Oceanic turbulence directly influences the transport of marine particles such as debris or organisms, which impact the ecosystem. This research aims to understand the physics of particle motion in turbulent fluids in a laboratory environment. We perform experiments to explore the relationship between fluid flows and particle dynamics. Specifically, we record the kinematic response of fluorescent green polyethylene microspheres with diameters between 125-150 µm. We did this by using custom-designed cameras, and tracking their motions to examine fluid flows in a simulated wetland. The primary goal is to process images to determine the velocity of these microparticles passively following the fluid motions. We characterize the fluid turbulence using the resolved motions of these passive particles. This characterization is used to understand mixing, which leads to a better understanding of what happens to particles as they travel and how they interact amongst each other. This allows us to better comprehend the locomotion, feeding, colonizing, and escape mechanisms of marine organisms.

Methods

Experiments are conducted using a simulated wetland for particle tracking in turbulent flow and surveying the fluid motions. The primary goal is to process images to determine the velocity of these particles moving in groups, which implies the water was well mixed, which agrees with the equilibration rate and gas transfer velocity. Further data will be collected and analyzed to characterize the turbulence and inform the wetland management community of the impact of how the stirring of particles influences ecosystems.

Conclusions

The oxygen deficit decreases exponentially in our simulated wetland, which agrees with the theory being tested in the laboratory. Being able to describe the equilibration rate of oxygen with an exponential model allows us to measure the near-surface stirring in the water, which drives the exchange of fluids across the air-water interface. This is significant because net fluxes of gas exchange in wetlands are sensitive to the availability of oxygen. The calculated velocities of these particles moving in groups imply the water was well mixed, which agrees with the equilibration rate and gas transfer velocity.

Future Work

Further data will be collected and analyzed to characterize the turbulence and inform the wetland management community of the respiration rate of our simulated wetland. Additonally, the impact of how the stirring of particles influences ecosystems will be informed. This will ultimately bring about environmental engineering applications for climate and ecological impact.

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