

Periodic sedimentation rates revealed by high-temporal-resolution view of biological carbon pump



We used an optical sediment trap to observe the biological carbon pump at 890 m depth, 3 x an hour for 3 months.

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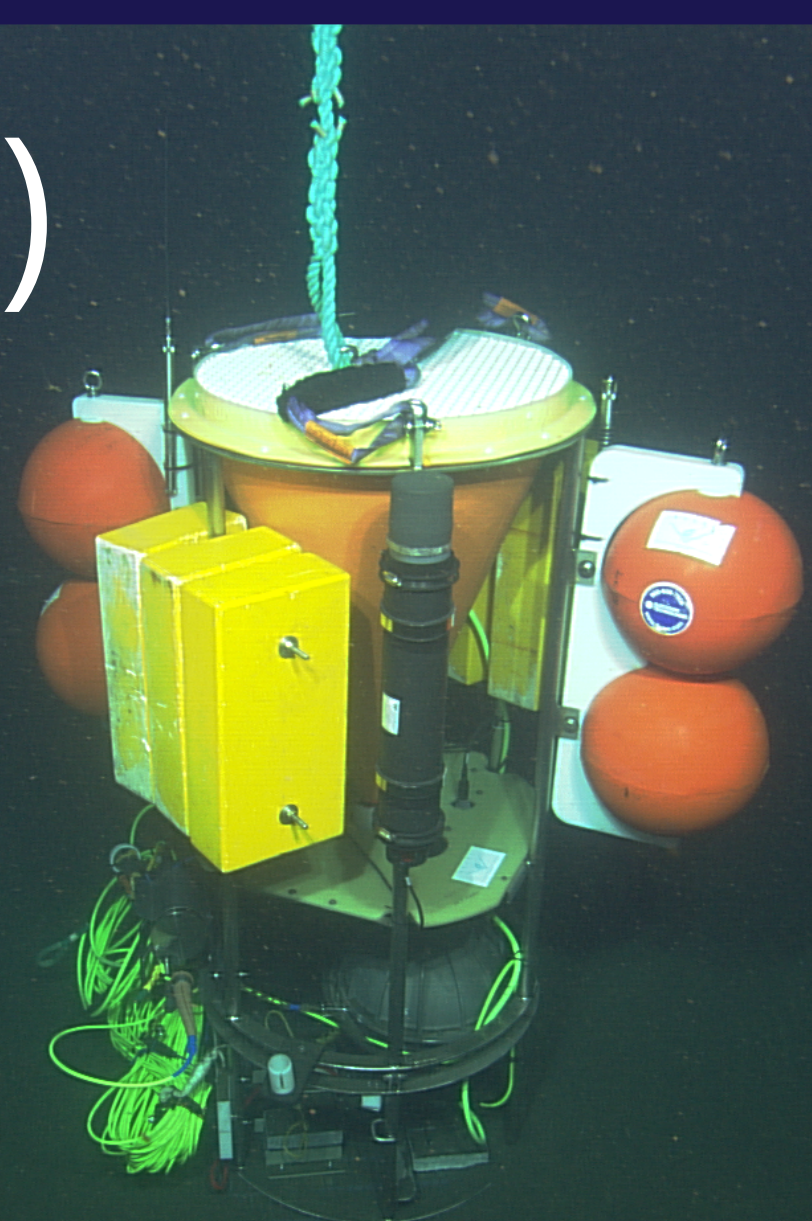
Context and aims

Sinking biological particles bring important quantities of carbon to the deep sea.

Our goal is to reveal mechanisms of the biological carbon pump that can be used to improve deep-sea carbon sequestration models.

Methods

(1)



(1) The Sedimentation Event Sensor (SES) was deployed on the seafloor at 890 m depth, near Monterey Bay, California, USA.

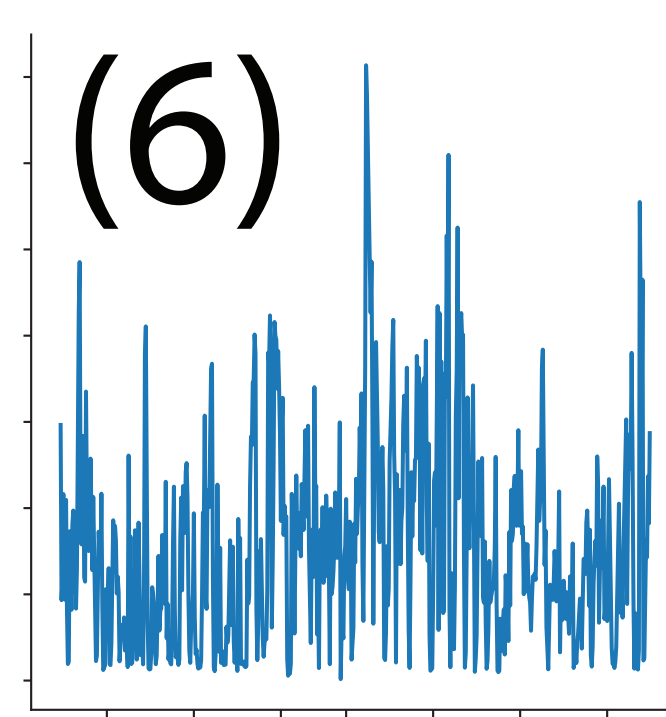
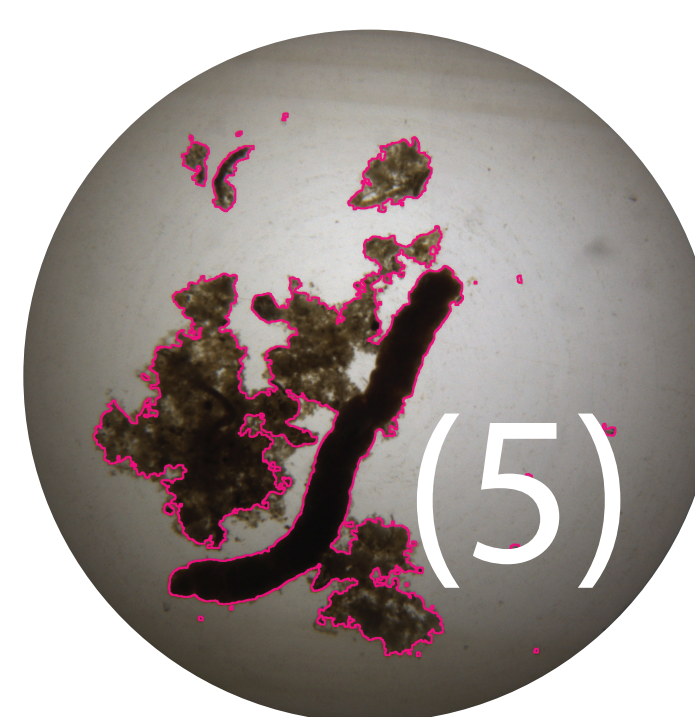
(2) The SES was plugged into the Monterey Accelerated Research System, allowing for real-time communication and data transfer to shore.

(3) Two Lowell TCM tilt current meters were deployed nearby.

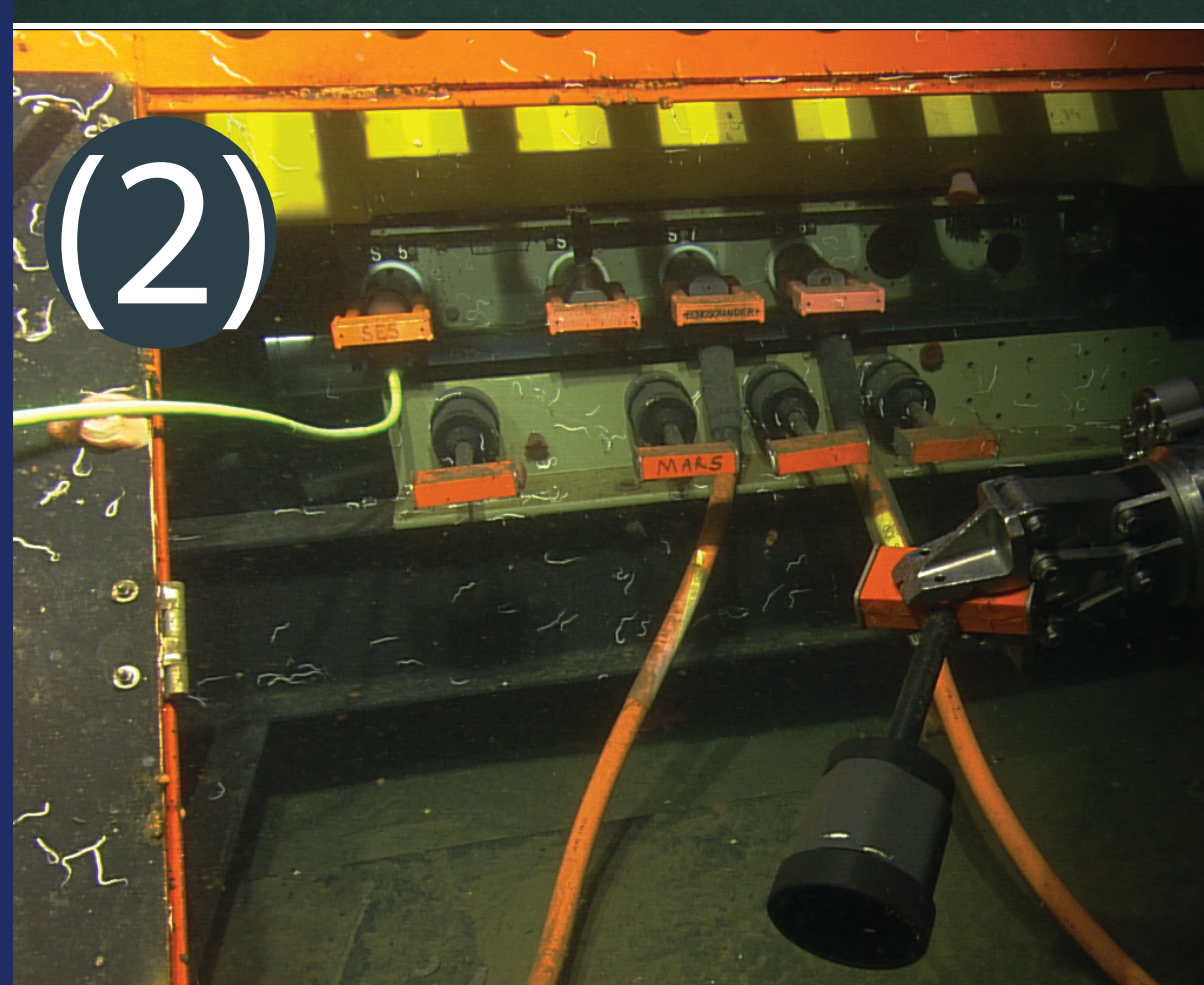
(4) The SES collected and imaged 3 samples/h (5 minutes collections followed by a 15 minute flow-through period).

(5) Automated image analysis detected particles for calculations of attenuation.

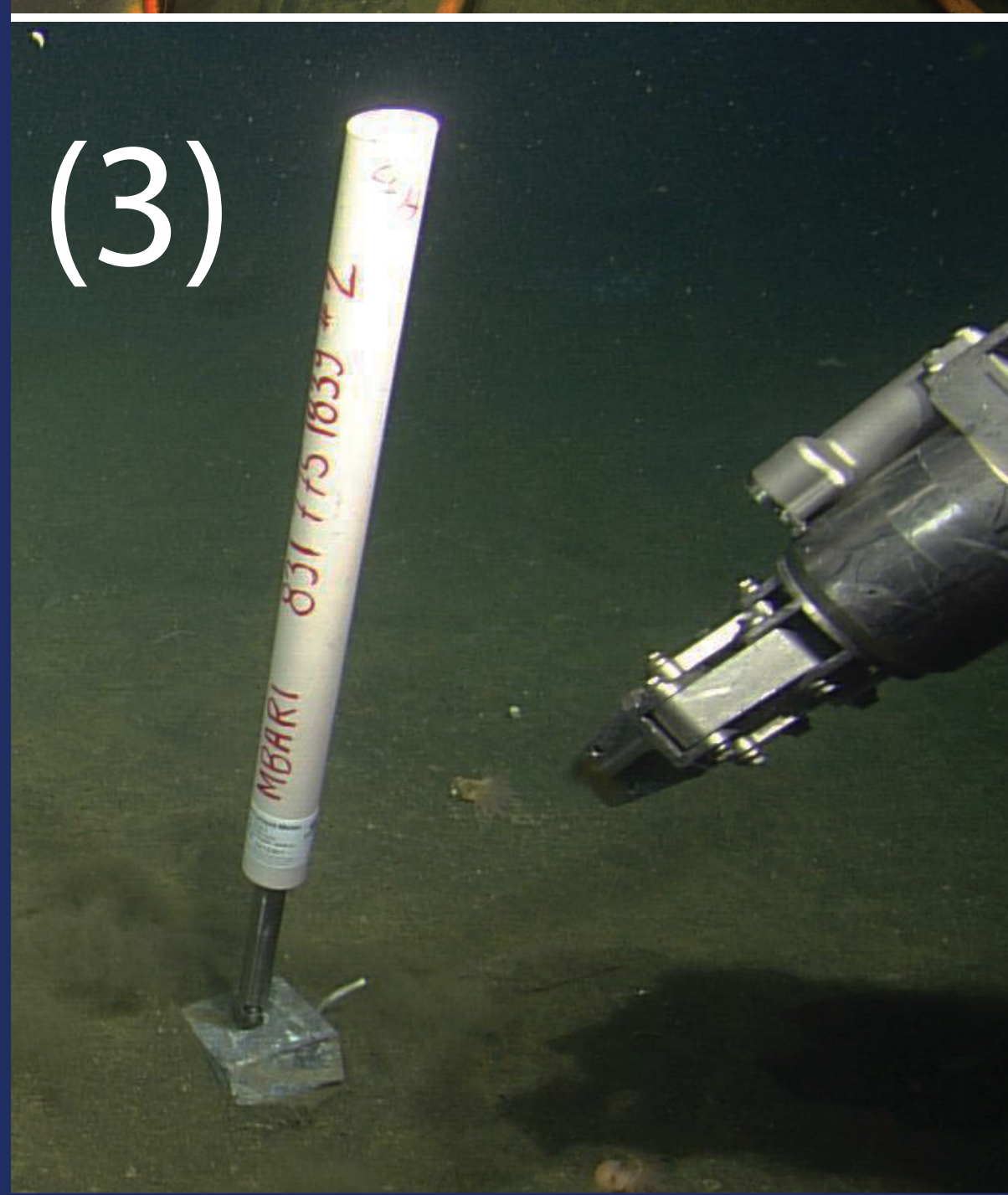
(6) Attenuance from the SES can be considered a proxy for carbon flux.



(2)



(3)

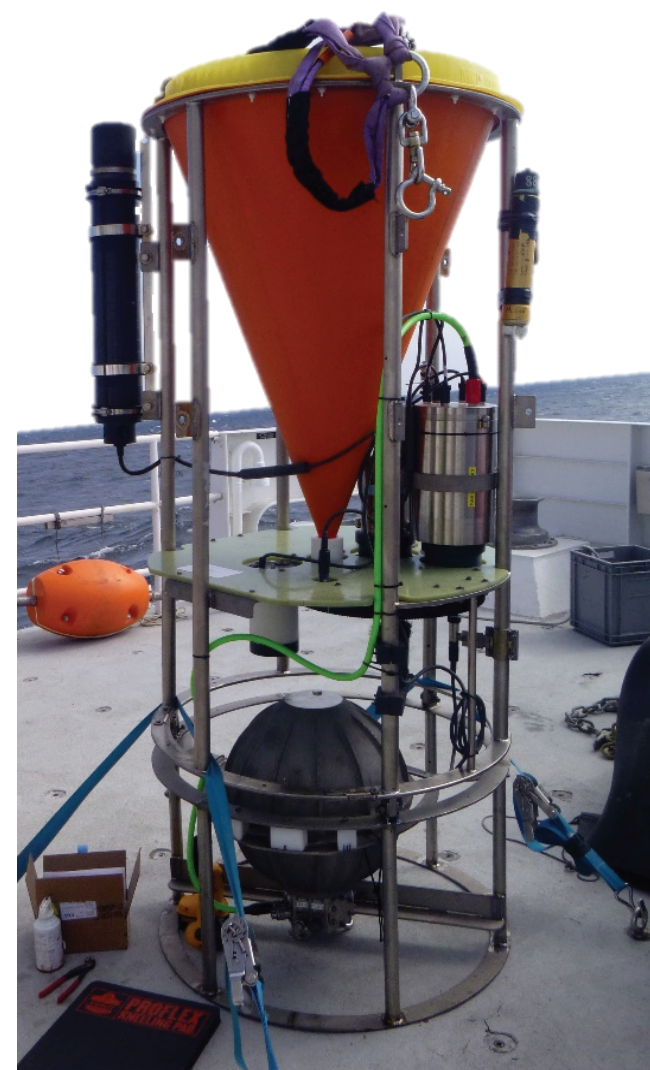


What is the SES?

SES is an optical sediment trap sensor package on a modified commercially available McLane Sediment Trap.

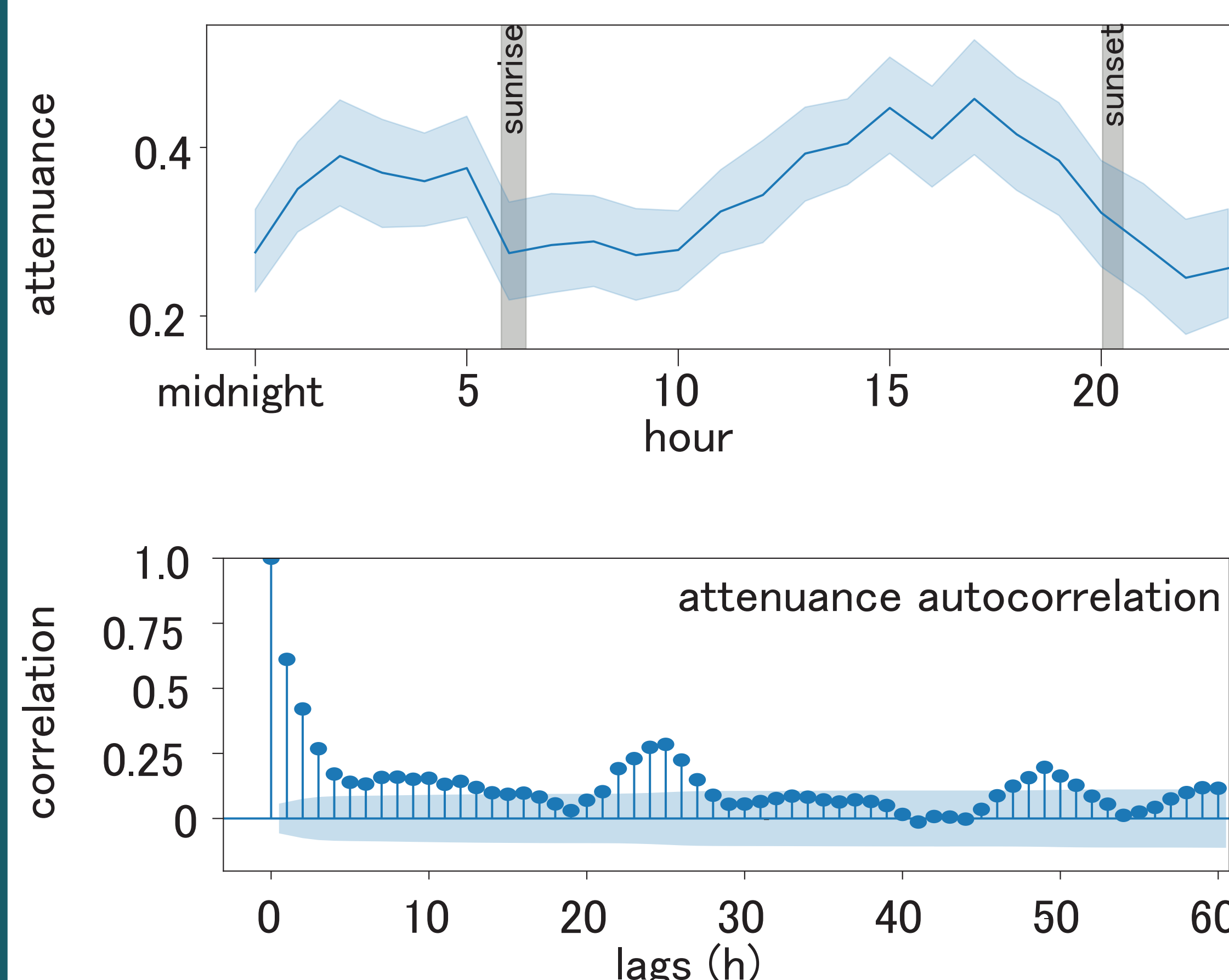
It takes front- and back-lit images, and fluorescence readings of sinking particles, and then discards the sample.

It has endured multiple year-long deployments to 4,000 m depth, with seasonal Wave Glider communication.

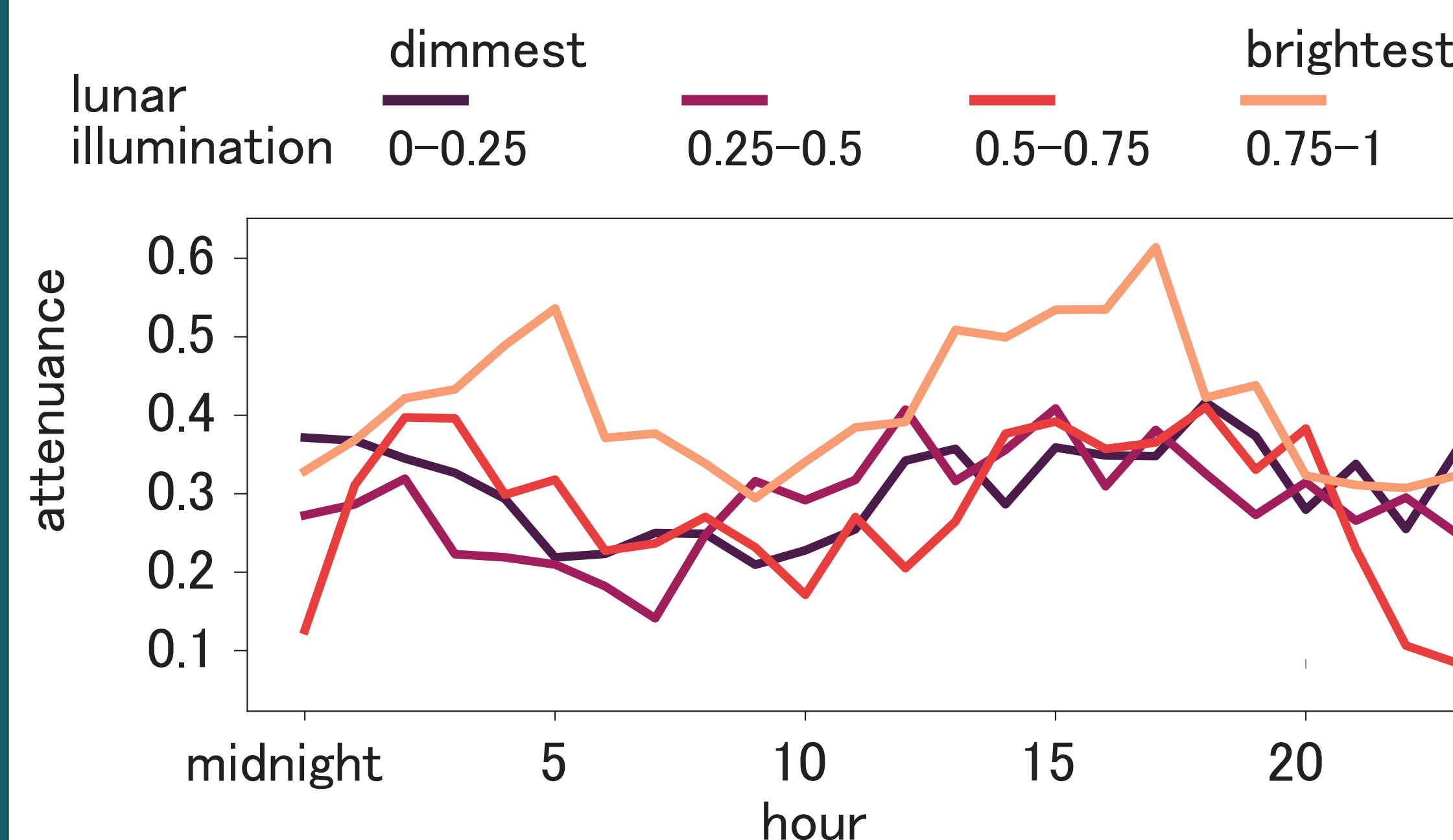


Initial results

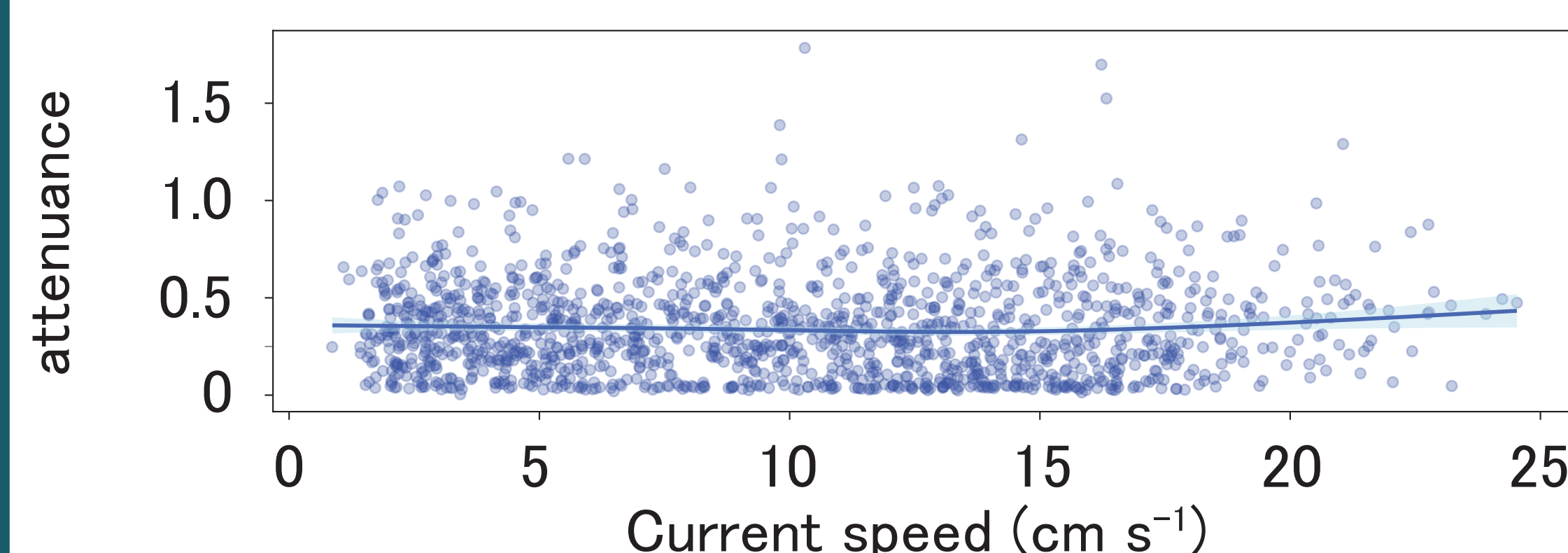
(1) Attenuance at 890 m depth had two 24-hour cycles-- one peaked before dawn, and the other peaked before sunset.



(2) Attenuance at 890 m depth was higher when lunar illumination at the surface was brightest.



(3) Current speed did not correlate with attenuation.



Conclusions

(1) Diel cycles in attenuation suggest active transport by migrating zooplankton may drive particle flux to 890 m depth.

(2) Particle flux was higher during full moons.

(3) Local resuspension did not drive the dominant patterns seen here.

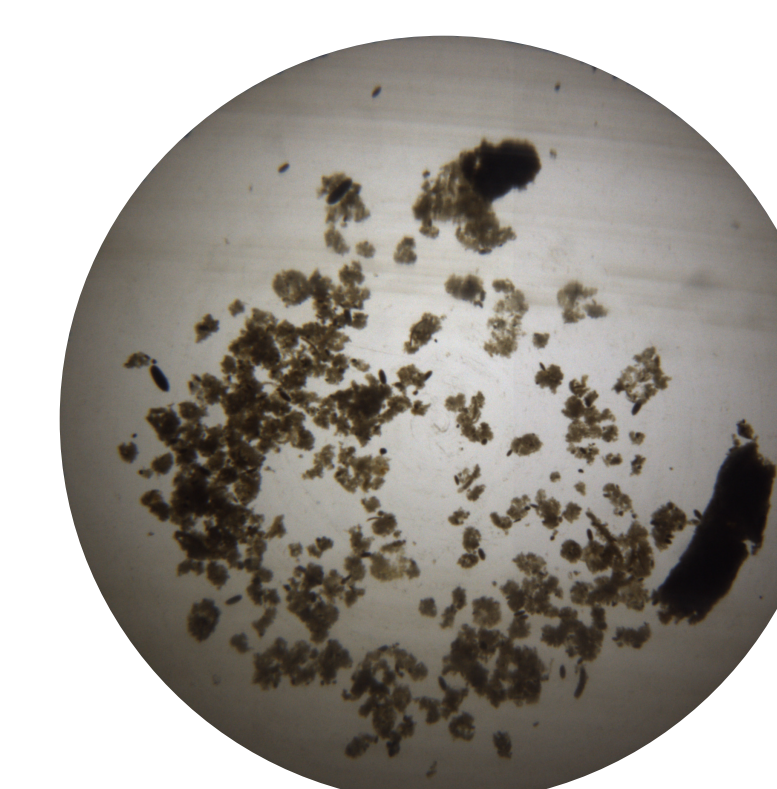
Next steps

Assess influence of lunar and diel cycles on active transport of carbon to 890 m depth:

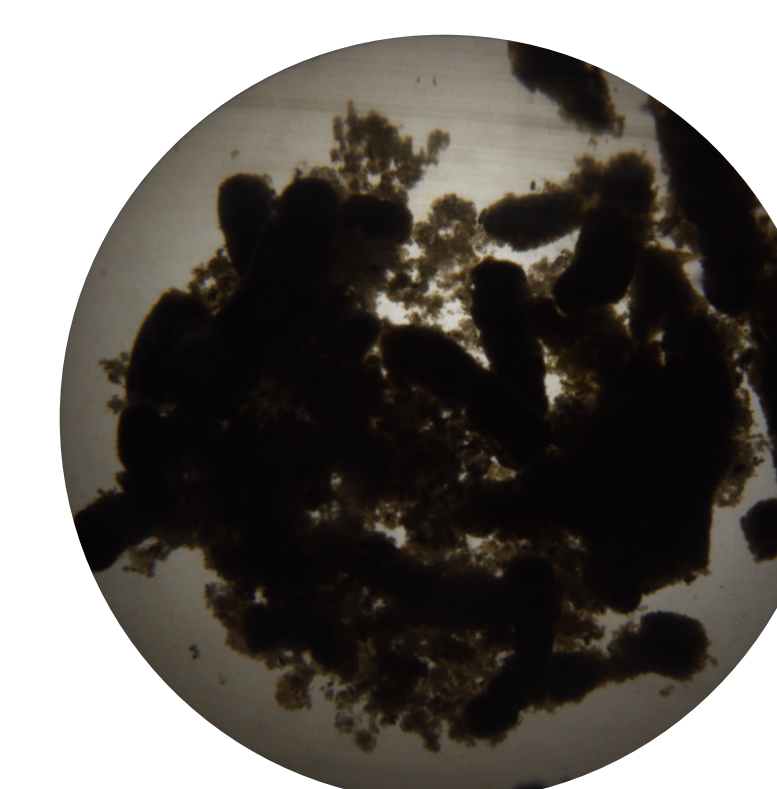
- Identify particle types
- Compare to overlying zooplankton vertical migrations, and lunar/diel cycles.

Teaser

While attenuation was higher during full moons than dimmer periods, each full moon was different.



Full moon July 2023



Full moon August 2023