# Analysis Of The Seasonal Distribution Of The Reduced Water Layer In Uzbekistan

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**Abstract:** This article discusses the seasonal distribution of the depleted aquifer in Uzbekistan. All of the above methods for obtaining fresh water are based on the implementation of certain technical-constructive and economically feasible projects. At the same time, in arid zones, including deserts, there is a natural source of fresh water, which is a product of condensation of atmospheric moisture – dew.
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**Keywords:** seasonal distribution, depleted aquifer, Uzbekistan, fresh water, implementation, technical-constructive projects, economically feasible projects, arid zones, deserts, natural source, product of condensation, atmospheric moisture.

## Introduction

Water is a renewable source. However, the world's population is growing by about 86 million people every year. The annual increase in demand for fresh water is 64 million cubic meters. Since the world's population has tripled, the use of fresh water has increased 17 times. Moreover, according to some forecasts, in 20 years it may increase threefold. And the amount of clean fresh water available is decreasing. Mainly due to insufficient treatment of industrial and agricultural wastewater, which can poison entire rivers and lakes and make their water unusable and even dangerous.

Nowadays, people mainly use easily accessible water from lakes or rivers. There are 91 thousand cubic meters of freshwater lakes. km or 0.26% of all fresh water reserves in the world, in atmospheric vapors - 12.9 thousand cubic meters km (0.04), in rivers - only 0.006%, or 2.12 thousand cubic meters km. At the same time, a third of the world's fresh water is underground, and 68.7% is contained in glaciers.

## The main findings and results

It turns out that there is a lot of fresh water on the planet as a whole, it is unlikely that it will end in the foreseeable future. But sources of readily available water are shrinking, and this is a big problem. More and more regions suffering from water scarcity will appear [4].

Various existing methods of obtaining fresh water.

- obtaining fresh water from icebergs delivered from Antarctica;
- desalination of sea salt water (distillation, electrodialysis and reverse osmosis);
- collection of water contained in mists;
- collection;
- obtaining fresh water from atmospheric moisture.

All of the above methods for obtaining fresh water are based on the implementation of certain technical-constructive and economically feasible projects. At the same time, in arid zones, including deserts, there is a natural source of fresh water, which is a product of condensation of atmospheric moisture - dew.

Atmospheric air is a gigantic reservoir of moisture, and even in arid regions contains, as a rule, more than 6-10 g of water per 1 $m^3$. There are two main ways to obtain water from air: a) by condensation on a cold surface and b) by its absorption by sorbents, which in turn are subdivided into liquid (absorbents) and solid (adsorbents) [5].

Cattle herders built so-called (breathing wells) on the Ustyurt fee. Their walls were covered with porous limestone, and moisture, condensed into many holes inside the wall, collected at the bottom of the well in the form of water. The water in these wells was cold and clean.

The method of obtaining water by natural condensation of water vapor from the air has been known for a very long time. Even in ancient times in the Crimea, to provide water to Feodosia, crushed stone mounds in the form of a pyramid - kurums, which were built on a low mountain plateau, were used. Due to the difference between the day and night temperatures of the ambient air, condensation formed on the surface of the crushed stone and flowed into a special container. From there, in a natural way, through a gutter, it entered the water-folding structures of the city of Feodosia.

Interest in this kind of method of condensation of atmospheric moisture revived at the end of the 20th century. The method of obtaining fresh water from humid air, described in [1], is based on natural processes occurring in nature and does not introduce pollution into the environment. With this method, fresh water is obtained from moist air by condensation of the water vapor in it.

Obtaining fresh water with this method is carried out by collecting the smallest droplets that are formed in the air as a result of its natural cooling due to the radiation of both the air mass and the surface. To control the droplets, obstacles are set in the path of air movement, into which the droplets hit and settle on them. Large networks with cells of the order of 1 cm are used as collectors. Experiments on obtaining water by this method are carried out in many parts of the world (in 47 places, in 22 countries on 5 continents). In 1989-1990 in northern Chile, a large-scale freshwater collection unit was carried out using 50 collectors in the form of networks of 48 $m^2$ each, installed vertically [1]. The experiment was carried out over three dry years in the extra-arid zone (10-80 mm of precipitation per year), the installation gave an average of 7200 liters per day. The cost of water production by this method depends on many factors, including the location of the installation.

Israeli inventors have been working successfully for a long time to create high-performance and economical installations for condensing water from the atmosphere. The results of the work of a group of students from the Technion of Haifa were, they believe, so significant that their work was funded by NASA. The best plant designs were selected to finance the manufacture of prototypes, testing and setting up their production.

Currently, the industry of many countries in a large assortment produces installations (both stationary and mobile) for the production of water from the moisture of the atmospheric air. The disadvantage of such devices is the need to connect to an external power supply to power the cooler and blower, high retail price, low performance [6].

Despite the simplicity of this method of obtaining fresh water, it cannot be considered as a permanent source of water supply. This is due to the fact that the conditions under which the smallest drops of water are formed in the air significantly depend on the location and climatic features of a given area.

For the effective placement of various condensing units, obtaining fresh water from atmospheric moisture, it is necessary to study the potential resources of fresh water in the atmosphere in the climatic regions of the Republic of Uzbekistan.

Obviously, insufficient attention was paid to the problems of studying dew in Uzbekistan. Let us note in this direction the research carried out by M.I. Kurganskim [2].

In order to assess the potential fresh water resources in the climatic regions of Uzbekistan, studies were carried out to determine the reduced water layer in the atmosphere using an empirical formula developed for

$$W_\infty = 0{,}163e + 0{,}367$$

*e - partial pressure of water [3]*

**Seasonal distribution of the reduced water layer in Uzbekistan**

The atmospheric air always contains a certain amount of water in a gaseous state. The fresh water contained in the atmosphere can be expressed as a reduced water layer calculated on the basis of an empirical formula that was developed for the conditions of Uzbekistan.

Based on the results obtained, values were calculated for 14 climatic regions of Uzbekistan. Information on the territorial distribution of these values can serve as an important factor in the effective placement of condensing units throughout the republic. Consider the seasonal distribution of the reduced water layer in the atmosphere over 14 climatic regions of Uzbekistan (average monthly, average annual, average for warm and cold periods).

| № | Station | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | XII | TII | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Karakalpak | 8,7 | 8,8 | 1,10 | 14,2 | 17,6 | 20,2 | 22,7 | 21,9 | 17,6 | 14,2 | 11,8 | 10,1 | 10,8 | 18,9 | 14,9 |
| 2 | Chimbai | 9,2 | 9,7 | 1,19 | 16,3 | 21,1 | 26,3 | 30,5 | 28,4 | 21,7 | 15,2 | 11,9 | 10,1 | 11,4 | 23,8 | 17,6 |
| 3 | Urgench | 9,8 | 10,6 | 1,31 | 17,3 | 19,9 | 23,3 | 28,1 | 26,4 | 20,6 | 15,4 | 12,7 | 11,1 | 12,4 | 22,2 | 17,3 |
| 4 | Akbaytal | 11,0 | 11,9 | 1,44 | 18,0 | 20,2 | 20,7 | 22,2 | 20,9 | 17,1 | 14,4 | 12,6 | 11,6 | 13,2 | 19,3 | 16,3 |
| 5 | Tamdi | 10,0 | 10,8 | 1,27 | 16,2 | 18,1 | 18,9 | 20,6 | 19,3 | 15,5 | 13,1 | 11,8 | 10,6 | 11,9 | 17,6 | 14,9 |
| 6 | Samarkand | 11,3 | 12,4 | 1,52 | 19,9 | 22,4 | 23,3 | 25,1 | 23,2 | 18,8 | 16,3 | 13,7 | 12,3 | 14,2 | 21,4 | 17,8 |
| 7 | Ayakagitma | 11,6 | 12,4 | 1,52 | 19,9 | 20,9 | 22,5 | 25,0 | 23,5 | 19,3 | 15,7 | 13,4 | 12,6 | 14,2 | 21,1 | 17,8 |
| 8 | Bukhara | 11,4 | 12,4 | 1,54 | 20,2 | 21,6 | 23,8 | 26,4 | 24,8 | 19,9 | 15,7 | 13,4 | 12,6 | 14,2 | 22,0 | 18,1 |
| 9 | Termiz | 13,1 | 14,4 | 1,71 | 22,0 | 24,5 | 24,3 | 26,4 | 24,5 | 20,7 | 17,8 | 15,4 | 14,1 | 16,0 | 23,0 | 19,4 |
| 10 | Boysun | 12,9 | 14,2 | 1,68 | 21,6 | 23,7 | 22,9 | 25,1 | 2,35 | 19,4 | 16,8 | 14,5 | 13,7 | 15,6 | 21,9 | 18,8 |
| 11 | Jizzakh | 11,6 | 12,9 | 1,60 | 20,9 | 23,2 | 22,7 | 24,2 | 22,5 | 18,3 | 15,8 | 14,1 | 12,4 | 14,5 | 21,1 | 17,8 |
| 12 | Tashkent | 11,0 | 11,9 | 1,47 | 19,8 | 23,5 | 24,5 | 25,8 | 24,6 | 19,4 | 16,7 | 14,1 | 12,1 | 13,9 | 22,4 | 18,1 |
| 13 | Oygaing | 11,1 | 12,4 | 1,57 | 20,9 | 24,2 | 26,1 | 29,0 | 27,6 | 21,4 | 17,3 | 14,5 | 12,6 | 14,5 | 24,2 | 19,4 |
| 14 | Fergana | 10,6 | 12,3 | 15,5 | 20,2 | 24,8 | 27,6 | 30,5 | 29,2 | 23,3 | 18,5 | 14,5 | 12,1 | 14,2 | 25,6 | 19,8 |

**Seasonal distribution of the reduced water layer in Uzbekistan**

**Ustyurt climatic region.** The minimum values of the reduced water layer contained in the atmosphere in the form of water vapor in this climatic zone are observed: in January (8.7 mm), February (8.9 mm), December (10.1 mm), March (11.0 mm) and November (11.8 mm). The maximum values are observed: in July (22.7 mm), August (21.9 mm) and June (20.2 mm). For the cold period of the year, the average value is 10.8 mm, for the warm period - 18.9 mm, and the average annual value of this value is 14.9 mm.

**Aral climatic region.** In this climatic zone, the minimum values of the reduced water layer in the atmosphere in the form of water vapor in this climatic zone are observed: in January (9.2 mm), February (9.7 mm), December (10.1 mm), March (11.9 mm), November (11.9 mm). in January (9.2 mm), February (9.7 mm), December (10.1 mm), March (11.9 mm), November (11.9 mm). The average value for the cold season is 11.4 mm, for the warm season - 23.8 mm, and the average annual value is 17.6 mm.

**Lower Amudarya climatic region.** In this climatic zone, the minimum values of the reduced water layer in the atmosphere are observed: in January (9.8 mm), February (10.6 mm), December (11.1 mm), November (12.7 mm). The maximum values are observed: in July (28.1 mm), August (26.4 mm) and June (23.3 mm). The average value for the cold season is 12.4 mm, for the warm season - 22.2 mm, and the average annual value is 17.3 mm.

**Northern Kyzylkum climatic region.** The minimum values of the reduced water layer in this climatic zone are observed: in January (11.0 mm), February (11.9 mm), December (11.6 mm), November (12.6 mm), March (14.4 mm). The maximum values are observed: in July (22.2 mm), August (20.9 mm) and June (20.7 mm). The average value for the cold season is 13.2 mm, for the warm season - 19.3 mm, and the average annual value is 16.3 mm.

**Central Kyzylkum climatic region.** In this climatic zone, the minimum values of the reduced water layer in the atmosphere are observed: in January (10.0 mm), December (10.6 mm), February (10.8 mm), November (11.8 mm), March (12, 7 mm). The maximum values are observed: in July (20.6 mm), August (19.3 mm) and June (18.9 mm). The average value in the cold season is 11.9 mm, in the warm season - 17.6 mm and the average annual value - 14.9 mm.

**Zarafshan climatic region.** In the considered climatic zone, the minimum values of the reduced water layer in the atmosphere are observed: in January (11.3 mm), December (12.3 mm), February (12.4 mm), November (13.7 mm). The maximum values are observed: in July (25.1 mm), June (23.3 mm), August (23.2 mm). The average value in the cold season is 14.2 mm, in the warm season - 21.4 mm, and the average annual value is 17.8 mm.

**Southern Kyzylkum climatic region.** In this climatic zone, the minimum values of the reduced water layer are observed: in January (11.6 mm), February (12.4 mm), December (12.6 mm), November (13.4 mm). The maximum values are observed: in July (25.0 mm), August (23.5 mm) and June (22.5 mm). The average value in the cold season is 14.2 mm, in the warm season - 21.1 mm, and the average annual value is 17.8 mm.

**Southeastern Kyzylkum climatic region.** In this climatic zone, the minimum values of the reduced water layer are observed: in January (11.4 mm), February (12.4 mm), December (12.6 mm), November (13.4 mm), March (15.4 mm). The maximum values are observed: in July (26.4 mm), August (24.8 mm) and June (23.8 mm). The average value in the cold season is 14.2 mm, in the warm season - 22.0 mm, and the average annual value is 18.1 mm.

**Southern Upper Amudarya climatic region.** The minimum values of the reduced water layer in the climatic zone are observed: in January (13.1 mm), December (14.1 mm), February (14.4 mm), November (15.4 mm). The maximum values are observed: in July (26.4 mm), August (24.5 mm) and June (24.3 mm). The average value in the cold season is 16.0 mm, in the warm season - 23.0 mm, and the average annual value is 19.4 mm.

**Northern Upper Amudarya climatic region.** In this climatic zone, the minimum values of the reduced water layer are observed: in January (12.9 mm), December (13.7 mm), February (14.2 mm), November (14.5 mm). The maximum values are observed: in July (25.1 mm), May (23.7 mm), August (23.5 mm) and June (22.9 mm). The average value in the cold season is 15.6 mm, in the warm season - 21.9 mm, and the average annual value is 18.8 mm.

**Jizzakh climatic region.** The minimum values of the reduced water layer in this climatic zone are observed: in January (11.6 mm), December (12.4 mm), February (12.9 mm), November (14.1 mm), October (15.8 mm). The maximum values are observed: in July (24.2 mm), June (22.7 mm) and August (22.5 mm). The average value in the cold season is 14.5 mm, in the warm season - 21.1 mm, the average annual value is 17.8 mm.

**Tashkent climatic region.** In this climatic zone, the minimum values of the reduced water layer are observed: in January (11.0 mm), February (11.9 mm), December (12.1 mm), November (14.1 mm). The maximum values are observed: in July (25.8 mm), August (24.6 mm) and June (24.5 mm). The average value in the cold season is 13.9 mm, in the warm season - 24.4 mm and the average annual value - 18.1 mm.

**Western Tien Shan climatic region.** In the considered climatic zone, the minimum values of the reduced water layer are observed: in January (11.1 mm), February (12.4 mm), December (12.6 mm), November (14.5 mm). The maximum values are observed: in July (29.0 mm), August (27.6 mm) and June (26.1 mm). The average value in the cold season is 14.5 mm, in the warm season - 24.2 mm and the average annual value - 19.4 mm.

**Fergana climatic region.** In this climatic zone, the minimum values of the reduced water layer are observed: in January (10.6 mm), December (12.1 mm), February (12.3 mm), November (14.5 mm), March (15.4 mm). The maximum values are observed: in July (30.5 mm), August (29.2 mm) and June (27.6 mm). The average value in the cold season is 14.2 mm, in the warm season - 25.6 mm, the average annual value is 19.8 mm.

Analysis of the territorial and seasonal distribution of the thickness of the reduced water layer in the above-mentioned 14 climatic regions of Uzbekistan (average monthly, average annual, average for warm and cold periods) shows that the highest value is 30.5 mm in the Aral and Fergana climatic regions in July, and in Ustyurt the lowest value is observed - 8.7 mm.

The highest average value in the warm season is 25.6 mm in the Fergana climatic region, the lowest average value is 17.6 mm in the Central Kyzylkum climatic region.

The highest average value in the cold season is 16.0 mm in the Southern Upper Amudarya climatic region, the lowest average value is 10.8 mm in the Ustyurt climatic region.

The highest average annual value is 19.8 mm in the Fergana climatic region, the lowest average value is 14.9 mm in the Ustyurt and Central Kyzylkum climatic regions.

## Conclusion

In conclusion, we can say that for the effective placement of condensation devices when obtaining fresh water from atmospheric moisture, it is necessary to take into account the analysis of data on the seasonal and territorial distribution of the reduced water layer in the atmosphere.

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Average annual distribution of water thickness (w) by climatic regions - mm