Poster #30

Rain Promotes Methane Production & Methane Oxidation in a Thermokarst Bog in Interior Alaska
TES Early Career Award

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Methane (CH_4) is a potent greenhouse gas, and wetlands represent the largest natural source of CH_4 to the atmosphere. However, 20-90% of generated CH_4 is oxidized to carbon dioxide before emission to the atmosphere, making CH_4 oxidation an important CH_4 sink. In a thermokarst bog located near Fairbanks, Alaska, a two-year field investigation that captured both an average year and the fourth wettest year on record revealed that rain promotes both methane production and methane oxidation. In the wet year, rainwater quickly warmed the entire bog soil profile down to at least 150 cm in depth and collapsed the temperature gradient in the top 60 cm. The warmer soil environment facilitated faster rates of methane production and methane oxidation. The greater rate of methane production in the wet year was fully explained by the warmer peat temperature using a Q_{10}temperature coefficient. However, rates of methane oxidation in the wet year were greater than what could be attributed to warmer peat temperatures. Oxygen concentrations measured with planar optical oxygen sensors installed in the bog showed that, in addition to warming the peat, rain also oxygenated the peat surface. The delivery of oxygenated rainwater to the bog explains increased rates of methane oxidation during the wet year. These results, which indicate that energy and oxygen inputs from rainwater can increase rates of methane production and oxidation in boreal bogs, have implications for how wetland methane emissions may respond in the future to altered precipitation patterns. Advective delivery of energy and oxygen to wetland subsoils via rainwater is not currently a mechanism included in wetland methane models.