The biogeochemical impact of an across-shore filament in the California Current ecosystem

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1. Introduction

The biogeochemical impacts of mesoscale and submesoscale physical dynamics are particularly important in zones of coastal upwelling where chemical and ecological gradients are large.

Both eddies and filaments are common, stochastic phenomenon off the coast of California whereby nutrient rich waters and coastal species are advected offshore 100's of km.

We seek to integrate a process-based understanding of the ecosystem with the dynamic physical environment.

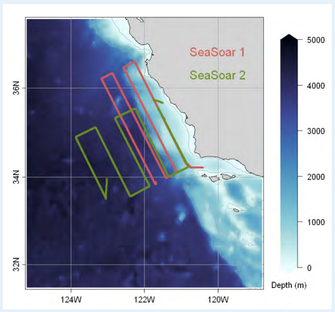
Checkout the interactive data and animations!

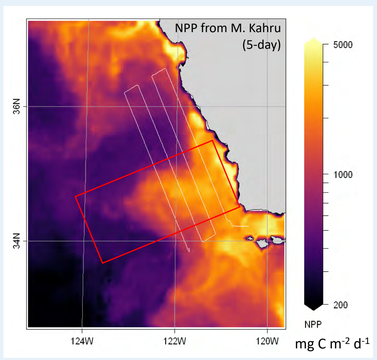
2. The Data

Data comes from a CCE LTER process cruise (P1706)

Two SeaSoar surveys (towed CTD) captured quasi-synoptic snapshots of a mesoscale filament

In addition:
4x Lagrangian experiments to determine ecosystem rates
&
4x transects to assess gradients within the filament





This remotely sensed NPP field shows the early stages of the filament.

First SeaSoar survey in white.

Dramatic increase in NPP

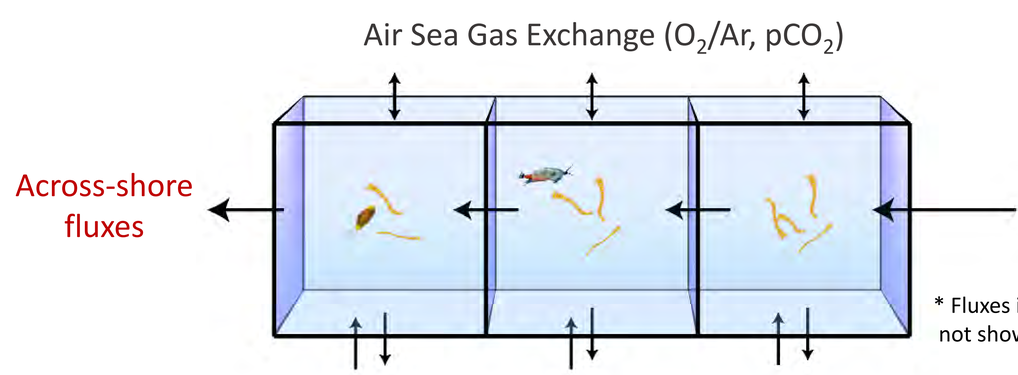
"What is the biogeochemical role of this filament?"

Primary Measurements
- [NO_3] measurements
- SeaSoar Surveys
- Nitrate uptake
- O_2Ar NCP
- ^{234}Th–disequilibrium
- Sediment Trap (PIT) Export
- Remote Sensing Products (NPP, SST, Z_{eu})
- Physical Model (4dvars ROMS)

3. Model Framework

A segmented box model allows direct application of data to inform bulk transformation rates and assessment of inventories.

The model tracks **carbon and nitrogen** along the filament.

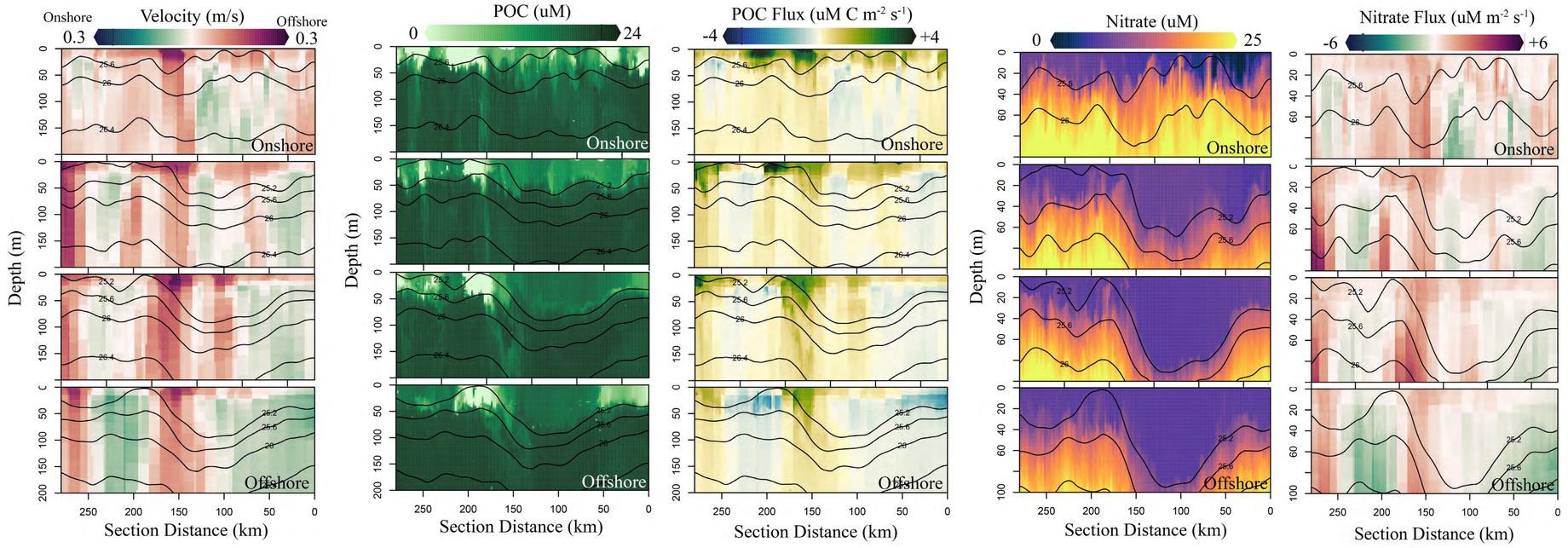


Physical Model

Data assimilative, physically consistent hydrodynamic model (ROMS 4DVARS)
1/10th degree, 42 vertical layers
Model run is centered on the time of the cruise and assimilates cruise observations

For another exciting modeling poser, check out **John Irving's** poster: *"Quantifying the sequestration time of remineralized CO_2 using MITgcm"*!

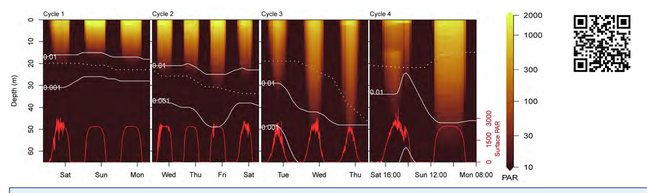
4. Results & Progress



Preliminary Numbers

Offshore Velocity:	8 cm s^{-1}
Volume Transfer:	200 million liters s^{-1}
POC across-shore flux:	8,600 mol C d^{-1}
NPP within filament:	1,000 to >10,000 mg C m^{-2} d^{-1}

Also: Working on mixed layer GPP model based on FRRf photo-physiology measurements & O_2Ar NCP Calculations.



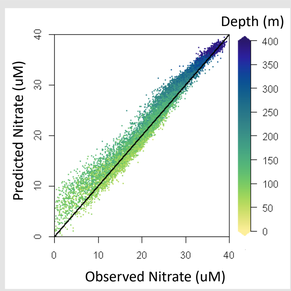
Take-aways

- Mesoscale formations are seasonally variable and drive high biomass pulses in otherwise oligotrophic waters
- Primary productivity was limited by light (& iron) within the filament
- Filaments are likely important exporters of organic matter to offshore mesopelagic communities.

Euphotic Correction for T-S-Nitrate Relationship

Since nitrate is not conservative in the euphotic zone, we apply a linear correction term based on observed nitrate concentrations

$$[NO_3](\rho) = \frac{[NO_3]_{Zeu} - [NO_3]_{surf}}{\rho_{Zeu} - \rho_{surf}} (\rho - \rho_{surf}) + [NO_3]_{surf}$$



About Me

I am a 5th year PhD Candidate in oceanography at **Florida State University** under Dr. Mike Stukel. I would like to acknowledge the NSF for funding as well as NASA and GoMRI.

Checkout my projects:

- ^{234}Th, e-ratio, O_2Ar, satellites, & ocean models
- Scripts, models, publications and more

http://about.tkelly.org/