Impact of modern climate changes on soil condition and stability of structures in the permafrost zone of Russia.

<u>Artem Sherstiukov</u>[†]; [†] RIHMI-WDC, Russia Leading author: <u>artem@meteo.ru</u>

Climate change influences on soil condition in the permafrost zone and can have negative effects on buildings and infrastructure, including pipelines, bridges, roads. Structures in this zone are built on frozen soils, the strength properties of which depend on their thermal condition. For research of this problem the following has been done: 1. The daily data set of soil temperatures at depths up to 320 cm at the meteorological stations of the Russian Federation has been prepared. Period of observations at stations is different, the earliest year of data set is 1963, the current version of data set ends in 2008 (available online: http://meteo.ru/english/climate/soil.php). The data set contains information on soil temperature under original surface at depths of 2, 5, 10, 15, 20, 40, 60, 80, 120. 160, 240, 320 cm from 431 stations of international exchange. Original data quality control was performed in creating the data set. 2. Based on prepared data set, changes of soils' condition for the last four decades were researched: A) The change of mean annual soil temperature at depths was considered and soil warming in the vast area for the period 1965 - 2006 was shown, herein the greatest trends (0.2 - 0.4°C /10 years) of the mean annual temperature increase at a depth of 320 cm were found in the southern part of Siberia. It is known that seasonal thawing is only in the warm season. The analysis of soils' temperature trends at depths of 80, 160 and 320 cm during the warm season was carried out. It showed that the greatest warming of soils during the warm season was observed in Siberia and amounted (0.4 - 0.6oC /10 years). Soil temperature trends are (0.5 - 0.6oC/10 vears) at stations in a southern part of Siberia and in the middle Siberiaat depths of 80 and 160 cm. and great trends are (0.5 - 0.6oC/10 years) at stations in south part of Eastern Siberia, near Angara, Pribaikalia and Transbaikalia at a depth of 320 cm. Thus, favorable conditions for increase of seasonal thawing depth in a permafrost zone has been shown. B) Change of seasonal thawing depth was considered. Changes of the seasonal thawing depth in population places in Siberia, vulnerable in terms of increase of the depth of seasonal thawing, were submitted. In Zhigansk the depth of seasonal thawing in 1965 - 1969 was about 210 cm, by 2001 - 2005 it increased for about 60 cm, at present about 270 cm and it reaches the base of the foundations of the buildings and structures that were built earlier. This leads to an increase of cases of basement subsidence. In Verkhovansk the seasonal thawing depth has increased for about 40 cm. Such an increase also leads to a significant decrease of stability of buildings and infrastructure constructed in the past. In Norilsk, the seasonal thawing depth was increased approximately by 80 cm for the period 2001 - 2005 in comparison with the period 1977 - 1981. The increase in the number of buildings in Norilsk, received various kinds of damage because of uneven basement subsidence for the period under review, is mentioned in various researches. General tendency of depth increase of seasonal thawing in Siberia is the result of climate change. The increase of seasonal thawing depth of permafrost soils in the basement of buildings creates a deformations of the basements and buildings and their further destruction. In some population places from 10 to 80% of the buildings are in a dangerous condition.