16th Annual CHS MST Magnet Student Research Symposium

Wednesday, May 24th, 2023
6:00 p.m.

hp
BROWN
RIWEST
Portland State University
WYZE
W
Multnomah ESD Outdoor School
MIT Massachusetts Institute of Technology
Orca Behavior Institute
PROactive Physical Therapy Specialists
Vancouver
UC San Diego
Southcoast Health
LSW
TECTONIC
FYZICAL Therapy & Balance Centers
Operation Wallacea www.opwall.com
NorthWest Smile Design

Wednesday, May 24th, 2023

6:00 -7:00 p.m. **Showcase in Main Commons**

- Project viewing
- Refreshments

7:00 - 8:00 p.m. **Presentations in Theater**

- Welcome
- Presentations and Panel
- Awards
- Closing remarks

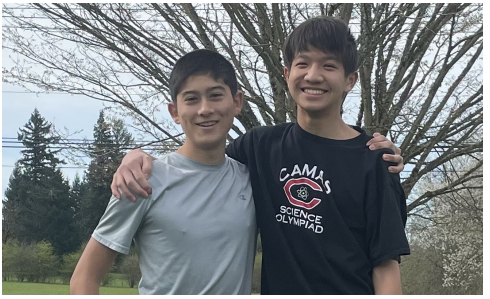
We would like to thank you for being a part of this event!

Freshmen

Effect of Urbanization on Bird Diversity

Gavin Reyes
Duncan McCarthy
Yu-Cheng Liang
Kathryn Sitler

In the past five decades, there has been a decrease of nearly 2.9 billion birds in North America. As urbanization has increased, the biodiversity of avian communities has decreased. The purpose of this study was to confirm the effect of urbanization on the biodiversity of avian communities. The short duration of the study contributed to the small overall sample size. Future research should include multiple cell locations within each study area and more controlled motion-sensing cameras.



Developing a Cost-Effective Desalination Device

Thor Rude
Leo Zhao

Millions of people around the world lack access to fresh clean water. We constructed a low-cost yet effective desalination device that uses solar energy to evaporate water and condensation to collect the resulting fresh water. We tested each component of our design (the wicking fabric, absorbing fabric, and greenhouse plastic) to find the best material for our prototype. We ran our test over a 24 hour period and collected a total of 103 ml of purified water.

Freshmen

Semi-Autonomous Crash Avoidance Car

Evan Gaasch
Thatcher Moore
Justin Chiu

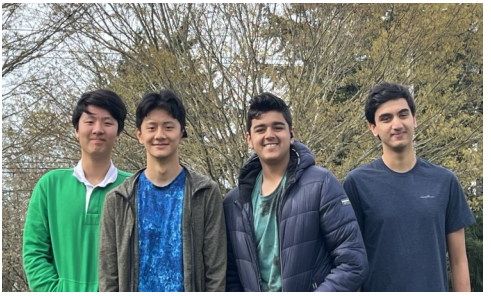
Car crashes are extremely dangerous and cause many fatalities each year. Therefore, most newer cars now use automatic braking systems. To improve upon these systems, we built a car with the ability for more complicated avoidance maneuvers. We used three sensors to detect obstacles and three processors to avoid them. The LiDAR uses light pulses and the ultrasonic sensors use sound waves to calculate distances, and the Oak-D uses cameras to identify objects.

The Effects of Road Salt: How to Mitigate it

Sophie Zhang
Reagan Sheffield
Akhila Pattamatta

Despite its benefits, road salt causes short- and long-term damage to plants, animals, humans, and infrastructure. We compared magnesium chloride, calcium chloride, and porous pavement, against sodium chloride in terms of chloride concentration, ice-melt, price, and road damage by simulating ice formation in four microenvironments. Our analysis suggests that porous pavement is the best deicing material overall. This provides reasons to reconsider the usage of sodium chloride road salt during winters and to investigate ways to improve on and implement porous pavement.

Freshmen



Developing a Food Tracker to Reduce Food Waste

Henry Zhu
Tenzin Kelsang
Yugg Nanavati
Deven Pokharel

Food waste affects not only the economic situation of countries but also the wastage of natural resources and the use of pesticides and fertilizers, negatively affecting the environment. Food is wasted in many ways, including being thrown out due to expiration. Our group decided to create an application that would log the user's food expiration date so that the user could look at it and use it on time.

Developing an Allergen Management App

Sophie Jacobs
Kevin Han
Jacob Koprowski

Unclear food labeling is a problem in the United States, causing problems for those with food allergies. We designed an app to provide more information to users. Using feedback from our local community members, we created an app with features specifically requested by actual users. We used our results to see if an app like ours might help people manage their food allergies better and enable them to feel safer when shopping for food.

Freshmen

Robust Pest-Bird Detection in Crop Protection Using Sensor Fusion

Zaina Abu Hweij
Shangqiu Li
Mithil Krishnan

Pest-birds cause significant economic losses for farmers, with $4.7B in damages in the US alone. Newer, more effective automated technologies require an environmentally robust pest-bird detection system. We developed a system using sensor fusion of an mmWave radar and camera, which significantly outperformed detection by camera or radar in our testing (two common detection methods). Overall, our study demonstrates that sensor fusion can be a reliable pest-bird detection method and advance repellent technology.

The Moving Sofa Problem

Adrian Cooray
Peter Sosnowski

We performed an approximation for the solution of the moving sofa problem using a regression analysis. Data for regression came from an iteration program, generating points from two inputs and their output. We determined a value of 2.219525689, which aligned with the best solution, derived by Joseph L. Gerver, roughly 2.219531668, to four decimal places. We concluded that the Gerver sofa is likely the solution to the problem based on our approximation. Further work should focus on a formal mathematical proof.

Freshmen

Algae Segmentation with AI

Rafael Lavagino
Jasmine Cha
Edward Tang
Leo Chen

Identification of algae is especially critical in controlling harmful algae blooms. Our goal was to aid researchers by creating a segmented image database that could train an AI to identify algae. Our system, using the StarDist image segmentation software, was able to successfully segment the cells in several images. Our design indicates that low cost programs can identify algae, while being more accessible to researchers than other current technologies.

The Building Blocks to the Future

Yvonne Yin
Florence Liang
Sarah Nilles
Lena Ruddy

Every year, the production of construction materials adds more than four billion tons of carbon to the atmosphere. If this continues, many habitats and species will soon disappear. Industries need a new building material that is strong, flexible, and environmentally friendly. Bricks composed of the roots of mushrooms (mycelium) are one such material. However, we were unable to grow mycelium and did not successfully produce bricks.

Sophomores

Mental Health and Extra-curriculars

Cheryl Li
Raye Jensen
Maddie Schodowski
Lilly Langer

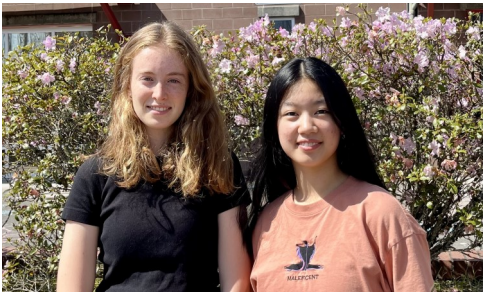
Our research focused on mental health and extracurricular activities. We investigated the effectiveness of two study strategies, a to-do list and a calendar. Our data didn't show any correlation between stress levels and participation in extracurricular activities, but they did suggest that a to-do list was more effective than a calendar. However, since our sample size was small, more investigation would need to be conducted to draw a more accurate conclusion.

Impact of Fire Retardants on Abiotic Factors

Hyacinth Cook
Yuna Lee
Bethany McKinstry
Meghana Parasa

We tested how fire retardants impact abiotic resources within the soil. We hypothesized that the Chitosan, a natural carbon-skeleton fire retardant, would have the smallest impact on the chemical composition of the soil and that the No-Burn spray fire retardant would be the most effective in extinguishing the fire because of its commercial use. We found that the bio-based Chitosan fire retardant had the smallest impact on abiotic factors as well as the best efficacy for extinguishing the fires.

Sophomores



Tesla Turbine: Outdated or Modern Innovation?

Alex McNutt
Jenny Wang

We hypothesized that a household, small-scale Tesla turbine would be most efficient at 60 to 70 PSI of pressurized air. We constructed 3D models and tested our physical turbine at various fluid flow ranges. We concluded that we can accept our hypothesis and that 70 PSI generates the highest amounts of voltage and RPM while using the least amount of fluid. The turbine was easily adapted to power a small appliance and should be 3D printed and used as an environmentally friendly power source.

Human Impacts on Nearby Bodies of Water

Pranaya Shrestha
Cai Davis
Austin Fewel

Our project deals with the following question: "How does nearby human activity affect bodies of water?" We conducted our research through the use of high-tech meters and readers, meeting at Lacamas Lake to conduct research on a bi-weekly basis. We gathered data from our tests, and created graphs, analyzing certain characteristics of the lake such as pH, turbidity, and electrical conductivity.

Sophomores

Rootin' Shootin' Trees Part 2

En-Chi Hsiao
Logan Vo
Ainsley Schweitzer
Ethan Lu

We continued a previous MST project, measuring the growth of black cottonwood trees at the Steigerwald nature preserve. There were two groups of trees, planted at different depths, either one foot or two feet deep. We compared the heights and circumferences of both groups of trees to determine if the depth of planting impacted the growth of the trees. We found no significant statistical difference.

Mental Health Correlated with Cell Phones

Aiden Premji
Krishna Vijay
Jeremy Lu
Codrin Andrei

Cell phones and social media have greatly impacted people's lives. To further understand the relationship between cell phone usage and adolescents' mental health, our team designed a survey via Google Forms to gather information from high school students. The data we collected supported our hypothesis that students who spent more time on their cell phones had lower average mental well-being.

Sophomores

3D Printing Our Future

Arielle Greenstone
Liam Hillyard

Homelessness affects more than two billion people worldwide. Tiny homes have been used in the past for homelessness, but 3D printing has just begun to scratch the surface of its potential in the housing industry. We researched most cost-effective, ergonomic, and environmentally friendly tiny-house design feasible for mass production. We found that a rectangular house with a domed roof was the most economically friendly, energy efficient, and weather resistant solution possible.

The LAN Library

Ethan Gordon
Ephram Kukartsev

Our goal was to make an offline wireless local area network (WLAN) server for management and distribution of school-related resources. To be viable, it had to be easy to use, effective, and cheap for both the instructor and student ends. Overall, we think we achieved our goals with this project, despite some issues.

Sophomores

Light Pollution's Effect on Autotrophs

Chloe Liou
Angela Ye
Elsa Lu
Jasmine Chen

Our experiment focused on determining whether light pollution affects plant growth. We set up five groups of plants, each exposed to a different amount of light. We hypothesized that the three and six-hour plants would grow the best. The three-hour plant grew the best, but the six-hour plant died. This suggests that light pollution does have an effect on plant growth and photoperiodism.

Seniors

Gannon Albertsen

Predicting Elections With Polls

I investigated whether polling data could reasonably determine the most likely winner in state-wide elections. To test this, I predicted the outcome of the 2022 US Senate election in Washington, using a combination of pollster data, primary information, 2020 census data, and turnout rates among different demographic groups. Ultimately, I was able to accurately determine the percentage each candidate would receive months before the election, having a percent error of less than 5%.

Aiden Bai

Million.js: A Fast, Compiler-Augmented Virtual DOM For The Web

Interactive web applications created with declarative JavaScript User Interface (UI) libraries have increasingly dominated the modern internet. However, existing libraries are made for run-time execution and rely on the user to load and render web applications. This led us to create Million.js, a fast compiler-augmented virtual document object model (DOM). When benchmarked against the most popular virtual DOM libraries, Million.js resulted in 133% to 300% faster rendering and 2347% faster load. In a real-world web application with both comparative benchmarks and an informal user study, Million.js loaded 35.11% faster after migrating from React.

Seniors

Minwoo Dang

The Effects of Ink Starvation on Printer Cartridge Behavior

I investigated the impact of ink starvation on HP inkjet printer cartridges. By measuring the temperature changes of an ink cartridge, we attempted to predict the amount of pages that can be printed with the remaining ink. The project provided insights into the factors that affect ink usage in printer cartridges and developed a practical method for estimating ink levels to help customers better manage their printing needs.

Andrew deLeon

Improvements to Decap Performance Through Temperature

In my internship with HP, I tested the effects of ambient print temperature on a common print defect, called decap. Decap occurs when the printhead nozzle (the part of the printer that shoots ink onto the page) dries up after not being used for some time. I designed and implemented an experiment to determine how noticeable this print defect was depending on the ambient temperature of the printhead.

Seniors

Stephen Fewel

Cancer Treatment Through Various Methods of Radiation Therapy

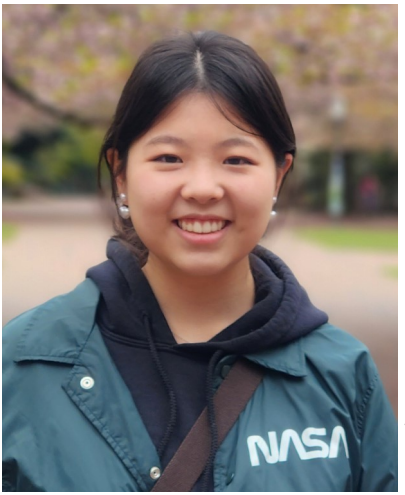
I researched data on the effectiveness of 3D-CRT and IMRT cancer treatments on prostate cancer. My hypothesis was that the IMRT method would produce lower amounts of radiation to areas outside of the target area. Prior to my research, I spent the summer shadowing Dr. Gagnon, a radiation oncologist from Massachusetts.

Paige Frawley

Assessing the Impact of Changing Water Availability on Fauna Biodiversity in Mexico

The Calakmul Biosphere Reserve contains endangered species that are struggling to adapt to changes in rainfall patterns. I recorded the population of birds, mammals, and herpetofauna in the northern region, and tracked their movement over time to determine how they responded to the lack of aguadas. The results revealed that amphibians and large mammals are migrating south, leaving them unprotected by the reserve's hunting regulations.

Seniors



Anabel Jiang

Investigating Pick Tire Designs

I studied the effectiveness of different printer pick tire designs at Hewlett-Packard Vancouver. I hypothesized that the tire with taller teeth would generate more friction force than the softer tire with small ridges. Testing the rolling friction and surface friction of each tire showed that the softer tire with smaller ridges produced more force. We concluded that the softer tire was a better fit for the smaller printers, and different adaptations of the other tire should be investigated further.

Hana Kawamura

Measuring Thermal Temperature of Inkjet Cartridges

One of the components of a thermal inkjet printer is the ink cartridge. When the ink gets too hot, a thermal mask turns on which stops the printer from printing to prevent any thermal damage to the cartridge and sends out a "very low on ink" message to the user which is often ignored. To improve the thermal accuracy, I compared the thermal data of ink cartridges by recording print jobs through an infrared camera and an internal thermal program.

Seniors

Nathan Kim

Determining How the Intensity of PT Recovery Increases Range of Motion

Physical therapy combines the education and physical sides of medicine to help diagnose patients while actively working with them to recover. We assessed how the intensity of a PT program can affect patients' recovery time and the health of their recovery after knee replacement surgery or those with frozen shoulders. Our hypothesis was that higher intensity training would lead to faster recovery and full range of motion. The results showed that there was no statistical evidence to conclude that high intensity training was more effective.

Katrina Le

Weighing The Costs of Composite and Amalgam Fillings

Cavities, teeth decay and dental problems not only affect cosmetic issues, but health related issues involving teeth alignment and consumption. Dental fillings can alleviate these problems but can also pose health risks during implementation depending on the kind of filling used. I investigated the differences between composite and amalgam fillings by assessing patients with one or both of these fillings. I assessed the pros and cons between the two while looking into long-term affordability.

Seniors

Sarah Luo

Fetal Health Classification Using Machine Learning Algorithms

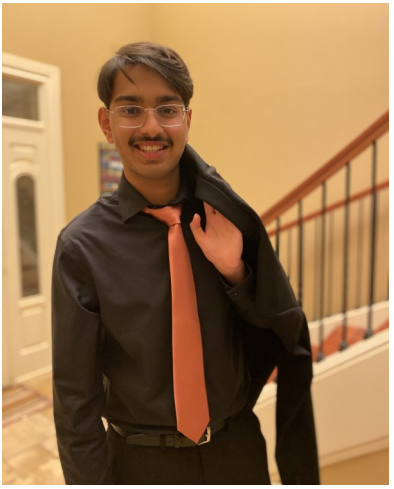
Fetal health is an overlooked topic because people worry more about infant mortality than fetuses. However, fetal health is important since it impacts the baby's health after birth and can harm the mother, sometimes resulting in death. My work fit three well-known models to data collected from CTG and classified by expert obstetricians to determine which one would most accurately label them as the obstetricians did.

Claire McOmie

Investigating methods of outdoor education

Outdoor education has always existed, but how does it compare to standard, in-classroom school? I studied the efficacy of various methods of teaching during one week of outdoor school. I hypothesized that inquiry-based learning would be the most effective method, but I found that a combination of various methods is the best way to help students engage with the material and retain information.

Seniors



Ishan Mehta

Assaying Soil Samples to Determine the Impact of Moisture on Antibiotic Presence

The overuse of antibiotics has rendered several detrimental pathogens non-susceptible. The most effective solution presently available to counter the AMR (antimicrobial resistance) crisis is to discover novel antibiotics. If more research and investment can be placed in microbiological research, there will be a greater chance to find unique bacterial strains that may proffer the potential to produce competent antibiotics.

Madhuri Parasa

How do changes in the CTSIB composite score correlate to changes in the DHI Questionnaire?

I interned at Fyzical Therapy and Balance Centers, which is classified as a neurological facility because of its ability to treat patients with vertigo/balance issues that often stem back to problems with the vestibular system. I researched the correlation between the results from two surveys (the computerized Clinical Test of Sensory Interaction on Balance and the patient survey, the Dizziness Handicap Index), taken by patients seeking vestibular rehabilitation.

Seniors

Ananya Pattamatta

Using JupyterLab to Analyze Confocal Scans of Microglia

Working with Ph.D. students at the University of Washington, I followed an experiment conducted at the Nance Lab. We worked to understand how oxygen glucose deprivation (OGD) treatments affected the morphology of small gray matter in the brain, known as microglia. I used JupyterLab and Python to quantify various factors of microglia cells' morphology from images taken with a confocal microscope.

Ayaan Premji

A New World of Teaching Physics

Technology is quickly evolving, and my mentor decided to take advantage of this. She and her colleagues coded a color tracker which uses the color of objects to track them then outputs data about the movement. I coded a graphical user interface (GUI) to allow her physics students to easily use this color tracker. This GUI would allow students to set up the tracker as needed with ease and run it multiple times without having to adjust it for each run.

Seniors

Taylor Redmond

Matrilineal Tendencies in *Orcinus orca*

Bigg's *Orcinus orca* are a mammal eating population of orca who can travel up to 100 miles in the span of 24 hours and are commonly sighted across areas of the west coast ranging from Southeast Alaska to California. Using collected data points from 2019-2021, I sorted through locations of sightings to see if specific matrilines have tendencies in their travel patterns.

Emma Sadewasser

Monitoring Stocks with Predictive Modeling

As an intern at the gym Tectonic Strength and Conditioning, I created a survey for functional fitness athletes that measured their self-reported consistency with exercise, as well as several variables of mental well-being. This survey was advertised on social media and inside the gym. I found that consistency of exercise was not strongly linked with mental health, but workout intensity was correlated with mental well-being, suggesting certain types of exercise could be used as a treatment for mental health.

Seniors

Camdyn Segall

Building an Image, Audience, and Product in Business

Social media is dramatically changing the landscape of tried and true marketing strategies. Through a summer internship with local clothing brand Jade Green, I was able to observe the process of brand definition, consumer curation, and product chain management. The goal was to explore other efficacious business strategies involving social media, specifically focusing on brands with a strong dependence on specific consumer preferences.

Austin Shin

Applying SEO to Enhance Content Reach for Rioja

Working with R\West and Rioja Trade, I tested various search engine optimization strategies in hopes of achieving an increase in publicity (measured by page views) for the Rioja Trade website. I hypothesized that using on-site SEO would be effective in achieving this goal. Thanks to the wonderful people I got to work with around the world, I was able to succeed in making an impact on the site's publicity.

Seniors

Lisel Shyam

Using Machine Learning to Determine Healthiness of Different Cell Samples

I applied unsupervised machine learning to automatically calculate the vitality of given bull sperm cell samples to determine whether the lab's hydrofluidics machine was calibrated correctly. I wrote the program using Python and processed images of samples. Due to confounding external factors, some portions of the program were unable to complete accurate analysis. Despite this, the project was successful in advancing machine learning applications.

Aiden Stewart

Skeletal Tracing: An Application of Physics Principles

A quarter of high school students take physics; however, with so many complex concepts, like the center of mass, many struggle to keep up with the workload. By combining earlier research and new advancements in technology, we created a program that addresses the center of mass problem and more. Our program tracks the center of mass of an individual and the angular velocity of an arm in real time. Our program is being used in the classroom and is easily accessible.

Seniors

Lena Trieu

Library and Museum of Sustainability

Washougal lacks community centers for youth to access reliable amenities for learning and recreation. At the same time, the greater Columbia Gorge National Scenic area is full of historic landscapes and biodiverse ecosystems that deserve to be discovered. Our hybrid Library and Museum of Sustainability will actively demonstrate sustainable architecture by integrating nature into the design. It will provide interactive material to teach audiences about protecting the local environment and aspects of sustainability.

Ava Wagner

Restrictions on Tourism Effectiveness in Improving *Chelonia mydas* Health and Behavior

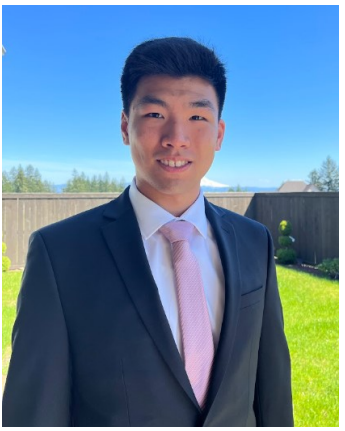
Akumal, Mexico, has high rates of tourism due to its large sea turtle population. However, snorkel tours and pollution have caused the health of marine life to suffer, including causing fibropapillomatosis (tumors) in turtles. To mitigate this, restrictions were placed on tour companies. I compiled data I collected with previous data to determine the effectiveness of these restrictions on turtle behavior and health. Overall, turtle behavior has improved due to a decrease in direct contact with tourists.

Seniors

Andrew Wessel

Tourism and Immature Green Turtle Behavior in Akumal Bay

I investigated the efficacy of current tourism regulations at reducing stress levels experienced by green turtle populations in Akumal Bay, Akumal, Mexico. Due to an influx in sediments after Hurricane Katrina, Akumal Bay became a thriving home for sea grass and green turtles who graze on them. Ecotourism brought economic prosperity to the area, but elevated rates of fibropapillomatosis (a tumor-causing disease) in the turtles caused by stress and pollutants. Operation Wallacea worked closely with the government to impose regulations on tourists to reduce their effects on the environment.



Steven Wu

Algal Bloom Imaging CubeSat

During my internship at MIT Beaverworks CubeSat Program partnered with Woods Hole Oceanographic Institute (WHOI), I built a CubeSat that simulated imaging and area calculation of harmful algal blooms (HABs) off the coast of New England. By tracking HABs from space, oceanographers can watch their movement and growth and prepare preventive measures to reduce ecosystem damage. Using Python, we coded imaging, position tracking, communications, and image processing functions on two Raspberry Pi computers representing flight control and ground stations.

Seniors

Joy Young

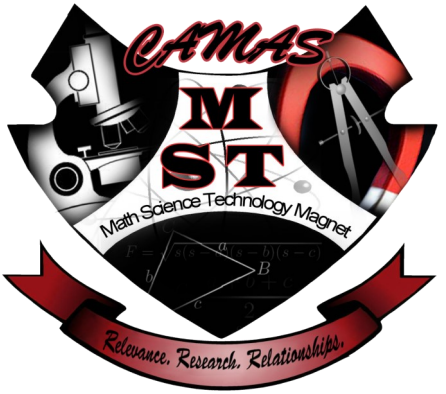
Using Laser Ablation to Study Axonal Degeneration in Huntington's Disease

Huntington's disease (HD) is a neurodegenerative disease that impairs cognitive, psychiatric, and motor abilities. We used a robotic laser microscope (RoBoLase) to study the axonal injury and repair mechanism for HD neurons. Our results show inhibiting SARM1 was an ineffective method for preventing axonal degeneration and that oxidative stress further exacerbates the axonal degeneration from laser-induced damage. We concluded that the RoBoLase system is an effective method for studying the degeneration response of axons in HD neurons.

Selina Zou

Adjusting to Environmental Influences in Developing Methane Flux Chambers

Aquatic methane (CH_4) emissions from water substantially contribute to atmospheric concentrations contributing to global warming. However, it can be difficult to measure this phenomenon. New technology using floating chambers with semiconductor CH_4 sensors has been developed to increase spatiotemporal resolution and lower cost. I compared a regression model of CH_4 readings based on humidity to one based on temperature to correct for ambient influences on the sensors.



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