Brief information about the project

Name of the project	AP09058406 “Modeling of flood, breakthrough waves and mud-stone impurities during normal and emergency dam breaks in a complex system of rivers and canals.”
Relevance	This Project is devoted to the development of mathematical models that describe the transfer of mud-stone flows under normal and abnormal conditions, considering the terrain and their numerical implementation. The software package being developed in the project will allow real-time monitoring of mud-stone flow in a complex system of rivers and canals.
Purpose	development of an expert system for the elimination of floods, breakthrough waves and the transfer of mud and stone impurities during the breakthrough of hydraulic structures in a complex system of rivers and canals using mathematical modeling methods.
Objectives	development of a mathematical model and numerical modeling of the propagation of flood (air - liquid) and breakthrough waves in real time. conducting a series of computational experiments for various flooding scenarios in emergency situations in order to minimize damage. Conducting a series of computational experiments for various dam break scenarios and analyzing the results obtained, which can be used to determine the flood zone and time. Conducting a series of computational experiments for various dam break scenarios in cascading open channels to develop recommendations for the design of new hydraulic structures. development of a software package that implements operational modeling of the propagation of flood and breakthrough waves in real time. development of a mathematical model and numerical modeling of the propagation of mud and water flows (air – liquid – mud) in real time. numerical study of the behavior of water flow in a sharply expanding channel above a moving layer of a homogeneous mud layer. conducting a series of computational experiments on dam breakthrough to study morphological changes in the topography of the river bottom and the destruction of the coastal contours and foundation. assessment of the duration of the flooding process and calculation of the breakthrough wave taking into account the mud flow during the collapse of hydraulic structures in complex river terrain. development of a software package that implements operational modeling of the spread of mud and water flows (air – liquid – mud) in real time.

	development of a mathematical model and numerical modeling of a mudflow with particles of various sizes (air - liquid - dirt - particles) during an emergency dam break. conducting a series of computational experiments for various mudflow scenarios with particles of various sizes (air - liquid - dirt - particles) and analyzing the results obtained, which can be used to develop recommendations for eliminating the consequences of the accident and protecting populated areas. research of new types of multi-level protection in open river channels to minimize damage to the main dam from mudflows with particles of various sizes. Conducting a series of computational experiments for various scenarios of mudflows and mud flows, considering particles of various sizes through an idealized populated area. development of a software package that implements a mathematical model of a mudflow with particles of various sizes for various dam break scenarios in open complex river beds.
Expected and achieved results	a mathematical model was developed and the propagation of flood (air-liquid) and breakthrough waves was numerically simulated in real time. A series of computational experiments were carried out for various flooding scenarios in emergency situations in order to minimize damage. A series of computational experiments were carried out for various dam break scenarios and an analysis of the results obtained, which can be used to determine the zone and time of flooding. A series of computational experiments were carried out for various dam break scenarios in cascading open channels to develop recommendations for the design of new hydraulic structures. a software package was developed that implements operational modeling of the propagation of flood and breakthrough waves in real time. a mathematical model was developed and the propagation of mud and water flows (air – liquid – mud) was numerically simulated in real time. The behavior of water flow in a sharply expanding channel above a moving layer of a homogeneous mud layer was numerically studied. a series of computational experiments on dam breakthrough were carried out to study the morphological changes in the topography of the river bottom and the destruction of the coastal contours and foundation an assessment was made of the duration of the flooding process and the calculation of the breakthrough wave taking into account the mud flow during the collapse of hydraulic structures in the complex river terrain.

	a software package was developed that implements operational modeling of the spread of mud and water flows (air – liquid – mud) in real time. a mathematical model was developed and a mudflow with particles of various sizes (air - liquid - dirt - particles) during an emergency dam break was numerically simulated. a series of computational experiments were carried out for various scenarios of debris flow with particles of various sizes (air - liquid - dirt - particles) and an analysis of the results obtained, which can be used to develop recommendations for eliminating the consequences of the accident and protecting populated areas. New types of multi-level protection in open riverbeds were investigated to minimize damage to the main dam from debris flows with particles of various sizes. A series of computational experiments were carried out for various scenarios of mudflows and mud flows, considering particles of various sizes through an idealized settlement. A software package was developed that implements a mathematical model of a mudflow with particles of various sizes for various dam break scenarios in open complex riverbeds.
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List of publications with links to them	Issakhov A., Borsikbayeva A. Dam-break flow on mobile bed through an idealized city: numerical study. Water Resources Management, 2022, 10.1007/s11269-021-02977-2 (2019 Impact Factor: 3.517; Scopus: SJR: 0.929, percentile: 87)
Patents	-