

Toward the two-way coupling of swimmer and surface gravity waves

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Motivation

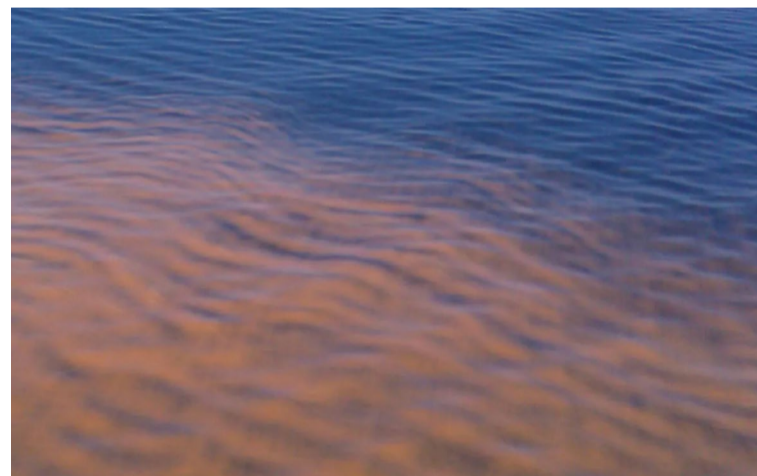
Swimmers like protozoa and zooplankton are ubiquitous in lakes and oceans, and the swimmers are in the surface waves. Zooplankton plays a key role in linking primary producers to higher trophic levels in marine food webs. There is a two-way coupling between swimmers and surface gravity waves.

Project Description

1. Use numerical modeling to study how swimmers are transported in surface gravity waves.
2. Use experiments to study whether there is an enhanced turbulent production around swimmers in surface gravity waves.

Context

- We will use both laboratory experiments and empirical modeling to characterize the transport of zooplankton in idealized wavy flows that are representative of ocean waves.



A picture of the distribution of plankton (red color) in waves. The density variation is highly correlated with a wave, indicating that the wave could play a key role in their transport, tumbling, dispersion, and preferential accumulation.

The proposal aims to further our understanding of the two-way coupling between swimmers and surface gravity waves.

Project Deliverables

- By the end of year one, we will submit 1 NSF proposal.
- We will produce two papers on this topic.
- We will set up a surface gravity wave tank.

Potential Impact

- The swimmer in surface gravity waves has not been studied before, and we will set up the foundation for the understanding of how surface waves can transport active particles.
- The proposed research can further inform how physical ocean environments shape the primary production and, thus the food web in the ocean.

References and/or Acknowledgements

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