Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.38155

Insights on wetland greenhouse gas fluxes using an open-source monitoring platform

JACOB HOSEN[1], CLARK JACKSON[1] AND ZAVEN ARRA[2]

[1]Purdue University
[2]RRIV

Gas fluxes from soil and water surfaces are critical for quantifying greenhouse gas fluxes, among other ecosystem processes. Existing devices can estimate these fluxes, but the cost of these devices limits the spatial and temporal scale of data collected. This is particularly problematic for ecosystems such as wetlands, where processes can be highly variable across space and time. Researchers have developed lower-cost devices, but most require extensive experience with electronics and embedded device programming. To address these issues, we have developed the RRIV platform. The RRIV data logger is designed to connect to a wide variety of environmental sensors without the need for programming. The device is also designed to serve as a platform for developing environmental robotics, including multiple air pumps used for our portable greenhouse gas flux analyzers. We have also developed and open-sourced 3D-printed designs for the chamber with compartments for the data loggers, gas pumps, and gas sensors. Here we report on methane (CH_4) fluxes in wetlands using our gas flux analyzer equipped with a Figaro NGM-2611 CH_4 sensor. We tested a series of novel machine learning-based approaches for calibration of the NGM-2611 sensor and have developed a set of best-practice recommendations. We used these sensors to evaluate how CH_4 fluxes varied in wetlands in Indiana, Ohio, and Michigan, USA. We examined how water depth and freeze-thaw events impact CH_4 fluxes. Overall, CH_4 fluxes were highest from soils that were saturated, but not covered with standing water. This pattern shifted to sites with standing water following freeze-thaw events. We argue that distributed collection of CH_4 flux data using standardized, low-cost devices will improve estimates of global fluxes and provide new insights into the mechanisms controlling CH_4 emission from wetlands and other ecosystems.