Correspondence Between Net Oxygen Production and Measurements of Inherent Optical Properties

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Hypothesis

- Given: variability in the biological oxygen stock is the net result of the production and consumption of the organic particles…….

- *We can derive Net Community Production (P-R) if we can accurately account for organic particle growth and consumption in time and space*

- *Further, we can retrieve organic particle stock information using inherent optical properties*

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Abstract

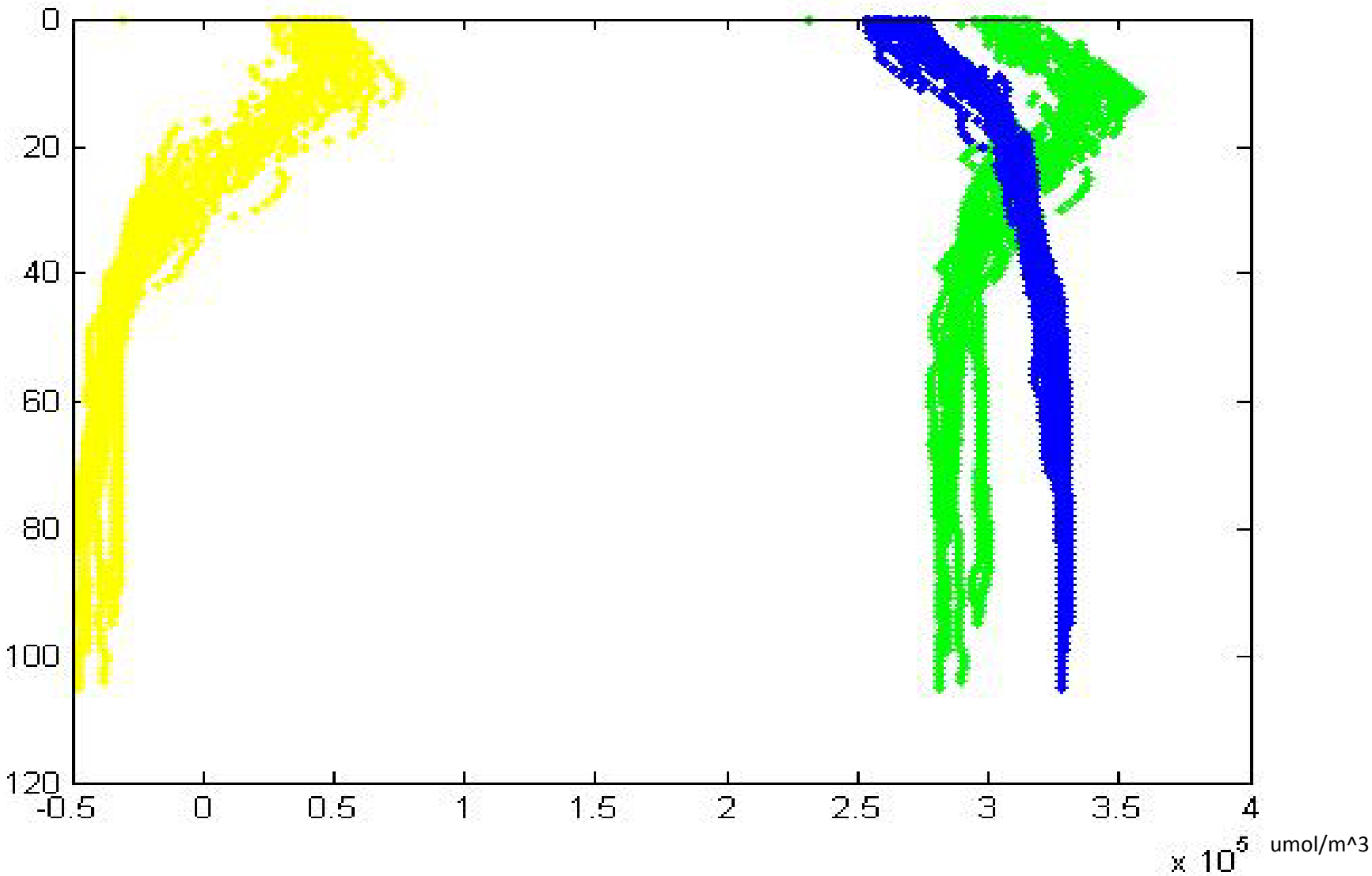
- Data Collection
  - Lagrangian cruise
  - Bottles and Profiling sensors
- Data Processing
  - Calculate the biological oxygen anomaly to the 1% light level
  - Integrated inventories of absorption, attenuation, and particle backscattering at different wavelengths, and chlorophyll fluorescence to the 1% light level
- Explored relationships between optical variables and the biological oxygen anomaly
  - Concentrations (mass/volume)
  - Inventories (per meter^2)
  - Rates of change of inventories (mass per time)

Background Info

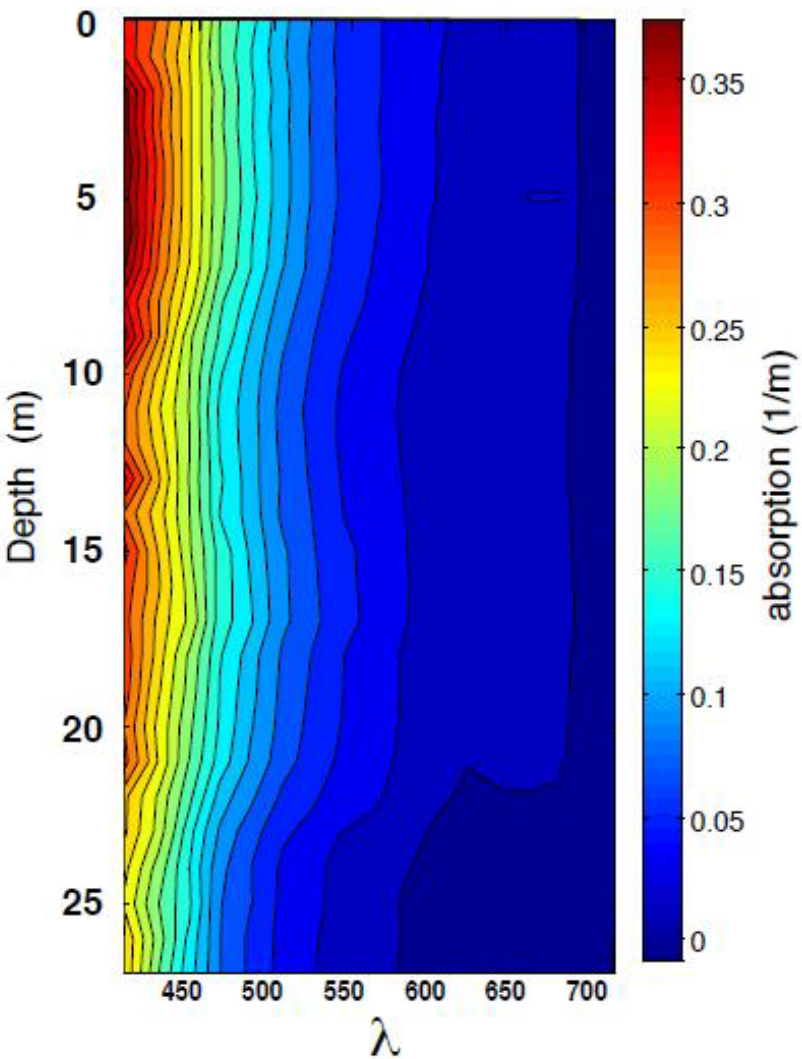
- Photosynthesis and respiration are the two main processes in the production and consumption of oxygen in the ocean
  - Starts with phytoplankton
    - Absorbs light and consumes Dissolved Inorganic Carbon(DIC) through chlorophyll
    - Produces Particulate Organic Carbon (POC, living tissue) along with oxygen.
    - Respiration occurs as the heterotrophic community consumes POC

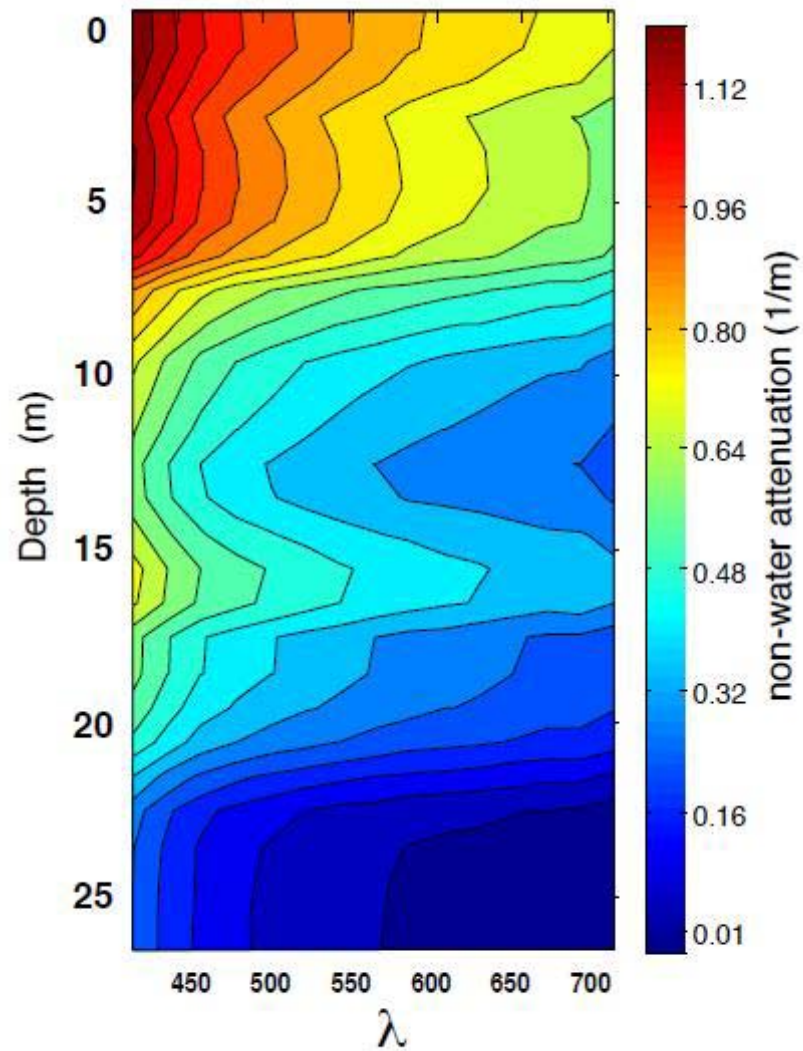
- The *biological oxygen anomaly* is the observed oxygen minus the expected oxygen
  - The purpose of the finding the anomaly is to account for the variability in oxygen produced solely due to biology.

Biological Oxygen Anomaly



Absorption and Attenuation from the Wetlabs ac-s

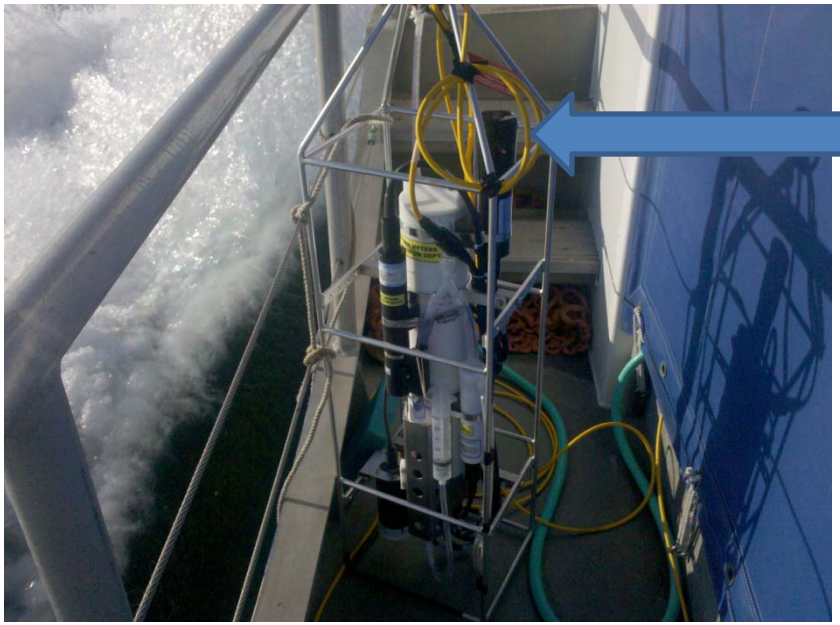




Lagrangian Cruise

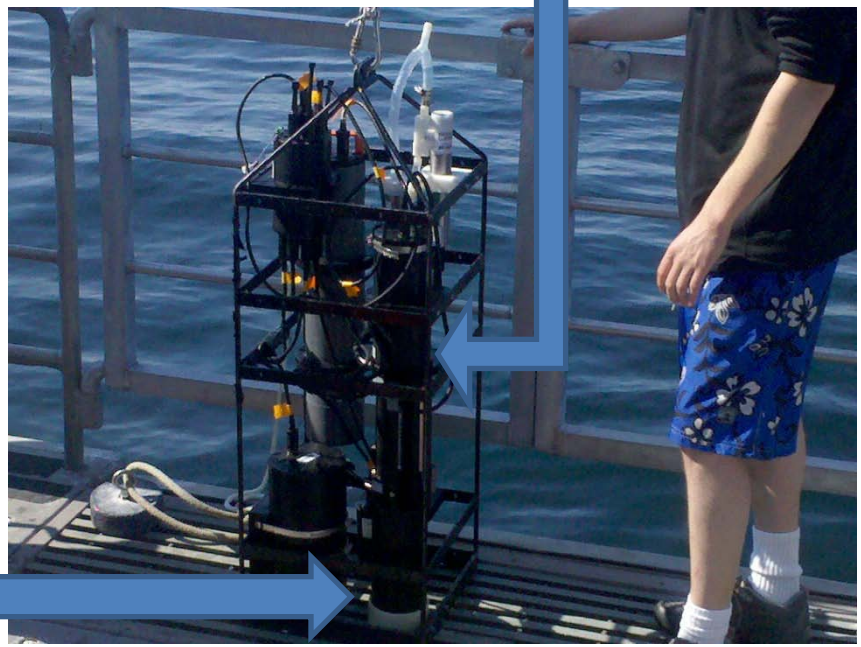
Drogue drifted at 12m because that was the expected chlorophyll maximum depth

Profilers



PAR Sensor

Absorption and Attenuation Tubes



Chlorophyll Fluorescence Sensor

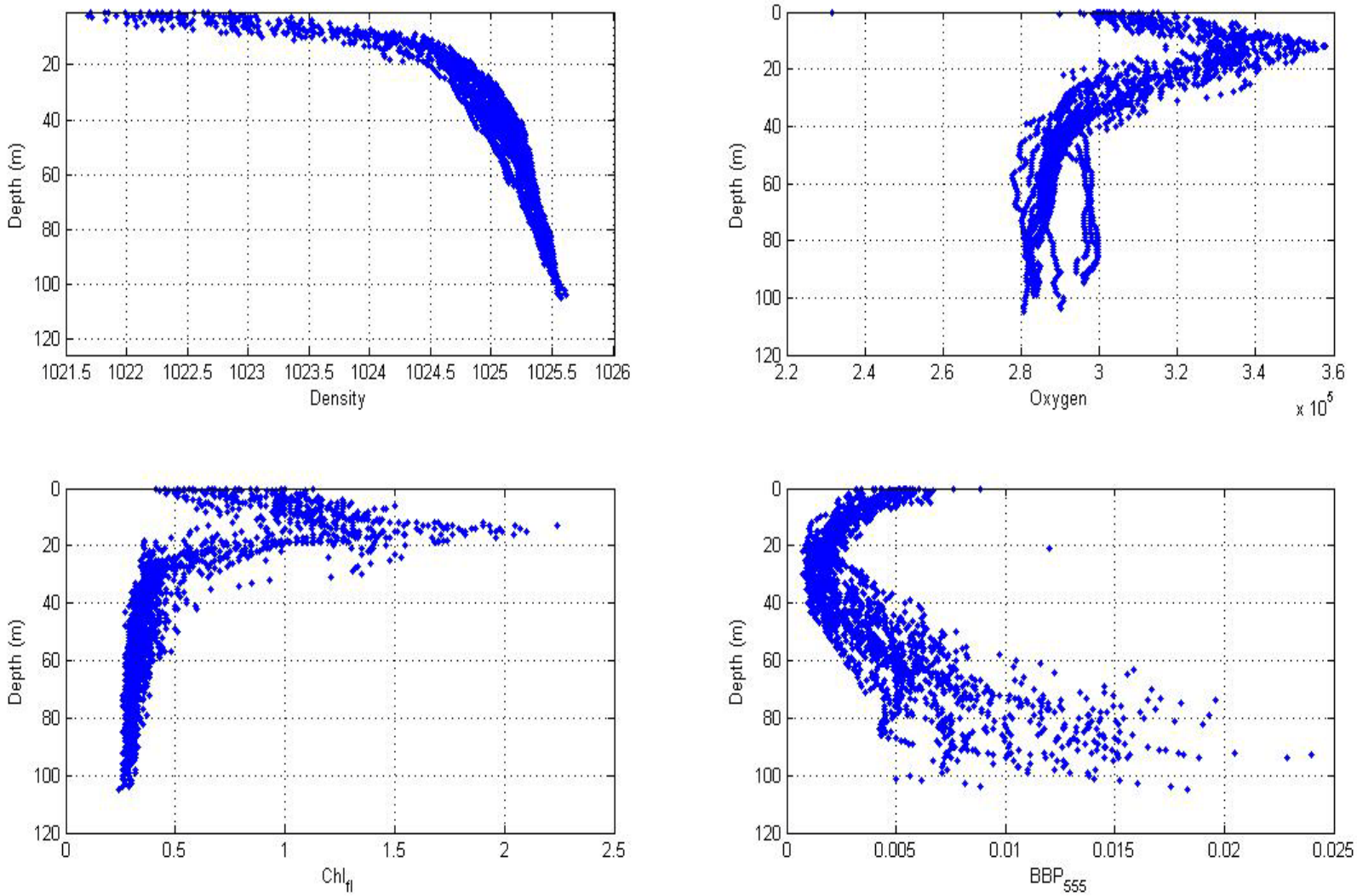
Water Sampling

- We got water from depths of 2m and 12m
- Samples were used to offset the oxygen profiles from the IOP machine.
- Water used to calibrate the instruments for chlorophyll and oxygen.

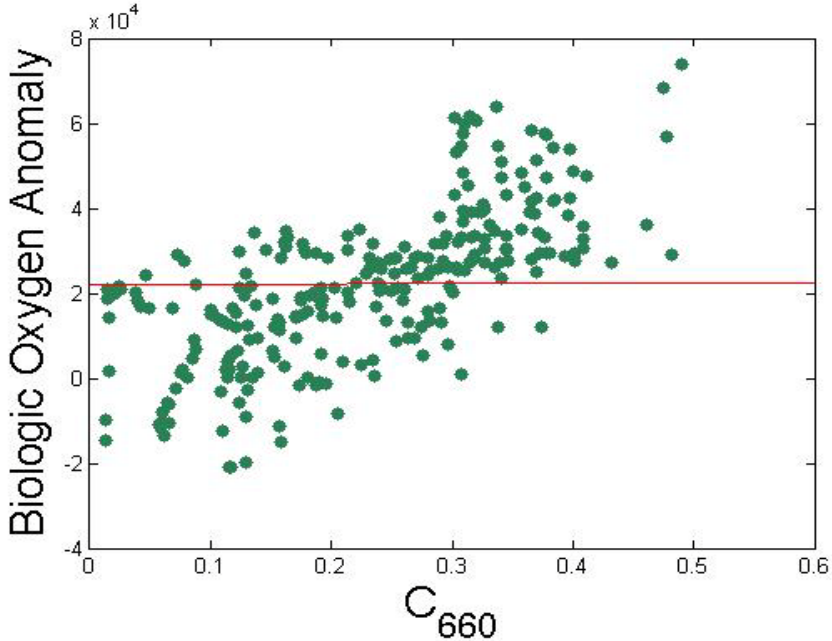
Data Processing with Matlab

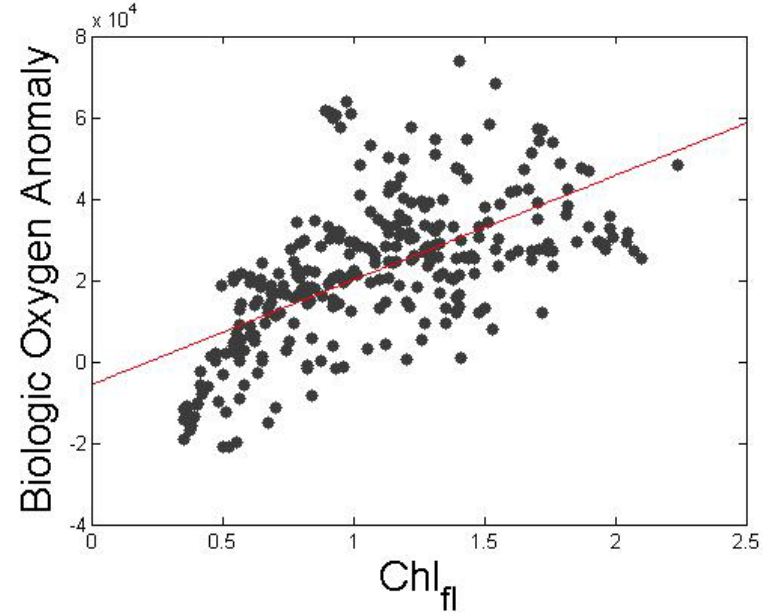
- After seabass files were read into Matlab, programs were developed to manipulate data.
- We used the PAR data from the little CTD machine in order to find depths of 1% light level.
- Developed program to integrate variables to the 1% light level.

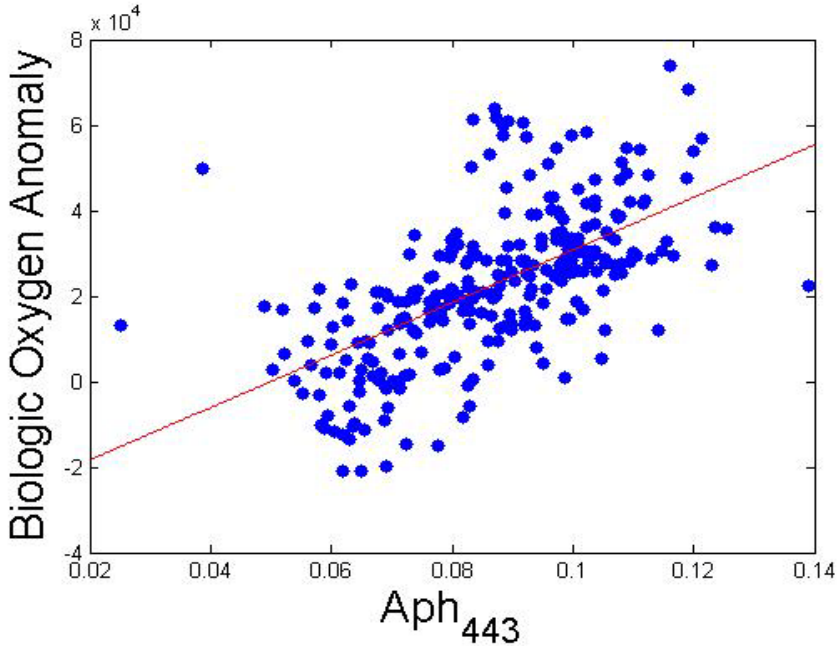
Profiles (n=23)

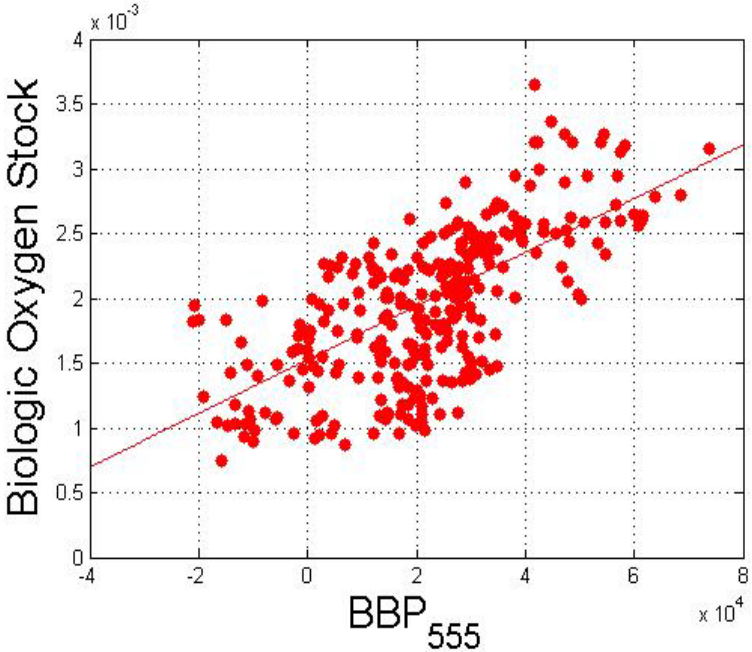


Robust Relationships

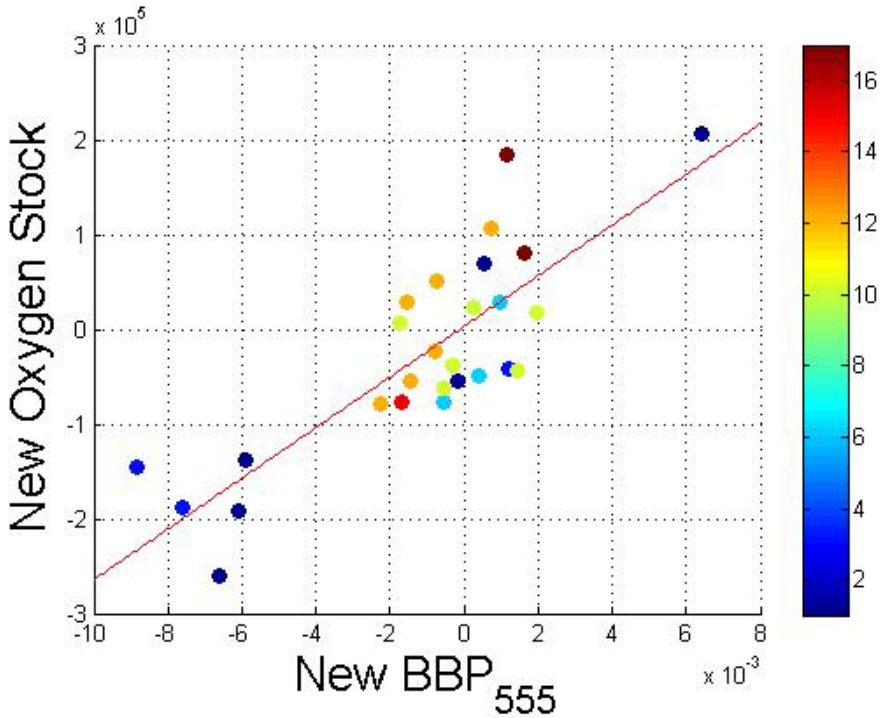


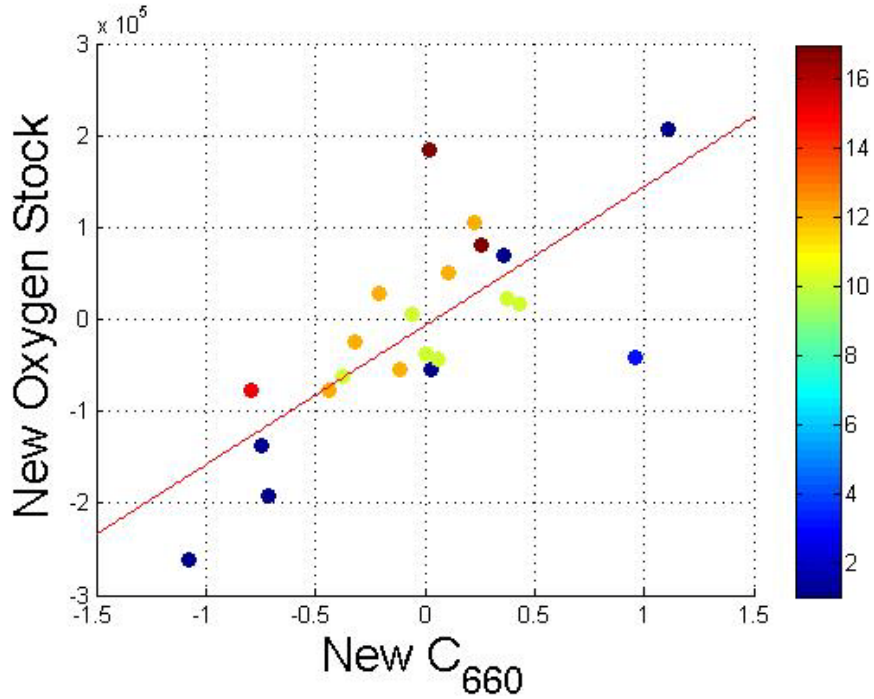






Temporal Differencing Plots





NASA Significance

- If you can track the oxygen stock in time and space through information on particle dynamics, then you can estimate net community productivity with satellite data

Conclusions

- bbp555 corresponds best with the biological anomaly, others were not as good
- The change in the optical properties and the change in the biological oxygen stock tend to correspond at measured time scales.
- If further research proves these relationships to be robust, then it implies that we can track and predict NCP from optical measurements.

Acknowledgements

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