciences” scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of Geology and Technical Sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

«Орталық Азия академиялық ғылыми орталығы» ЖШС «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

ТОО «Центрально-азиатский академический научный центр» сообщает, что научный журнал “Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

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MATHEMATICAL MODELING AND COMPUTER CALCULATION OF THE PREDICTION OF POSSIBLE CONSEQUENCES OF EARTHQUAKES

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Abstract. This article discusses the actual problem of mathematical modeling and computer forecasting of the consequences of seismic activity. The aim of the study is to develop an integrated methodology and software for rapid assessment of potential damage from earthquakes of various magnitude.

The methodological basis of the work is based on the combination of several mathematical approaches. The study used the macroseismic field equation (Shebalin equation) to calculate the intensity of the seismic impact based on the magnitude and hypocentric distance. The results of finite element modeling are used to assess the physical vulnerability of buildings and structures. Special attention is paid to modeling catastrophic events: to describe the probability of critical disturbances above 7.0, a generalized Pareto distribution was included in the computational algorithm, which makes it possible to estimate taking into account the maximum danger levels. The practical value of this research was to develop an interactive

interface that would allow users to simulate earthquake scenarios by selecting the magnitude and region. The system automatically calculates and visualizes predicted sanitary and irretrievable population losses, the number of damaged buildings and the length of destroyed roads in 3D graphics format. The proposed approach allows emergency response services and planners to effectively assess risks, analyze the predicted consequences of earthquakes, and develop public safety measures.

Keywords: earthquake, seismic activity, magnitude, mathematical modeling, web application

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ЖЕР СІЛКІНІСІНІҢ ЫҚТИМАЛ САЛДАРЛАРЫН БОЛЖАУДЫ МАТЕМАТИКАЛЫҚ МОДЕЛЬДЕУ ЖӘНЕ КОМПЬЮТЕРЛІК ЕСЕПТЕУ

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Аннотация. Бұл мақалада сейсмикалық белсенділіктің салдарларын математикалық модельдеу мен компьютерлік болжаудың өзекті мәселесі қарастырылған. Зерттеудің мақсаты әртүрлі магнитудадағы жер сілкіністерінің ықтимал залалын жедел бағалау үшін интеграцияланған әдістеме мен бағдарламалық қамтамасыз етуді әзірлеу болып табылады. Жұмыстың әдіснамалық негізі бірнеше математикалық тәсілдерді біріктіруге негізделген. Зерттеу барысында сейсмикалық әсердің қарқындылығын магнитудасы мен гипоцентралды қашықтығына қарай есептеу үшін өрістің макросейсмикалық теңдеуі (Шебалин теңдеуі) пайдаланылды. Ғимараттар мен құрылыстардың физикалық осалдығын бағалау үшін шекті элементтер әдісі

арқылы модельдеу нәтижелері қолданылады. Жұмыста апатты оқиғаларды модельдеуге ерекше назар аударылады: 7.0-ден жоғары магнитудадағы сыни бұзылулардың ықтималдығын сипаттау үшін Паретоның жалпыланған таралуы есептеу алгоритміне енгізілді, бұл қауіптіліктің шектік деңгейлерін ескере отырып, бағалауға мүмкіндік береді. Зерттеудің практикалық құндылығы пайдаланушыларға магнитудасы мен аймағын таңдау арқылы жер сілкінісі сценарийлерін модельдеуге мүмкіндік беретін интерактивті интерфейсті әзірлеу болды. Жүйе халықтың болжамды санитарлық және қайтарымсыз шығындарын, зақымдалған ғимараттардың санын және қираған жолдардың ұзындығын 3D-график форматында автоматты түрде есептейді және визуализациялайды. Ұсынылып отырған тәсіл төтенше жағдайларды жою қызметтері мен жоспарлаушыларға тәуекелдерді тиімді бағалауға, болжамды жер сілкінісі салдарын талдауға және тұрғындардың қауіпсіздік іс-шараларын әзірлеуге мүмкіндік береді.

Түйін сөздер: жер сілкінісі, сейсмикалық белсенділік, магнитуда, математикалық модельдеу, web-қосымша

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МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ И КОМПЬЮТЕРНЫЕ ВЫЧИСЛЕНИЯ ДЛЯ ПРОГНОЗИРОВАНИЯ ВОЗМОЖНЫХ ПОСЛЕДСТВИЙ ЗЕМЛЕТРЯСЕНИЙ

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Аннотация. В статье рассматривается актуальная проблема математического моделирования и компьютерного прогнозирования последствий сейсмической активности. Цель исследования заключается

в разработке интегрированной методологии и программного обеспечения для оперативной оценки потенциального ущерба от землетрясений различной величины. Методологическая база исследования основана на объединении нескольких математических подходов. В работе использовано макросейсмическое уравнение поля (уравнение Шебалина) для расчета интенсивности сейсмического воздействия на основе величины и гипоцентрического расстояния. Результаты моделирования методом конечных элементов применяются для оценки физической уязвимости зданий и сооружений. Особое внимание уделено моделированию катастрофических событий: для оценки вероятности критических возмущений магнитудой выше 7,0 в вычислительный алгоритм включено обобщенное распределение Парето, что позволяет учитывать предельные уровни опасности. Практическая ценность исследования заключается в разработке интерактивного интерфейса, позволяющего пользователям моделировать сценарии землетрясений, выбирая величину и регион. Система автоматически рассчитывает и визуализирует прогнозируемые санитарные и безвозвратные потери населения, количество поврежденных зданий и протяженность разрушенных дорог в формате 3D-графики. Предлагаемый подход дает возможность службам чрезвычайного реагирования и планировщикам эффективно оценивать риски, анализировать прогнозируемые последствия землетрясений и разрабатывать меры по обеспечению безопасности населения.

Ключевые слова: землетрясение, сейсмическая активность, магнитуда, математическое моделирование, web-приложение

Introduction. Earthquakes are shaking and vibrations of the Earth's surface caused by natural causes (mainly tectonic processes) or artificial processes (explosions, filling of reservoirs, collapse of underground cavities of mining operations). Small shocks can also be caused by the rise of lava during volcanic eruptions. Every year, about a million earthquakes occur all over the world, but most of them are so small that they are not noticeable. Indeed, strong earthquakes, causing great destruction, occur on the planet about once every two weeks. Most of them occur at the bottom of the oceans, so they do not have catastrophic consequences (if the earthquake under the ocean does not cause a tsunami). Earthquakes are known for the destruction they can cause (Xu et al, 2022; Mavroulis et al, 2023; Bata et al, 2022; Raimbekov et al, 2013). The collapse of buildings and structures is caused by ground vibrations or giant waves (tsunamis) that occur during seismic waves on the seabed. This implies the importance and urgency of solving the problem of predicting the consequences of an earthquake, which will allow minimizing the consequences of the disaster and reducing the number of human casualties by organizing timely preventive measures to protect the population and evacuate them.

First, let's look at what an earthquake is. The uppermost crust of the Earth is the lithosphere, which consists of a solid surface - it is divided into a number of plates

called the lithosphere. Below is the solid upper mantle, or rather its upper part. These geospheres consist of various rocks of high hardness. But in the thickness of the upper mantle, a layer called the asthenosphere is located at different depths. It is, unlike other neighboring layers, flexible. The asthenosphere is considered the layer along which lithospheric plates and parts of the upper mantle move. When the plates move, they can collide, forming large mountain ranges, and in other places, on the contrary, they separate with the formation of oceans (León et al, 2022; Kirillov, 2013; Guerrero-Miranda et al, 2021; Yunus et al, 2023). The interaction of these plates creates huge stresses in the rocks, compressing them or, conversely, stretching them. If the stresses exceed the strength limit of the rocks, they can shift very quickly, instantly, and burst. This moment of displacement is called an earthquake.

Modeling seismic activity and its consequences requires a thorough study of the technical characteristics of objects exposed to earthquakes and seismic activity, identification of periods and characteristic waves of seismic activity, and identification of patterns underlying the socio-economic consequences of an individual event or group of events.

Materials and methods. Earthquake intensity is a seismic effect, which is rated on a descriptive scale based on the reaction of people, structures, and changes in natural features. The maximum intensity value on most scales is 12 points. Detailed seismic zoning is necessary to determine the potential seismic effect in a given area. Since the researcher is most interested in the largest earthquakes, that is, earthquakes that occur in the «tail» of the probability distribution, the basic rules of extreme value theory can be used to provide detailed seismic zoning according to the Balkema-Pickands-De Haan theorem (Alimkanov et al, 2020; Samarskii et al, 2001; Trusov, 2007; Ponomarev et al, 2006).

$$F_u(y) = P(X - u \leq y | X > u) = \frac{F(u + y) - F(u)}{1 - F(u)}$$

The conditional distribution of random excesses X is described by a somewhat higher bound asymptotically generalized Pareto distribution, and the distribution function is as follows:

$$F_u(a(u)y + b(u)) \rightarrow G_{k,\sigma}(y), \text{ as } u \rightarrow \infty,$$

here

$$G_{k,\sigma}(y) = 1 - (1 + ky/\sigma)^{-1/k}, \text{ if } k \neq 0$$

$$G_{k,\sigma}(y) = 1 - e^{-y/\sigma}, \text{ if } k = 0.$$

To implement the program complex, a hybrid mathematical model has been developed that combines deterministic patterns of seismic wave attenuation and probabilistic methods for assessing the vulnerability of structures. The seismic impact model is based on the macroseismic field equation (Shebalin's equation), which takes into account magnitude M , hypocentral distance, and local ground conditions, calculating the intensity of earthquakes I at an arbitrary point in the area (Gubar, 2007; Popov et al, 1983; McKinney, 2021; Silén et al, 2016):

$$I = b * M - v * \lg r + c$$

where,

I - earthquake intensity at a given point (for example, on the MSK-64 scale);

M is the magnitude of the earthquake (a value that characterizes the total energy released in the hearth);

R -hypocentral distance (distance from earthquake epicenter to control point);

b, v, c — empirically determined regional coefficients for certain seismically active regions.

For the formation of damage Probability Matrices (DPM), numerical modeling of typical buildings of the region by the method of threshold elements was used. The numerical simulation results were approximated using the Pareto distribution to describe the «severe consequences» of the catastrophic magnitude ($M > 7.0$) damage distribution. Integral probability of damage of degree $K(P_k)$ for intensity I :

$$P(D \geq k|I) = (1 + \frac{\xi(I - u)}{\sigma})^{-1/\xi}$$

where, σ and ξ - Parameters of the scale and shape of the Pareto distribution.

Operational prediction algorithm (implementation algorithm) to ensure that the web application runs in real time («on-the-fly»), complex integral calculations obtained during the fem modeling phase have been transformed into linear lspec cost ratios. The final forecast of Loss costs is calculated by the program using the following formula:

$$\text{Loss} = \sum_{i=1}^N (Pop_i * K_{vuln}(M, S) * (1 + a_{corr}))$$

Mathematical modeling of post-earthquake losses is an important tool for estimating losses, predicting impacts, and developing risk reduction strategies. It includes several key aspects:

1. Input data for the model:

- seismic parameters (magnitude, depth, epicenter, rupture mechanism);

- geological and geotechnical data (soil type, landslide probability, seismic wave amplification);

- construction and infrastructure (characteristics of buildings, bridges, roads, life support networks);

- demographic information (population density, socio-economic indicators).

2. Seismic wave propagation model.

The following types of models are used:

- attenuation laws - describe the decay of seismic waves over distance;

- finite difference or element methods - numerical modeling of ground motion;

- empirical and stochastic models - approximate assessment of seismic effects.

3. Damage and loss assessment:

- physical damage: calculating the probability of building collapse based on vulnerability (e.g. HAZUS technique);

- economic costs: recovery costs, business damage, job losses;

- social costs: number of victims, injuries and deaths, impact on quality of life.

4. Mathematical modeling methods:

- statistical models: regression analysis, Bayesian methods;

- stochastic models: Monte Carlo method for estimating uncertainties;

- machine learning: neural networks, time series analysis for forecasting costs;

- Geographic Information System (GIS) modeling: spatial analysis of risk areas.

5. Risk prediction and management:

- evacuation optimization;

- development of insurance strategies.

Results and discussion. Summing up the above data, a special application was created with the introduction of all mathematical calculations for the consequences of earthquakes with software code.

Web-the main page of the application is the main interface for user interaction with the system. When loading the page, the user is offered a convenient interface for selecting the magnitude of the earthquake, as well as displaying and analyzing data on losses in different regions. The main page displays a drop-down list with the ability to select the magnitude of the earthquake shown in Figure 1. This item allows you to set the user's interest level. After the user selects the magnitude, the system will begin to automatically calculate the costs for each region, based on predefined data such as population, number of buildings, number of roads and other parameters that can be set during the data processing process.

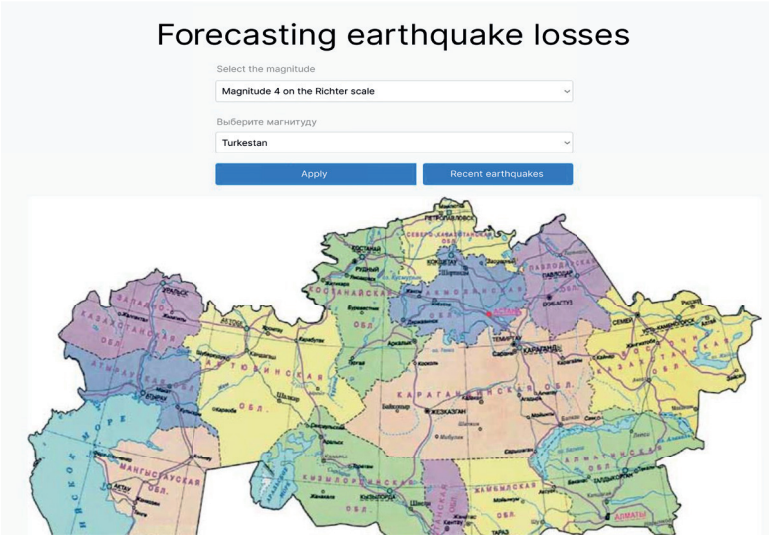


Figure 1. Home page

Also on the main page is a table with the calculation results, which is updated immediately after the magnitude is selected. This table displays the cost data for each region for the selected magnitude. For each region, there are various indicators such as sanitary losses, loss of life, damage to buildings and road damage. This table gives the user a clear idea of what impact the earthquake might have in different regions depending on its magnitude, as shown in Figure 2.

Estimated loss rates for: Turkestan city						
Sanitary losses (residents)	Human losses (residents)	Buildings damaged (units)	Roads destroyed (km.)	Total number of inhabitants	Total number of inhabitants	Total number of inhabitants
0	0	49	16	221471 people	is 32780	532 km.

Figure 2. Table of losses

In addition, the home page contains 3D graphs that show the losses for each of the parameters listed for each region. These graphs allow for data visualization and make the perception of information more visual and intuitive. Each graph can be generated for a selected magnitude and shows the change in losses with increasing earthquake strength, as shown in Figure 3.

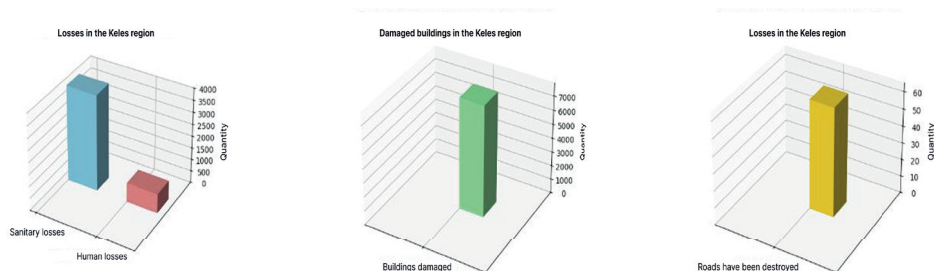


Figure 3. Graphical representation of the table of losses

Conclusions. The developed web application allows you to improve the operational processing and analysis of seismological data, opening up new opportunities for solving complex problems in the field of earthquake forecasting. The software will be developed based on a hybrid mathematical model that combines the shebalin macroseismic decomposition equation and the physical vulnerability curves of buildings; the generalized Pareto distribution and probabilistic damage matrices are used to increase prediction accuracy. The results of the study show that seismic zones have a mosaic structure, prove the heterogeneity of regional activity and determine the need for further improvement of forecasting algorithms and models. In addition, the proposed algorithms and models make it possible to analyze the possible consequences of seismic hazard, identify hazardous areas in a timely manner, effectively plan preventive measures and ensure the safety of the population.

References

- Xu S., Dimasaka J., Wald D.J., Noh H.Y. (2022) Seismic multi-hazard and impact estimation via causal inference from satellite imagery. *Nat Commun* 13, 7793. <https://doi.org/10.1038/s41467-022-35418-8> (in Eng.).
- Mavroulis S., Mavrouli M., Lekkas E., Tsakris A. (2023) Managing earthquake debris: environmental issues, health impacts, and risk reduction measures. *Environments* 10(11):192. <https://doi.org/10.3390/environments10110192>. (in Eng.).
- Bata M.H., Carriveau R., Ting D.S-K. (2022) Urban water supply systems' resilience under earthquake scenario. *Scientific Reports* 12(1):20555. DOI:10.1038/s41598-022-23126-8. (in Eng.).
- Raimbekov K.Zh., Kusainov A.B. (2013) Podverzhennost' Respubliki Kazakhstan chrezvychaynym situatsiyam prirodnoy i tekhnogennogo kharaktera [Susceptibility of the Republic of Kazakhstan to natural and man-made emergencies]. *Materialy mezhdisciplinarnoy nauchno-prakticheskoy konferencii s mezhdunarodnym uchastiem «Kultura i bezopasnost v sovremennom mire»*. Akademiya GPS MChS Rossii. — P. 229-232. (in Rus.).
- León J.A., Ordaz M., Haddad E., Araújo I.F. (2022) Risk caused by the propagation of earthquake losses through the economy. *Nat Commun* 13, 2908. <https://doi.org/10.1038/s41467-022-30504-3>. (in Eng.).
- Kirillov G. (2013) Organizatsiya i vedeniye GO i zashchity naseleniya i territoriy ot CHS prirodnoy i tekhnogennogo kharaktera [Organization and management of civil defense and protection of the population and territories from natural and man-made emergencies]. *Uchebnoe posobie*. — M.: Institut riska i bezopasnosti. ISBN 978-5-89635-113-9. (in Rus.).

Guerrero-Miranda P., Luque González A. (2021) Social Responsibility, Sustainability, and Public Policy: The Lessons of Debris Management after the Manabí Earthquake in Ecuador. *International Journal of Environmental Research and Public Health*, 18(7). — P. 3494. <https://doi.org/10.3390/ijerph18073494> (in Eng.).

Yunus A.P., Xinyu C., Catani F. et al. (2023) Earthquake-induced soil landslides: volume estimates and uncertainties with the existing scaling exponents. *Scientific Reports* 13, 8151. <https://doi.org/10.1038/s41598-023-35088-6>. (in Eng.).

Alimkanov A.A., Satybaev A.D., Kasymbekov S.N. (2020) Matematicheskoe modelirovanie zemletryaseniy i algoritm opredeleniya obratnoy zadachi [Mathematical modeling of earthquakes and an algorithm for determining the inverse problem]. *Mezhdunarodnyy nauchnyy zhurnal: Molodoy uchenyy*, (35/325), — P. 6-11. (in Rus.).

Samarskii A.A., Mikhailov A.P. (2001) Matematicheskoe modelirovanie: Idei, metody [Mathematical modeling. Ideas. Methods]. Monografiya, – M.: Fizmatlit. ISBN 592210120X. (in Rus.).

Trusov P.V. (2007) Vvedenie v matematicheskoe modelirovanie [Introduction to mathematical modeling]. Uchebnoe posobie, – M.: Universitetskaya kniga, Logos. ISBN 978598704037X. (in Rus.).

Ponomarev V.B., Loshkarev A.B. (2006) Matematicheskoe modelirovanie tekhnologicheskikh protsessov [Mathematical modeling of technological processes]. Kurs lektsiy. Yekaterinburg: GOU VPO UGTU UPI. — P. 129. (in Rus.).

Gubar Y.V. (2007) Vvedenie v matematicheskoe programmirovaniye [Introduction to mathematical programming]. Uchebnoe posobie. – M.: Internet Universitet informatsionnykh tekhnologiy. ISBN 9785449708724 (in Rus.).

Popov Yu.P., Samarskii A.A. (1983) Vychislitel'nyy eksperiment [Computational experiment]. Uchebno-metodicheskaya literature. — M.: Znanie. — P. 64. (in Rus.).

McKinney W. (2021) Python i analiz dannykh [Python for data analysis]. (A.A. Slinkin, Trans.). – M.: DMK Press. ISBN 978-5-97060-590-5. (in Rus.).

Silén D., Meijsman A., Ali M. (2016) Introducing data science: Big data, machine learning, and more, using Python tools. Manning Publications. ISBN 9781633430037. (in Eng.).

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