Geophysical Research Abstracts
Vol. 19, EGU2017-1522, 2017
EGU General Assembly 2017

Cryogenic disturbance and its impact on soils of frost boil ecosystems of Taz peninsula, West Siberia

Alexander Myshonkov, George Matyshak, and Natalia Petrzhik
Soil Science Faculty, Moscow State University, Moscow, Russian Federation

For the last years there is an active development of permafrost zone, which is about 60% of the territory of Russia. More than 15% of this area belong to different types of tundra. Frost boil ecosystems, the formation of which is associated with the cryogenesis and cryogenic disturbance processes are one of the most specific tundra landscape. Such landscape forms of tundra ecosystems cover the area over 68000 sq. km - 20% of total Russian tundra area. Cryogenic processes leading to the formation of patterned ground (such as frost boils, non-sorted circles, ice-wedge polygons) are important mechanisms, which control the landscape distribution of soil and phytomass carbon in continuous permafrost terrain. Frost boil ecosystem's properties have been poorly studied. So, the aim of this work is to explore the functioning parameters and properties of frost boil soils.

The object – frost boil ecosystems, - is located in the southern tundra of Taz peninsula, about 150 km north from Novy Urengoy (57°28 ′50,6″ N, 76°42 ′32,6″ E). Frost boils are small (0,5-2 m diameter and 5-15 cm height), barren, non-sorted circles separated by completely vegetated (moss-lichens and shrubs) troughs - interboils.

Our monitoring section (100 sq. m.) was set on a typical frost-boil landscape. Within this area we obtained moisture content and temperature of upper layer (0-10 cm), active layer depth, CO_2 flux. This analyzed site includes more than 40 frost boils. Measurements were made both on boil and interboil patches in 10-20 replicates. Samples were taken both from frost boils and interboils upper layers as well as from horizons two soil pit profiles. Different soil parameters were obtained by laboratory analysis: pH (1: 2,5), BR, SIR (Anderson, 1978), TC, DOC (Kalbitz, 2003).

It is estimated that total area with frost boils is approx. twice larger than troughs area with vegetation cover within the monitoring site. The soil properties of frost boil and interboil are significantly different. Frost boils have lack of vegetatio and, as consequence, no organic matter in uppers pit horizons. We find organic horizon in interboil areas – it can be up to 15 cm height. Frost boils have higher moisture and temperature levels: 25,6 ±6 % and 12,5 ±0,8 °C, as compared with interboil areas: 15 ±4 % and 8,5 ±0,8 °C. Active layer is found on an average depth of 125±5 cm under the frost boils to 110±5 cm under the interboils. Chemical analysis shows that pH varies from neutral values at the bare spot (∼ 6-6.2) to a slightly acidic at microdepressions (∼ 5-5,3). These differences lead to the contrast in biological activity: CO_2 flux is higher in the troughs than in spots (193 and 55 mg*m2/hour, resp.). BR results are the same: it is higher in troughs than in spots more than 10 times.
Cryogenic processes actively influence on the soil formation and redistribution of substances in studied ecosystems. These facts of influence should be considered in different calculations.