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 DOI 10.51582/interconf.19-20.03.2024.037

The influence of global climate change on the hydromorphological regime of river waters in the Sabirabad and Ujar regions

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Abstract.

In recent decades, climate change has caused impacts on the natural systems of all rivers. Since in the Sabirabad and Ujar regions, which are the objects of the study, the impact of global climate change on river waters has not been studied on such a large scale, the topic is considered very relevant. The article presents some results of a study of the influence of climatic factors on the hydromorphological structure of the Araz rivers, the right branch of the Kura, and the left branch Turyanchay.

Keywords:

*water resources
monitoring
climate change
river*

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Introduction. Water resources are an important factor in the social and economic development, as well as the environmental well-being of the country. The study of water resources is one of the areas of fundamental research of water bodies [1,2]. The river network of the republic includes more than 8,350 rivers and the vast majority of rivers (8,295) are small – less than 50 km long. A thorough study of the hydromorphological features of these rivers will make it possible to rationally use them in the interests of the economy, in particular, for water supply to the population, agriculture, industry, energy, etc. The studies were carried out on gray-meadow soils of the Sabirabad region and Ujar region located in the northern part of the Mugan steppe, part of the Kura-Araz lowland. Alluvial deposits influence of the Kura river on the right tributary of the Turyanchay and the right tributary of the Araz river reaching a thickness of 10–20 m, which gradually decreases from the west to the East (Fig.3). The silt deposits of rivers differ sharply in color. The Kura sediments are gray-brown in color, and the Araz sediments are reddish. Soil salinity map of Kura-Araz basin of Azerbaijan. Salinity degree is given by total soluble salts (%). Salinity area 10.3: non-saline: 495.4; slightly saline: 382.8; saline: 415.6; strongly saline: 448.9; extremely saline: 174.4 ha. (Fig.1,2).

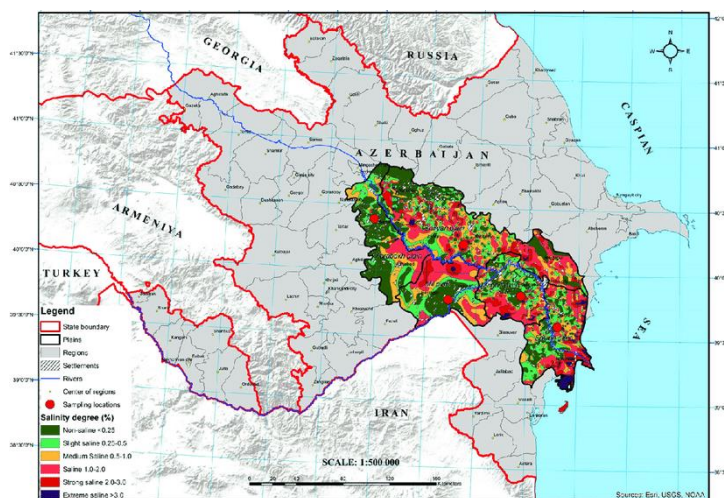


Figure 1
Map of the study area, location of soil sampling sites

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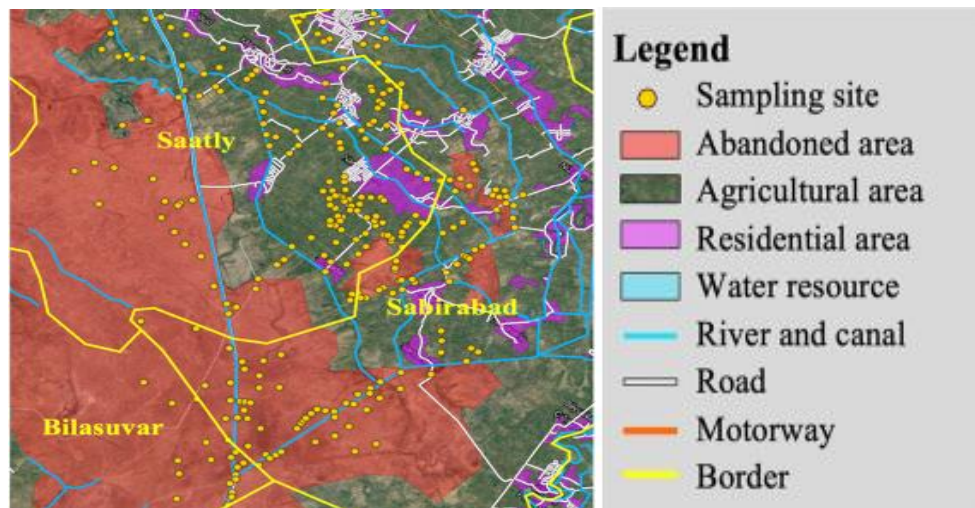


Figure 2

Satellite map of the study area, location of soil sampling sites and land use classification of the Mugan Plain, Republic of Azerbaijan

Changes in intra-annual water content and river regime it should be noted that these works consider rivers that are quite large in terms of catchment area and practically do not take into account the degree of agricultural development of their catchment areas, which largely determines the features of runoff formation, primarily on small rivers. Intra-annual distribution of runoff in small river basins, constituting more than 82–85% of the total river length. Observations of water flow in the studied basins are carried out for quite a long time, which, firstly, makes it possible to establish a fairly objective trend of the changes taking place; secondly, it makes it possible to judge the trend of changes in water flow during the period of global warming. The unevenness of the river flow was assessed by normalizing the maximum, minimum and annual water flows of a particular year to its average annual meaning. Temporal variability (directional changes) of river flow was estimated by the regression equation. The trend towards a reduction in the maximum river flow is due to an increase in air temperature in the cold season, an increase in the frequency of thaws and, as a consequence, a decrease in the depth of soil freezing and, in many cases, a decrease in the reserves of snow in the snow cover at the time of snowmelt. An increase in atmospheric

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temperature leads to an increase in the moisture-holding capacity of the atmosphere, but has little effect on the level of relative humidity. This increases the rate of evaporation over a large portion of water surfaces. For its part, there is a very high probability that evaporation at the Earth's surface will increase in a warmer climate. Evaporation affects soil moisture, runoff, the amount of water in reservoirs, and the salinity levels of aquifers. Increased droughts are associated with decreased precipitation and increased evapotranspiration, which change soil characteristics. The overall increase in water temperatures caused by global warming reduces the overall quality of available fresh water, particularly by causing an increase in the number of pathogens present in the water and allowing bacteria and other contaminants to spread at a greater rate. This has catastrophic consequences for human health, mainly in areas where access to water and sanitation is non-existent or inadequate. In addition, droughts and floods often lead to contamination of fresh water supplies.

Methods. The study of soils and river waters at the study sites was carried out in field and laboratory conditions using generally accepted methods. For the study, water samples were taken from the Turyanchay and Araz rivers, and monitoring was carried out using aerospace photos.

Results. Depending on soil and geological conditions and the water regime of rivers, this change is of a different nature. The hardness of the waters of the rivers of Azerbaijan changes in accordance with their water regime and the nature of nutrition (table 1).

Table 1

River water hardness

River - point	Average long-term mineralization values, C, mg-l	mEq-l	Removable hardness, mEq-l	Constant hardness, mEq-l
Turyanchay	543	5,90	3,60	1,83
Goychay	583	6,20	3.70	2.00

In general, the republic's water supply meets the requirements for good and satisfactory drinking water and is

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suitable for irrigating agricultural crops. The quality of river waters is currently closely related to human activities. The determining factor in changes in water quality is industrial and municipal wastewater discharged into rivers, as well as agricultural runoff from fields and livestock farms. The problem of water quality protection has not yet been completely resolved and continuing pollution can make rivers unsuitable not only for drinking and cultural water use, but also for irrigation [3,6].

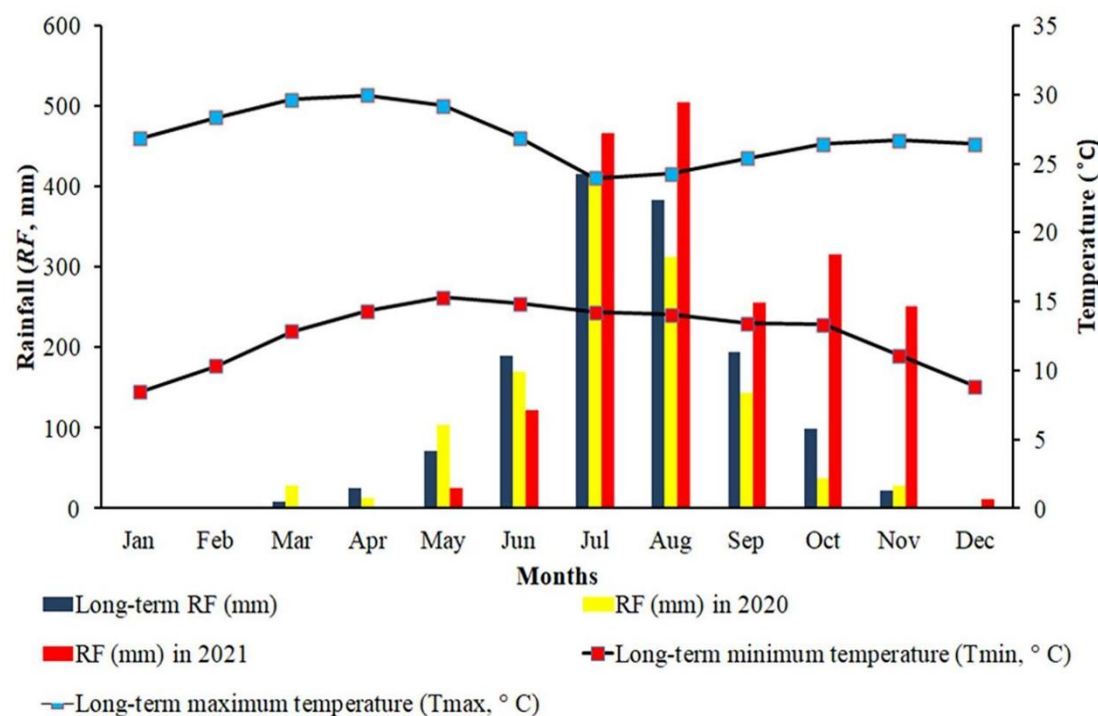


Figure 3
Average monthly precipitation for two years in the study area

The climatic factors that have the greatest influence on freshwater resources are precipitation, temperature and evapotranspiration. Their change accelerates the water cycle in several regions of the world, affecting, among other things, the frequency and intensity of precipitation, the melting of snow and ice, increased evaporation and water vapor in the atmosphere, changes in soil moisture and water infiltration, and runoff (Fig.3).

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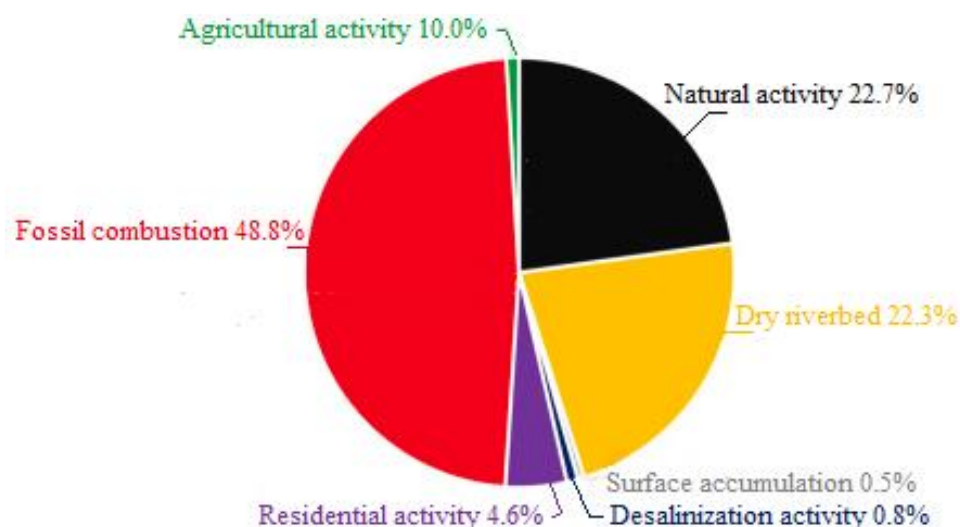


Figure 4
General activity indicators of various areas
in the region (2022–2023 years)

Residential activities, surface accumulations, dry river beds, natural activities are highly subject to change due to global climatic factors (Fig. 4). The study of changes in the hydromorphological state of the Kura River and its tributaries (Araz, Turyanchay), which is the main source of water used for irrigation in agriculture in Azerbaijan, is of great importance from the point of view of protecting natural resources.

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