


COMPARATIVE RESEARCH OF CLIMATE CONDITIONS AND PECULIARITIES OF RIVERS AND LAKES ON THE TERRITORY OF THE AZERBAIJAN REPUBLIC AND ON TERRITORY OF THE STATE OF CALIFORNIA (USA) FOR PROMOTION OF INNOVATIVE DEVELOPMENT OF NATIONAL TOURISM ECONOMY

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In this report its authors describe problems of climate conditions, as well as the problems of rivers and lakes on the territory of the Azerbaijan Republic and on the territory of the state of California (USA).

Keywords: climate, rivers, lakes, rainfalls, snow, temperature, tourism.

Conference participants, National championship in scientific analytics,
 Open European and Asian research analytics championship

 <http://dx.doi.org/10.18007/gisap:ess.v0i8.1097>

Comparative analysis of climate in California and Azerbaijan

Large part of the territory is in the etesian climate zone, wet winter and dry summer are observed. The climate type of Azerbaijan is more colorful, changing with the occurrence of the subtropical type. Geographical location, relief and the Caspian Sea mainly affect the climate of Azerbaijan. Impact of the ocean prevents sharp decrease of temperatures in California. It provides a basis for cool summer and moderate winter. Continentality is increasing in the inland part of area. There are acute temperature changes in winter and summer. Westerly winds from the ocean with rains are observed. There is more rains in the north areas than in the south. Rains most commonly impact the climate; rains are prevented from entering the inland of area from the ocean side.

The north-western part of California has sharp, dry climate, usual amount of the rainfalls is 38-100 mm per year. Etesian climate prevails on the plain of California. However, there is a sharp variation in temperatures.

The mountain climate is typical for mountainous areas of California. There one can discover snowy winters and hot summers. There are desert regions from mountainous hills to the east. General features of mountainous climate here: low atmospheric pressure, high-intensity solar radiation, air cleaning (except for the depressions between the mountains), low temperature and high air humidity, precipitation, depending on the height

of the mountain - valley winds. High mountainous climate is formed on the altitude of 2000-3000 meters.

Sacramento city - is located in the valley of Sacramento River. Sacramento is located in Sierra-Nevada mountain slopes, in conditions of etesian climate. There is moderate, rainy winter and dry hot summer.

Heavy fogs are observed in winter and early spring. It is considered to be one of most sunny towns in USA from June to September. Despite intense heat during summer afternoons, the weather is always cold. Sometimes it snows 1-2 times per year. Nakhchivan city of Azerbaijan may be compared to Sacramento city for some of its climate features. Mountainous landscape affects the climate of Nakhchivan city. Sunny days are mostly observed here. As there is continentality in the climate of both, annual and daily temperature amplitude is high.

San Jose - is located in the west of the State. The climate of San Jose is one of the best in northern California. The city is located a bit far from Pacific, therefore impact of the cold Pacific stream is weak. Due to this positive difference, the temperature between San Francisco and San Jose is 5-10 in summer and 10-15 degrees in winter. Number of sunny days observed during year is 320. The weather is warm in San Jose. It is less dangerous than San Francisco. The lowest rainfall level is observed during the summer (May-September). There are similar climate features when comparing San Jose with

Shirvan city of Azerbaijan. Shirvan city is located more far from Caspian than Baku. Thus, its climate is more favorable than in Baku. There are the less windy days.

San-Francisco - The words told by Mark Twain are wrong. "The coldest winter I ever lived was the summer in San Francisco". The climate of San Francisco is similar to the etesian climate. San Francisco is surrounded by water from 3 sides, just like Baku. Therefore, cold Pacific stream impacts its climate. The average annual temperature is 18 degrees; it is 10 degrees below in the Livermore. Livermore is a little city in the continental interior. The highest temperature recorded was 39 degrees on July 14, 2000. The average monthly temperature is 18.2 degrees °C in September; it is colder than July in Moscow. San Francisco is located more to the south than Baku according to the latitude, but it is on the same latitude with Ashgabat. The average daily temperature is 16 degrees from the beginning of May until the end of October. Daily temperature is 15 degrees °C in winter. The lowest temperature was recorded on December 11, 1932 (-3 degrees). It is dry from May up to September. Rainfall season starts in November and lasts until March. Starting from 1852, only 10 times snow has been recorded there. There are days with strong fog from the end of summer until the beginning of autumn.

Positive temperature record of the weather belongs to the Death Valley in the USA State of California, not to Al Aziziyah city of Libya. Experts

from the UN World Meteorological Organization have come to this conclusion. Now the status of the world's hottest place was given to the Death Valley. Thus, the positive weather temperature record of 56.7 degrees was registered in the "Greenland" ranchos area on July 10, 1923. Death Valley is located in the desert of Mojave and is considered to be the hottest place on the planet. The average temperature reaches 25 degrees here. Death Valley is also known for Badwater trough located 86 meters below the sea level.

In North America there is the deepest place of the surface. In addition, the highest place of continental United States is 136 km away, at an altitude of 4421 meters above the sea level - Whitney Mountain rising to the heavens. The lowest air temperature of -45 °C was observed in the high mountains of Azerbaijan Republic. This is considered to be the absolute minimum. -32 °C was recorded in Aras River valley. The absolute maximum of +44 °C was recorded in Julfa.

The coldest climate of California territory was observed in Sierra Nevada and Cascade Mountains.

Moderate - warm climate, rainfall is equally distributed throughout the year; it covers low mountains and foothills zones of Talysh Mountains, the south and the north-east of the Greater Caucasus in Azerbaijan. It rains throughout the year. Most of the precipitation falls in Lankaran, 2000mm.

Comparison of rivers of Azerbaijan and California

Hydrographically the Republic of Azerbaijan belongs to the Caspian Sea basin. The hydrographic network of the Republic (rivers, lakes) has been forming over a long geological period. It has undergone significant changes since that time. Currently existing remains of several ancient river valleys found in the territory of the country prove this. Today the hydrographic network is changing due to natural factors and economic activities of people. Artificial watercourses (canals) and water reservoirs are also attributed to the hydrographic network. The State of California hydrographically belongs to the Pacific Ocean basin. In

contrast to the Republic of Azerbaijan, the rivers of the State of California belong to the open basin, namely to the basin of Pacific ocean. As in the Republic of Azerbaijan, hydrographic network of the State of California has been forming over a long geological period and has considerably undergone significant changes since that time. As in the Republic of Azerbaijan, the rivers of the State of California network are changing due to natural factors and economic activities of people. Currently, the rivers of the State of California act as a part of two large water projects. The Project of Central Plains - the main objective of this project is to supply the agriculture with plenty of water. For this purpose, the direction of rivers flowing to the north is diverted to the south by changing their direction in the State of California. The second project is provision of every territory with the water in the State of California. There are nearly 8400 rivers in Azerbaijan. The number of rivers having the length of more than 5 km is 190. The length of 21 river is more than 100 km. Only two rivers have the length of more than 500 km. Rivers are mainly formed in the mountains. They come together in the plain or directly flow to the Caspian sea. All rivers of Azerbaijan belong to the closed standing Caspian basin. The average annual water flow of rivers is nearly 31 cm³ and 2/3 of them are formed in neighboring countries. Increase of drought in climate leads to the decreasing density of the river network going down to the plains from Greater and Lesser Caucasus. The densest river network is observed on the middle upland, but the least dense river network is in plains. California has various, not very dense river network. The rivers take emerge in high mountainous areas and flow to the basin of Pacific ocean in direct or indirect ways. Two largest rivers of California are Sacramento and San Joaquin. Several major rivers with plenty of water flow to Sacramento and San Joaquin. Pit and Feather rivers are example of these.

Kur river

The length of the Kur river is 1515 km. It comes from Gizilgadik mountain (2740 m) of Turkey, enters Azerbaijan passing through Georgia. The

length of Kur is 906 km in Azerbaijan. It flows into Caspian sea in Neftchala region. Kur river has plenty of water during the late spring and the beginning of summer, when intensive melt of snow feeds river waters. The level of the river is maximum in April and minimum in September. The right branches of Kur are Shamkirchay, Ganjachay, Zayamchay, Khachin chay, Tartar and etc. which starts from the Lesser Caucasus; lefts branches are Ganikh, Gabirri, Turyanchay, Alijanchay and etc, which starts from the southern slope of the Greater Caucasus. There are Mingechaur, Yenikend, Shamkir, and Varvara water reservoirs on the Kur. The creation of these reservoirs caused the increasing level of ground water, considerable part of tugay forests and lands remain under water. Kur is the only navigable waterway of Azerbaijan. The ships here are going from the mouth of Kur to Yevlakh city. As the river flows through meander turnings on Kur-Aras lowland; some turnings in the river bed were adjusted by fencing off in order to facilitate the movement of ships. "Closed lakes" of Kur, Aghgol, Hajigabul, Sarisu and Mehman are formed in this meander. After Sabirabad city Kur hasn't any inflows up till its outfall. Kur river is used for fishing, transportation, irrigation and hydropower production. Long-term water consumption of Kur is 485m³/s.

San Joaquin River

San Joaquin River is considered to be the largest river in Central California. Having 585 km (366 miles) length, this river reaches Suisun Gulfs, San-Francisco Gulfs and Pacific Ocean, as well as high Sierra Nevada. The river passed through the region previously known as Joaquin Valley, rich in agricultural aspect. The dam was built on this river and its direction was changed, as it has been widely used for irrigation. The outfall of the river is located on Ansel Adams steppe - from the combination of three main resources in south-west Sierra Nevada. The river comes out from the foothills by crossing through four hydroelectric water reservoirs along its course. After this, Friant water reservoir in Millerton city was built on it. From Friant water reservoir the river goes down San Joaquin Valley from the south part of Great Central plains and flows

to the west, south-west. Snow and rain water is a major feeding source of the river. It is known that, California belongs to the etesian climate. For this reason, the river becomes a lot tumultuous in winter, spring and in the beginning of summer. Annual flow of the river is 145 m³/s.

We come to a conclusion about similarities and differences between both above mentioned rivers. Both rivers are the largest rivers in the area. Both rivers start from high mountainous areas. There is a distinctive feature in feeding of both. Thus, snow waters are major feeding source of Kur River, but the major feeding source of San Joaquin is snow and rain waters. Cascade water reservoirs were built on both rivers. These water reservoirs are widely used in regulation of river water and electric power production. As there are severe floods, the dams were built on both rivers. In addition, canals were built from both rivers for the irrigation purpose. In contrast to the Kur River, San Joaquin River is more useful for navigation and is used much more.

Aras River

Aras river joins Kur river in Sugovushan village of Sabirabad region, starting from Bingol mountainous range (2990 m) of Turkey, passing by Armenia and Iran border. The length of Aras River is 1072 km, basin area is 182 sq. km and its water is turbid. In contrast to Kur river, it is fed by underground waters (46%). Level of water is highest in summer and lowest in winter. Arpachay, Ordubadchay, Nakhchivanchay, Gilanchay and Alinjachay in Nakhchivan; Hakari, Okhchuchay and Bargushad in Karabakh volcanic plateau are major rivers flowing into Aras river. Bahramtepe, Mil-Mughan and Aras water junction were established on Aras River. Bash Mughan, Bash Mil and Azizbayov canals were built from Aras River to irrigate Kur-Aras lowland.

Sacramento River

Sacramento River is major river of Northern California in the United States. It starts from Klamath Mountains. It flows into San Francisco Gulf with the length of 445 miles (716 km) flowing southward. Waters of Sacramento rise on volcanic plateaus and ranges - the Upper Sacramento and Pit of northern

California as two flows. Major river rises in the shadow of Shasta mountains and flows to the south from Klamath, former Shasta mountains, through Dunsmuir and Lakehead. However, the largest branch of the river is Pit River (315 miles), flowing through Modoc Plateau, formed by south-west flows. Water reservoirs change the ambiance of the south in Sacramento foothills and adjacent Redding mountains play a major role in the flow of the river. Very small and moderate-sized tributaries join the river entering from both east and west. As the river flows to the Central plains, large part of its flow turns into several irrigation canals in Red Bluff. Twenty-five miles (40 km) south-east of Fremont Landing close to Colus, its largest tributary flows - Feather river, joining it on the north-east of the Sierra Nevada. About 10 miles (16 km) downstream, the Sacramento River flows through the city of Sacramento and receives the American River, its second largest tributary. Here the river divides into the mainstream and artificial Sacramento Deep (Deep water) Ship Canal. Both waterways continue from the lowlands.

Construction of water reservoirs, power stations and canals required huge workforce, so the government arranged construction of Sacramento River water reservoirs and other structures as public works projects. Construction of Shasta water reservoir began in 1938 and was completed in 1945. Shasta is the largest water reservoir on Sacramento river. Water reservoirs were consistently built on Sacramento river and its tributaries to prevent huge floods and droughts: Pit, Feather and American, Folsom, Oroville and other water reservoirs.

When comparing Aras and Sacramento rivers, both rivers are considered to be the largest rivers in the area where they flow. There are differences in feeding features. Thus, source of feeding of Aras river is underground waters, but source of feeding of Sacramento is rain and snow waters. Maximum level in Aras river is observed in the spring months, minimum level - in the summer months. Level of Sacramento is maximum in winter months, minimum - in autumn months. Both of rivers have several left and right tributaries. A number of water reservoirs were built on both of rivers. Moreover, both rivers are widely

used in agriculture and several canals have been built from both rivers. In contrast to the river Aras, Sacramento river is widely used for navigation. In general, rivers of the Republic of Azerbaijan and the State of California have been exposed to contamination by the domestic and industrial wastes. It was found from the comparative analysis that, rivers of both regions have similar features and problems. We will offer the solution of existing problems in our future investigations.

Lakes in Azerbaijan and California

Most of the territory of the Republic of Azerbaijan is situated in subtropical climate zone, but the north-east of Great Caucasus Mountains is situated in the temperate climate zone. The Great Caucasus Mountains prevent the cold air masses from coming from the north, the Lesser Caucasus Mountains prevent hot dry tropical air currents from coming from the south, weakening their impact.

A large part of its territory is in the etesian climate of the subtropical climate zone and cool, rainy winter months and dry summer months are specific for these places. Cool California current running on the ocean shores causes the formation of fog in the coastal areas during summer months. In inland areas the weather becomes warmer in summer months and gets colder during winter months. Northern part of California is more humid than its south part. There is temperate climate in the North West of California. Highlands of the state are covered with snow during the winter, but there is temperate climate here during summer months.

Number of lakes in Azerbaijan reaches 250. The lakes are basically divided into 3 groups: 1. Kur-Araz lowland lakes 2. Mountain lakes 3. Absheron lakes.

The lakes of Kur-Araz lowland are closed lakes, for example: Aghgol, Mehman, Sarisu, Hajigabul etc. The largest lake is Sarisu.

There are about 150 lakes in Absheron, its common area is 50 km². The lakes are very small. The largest lakes here are Bayuk Shor, Masazir,

Binagadi, Kurdakhani, Khoja-Hasan etc. There are several lagoon lakes in the coast of Caspian sea: Aghzibirchala, Olkhovka etc. The lakes in Absheron are more polluted because wastewater from sewages is dumped into the lakes.

The lakes formed in the mountains are lakes of volcanic and glacier origin. These are freshwater lakes. Volcanic origin lakes are in the Karabakh volcanic plateau; most of glacier origin lakes are formed on the highest peaks of the Caucasus Mountains.

There are many lakes in California. These lakes are used for boat rides, water skiing, fishing. They are mainly located in the Central plains of California. The lakes are in the northern part of the state. Most of the lakes in High Sierra are formed from Cascades and Kalmaths glaciers. The volcanic activity caused the formation of some lakes. Lakes in such areas are formed in volcanic craters and calderas, Medicine lake was formed on the east of the huge Cascade mountains. Famous Tahoe lake stretches between Sierra and the Carson ranges. The largest lake of California is Clear lake; it has topographical depression and is exposed to the lava flows. Freshwater lakes are mainly found on the coasts of California.

Sometimes most dry lakes can be found in the Death Valley, the hottest and the driest place in California. The lakes in Klamath basin and Central plains have better appearance during the spring than the autumn. California lakes are famous everywhere as recreation area, especially quiet and with frequently changing backgrounds. The main industry in California lakes is fishing: salmon and other types of fish are angled in the rich waters of Tahone lake.

Lakes in Azerbaijan are not rich in biological resources. California Economic Cooperation Organization undertakes protection of biological resources of the lakes. The famous Mono lake of California is located in 13 miles away from Yosemite National park and is distinguished for its million years old age. Tahoe lake was formed 2 million years ago, it is the second deepest lake in USA and tenth in the world. Honey lake is shallow and alkaline lake located in the desert of Great Basin.

There is Shasta Cascade region, the island of miracles in the far northern California. The region covers 25% of California and is famous for its lakes. There is Shasta lake there; this lake is very famous. Yachts are floating all over the lake.

Though lakes in Azerbaijan are not so large, they have wide economic and environmental importance. Freshwater of Goygol has great importance for supplying Ganja city with drinking water. Lakes of medium and high mountain zones are used for irrigation of livestock during summer. Lowland lakes, especially lakes in the Kura-Araz lowlands and Caspian littoral lowlands, have an important role as the ecological shelter. Many species of birds have taken shelter around these lakes, growing and hatching here.

The role of lakes in the water industry of Azerbaijan is not too high as well. But it is possible to create fish farms from some lakes. Only Hajigabul lake is used for this purpose. Lowlands, mountain lakes and their surroundings should be given the statuses of nature reserves or protected areas. Main lake regions of California are: Bay Area (Cast Trail Lakes, Point Reyes), National Seashore (Bass lake, Pelican, Crystal, Ocean, Wildcat lake).

Five lakes make the list of Coast Trail Lakes: Bass lake, Pelican lake, Crystal, Ocean, Wildcat lake. Kelly lake region - Kelly lake is Pacific lake located in the Monterey golf area of California. The lake is situated between Santa-Cruz and Monterey cities. The excursions such as boat rides, water skiing, fishing etc. are organized on the lake.

Las Vaqueros Reservoir - lake is located in this region. Central Coast region - Cachuma lake and Nacimiento Lake are located here.

There are the Central Plains regions, Desert Region, Gold Country region, High Sierra Inland Empire, Los Angeles County, the North Coast, San Diego County, Shasta Cascade.

In Azerbaijan, the lakes are divided for their origin into:

1. Tectonic lakes - Ajinohur.
2. Volcanic - Lesser Caucasus (Ishigli, Karagol, Gizilboghaz etc.)
3. Volcanic dam lakes - Large

and Small Ala lakes, Perichingili, Zalkhagolu etc.

4. Avalanche lakes - Goygol, Maralgol and others.

5. Glacial lakes - Murovdag, Sahdag and etc.

6. Landslip lakes - Girdimanchay, Valvalachay, Gilgilchay, Atachay etc.

7. Lagoon lakes - Aghzibirchala.

8. Bed-flood - closed lakes of Kur-Araz lowland - Sarisu, Aghgol etc.

As climate features of Azerbaijan and California are similar, feeding of the lakes is also similar here. Feeding of the lakes is connected with regime of the rivers flowing into them: if the lake is open, it is connected with flowing rivers related to the melt of snow during summer. There are strong snow water streams in spring. Rain waters are feeding the closed lakes.

There are ecological problems of lakes in Azerbaijan, just like in California. This problem is flow of wastewater from sewage systems into rivers to the lakes. This problem is mostly observed in relation to the lakes of Absheron. The reasons for this are industry, oil spills and so on. In contrast to this, according to the resolution of the state in California, special attention is paid protection to of lakes. Thus, recreational area is established, preserves are organized around the lake, special measures have been carried out to avoid the wastes. Most importantly, the state collaborates with a number of organizations in this direction.

The lakes in California are mainly used for industrial, energy, housing and communal spheres, partially for the agriculture. Freshwater lakes are used in agriculture in Azerbaijan. When comparing the lakes of Azerbaijan and California, we can give example of Caspian and Salton lakes.

Caspian sea is the largest lake in the world. The length of coastline of the Caspian is 6500-6700 km. It's border touches 5 countries. Azerbaijan Republic from the west - 825 km, Kazakhstan - 2320, Iran IR - 900, RF - 695, Turkmenistan - 1200 km. The length of Caspian is 1200 km, the average width is 310 km. Caspian sea is 27,3 m lower than the World Ocean. Surface area is 392600 km², the

largest river flowing into Caspian sea is Volga. The Caspian sea has serious environmental situation. The main reason for this is pollution of the water with oil wastes when oil and gas are produced, sea transportation etc.

Rivers flowing into Caspian sea enrich it with organic substances, biogenic elements.

A lot of special materials and chemical reagents having different degrees of toxicity are dumped, huge amounts water are used during the drilling process, technological wastes are generated. All this adversely affects the flora and fauna of the Caspian Sea. It is not rich in flora and fauna. But there are types that are unique. Nevertheless, there are beluga, sturgeon, longnosed fish, herring, salmon, ziyad, gulme, cheki.

The area covered by the Salton lake, the largest lake in California (Sonora Desert, California) is located in the south-east. The mean water surface is 1360 km². The lake was created in 1905, but it actually is now saline. It covers the area of 376 square

miles in the south-east of the country, it is shallow. Surface of the lake is 228m lower than the sea level. It is located 5m higher than the Death Valley, the lowest point of the area. Surrounded by desert landscape, Salton was very useful for fishermen. With increasing salinity of the lake the fish (molluscs, paltus, bonefish, salmon, etc.) died. However, some types of fish survived (croaker, sargo, orange, etc). Many resorts, water skiing and boatman locations, places for yachting were developed on the coast. The Salton lake is much more saline than the Pacific, therefore the lake area was planned to be decreased.

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