Science in the Arctic Region

Convener:*Sei-Ichi Saitoh(Faculty of Fisheries Sciences, Hokkaido University), Jun Inoue(National Institute of Polar Resarch), Naomi Harada(Japan Agency for Marine-Earth Science and Technology), Rikie Suzuki(Research Institute for Global Change, Japan Agency for Marine-Earth Science and Technology), Chair:Sei-Ichi Saitoh(Faculty of Fisheries Sciences, Hokkaido University)

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The Arctic region and surrounding circumpolar region is the key area for the study of global change because the anthropogenic impact is projected to be the largest in this area due to the complicated feedback processes of the nature. A number of international and interdisciplinary research projects are in progress for the studies on the atmosphere-ocean-land system under the extension program of the International Polar Year (IPY) during 2007 to 2008. In order to understand the feedback processes occurring in the Arctic and to project the global warming in the future, we need to establish the intense observational network and to exchange the knowledge and information by combining the different scientific communities under the common interest of the Arctic. Contributions from Green Network of Excellence (GRENE) Arctic Climate Change Research Project are also welcome.

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Mineralization Rate of Soil Organic Carbon at the Lowland of Indigirka River in Northeastern Siberia

3-min talk in an oral session

*Ryo SHINGUBARA¹, Shinichi TANABE², Shinya TAKANO¹, Ivan BRAGIN³, Jun MURASE⁴, Shunsuke TEI⁵, Trofim C. MAXIMOV⁶, Atsuko SUGIMOTO⁷ (¹Grad. School of Env. Sci., Hokkaido Univ., ²School of Sci., Hokkaido Univ., ³Far East Geological Inst. FEB RAS, Vladivostok, Russia, ⁴Grad. School of Bioagr. Sci., Nagoya Univ., ⁵National Inst. of Polar Research, ⁶Inst. for Biol. Problems of Cryolithozone SB RAS, Yakutsk, Russia, ⁷Faculty of Earth Env. Sci., Hokkaido Univ.)

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The Arctic has a large amount of organic carbon accumulated in the soil. If the enhanced warming under the Arctic amplification leads to higher soil temperature or deepening of the active layer, emission of greenhouse gases, i.e. CO₂ and CH₄ can increase. The decomposition rate of organic matter, which is an important factor of CO₂ and CH₄ emission, depends not only on the quantity of organic matter, but also on that quality. In this work, surface soils from the lowland of Indigirka river in Northeastern Siberia were incubated at constant temperatures (5, 10 ℃) to evaluate the production rates of CH₄ and CO₂ and to know the degradability of the soil organic matter. The study site is around Chokurdakh (70.62 N, 147.90 E) located in the continuous permafrost of Eastern Siberia and situated in the boundary of tundra and taiga. Surface soil layers (ca. 10-60 cm deep) were sampled at 7 points of a drier mound with larch trees and of wetter areas with sedges and Sphagnum spp.. Besides thawed layers (10, 20, 30 cm deep) sampled in July were incubated at Chokurdakh for 8 days anaerobically, frozen soil layers sampled in the early summer of June (13-62 cm) were incubated in Japan for 34-42 days both anaerobically and aerobically. These soils include the active layer (ca. 20-50 cm) and the top of the permafrost of this region.CH₄ production was not detected in the mound soils while CO₂ production was, suggesting areas with dry condition have few methanogens and will not produce CH₄ even if they turn into anaerobic condition. On the other hand, soils from wet areas produced CH₄ (0-0.88 μmol (g dry soil)⁻¹ day⁻¹) and the
production as well as that of CO₂ was more active at the shallower layers, representing larger amount of labile organic matter. The rate of CH₄ production at 10 °C were found to be 0.9-1.1 times of that at 5 °C in the shallower layers (ca. 10-40 cm), while 1.9-3.3 times in the deeper layers (32-45 cm). It indicates that the temperature dependency of CH₄ production is higher in the middle to the bottom of the active layer than in the top layer.