

## **FEATURES OF CLIMATE FORMATION IN WESTERN FERGANA, TRENDS OF CHANGE, AND ECOLOGICAL CONSEQUENCES**

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**Abstract:** This article analyzes the natural-geographic factors influencing the formation of the climate in the Western Fergana region, particularly the orographic structure and the degree of continentality. The author scientifically substantiates the historical changes in the region's climate and current trends under conditions of global warming, such as rising temperatures and glacier retreat. The study provides a detailed description of the main meteorological indicators of Western Fergana: air temperature, precipitation amount, humidity, and evaporation levels (1200-1500 mm/year). Special attention is paid to the intense wind activity in the region and its impact on agriculture. The article concludes that climate aridity, high temperatures, and strong winds are the primary factors intensifying processes of deflation (wind erosion), sand migration, and soil salinization in the soil cover.

**Keywords:** Western Fergana, continental climate, global warming, climate monitoring, wind activity, deflation, soil salinization, aridity, meteorological indicators.

### **Introduction**

The climatic characteristics of Western Fergana emerge under the influence of factors shaping the climate of the Fergana Valley. Its geographic location—being surrounded by three ranges of adyrs (foothills) and low mountains, as well as medium and high-altitude mountain ranges; belonging to the continental type of the subtropical climate zone; being far from oceans (in the interior of the continent); and bordering deserts—determines the extreme continentality, aridity, and extra-aridity of Western Fergana's climate.

The aridity of the territories is increasing further under conditions of global warming. The Intergovernmental Panel on Climate Change (IPCC) report "Climate Change 2007" (Paris, 2007) predicted a temperature rise of 1.4 to 5.8°C over the new century, provided measures are taken to reduce greenhouse gas emissions. Climate monitoring data indicates a stable warming trend in Uzbekistan during the 20th century and the early 21st century. Its rate exceeds 0.2°C per decade, which is 40% higher than the average warming rate for the Northern Hemisphere. As a result of warming, the mountain glaciers of Central Asia have shrunk by more than one-third in the last half-

century (MM, 2008). The trend identified based on indicators from the Republic's main meteorological stations shows a stable warming principle occurring against the backdrop of sharp interannual climate variability in the region.

### **Historical Climate Context**

According to the observations of M.E. Masson (1948), during the era of Alexander the Great, the slopes of the Angren and Karamazar mountains around Tashkent, Karatepa, and similar areas—which are now almost bare—were covered with juniper forests and other forest vegetation. This indicates that the climate was relatively humid in that era. In the distant past, the central part of the Fergana Valley was covered with numerous lakes and impassable swamps with thick reed beds, while the slopes of the mountains surrounding the valley were covered with forests. Rivers flowing from the Turkestan and Alay mountain ranges were water-abundant and flowed into the Syr Darya (Middendorf A.F., 1882; Nalivkin V., 1887; Melik-Sarkisyan S.A., 1899; Bartold V.V., 1914). During the last glacial period, vertical natural zones were located much lower than their current positions (Popov V.I., 1954).

The warming and drying of the climate, along with a decrease in precipitation, caused the disappearance of lakes and swamps in the low-lying parts of the valley and the elevation of zones in the mountains. Of course, human economic activity also played a certain role in these processes (Popov V.I., 1954; Pankov M.A., 1957).

### **Meteorological Characteristics**

Analysis of long-term data series allows for the assessment of the recurrence and intensity of moisture deficits. Long-term data from 1933–2007 show that in the last decade, against the background of rapid warming in the region, the variability of the interannual precipitation regime is intensifying, with a trend toward an increase in precipitation being observed.

Being surrounded by high mountains on all sides, the strong variation in elevation, and the valley's extension over large distances from west to east and south to north give rise to the unique characteristics of the Fergana Valley's climatic conditions. The western and central parts of the valley are located in the desert zone, while the eastern part is in the semi-desert zone.

The territory of Western Fergana, consisting of the alluvial fans of the Isfara and Sokh rivers, the depression between the fans, and the alluvial plains of the Syr Darya, is characterized by a desert zone climate. Its climatic conditions are defined by the indicators of the "Kokand," "Kirov," "Isfara," and "Ultarma" meteorological stations.

- **Temperature:** The long-term average annual air temperature is 13.4–13.6°C. The average monthly temperature of the hottest month (July) is 26.8–28°C, and the average temperature of the coldest month (January) is -2.2 to -2.4°C. The maximum air temperature value is 42–46°C, and the minimum value is -27 to -29°C. The length

of the frost-free period is 190–214 days, and the sum of effective temperatures constitutes 2400–2600°.

• **Precipitation:** The annual amount of atmospheric precipitation is 86–108 mm, with more than 60% falling in the winter and early spring months. The summer is hot and dry. Since the amount of precipitation is small, it does not have serious significance as a source of groundwater or in the irrigation regime of agricultural crops.

• **Humidity and Evaporation:** In summer months, relative air humidity constitutes 44–72%, and in winter months, 75–87%. The high and dry air temperature ensures a large volume of evaporation, amounting to 1200–1500 mm/year.

### **Wind Activity**

Atmospheric wind activity is strongly expressed. Winds occur as a result of air exchange between the Fergana Valley and the Mirzachul territories. This process happens under the influence of the Siberian anticyclone during winter months. Accordingly, cold weather and increased precipitation are observed. In summer, it is under the influence of the Central Asian thermal depression, like all of Central Asia. The intense heating of the air is periodically reduced by the influence of cold air masses coming from the north. The cold air flow transforms due to heating; for this reason, the air in the territory does not become excessively cold. However, the intrusion of cold air flow causes strong dust storms during drought periods.

For the winter and spring months, easterly winds are characteristic, while westerly winds are characteristic for the summer months. In the autumn months, the wind blows in various directions. The average wind speed exceeds 4 m/sec. The number of days with strong winds (15 m/sec) reaches 45, of which 30 fall during the vegetation period. Spring months are particularly distinguished by a high frequency of strong winds. On average per year, strong winds occur for 42 days in the Besharyk area (17 of which are in spring), 39 days in Kokand, and 23 days in Fergana (7 of which are in spring). When the wind blows strongly, mechanically light sand and soils are blown about, and fine particles are lifted and deposited onto crop fields. The Kokand group of districts is considered a wind corridor zone. In the spring months, stagnant air, occasional temperature drops, continuous rains, and road incidents are observed.

### **Conclusion**

The dryness of the air, high temperatures, and strong winds are the causes for the formation of sandy tracts in the region and the intense occurrence of salt accumulation processes in the soil.

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