

EXTREME SNOWFALLS IN RUSSIA

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ABSTRACT: There are few homogeneous snowfall data records to draw a conclusion about their changes. This happens because of difficulties in studying snowfall data characteristics. Extreme snowfalls, as a phenomenon, have a high development potential. Extreme snowfalls create snowdrifts, isolated houses and blocked roads. Rightly to split extreme snowfalls in terms of geographical distribution, duration and intensity and manifestation time. The analysis of snowfalls have already given an opportunity to organize data from different sources of extreme snowfall in terms of geographical location.

KEYWORDS: extreme snowfalls, snowpack in Russia, snowfall.

INTRODUCTION

The work is devoted to one of the topical problems of physical geography and glaciology, the study of the snow cover and its components in modern conditions of a changing climate. Snowfalls are one of the most important factors in the formation of snow cover. In meteorology it is customary to allocate the following kinds of snowfalls: weak, medium and strong. "Extreme snowfalls" is a term rarely used by specialists. In the work it is considered as one of the most dangerous natural hydrometeorological phenomena determined by the maximum and minimum amount of solid precipitation for a given territory under given conditions and has a negative impact on the life of the population and economic activity. The goal set for the work is topical and its solution is aimed at studying and preventing the effects of heavy snowfalls.

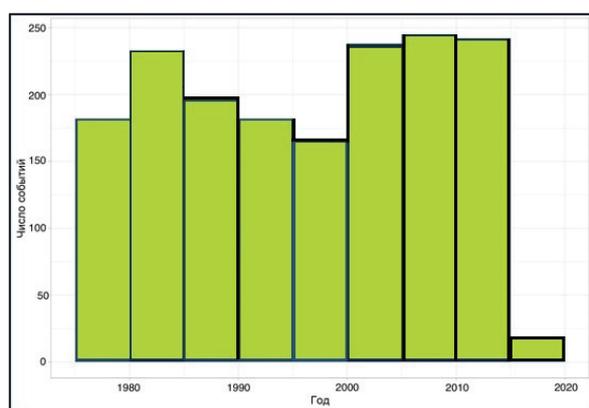


Figure 1: The number of extreme snowfalls in Russia in the period 1970-2015

The extreme snowfalls data obtained by various methods are used in the work. When studying extreme snowfalls and the snow cover in general or its characteristics, the following methods are

used: geographic (snow measuring works, snow avalanche and structural-stratigraphic methods), cartographic meteorological studies of snowfalls, a technique for identifying extreme snowfalls in the meteorological data, collecting historical data and modeling.

Methods are constantly being improved and used for various purposes. Some methods are part of the current regulatory documents that should be used in research. As a rule, different versions of the same methods are used for different research directions, which complicates the generalization of the results.

Snowfalls are usually distinguished by several parameters: according to the synoptic situation; the state of the sky; the magnitude; the bulk density; the speed of fall; the form and humidity of the falling particles. Analyzing these parameters in combination with data on snowfalls it became clear that snowfall can become extreme regardless of these parameters. Snowfalls are characterized by intensity, it is believed that the duration of the snowfall is usually inversely proportional to its intensity.

The sensitivity of snowfalls to climate change is well traced, but there are very few homogeneous snowfall data records in order to judge these changes due to the difficulties in studying snowfall characteristics. Extreme snowfalls as a phenomenon has a high development potential. They generate snowdrifts isolating houses and blocking roads.

It is fair to distinguish extreme snowfalls in terms of geographical distribution, duration and intensity, time of manifestation. With the coincidence of several meteorological parameters, snowfalls become disastrous for the population due to the

fact that dwellings in the tropical regions are not designed for cold weather, and the constructions are made of materials incapable of withstanding snow loads. Snowfall in an unexpected time can affect even the territories well-prepared for the phenomenon. Extreme snowfalls are sometimes very dangerous due to the fact that they can continue for a long time and in the absence of a sufficient amount of equipment there are difficulties with combating snow blanket.

The study revealed that extreme snowfalls occurred constantly and caused no less damage than other natural disasters. Snowfalls sometimes end in catastrophe, and even now such cases are not unique, which once again confirms the insufficient knowledge of the snow cover, which determines the conditions of crops wintering and the depth of soils seasonal freezing.

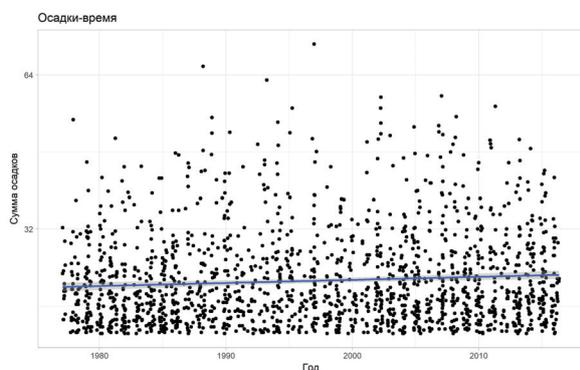


Figure 2: Allocation of extreme snowfalls cases in the the period 1977-2015.

Comprehensive study and observation of the snow cover is also of great theoretical and practical importance because in the case of the early, abundant or geographically extreme snowfalls difficulties may arise for the population, infrastructure and transport operation, and as a result of significant snow accumulation and its subsequent sudden melting the danger of flood as well as other consequences is high.

The work carried out allows us to draw the following conclusions:

1. Current climate change causes the increase in the number of extreme snowfalls and their occurrence in regions previously unaffected by such phenomena,

which is not always reflected in existing maps and in regulatory documents.

2. Snowfalls are one of the most urgent problems especially in the city characterized by heavy traffic. The abundant precipitation leads to congestion on the roads and difficulty in a growing number of cars movement, which is a serious problem throughout the territory of Russia. Economic damage from the effects of heavy snowfalls often exceeds the cost of timely snow removal. Local residents suffer from a power outage or emergency services inability to drive trough.
3. It is necessary to adapt the economic activity of people in the conditions of climate change and extreme snowfalls. For example, construction should be carried out using more advanced structures for increased snow loads. It is necessary to calculate the required stocks of fodder in the conditions of a sudden snowfall in pre-winter and early spring; to consider a possible change of the prevailing wind direction in the engineering protection of roads from snowdrifts.
4. It is necessary to take into consideration the existing differences in the snowfall criteria for different regions of Russia. Another important factor is the technogenic environment. Under the same conditions snowfalls in cities and towns become extreme more often than in remote regions.
5. It is established that we do not have enough data about extreme snowfalls for their forecasting. It is necessary to record cases for further analysis of the situations of extreme snowfall, its causes, modeling and numerical prediction.

In the course of the work there were also difficulties related to the insufficient amount of data about extreme snowfalls in Russia, insufficient knowledge and lack of statistics. The information obtained as a result of the research helped to deepen knowledge about snowfalls in Russia. It should be noted that in the future it is important to continue research, review the criteria for distinguishing extreme snowfalls for particular regions. I hope this work can serve as a basis for further research, studying the possibility of reducing the damage and finding the most energy-efficient cleaning means from snowdrifts and engineering solutions to minimize losses.

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