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UDC 630

THE FORECAST OF THE FOREST FIRE SITUATION IN KHANTY-MANSIYSK AUTONOMOUS OKRUG BASED ON THE CLIMATE DATA FOR THE LAST 40 YEARS

SUMMARY. The article is devoted to the tendencies of a change in the temperature of air and amount of precipitation of the territory of Khanty-Mansiysk autonomous region in the period from 1970 through 2009. Are as a result revealed an increase in temperatures, reduction in the amount of precipitation, increase in the warm period of year. This made it possible to give the extended forecast of forest-fire situation to the territory of region as unfavorable that has the tendency of an increase in the quantity of centers and region of forest fires.

KEY WORDS. Khanty-Mansiysk autonomous region, air temperature, amount of precipitation, forest fires, warming of the climate.

In the plains and areas distant from the ocean in Khanty-Mansiysk Autonomous Okrug, the main natural hazards are floods due to the spill of the Irtysh and the Ob and forest fires, which are of particular importance because of the vast territory, large areas of woodland and a poorly developed road network.

The number and size of forest fires in the area vary dramatically from year to year, which is highly dependent on the air temperature and the presence or absence of precipitation.

In V.G. Tryastsyn and E.V. Viktorova's work [1] it is shown that the most part of forest fires occurs during the hot and dry periods of summer. Such weather from the maximum air temperature of +30°, +33° and the deficiency of precipitation was characteristic for the Autonomous Okrug in summer 1989. It was the time when an unprecedentedly difficult fire situation developed. The number of fire points then reached 2.5 thousand; they covered the territory of nearly 600 thousand hectares, having repeatedly exceeded mean annual indicators (550 fires in the area of 24 thousand hectares).

In subsequent years, the forest fires on the same scale were not observed in the area, but one can expect a similar situation, taking into account the current global warming.

Nowadays most scholars support the theory of global warming. However, there are arguments as to the natural or anthropogenic factors of global warming and the possibilities of predicting the climate changes. According to the information given in work [2], in the last 100 years, the average global surface temperature has increased by 0.74°C, and its rate is still increasing.

G.V. Gruza and E.Y. Rankova [3] point out that the territory of Russia is more prone to global warming than the globe in general, and the warming trend in this territory can be seen throughout all the seasons except winter in Eastern Siberia.

In works by O.A. Anisimov and others [4], it is noted that not all of the administrative regions of the Russian Federation are homogeneous with respect to ongoing and expected future changes in air temperature. The secular trends in the mean annual temperature, calculated for the years 1900-2004, range from 0,5°/100 years in the north of European Russia to 1.4-1.6°/100 years in the Seaside (Primorye), in the south of the Urals, Siberia and Far East.

In the work of V.P. Meleshko and others [5], the results of calculations of the future climate change in Russia, combined from the 16 global general circulation models of the atmosphere and ocean, are given. They show that in the XXI century the mean surface air temperature in Russia will continue to rise faster than the global. The greatest warming is expected in Siberia and the northern regions of Russia, as well as in the Arctic.

Climate warming leads to increased forest fire risk. I.M. Shkolnik and others in work [6] indicate that the conditions of the current climate in Russia influence the frequency of days with extremely high fire risk, which is 1-2 days in 20 years. Under these conditions there are extremely intense forest fires, when large areas of forest are burnt down. The calculations of the CGO (Chief Geophysical Observatory) showed that the frequency of such conditions in the XXI century is going to increase.

Rather sustainable meteorological observation (since 1893) in Khanty-Mansiysk, helps to evaluate the changes in temperature over time. The analysis of the meteorological data of Khanty-Mansiysk shows that not only average annual but also average monthly temperatures change during the year. The average annual temperature has increased from -1.7° in the period of 1893-1935; to -1.3° in the period of 1970-1999. All warm years (with an average temperature above 0°) have been observed in the last two decades. [7]

The current research analyses the average monthly air temperature, annual and monthly precipitation for the 40 years from 1970 to 2009 in eight meteorological stations in the district, located in the south-west and north-west (Leushi, Berezovo), in the central part (Khanty-Mansiysk, Octyabrscoe, Ugut), in the east district (Larjak) and in the west — near the Ural Mountains. This climate information was obtained from public databases RIHMI (Russian Hydro Meteorological Data Research Institute) (http:www.meteo.ru/climate/) and includes all the weather database of the Autonomous Okrug. In addition, the same characteristics were considered at stations, located outside the district and near its boundaries: Halyasavey (Yamal-Nenetskiy Okrug) and Alexanderovskoe (Tomsk Region).

The analysis showed that for all the stations studied the average air temperatures have been increasing, and the linear tendency ranges from 1.0°/40 (Berezovo) to 1.9°/40 (Ugut) (Table 1).

Table 1

The tendency of changes in average air temperature for the period of 1970-2009 (°C/40 years)

№	Meteorological stations	Year	May	October
1	Berezovo	+1.0	+2.8	+4.0
2	Octyabrskoe	+1.5	+3.1	+4.2
3	Khanty-Mansiysk	+1.7	+3.8	+4.0
4	Leusha	+1.4	+3.2	+3.8
5	Ugut	+1.9	+4.0	+4.0
6	Laryak	+1.6	+4.3	+3.6
	Meteorological stations near the Ural Ridge			
7	Nyaksimvol	+1.5	+2.7	+4.5
8	Saranpaul	+1.3	+2.1	+4.6
	Meteorological stations outside of Khanty-Mansi Autonomous Okrug			
9	Halyasovey	+1.1	+3.8	+3.5
10	Aleksandrovsk	+1.7	+4.3	+3.6

In most months, the average air temperature has a positive tendency, with the exception of December, having a negative tendency in all the stations, and mostly detrended April and November.

The general upward tendency of the average air temperature is clearly observed in May (in 2.8-4.3°/40 years) and in October (3.6-4.2°/40 years) (Table 1), which indicates the increase of the warm season in the Autonomous Okrug. The analysis of the time period of accumulation of snow cover, conducted by station Khanty-Mansiysk for the same period (1970-2009), shows a marked tendency to shift to a later date, and this fact confirms the conclusion about the increasing warm period (Fig. 1).

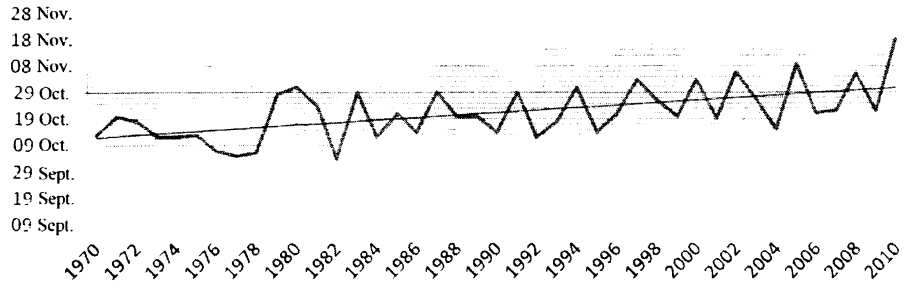

Fig. 1. The time period of accumulation of snow cover at station Khanty-Mansiysk

The increasing warm season leads natural expansion of the forest fire period. A good example of this is the forest fires in 2011. While in the previous years, the first fires in the district were observed in May (in the northern part of the county — in June), in the year of 2011 the first fire occurred in April. Fires usually end in September, whereas in 2011, the last recorded fire happened on October 3rd.

The analysis of monthly precipitation, another major forest fires characteristic, showed that the majority of the stations faced a reduction in the total amount

of rainfall in June and July, reaching 50% of the average amount in the central part of the district. The deviation from the general pattern was found in the foothill Saranpaul station exception. A slight increase in summer precipitation there can be explained by the influence of the Ural Mountains (Table 2).

The decreasing tendency in precipitation in the central months of the warm period also leads to deterioration of the forest fire situation.

Table 2

The total and size of the precipitation tendency of June-July 1970-2009

№	Meteorological stations	Total precipitation (mm)	Size of the tendency (mm/40 years)
1	Berezovo	130	- 17
2	Octyabrskoe	141	- 16
3	Khanty-Mansiysk	135	- 71
4	Leusha	132	- 13
5	Ugut	140	- 54
6	Laryak	144	- 23
7	Nyaksimvol	137	- 5
8	Saranpaul	130	+19
9	Halyasovey	131	- 44
10	Aleksandrovsk	129	- 38

Thus, the temperature and precipitation data analysis for the past 40 years revealed the increase of the warm season and the decrease of precipitation in the central summer months with the overall warming, which makes it possible to predict an unfavorable forest fire situation with a bigger number of fire points on the territory of Khanty-Mansiysk Autonomous Okrug.

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