

WEATHER EXTREMES AND THEIR RELATION WITH CYCLONIC CIRCULATION OVER THE TERRITORY OF BELARUS



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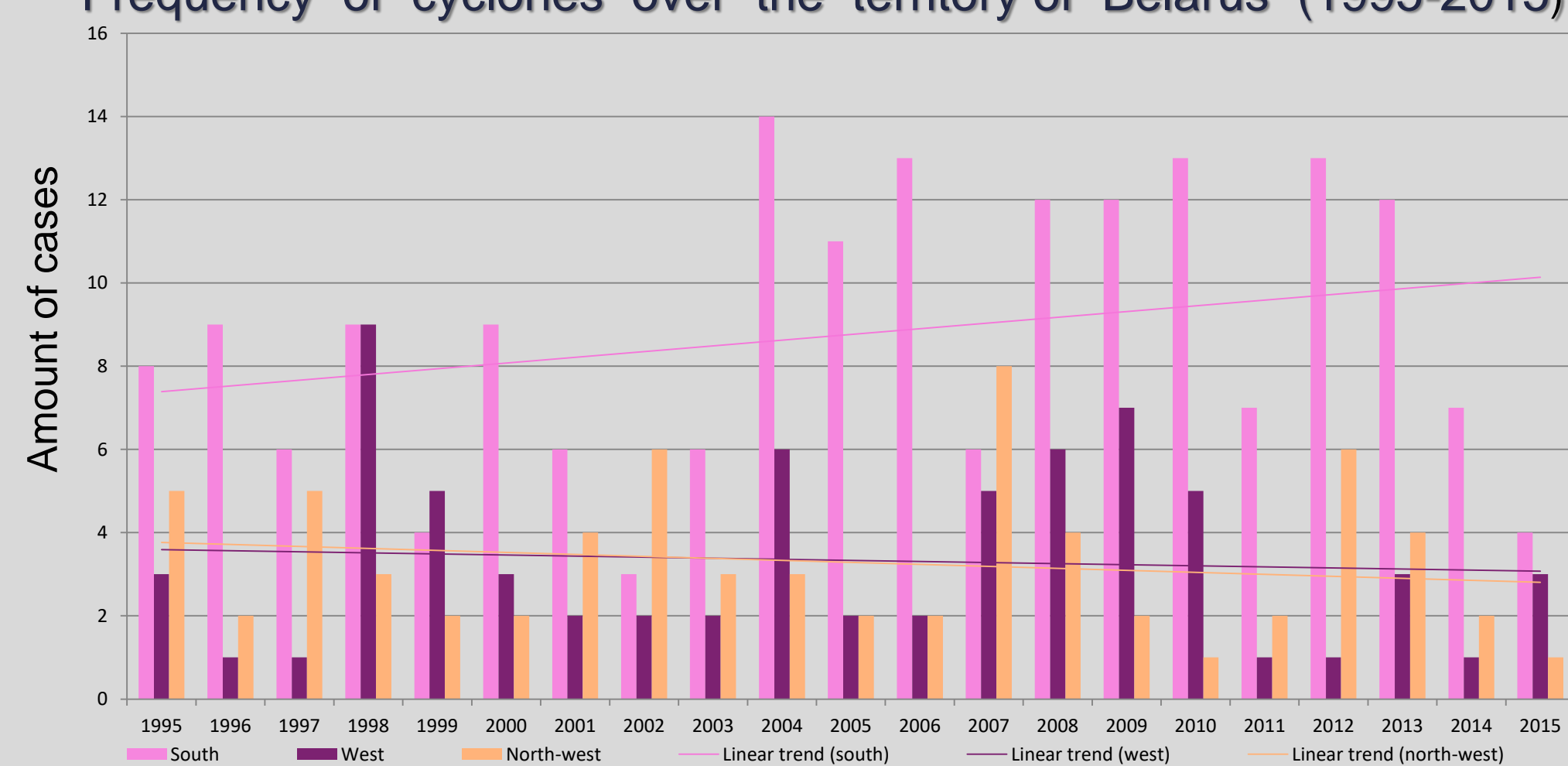
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INTRODUCTION

Weather extreme events are registered over the territory of Belarus every year. They are originated under the influence of various natural factors or their combinations, and have a damaging effect on people, agriculture, economic objects and the environment. In last years the economic losses of the country are increased due to more frequent cases of their manifestation. As a result of the destructive squalls the lodging of grain crops was observed over the territory of agricultural enterprises, the trees were killed in forestry and the power lines were becoming unusable in the communal services. The establishment of patterns of formation and spatio-temporal changes of weather extremes becomes particularly relevant and has practical significance.

As known, the most of weather extremes, causing serious material damage, arise in the area of cyclonic circulation. Intensity of cyclonic activity in the center of Europe depends on dynamics of main baric centers in atmosphere of the North Atlantic (described by NAO) and location of main tropospheric flows. Therefore, the current climate changes might influence to trajectories and intensity of cyclones and consequently for the emergence of weather extremes.

Frequency of cyclones over the territory of Belarus (1995-2015)



Frequency of cyclones, which caused weather extremes over Belarus



Half cases of western cyclones, which caused weather extremes, were observed in July and August. In winter months and transitional seasons of the year the cyclones of western origin didn't cause the weather extremes events. The western cyclones mainly caused squalls, very intensive snowfalls and showers. The highest frequency of very intensive showers was observed in summer months as a result of deep convection on atmospheric fronts. An average 2 cases of weather extremes were noted in each western cyclone.

The cyclones of western origin, which caused weather extremes events over Belarus during the study period, were formed mainly over Atlantic Ocean.

OBJECTIVE

The objective of the study is analysis of trajectories and frequency of cyclones, which were moving by the territory of Belarus during the period of 1995-2015 and connected with them weather extremes.

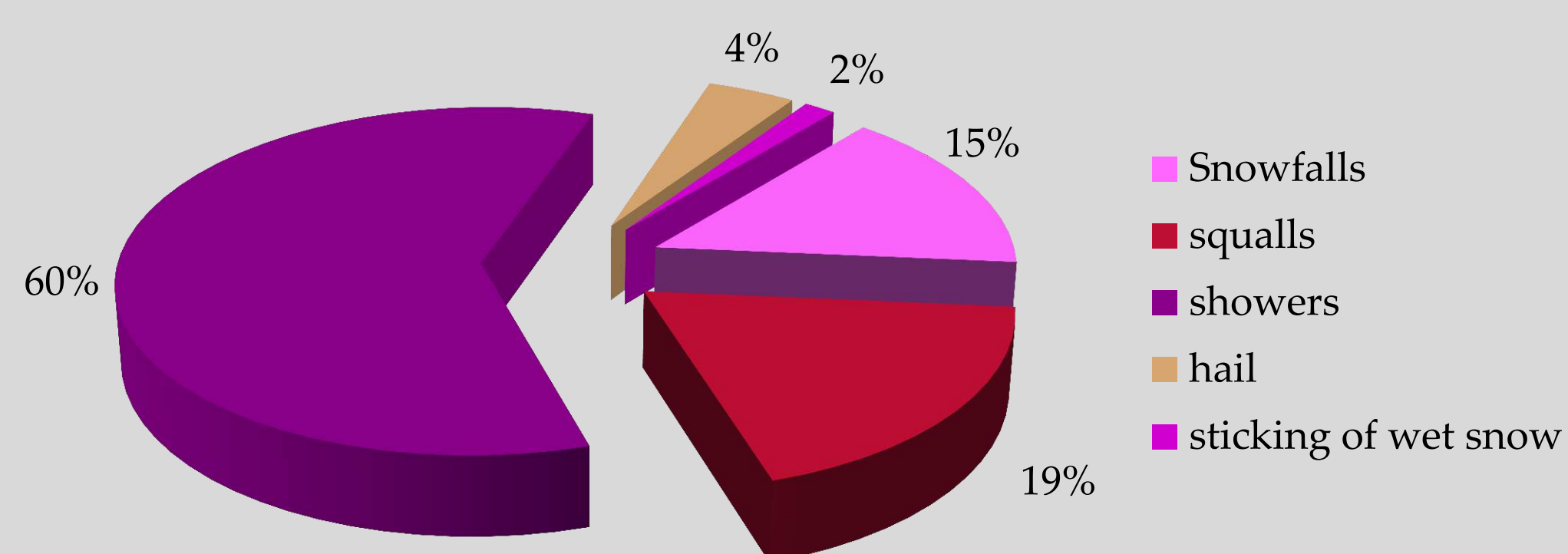
MATERIALS AND METHODS

The study was conducted in two phases: at the first phase by dint of methods of synoptic analyses a cyclone database was created for the period of 1995-2015 and then at the second stage it has been identified the relation between weather extremes and the trajectories of cyclones.

For the analysis of structure pressure fields were used two types of data. For the period of 1995-2003 - ECMWF ERA-Interim Reanalysis (1.5x1.5°), interval 6h; 2004-2015 - surface pressure field of Offenbach weather center (Germany), interval 6h. The obtained results we visualized on the basis of a graphic package GMT (Generic Mapping Tools) (<http://gmt.soest.hawaii.edu/>).

The database of weather extremes was used from the weather stations of the Republic of Belarus for the period of 1995-2015.

Frequency of weather extremes in southern cyclones



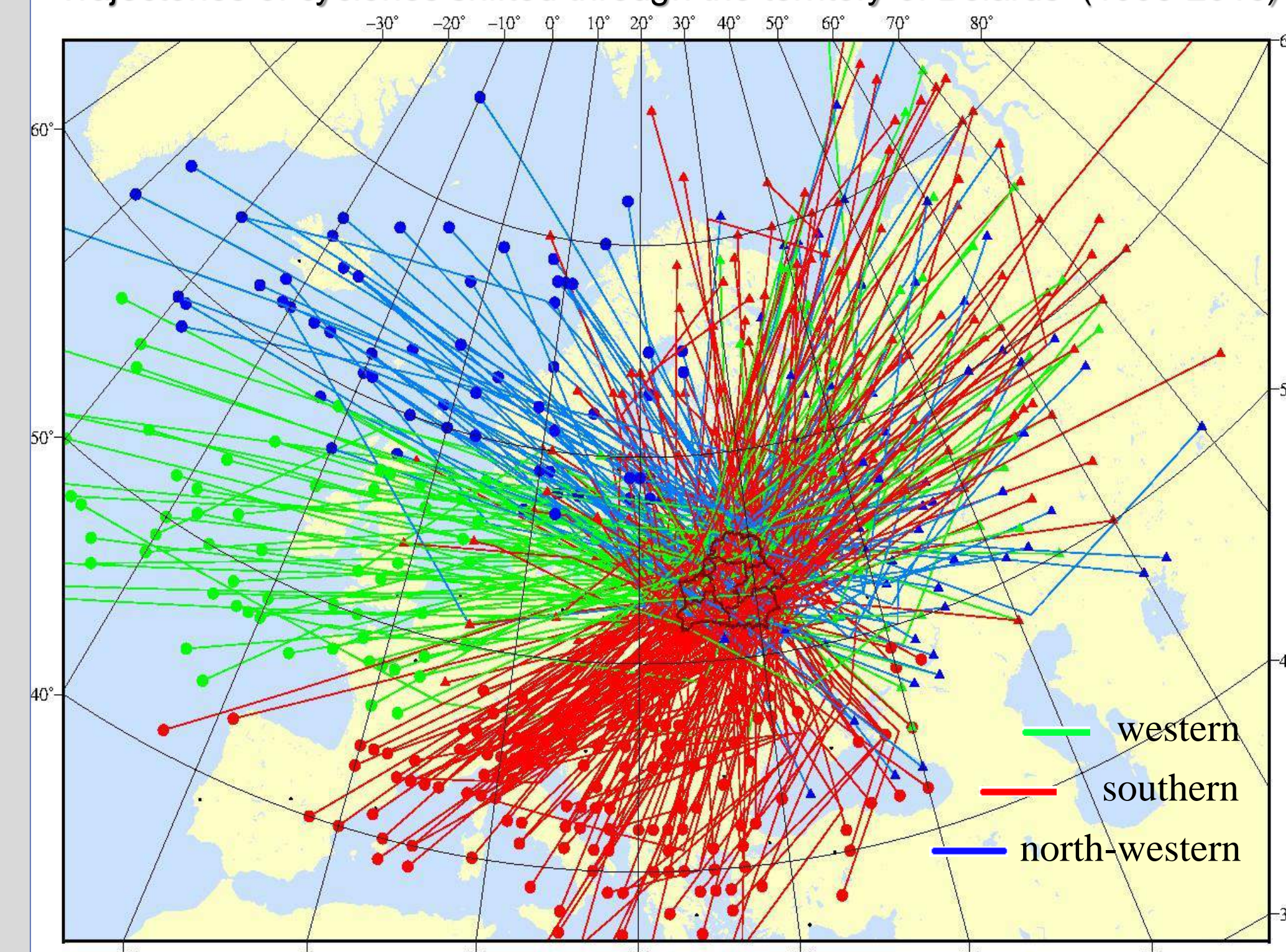
The maximum of southern cyclones, which caused weather extremes was observed in 1996-1998, 2008, 2009 and 2013 - 5-7 cases, minimum number - in 2001, 2003, 2011 and 2015 - 2 cases/per year. The western Atlantic cyclones which caused weather extremes were observed in 1998 and 2004 - 2 cases, in other years - 1 case/per year.

The highest frequency of southern cyclones, which caused weather extremes, was observed in warm season (from May to August), an average about 10-11 cases and was associated with the severe convection (showers, thunderstorms, squalls, tornadoes, large hail).

The most part of southern cyclones accompanied of weather extremes events was formed over the Western Mediterranean, the Gulf of Genoa and Hungarian and Danube lowlands. Minimum cyclones were shifted from the Aegean Sea and Crete.

RESULTS

Trajectories of cyclones shifted through the territory of Belarus (1995-2015)



During the studied period 329 cyclones moved over the territory of Belarus. So, about 15-16 cyclones per year affected the weather conditions. 22% were of western and northwestern types of cyclones separately, 56% constituted southern cyclones. The maximum number of all types of cyclones (21-23 cases per year) observed in 1998, 2004, 2008 and 2009. Minimum of cyclone activity (about 10 cases) was in 2015.

The cyclones accompanied by weather extremes constituted 23% of the total number of cyclones, the southern cyclones amounted 66 cases, the western cyclones - 10 and north-western cyclones didn't cause the weather extremes.

CONCLUSIONS

The study showed, that cyclonic activity over the territory of Belarus during the period of 1995-2015 was very intensive that indicated by high frequency of cyclones.

The main part of weather extremes events, which were observed over the territory of Belarus related to the cyclonic activity. The most of them associated with cyclones of southern origin in all seasons of the year.

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