Geophysical Research Abstracts
Vol. 12, EGU2010-14093-1, 2010
EGU General Assembly 2010

Methane fluxes at the Biocomplexity Experiment site near Barrow, Alaska during the fall season of 2009

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Arctic tundra is already experiencing altered moisture conditions as a result of climate change, with reports of widespread drying and instances of increased wetness in areas of thermokarst. The altered moisture state of tundra soils will undoubtedly have a significant effect on the future carbon dynamics of the Arctic, which in turn could greatly influence the global carbon balance through feedbacks to the climate system. The Biocomplexity Experiment (BE) on the Arctic Coastal Plain near Barrow, Alaska was initiated to examine the effect that large-scale altered tundra moistures will have on landscape level atmospheric carbon exchange in this region. The BE site is an approximately 0.5 km x 1 km vegetated drained lake basin that has been divided into three sections, where the moisture levels in each are manipulated to represent “dry”, “wet”, and “ambient” soil moisture levels. The research presented here focuses on methane fluxes at this experimental site during the fall season of 2009.

The fall season has been identified as an influential period to the yearly net carbon exchange in Arctic regions yet remains understudied, especially regarding a potentially large fall methane release. To address this research need, open path CH4 (LI-COR 7700) analyzers were deployed at the Biocomplexity Experiment site from August 19 to October 25, 2009 to measure the atmospheric fluxes of methane using the eddy covariance method. Our goal was to examine the nature of fall methane efflux in a vegetated drained lake representative of the Arctic Coastal Plain and compare the efflux between different tundra moisture conditions. We found that the temporal pattern of fall methane release was similar in both “wet” and “dry” conditions, with a gradual decrease in efflux as the season progressed. However, the “wet” tundra emitted CH4 at approximately twice the rate of “dry” tundra, and while the emission of CH4 in the “dry” section had reached approximately zero by the end of the measurement period, the “wet” section was still a small source of methane. The full results of this investigation are presented here along with their implications for seasonal and yearly estimates of methane release on the Arctic Coastal Plain.