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Assessment of the Consequences of Global Warming in Azerbaijan

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Abstract

One of the issues discussed among researchers is how the modern warming will damage on agricultural productivity. Thus, the increase of the temperature is observed by the decrease of rainfall and increase of drought frequency in some regions of the world. In this case, the decrease of agricultural productivity is inevitable. Of course, in some regions contrast process also can happen, ie., temperature and rainfall may increase and drought tendension may decrease. In this case, productivity will increase. For clearing the issue, new strategy, that will take into account climate changes happening in both warming and colding periods is suggested. On the other side, the ways of defining supposed risks of processes influencing on productivity dynamics are shown. For this the notion of angle coefficient of trend is included for the first time.

Keywords: *trend, angle coefficient, drought, productivity, period, strategy.*

Introduction

Nowadays, the damage that climate changes formed, especially influence forms on agricultural productivity is disturbing researches. One of the ways of the problem solution is the adaptation of agricultural producers on climate change. A definite strategy must be worked out, that will take into account the work of farmers working in cattle-breeding, fishery and forestry and their work depends on climate change. Defining of such a strategy can be applied on any climate change form. For this, of course, the prediction of climate hesitation issue must be taken into account [1, 3]. In the next stage, the ways of increase of land productivity must be defined, then the damage of natural events on the agriculture must be minimized [2]. The delay of urgent adaptationnprogramme can cause serious danger for sustainable development programme, it may cause to food scarcity in 2030s [4,7].

Global food security is serving in the existence of the as one of the main factors providing population security. According

Table 1: *World wheat production, demand (billion ton) and population increase dynamics by mln.*

	Years					
	1990	1995	2000	2005	2010	2015
Demand	1,710	1,763	1,878	2,025	2,231	2,407
Production	1,952	1,897	2,060	2,268	2,475	2,817
Population billion. p.	5,3	5,7	6,1	6,5	6,9	7,3

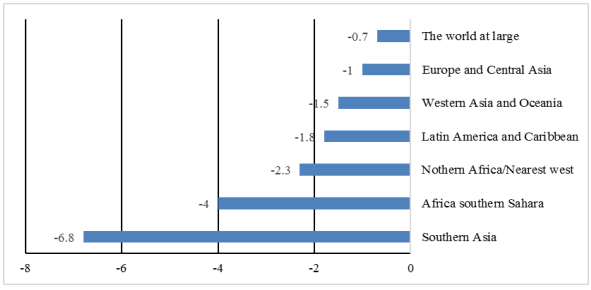


Figure 1: *The change of real income in agriculture from global warming to 2030,% [5].*

to the calculations of Federal Science Fond, till 2030 wheat production will increase to 2.1 billion and demand to 2.7 billion. It is predicted that, sea food production will increase to 100 mln. Against to 170 mln.. According to such indicators, the protection of food security in any state can be obtained by keeping development dynamics of special forms [5, 6].

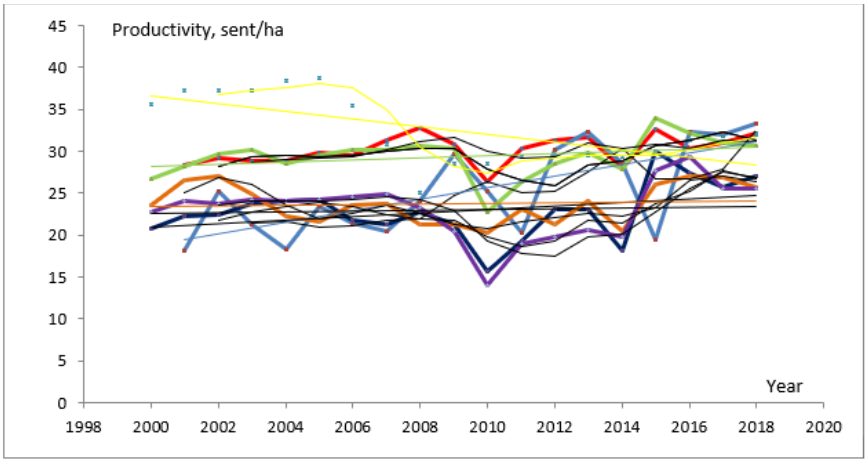
In the relation of global warming, the prediction of real income value for some regions of the world is given in Picture 1. As it is seen, the quantity of total income is 4-10 times less in Africa and South Asia in comparison with other regions.

As in different regions of the Earth, global warming pecularily influencing agriculture in Azerbaijan. As it is seen from Table 2, productivity dynamics on wheat productivity in the XXI century the stability of productivity dynamics till 2010 is replaced by a bit increase in 2011-2018. The got result does not match to the damage caused by global warming. Thus, in some regions of the Republic the damage caused by climate change deepens (the temperature was 20C more than norm, rainfall was 200 mm less than norm) the reasons of productivity increase must be cleared out. For this, climate indicators for different regions must be taken into account [3].

The analyse of Picture 2 shows that, beside Nakhchıvan Autonomuos Republic the wheat productivity in all regions of Azerbaijan increased in 2000-2018. Thus, global warming stimulated the wheat productivity increase. In reality, the

Table 2: *Wheat productivity in Azerbaijan sent/ha*

Total for the republic	Years																		
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	23.8	26.5	26.7	26.6	26.5	26.5	26.5	27.1	27.9	26.6	20.7	25.4	27.2	27.5	24	31.5	30.6	29.8	30
Absheron economic region	12	13.5	13.7	13.9	13.9	14.1	13.4	14.1	14	15.1	14.4	14.7	15.1	15	13.7	14.9	16.7	17.6	17.1
Ganja - Gazakh economic region	24.2	28.4	29.1	28.8	28.9	29.8	29.5	31.3	32.8	30.9	26.3	30.3	31.3	31.6	28.1	32.7	30.3	31	32.1
Shaki - Zagatala economic region	18.1	25.2	21.2	18.3	23.4	21.4	20.5	24	29.6	25.3	20.2	30.2	32.3	28.6	19.4	32.3	32	33.3	33.8
Lankaran economic region	22.7	24	23.8	24.2	24	24.2	24.6	24.9	23.3	20.5	14	18.9	19.7	20.6	19.8	27.7	29.3	25.6	25.5
Guba - Khachmaz economic region	23.5	26.6	27.1	24.9	22.3	21.6	23.5	23.8	21.3	21.3	20.2	23	21.2	24.1	20.4	26.1	27.1	26.9	25.7
Aran economic region	26.7	28.2	29.6	30.1	28.6	29.5	30.2	30.1	30.7	30.4	22.7	26.4	28.6	29.9	27.9	34	32.1	31	30.7
Upper Garabagh economic region	24.4	24.2	26.4	27.3	27.6	27.3	27.9	28	28.5	25.2	18.7	23	27.7	28	25.3	32.6	32.6	29.9	30.8
Kalbajar - Lachin economic region	11.6	13.8	17.1	20.1	22	27.2	29.1	29.1	30.2	30.6	24.1	25.5	29.5	28.2	28.7	29	26.3	23.7	22.7
Daghlig Shirvan economic region	20.8	22.2	22.4	23.7	24	24.2	21.8	21.2	22.7	21.2	15.6	19.3	23.1	23.1	18.1	30	27.4	25.7	27.1
Nakhchivan Autonomous Republic	35.6	37.3	37.3	37.2	38.4	38.7	35.5	30.9	25.1	28.5	28.6	29.4	29.5	29.5	29.3	29.8	31.4	31.8	32



Pic.2. Wheat productivity dinamics in different regions of Azerbaijan in 2000-2018 (sent/ha)

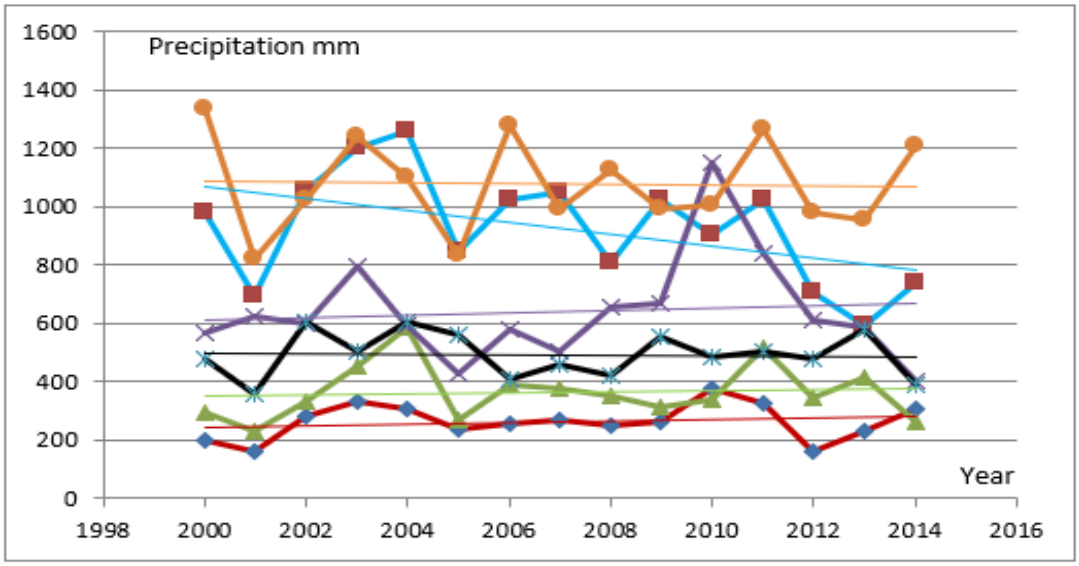
Ganja - Gazakh economic region; Shaki –Zagatala economic region; Aran econor

Daglig –Shirvan economic region; Nakhchıvan Autonomuos Republic; Guba –Kha

economic region; Lankaran economic region;

increase of temperature is resulted by the increase of drought and decrease of rainfall. If it is so, then what is the reason of productivity increase? For clearing out the issue, let's have a look at rainfall distribution chart of the noted regions, Pic 3.

Besides Shaki-Zagatala region, in all other regions of the Republic a little increase in rainfall was observed in 2000-2014. So, in the mentioned areas side by side with temperature increase rainfall also increased. Naturally, it effected on



Pic.3. Rainfall dinamics in different regions of Azerbaijan in 2000-2014 (mm).

Ganja - Gazakh economic region; Shaki-Zagatala economic region; Aran economic region; Daglıq –Shirvan economic region; Guba –Khachmaz economic region; Lankaran economic region;

Table 3: *The number of drought and productivity on Azerbaijan regions in different years*

Regions	The number of drought periods			Productivity, sent/ha		
	2000	2005	2008	2000	2005	2008
Absheron	2	1	1	10.6	14.3	14.2
Ganja	3	1	2	14.5	24.2	16.6
Dashkasan	2	1	1	6.1	10.5	20.2
Zagatala	2	2	2	27.4	32.8	37.5
Lankaran	3	1	1	22.8	21.0	19.7
Guba	3	3	2	19.0	23.7	22.9
Jafarkhan	2	2	-	30.9	42.0	38.3
Shamaxi	3	2	1	20.0	23.5	20.6
Nakhchivan	1	-	1	35.6	38.7	21.5

productivity increase, Pic.3. Let's have a look at drought frequency during this noted period.

Besides Shaki-Zagatala region, in all other regions of the Republic a little increase in rainfall was observed in 2000-2014. So, in the mentioned areas side by side with temperature increase rainfall also increased. Naturally, it effected on productivity increase, Pic.3. Let's have a look at drought frequency during this noted period.

As it is seen from Table 3, the increase of the drought number in most of the regions accompanied by productivity decrease. But in some regions this rule is broken and it is explained by other factors influencing on productivity. For example, although 3 seasons were dry the level of productivity does not differ from 2008, when only 1 season was dry in Shamakhi in 2000. In 2008, the decrease of productivity is related not to drought, but the rainfall was more than norm. Thus, in that year the rainfall was 15 mm less than norm in winter and it was 40 mm more in spring, 110 mm in summer and 67 mm in autumn in Shamakhi. In 2000, in Dashkasan because of two drought (mild and strong) happening during vegetation period, productivity was sharply less (6.1 sent/ha), but in the later years sharp drought changed into mild and weak drought and it caused to high productivity. Thus, as factors influencing on productivity decrease are different, their defining, valuing effect risk are considered as important issues in the preparing food programme [1,2].

The method of angle coefficient of trend for valuing influence risk on productivity

It is known that, agricultural productivity may increase or decrease in any climate change period. Draught, rainfall, more fertilizing than norm, hail, flood, different diseases, etc. may have negative impact on agricultural productivity. Just, in this article, for the first time on the base of suggested method, it is possible to value the impact of each factors.

By angle coefficient of the trend, we mean the value of angle between time arrow and trend line on any chart for quantity distribution. For ex, the angle got from the junction of trend line and time arrow on the chart for drought, the defined value of the same name for the productivity is compared. The decrease of the inclination angle for drought means productivity increase. Because, at this time, change frequency of the trend becomes less, vs, if the change frequency increases for the given quantity (for ex, for rainfall hesitation), the sharpness of the change will increase.

Thus, if we mark the defined value of the angle coefficient as km, rainfall as ks in perennial dynamics of productivity in the given regions, then the influence risk of rainfall on productivity can be defined out as ks/km. Of course, as it was mentioned above, increase and decrease of productivity can be not depend on rainfall increase and decrease. If we take into account that, approximately 50% of Azerbaijan territory situate in arid zone. Then it can be said that, the productivity decrease is related to drought. In other case, other factors influencing on productivity must be analysed. If we mark suggested angle as kq for drought, then for valuing the productivity the condition must answer to 0< kq/km <1 ratio. As it was mentioned kq/km s decreases and the the productivity increases. In other words, as kq/km ratio is more, the influence risk of the drought on productivity becomes more.

Picture 4 shows that, autumnal wheat productivity increased in 1995-2013 in the Republic. From chart it is seen that, from the years when productivity was 27.8 and 27.5 s/ha

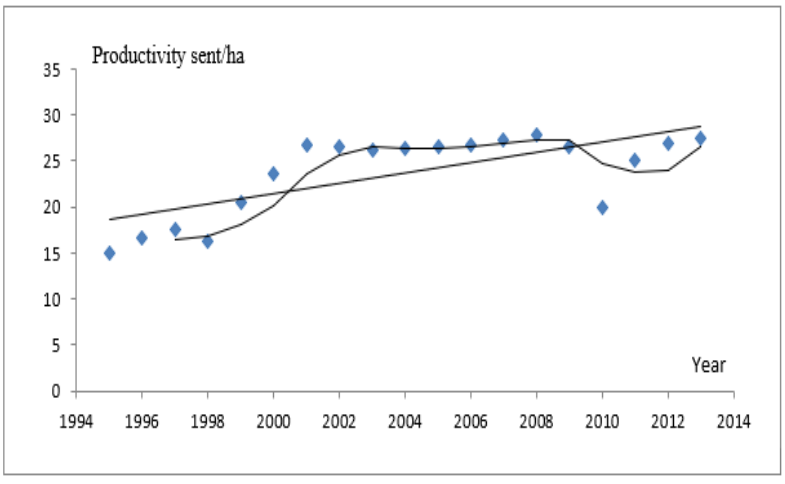


Figure 4: *The productivity of autumnal wheat in the Republic in 1995 -2014, sent/ha*

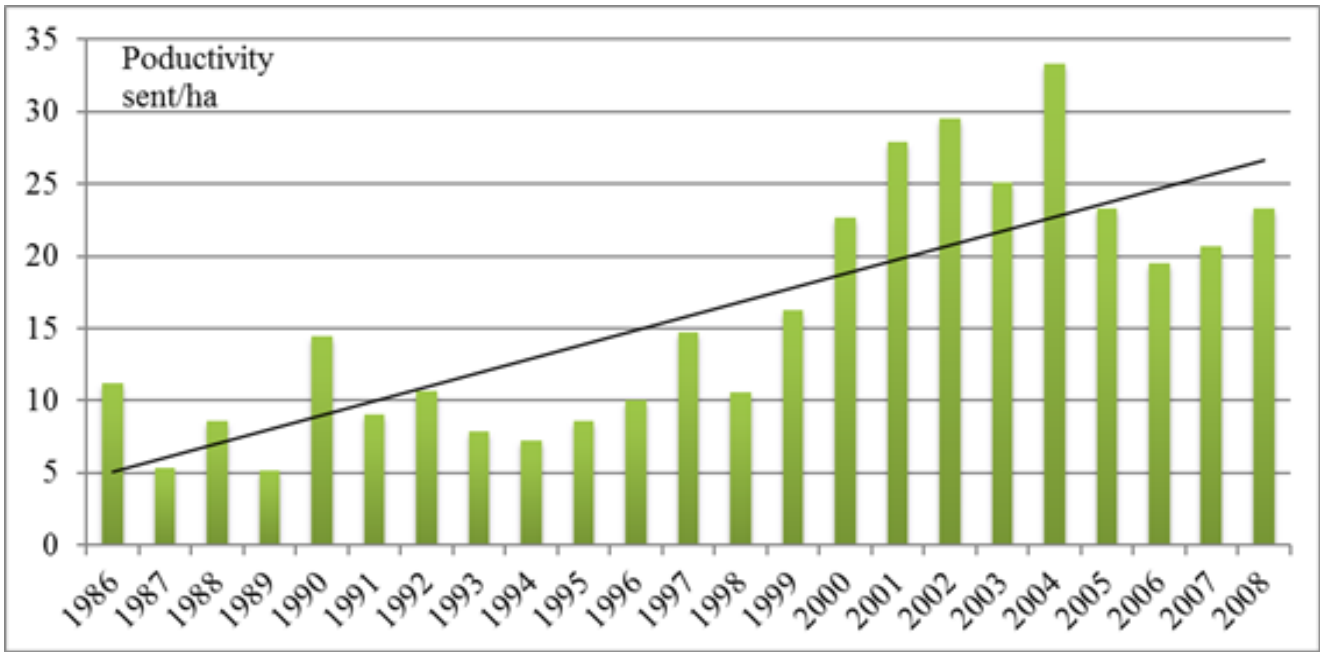


Figure 5: *The productivity of spring wheat in Azerbaijan in 1986- 2008 (sent/ha).*

(2008,2013) till 2001 there was increase, from that time till 2008 it was stabile, from 2009 decrease was observed. The most decrease was in 2010, in that year productivity decreased from 26.5 s/ha to 19.9 s/ha. It means that the productivity decreased about 25%.

The productivity of spring wheat was nearly 30 s/ha from 1986 to 2004, in 2005-2008 it decreased a bit (10 s/ha). In 1987-1997 years of the mentioned years the increase was 3-4 s/ha, in 1999-2004 25-30 s/ha, but in later years it decreased 5-10 s/ha, Pic.5. according to the trend's condition the stabile increase in productivity was in 1999-2004. Thus, from warming period of 2000, the increase in wheat productivity attracts attention. For clearing out the issue, let's have a look at angle coefficient of tendension in some economic regions of

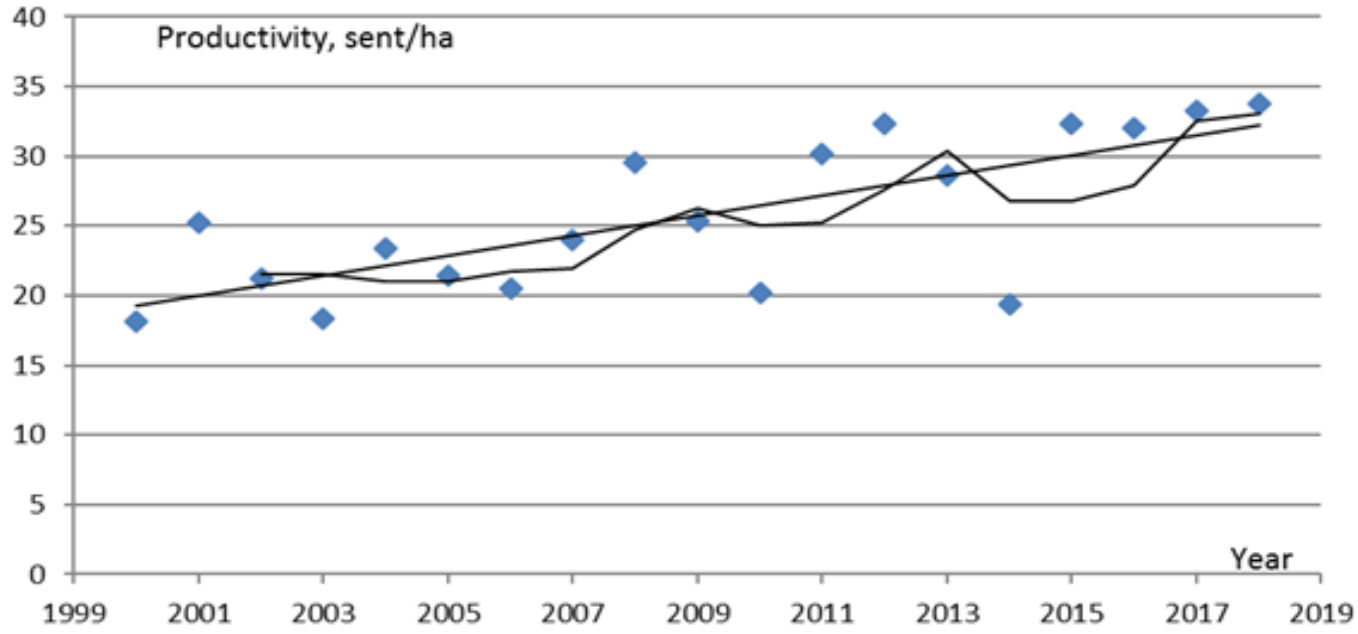


Figure 6: *Wheat productivity dynamics in Shaki-Zagatala economic region in 2000 -2018 (sent/ha).*

the Republic:

From Table 2 it is seen that, the wheat productivity in Shaki-Zagatala region increased from 18 s/ha to 33 s/ha in 2000-2018. For comparing main factors- rainfall and drought, which can cause such increase, let's have a look at productivity dynamics in the region, Pic .6.

From picture it is seen that, angle coefficient of the productivity trend is Km =150. Angle coefficient for drought trend in the economic regioned is defined as Kq=1,50 , Pic. 7.

In the next stage Kq/Km =(1,5/11)*100=13,6% - this quantity shows the influence of drought on productivity in Shaki-Zagatala region. For valuing the influence of rainfall on productivity, the angle coefficient of rainfall trend is defined on the base of Picture 7.

From Picture 8 it is seen that, the angle coefficient of rainfall hesitation is defined as Ky=10 and the influence of rainfall on productivity is (Ky/Km)*100=(1/11)*100=9,9% .

As in all regions of the Earth, on the base of observation data of 1981-2008, it may be noted that the temperature increased about 20C (pic.9).

According to the last propose of the resident, I intend to prepare it as a prediction matter in the next article.

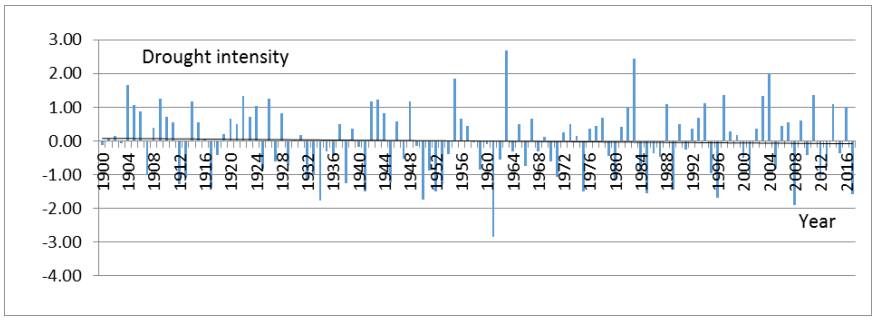


Figure 7: *Drought index dynamics in Shaki-Zagatala economic region in 1900 – 2018 (according to SPİ).*

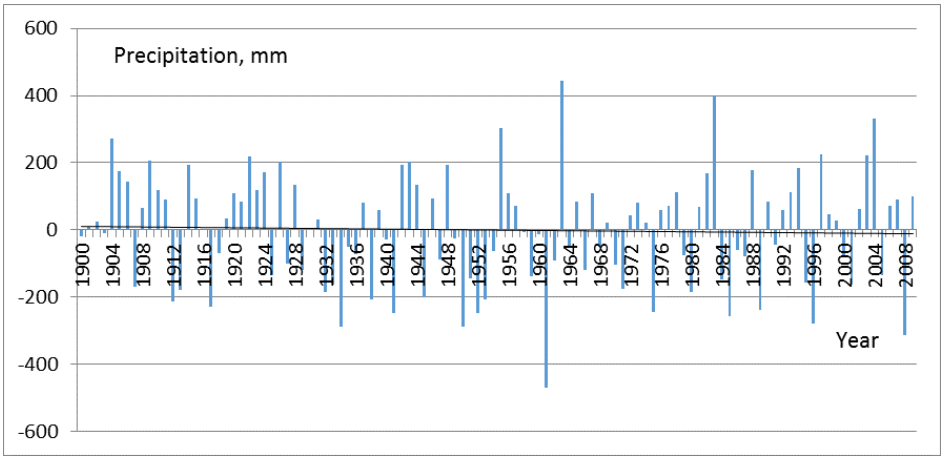


Figure 8: *Precipitation hesitation dynamics in Shaki-Zagatala economic region in 1900 – 2010 (mm). Picture 8 shows negative value of rainfall, how many it is below than norm (ie, expresses rainfall hesitation).*

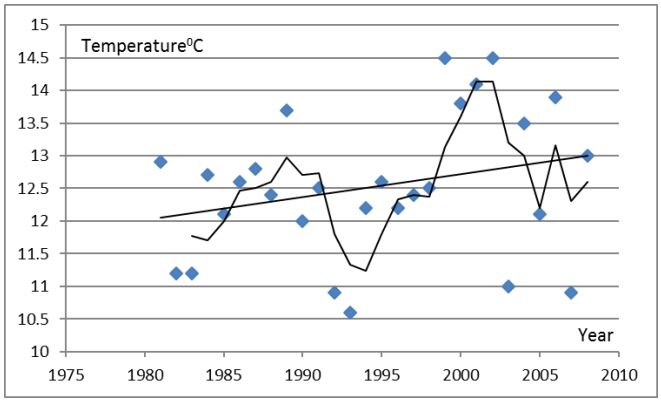


Figure 9: *The dynamic of average air temperature (0C) in Azerbaijan in 1981 -2008*

Result

The article is dedicated to one of the modern demands of the day, the implementation of struggle measures against damages caused by global warming. For this, for every climate change period (by taking into account climate changes) new strategy is suggested.

In the example of Azerbaijan territory, wheat production dynamics was analysed, increase tendension of the increase was defined out. The ways of calculating supposed risks of nature evets that can influence on productivity are shown.

The calculation of repetition risks of atmosphere processes is one of the main conditions for predicting productivity.

Discussions and suggestions

One of the issues that takes attention is generally, global warming does not influence on productivity decrease, but in some cases, causes productivity increase. That is why, for each climate change period it is suggested to prepare definite adaptation proposal programme.

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