Geophysical Research Abstracts
Vol. 13, EGU2011-597, 2011
EGU General Assembly 2011

CO2 emissions from cryogenic soils Asiatic Russia

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On the frozen soil as a source of CO2, we should say especially since they occupy a significant portion of Russia and their importance in the total emissions can not be underestimated. In the case of high-latitude warming ecosystems may become the objects of the flow of CO2 (what they are now) in his powerful source (Oechel et al., 1993). For maximum rating, permafrost and active layer of cryogenic ecosystems contain about 25% of the global soil carbon pool (Billings, 1987; Oechel, Vourlitis, 1994). With increasing temperature, air and soil, much of this carbon can go from a bound state in carbon dioxide atmosphere (Billingsetal, 1982). In addition, the permafrost sequences already has a free carbon dioxide, the output of which on the surface is currently blocked by permafrost (Fedorov-Davydov, 1993). It follows the important role of cryogenic ecosystems as potential sources of carbon emissions in response to climate change, and especially temperature.
Objects of study is the meadow-chernozem cryosoils (Corg 4.0%; 7.0) soil of south Vitim's plateau (520 71'N 111056'E), meadow long seasonally freezing through (Corg 4.2%, pH 7.5) - delta of Selenga basin of Lake Baikal (520 05'N 1060 62'E) and meadow-chestnut soil it is long seasonally freezing (Corg 2.4%; 7.4) – of Selenginskoye middle mountain area (5136'N 10661'E).
Climate of Vitim plateau, like the whole territory of Baikal is extremely continental, average air temperature is -4,1°C. The absolute minimum temperature ranges from -50 to -54°C. This leads to the closure of the seasonally thawed layer of permafrost. The average annual rainfall in the district is 304 mm. Meadow-chernozem cryosoils are formed in the freezing conditions of the mountain-steppe, where the thickness of permafrost reaches 70-100 m and the depth of thaw - only 1.5-3.0 m. A distinctive feature of the studied soils - a manifestation of the processes of cryogenic immobilization of humic substances beyond the root zone. Humus stores in 0-50 sm a layer compound 18 tons on hectare. Delta ecosystem. Selenga developed in several transformed climate due to the influence of Lake Baikal, mainly in spring and summer. Average annual air temperature is-1.2oS. The annual rainfall is 350mm. Climate Selenginskoye middle mountain area typical negative average annual temperature (-1.7oC). With a total rainfall of 280 mm the distribution is extremely uneven, in July-August, falling to 80-90% of the annual amount. Low power snow promotes deep freezing of the soil to a depth of 2.5-3.0 m.
The total emission of CO2 during the growing season of meadow humus soil on average over 3 years was 353 g C/m2. Depending on the nature of use (virgin soil, couples and arable land) meadow humus permafrost soil emission fluxes ranged from 175 to 381 g C/m2. Of meadow soils flow CO2 was - 1160, of meadow-chestnut 633 g C/m2. Our assessment of carbon dioxide fluxes from soils is quite identical to estimates available in the literature for soils of forest-steppe and steppe ecosystems of the boreal zone (Vompersky et al, 2000; Maximov, 2007; Vedrova, 2008).
The correlation between the rate of CO2 emissions and temperature of the topsoil is almost always positive and most closely on the virgin soil (R = 0.72). This relationship is weaker in the sowing and steamed. Correlation between intensity of emission CO2 and humidity of the upper layer of soil less tight (R=0.36). Similar patterns were found when we compared the respiratory activity of meadow soils river delta Selenga and meadow meadow-chestnut soil of Selenginskoye middle mountain area. For all data series are found close positive relationship between average daily intensity of emission CO2 from soils and soil temperature (R = 0.35-0.80). The response of the soils studied at increasing temperature decreases in the following sequence: meadow-chernozem cryosoils > meadow soils > meadow-chestnut soil.
Our data suggest that the expected climate change, reflected in a change of air temperature and soil will have different effects in different climatic zones. For example, increasing soil temperature in permafrost-steppe may lead to a much more marked increase of respiratory activity compared with the soils of dry steppes.