Inter-annual variation in CH_4 efflux and the associated processes with reference to delta-^{13}C-, delta-D-CH_4 at the Lowland of Indigirka River in Northeastern Siberia

Ryo Shingubara[1], Atsuko Sugimoto[1,2], Jun Murase[3], Shunsuke Tei[2,4], Shinya Takano[1], Tomoki Morozumi[1], Maochang Liang[1,*], Go Iwahana[2,†] and Trofim C. Maximov[5,6]

[1]*Grad. School of Envir. Sci., Hokkaido Univ., Sapporo, Japan*

[2]*Fac. of Earth Envir. Sci., Hokkaido Univ., Sapporo, Japan,* [3]*Grad. School of Bioagr. Sci., Nagoya Univ., Nagoya, Japan,* [4]*NIPR, Tokyo, Japan,* [5]*IBPC SB RAS, Yakutsk, Russia,* [6]*BEST center, NEFU, Yakutsk, Russia*

*Present addresses: *School of Horticulture and Garden, Yangtze Univ., China, †IARC, UAF, Fairbanks, USA*

CH_4 emission from Arctic wetlands is recognized as one of the important feedback processes to the climate, and the climatic response of the CH_4 emission needs to be understood and predicted. CH_4 efflux from wetlands is known to be controlled by environmental factors such as water level (soil moisture), soil temperature and vegetation (Olefeldt et al., 2013), while the quantitative relationship between the environmental factors and CH_4 efflux are still unclear, which depends on the region and the time scale (Turetsky et al., 2014; Treat et al., 2007). One difficulty is that CH_4 emission is composed of 3 processes, i.e. CH_4 production, oxidation, and transport; they can respond to environmental factors and affect CH_4 efflux in a different way. Stable isotope ratios of CH_4 (delta-^{13}C-CH_4, delta-D-CH_4) reflect such processes and are available in field under natural conditions (e.g. Chanton, 2005).

Indigirka Lowland in Northeastern Siberia has wetlands in a taiga-tundra boundary on permafrost, whose ecosystem are possibly sensitive to the climate change. We assessed year-to-year variation of chamber CH_4 efflux over 2009-2013 near Chokurdakh (70.62 N, 147.90 E), aiming to understand the relationship between CH_4 efflux and environmental factors based on the 3 processes.

CH_4 efflux was around the detection limit at dry tree mounds through the observation period, while large inter-annual variation was observed at wet areas of sphagnum moss and sedges. Wet event concurrent with the highest precipitation occurred in 2011 and CH_4 efflux increased at wet areas in the same year. Although water level decreased from 2011 to 2013, large CH_4 emission continued. Moreover, dissolved CH_4 concentration in soil pore water (at 10-15 cm depth) increased by 1 order of magnitude from 2011 to 2012 and kept high till 2013. Such variation in CH_4 efflux and in dissolved CH_4 concentration will be discussed in relation to the 3 processes in this presentation.

References

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