Lead PI / Institution

Craig Lee, Applied Physics Laboratory, University of Washington

Project Title

Autonomous Investigation of Export Pathways from Hours to Seasons

CoPIs / institutions

Eric D'Asaro, Applied Physics Laboratory, University of Washington

David Nicholson, Chemical Oceanography Department, Woods Hole Oceanographic Institution

Melissa Omand, Graduate School of Oceanography, University of Rhode Island

Mary Jane Perry, self-affiliated

Andrew Thompson, Department of Environmental Science and Engineering, California Institute of Technology

Measurements to be made & from which ship

Autonomous

Sustained measurements in a float-following framework.

Float will drift and sample just below the euphotic zone, accompanied by a profiling glider.

Additional gliders will sample the region around the float.

Systems will sample for a ~6-month span, targeted for deployment well before, and recovery well after, the main sampling period.

Measurements include: T, S, dissolved oxygen (NCP from budgets), nitrate (NCP from budgets), chlorophyll fluorescence (phytoplankton biomass proxy), optical backscatter (POC proxy), PAR, multi-spectral irradiance, optical attenuation (beam-c, POC proxy), acoustic backscatter (from 1 MHz ADCP, mesozooplankton proxy), optical sediment trap, Snocam for particle characterization.

Ship-based

We would like to establish one set of sensors for use on the survey vessel CTD as the program reference sensors (the gold standard), and are willing to coordinate this, as well as the pre- and post-cruise calibration of the survey and process ship sensors.

Will need collocated calibration casts between survey ship and process ship, and survey ship and autonomous floats and gliders.

Provided that other components will provide calibration and proxy measurements, we will not need our own specific sampling from the ships. We will need the ability to target some survey ship sampling to be tightly collocated with the other platforms, though.

Equipment to be brought to sea

Lightweight deployment and recovery gear (no special storage or handling requirements) to be sent on survey ship in case emergencies arise that require recovery of autonomous platforms.

Similar equipment will be used on deployment and recovery cruises, which are envisioned to take place from a vessel of opportunity.

Known field requirements (vans, ship equipment, lab bench space, hoods, over the side time, sampling equipment, etc.)

Crane or davit for deployment and recovery of floats and gliders.

CTD casts dedicated to calibration of autonomous sensors (see below).

Berthing guesstimate

One person (likely Melissa Omand, who will sail in support of this and the Estapa component).

Needed measurements from other groups

Calibration: Used to cross-calibrate all sensors (process ship CTD, autonomous platforms, etc). This will require collocated casts with the process ship and with each autonomous platform.

Proxy Building: Sensor-based sampling paired with analyses of collocated in situ samples will also be used to build proxy relationships. These casts do not need to be collocated with the autonomous platforms.

The following measurements will be needed collocated with floats and gliders for calibration:

- oxygen (optode paired with bottle oxygen samples for calibration)
- HPLC (paired with fluorometer for proxy-building)
- chlorophyll (paired with fluorometer for proxy-building)
- nutrients (paired with nitrate sensor for calibration)

Additional samples for proxy building:

- HPLC (paired with fluorometer for proxy-building)
- POC (paired with backscatter and beam-c for proxy-building)
- phytoplankton (paired with fluorometer and backscatter for proxy-building)
- zooplankton net and/or UVP profiles (paired with Nortek ADCP that we will supply, for proxy-building)

Will need at least 4 casts per float and glider per cruise, plus inter-ship calibration casts.

Float/glider casts must begin within 100 m of the diving target vehicle.

Additional casts will be needed for generation of optical phytoplankton & POC proxies.

Will need 6-10 bottles per cast of Chlorophyll, HPLC, nutrients, POC, pico/nano phytoplankton all by specified protocols.

Which EXPORTS Science Questions does your project respond to best

SQ 1 (a,b,d) and 2 (a, b).

What aspects of your inclusion on the EXPORTS Science team are you most excited about

Understanding variability in export pathways as a function of NCP and carbon export over temporal and spatial scales that are large enough to encompass numerous states – scales we've

not been previously able to access. Contributing to this large, integrated program and advancing our approaches for using autonomous platforms for problems at the interface of biology, biogeochemistry and physics.