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Assessment of Dangerous Hydrometeorological Events Affecting Agricultural Crops with a Modern Program (In the Case of the Republic of Karakalpakstan)

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Abstract: Dangerous hydrometeorological phenomena affecting agricultural crops were studied and analyzed based on the data obtained at meteorological stations located in the Republic of Karakalpakstan. In addition, the drought events of the Lower Amudarya geographical district were compared based on the SPI program and the results of the analysis were obtained.

Keywords: Spring and autumn black frost, drought, climate change, air temperature, summer thermal depression, harmsel.

Introduction. One of the biggest environmental disasters of the Central Asian countries in the recent past is the drying up of the Aral Sea. The ecological, hydrometeorological, socio-economic and humanitarian consequences of this natural disaster pose a direct threat to the region's sustainable development, population health, gene pool and its future in general. Before the ecological collapse, the Aral Sea served as a source of water that moderated the region's climate, mitigating extreme meteorological changes not only in the Aral region but also in Central Asia. The Aral Sea influenced the softening of cold air masses entering the region from the west in winter, and the moderation of hot and dry air masses in summer. As a result of the drying up of the Aral Sea, it can be observed that the recurrence of dangerous hydrometeorological events has increased in Central Asia, in particular in the Lower Amudarya region, which occupies the territory of the Republic of Karakalpakstan. Another reason for the increase and intensification of dangerous hydrometeorological events in the region is the result of global climate change. In recent years, the negative impact of dangerous hydrometeorological events on agricultural crops in the Lower Amudarya region is increasing year by year [8., 9]. Due to this, as stated in the law of the Cabinet of Ministers of the Republic of Uzbekistan "On additional measures for the establishment of "green covers" - protective groves on the dry bottom of the Aral Sea and in the Aral coastal areas", it is resistant to desert. , including the planting of plants such as saksovol, blackberry, sugarcane, etc. The study of dangerous hydrometeorological phenomena of the Lower Amudarya region (black frost, extreme air temperatures, drought, strong wind, heat wave) taking into account the impact of climate change is underway. As a result of climate change, the recurrence of dangerous hydrometeorological events is increasing and the level of their negative impact is increasing. Dangerous hydrometeorological events, including spring and autumn black frosts, hot summer heat, negatively affect the productivity of agricultural crops. Due to the increase in the frequency and severity of dangerous hydrometeorological events as a result of climate change, the study of dangerous hydrometeorological events becomes important in the development of measures for the development of the agricultural economy and food security in the region. Black frost seriously damages the

quality and quantity of the crop. During the growing season, late spring frosts and early autumn frosts slow the growth of agricultural crops and reduce productivity. This, in turn, has a negative impact on economic sectors. From this point of view, monitoring of these dangerous hydrometeorological phenomena, studying the trends of changes in their indicators is one of the urgent issues.

Systematic study of atmospheric processes in Central Asia began in 1921, and at that time dangerous hydrometeorological phenomena were studied in the synoptic department of the Turkestan Meteorological Institute. In the 30s and 40s, scientists V.A. Bugaeva and V.A. Georgiou developed the methodology of the atmospheric phenomena of synoptic processes in Central Asia. V. A. Bugaev, V. A. Georgiou, V. I. Gubin, M. A. Petrosyants, E. M. Kozik, N. N. Romanova and other scientists considered it very necessary to study the origin of synoptic processes in Central Asia and the danger to the national economy, therefore researches were carried out intensively. As a result of research carried out in the years 1920-1950, the work done on the orographic distribution of synoptic processes in Central Asia, the impact on the region and the assessment of climate change is being used by scientists in the form of monographs and textbooks for students. The issues of studying the synoptic processes and dangerous hydrometeorological phenomena of Central Asia, assessing their impact on agricultural crops have been considered in the scientific researches of many scientists. Including N.A. Agaltseva, Yu.N. Ivanov, S.V. Myagkov, T.A. Ososkova, A.V. Pak, E.V. Petrova, T.Yu. Spektorman, G.N. Trofimov, V.O. Usmonov, V.F. Usmonov, V. Chub, A. Alautdinov, G. Holboev, It was studied by O. Sultashova and other scientists [1., 7].

1-table

	Years	Winter	Spring	Summer	Autumn
Kungrad	1950-1959	-4,8	10,8	24,3	8,71
	1960-1969	-3,6	11,7	25	10,1
	1970-1979	-5	12	25,7	11,1
	1980-1989	-3,2	11,7	26,4	10,4
	1990-1999	-3,5	12	26,6	11
	2000-2009	-2,8	14,2	26,7	11,2
	2010-2019	-2,8	14,5	26,5	10,9
Nukus	1950-1959	-4,4	12,4	25,9	9,7
	1960-1969	-3,4	12,7	26,3	10,8
	1970-1979	-4,4	13,3	26,9	11,9
	1980-1989	-2,3	12,9	27,6	11,2
	1990-1999	-2,5	13,1	27,7	12
	2000-2009	-2,2	15,1	27,9	12,1
	2010-2019	-2,5	13,7	25,8	10,6

Average seasonal air temperature in Kungrad and Nukus meteorological stations (1950-2019) located in the Republic of Karakalpakstan.

Seasonal average air temperature data observed at Qong'irot meteorological station in the Republic of Karakalpakstan (1950-2019) were collected and analyzed. According to it, we can see that the average air temperature in the winter season was -4.8˚C during the base period, and -2.8˚C during the current period, and it decreased by -2 during the past 70 years. As a result of observations, the average air temperature in Qong'irot meteorological station in the spring season was 10.8˚C in the base period, and 14.5˚C was observed in the current period. The difference between the base period and the average air temperature in the spring season of the current period was 3.7˚C. The average air temperature in Qong'irot meteorological station during the summer season was 24.3˚C in the base period and 26.5˚C in the current period. We can see that the average air temperature in the summer season has changed by 2.2˚C for 70 years at the Qong'irot meteorological station. One of the main reasons for this is climate change and the increase in industrial production, which can be attributed to population growth. In the selected meteorological station, Qong'irot, the average air temperature in the autumn season was observed at 8.71˚C in the base period and 10.9˚C in the current period. As a

result of the analysis, it is clear that the average air temperature in the autumn season has increased by 2.19˚C compared to the base calculation. The seasonal average air temperature observed in the years 1950-2019 at the Nukus meteorological station located in the Republic of Karakalpakstan was compared and analyzed. According to him, the average air temperature in the Nukus meteorological station in the winter season was -4.4^{0}C in the base period, and -2.5˚C was observed in the current period. At the Nukus meteorological station, the difference between the base period in the winter season and the current period is -1.9˚C. In the selected meteorological station, that is, in the Nukus meteorological station, the average air temperature in the spring season was 12.4˚C in the base period and 13.7˚C in the current period. The difference between the average air temperature in the spring season at the Nukus meteorological station and the current period was 1.3˚C. The average air temperature observed in the summer season at the Nukus meteorological station was 25.9˚C in the base period and 25.8˚C in the current period. We can see that the average air temperature of the selected meteorological station during the summer season has not changed much. In this meteorological station, the average air temperature in the autumn season was 9.7˚C in the base period, and this value was 10.6˚C in the current period. According to the results of the comparison and analysis at the Nukus meteorological station, the difference between the current period and the base period was 0.9˚C.

2-table

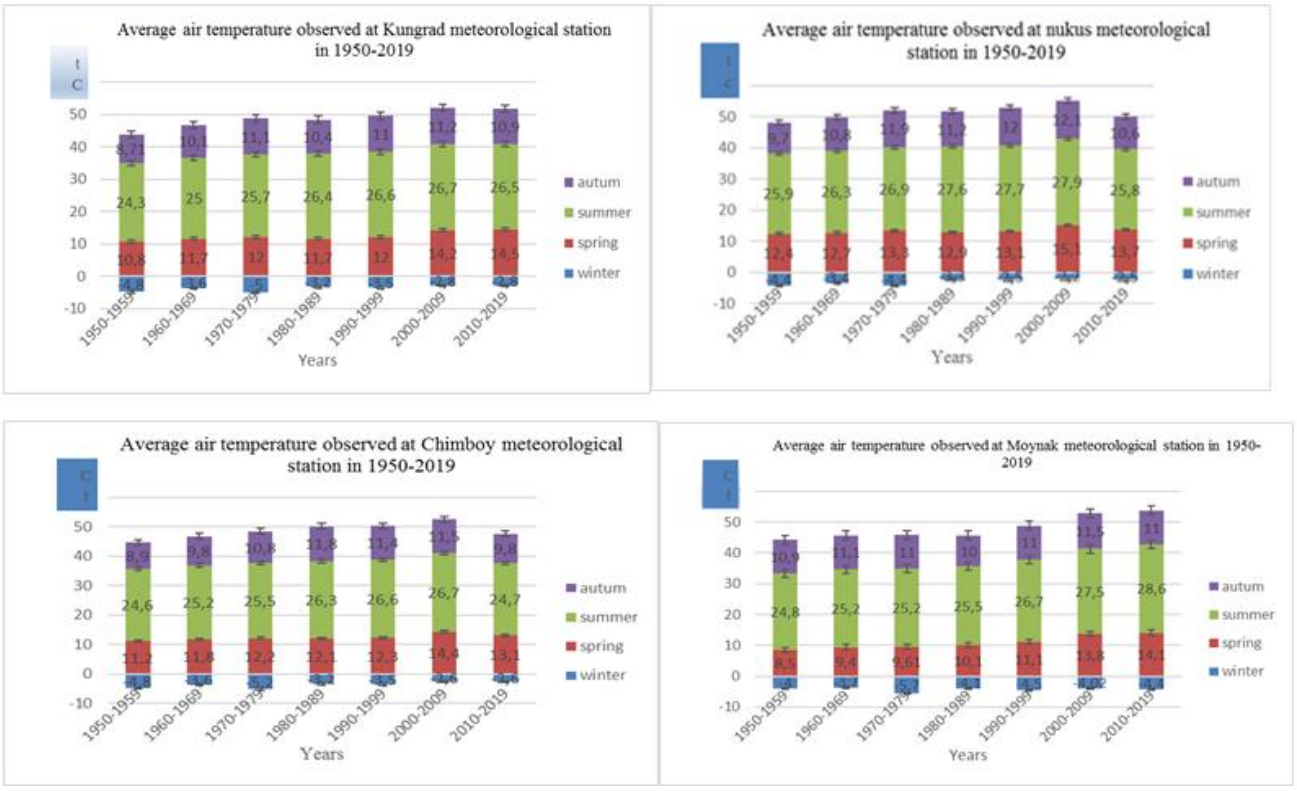
	Years	Winter	Spring	Summer	Autumn
Mo'ynok	1950-1959	-4	8,5	24,8	10,9
	1960-1969	-3,7	9,4	25,2	11,1
	1970-1979	-5,7	9,61	25,2	11
	1980-1989	-4,1	10,1	25,5	10
	1990-1999	-4,5	11,1	26,7	11
	2000-2009	4,02	13,8	27,5	11,5
	2010-2019	-4,4	14,1	28,6	11
Chimboy	1950-1959	-4,8	11,2	24,6	8,9
	1960-1969	-3,6	11,8	25,2	9,8
	1970-1979	-5,2	12,2	25,5	10,8
	1980-1989	-3,2	12,1	26,3	11,8
	1990-1999	-3,5	12,3	26,6	11,4
	2000-2009	-2,6	14,4	26,7	11,5
	2010-2019	-2,6	13,1	24,7	9,8

Average seasonal air temperature in Chimboy and Moynak meteorological stations (1950-2019) located in the Republic of Karakalpakstan.

The seasonal average air temperature observed in the base period at the Moynaq meteorological station located in the Republic of Karakalpakstan was analyzed. In this meteorological station, the average air temperature for the winter season was -4^{o}C in the base period, and it was found to be -4.4^{o}C in the current period. So, the results of comparing the current period with the base period show that we can see -0.4^{o}C decrease in the last 10 years (2010-2019) compared to the previous 10 years (1950-1959). In the selected Moynaq meteorological station, the average air temperature in the spring season was 8.5^{o}C in the base period, and 14.1^{o}C in the current period. It can be seen that the difference between the base period and the observed air temperature in the spring season in the current period was 5.6^{o}C. The average air temperature observed in the summer season at the Moynaq meteorological station was recorded and analyzed. According to it, the average air temperature in summer was 24.8^{o}C during the base period, and 28.6^{o}C was observed in the current period. We can see that the average air temperature in the summer season has increased by 3.8^{o}C over the past 70 years at the Moynaq meteorological station. As a result of the research, the average air temperature in the autumn season at the Moynaq meteorological station was 10.9^{o}C during the base period, and 11^{o}C was recorded in the current period. We can see that the average air temperature in the autumn season has not changed much over the past period. The seasonal average air temperature observed in

the base period at the Chimboy meteorological station located in the Republic of Karakalpakstan was analyzed. In this meteorological station, the average temperature of -4.8°C was returned in the winter season in the base period, and -2.6°C was observed in the current period. So, the comparison between the current period and the base period shows that we can see an increase of 2.2°C in 70 years. At the selected Chimboy meteorological station, the average air temperature in the spring season was 11.2°C during the base period and 13.1°C was recorded in the current period. It can be seen that the difference between the base period and the air temperature observed in the spring season in the current period is 1.9°C. The average air temperature observed in the summer season at the Chimboy meteorological station was recorded, and according to the analysis, the average air temperature in the summer season was 24.6°C in the base period, and 24.7°C in the current period. We can see that the average air temperature in the summer season at the Chimboy meteorological station has not changed much over the past 70 years. As a result of research, it was found that the average air temperature in Moynaq meteorological station in the autumn season was 8.9°C in the base period, and this value changed to 9.8°C in the current period. During the past period, it was found that the average air temperature in the autumn season increased by 0.9°C.

Figure 1.1. The average air temperature observed in the years 1950-2019 at the Qungirat, Chimboy, Nukus, and Moynaq meteorological stations located in the Republic of Karakalpakstan



Based on the data of the selected meteorological station in the Republic of Karakalpakstan, the spring black and cold periods observed in 2005-2019 were summarized (Table 1). In the table, the earliest period of spring black frost was observed at the Nukus meteorological station on 11.03.2019. In Chimbay and Kungrad, the earliest period of this dangerous Hydrometeorological event was observed on 12.03.2019 and 28.03.2010, respectively. The average duration of the last black frost in spring is 1.04 in Nukus. it was determined that it corresponds to the date. The average duration of spring black frost at Chimbay and Kungrad meteorological stations was 5.04 and 6.04, respectively. The latest black frost observed in the spring was recorded at the Nukus meteorological station on 04/17/2008. At Chimbay and Kungrad meteorological stations, this indicator was recorded on 04/17/2008 and 04/22/2019, respectively. The results obtained in the work were compared with previously studied periods of black frost at selected meteorological stations. According to it, we can see that the earliest date of the last black frost in spring was observed 2 days earlier at the Nukus meteorological station compared to the old period (1971-2005). In 2005-2019, early spring black frost was detected at Kungrad meteorological station on April 22, 2019, while V.E. Chub observed

early spring black frost in Kungrad meteorological station in 1971-2005 on April 30, 1989. It can be seen that in the next period, the spring black frost happened 8 days earlier. At the Nukus meteorological station, the latest black frost in spring moved forward by 11 days compared to the base period. At the Kungrad meteorological station, the latest black frost period in spring in the data of 2005-2019 was observed 8 days earlier compared to the data of V. E. Chub. There was no significant change in the average duration of the studied black frost compared to the base period. These dates corresponded to 01.04/02.04 in Nukus and 06.04/07.04 in Kungrad.

Table 3. Spring Black frost periods observed in the Republic of Karakalpakstan in 2005-2019

Weather station	The last black frost dates of spring			Last spring black frost dates (according to V.E. Chubb)		
	The earliest spring black frost date	Average	Late spring black frost	The earliest spring black frost date	Average	Late spring black frost
Nukus	11.03.2019	01.04	17.04.2008	13.03.1985	01.04	09.05.1993
Chimbay	12.03.2019	05.04	17.04.2008			
Kungrad	28.03.2010	06.04	22.04.2019	18.03.2002	07.04	30.04.1989

The duration of the autumn black frost was also studied on the basis of meteorological data from 2005-2019 at the meteorological stations involved in the work (Table 2). The earliest occurrence of autumn black frost was observed at the Nukus meteorological station on 01.10.2017, and it was found that it occurred at the Chimbay and Kungrad meteorological stations on 09.30.2017 and 09.29.2017, respectively. The average values of the first autumn black frost periods observed in 2005-2019 at the selected meteorological stations were also determined. At the Nukus Hydrometeorological station, the average autumn black frost was on October 18, and at Chimbay and Kungrad meteorological stations, the first autumn black frost periods were observed on October 15 and October 12, respectively. The latest occurrence periods of autumn black frost were also studied. According to him, this indicator of autumn black frost occurred at the Nukus meteorological station on November 30, 2006, at the Chimbay meteorological station on November 22, 2016, and at the Kungrad meteorological station on November 30, 2006. The studied indicators of autumn black frost were compared with the results of the base period 1971-2005 by V.E.Chub. According to the results of the comparison, the earliest autumn black frost was observed at the Nukus meteorological station 5 days later than this year. The period of early autumn black frost at the Kungrad meteorological station has shifted by 3 days compared to the base period. When comparing the latest black frost periods in autumn, it was found that this indicator was 20 days later than the base period at the Nukus meteorological station. Similar periods were observed at Kungrad meteorological station on 30.11.2006 in the studied period, and 01.11.1984/1997 in the base period. It was found that the latest occurrence of autumn black frost was 29 days later than the base period in the current period. The average duration of autumn black frost in the current and base periods differed during 1-3 days.

Table 4. Autumn black frost periods observed in the Republic of Karakalpakstan in 2005-2019

Weather station	Black frost dates in autumn			The latest autumn frost date (according to V.E.Chub)		
	The earliest autumn black frost	Average	Late autumn black frost	The earliest autumn black frost	Average	Late autumn black frost
Nukus	01.10.2017	18.10	30.11.2006	26.09.2000	15.10	10.11.1974
Chimbay	30.09.2017	15.10	22.11.2016			
Kungrad	29.09.2017	12.10	30.11.2006	26.09.2000	14.10	1.11.1984, 1997

Summary. We can see that hydrometeorological processes and dangerous hydrometeorological events have changed dramatically in the territory of the Republic of Karakalpakstan during the base

period. The results of studies and analysis revealed that hydrometeorological events have increased. That is, during the last 70 years, the average air temperature at the Nukus meteorological station has increased by 1.9˚C in winter. This, in turn, leads to further aridification of the region's climate, an increase in extreme values of meteorological indicators in the region, and an increase in the number of dust and sand storms. Hydrometeorological events have been increasing in the Lower Amudarya region in recent years. One of the main reasons is the drying up of the Aral Sea. In the dry part of the Aral Sea, a lot of work is being done to improve the health of the population by planting desert-resistant plants, restoring the animal world [7., 10].

References:

1. Матмуратов Д. Агроклиматические условия Северо-Западного Узбекистана. Нукус, Каракалпакистан, 1989
2. Муминов Ф.А., Абдуллаев Х. М. Агроклиматические ресурсы Узбекистана. - Ташкент: САНИГМИ, 1997
3. Рахманова Ф.Ф. Агроклиматическая оценка термических ресурсов вегетационного периода с учетом условий созревания коробочек хлопчатника в Узбекистане // Труды САНИГМИ. - 1988.
4. Рейзвих О.Н. Агроклиматические основы фитомелиорации освоения пустынь // Проблемы освоения пустынь. - 1989
5. Спекторман Т.Ю. Оценка изменений основных климатических характеристик по территории Узбекистана // Труды НИГМИ. - 2006.
6. Чуб В.Е. Изменение климата и его влияние на природно-ресурсный потенциал Республики Узбекистан. - Ташкент: САНИГМИ,
7. Чуб В.Е. Изменение климата и его влияние на гидрометеорологические процессы, агроклиматические и водные ресурсы Республики Узбекистан. -Ташкент:Ворис нашриёт, 2007.
8. Imanmurzaev Adilbek Qaldibaevich., Abdullaev Tozabek Jumabay O'g'li., Ganiev Nurman Janabergenovich., Khudaybergenov Nurlan Saparbay O'g'li., Amangeldieva Umida Joldasbayevna. ASSESSMENT OF HAZARDOUS HYDROMETEOROLOGICAL PHENOMENA AFFECTING AGRICULTURAL CROPS. British Journal of Global Ecology and Sustainable Development, ISSN (E): 2754-9291, 125-131b
9. Imanmurzayev Adilbek Qaldibayevich., Umirzoqov G'ulomjon O'ng'arboyevich. QISHLOQ XO'JALIGI EKINLARIGA TA'SIR ETUVCHI XAVFLI GIDROMETEOROLOGIK HODISALARNI BAHOLASH. Geografik tadqiqotlar: innovatsion g'oyalar va rivojlanish istiqbollari xalqaro konferensiya, 485-491b
10. Imanmurzaev Adilbek Qaldibaevich., Abdullaev Tozabek Jumabay O'g'li. JANUBIY OROL BOYI IQLIM SHAROITI. International conference on innovative development of education" 2023/21 ISSN: 2181-3515, 74-78b