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Research Article

CONDUCTING SEISMIC MONITORING IN THE TERRITORY OF FERGANA CITY

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ABSTRACT
The article deals with seismic observations and microseismic measurements carried out in the Fergana region. Seismic monitoring was carried out at stations located in the vicinity according to new international standards. Seismic monitoring was carried out at stations located in the vicinity according to new international standards. A new approach has been applied to measuring the seismic properties of the soil at the site. When analyzing the data obtained by seismic observations, programs were used that correctly estimate the accuracy. Information about historical strong earthquakes that occurred in the South Fergana seismogenic zone is also given.

***Keywords*:** seismic monitoring, microseismic, analysis, seismogenic zone

INTRODUCTION
The Southern Fergana seismogenic zone is considered one of the tectonically and seismically active regions of the Republic of Uzbekistan. Over the past 136 years, from 1883 to 2019, the research area has experienced numerous significant earthquakes, including: the 7-magnitude Osh earthquake (1883), followed by another 7-magnitude Osh earthquake in the same year; the 8- and 7-magnitude Ura-Tyube

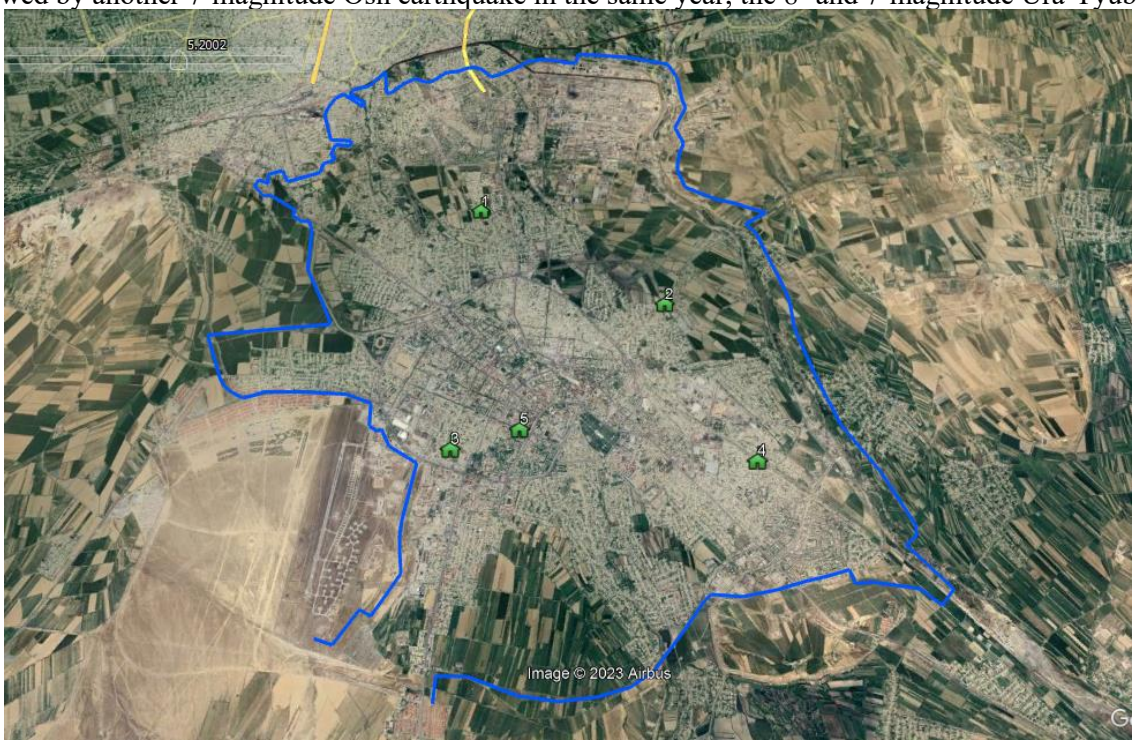


Figure 1: Seismic stations installed in the territory of Fergana city

Figure 1 description:

№	Guralp 6TD Seismometer ID	Locations of Seismometers		
		Location Description	Latitude	Longitude
Station 1	6Y92	36 Sadokat Street	40.370978	71.835409
Station 2	6Y93	Juydam Cemetery	40.417269	71.768706
Station 3	6Y94	School No. 33	40.399750	71.843947
Station 4	6Y96	Chekshura Cemetery	40.369805	71.769070
Station 5	6Y97	Fergana Seismic Station	40.374133	71.783574

earthquakes (1897); the 8-magnitude Qirqqul earthquake (1907); a 6–7-magnitude earthquake in 1914; the 8- and 9-magnitude Qurshob 1 and Qurshob 2 earthquakes (1924); the 8-magnitude Isfara-Batken earthquake (1977); the 7-magnitude Haidarkul earthquake (1977); the 8-magnitude Chimgan earthquake (1982); the 8-magnitude Gulchin earthquake (2008); as well as a number of relatively weaker seismic events.

In the territory of Fergana city, geological and geophysical research has been conducted over different years by geophysicists and geologists for various purposes. These investigations have included magnetometric, gravimetric, and electrometric mapping, providing data on the general geological characteristics of the region.

During the course of the work, potential sources of noise interference were studied at various points across the territory of Fergana city in order to clarify areas of increased seismic intensity. As much as possible, the seismometers were installed in quiet and undisturbed locations.

Seismic monitoring research was carried out using modern and comprehensive Guralp 6TD seismometers (Figure 2).

Figure 2: (Station №. 5)

MATERIALS AND METHODS

Before installing seismic stations and conducting observations in the regions, the following tasks are performed:

- Identification of local, technogenic, and artificial noise sources affecting the sensitivity of seismic measuring instruments that are not indicated on the map;
- Measurement of seismic noise levels;
- Study of local seismo-geological conditions.

Seismic noise levels vary significantly depending on the season, weather conditions, and other unforeseen factors. The seasonal variability of seismic noise is mainly related to natural causes. It is important to carry out measurements of seismic noise at several locations within the selected area (Figure 3) and to assess the ability to detect low-magnitude seismic events.

Figure 3: Noise level investigation process using the Guralp 6TD seismometer

The recorded seismic data are analyzed to determine the spectral density values of ground vibrations. Figure 4 shows the spectral density values for the case of low (normal) noise levels.

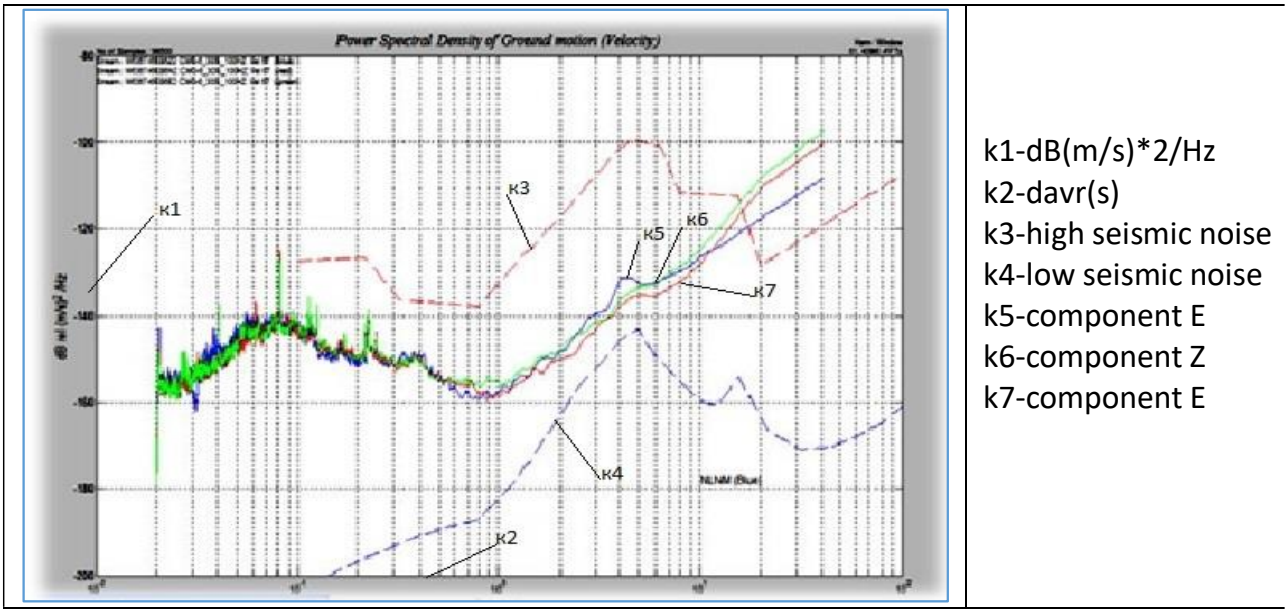
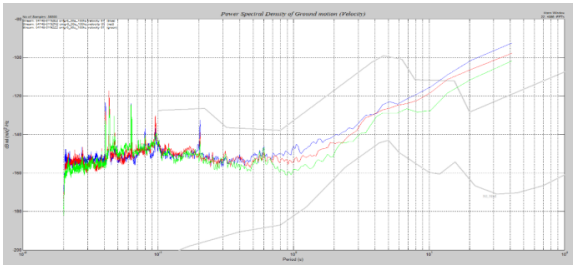
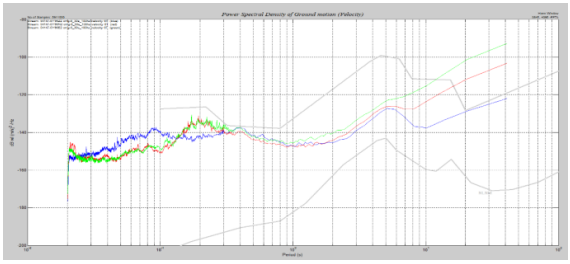


Figure 4: Spectral density measurements

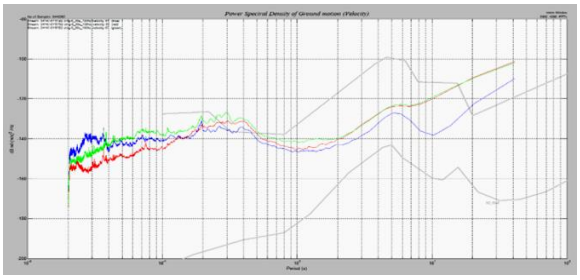
The spectral density values of the seismic stations installed in the study area can be seen in Figure 5 below:



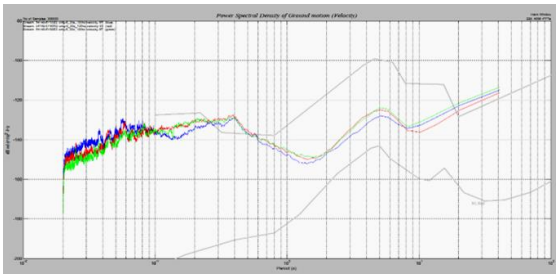
Station №1



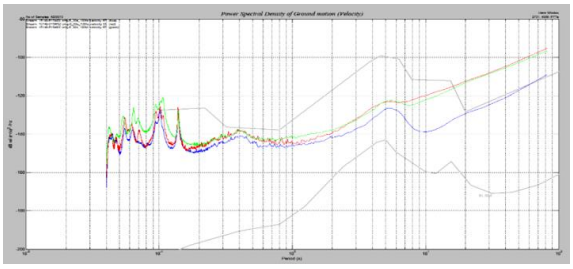
Station №2



Station №3



Station №3



Station №. 5

Figure 5: Spectral density values of seismic stations installed in the study area

RESULTS

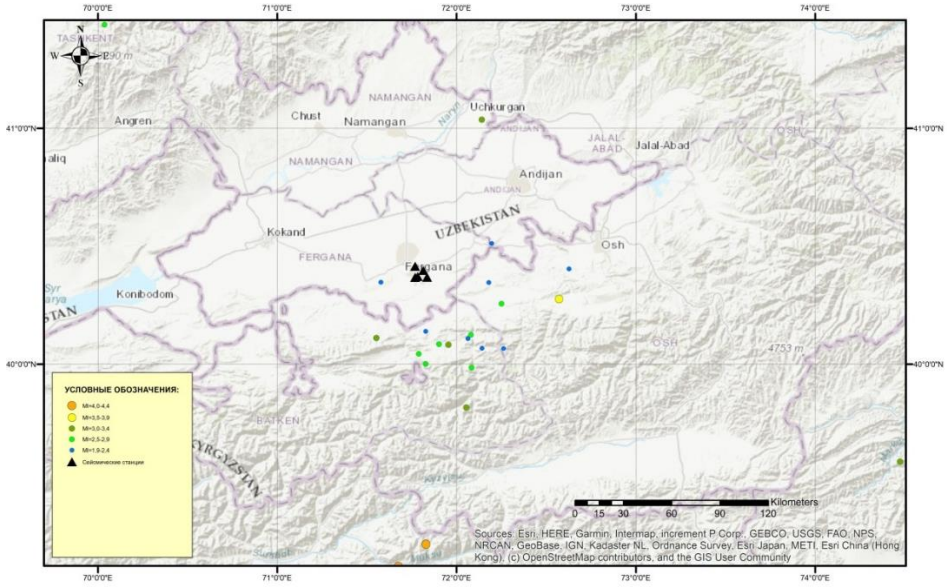


Figure 6: Map of earthquake epicenters within a 100 km radius recorded by seismic stations

The results of the research conducted in July and August 2022 using five broadband (highly sensitive to seismic impacts) digital seismometers installed in the territory of Fergana city showed that the installed reference seismic stations recorded nearly 25 earthquakes with magnitudes ranging from 1.9 to 4.1 within a radius of 100 km. Most of these events occurred in the Southern Fergana seismogenic zone, with depths between 4 and 20 km and magnitudes ranging from 1.9 to 3.9, totaling about 20 earthquakes (Figure 6).

The variation of seismic impact intensity is calculated based on earthquake data. This variation of seismic effects is determined using the following formula:

ΔI=3,3*Lg(Ai/An)

Here, Ai A _i Ai is the amplitude of the signal at the studied point, and An A_n An is the amplitude of the signal at the reference point.

Table 1 below presents seismic events with high amplitudes:

Table 1

Date	Time	Wave Amplitude (mm/s)				
		Ст№1_6Y92	ст6Y93	6Y94	6Y96	6Y97
18.07.22	14:28	2,02	1,11	1,51	1,24	1,11
23.07.22	20:47	2,03	0,62	3,09	4,21	2,58
24.07.22	23:54	1,90	2,50	1,80	3,50	2,10
26.07.22	20:37	1,19	1,37	2,01	0,75	1,07

Below, the calculations of seismic intensity variations according to the MSK-64 scale are presented in Table 2. Here, based on the seismic data, the station with the highest velocity readings, "Station №5," is accepted as the reference point.

Table 2

Earthquakes		6Y92 (36 Sadokat Street)		6Y93 (Juydam Cemetery)		6Y94 (School No. 33)		6Y96 (Chekshura Cemetery)		6Y97 (Fergana Seismic Station)	
		40.370	71.835	40.417	71.768	40.399	71.813	40.369	71.769	40.374	71.783
Date	Time	A max	ΔI	A max	ΔI	A max	ΔI	A max	ΔI	A max	ΔI
14.07.22	14:40	77485	0.23	106700	0.69	125373	0.92	86593	0.39	66031	
16.07.22	07:10		0.23	1775	0.34	1677	0.26	1945	0.47	1399	
16.07.22	11:27	19337	0.30	12778	-0.29	14317	-0.13	14159	0.15	15693	
16.07.22	16:11	7626	0.43	6949	0.30	11194	0.98	5189	0.12	5644	
17.07.22	11:20	918	0.03	619.9	-0.53	1067	0.25	1167	0.38	896.4	
17.07.22	18:55	4821	0.36	3133	-0.26	4266	0.18	5092	0.43	3762	
18.07.22	11:34	1941	0.02	2085	0.12	2637	0.46	2967	0.63	1914	
18.07.22	12:22	55300	0.47	42897	0.11	36337	-0.13	50247	0.33	39813	
18.07.22	14:28	77485	0.23	106700	0.69	125373	0.92	86593	0.39	66031	
19.07.22	20:52	10526	-0.10	9189	-0.29	13348	0.24	11265	0.00	11288	
19.07.	23:28	5729.4	-0.42	10410	0.44	10652	0.47	13827	0.84	7676	

22											
20.07. 22	11:12	1690	0.44	1226	-0.02	1432	0.20	1451	0.22	1245	
21.07. 22	11:23	5344	0.64	4956	0.53	3956	0.21	7670	1.16	3419	
23.07. 22	20:47	28415	-0.30	20767	-0.75	29609	-0.24	29001	0.27	35005	
24.07. 22	23:54	22987	-0.77	17988	-1.12	37786	-0.06	28333	0.47	39318	
25.07. 22	03:17	3463	0.20	2312	-0.38	4352	0.53	3622	0.27	3005	
26.07. 22	16:20	900	0.35	776	0.14	978	0.47	892	0.34	704	
26.07. 00	20:37	382396	0.08	438017	0.28	508897	0.49	46426	0.36	361113	
27.07. 22	09:52	88685	-0.64	103601	-0.42	115507	-0.26	16120	0.22	138525	
28.07. 22	04:16	3397	0.63	2429	0.15	3337	0.61	2929	0.42	2182	
28.07. 22	07:22	9884	0.24	3209	-1.37	7859	-0.09	9692	0.21	8355	
28.07. 22	13:29	15345	1.43	13533	1.25	7944	0.49	5189	0.12	5652	
29.07. 22	06:25	6814	0.43	3856	-0.39	5117	0.02	8246	0.70	5055	
01.08. 22	09:53	2931	-0.89	2239	-1.28	2513	-1.11	9763	0.83	5452	
01.08. 22	15:27	401.17	-0.04	627.39	0.60	544.49	0.39	471.0	0.19	413.49	
02.08. 22	00:15	819.3	0.34	666.8	0.04	770.0	0.25	678.5	0.07	648.1	
02.08. 22	00:40	801.6	0.25	647.1	-0.05	1073	0.67	920	0.45	671.3	
03.08. 22	15:33	760.8	0.31	761.7	0.31	840.8	0.45	1084	0.82	612.5	
dI mean			0.0		-0.04		+0.27		+032		

According to the analysis of the obtained data, the average values of dI (the change in score) relative to Station No. 5 for the reference station can be seen in Table 3 below:

Table 3

№	Name.	dI (Variation in Score Amount)
1.	Station No. 1	0.0
2.	Station No. 2	-0.04
3.	Station No. 3	+0.27
4.	Station No. 4	+0.32
5.	Station No. 5	

CONCLUSION

As a result of seismic monitoring studies conducted on various types of soils in the city of Fergana, nearly 25 seismic events were analyzed using seismic stations installed in noise-free locations. The following was identified from the analysis of these events. The change in score (dI) indicates that the smallest value, dI = -0.04, was recorded at Station No. 2, while the largest value, dI = +0.32, was observed at Station No. 4.

The studied area was relatively divided into northern and southern segments. In this way, the increase in score showed stable zero values in the northern segment, whereas locations closer to the city center showed negative values. The southern segments were characterized by stable positive values.
Based on the above, it can be concluded that the intensity level of the score values obtained from the research results does not show significant variation across the entire territory of the city of Fergana. It is recommended to consider these results in the general seismic zoning map.

REFERENCES

Borman, P., Baumbach, M., Bock, G., Grosser, H., & Choy, G. L. (2009). Seismic sources and source parameters. *NMSOP*, Potsdam, 1–98.
Ibragimov, A. Kh., Khamidov, Kh. L., Yuldashev, E. Sh., & Mazhidov, Zh. R. (2019). Evaluation of kinematic elements of seismic waves under dynamic industrial explosions. *Problems of Seismology*, **2, 1–12.**
Borman, P. (1994). Concept for a new "Manual of Seismological Observatory Practice." *European Seismological Commission Proceedings and Activity Report 1992–1994***.** University of Athens, Faculty of Science.
Nakamura, Y. (1989). A method for dynamic characteristics estimation of subsurface using microtremor on the ground surface. *Quarterly Report of RTRI*, **30**(1) 25–33.
Nakamura, Y. (2000). Clear identification of fundamental idea of Nakamura's technique and its applications. *Proceedings of the 12th World Congress on Earthquake Engineering*, Auckland, New Zealand.
Gorshkov, G. A. (2017). Normative chaos in Russian microzonation. *Geoinfo.ru*.
Turdukulov, A. T., Kamchybekov, M. P., Egemberdieva, K. A., & Kamchybekov, Y. P. (2013). Theoretical foundations of seismic microzonation on the example of studies in Kyrgyzstan. *Journal of Seismology*, **2**(2) 1–15.
Yuldashev, E. Sh. (2021). Modern methods of continuous seismic monitoring in reservoirs. *Seismology Studies*, **1–10.**
Shebalin, N. V. (1971). On the maximum magnitude and maximum intensity of earthquakes. *Physics of the Earth*, **6** 12–20.
Rautian, T. G. (1974). The problem of determining the energy of earthquakes. In: *Magnitude and Energy Classification of Earthquakes*. Institute of Physics of the Earth, Academy of Sciences of the USSR, Moscow, pp. 107–112.