

# Coupling of Sinking Biogenic Particulate Fluxes and Primary Production in the Euphotic Zone of the Cariaco Basin, Venezuela

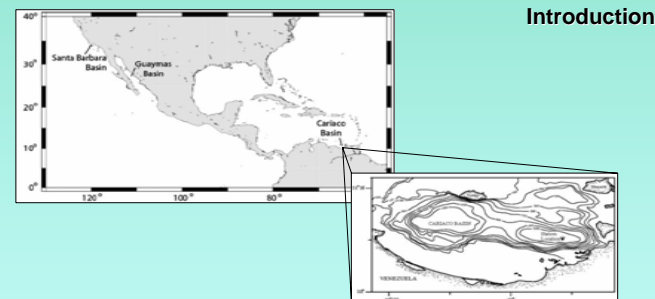
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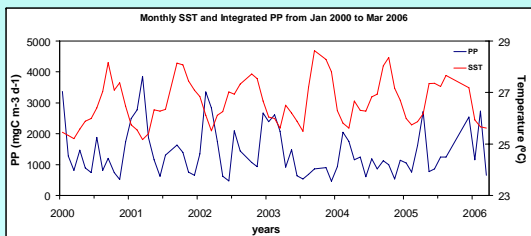


## Abstract

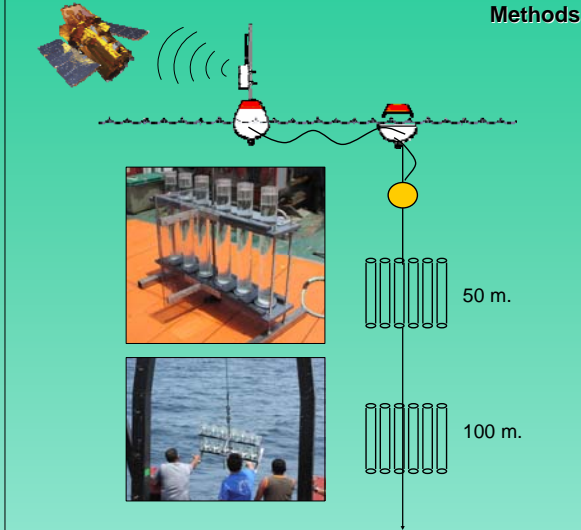
One of the processes that draws CO<sub>2</sub> from the atmosphere into the ocean is photosynthesis, which generates organic particles. A fraction of these particles sinks toward the sea floor. Only 1% of the organic matter produced in the upper ocean reaches depths below 1500 m, due to dissolution and microbial degradation. Several studies have shown that the vertical flux of particulate organic carbon (POC) is strongly correlated to the settling rates of minerals like calcium carbonate, opal and lithogenic material, suggesting that they act as ballast and provide physical protection from degradation to POC. Results from the CARIACO (Carbon Retention in a Colored Ocean) time series program support this hypothesis. For over ten years, CARIACO has been studying the connections between primary production (PP) and the biogeochemical features of sinking particles in the Cariaco Basin, Venezuela, with moored sediment traps that collect settling matter at five depths between 125 and 1300 m, on a bi-weekly basis, for periods of six months. The geomorphology of this basin, which is a depression on the continental margin off the eastern coast of Venezuela, restricts deep water ventilation, making it anoxic below 250 m. Although the Cariaco Basin exhibits strong seasonal production cycles related to wind-driven upwelling, it has been observed that the flux of biogenic matter at all depths below the oxic-anoxic interface is not significantly correlated to primary production. **In order to understand the flux of particles in the upper 100m of the water column, deployments of drifting sediment traps in the Cariaco Basin were carried out, collecting settling material at 50 and 100 m. The hypothesis is that the flux of sinking material through the euphotic zone may be less affected by decomposition and dissolution than material reaching the deep moored traps, and that it is connected to variability of surface chlorophyll a concentrations as a proxy for PP.** Initial results show significant differences in flux rates of POC, PON and carbonate between these two depths and among periods. The following steps of this research include comparing shallow vs. deep sediment traps data.



**Fig 1.** The Cariaco Basin is a large (~160 km long, 70 km wide and 1400 m deep) tectonic depression located on the continental shelf of the Venezuelan central coast. It has two sub-basins separated by a saddle that rises up to 300 m. It exhibits an oxic-anoxic interface at ~250 m.

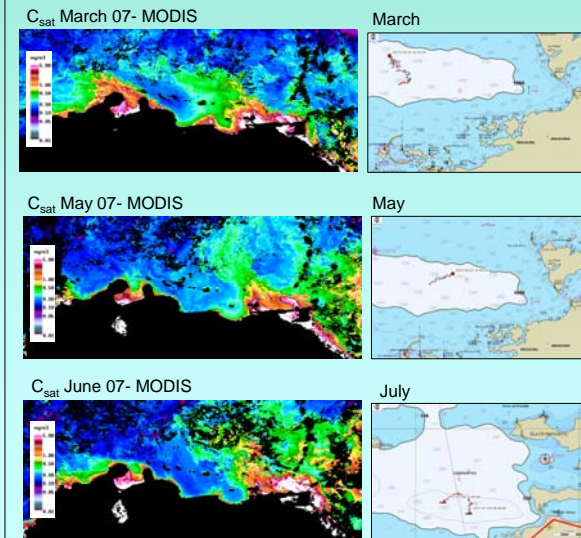


**Fig 2.** Upwelling, induced mainly by winds, brings nutrients from deeper waters and drives the annual production cycle, as can be seen in the negative correlation between sea surface temperature (SST) and primary production (PP) of the CARIACO Time Series.



**Fig 3.** Sediment samples were collected within the euphotic zone in the eastern sub-basin of the Cariaco Basin using a drifting array of Particles Interceptor Traps (PIT). 19-56 hours deployments were carried out in March, May and July 2007. An Argos unit attached to the surface buoy allowed recording the position of the drifter every ~30 minutes.

## Results

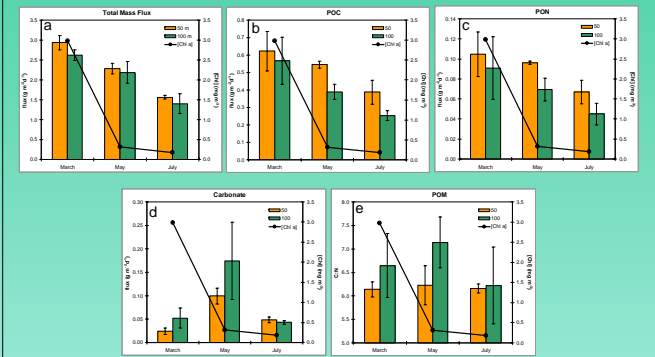


**Fig 4.** Mean satellite chlorophyll a (C<sub>SAT</sub>) monthly composites of the Cariaco Basin derived from ocean color images provided by MODIS.

## Results



**Fig 6.** Examples of types of material collected with the PITs. Gastropod and bivalve shells, forams, fish scales and 'swimmers' (copepods, chaetognaths, fish larvae) were frequently found. After removal of swimmers, this material was dried and pulverized for elemental analysis.



**Fig 7.** Biogenic fluxes (a-d) and C:N mass ratios (e) measured in samples from each period and depth. Chlorophyll a concentrations ([Chl]) are mean C<sub>SAT</sub> values along each transect, extracted from the corresponding C<sub>SAT</sub> composites. Error bars represent the standard deviation.

## Conclusions

- POC and PON fluxes decrease with depth within the first 100 m.
- PON is remineralized faster than POC in the euphotic zone.
- Fluxes of POC and PON suggest connections to variations of surface chlorophyll a concentrations measured with satellite imagery.

## Future Work

- Assess possible connections of biogenic fluxes with changes in the phytoplankton assemblage
- Estimate opal fluxes for the same periods
- Compare the flux of biogenic compounds within the euphotic zone with flux measurements of the deep traps in the Cariaco Basin and other anoxic basins.

## References

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