



Impact of current climate on soil condition changes in the permafrost zone of Russia

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In the permafrost zone climate changes have a great influence on soil condition. This can lead to negative effects on buildings and infrastructure. In this zone structures are built on frozen soils. Their strength properties depend on their thermal condition.

For research of this problem:

1. The daily data set of soil temperature under natural surface at depths up to 320 cm at the Russian meteorological stations has been prepared. Current version is ending in 2010 (458 stations of WMO).
2. The yearly data set of computed depth of soil seasonal thawing at the Russian stations till 2010 has been prepared (74 stations of WMO).
3. Changes of soils' condition for the last five decades have been researched based on the prepared data sets.

The change of mean annual soil temperature at depths has been researched and soil warming in the vast area for 1963 - 2010 has been shown, the great trends (0,2 - 0,4 /10 years) increase at 320 cm have been found in Western and Eastern Siberia, and the greatest trends (0,4 – 0,5/10 years) have been found in their south part.

The greatest loss of the load-carrying capacity of foundations can be during a warm season.

During the warm season the analysis of soils' temperature trends at depth 320 cm has shown that the greatest soils' warming is observed in south part of Siberia (0,4 - 0,6 /10 years). Trends which are more than 0,6/10 years are found in the Baikal lake area, also in the Amur river region.

So, favorable conditions for increase of seasonal thawing depth in a permafrost zone, especially in its south part, have been shown.

The map of average depth of soil seasonal thawing for 1963-2010 was made. It showed the following: the greatest depths of thawing 300-400 m were observed near the border of permafrost, the smallest depths 50-250 m predominate over the area of continuous permafrost.

Thawing depth changes for 2001-2010 compared with 1971-1980 were researched. Prevail significant increase of thawing depth in Eastern Siberia (increase in 40-120 cm for different stations) and more moderate increase in the north part of the Russian Far East were showed.

Trends of average thawing depth for 1963-2010 have been obtained. The greatest significant positive trends have been found in the north part of Eastern Siberia (3-4cm/year) and also in the Russian Far East (2-3cm/year).

Conclusions:

1. The 40-50 years long observations show soil warming down to the 320 cm depth over the vast territory of the Russia.
2. The general tendency for the increase in the seasonal thaw depth on the vast territory of Eastern and Western Siberia is one of the impacts of the current climate changes.
3. The increase of seasonal thawing depth of permafrost soils in the basement of buildings can lead to deformation of the basements and buildings and their further destruction.