Thank you for thoroughly checking the paper and given comments. After addressing your comments, the quality of paper has been increased.

1) *In particular, I think the introduction could cover a bit more the state of the art (methods, tools and approaches that exist in literature, not only for the study area but in general).*

Answer: We have included several references in the introduction section.

As of today, Peresan et al. (2023), Poggi et al. (2021), Bragato et al. (2020), Petrovic et al. (2022, 2023), Scaini et al. (2021, 2023), Bhochhibhoya et al. (2022), and Xin et al. (2021) explore contemporary methods for assessing seismic risk and hazard using modern information technologies. Bhochhibhoya et al. (2022) integrated earthquake risk assessments with vulnerability parameters (social and economic factors) in Nepal. The calculation of the Social Vulnerability Index (SoVI) used a principal component analysis method. OpenQuake, based on classical Probabilistic Seismic Hazard Analysis (PSHA), was utilized for calculating annual average losses from engineering risk. In the work of Peresan et al. (2023), the focus is on data collection about buildings through crowdsourcing and distance learning for new opportunities to engage students in seismic risk reduction.

2) *Also, following the reviewers' suggestions, some figures (e.g. 11 and 12) and tables (e.g. table 1) are somehow redundant and some tables (e.g. table 5 and 6) could be merged together, improving the paper readability.*

Answer: We have removed redundant figures and tables, and merged tables 5 and 6, which improved the paper readability.

Table 4. Residenttial building taxonomy

	Our classification	Classification of buildings in Uzbekistan	EMCA Classification
1	Adobe (local)	Residential buildings constructed from local low-strength materials (without anti-seismic measures)	EMCA4
		One-story clay walls of the guvalyak and pakhsa types	
2	Masonry	Three- to five-storey frameless brick buildings with wooden floors constructed until 1958	EMCA1
		One- to two-storey frameless brick walls with wooden floors	
		Walls made of bricks, small concrete or natural stones; ceilings - prefabricated reinforced concrete	
		Buildings with external load-bearing brick walls; internal - reinforced concrete frame elements	
		Walls made of large blocks (concrete, vibro-brick, or reinforced vibro-brick panels)	
		Reinforced concrete frame with brick filling	
3	Wooden	One- to two-storey wooden houses (chopped or panel)	EMCA5
		One- to two-storey wooden frames filled with raw bricks (sinch)	
4	Concrete	Prefabricated reinforced concrete frame made of linear elements with a welded joint in the zone of maximum effort, or the same with stiffening diaphragms in one direction (framework III of the IIS-04 series and their modifications)	EMCA2
		Large-panel walls without anti-seismic measures	
		Walls of complex construction (with reinforced concrete inclusions); ceilings - prefabricated reinforced concrete	

		Large panel walls	
		Monolithic reinforced concrete frame	EMCA3
		Prefabricated reinforced concrete frame-braced frame with monolithic nodes, with stiffening diaphragms in two directions or stiffening cores	
		Frame made of spatial elements (volumetric cross) with monolithic knots	
		Frame made of spatial elements (volumetric cross) with monolithic knots	
		Volumetric blocks per room	
5	Metal frame	Metal frame or frame with diaphragms (bonds)	EMCA6

3) *Finally, the conclusions could be polished a bit more so that the reader can understand which are the main findings and how they contribute to the current state of knowledge.*

Answer: We have polished the conclusion section and revised main findings and contribution to the current state of knowledge.

4. Conclusions

Based on the study of geomorphological and geological structure, as well as changes in the composition of the upper 10-meter soil strata, features of changes in engineering-geological conditions and seismic resistance of soils in the territory of Uzbekistan have been identified. Using seismic zoning maps of the country (OSR-2017) with a 90% probability of not exceeding seismic impacts over a 50-year period and considering seismic intensity increments, a microscale seismic intensity map (1:1 000 000) for the entire republic has been developed. The seismicity of the territory has been calculated, taking into account soil categories by their seismic properties. Seismically hazardous areas consist of different soil conditions, whereas the General Seismic Zoning (OSR) map considers average soil conditions. By meticulous consideration of soil conditions of the regions, the reliability of the assessment of seismic hazard in regions has been increased.

At the national level, as of February 1, 2021, a systematic electronic database has been created, containing information on 7135881 real estate properties, specifically residential buildings. Each property has been grouped based on its construction type and coordinates in relation to administrative districts. This comprehensive database has been established to facilitate the quantitative assessment of potential building damage during strong earthquakes, enabling the identification of preventive measures to mitigate possible losses.

Based on the compiled schematic map of seismic intensity for the territory of Uzbekistan and the vulnerability functions established for each construction type, the seismic vulnerability of the developed areas within the administrative districts has been determined. The values of seismic vulnerability for the administrative districts fall within the following ranges: 0-0.15; 0.16-0.3; 0.31-0.45; 0.46-0.6; 0.61-0.75. From these vulnerability values, it is possible to determine the degree of vulnerability for each region.

Seismic vulnerability analysis and assessment were conducted using GESI_Program. Vulnerability models built depending on the construction types of residential buildings characterized the vulnerability of residential buildings in all administrative regions of Uzbekistan, which are subsequently considered as calculation cells. To assess the magnitude of potential damage in monetary terms, cost indicators of the restoration of residential buildings were used. Seismic impacts were considered within the framework of the project in the form of a probabilistic seismic hazard map. This approach allows for a comparative analysis of the distribution of seismic risk across seismically hazardous areas.

The present study covered only the estimation of direct economic losses of residential buildings in the Republic of Uzbekistan. At the same time, considering that residential construction predominates in the development of many states, the presented results can serve as a clear guide for a comparative analysis of risks across the entire seismically hazardous territory. The obtained results and such seismic risk maps can serve as a basis for the development of plans and measures to reduce the existing level of risk and prevent catastrophic consequences of future earthquakes for government agencies dealing with emergency situations.

4) *Please explain carefully the methodology that you use and make sure you disambiguate what you mean by 'probable seismic damage'.*

Answer: The seismic vulnerability of buildings was assessed based on the GESI_Program, which was developed during the RADIUS program (1999-2001). Vulnerability functions were developed according to the material of structural system. Based on this, map with spatial distribution of buildings having different vulnerabilities within the administrative regions of the Republic of Uzbekistan was compiled. We determined the percentage of building damage based on the vulnerability function, obtained the building inventory value from the Cadastral Agency of the Republic of Uzbekistan, and established the economic loss from the amount of damage that the building suffered from the scenario earthquake.

Probable seismic damage refers to the likelihood of socio-economic harm resulting from potential earthquakes, based on the calculated seismic hazard of the area and the vulnerability of buildings. Maps of seismic risk can be compiled by combining assessments of seismic hazard and vulnerability of buildings and structures in populated areas. These maps serve as the basis for estimating the expected damage in monetary terms, considering the cost of objects within the affected regions.

5) *Please discuss how the buildings classification that you used compares with other building typologies defined for Uzbekistan and at the regional scale for Central Asia (e.g. EMCA).*

The correlation of the used building classification with other building typologies (e.g. EMCA) is summarized in the table below.

	Our classification	Classification of buildings in Uzbekistan	EMCA Classification
1	Adobe (local)	Residential buildings constructed from local low-strength materials (without anti-seismic measures)	EMCA4
		One-story clay walls of the guvalyak and pakhsa types	
2	Masonry	Three- to five-storey frameless brick buildings with wooden floors constructed until 1958	EMCA1
		One- to two-storey frameless brick walls with wooden floors	
		Walls made of bricks, small concrete or natural stones; ceilings - prefabricated reinforced concrete	
		Buildings with external load-bearing brick walls; internal - reinforced concrete frame elements	
		Walls made of large blocks (concrete, vibro-brick, or reinforced vibro-brick panels)	
		Reinforced concrete frame with brick filling	
3	Wooden	One- to two-storey wooden houses (chopped or panel)	EMCA5
		One- to two-storey wooden frames filled with raw bricks (sinch)	
4	Concrete	Prefabricated reinforced concrete frame made of linear elements with a welded joint in the zone of maximum effort, or the same with stiffening diaphragms in one direction (framework III of the IIS-04 series and their modifications)	EMCA2

		Large-panel walls without anti-seismic measures	
		Walls of complex construction (with reinforced concrete inclusions); ceilings - prefabricated reinforced concrete	
		Large panel walls	
		Monolithic reinforced concrete frame	EMCA3
		Prefabricated reinforced concrete frame-braced frame with monolithic nodes, with stiffening diaphragms in two directions or stiffening cores	
		Frame made of spatial elements (volumetric cross) with monolithic knots	
		Frame made of spatial elements (volumetric cross) with monolithic knots	
		Volumetric blocks per room	
5	Metal frame	Metal frame or frame with diaphragms (bonds)	EMCA6

6) *Carefully rewrite section 3. Please make sure that session 3 only contains results and discussion, while data sources and methods should be included in section 2. For example, the number and type of buildings are necessary to perform the risk assessment so they should be introduced before you estimate the risk. Also, 3.1 speaks about asset values but you provide figures in terms of number of buildings, not economic value, which is mentioned in section 3.2.*

Answer: Thank you for your comment. We have revised section 3 and put the data sources and methods in section 2. Also, we have added the figure in terms of economic value which is mentioned in section 3.2 (Fig. 11).

3. Seismic risk assessment

Analysis of given data demonstrates a large spread in the number of buildings by structural types. For example, in the Kashkadarya region, the share of buildings built from local clay material exceeds 83% (27 trillion Uzbekistani soms) of the total number of residential buildings; in the Samarkand (40 trillion Uzbekistani soms) and Andijan regions (21 trillion Uzbekistani soms), the share is 82%; and in the Tashkent region, 48.3% (16 trillion Uzbekistani soms). In large cities, the percentage of adobe residential buildings is smaller and ranges from 13% to 27%. This circumstance must be considered when assessing the seismic risk, since the amount of damage due to an earthquake in the selected territorial units depends on the proportion of the specific structural types of buildings.

To assess the seismic risk within the context of the administrative districts of the Republic of Uzbekistan, it is necessary to take into account the share of the housing stock across all administrative districts, considering zones with different intensities. The number of residential buildings located in the territory with different seismicity values, expressed by peak ground accelerations is shown in Figure 10. This diagram shows that a large number of buildings, approximately 31% of the total number of residential buildings are located in the territory with PGA ranging from 100 to 150 cm/s^2, 27% of the buildings are located in areas with PGA of 0,15–0,20 m/s^2 and more than 30% are located in areas with peak accelerations higher than 0,20 m/s^2, representing the zone with an intensity of 8 (according to EMS-98, https://www.franceseisme.fr/EMS98_Original_english.pdf).

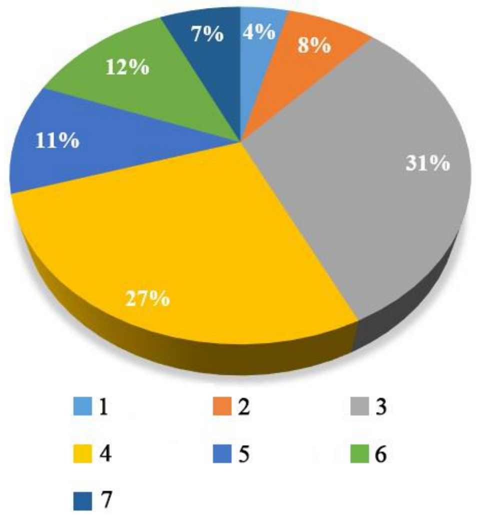

Fig. 10. Distribution of residential buildings in areas with different seismic effects (values of the peak ground acceleration are given in m/s^2). **1:** 0-0.05; **2:** 0.05-0.10; **3:** 0.10-0.15; **4:** 0.15-0.20; **5:** 0.20-0.25; **6:** 0.25-0.30; **7:** 0.30-0.35

Information on the distribution of residential buildings by the material of structural system depending on zones with different seismic effects is given in Tables 5

Table 5. Distribution of residential buildings by the material of structural system in (as of February 1, 2021)

Structural type of the building	Total, %	including (%)	
		in cities	in rural areas
Type A	69,2	27,2	84,8
Type B	22,5	54	10,9
Type C	1	0,6	1,1
Type D	7,1	18	3,1
Type E	0,2	0,2	0,1

Figure 11 shows a microscale map depicting the seismic risk assessment of potential economic losses across the territory of the Republic of Uzbekistan. This seismic risk map assesses the probability of economic damage within the administrative districts under the maximum level of seismic impact for a return period of T=475 years.

The developed map of seismic risk of the territory of Republic of Uzbekistan is based on the assessment of probable economic losses within administrative regions, depending on the combination of seismic hazard factors, seismic vulnerability and concentration of values. It is important to emphasize that the level of seismic hazard used in the calculation of physical and economic damage corresponds to a 90% probability of not exceeding of seismic impacts for 50 years, which corresponds to an average return period of 475 years. This study is limited to the use of the return period of 475 years because this level of probability is generally accepted standard in seismic hazard assessment during the design and construction of conventional buildings and structures. Of course, considering a different probability, the level of danger and estimates of damage and potential losses may differ from the data presented.

The present study covered only the assessment of direct economic losses that may be caused by structural damage to residential buildings as a result of seismic events. At the same time, given that residential buildings predominate in the development of cities and administrative districts of the Republic of Uzbekistan, the presented results could serve as a clear reference for a comparative analysis of the seismic risk in various administrative districts.

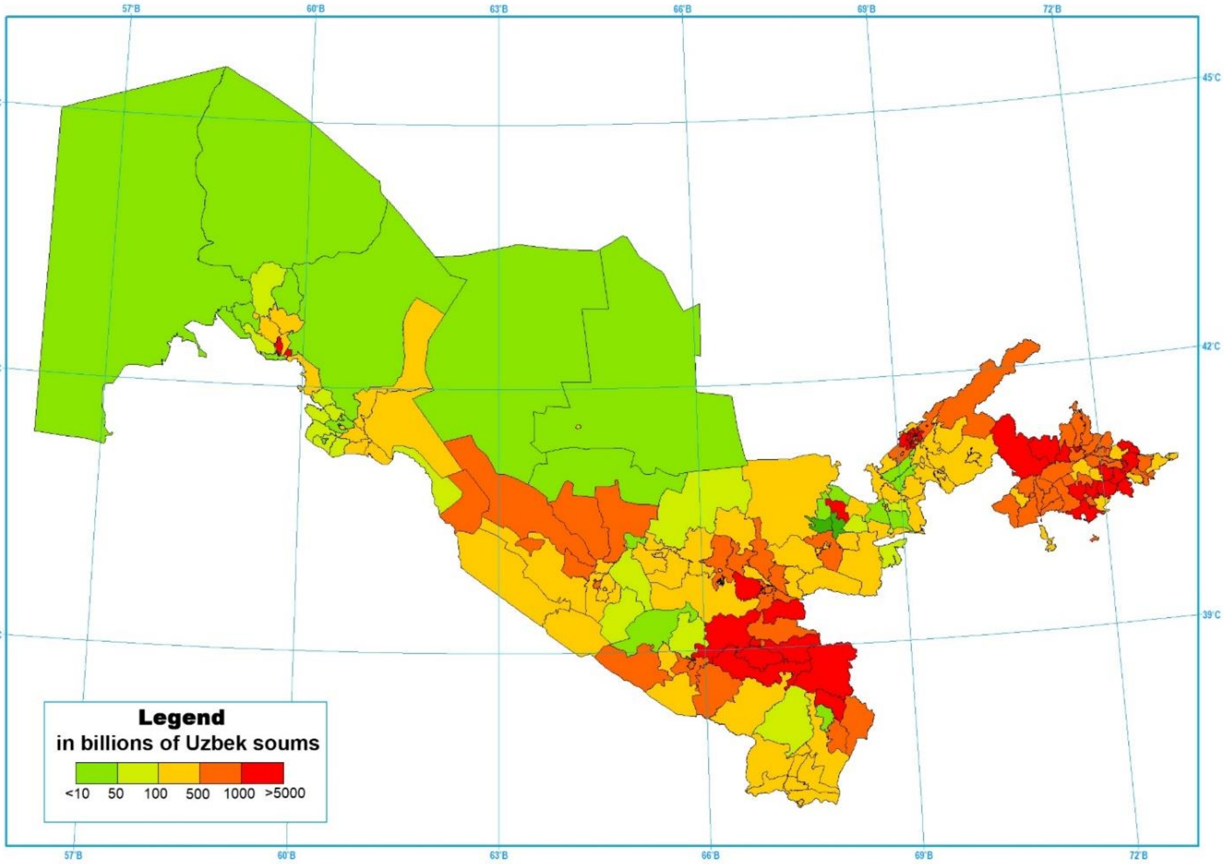

Figure 11. Seismic risk assessment of the probable economical losses (in billions Uzbekistani soms) by administrative regions of the Republic of Uzbekistan

7) *Please make sure the figure captions contain enough explanation for the reader to understand them, and consider merging figures.*

Answer: We have revised the figure captions to have a better explanation

8) *I think your response to the last comment of reviewer #1 is unclear ("The seismic risk map is calculated only considering the ground conditions"). Please specify in the manuscript what you mean, and discuss how your results compare to past risk assessments done in the region.*

Answer: We have specified in the manuscript the idea of compiling the seismic risk map based on the ground conditions and have added the past risk assessments and similar studies done in the region.

Variation of seismic intensity increments across the territory of Uzbekistan has been examined. An improved map of seismic zoning of the territory of the Republic of Uzbekistan (Artikov et al. (2020) (OSR-2017) has been compiled, considering the seismic properties of soils of different categories (Fig. 2).

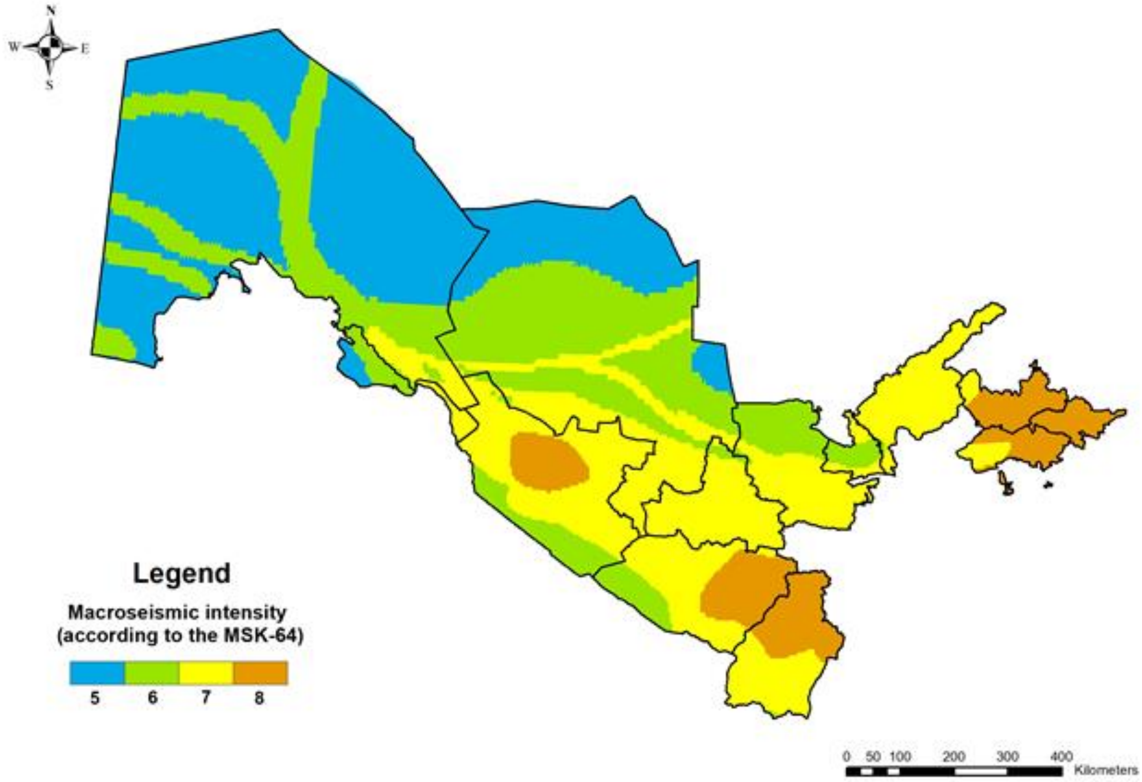

Fig. 2: Map of seismic zoning of the Republic of Uzbekistan (OSR-2017). Map of seismic zoning of the Republic of Uzbekistan (probability of not exceeding P=90% in 50 years) Authors:T.Artikov, R.Ibragimov, T.Ibragimova, M.Mirzaev

In the National Building Code No.2.01.03-19 "Construction in Seismic Areas", soils have been systematically classified into three categories based on their seismic properties, with corresponding seismic intensity increments established for each category, taking into account the engineering-geological conditions of the soils. The assessment specifically targeted the upper 10-meter strata. For the 1st category, encompassing rock soils, the seismic intensity increment is reduced by 1. This adjustment is based on the observation that structures within the region tend to experience a lower intensity, typically differing by approximately -1 from the regional intensity during an earthquake. Similarly, the 2nd category, comprising sandy and analogous soils, maintains the same seismic intensity as the considered region. In contrast, the 3rd category, encompassing clays, loess, and other soils with limited seismic resistance, witnesses a seismic intensity increment increased by 1. The general seismic zoning OSR-2017 (Fig. 2) is calculated based on the 2^{nd} category of soils. Using Fig. 1 of the engineering-geological conditions of the territory of the Republic of Uzbekistan and the general seismic zoning OSR-2017 (Fig. 2), we compiled the schematic map of seismic intensities in the territory of the Republic of Uzbekistan (Fig. 3).

Moreover, "Regional seismic risk assessment based on ground conditions in Uzbekistan" was a pilot project covering the entire territory of Uzbekistan. We have assessed seismic risk for the Djizak region and the city of Tashkent. Based on geological, seismotectonic, and seismological conditions, a scenario earthquake has been identified for the seismic risk assessment of the Djizak region and the city of Tashkent (RADIUS). Moreover, the social (individual) seismic risk for the Andijan region was calculated using the scenario earthquake.

In the RADIUS (1992) project, the seismic risk of the city of Tashkent was assessed using a scenario earthquake. The total damage from the scenario earthquake, considering the destruction of life support systems and infrastructure in Tashkent, is estimated at about 1 billion Uzbekistani soms. (The loss figures are determined in prices for the 1991 period and are taken at the book value, significantly underestimated.) As Tashkent is the capital, where a quarter of the country's gross domestic product is produced, the consequences of an earthquake will undoubtedly affect the entire country. Many international commercial, banking, and insurance connections will be temporarily disrupted. Human casualties will be significant. Years will be needed for the recovery of economic losses. In addition, the shutdown of industrial production is expected to result in losses of about 1 billion U.S. dollars. Preliminary calculations show that the scenario earthquake will cause damage to the city totaling more than 10 billion U.S. dollars (taking into account the book value of fixed assets determined at 1991 prices). Expert estimates suggest that about 80% of communication facilities will be out of operation for an extended period. Ongoing construction projects will incur irreparable damage amounting to approximately 1 billion U.S. dollars.

To assess individual (social) seismic risk, a map of a scenario earthquake was created using the GIS "Extremum," developed by the Center for Emergency Situations in collaboration with the Seismological Center of the Institute of Geoecology of the Russian Academy of Sciences and the Scientific Research Institute of the State Ministry of Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters of Russia. Data from the Andijan earthquake of 1902 were used. Based on calculations, a map of the individual seismic risk of the Andijan region and adjacent areas was constructed. It is estimated that the loss of population could amount to 8,260 people, and the total losses (including injuries) could reach 13,440 people.

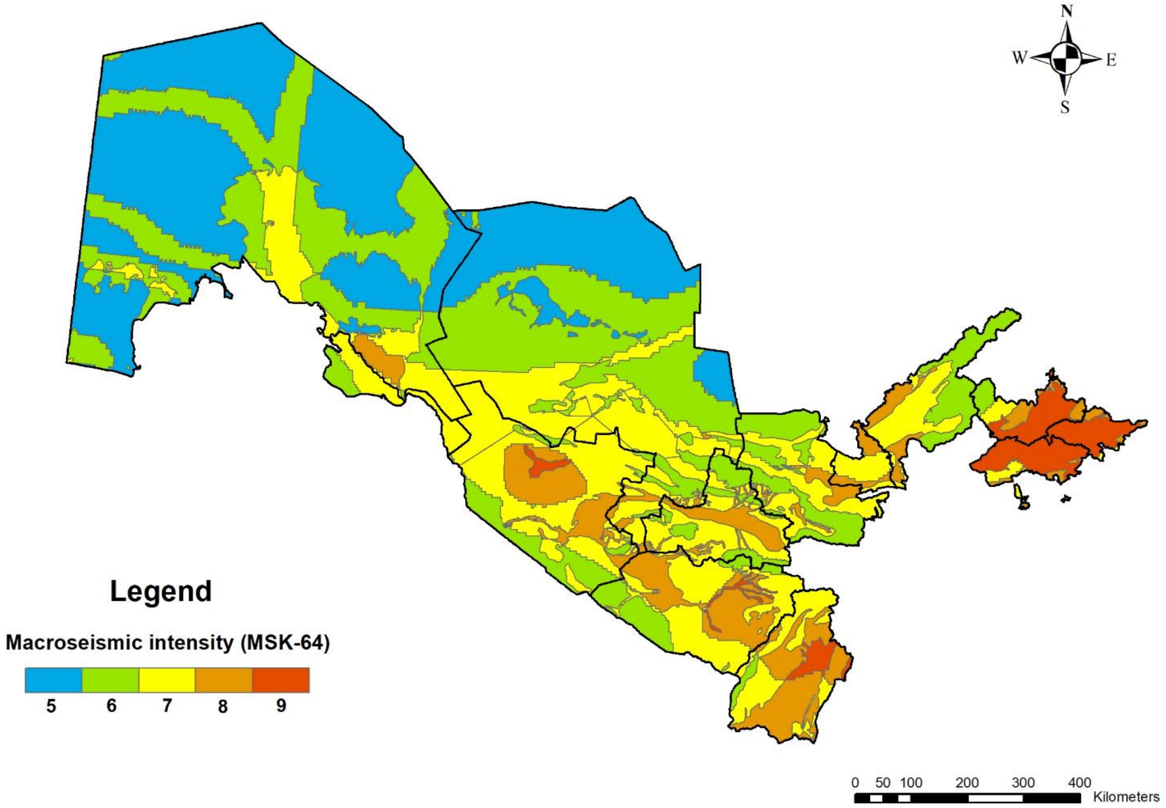

Fig. 3. The schematic map of seismic intensity in the territory of the Republic of Uzbekistan.