

GLOBAL WARMING IN THE SOUTH REGION OF UKRAINE AND IT'S IMPACT ON THE EUKARYOTES

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In this work the results of the studies of environmental change in terms of global warming are presented. Climate temperature parameters of the southern steppes of Ukraine were calculated and with help of the indices stable trends of their increasing impact on human activity was shown. Time-spatial changes in key parameters of the environment and their connection to the actual data of medical institutions of Kherson region were also analyzed.

Key words: *Climate, global warming, temperature, stress, emergency medicine.*

Formulation of the problem. Global climate change, also known as "global warming", can be felt now and in the foreseeable future impact of these changes on human activity will only grow. WHO estimates that climate change is currently responsible for approximately 150,000 premature deaths and the loss of about 55 million man-years of disability on average per year in the world, accounting for 0.3 and 0.4% of global indices, respectively.

For the 2001-2010 more than 370 thousand people died because of the warming, it is 20% more than in 1991-2000, respectively. The main contribution was made by extreme heat in Europe in 2003 and in Russia in 2010. [1].

According to WHO experts, the annual number of deaths in Ukraine associated with exposure to environmental and ecological factors that can be prevented is 155 thousand. Or 19% of total mortality indicators. [2].

Climate change is accompanied by an increase in the number of days with abnormally high temperature. It is known that stable, long hot weather causes increased mortality and exacerbation of cardiovascular disease.

In Europe, summer of 2003 was recognized as the hottest summer in the last 500 years. Abnormally high temperatures were observed in July and August: in UK up to +38.1 °C, in Bavaria up to 40.4 °C, in France up to 35.0 °C [3,4]. Weather

conditions in 2015 were as extreme and quite possibly a repeat of temperature records of 2003.

It should be noted that according to the literature data a rise in average surface temperature of the Earth in the XXI century up to 1,4-5,8 °C can be predicted. As a result, an anthropogenic warming by an average of 0. 1-0. 5 ° C every decade during the current century can be predicted. After the XXI century even more changes can be expected [1].

The purpose of the research is the usage of the temperature coefficients to calculate the stress changes in climatic characteristics in the south of Ukraine (Kherson region), their impact on the comfort of human existence in its adaptation to stress (high temperature).

Materials and methods of research. The material for the research were perennial climatic data of meteorological observations of the agrometeorological Kherson station [5,6] and the statistics of the "Regional Center of emergency medical care and disaster medicine" of the Kherson region. With Humidex-based Heat Stress Calculator [7,8] indices of the temperature stress and defined comforts of human existence were calculated. The analysis of the parameters between the thermal stress index and actual data on the number of medical institutions of the emergency medical aid vehicles calls in the city was also conducted.

Presentation of the main material. Research proved that the main parameter of global warming is the gradual increase in temperature of the environment and, consequently, changes in the conditions of existence of living organisms.

There has been a considerable work on the study of changes in temperature conditions of Kherson region over the past 30 years, according to agrometeorological station in Kherson [9].

A striking example characterizing climate change is the increasing amounts of the average temperature.

In this work the amount of average temperatures above 0 ° C and above + 15 ° C are taken into the account (Fig. 1,2).. Whereas, in the southern steppe maximum temperatures ranged + 30-37 ° C the division of the temperature mode into two components allows to view it's changes in great detail.

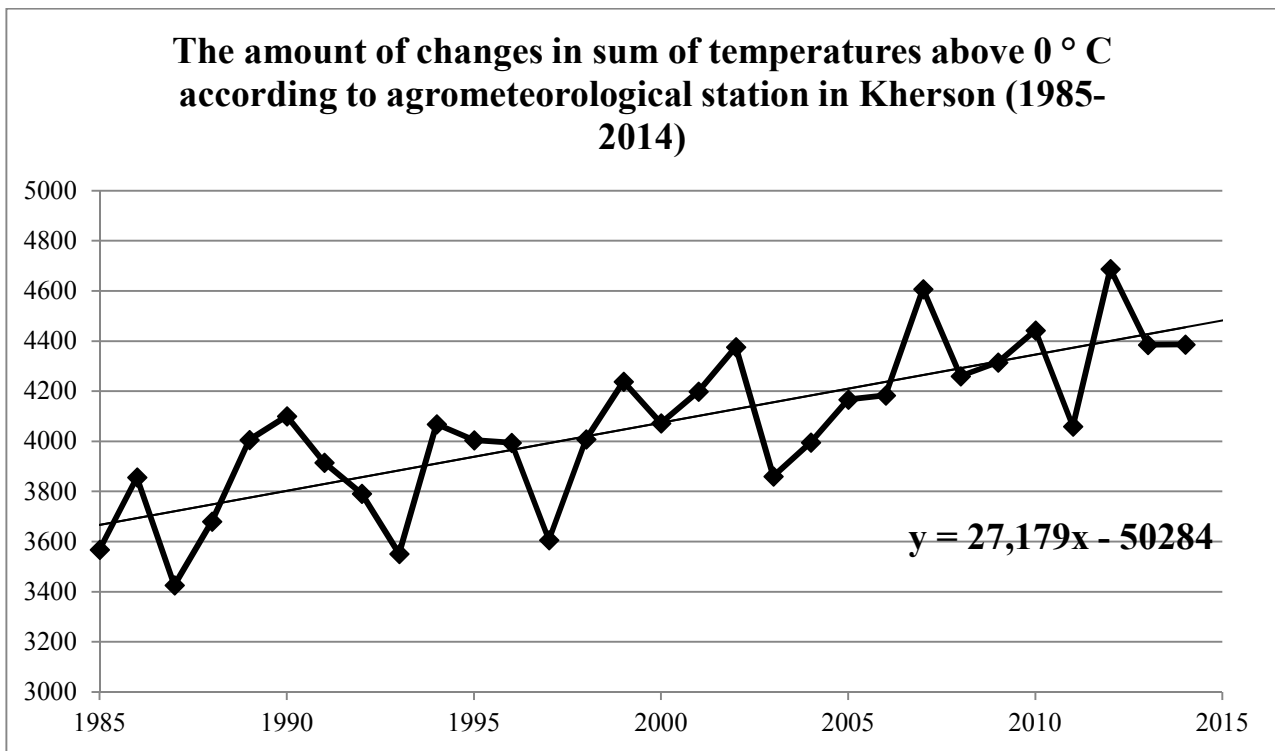


Fig. 1. The amount of changes in sum of temperatures above 0 ° C according to agrometeorological station in Kherson (1985-2014)

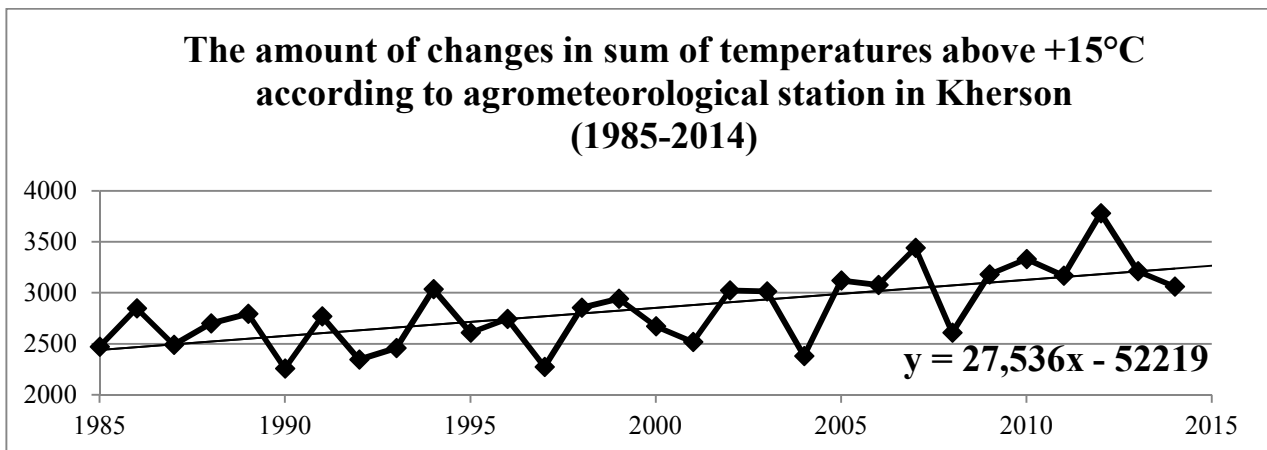


Fig. 2. The amount of changes in sum of temperatures above +15°C according to agrometeorological station in Kherson (1985-2014)

As can be seen, the sums of temperature from 1985 to 2014 are steadily increasing. It should be noted that the highest tendency to increase have temperatures above +15 ° C, according to many years of data.

Given that the maximum amounts of the mentioned temperatures occur in 2010-2014, to assess the magnitude of these changes a mathematical calculation for the amounts of active and effective temperatures for the last 5 years (2010-2014) according to the agrometeorological station in Kherson was implemented. Comparing them with the average long-term data, it was found that during the said period, the amount of active

temperatures relative to annual-average temperature increased from an average of 12% (active above 0 ° C) to 40% (effective above + 15 ° C) (Table1).

The above information shows a significant increase in the thermal load on the environment of our region.

Table 1

The annual amount of active and effective temperatures for the 2010-2014 years according to the agrometeorological station in Kherson.

Year	The annual amount of active temperatures				The annual amount of effective temperatures		
	Higher than 0°	Higher than +5°	Higher than 0°	Higher than +5°	Higher than 0°	Higher than +5°	Higher than 0°
2010	4443	4338	4066	3330	3142	1892	1042
2011	4060	3795	3534	3169	2720	1748	934
2012	4688	4654	4293	3780	3388	2219	1246
2013	4385	4120	3466	3211	2932	1788	1009
2014	4386	4228	3792	3030	2970	1859	1005
Middle	4392	4227	3830	3304	3030	1901	1047
Long term average	3926	3705	3357	2648	2604	1553	746
Deviation	466	522	473	656	426	348	301
Deviation%	+12%	+14%	+14%	+24%	+16%	+22%	+40%

For comparing indices of the temperature stress it was decided to analyze the past 16 years from 2000 to 2015. [10].

Analysis was conducted based on the two key parameters, namely:

1. Maximum temperature for the day;
2. Relative humidity at this time.

Whereas the basic temperature peaks occur in the summer months, data for June, July and August was added to the calculations.

The presence of other meteorological factors such as wind or staying in direct sunlight may slightly change the specified index.

Considering local climatic characteristics it was decided on the following distribution of indices for their negative impact (Table. 2).

Table 2

Allocation of the temperature stress indices according to their level of impact.

Humidex range	Level of comfort
Up to 29	Comfortable conditions
From 30 to 38	Minor discomfort
From 39 to 45	Significant discomfort
More than 45	Hazardous conditions

Given the significant impact on the living organism, specifically air temperature, the days, when the air temperature was increased to + 30 ° C and higher were separated (Table. 3).

Table 3

The number of days with different temperature stress index and the number of days with air temperature + 30 ° C and higher, according to agrometeorological station in Kherson.

Year	Number of studied days	Comfortable days	%	Minor discomfort days	%	Significant discomfort days	%	Hazardous days	%	Days with temp. higher than 30°	%
2000	92	38	41	50	54	4	4	0	0	54	59
2001	92	30	32	45	49	17	18	0	0	62	67
2002	92	37	40	35	38	20	22	0	0	55	60
2003	92	38	41	54	58	0	0	0	0	54	59
2004	92	38	41	50	54	4	4	0	0	54	59
2005	92	35	38	44	48	13	14	0	0	57	62
2006	92	30	33	52	57	10	11	0	0	62	67
2007	92	14	15	62	67	16	17	0	0	62	67
2008	92	28	30	53	58	11	12	0	0	64	70
2009	92	31	34	55	60	6	7	0	0	61	66
2010	92	29	31	56	61	25	27	0	0	81	88
2011	92	26	28	55	58	11	12	0	0	66	72
2012	92	23	25	48	52	21	23	0	0	69	75
2013	92	24	26	62	67	6	7	0	0	68	74
2014	92	29	31	58	63	5	5	0	0	63	68
2015	92	31	34	56	61	5	5	0	0	61	66
Average value	92	30	32	52	57	11	11	0	0	62	67

As can be seen from results, only 30 days from 92 summer days were comfortable for human functionality, which is only 32%. At the same time, there were 52 days with minor discomfort, which is 57%. Separately it should be noted, that the days with significant discomfort, on average there was 11, which is 11%, while this value ranges from 0 days in 2003 to 25 days in 2010. It can also be seen that there were no hazardous days.

As for days with air temperature + 30 ° C and above, their average was 62, which is 67%, while this value ranges from 59 in the same 2003 to 88 in 2010.

Analyzing this data over time (Fig 3), it can be seen, that such parameter as the number of days with little discomfort tends to increase and given that the one thing that tends to reduce is the number of comfortable days, it can be concluded, that number of days with little discomfort increases by reducing comfort days. At the same graph shows that the number of days with significant discomfort varies greatly, but the overall trend is stable.

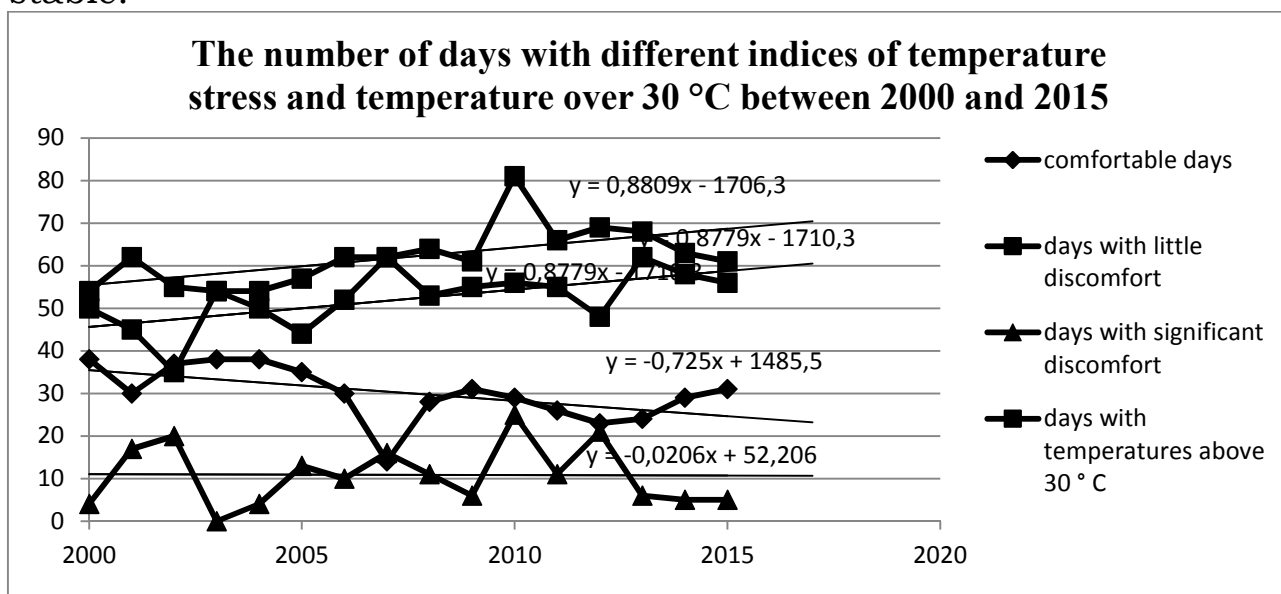


Fig. 3. The number of days with different indices of temperature stress and temperature over 30 ° C between 2000 and 2015

The number of days with a temperature of + 30 ° and higher also tends to increase and according to meteorological observations for the last years, the trend of growth will continue to be observed. It should be noted that for all the years of observation, days with hazardous criteria were not detected.

This study would be incomplete without the consideration of the actual results of human activity and vivid indicator of the presence or absence of problematic situations related to temperature stress, statistics are the number of calls of cars of

emergency medical care "Regional Center of emergency medical care and disaster medicine" in Kherson region.

The presence of temperature stresses inevitably leads to deterioration of health of people, especially those who have certain chronic diseases. Based on this statement it is logical to assume that the number of ambulance calls in the days with the highest indices of temperature stress will also increase.

Analyzing the data from tables 3 and 4 it can be seen that the maximum number of calls to ambulance is connected with the indices of temperature stress. So, the maximum number of uncomfortable days were observed:

- in 2010 – 81 days, that is 88% of the total number of summer days, in 2007- 78(84%) and in 2012 - 69(75%), at the same time maximum number of ambulance calls were observed in the summer months of 2010 – 2592 calls, accounting for 26% of all calls for the year 2007 – 25066 (25%) and in 2014 – 24584 (23%).

It should also be noted that the absolute leader in both parameters is August 2010, when from 31 days only 5 days were comfortable, 10 days with minor discomfort, and significant discomfort was observed for 16 days. During this month in 2010, the maximum number of ambulance calls was observed, namely 9545 that 1245 more than the average number for 11 years.

Table 4

Shows the number of calls of cars of emergency medical care for the 2004-2014 period [11].

Year	Total for the year	june	%	july	%	august	%	Summer period total	%
2004	94663	7684	8,1	7503	7,9	8163	8,6	23350	24,6
2005	95516	7704	8,0	7548	7,9	8373	8,8	23625	24,7
2006	98933	7369	7,4	7572	7,6	8412	8,5	23353	23,5
2007	101989	7987	7,8	8523	8,3	8556	8,4	25066	24,5
2008	98122	7834	8,0	8103	8,2	8445	8,6	24382	24,8
2009	98113	7571	7,7	7697	7,8	7848	7,9	23116	23,4
2010	100352	7992	8,0	8055	8,0	9545	9,5	25592	25,5
2011	95650	7420	7,7	7645	8,0	7782	8,1	22847	23,8
2012	97563	7691	7,9	7609	7,8	8019	8,2	23319	23,9
2013	101112	7887	7,8	7738	7,6	8077	8,0	23702	23,4
2014	105278	8272	7,8	8225	7,8	8087	7,7	24584	23,3
Average value	98844	7764	7,8	7838	7,9	8300	8,3	23903	24,1

So there is no doubt in the accuracy of this work's assumptions and it can be confidently said that the increase in temperature load leads to deterioration of health and therefore the calculation of future climate change, taking into account not only the temperature parameters but also the calculation of stress is important for development of the measures to adapt all living organisms to future climate change.

Conclusion. Performed calculations using **Humidex -based Heat Stress indices** indicate that the climatic conditions in the south of Ukraine (Kherson region) have a strong tendency to upward changes in temperature parameters, creating uncomfortable conditions of human life. Temperature stress leads to deterioration of health, as evidenced by the growing number of calls for emergency medical care machines. The highest number of uncomfortable days (26) was recorded in August 2010 and during this month the number of emergency calls for medical aid vehicles increased by 14%. The same trend is observed in other periods.

Taking into account stated above, more attention should be paid to the usage of these indices in planning adaptation measures to future climate change.

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Ю. П. Кіріяк, І. Ю. Горбатенко. **Глобальне потепління на території Південного регіону України та його вплив на еукаріотів.**

Представлено результати досліджень зміни довкілля в умовах глобального потепління. Розраховано температурні параметри клімату Південного регіону України та за допомогою індексів показано стабільні тенденції збільшення їх негативного впливу на життєдіяльність людини. Проаналізовано часово-просторові зміни основних параметрів оточуючого середовища та їх взаємозв'язок з фактичними даними медичних структур Херсонського регіону.

Ключові слова: клімат, глобальне потепління, температура, стреси, екстрена медицина.

Ю. П. Кирияк, І. Ю. Горбатенко. **Глобальное потепление на территории Южногерегиона Украины и его влияние на эукариотов.**

Представлены результаты исследований изменения окружающей среды в условиях глобального потепления. Рассчитаны температурные параметры климата Южного региона Украины и с помощью индексов показаны стабильные тенденции увеличения их негативного воздействия на жизнедеятельность человека. Проанализированы временно-пространственные изменения основных параметров окружающей среды и их взаимосвязь с фактическими данными медицинских структур Херсонского региона.

Ключевые слова: климат, глобальное потепление, температура, стрессы, экстренная медицина.