

Международная научно-практическая конференция
«СЕЛЕВАЯ БЕЗОПАСНОСТЬ: ОЦЕНКА, ПРОГНОЗ, ЗАЩИТА»



**ПОЛЕВЫЕ СЕМИНАРЫ В ДОЛИНАХ РЕК
КИШИ И УЛКЕН АЛМАТЫ**

**22-25 августа 2017 г.
г. Алматы
Республика Казахстан**

ISSN 1998 – 7838

«ПАРАСАТ» ҰЛТТЫҚ ҒЫЛЫМИ-ТЕХНОЛОГИЯЛЫҚ ХОЛДИНГІ» АҚ
«ГЕОГРАФИЯ ИНСТИТУТЫ» ЖШС

АО «НАЦИОНАЛЬНЫЙ
НАУЧНО-ТЕХНОЛОГИЧЕСКИЙ
ХОЛДИНГ “ПАРАСАТ”»
ТОО «ИНСТИТУТ ГЕОГРАФИИ»

JSC «NATIONAL
SCIENTIFIC AND TECHNOLOGICAL
HOLDING “PARASAT”»
LLC «THE INSTITUTE OF GEOGRAPHY»

ГЕОГРАФИЯ ЖӘНЕ ГЕОЭКОЛОГИЯ МӘСЕЛЕЛЕРІ



ВОПРОСЫ ГЕОГРАФИИ И ГЕОЭКОЛОГИИ



Issues of Geography and Geoecology

4

ҚАЗАН – ЖЕЛТОҚСАН 2017 ж.
ОКТЯБРЬ – ДЕКАБРЬ 2017 г.
OCTOBER – DECEMBER 2017

ЖУРНАЛ 2007 ЖЫЛДАН ШЫҒА БАСТАҒАН
ЖУРНАЛ ИЗДАЕТСЯ С 2007 ГОДА
THE JOURNAL WAS FOUNDED IN 2007

ЖЫЛЫНА 4 РЕТ ШЫҒАДЫ
ВЫХОДИТ 4 РАЗА В ГОД
PUBLISHED 4 TIMES A YEAR

АЛМАТЫ АЛМАТЫ
ALMATY ALMATY

Ye. A. Talanov¹, V. Jomelli², K. M. Bolatov³

¹Doctor of Geographical Sciences, docent, Professor of the Department of Meteorology and Hydrology of the Faculty of Geography and Nature Management (Al-Farabi Kazakh National University, Almaty, Kazakhstan)

²PhD, Research Director (Physical Geography Laboratory Paris-1 Pantheon-Sorbonne University, Paris, France)

³Master of Science, second-year doctoral student of the Department of Meteorology and Hydrology, Faculty of Geography and Nature Management (Al-Farabi Kazakh National University, Almaty, Kazakhstan)

MUDFLOW RISK MANAGEMENT (AN EXAMPLE OF SOUTHEASTERN KAZAKHSTAN)

Abstract. The complex approach to the definition of erosion and mudflow zones in conditions of intensive economic development is considered for the mountain areas. The goals and objectives of the quantitative assessment of mudflow risk are defined for decision making and effective management of mudflow risk. The area of acceptable risk and the extent of possible direct socio-economic damage are justified on the territory of the subjects of the Almaty region. The identification of the most vulnerable areas in terms of the degree of mudflow hazard will allow timely organization of preventive measures and effective protection against catastrophic mudflows, which minimizes damage in urban areas.

Keywords: volume of mudflow, hazard, mudflow risk, management, damage.

Introduction. Mudflow (mudslide) is a rapid stream of water and fragmental rocks. Mudflow is characterised by a sudden rise in the level of flow, oscillatory (undulatory) movement, short duration (usually 1–3 hours) and by a significant denudation effect. Mudslides are formed (basic traits - abruptness and incidence) and move within the mudflow basin. The area of a mudflow basin can be from 1–2 to 100–200 km². Mudflow basins are divided into 3 cartographic zones – initiation, transit and accumulation of the mudslide. An average incline of the mudflow channel changes within an interval of 100–300%. Hard material takes up 10 to 75% of the volume of the mudflow during the movement. Density of the mudflow mass can change from 1100 to 2500 kg/m³.

Mudflow Hazard is the risk of losing people's lives and tangibles due to the impact of the mudflow. The danger of the mudflow (to population) is linked to its high speed (2–10 m/sec), powerful applied shock (mudflow can reach a speed of 1000 to 10000 m³/sec), channel erosion, accumulation of the mudflow deposits (up to 10⁷ m³ in the accumulation zone).

For creation of safe activity conditions (sustainable social and economic development) in the region, it is necessary to carry out a scientific assessment of mudflow risk based on a complex information system (monitoring, forecast) and to develop recommendations for effective protection of the population.

The development of monitoring basics and methodologies, the forecast of hazard occurrences and early emergency population warning, induced from mudflows, is the urgent direction of the research having great scientific and applied relevance on support of sustainable development of the southeast region of Kazakhstan. Emergency is such a situation which is developed or can be developed under the influence of the unfavorable factors representing threat for life of people and their normal activity.

Exploration technology. Heavy rains, flooding, significant accumulation of the landwaste in the area of occurrence and in the mudflow channel are the characteristic forecast signs of the rain mudflow formation. Certain success is achieved by drawing up the automated forecasts of triggering conditions based on the daily sums of rainfalls with the forecast interval of up to seven days. Application of a method of calculation of the amount of precipitation based on parameterization of microphysical processes in global spectral model of the atmosphere (T85L31) has allowed to increase the forecast quality of rainfall areas for the entire period of advance time (24–72 h) at the individual stations located in Russia's european part of the territory.

The method is focused on the forecast of light and moderate precipitation (with an assessment of intensity in mm/h). For example, in May 2002, the accuracy of liquid precipitation occurrence prediction has increased from 27 to 65%. Attempts to adapt numerical methods values of the meteorological fields forecast to the stochastic weather model SWM [1-2] are being made. Construction of such a model is an

important stage on the path of the creation of an innovative hydrological calculations methods system of a new generation.

The mudflow risk is a combination of the mudflow occurrence frequency (or probability), certain characteristics (maximum flow speed, volume and density of the mudflow) and consequences from these dangerous events. Quantitative index of the mudflow risk can be derived from the risk assessment or from the expected loss value. This characteristic gives us the information about the average damage which an object (economic activity) will incur (in case of the constant behavior strategy) during a certain period of time (average annual, average monthly). An object often selects the behavior strategy (protection against the consequences of adverse developments) based on the most acceptable damage value and the probability of its occurrence.

Management of risk – process by means of what decisions are made and operations are performed to eliminate or reduce influences of the identified dangers. Process of mudflow risk management can be subdivided into two independent components [3, 7]:

a) *Risk regulation* – is a process of supervision and danger source control; observation of a condition of the environment surrounding the person, its changes under the influence of economic and other activities, timely identification of tendencies of its change; the inspection of implementation of plans and actions for conservation, rational use of natural resources, observance of requirements of the nature protection legislation and standards of quality of the environment;

b) *Protection costs optimization* – is a process of the mudflow risk reduction for the purpose of it achieving such a level that is reasonable (accepted) from the point of view of practical experience. It is necessary to be guided by the principle of ensuring activity that demands a low risk level, which can only be achieved in real ecological, economic and social conditions.

Risk management process includes procedures of risk analysis and administrative decision making in the form of recommendations on risk reduction. Measures for the reduction of the torrential risk can have a technical or an organizational character. The general assessment of effectiveness of measures, which influence the risk, has a crucial importance in the choice of the types of actions. Mudflow risk management is generally based on the expenses comparison principle in preventive actions and the benefits received at the same time from reducing the risk.

The task of ensuring a certain safety level of social and economic system in mountainous areas is directly connected with the task of management of the mudflow risk for mudflow danger zones.

Development of the following technologies of forecasting, prevention and elimination of the emergency situations caused by the mud streams is promising:

- zoning of the territory based on the size of the combined risk from the emergencies of natural (mudflow risk) and anthropogenic type;
- mitigation of social and economic consequences and reduction of economic damage from the mudflow phenomena;
- assessment and certification of buildings and constructions engineering safety (real stability and durability residual resource);
- information support of decision-making on potentially dangerous objects in case of a powerful mudflow influence;
- management of city and civic complexes (various buildings) during the emergency prevention and elimination;
- monitoring of mudflow basins (potentially dangerous mudflow sites) which are under the potential danger and early mudflow warning;
- complex risk assessment of an individual mudflow site.

Research results and discussion. Definition of the value of acceptable risk criteria for a mudflow zone is at a discussion stage. Risk is a conscious danger (threat) of approach in any system of a negative event with the consequences defined in time and space. For each object located in a mudflow zone, the upper bound of the acceptable risk is rather individual. As a rule, it is defined by the size of unforeseen admissible expenses of its functioning (for industrial and economic facilities). For natural complexes, object stability degree in relation to force of anthropogenous influence is considered. Eventually, it is defined by a ratio of the expenses and benefits connected with decrease in mudflow risk. For each mudflow area which is in a zone of admissible values excess of risk it is necessary to make social

importance estimates of risk for the population in terms of total economic damage from death, traumatizing people and material losses as a result of an emergency.

Erosion type of occurrence is typical for the rain and human-induced mudflows.

Traditionally, the range of the intensity fluctuation of the potential erosion (t/ga) is divided into 5 classes: up to 0,5 t/ga (1 class); 0,5÷2 (2 class); 1÷5 (3 class), 5÷10 (4 class); 10÷50 and higher (5 class) [3]. Potential mudflow hazard is defined by the level of the mudflow activity. Parameters of the recurrence and the volume of the mud flow are used for evaluation of the mudflow activity in time within a single mudflow basin. All of the mudflow basins are sometimes divided into 4 or 5 danger categories, based on the mudflow activity (duration of the cycle equal to 100 years): volume of the debris mudflows (density of the flow equal to 2100–2500 kg/m³) is over 10⁶ m³ (I category); within the range of 10⁵÷10⁶ m³ (II category); 10⁴÷10⁵ m³ (III category); < 10⁴ m³ (IV category). Suspended mudflows (1100–1600 kg/m³) are characterised by the maximum flow speeds of: over 250 m³/sec (I category), 100–250 m³/sec (II), 10–100 m³/sec (III), < 10 m³/sec (IV). The fifth category characterises a mud flood, which is defined by a low debris saturation (density of less than 1100 kg/m³). We are proposing a single scale of the destructive power of the erosive and mudflow processes, which includes the volume of the soil loss and mud flow (m³), based on the following gradations: over 10⁶ (10 category); within the range of 10⁵÷10⁶ (9); 10⁴÷10⁵ (8); 10³÷10⁴ (7), 10²÷10³ (6), 10¹÷10² (5), 5÷10 (4), 1÷5 (3), 0,5÷1 (2 category) [4]. Dependency of the destructive force of the natural disaster parameter (J_c) on the characteristic, describing and intensity of the destructive factor, has been detected. Parameter (J_c changes from 0 to 1) characterises what fraction (from the maximum possible amount of loss $\lg E = 8 J_c$ within a year) the destructive power has within the zone of the mudflow influence. Noticeable disruptions of the economic objects' functioning start with the volume of the mud and debris flow equal to 1000 m³ (zero-order level of destruction corresponds to the gradation 6), while a full destruction of a concrete dam (gradation 10) occurs when 10⁶ m³ is exceeded.

Justification is given for the range (area) of the acceptable risk for geoecosystems, which is within $2,0 \cdot 10^{-6}$ – $5,0 \cdot 10^{-6}$, respectively, under anthropogenous and favorable conditions in the south of Kazakhstan [4].

The Almaty region can be classified in three categories - weak, average and severely eroded territories. In percentage terms they make up 4; 20 and 10% of the Almaty region's territory respectively, which belongs to the hazard category 3–5 [4, 5]. Potential erosion-hazardous territories and mudflow fans (category 7), as well as the area of mudflow sites (category 8) occupy 0.88 and 1.65% of the whole region respectively. In Karasay district, most of the territory (80%) is located in the mountainous area, with 204 mudflow sites, which have the total area of 314 km² [5]. Moreover, 17% of the mudflow basin area is a direct source of mudflow hazard. In Enbekshikazakh and Jambyl districts the similar situation is observed (15–17% of the territory is subjected to exogenous processes). In the desert zone of Ile district the mudflow center is human-induced. It is impossible to exclude a possibility of the development of the erosive process on the low-inclined underlying surface under the irrigation conditions and active land development (watering, underflooding).

During 1955–2004 on a northern slope Ile Alatau the mudflow sites' area has increased by 3,3 times at the expense of a new moraines area increment as a result of glaciers degradation. Further (until 2075) the tendency will remain, though with much smaller intensity of the mudflow sites' area increment [6]. According to monitoring of the mudflow phenomena in mountains of Ile Alatau for the last 30 years, an increase in the number of rain mudflows cases is noted, that averages 1 time in 2,2 years. Whereas in the fifties of last century they recurred each 4,5 years and at the beginning of the century after 7 years have passed. Glacial mudflows, according to observations, occur more rarely than a similar phenomena of the rain origin.

A linear dependence between the volume of washed-out soils (up to 20 thousand tons) and the costs of restoring their fertility (within the limits of 0.1–30 million tenge) is established. In the event of a mudflow disaster formation, the specific values of parameters, which are seen as a measure of the degree of destruction of the economic system infrastructure and the negative impact on the population, have a nonlinear appearance [3, 4]. The estimated cost of soil disturbance, resulting from the erosion-hazardous process on the territory of South-Eastern Kazakhstan, expressed by the direct material damage size, depending on the volume of the displaced mud mass (5000 tg/m³ [4, 5]) is determined.

The upper limit of the catastrophic rainfall frequency decreased from 59 to 35 years. At the same time, in the mudflow foci, the upper limit for the volume of mudflow decreased from 100,000 m³ to 72,000 m³ [5]. In the alpine zone, where the main mudflow foci are concentrated, in the case of rainfall under the conditions of climate aridization, the mudflows with the largest volumes up to 120,000 m³ (their occurrence probability is 1%) can be formed, whereas in the mudflow canal up to the outlet from the mountains, these volumes can reach more than 500,000 m³ [6]. It is commonly believed that the frequency of outstanding rainstorms, surface runoffs and mudflow phenomena corresponds to an average of one time per 100 years. However, not only the atmospheric precipitation, which is scarce in the layer, is able to form a mudflow, but also ordinary rains can cause the "emergence" of powerful debris and water-rock flows.

The most informative criteria are the public health indicators of population, which together characterize population's reproductive, social and economic activity. Second-order indicators are per capita parameters of GDP, comfort of the natural and social environment, all of the service sector. In the region, the index of potential losses essentially depends on the population density (the correlation coefficient is 0.81) and the economic factor ($r = 0.44$) plays an important role. In the Almaty region, the number of deaths per catastrophe can reach an average of 6.7 thousand people per year. For Kazakhstan, this figure reaches 7.9 thousand people (2003) [4]. At the same time, the correlation coefficient ($r = 0.16$) characterizes the weak connection with the catastrophe indicators (mostly random). In the Karasai district, on the erosion-hazardous territories (within an area of 50 km²), the amount of direct socioeconomic damage can on average reach 8.6 million tenge (with the recurrence of violent mudflow phenomena of 1 time in 45 years and less often) [4, 5]. In this situation, with the existing infrastructure and population density, the maximum damage can reach 27 million KZT (90% of all losses). Studies on the identification of the impact of climate warming in the region on the trigger of mudflow processes have shown that their frequency will increase. Consequently, powerful mudflows (with a mudflow volume of 1 million m³ or more) will recur more often (once in 15 years) [5, 6]. Consequently, in the future, the risks of losses from exogenous processes will increase and they should be taken into account when designing and developing urbanized areas.

Conclusions. Based on the results of the analysis, it is possible to concretize tasks on the topic of the scientific and applied research "Integrated management of mudflow risks in the mountainous regions of South-Eastern Kazakhstan" (on the example of the city of Almaty).

A. Establish a time scale of severe mudflow phenomena (2–3 hours), impact area (10–25 km²).

B. Construct the loss (damage) functions from powerful mudflows for the western and eastern parts of Almaty, taking into account the existing anti-mudflow protection.

C. Justify the crisis scenarios from possible powerful mudflows and develop measures for the timely warning and effective protection of the population of Almaty.

REFERENCES

[1] Polyakova S.Ye., Talanov Ye.A. Recommendations for characteristics fields of heavy rains modelling in the mountainous areas. Proceedings of the IV International Conference "Debris Flows: Disasters, Risk, Forecast, Protection", 6-10 September 2016 - Irkutsk: Institute of Geography Publisher them. V. B. Sochava SB RAS, 2016. P. 211-215 (in Russian).

[2] Talanov Ye.A. Technology of short-term probabilistic forecasting of floods and debris flows based on the forecast rainfall during 3 and 6 hours. Debris Flows: Disasters, Risk, Forecast, Protection: Proceedings of the IV International Conference (Russia, Irkutsk – the village of Arshan, 6 September 10, 2016.). Irkutsk: Institute of Geography. Sochava of the SB RAS, 2016. P. 229-233 (in Russian).

[3] Talanov Ye.A. Ecological-geomorphological basis for risk assessment of erosion-mudflow processes in the mountain-plain system: Author's abstract of diss. ... Dr of Geo Sc. Almaty, 2010. 36 p. (in Russian).

[4] Talanov Ye.A. Regional assessment of the ecological and economic risk from water erosion and mudflows. Almaty, 2007. 352 p. (in Russian).

[5] Talanov Ye.A. To the issue of assessment of geo-ecological risks caused by mudflows and water erosion in the territory of South-Eastern Kazakhstan // KazNU Newsletter. Geographic series. 2009. N 1(28). P. 65-71 (in Russian).

[6] Talanov Ye.A., Polyakova S.Ye. Forecast assessment of mudflow hazard in IleiskyAlatau under climate change with certain scenario assumptions // KazNU Newsletter. Geographic series. 2008. N 1-2 (26-27). P. 47-55 (in Russian).

[7] Yamalov I.U. Modeling of management and decision-making processes in emergency situations. M.: Laboratory of Basic Knowledge, 2007. 288 p. (in Russian).

ЛИТЕРАТУРА

- [1] Полякова С.Е., Таланов Е.А. Рекомендации по моделированию характеристик полей ливневых осадков для горных районов // Селевые потоки: катастрофы, риск, прогноз, защита: Материалы IV Международной конференции (Россия, г. Иркутск – пос. Аршан, Республика Бурятия, 6–10 сентября 2016 г.). – Иркутск: Изд-во Института географии им. В. Б. Сочавы СО РАН, 2016. – С. 211-215.
- [2] Таланов Е.А. Технология краткосрочного вероятностного прогнозирования паводков и селевых потоков на основе прогноза количества осадков на 3 и 6 ч // Селевые потоки: катастрофы, риск, прогноз, защита: Материалы IV Международной конференции (Россия, г. Иркутск – пос. Аршан, Республика Бурятия, 6–10 сентября 2016 г.). – Иркутск: Изд-во Института географии им. В. Б. Сочавы СО РАН, 2016. – С. 229-233.
- [3] Таланов Е.А. Эколого-геоморфологические основы оценки риска эрозионно-селевых процессов в системе "горы-равнины": Автореф. ... дис. д. г. н. – Алматы, 2010. – 36 с.
- [4] Таланов Е.А. Региональная оценка эколого-экономического риска от водной эрозии и селей. – Алматы, 2007. – 352 с.
- [5] Таланов Е.А. К вопросу оценки геоэкологических рисков, обусловленных селями и водной эрозией, на территории Юго-Восточного Казахстана // Вестник КазНУ. Серия географическая. – 2009. – № 1(28). – С. 65-71.
- [6] Таланов Е.А., Полякова С.Е. Прогнозная оценка селевой опасности в Илейском Алатау при изменении климата с определенными сценарными допущениями // Вестник КазНУ. Серия географическая. – 2008. – № 1–2 (26–27). – С. 47-55.
- [7] Ямалов И.У. Моделирование процессов управления и принятия решений в условиях чрезвычайных ситуаций. – М.: Лаборатория базовых знаний, 2007. – 288 с.

Е. А. Таланов¹, В. Джомелли², Қ. М. Болатов³

¹Г.ғ.д., доцент, География және табиғатты пайдалану факультетінің метеорология және гидрология кафедрасының профессоры. (әл-Фараби ағындағы Қазақ ұлттық университеті, Алматы, Қазақстан)

²PhD, зерттеу директоры (Францияның ұлттық ғылыми зерттеу орталығы және Пантеон-Сорбонна Париж-1 университеті, Париж, Франция)

³Магистр, География және табиғатты пайдалану факультетінің метеорология және гидрология кафедрасының 2 оқу жылы докторанты (әл-Фараби ағындағы Қазақ ұлттық университеті, Алматы, Қазақстан)

СЕЛ ТАСҚЫНЫ ҚАТЕРІН БАСҚАРУ (ОҢТҮСТІК-ШЫҒЫС ҚАЗАҚСТАН БОЙЫНША)

Аннотация. Таулы аудандарының қарқынды шаруашылық игеру жағдайындағы эрозияны және сел қаупі бар аймақтарды анықтаудың кешенді тәсілдемесі қарастырылды. Шешім қабылдау және сел қатерін эффективті басқару мақсатында сел қаупін бағалаудың мақсаттары мен міндеттері айқындалды. Алматы облысы субъектерінің территориясындағы қолайлы қауіптер аймағы мен ықтималды тікелей әлеуметтік-экономикалық залалдың көлемі дәлелденді. Сел қатерінің дәрежесі бойынша осал аймақтарды анықтау урбанизацияланған территорияларындағы залалдарды ықшамдайтын апатты селдерден превентивті шараларды және эффективті қорғанысты уақытында ұйымдастыруға жол ашады.

Түйін сөздер: сел көлемі, қауіп, сел қатері, басқару, залал.

Е. А. Таланов¹, В. Джомелли², К. М. Болатов³

¹Д.ғ.н., доцент, профессор кафедрасы метеорология және гидрология факультеті география және природопользования (Казахский национальный университет им. аль-Фараби, Алматы, Казахстан)

²PhD, директор по исследованиям (Национальный центр научных исследований Франции и Университета Париж-1 Пантеон-Сорбонна, Париж, Франция)

³Магистр, докторант 2-го курса кафедрасы метеорология және гидрология факультеті география және природопользования (Казахский национальный университет им. аль-Фараби, Алматы, Казахстан)

УПРАВЛЕНИЕ СЕЛЕВЫМ РИСКОМ (НА ПРИМЕРЕ ЮГО-ВОСТОЧНОГО КАЗАХСТАНА)

Аннотация. Рассмотрен комплексный подход к определению эрозионных и селеопасных зон в условиях интенсивного хозяйственного освоения горных районов. Определены цели и задачи количественной оценки селевой опасности для принятия решений и эффективного управления селевым риском. Обоснованы область приемлемого риска и размеры возможного прямого социально-экономического ущерба на территории субъектов Алматинской области. Выявление наиболее уязвимых участков по степени селевой опасности позволит своевременно организовать превентивные мероприятия и эффективную защиту от катастрофических селей, что минимизирует ущербы на урбанизированных территориях.

Ключевые слова: объем селя, опасность, селевой риск, управление, ущерб.

CONTENTS

Tourism and Recreation

- Plokhikh R.V., Smykova M.R., Ustenova O.Zh.* Adaptation basis of foreign experience for tourism development in Kazakhstan.....3
- Smykova M.R., Plokhikh R.V., Ustenova O.Zh.* Marketing basis for detecting the priority directions of Kazakhstan internal tourism.....11

Climatology

- Talanov Ye.A., Polyakova S.Ye., Kisebayev D.K., Bolatov K.M.* Statistical sequence structure of extreme of atmospheric cold and heat waves (an example of Ile Alatau).....19

Geocology

- Vereschagina N. G., Chub V. E., Schetinnikov A. A., Mukhametzyanova A. M.* The effect of salt removal on irrigated lands with irrigation water on the stock of salts in root zone soil in the lower reaches of the Amu Darya.....27
- Orazbekova K.S., Tolepbayeva A.K.* Analysis of the natural-agricultural system of Kyzylorda Region Kazaly District for improvement of land-use system.....32

Natural hazard

- Zakharova L.M.* Identification patterns of dissipative structures during development of a landslide.....39
- Talanov Ye.A., Jomelli V., Bolatov K.M.* Mudflow risk management (an example of Southern Kazakhstan)...51

Water management

- Temirbayeva R.K., Kelinbayeva R.Zh., Khen A.P., Yushina Yu.A.* Demographic risks in construction of the Eurasian Transit through the territory of Kazakhstan.....56

Expeditionary researches

- Bekkuliyeva A.A.* New data on the research of Mangystau Peninsula's caves.....69
- Yegemberdiyeva K.B., Temirbayeva R.K., Kelinbayeva R.Zh., Orazbekova K.S., Khen A.P., Yushina Yu.A., Gainulla S.A.* Expedition «Unique Mangystau».....77

Science reports

- Ismuhanova L.T., Zhadi A.O.* Influence of air temperature on the level mode of Balkhash Lake.....86
- Chichagov V.P., Belgibaev M.E.* An outstanding scientist of the XX century Boris Alexandrovich Fedorovich (1902–1981).....90

Chronicle

- III International Symposium "Physics, Chemistry and Mechanics of Snow" (October 2–6, 2017, Yuzhno-Sakhalinsk, Russia).....95

Anniversaries

- AMIRGALIYEV Nariman Amirgaliyevich (*For the 80-th anniversary*).....99

Editor T. N. Krivobokova

Makeup on the computer of *D. N. Kalkabekova*

Passed for printing on 09.11.2017.

Format 60x88¹/₈. Offset paper.

Printing – risograph. 7,25 pp. Number of printed copies 300.