HAZARDOUS HYDROMETEOROLOGICAL PHENOMENA AFFECTING THE OBJECTS OF THE NATIONAL ECONOMY AND RAIL TRANSPORT

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Annotation

This article discusses the issue of hydrometeorological phenomena affecting the objects of the national economy and railway transport. Next, the issue of precipitation is considered as a source of water resources in the region, largely determining the nature of natural landscapes and water availability of agricultural production. The distribution of precipitation over the territory of Uzbekistan depends on the geographical location of the area, relief and features of atmospheric circulation.

Keywords

Weather, temperature, precipitation, frost. precipitation, mountain places, mudslides, landslides, climatic conditions.

Hazardous weather phenomena include meteorological situations in which individual elements of the weather deviate significantly from the average values. Hazard criteria, of course, are different for different types of activities and even their stages. Thus, in the agricultural production of Uzbekistan, for some cultivated plants, air temperatures below -10°C at rest, below 0°C (frost) - at the beginning of the growing season and the final phase of crop ripening, + 39-40°C - throughout the growing season. For other plants, these boundaries may be different.

However, some phenomena are always considered particularly dangerous. This is an air temperature above 45°C and below -20°C, drought, low air temperatures and frosts, wind with a speed exceeding 15 m/s, precipitation with a semi-daily amount of 15 mm or more, dust storms and fogs with low visibility, etc. To hydrometeorological hazards formed under the influence of climatic factors, affecting the underlying surface, include snow avalanches, mudflows.

Accounting for such phenomena and the adoption of adaptation measures that contribute to the reduction or reduction of the damage caused by them is necessary to ensure the functioning and sustainable development of agriculture and industry of the republic.

Hazardous meteorological phenomena (heavy precipitation, hail, fog, dust storms)

Precipitation are a source of water resources in the region, determining to a large extent the nature of natural landscapes and the water supply of agricultural production [2]. The main amount of moisture is brought by air masses from the Atlantic Ocean, the Mediterranean Sea and the Persian Gulf [1, 2]. The moistening effect of the Aral Sea is

limited to
a narrow coastal strip and continues to decrease with the reduction of its area. Most of the flat arid areas, especially in the west. On average, from 80 to 250 mm falls here annually.

Figure 1. Impact of strong mudflows on the railway
(Angren-Papal direction of the railway)

In the foothills, their number varies from 100 to 500 mm. There is more precipitation in the mountains: on the windward slopes of the Western Tien Shan at high altitudes, their annual amount exceeds 2000 mm. A lot of precipitation also falls on the windward slopes of the Zeravshan Range (at Amankutan station - 960 mm/year).

The most important characteristic of precipitation is its intra-annual distribution. In Uzbekistan, the maximum precipitation occurs in March-April and the minimum - in the summer months. A consequence of very dry and hot summers is that most crops need to be cultivated only on irrigated land.

Liquid precipitation are possible on the territory of Uzbekistan all year round, but in the mountains their number rapidly decreases with height due to an increase in the amount of solid precipitation (snow). Snow falls on the plains and in the foothills from October to April, in the south of the republic - from November to March, and in the mountains, at altitudes of more than 1000 m - from October to May.

Snow cover on the plains of Uzbekistan, they form at the end of November, in the southern regions - in the third decade of December, a stable snow cover that persists for at least a month with interruptions of no more than three days is regularly observed only on the Ustyurt plateau and in mountainous regions. The average number of days with snow cover in the north of Uzbekistan exceeds 60, and in the mountains - 100. The timing of the appearance and disappearance of snow cover and the duration of its occurrence vary from year to year, and the average height of snow cover on the plains is 1-8 cm, the maximum is about 30 cm, in the foothills - 10-20 and 60 cm. In mountainous areas, the average snow depth exceeds 60 cm, and the maximum is 1.5-2.0 m.

Snowstorms have a significant impact on the spatial redistribution of snow cover, especially in mountainous areas. Both snow that fell (deposited) earlier and formed in clouds and has

not yet reached the Earth's surface can participate in the formation of blizzards. A favorable factor for the occurrence of a snowstorm is freshly fallen snow at an air temperature of at least -5°C, and mandatory - wind at a speed of at least 6-8 m / s. Snow that has lain for several days, especially during thaws, which are frequent in Uzbekistan, is inactive.

On the flat and foothill territory of Uzbekistan, snowstorms are not so common, which is associated with the occurrence of a slight snow cover. Naturally, they are most often observed in the north of Uzbekistan: on the Ustyurt plateau, for example, the maximum number of days with a snowstorm reaches 20, with an average long-term of 7 cases per year. In the southern regions, snowstorms do not occur annually - 1-5 times per decade.

In the Ferghana Valley at altitudes of 500-1500 m a.s.l. blizzards occur only 1-4 times in 10 years. And only in its westernmost part, where the frequency of strong winds is increased, the number of days with a snowstorm increases on average up to 2-3 times a year.

In mountainous areas, starting from a height of about 1500 m, a stable snow cover is formed annually, therefore, the number of days with a snowstorm increases. First of all, this applies to passes and open windward slopes. In the high-mountainous part of the Surkhandarya region, their annual number reaches 36, with an average long-term - 11, and in the mountains of the Western Tien Shan - up to 30 (on average - 19-20).

Dangerous it is customary to consider precipitation, the amount of which in 12 hours or less exceeds 15 mm with rain and 7 mm with snow over 30% of the territory. The corresponding criterion for especially dangerous precipitation, which is considered as a natural phenomenon, is considered to be 30 mm in rain and 20 mm in snow over the same period.

• On the flat territory of Uzbekistan, heavy precipitation (30 mm / 12 hours or more) was practically not observed - absent or single cases were noted in November-February in Karakalpakstan, Khorezm,Bukhara, Surkhandarya provinces and the north of Samarkand province.

• Precipitation of 15 mm/12 hours and more rarely occurs in Karakalpakstan, Khorezm and Bukhara provinces. As the mountains approach, their probability increases and depends to a large extent on the exposure of the slopes in relation to moisture-bearing flows [1].

• An increased frequency of heavy precipitation is observed at the foothill and mountain stations of the Tashkent, Samarkand, Jizzakh and Kashkadarya regions.

• There are four areas with a relatively high frequency of heavy precipitation [1]:

river valley open to the west. Chirchik, where the maximum average frequency of heavy precipitation is 2-3 cases (half a day) per year;

river valley open to the southwest. Akhangaran with a maximum average frequency of 3-6 cases per year;

western spurs of the Hissar Range (Kashkadarya region) with a maximum average frequency of 1-3 cases per year;

western spurs of the Zeravshan Range (Samarkand region, Amankutan region), where the maximum average frequency reaches 5 cases per year (Table 1).

Long heavy rains and short-term downpours impede traffic, washing away roads and runways at small airfields, and sometimes destroying buildings. In addition, they are the cause of another dangerous phenomenon - mudflows. Large snowfalls create additional

loads on structures and complicate the work of transport, are the cause of the formation and avalanches.

Icy frost formations – deposition of atmospheric ice on tree branches, wires of power lines, on the surface of structures, on road surfaces, airfields, etc. These deposits can reach large sizes and cause damage to various sectors of the economy. The deposition of ice on the soil surface and shrubs interferes with the extraction of food by animals, branches of ornamental and fruit trees break under the weight of ice. Icing of power transmission wires leads to their breakage and breakage of supports.

Table 1.

Number of days with precipitation of 15 mm or more in 12 hours (1961-2016)

Station	Months												Year	Average annual for 1961-2016
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
Kungrad	1	0	7	7	6	5	1	0	0	1	2	1	31	0,8
Nukus	2	0	6	2	6	0	0	0	0	0	2	1	19	0,5
Urgench	0	1	6	5	2	0	0	0	0	0	1	3	18	0,4
Chabankazgan	0	1	3	2	3	0	1	1	0	0	2	1	14	0,3
Kulkuduk	0	1	1	5	2	2	0	0	0	0	1	2	14	0,3
Tamdy	1	3	5	6	3	0	3	1	0	1	1	2	26	0,6
Nurata	4	5	17	19	12	1	2	1	0	3	5	5	74	1,8
Navoi	2	5	11	9	8	0	1	0	0	0	2	3	4	1,0
Bukhara	2	5	9	8	2	0	0	0	0	0	0	4	30	0,7
Karshi	8	6	22	17	8	1	0	0	0	2	7	7	78	1,9
Samarkand	7	5	25	28	18	1	1	0	1	12	12	14	124	3,06
Jizzakh	10	16	30	30	21	2	2	0	1	21	25	20	178	4,3
Syrdarya	8	9	17	17	15	2	0	0	0	11	8	18	105	2,6
Yangier	8	8	13	27	12	2	1	0	1	9	11	9	101	2,5
Tashkent	12	25	41	34	22	3	1	0	1	16	19	28	202	4,9
Pskem	40	45	64	69	45	9	7	4	8	68	77	68	504	12,3
Oygaing	9	22	37	51	31	19	10	7	11	53	35	32	317	7,7
Kyzylcha	42	52	58	77	42	10	8	4	9	52	61	65	480	11,7
Kamchik	7	14	20	27	17	4	3	4	5	19	22	18	160	3,9
Kasansay	1	0	3	3	3	2	4	0	0	7	2	2	27	0,7
Fergana	4	3	4	2	2	2	3	0	2	9	3	0	34	0,8
Sarykanda	2	2	5	15	21	8	5	2	5	5	5	2	77	1,9
Minchukur	33	42	95	73	38	8	5	1	0	15	30	52	392	9,6
Termez	0	2	10	5	4	1	0	0	0	0	1	1	24	0,6

Thunderstorms and hail fall are also hazardous weather phenomena. On the territory of Uzbekistan, thunderstorms are observed mainly in May-June, less often in autumn. On the plains, their number decreases from north to south. So, on the Ustyurt plateau, the annual number of days with a thunderstorm is on average 7-10, and in the southern regions of the Kyzylkum desert - 4-6. In the foothills, on average, from 10 to 20 days with a thunderstorm are observed per year, in mountainous areas at altitudes of 1000 m or more - up to 30. In some years, the number of days with a thunderstorm can increase significantly: on a flat territory - up to 20-24, in foothills - up to 30 days per year. The most frequent thunderstorms in the low-mountain zone - on the windward slopes of the Western Tien Shan - 40-50 per year.

The average duration of a thunderstorm varies from 0.1 to 2.5 hours, but sometimes the duration of thunderstorm activity reaches 8-17 hours on the plains and 18-22 hours in mountainous areas.

A direct lightning strike on ground objects causes fires, electrical discharges disrupt radio communications and damage power lines. Thunderstorms pose a great danger to people and animals in open areas.

Hail usually falls along with heavy rain, sometimes accompanied by squally winds and thunderstorms. On the flat territory of Uzbekistan, hail rarely falls: in 10 years it is possible from 1 to 6-7 days with hail. In the foothills, on average, 1-2 hail days are observed per year (Table 2). In the low-mountain zone (1000-2000 m) it falls on average 3-5 times a year.

On the plains and foothills, the duration of hail usually does not exceed 15 minutes, however, cases have been recorded when hail fell within 45 minutes.

In the mountains, the average duration of hail falls increases to an hour or more. The area of distribution of individual cases of hail, as a rule, is small, but occasionally it can cover a large area at the same time. The degree of damage from hail (in which agriculture is damaged) depends on the size of the hailstones, their density, intensity of fallout, as well as on the type of crops. For example, young cotton seedlings are affected by moderate to severe hail with a diameter of 6-8 mm, while sunflowers, corn and orchards are affected by hail over 10 mm in diameter. Cattle die when large hail falls, starting from a diameter of 30-40 mm. In the most hail-prone areas of Uzbekistan, mainly in the Namangan region, impacts are made on thunderclouds in order to prevent this dangerous phenomenon.

Fog – when the visibility is less than 1 km, it is considered a dangerous phenomenon, when the visibility is 50 m or less, it is considered as a particularly dangerous weather phenomenon. Fog of any intensity creates an unfavorable situation for the movement of all types of transport. The distribution of fogs over the territory of Uzbekistan is associated with the presence of water bodies, the characteristics of the soil, and the relief. On the plain, the average long-term number of days with fog decreases from north to south: from 25 on the Ustyurt plateau and in Muynak to 10 in the southern and central parts of the Kyzylkum desert. There are many days with fog on the coast, on the drained part and on the islands of the Aral Sea, which is explained by the contrast in the temperature of the sea surface and land.

table 2.

Numb
er of days with hail for the period 1971-2016

Station	Months												Yea r	Average annual for 1961-2016.
	I	II	III	IY	V	VI	VII	VIII	IX	X	XI	XII		
Pap	-	1	5	7	3	6	-	-	-	-	-	-	22	0,8
Namangan	-	-	-	1	2	2	-	-	-	-	-	-	5	0,3
Fergana	-	-	-	2	-	1	-	-	-	-	-	-	3	0,6
Baysun	-	1	1	14	7	3	-	2	-	2	-	-	30	1,0
Huzar	1	1	-	3	4	1	-	1	-	-	-	1	12	0,4
Sherabad	-	-	1	1	-	-	-	-	-	-	-	-	2	0,1
Tashkent	1	-	2	9	3	2	-	2	-	2	-	-	21	0,7
Kasansay	-	-	3	7	6	5	3	2	1	-	-	-	27	0,9
Denau	1	2	3	7	5	1	1	-	-	1	1	-	22	0,8
Termez	1	-	1	5	-	-	-	-	-	-	-	-	7	0,2
Akrabat	1	2	15	20	16	9	-	-	-	2	4	1	70	2,4
Samarkand	2	3	7	16	8	1	1	-	2	1	-	-	41	2,5
Kokand	-	-	-	-	-	1	-	-	-	-	-	-	1	0,03
Andijan	-	-	-	1	1	2	-	-	-	-	-	-	4	0,2
Tamdy	-	-	2	1	1	-	-	1	-	1	-	1	7	0,2
Jizzakh	-	6	2	12	4	3	-	-	-	1	-	-	28	0,95
Bogarnoe	-	6	6	20	8	3	2	-	-	1	1	-	47	1,6
Kushrabad	-	-	2	9	7	1	1	-	-	-	2	-	22	0,8
Kyzylcha	-	-	2	25	32	28	13	11	-	6	3	-	120	4,1
Zaamin	-	1	4	5	9	2	1	-	-	2	1	-	25	0,8
Dukant	-	1	8	59	48	32	17	11	6	10	5	-	197	6,8
Bekabad	-	-	1	1	4	3	-	-	-	-	-	-	9	0,3
Sanzar	-	-	16	17	17	13	7	3	-	-	1	-	74	2,6
Minchukur	-	3	12	56	38	9	8	-	2	4	4	-	136	4,4

Pskem	-	-	-	2	-	-	1	-	-	-	-	-	3	0,1
Dehkanabad	2	-	5	11	15	-	-	-	-	-	-	-	33	0,8
Nurata	-	2	6	3	7	-	1	-	-	-	1	-	20	0,7
Urtatokay	-	-	2	4	9	9	2	3	-	-	-	-	29	1,0
Shurchi	-	-	3	3	5	-	-	-	-	-	-	-	11	0,3
Karshi	-	2	4	11	3	1	-	-	-	-	-	-	21	0,4

The largest annual number of days with fog in the long-term context (Table 3) is observed in the Jizzakh and Syrdarya regions and reaches 35-50. In areas with strong winds, the number of days with fogs is less: in Yangiyer - 17, Termez - 9. Fogs are most often observed from November-December to February-March, mainly during anticyclonic processes, frontal fogs are less common.

As the height of the terrain increases, the frequency of fogs increases. At altitudes of 1000 meters or more, it averages 60-70 days a year. As a rule, in the mountains they are more often observed in spring (March-April) and their number varies on average from 10 to 14 per month.

Table 3

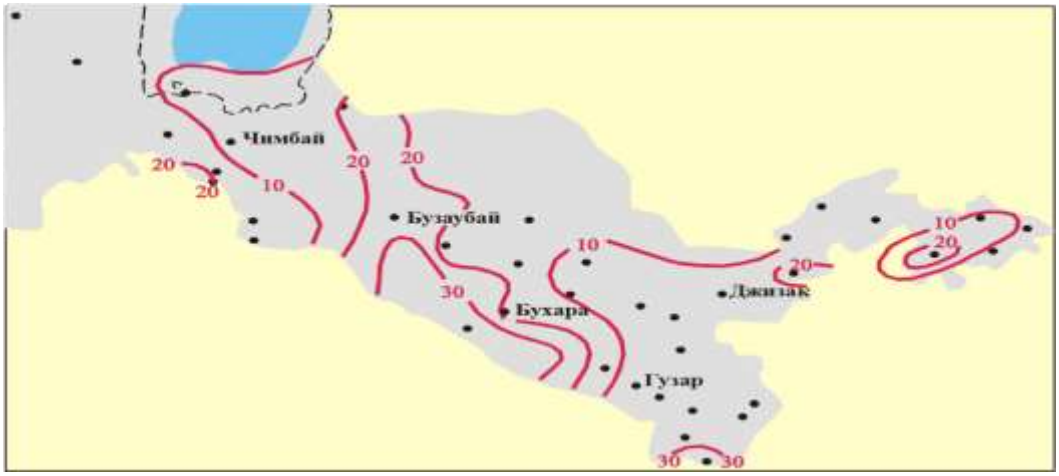
Number of days and duration of fog in regions of Uzbekistan (1950-2016)

Republic, viloyat	Number of days in a year		Duration, h		
	average	maximum	in just a year	on a foggy day	
				half a year	
				cold	cold
Karakalpakstan	15-28	35-50	100-140	4,5-5,7	2,0-6,0
Navoi	11-30*	22-55*	6-240	5,0-5,3	1,0-2,0
Tashkent	21-32		120-490	5,0-6,0	1,5-2,5
(the mountains)	45-50	40-83			
Khorezm	15	-	80	5,0	3,5
Bukhara	11-16	19-27	55-80	5,0-5,5	2,0-2,5
Namangan	20-30	25-30	80-150	5,0-6,0	2,5-3,0
Andijan		35-65**	160	7,0	2,5
Fergana	20-30	35-65	110-250	5,5-8,0	1,5-2,5
Syrdarya	15-35	60	200	7,5	3,0
Jizzakh	20-40	40-90	200-400	8,0-9,0	3,0-5,5
Samarkand	17	35-45	65-75	4,0-4,5	2,0-2,5
Kashkadarya	13-15	28	60-66	5,0	3,5
(the mountains)	30-60	75-85	250-450		
Surkhandarya	9	20-25	35-45	4,0-6,5	3,5-5,5
(the mountains)	35	60	300		

Note: * Nurata ** Namangan

Dust storms It is disastrous to distinguish local dust storms from frontal ones. In the first case, the phenomenon covers a small area. Frontal dust storms can cover large areas, in some cases 500-1000 km across.

A necessary condition for "local" dust storms is the presence of small loose, relatively light soil particles (dust, sand) and impact on agriculture and livestock, complicate the work of transport, especially aviation. The presence of a large amount of sand and dust in the air disrupts the operation of gas pipelines and power lines.



Rice. 2. Frequency (days/year) of dust storms in Uzbekistan.

In Uzbekistan, such conditions are found on the plains and in the foothills. Dust storms begin mainly at a wind speed of 10-14 m/s, however, in a number of places (Nukus, Samarkand, Termez) wind speeds of 6-9 m/s are already sufficient for the occurrence of such a phenomenon.

A good indicator of the intensity of a dust storm is the visibility range, which can often drop to almost zero, especially at the beginning of the storm. However, this rarely happens, most often visibility drops to only 3-4 km. A decrease in visibility to 1 km or less is observed during dust storms in the Termez region. The continuous duration of dust storms usually does not exceed three hours. The longest dust storms in Uzbekistan are observed in the Termez region, where in about 5% of cases they last a day or more.

On the flat territory of Uzbekistan, the average long-term annual number of days with dust storms, depending on the type of soil and wind speed, ranges from 3-5 to 30 or more, especially where there are local wind intensifications, for example, in the Termez region. There are significant fluctuations in the number of days with dust storms. In the foothills, the average number of dust storms per year mainly does not exceed 10, in areas where local winds develop, their number reaches 30 or more (near the cities of Yangiyer, Kokand, etc.).

In the mountains, due to stony or vegetated soils, rocks, snowfields and glaciers, local dust storms are rare, frontal storms predominate here, bringing dust from the flat areas. On average, there are 2-5 cases per year, and in some places only 2-4 cases are possible in 10 years. There are almost no dust storms in mountainous regions.

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