The image shows a stone arch bridge spanning a river valley. The bridge is constructed from large, weathered stone blocks and has a prominent arch. The surrounding landscape is lush with green trees and vegetation, with a large, rocky mountain peak in the background under a clear blue sky. The overall scene is a natural, scenic view of a mountainous region.

**IRS** My Azerbaijan

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# **CLIMATE OF AZERBAIJAN AS A NATURAL TREASURE**



**A**zerbaijan, located in the northern and eastern hemisphere, 38-41° north latitude and 44-50° east longitude, is a country with an ancient history, culture and rich surface and underground natural resources. Due to the geographical latitude, a large amount of solar energy falls here, creating conditions for the development of various sectors of agriculture in this area, large climatic reserves and consequently, resort-tourism potential.

In general, the republic is a mountainous country. Sixty per cent of its territory is mountains, and 40 per cent - plains. Along with the ice-covered peaks, plains located below sea level (18 per cent of the territory) are also common. The complexity of the relief is one of the factors responsible for the special diversity of climatic conditions. The Greater Caucasus Mountains, stretching from west to east in the north of the country, prevent the direct invasion of cold air masses from the north. These air masses head for the east and west, passing over the Black and Caspian seas, then are transformed, and come to Azerbaijan in a moderate condition, which is why the winter is never harsh. If it were not for the Greater Caucasus Mountains, the climate in Azerbaijan would be colder in the winter, i.e. continental.

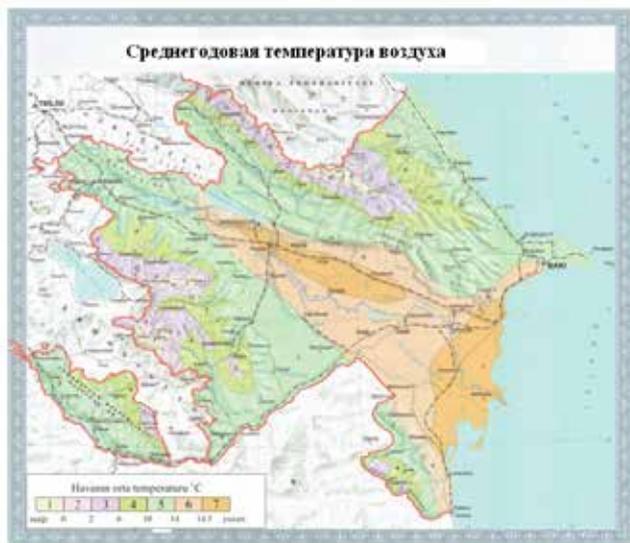
The Lesser Caucasus Mountains, situated in the southwest of the country, and the Talish Mountains in the southeast also have a moderating effect on the climate. These mountain ranges constitute an obstacle to the

direct invasion of dry, warm tropical air masses coming from the south, making them much more temperate.

A big role in shaping the climate of Azerbaijan belongs to the Caspian Sea, which washes its shores from the east. Washing the coast over a distance of more than 800 km, it affects the air masses (cold in winter and dry and warm in summer) coming to Azerbaijan from the east, namely, Central Asia, making them much more temperate. Due to the fact that these air masses, passing a distance of approximately 320 km above the water body, which is relatively warm in winter and relatively cool in summer, change their properties, they invade Azerbaijan in a more softened state.

Another important factor affecting the climate in the country is different air masses coming from different directions. These are the Kars and Scandinavian Arctic anticyclones; Azores, Siberian and Central Asian anticyclones that form in the temperate zone; Southern cyclones that form over the Mediterranean Sea; tropical air masses originating over North Africa and the Arabian Peninsula, as well as local air masses.

The course of the air temperature on the territory of the republic also has its own peculiarities. The annual distribution of the air temperature in Azerbaijan is largely dependent on the air masses coming here. The Arctic and continental air masses coming from the north reduce the air temperature. Sometimes, the air masses coming from this direction are capable, especially in winter and in the offseason, of lowering



*Map "Average yearly temperature in Azerbaijan"*

the temperature during the day by 3-5° C or even 10° C.

Conversely, tropical air masses coming from the south greatly increase the temperature in summer. Annual maximum temperatures are observed precisely at this time. When such air masses arrive, the air temperature rises to 35-40° C and above. In rare cases, tropical air masses invade the republic in winter, and as a result, the temperature increases and very mild weather conditions emerge.

In the coastal strip, the temperature is influenced by the Caspian Sea. In summer, the temperature in the coastal zone is 1-2 degrees lower than in the Kura-Aras

lowland, and in winter it is higher.

In the lowland regions, the average annual temperature ranges between 14° and 14.6° C. In the foothills and lowlands, the figure is 11-13° C. In the highlands, the average annual temperature lowers. At such summits as Bazarduzu (4,466 m), Shahdag (4,243 m), Tufandag (4,191 m), Gamishdag (3,724 m) and Gapijig (3,904 m) the average annual temperature can be constantly below zero.

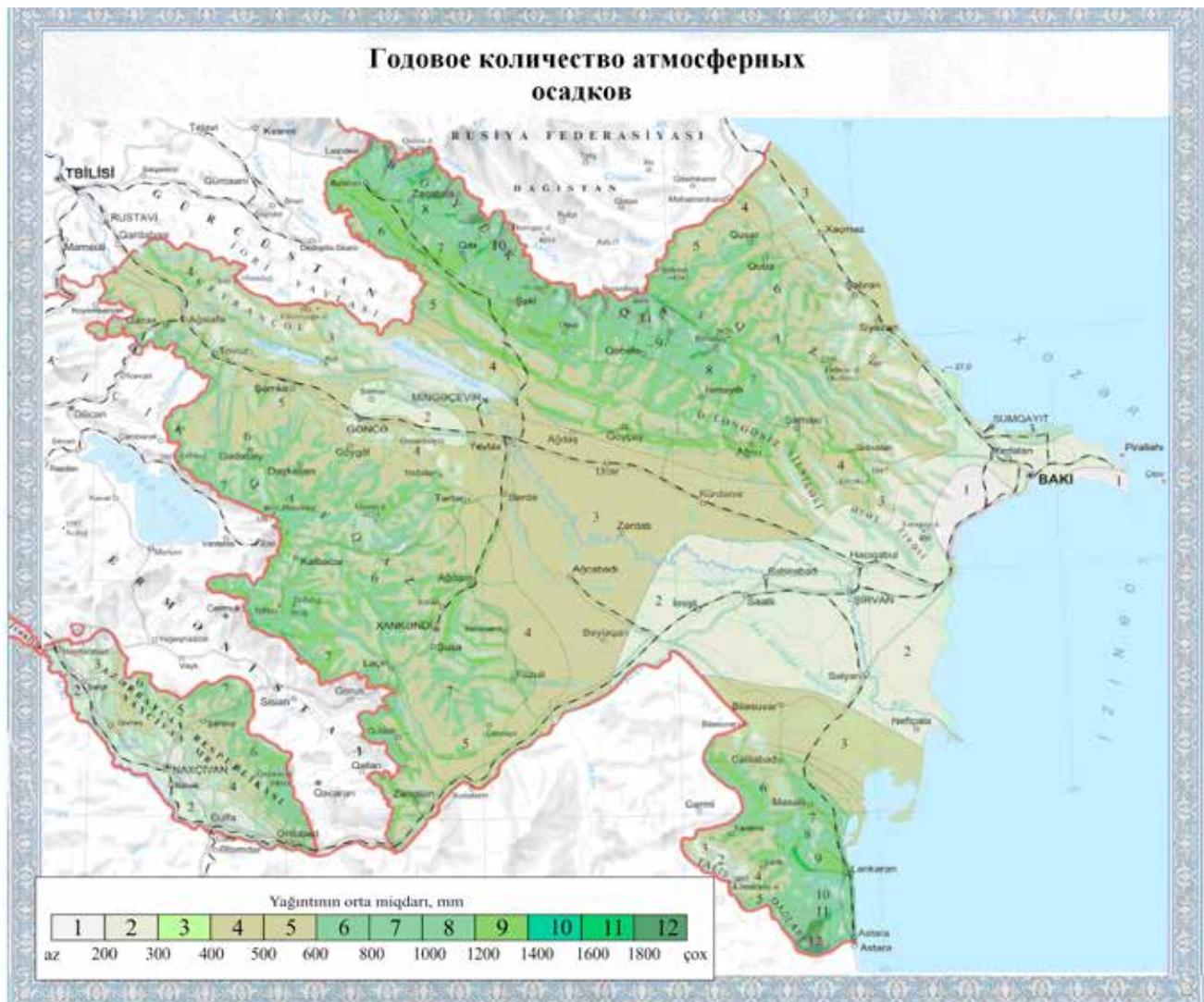
The hottest month in the country is July. If the average July temperature in the lowlands is 24-27° C, in the midlands it is 20-15° C and in the highlands - 10-5° C. In all lowland regions, the average January temperature is 0+4° C, in the foothills - 0-3° C, in the midlands - 3-6° C, and in the highlands it ranges between -6 and -14° C. In the territories of the Greater Caucasus and Zangezur above 3,500-3,800 m, the figure is -10-11° C and sometimes fluctuates between -14 and 15° C. Sometimes between the top of the mountains and intermountain troughs and valleys, the temperature difference even at the shortest distance is up to 10° C.

In the plains and foothills of the republic the average daily air temperature is above 5° C 260-290 days a year, above 10° C 200-220 days, above 15° C 150 days, above 20° C 100-125 days, above 25° C 65-75 days and above 30° C 25-35 days. The average daily temperature can be above 35° C 5-10 days a year. The number of days with these indicators decreases closer to the mountains.

In the lowland areas of the republic the absolute



Map "Annual precipitation in Azerbaijan"



maximum temperature is 40-43° C, in the foothills - 37-40° C, in the middle mountains 27-30° C and in the highlands - 20-30° C. Above 3,500 m, it is 10-12° C. The absolute maximum temperature (46° C) was observed on 1-2 August 2000 in Julfa and Ordubad.

In the central parts of the Kura-Aras lowland the absolute minimum temperature is -10-12° C and in the foothills, it reaches -14-18° C. In the middle mountains the absolute minimum temperature is -22-26° C and in the highlands - -26-30° C. The highest indicator of the absolute minimum temperature was observed in Julfa -33° C. And at such summits as Bazarduzu and Shahdag the absolute minimum temperature is assumed to be -42-44° C.

In connection with the relief conditions, the distribution, quantity and annual and seasonal course of rainfall has a unique feature in Azerbaijan. According

to common geographical laws, the amount of rainfall increases from the Kura-Aras lowlands to the mountains, but to a certain height. Then, their number falls. On the southern slopes of the Greater Caucasus the maximum annual amount of precipitation is observed at an altitude of 2,400-2,800 m, accounting for 1,400-1,450 mm; 800-850 mm is observed at an altitude of 2,500-2,700 m on the northern slopes of the Murovdag Ridge, and on the Zangezur Ridge at an altitude of 2,500-3,000 m it is 850-900 mm. Rainfall gradually decreases with a further increase in height. In the Talish Mountains the maximum rainfall 1,400-1,700 mm falls at an altitude of 200-600 m, and rainfall gradually decreases with height.

In Azerbaijan, the lowest amount of average annual precipitation (120-150 mm) falls on the southern part of the Absheron Peninsula - Alat and Puta. The absolute minimum rainfall here is about 96 mm.



Rainfall in the eastern and southern part of the Kura-Aras lowland, Gobustan, plains along the Aras and the foothills of Nakhchivan is 200-300 mm per year. The isohyets of annual precipitation, accounting for 300 mm on the site, pass at an altitude of 0 m in the central part of the Shirvan plain, at an altitude of 400-500 m in Gobustan, at 400 m in the eastern part of the Ganja-Gazakh plain, at an altitude of 50-100 m in the Karabakh plain and 200-300 m in the west of the Mil plain. It can be observed that not all areas at the same height get the same amount of precipitation.

Rainfall varies not only depending on the altitude of an area above sea level, but also on the proximity and direction of the mountain ranges. Analysis of the distribution of precipitation in Azerbaijan shows that some physical and geographical areas differ in the amount of annual precipitation and in their seasonal distribution. And this is the cause of the diversity of nature and landscape in a small area.

The climatic features of the territory and the resulting climatic and agro-climatic resources are the basis for establishing a common economy, especially various branches of agriculture. In this regard, Azerbaijan's territory has attracted attention since ancient times with the wealth of its climatic and agro-climatic resources. Greek scholar Strabo, who lived in the middle of the first century BC and the beginning of the first century AD, wrote that "the climate of this country is very favorable, and the land is very fertile. Here, in many places, they collect the harvest 2-3 times a year." Climatic studies conducted in subsequent years proved the truthfulness of these assertions.

In the 1960s, under the leadership of Professor A. J. Eyubov, extensive research was conducted in this direction. For the first time on the example of our republic, the principle and method of agro-climatic zoning were prepared for mountain areas, and agro-climatic zoning of the territory was carried out. As a result of long-term studies, the "Agro-Climatic Atlas of the Azerbaijan Republic" was prepared and published for mountain areas for the first time in 1993.

There is great potential for the organization and intensive development of such sectors as agriculture and livestock farming in the republic. The main indicator of agro-climatic resources is the sum of the average daily temperature above 10° C, which is called the sum of active temperatures. In the lowland areas of the republic, the sum of active temperatures is above 4,500-5,000°. The sum of active temperatures naturally decreases as you move away from the central part of the Kura-Aras lowland to the mountains. In the country, in areas located at an altitude of 600-700 m above sea level, the sum of active temperatures is above 3,800°. In these areas there are ample opportunities for growing heat-loving plants such as cotton, pomegranates, olives, grapes, corn, vegetables and melons, tea, citrus fruits (lemon, tangerine, orange, pineapple guava, kiwi, etc.). At the same time, after the harvest of winter wheat, 2,200-2,500° C of the sum of active temperatures remains in these areas, which are used for the production of plants with a short vegetation period. In areas with a height of up to 1,200-1,400 m, the sum of active temperatures ranges from 2,800 to 3,800°. In the same areas that have such a reserve of heat, such

strategically important plants like corn, grapes, potatoes, and tobacco are grown under dry farming conditions. In Zagatala District of the republic, rose gardens have been planted. Rose oil produced there is of great economic importance.

In terms of climate resources, the republic also has large resort and recreational reserves. While assessing the resort and recreational resources, the amount of sunshine hours is considered one of the main indicators. According A. J. Eyubov, in the summer period the country has 65-95 per cent of sunny weather. By the number of sunny days and the intensity of solar radiation, the Azerbaijani part of the coast of the Caspian Sea is much more significant than the Caucasian and Crimean coasts of the Black Sea. In the Absheron peninsula and north of it, even in winter months, the number of sunny days is 50 per cent, and in the Kura-Aras lowland - 50-75 per cent. As you can see, in terms of climate indicators, the territory of the republic has great resort and recreational resources.

Of course, global climate change affects the territory of Azerbaijan too. Therefore, over the past 10-15 years numerous studies have been conducted here on the impact of the expected climate change on agriculture and the environment. Calculations are made on the most appropriate scenarios for the country GISS, GFDL-3, expert and PRECIS-1.4. It is estimated that compared with the indicators of 1961-1990 adopted by the WMO as the norm,

the average annual air temperature is expected to increase by 1.5-6° C in the near future in Azerbaijan, while in some places, various kinds of precipitation are expected to increase by 4-40 per cent and decrease by 1-5 per cent in other places. These changes, in turn, may lead to changes in the upper and lower limits of thermal zones and zones of hydration, the main areas of agricultural plants.

Calculations show that the sum of active temperatures can vary between 300-1,500°, depending on regional climatic characteristics of the area and the selected scenario. The number of days with average daily temperature exceeding 10° will increase by 20-50. Under these conditions, the boundaries of thermal zones will pass 250-850 m higher than now. Thus, in all scenarios, heat resources and areas of warm and temperate zones are expected to increase in the country, while cold zones will shrink.

On the basis of these scenarios, according to calculations, changes in resources of humidity are expected too. According to the GISS model, the average annual rainfall in the country could increase by 6-12 per cent. In this case, in summer it is expected to increase it by 15-40 per cent and in winter - 15-21 per cent. However, at the same time, the increased heat and vaporization indicates that the increasing amount of precipitation will not play a significant role. Thus, a greater increase in moisture compared with the increase





in rainfall could cause moisture weakening in the country. Forests account for only 11 per cent of the territory of the republic, which is 2.5-3 times less than the global indicator. Climate change will cause changes in the modern borders of forests. For example, a rise in the temperature in the Greater and Lesser Caucasus may lead to an increase in the upper limit of forests by 550-950 m compared to the current limit and a decrease of 100-200 m in the Talish Mountains. Depending on the territory, their lower boundary can rise by 50-200 m. Consequently, the area of forests is expected to increase.

The expected climate change will also affect the area of crops.

The increasing amount of active temperatures (400-1,500°) and an increase in the vegetation period (from 10-15 to 40-50 days) can create favorable conditions for growing cotton, because in terms of climatic conditions its possible area of cultivation is expanding. At the same time, sorts of medium ripening may be replaced by higher-quality sorts of late ripening with delicate fibers. An increase in winter precipitation may improve soil moisture and have a positive impact on the provision of this plant with natural moisture.

As a result of climate change in regions of traditional grain production, the vegetation period of winter wheat is expected to decline by 10-40 days. Therefore, the current upper limit of winter wheat will possibly increase from 1,300-1,400 m to 1,600-1,800 m.

In all scenarios, due to expectations of rising temperatures, i.e. thermal resources, the expansion of plantations of grapes, another important crop, is possible

in the middle mountains. An increase in the temperature during ripening may reduce the amount of acid and increase the amount of sugar in the fruits of this plant. At the same time, a decrease in precipitation will contribute to this in the fall.

Although the territory of the republic is not very large, its climatic conditions are quite diverse. These differences have led to a variety of natural systems. Therefore, the country has 9 different types of climate.

**I. The climate of semi-deserts and dry steppes with mild winters and dry warm summers.** This type of climate covers about 50 per cent of the territory. It includes the Kura-Aras, Samur-Davachi lowlands, Gobustan, Absheron, Jeyranchol and Ajinohur. The average temperature of the hottest month is 26-27° C and the coldest 2-4 ° C. The average annual temperature is above 10° C. The annual atmospheric precipitation is within 400 mm.

**II. The climate of semi-deserts and dry steppes with cold winters and dry warm summers.** (Sometimes it is referred to as a semi-type). It covers the sloping plains along the river Aras in the Nakhchivan AR. The climate is continental. In the republic, the absolute maximum and absolute minimum temperatures are observed in this type. The average temperature of the hottest month is 26-27° C and the coldest minus 4 - minus 5° C. The average annual temperature varies between 10-14° C. The amount of average annual precipitation is 200-400 mm.

**III. Temperately warm climate with dry winters.** It is common in the Ganikh-Ayrichay valley on the southern

slope of the Greater Caucasus and in the northern and eastern parts of the Lesser Caucasus. The average annual temperature varies between 10-12° C. The amount of precipitation is 400-600 mm. The average temperature of the coldest month is 0-3° C and hottest month - 20-24° C.

#### **IV. Temperately warm climate with dry summers.**

It is common in the south-east of the Greater Caucasus in the south-east of the Lesser Caucasus, in the Lankaran lowland and in large parts of the Talish Mountains. The amount of average annual precipitation ranges between 600-700 mm and 1,000-1,600 mm.

The absolute maximum amount of precipitation is observed in the republic in this type, falling on the eastern slopes of the Talish Mountains. The average temperature of the coldest month is between -3° C and 3° C, while the average temperature of the hottest month is 20-25° C.

#### **V. Temperately warm climate with approximately equal distribution of precipitation.**

It covers the southern and north-eastern slopes of the Greater Caucasus at a height of 600-1,500 m and 200-1,300 m, as well as the middle part of the Talish Mountains. The average annual temperature is 6-10° C, the average temperature of the coldest month is minus 0.3 - minus 6 degrees, while the average temperature of the hottest month is 15-20° C. The amount of annual precipitation is 600-1,000 mm.

**VI. Cold climate with dry summers.** It is common in areas above 1,000-1,200 m in the Nakhchivan Autonomous Republic. The average annual temperature is 6-10° C. The average temperature of the hottest month is 15-25° C, while the observed average temperature of the coldest month is 6-10° C below zero. The amount of annual precipitation is 300-600 mm.

**VII. Cold climate with dry winters.** It covers the north-eastern slope of the Greater Caucasus (at an altitude of 1,000-2,700 m) and the northern and partly central part of the Lesser Caucasus (at an altitude of 1,400-2,700 m). The average annual air temperature is

6-10° C. The average temperature of the hottest month is 15-20° C and the average temperature of the coldest month is between 0° and -3° C. The amount of average annual precipitation is 600-800 mm.

#### **VIII. Cold climate with abundant rainfall in all seasons.**

It is common between the heights of 1,500-2,700 mm on the southern slope of the Greater Caucasus. The average annual air temperature is 2-6° C. The average temperature of the hottest month is 15-20° C, and the average temperature of the coldest month is between -3° and -6° C. The average annual precipitation is 900-1,600 mm.

**IX. Climate in the mountain tundra.** It covers areas located above 3,000 m in the Greater and Lesser Caucasus, and above 3,200 m in Nakhchivan. The average annual air temperature is between 0 and 2° C. The average temperature of the hottest month is 10-5° C, and sometimes it is lower. The average temperature of the coldest month is between -10° and -6° C. The amount of precipitation varies from 600 to 1,000 mm. ❁

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