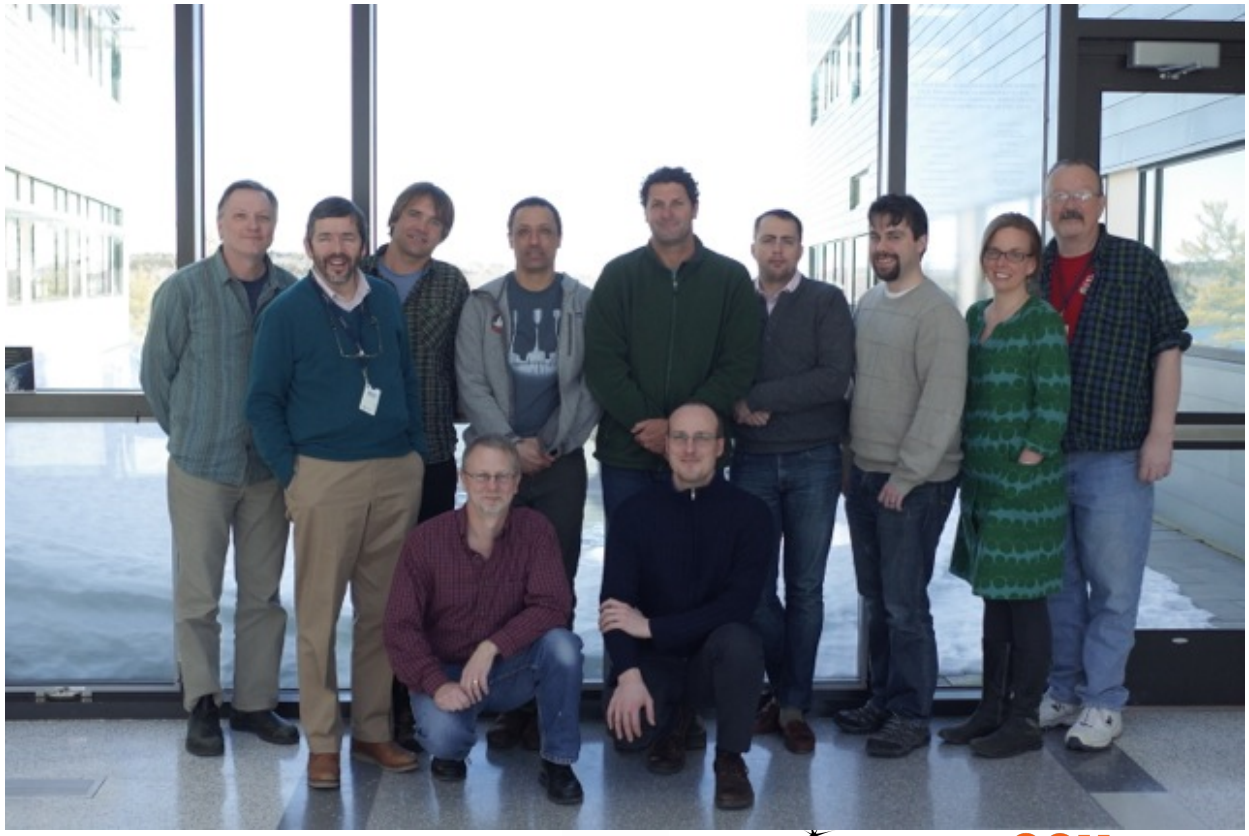
Collecting and processing underway in-line optical data

E. Boss, B. Balch, B. Bowler, G. Dall'Olmo, S. Freeman, W. Neary, N. Nelson, M. Novak, C. Proctor, W. Slade, T. Westberry



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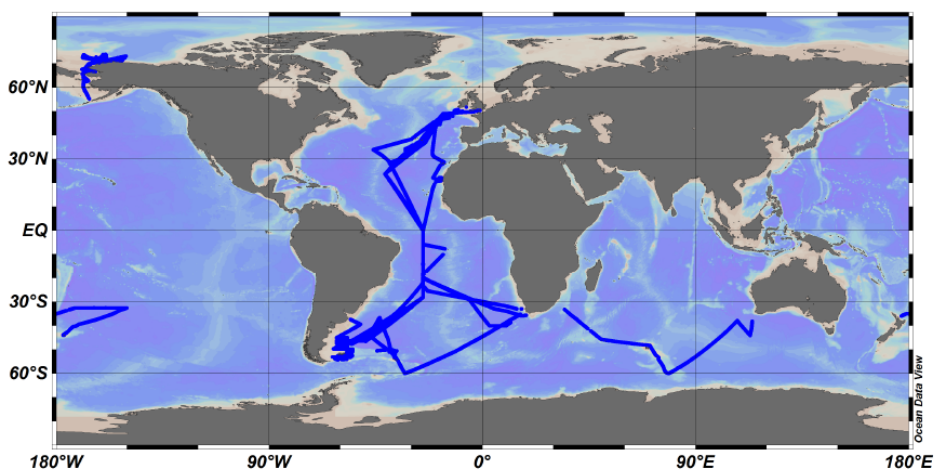
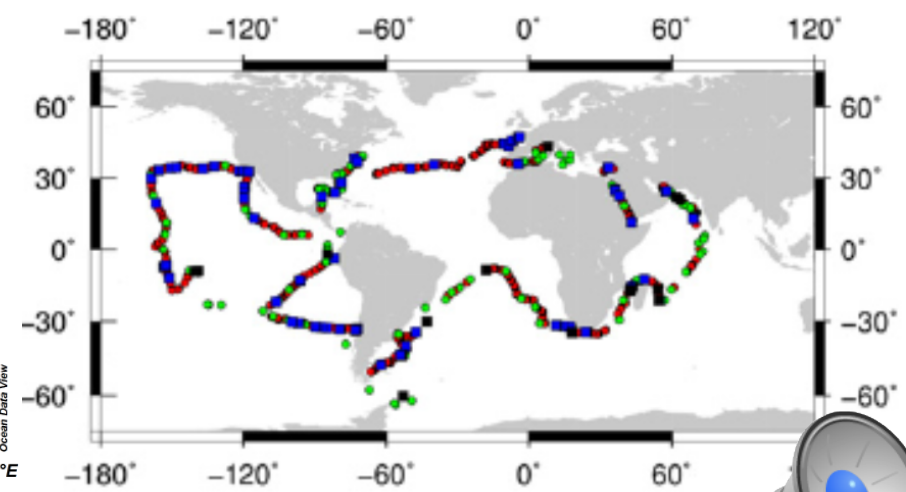
Why is it of interest to collect in-line optical data:

1. High-resolution (space/time) proxies of biogeochemical variables.

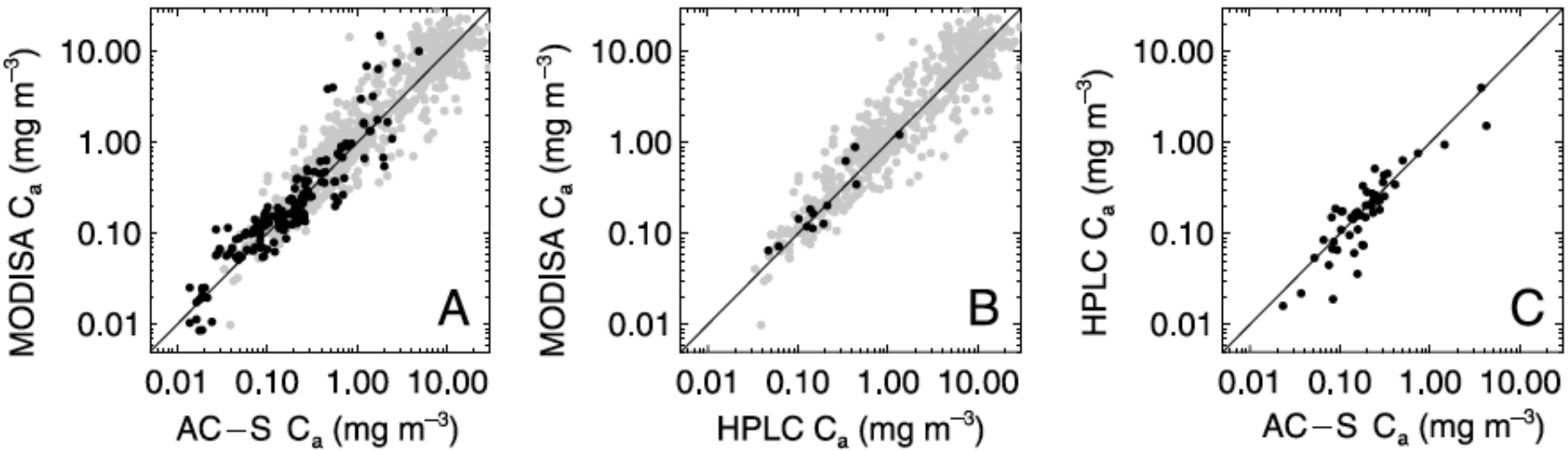
2. Cal/Val:
   a. Increase opportunity for match-up data sets.
   b. Sub-pixel variability.

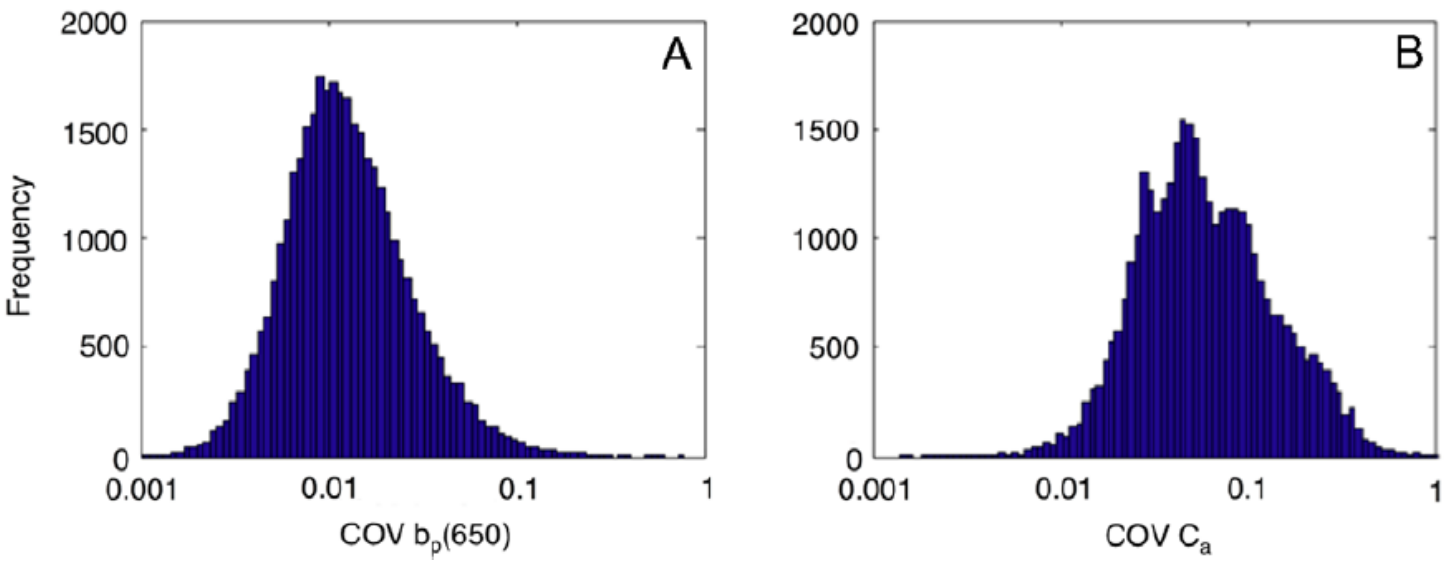




More than 400,000km of continuous IOP data (more than half hyper-spctra)

A cal/Val example:





Werdell et al., 2013

History:

1. Chlorophyll fluorometry – since the 60's.
2. Added beam-attenuation and CDOM fluorometry in the 80's.
3. Ancillary data: GPS & thermosalinograph.

Major issue:
Data quality – data is collected by non-specialists, sensors are calibrated at manufacturer only.

We have an obligation, as the experts, to insure the best possible quality of data is collected and that we can constrain associated uncertainties.

More recently:

1. Expended variables: spectral IOPs – absorption, attenuation (ac-meters) and backscattering. Use of an automated switch using the fraction below 0.2μm as a blank.

2. Adding in-line microscopy (IFCB, FlowCam).

Cal/Val is one of the major motivations hence it is critical that we constrain uncertainties and minimize biases.

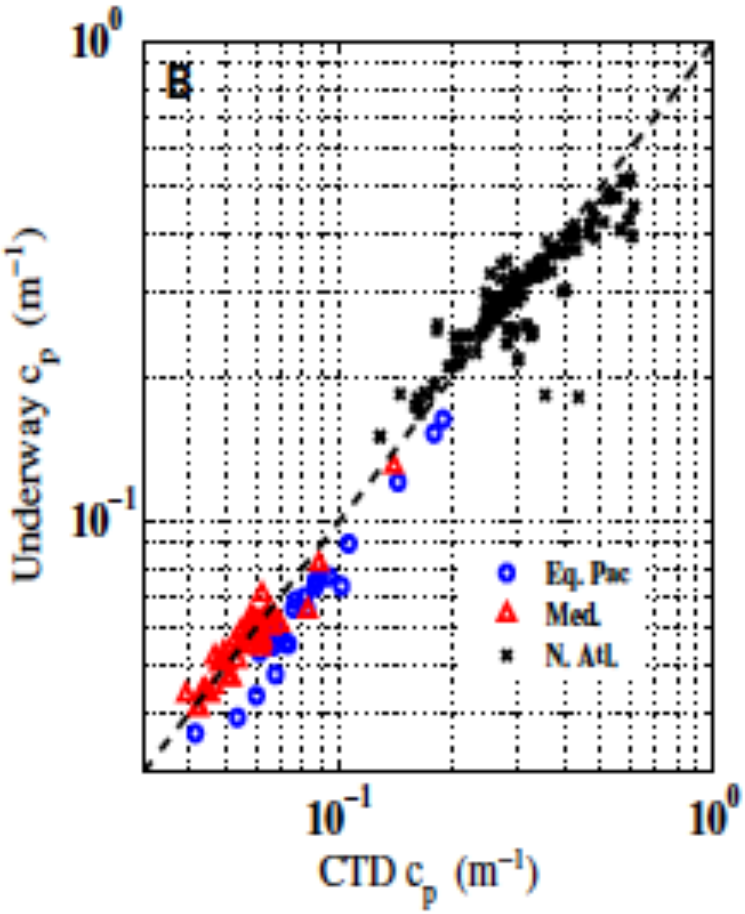
Given expansion and interest we saw value in:

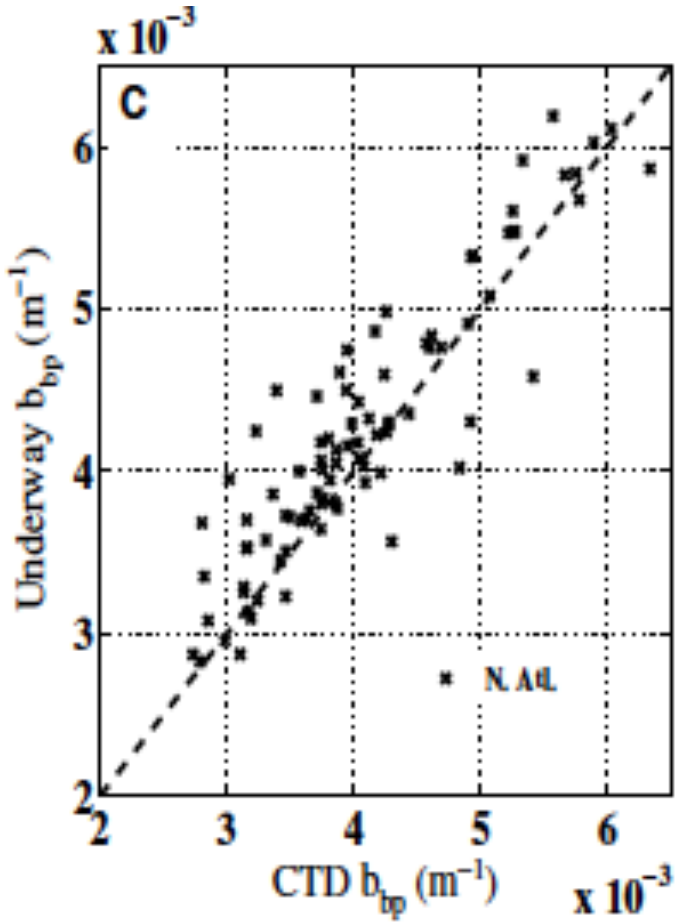
1. Sharing lessons learned.

2. Sharing codes to analyze data so we have a coherent framework (Matlab and python).

QA/QC

Need to insure in-line system itself does not affect results.





Westberry et al., 2010

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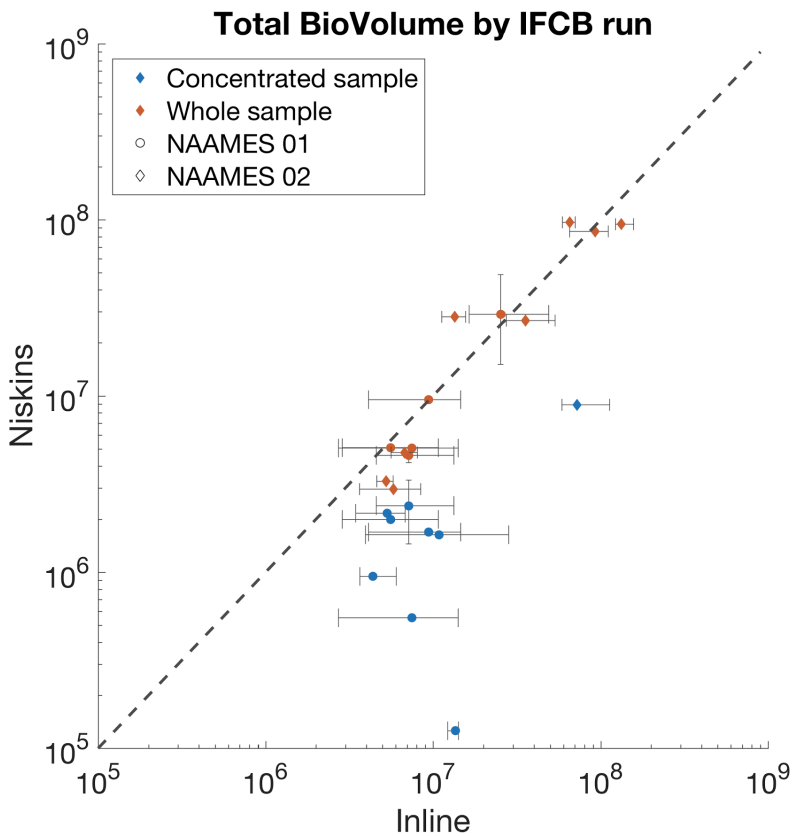
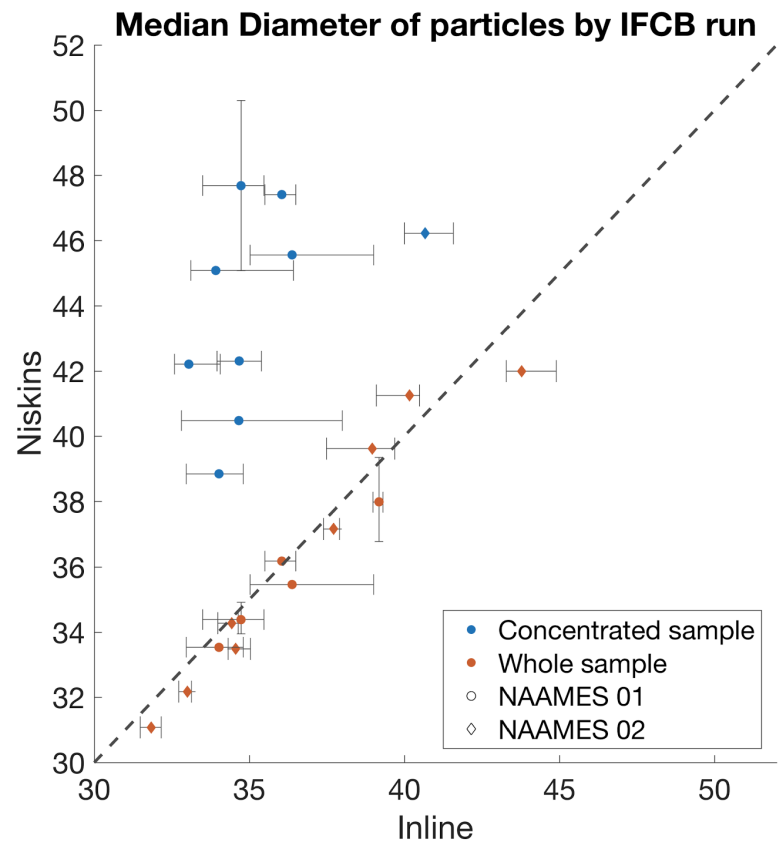




Nils Haentj

What components of system are particularly an issue?

Attached fauna and flora within:

Water source (sea chest, moon pool)

Pipes

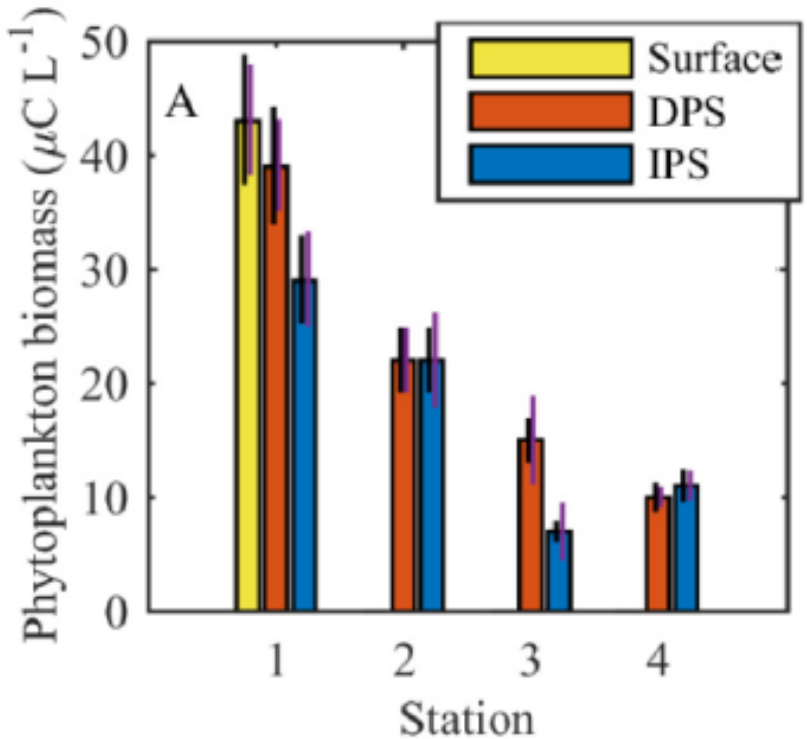
Flaking bits of materials.

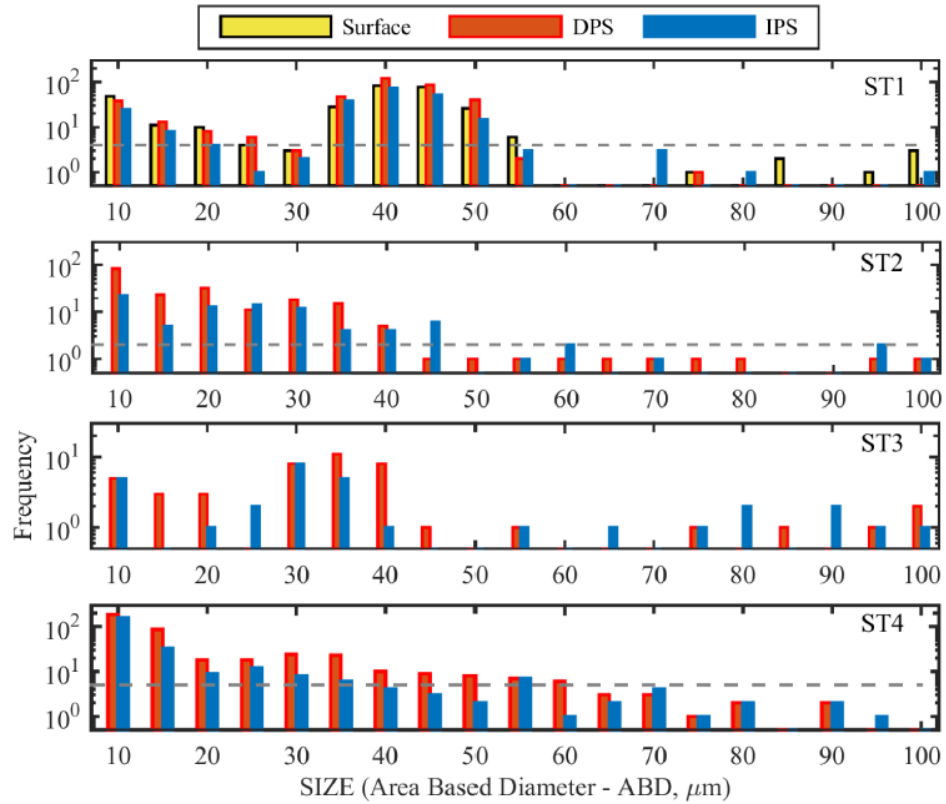
-solution: inspect boat before going on.
Request bleach cleaning of pipes.

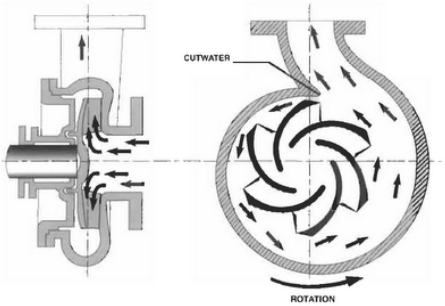
Saving grace- large volume of water- O(10l/min).

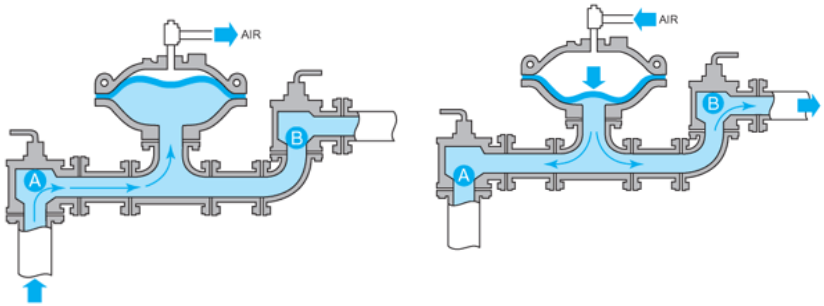
What components of system are particularly an issue?

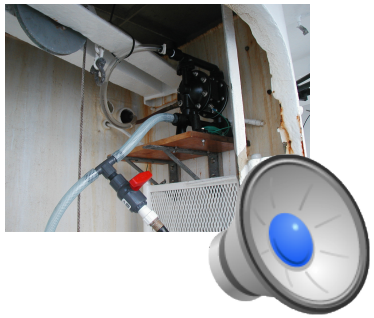
Pump – Cetinic et al., 2016:











Other major issues:

Bubbles

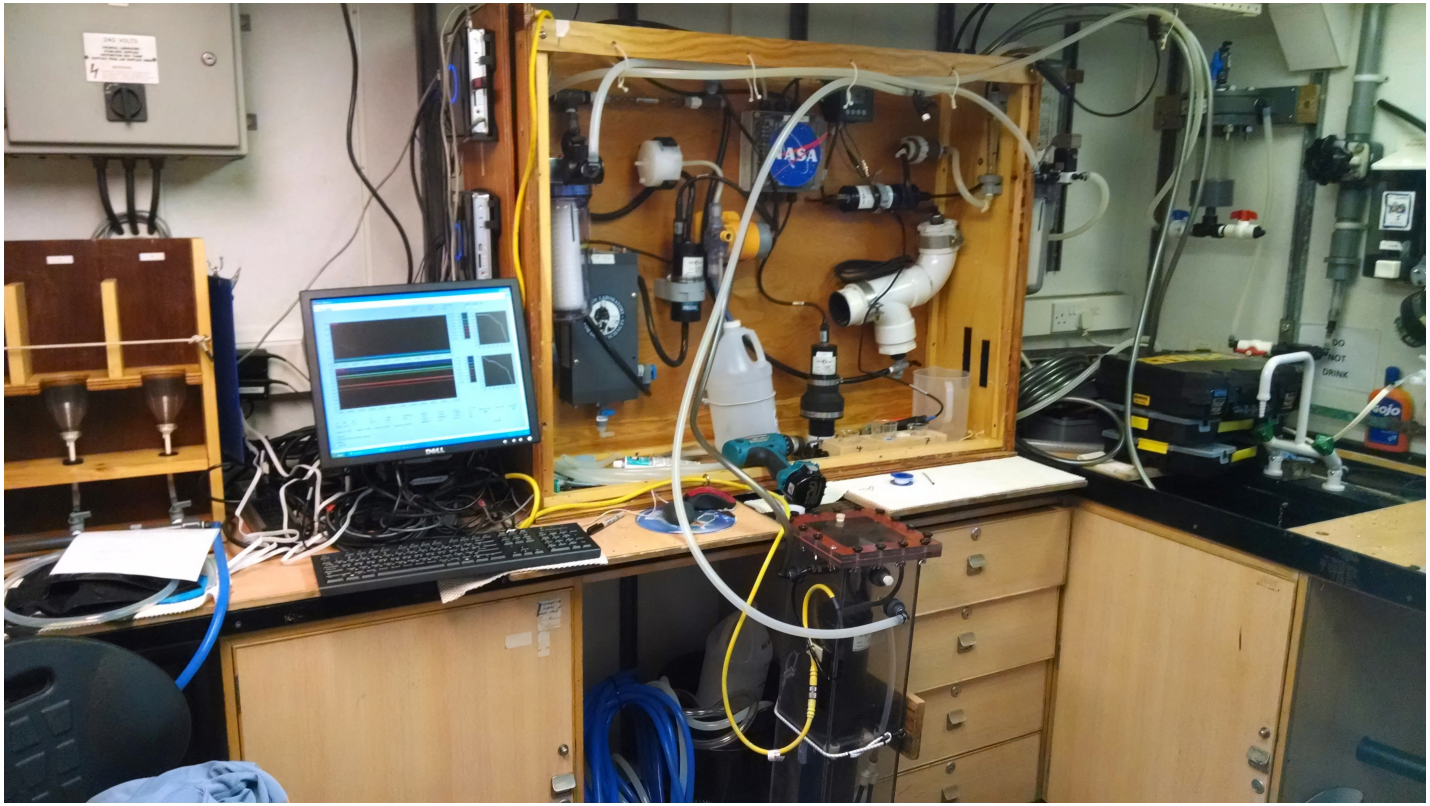
- Rough seas
- Exposure of intake
- Cavitation (rapid pressure change)
- Warming of water.

Diagnosis: highly noisy IOP data.

Solution: one or more debbublers.
Back pressure on the water outflow..

Other major issues:

Temperature -- fogging.



Solution: temperature bath.

Other major issues:
Instrument cleaning & calibration

- Weekly cleaning is sufficient in most cases.

- When eutrophic, requires cleaning more often.

You are not cleaning often enough if you observe a significant change before/after.

- Not always possible to have appropriate calibration standards (particularly H_2O) → Direct effect on uncertainties.

Filter/unfiltered help diagnose drift.

Future/present: automated system to inject calibration fl

Other major issues:

Logging, time stamping

Automated time-syncing/time stamping.

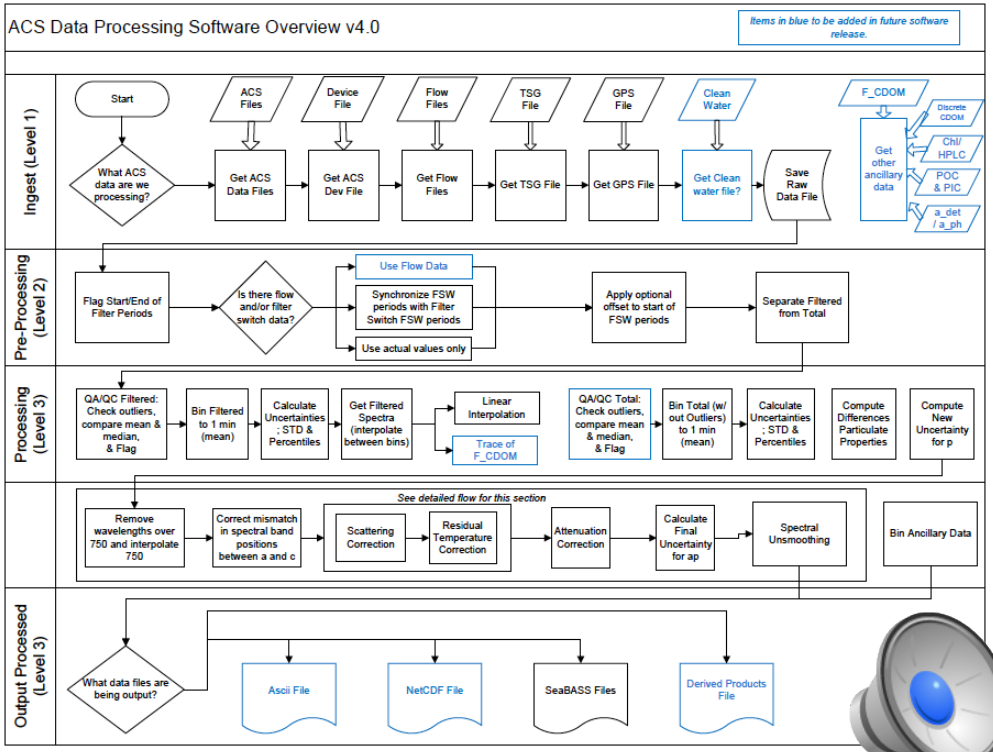
Future/present: Arduino based (Nils' inlinino).

Software for analysis of in-line data

- Available at GitHub:

https://github.com/OceanOptics/ACCode

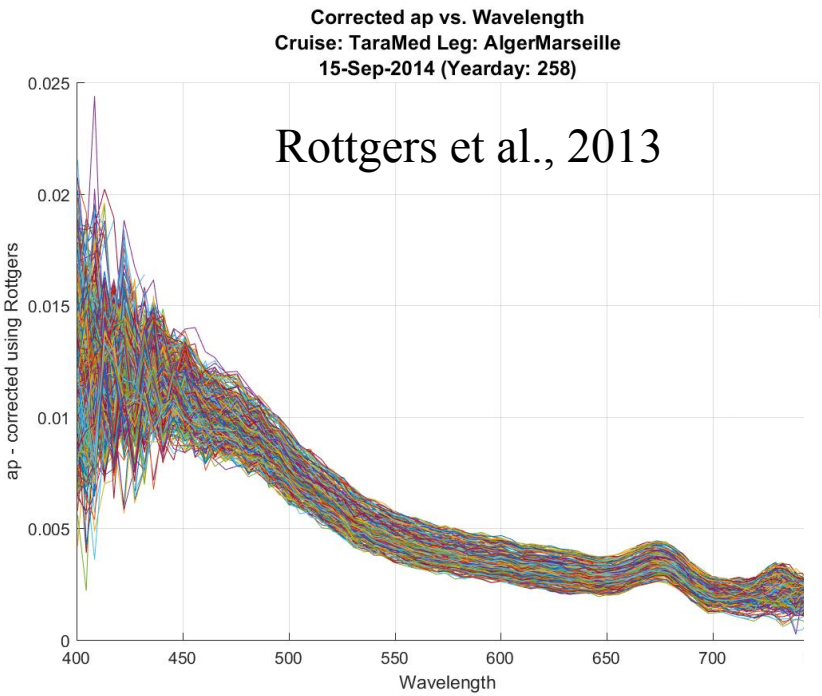
- Deals particularly with filtered/unfiltered ac-meters.
- Currently in Matlab. Python is next.
- Compute uncertainties.
- Modular
- Prepares SeaBASS files

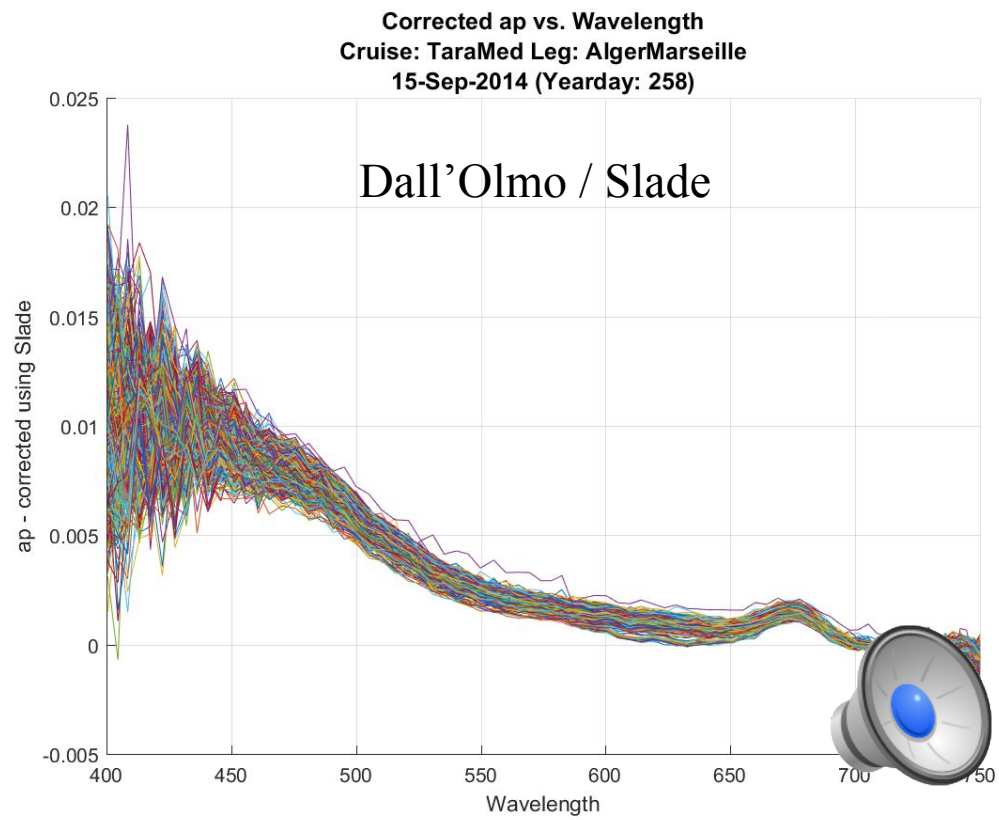


Comments welcome

Wendy Neary

Accommodates different scattering correction:





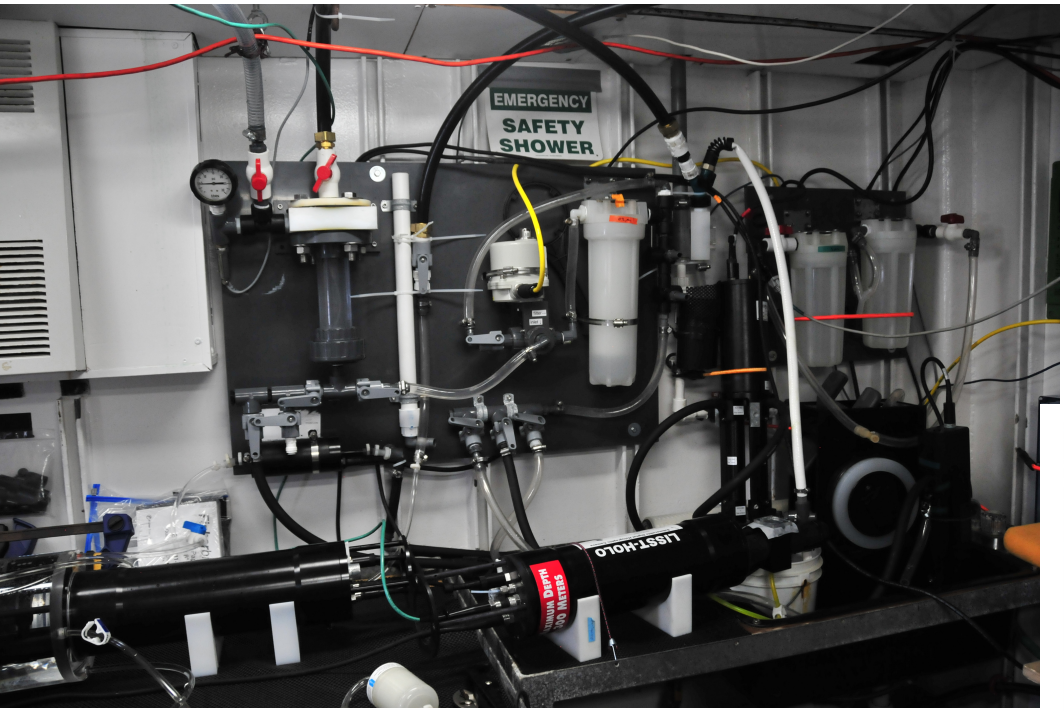
Software can accommodate future scattering correction changes.

How will we disseminate our results?

Website with relevant papers & resources:
https://new.umaine.edu/inline/home/

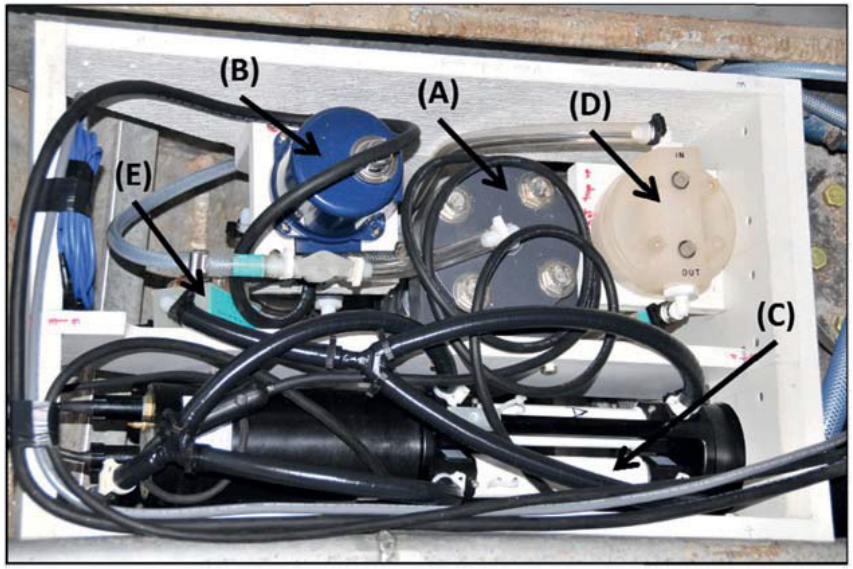
To do in 2017: Method paper or protocol on measuring IOPs with in-line systems – Boss will lead.

Thank you!



SABOR cruise setup (Cetinic & Slade)

Slade et al., 2010



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