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Carbon fluxes change and major carbon sources after palsa thawed into pond

Zheng Wang, Nigel Roulet, and Tim Moore

1Department of Geography, and Global Environmental and Climate Change Centre, McGill University, Montreal, Canada (wzhwangzheng@gmail.com)

Permafrost thaw is pronounced across discontinues permafrost peatland region with the ongoing climate change. My research is assessing carbon (C) fluxes change after permafrost mounts (palsas) thawed into ponds, and the major C source for the thawed pond C fluxes. In spite of shallow water depths (about 3m), the thawed ponds are strongly stratified with a thick anoxic hypolimnion from 1 m to the pond bottoms. The CO_2 flux and most CH4 fluxes from the ponds were positive – i.e. to the atmosphere, while palsas sequestrated CO_2 and CH4 for most of the growing season. The average seasonal loss after palsa thawed into pond is 9.46 mmol CO_2 m-2 h-1 for CO_2, and 1.69 to 2.00 μmol m-2 day-1for CH4. Over season, the middle sized pond had significantly higher CO_2 effluxes, while the smallest pond had significantly higher CH4 effluxes. Bubble emission accounted a large part of pond CH4 emission, with the highest ebullition observed at the pond edges. The diffusion bags showed dissolved CO_2 and CH4 concentrations increased hundreds times from 10 to 50 to 230cm along pond profile, and followed δ13C measures demonstrated there was a CH4 production shift from high acetoclastic methanogenesis to high CO_2 reduction. DOC effect factor which both considered the effects of DOC mass and biodegradability (SUVA/FI) had a very high co-relationship with pond C gas effluxes, which indicated surface pond water DOC may have the main liable C source to support pond C gas effluxes. Based on δ13C in surface dissolved CO_2 and CH4, DOC, peat, sediment and plant roots (the same δ13C of liable DOC), we used isotopic mixed model to quantified show that plant new produced liable DOC was the major C source for dissolved C fluxes in thawed pond. Therefore, Palsas thawed into ponds lead to large amounts of CO_2 and CH4 emissions, and new produced labile DOC from surrounding plants mainly supported thawed pond C effluxes rather than old sediment.