Reoccurence of droughts on the territory of Belarus in current climate changes

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Drought conditions are characterized by the lack of rainfall exceeding 5 mm per day for more than 30 days, with high air temperature (over 25 ºC in the day time) during at least half of this period. A drought in Belarus is a period when air temperature exceeds 25 ºC with relative humidity less than 30 % for 5 consecutive days. Such conditions are recorded almost annually.

On the territory of Belarus a dry month can be any one from May to September (it occurs once every 5–10 years on average), 2 consecutive months can be dry once every 10–15 years. Annually Belarus experiences 3–4 periods with no precipitation for 10 days, one period of 20–25 days every two years, one period of 30–35 days every 10 years. Droughts are most often observed in the central and southern parts of Belarus, in the south and north of the country in July, in the center and north of the country in August, in the center and in the south in September.

In May dry conditions are most often observed in Gomel region (12% of the days). In June Gomel and Mogilev regions have droughts more often than the other regions of the country (30 and 28% of all the days with droughts), they rarely occur in Brest and Vitebsk regions (9 and 3% of all the days with droughts, respectively). In July dry conditions are most often recorded in Vitebsk and Brest regions (63 and 59%, respectively). In Minsk and Grodno regions nearly 15 days can be dry in August. The least number of dry days is in September. The duration of dry season is from 7 to 60 days or more.

Droughts are characterised by dry and hot weather, air temperature reaching its maximum. The analysis of air temperature extremes with their considerable space-time variability can be of practical use. Extremely high air temperatures cause serious problems for the economy of Belarus. In particular, agriculture becomes vulnerable as crops perish due to droughts.

Maximum air temperatures registered on the territory of Belarus reached 35.0–38.0 °C. Table 1 shows the ranked values of absolute maximums of air temperature.

The drought in July–August 2010 resulted in round-the-clock maximums exceeding 30.0°C over most territory of Belarus for a long time. 15 meteorological stations registered a temperature record ever observed during the whole period of instrumental observation. At 7 stations absolute maximum of air temperature exceeded 38.0 °C (Table 1). Maximum value of 38.9 °C was reported for Gomel in August 2010. Most of the weather stations with the temperatures over 36.0 °C are located in the east of the explored area.

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The analysis of time series (1950–2013) of extreme temperatures definitely points at their cyclic recurrence. Fig. 1 shows the curves of 5-year moving average for regional centers of Belarus. The 11-year cycle stands out against long-period variations, which hints to look for connection between droughts and solar activity.

Climate scientists point out a significant increase in anomalies of summer temperatures since 1977 in the Northern Hemisphere. A proof for this is Figure 1 showing an abrupt rise in positive extremums for the territory of Belarus during this period.

t. °C	Month	Year	Meteorological station
38.9	August	2010	Gomel
38.8	August	2010	Kostyukovichi
38.7	August	2010	Gorki
38.5	August	2010	Chechersk
38.2	August	2010	Orsha, Lelchitsy
38.1	August	2010	Bragin
37.9	August	2010	Oktyabr
37.8	August	2010	Vitebsk, Slavgorod, Zhlobin
37.7	August	2010	Krichev
37.6	August	2010	Vasilevichi
37.5	August	2008	Lelchitsy
37.4	August	2010	Senno, Lelchitsy
37.3	August	2008	Gomel
36.8	August	2010	Mogilev, Vasilevichi
36.7	August	2012	Vasilevichi
36.7	July, August	2007	Lelchitsy
36.6	July	1959	Brest

Tab. 1: Ranked values of absolute maximums of air temperature in 1950–2013

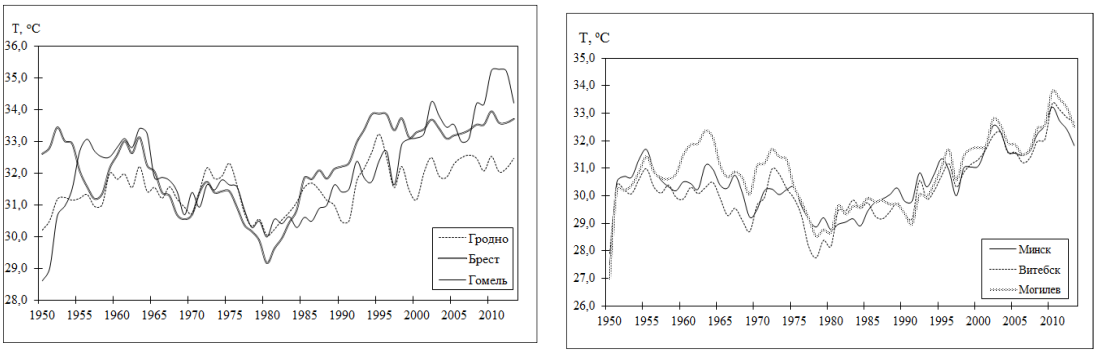

Fig. 1: Curves of moving average of 5-year absolute extremums of air temperature for regional centers of Belarus

As a result of the analysis of long-term series of extreme air temperatures (1950–2013) there have been established respective linear trends which reflect the tendency of temperature changes (Tab. 2).

Positive trends for extreme air temperatures are observed at all the meteorological stations. Maximum temperatures over the territory of Belarus are growing at the speed of 0.01–0.04 ºC per year. A certain zonation is characteristic for the nature of increase in temperatures (Fig. 2).

Met. Station	Maximum air temperature
Mogilev	T=0.018t+30.283
Minsk	T=0.026t+29.723
Brest	T=0.034t+31.139
Gomel	T=0.031t+31.128

Tab. 2: Linear trends of changes of extreme air temperatures, º C

The zoning displays the tendency of leveling extreme positive air temperatures over the territory of Belarus. The registered changes correlate with global processes caused by global warming in the Northern Hemisphere. They correspond to losing some features of continental climate in Belarus.

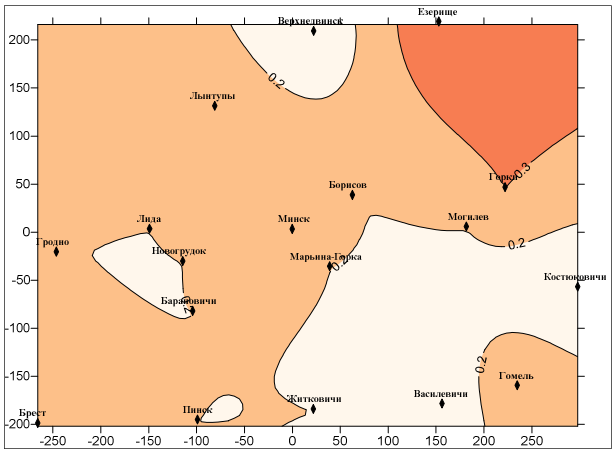

Fig. 2. Gradient showing changes of maximum air temperatures, ° C /10 years

The research has defined space-time variability of extreme temperature regime on the territory of Belarus. The current changes in maximums of air temperatures are of statistic importance. They are not uniform over the area of the country, which is caused by peculiarities in air circulation and local differences in underlying surface. Drought recurrence tends to increase.