B23L-1915 Extreme environmental conditions and their role in carbon dioxide and methane fluxes in forested wetlands.

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Hall EFG (Poster Hall) (NOLA CC)

Abstract

Process-based models are increasingly used to quantify greenhouse gas fluxes from wetlands. However, methane (CH_4) fluxes often exhibit significant spatial and temporal variability, making it challenging for these models to accurately capture temporal dynamics—especially during periods when fluxes deviate substantially from the site average. The CH_4 and carbon dioxide (CO_2) fluxes are driven by a range of environmental conditions, including soil temperature, soil moisture, precipitation, and substrate availability. To better understand the underlying processes controlling CH_4 and CO_2 fluxes, this study explores the relationship between extreme events and these fluxes. Few studies have incorporated these extremes as functional components in process-based models to date. We hypothesize that weather extremes—such as heavy precipitation, prolonged drought, or other similar conditions—are key drivers of unusually high or low magnitude CH_4 fluxes.

We selected wetland ecosystem study sites across the United States that provide both net ecosystem carbon flux (FC) and methane flux (FCH_4) and have >10 years of data. Extreme events are defined by values with absolute z-scores >2, indicating observations that are >2-σ from the typical range of that site. Correlation plots are used to evaluate relationships between extreme events and CH_4 and CO_2? fluxes. Preliminary results suggest that extreme precipitation or temperature events are often followed by elevated CH_4 fluxes, with a lag of roughly 10 to 40 days at some sites; however, most of these findings are not statistically significant. Granger causality tests add support these relationships. Further analysis is being done to fully attribute the functional relationship between the magnitude of carbon fluxes and extreme events. Incorporating these relationships into process-based models

will enhance their predictive capacity and support improved climate-related policy and management decisions.

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