Offshore transport of POC due to mesoscale eddies in the California Current System

Caitlin Amos and Renato M. Castelao

Department of Marine Sciences, University of Georgia, Athens, GA

Introduction

Nonlinear mesoscale eddies can have a significant impact on the distribution of organic materials throughout the world's ocean. In the California Current System (CCS), high particulate organic carbon (POC) concentrations found in near shore waters can be horizontally and vertically advected by eddies.

Using satellite measurements of ocean color to estimate surface POC, this study quantifies the influence of eddies in the CCS on the offshore transport of POC.

POC and Eddies

Particulate Organic Carbon

- Calculated using *Stramski et al., 2008* algorithm from SeaWiFS reflectance*:*

$$POC = 203.2 \times \left(\frac{Rrs(443)}{Rrs(555)}\right)^{-1.034}$$

- Daily POC averaged at 7 day intervals and filtered using 6° x 6° moving average

Eddies

- *Chelton et al. 2011* Version 4 dataset
- Analyzed weekly cyclonic eddy tracks for 1997-2015 to align with weekly averaged POC

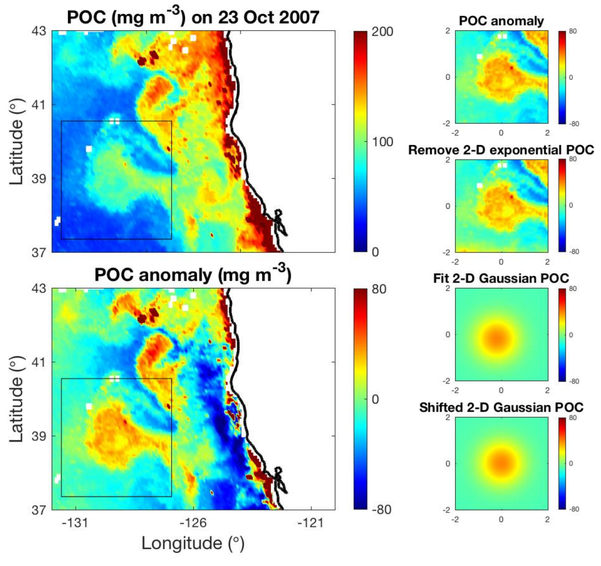

Figure 1. Procedure used for quantifying the POC anomaly within each eddy. Left panels are example of full POC field (top) and POC anomaly (bottom; mg m^{-3}) on October 23rd, 2007. Right panels are the region within a 2 by 2 eddy radii from the eddy center for the cyclone shown in the black box in the left panels.

Eddy Induced Cross-shelf Transport

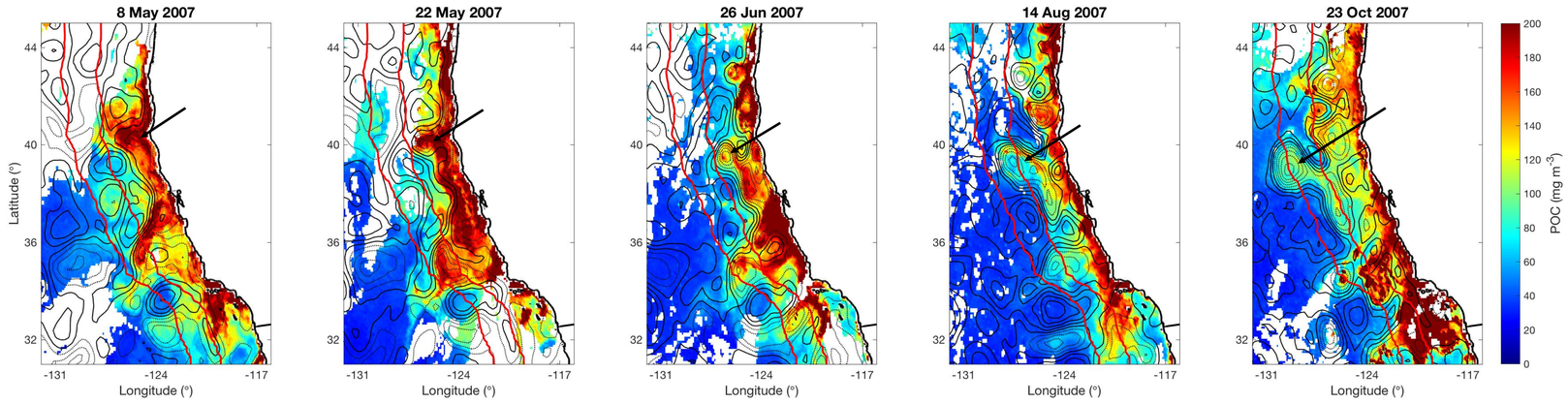

Figure 2. Full POC field (mg m^{-3}) and MSLA contours at 4 cm intervals. Solid contours are positive values (anticyclones) and dashed contours are negative values (cyclones). Red lines indicate distances of 300 and 500 km from coast.

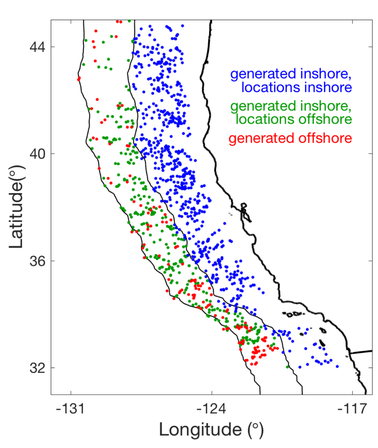

Figure 3. Cyclonic eddies with at least 90% POC pixel coverage used for analyses. Black lines distances of 300 and 500 km from coast.

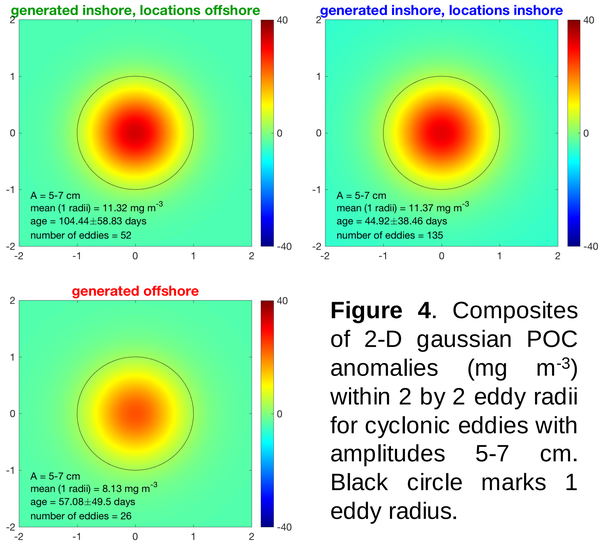

Figure 4. Composites of 2-D gaussian POC anomalies (mg m^{-3}) within 2 by 2 eddy radii for cyclonic eddies with amplitudes 5-7 cm. Black circle marks 1 eddy radius.

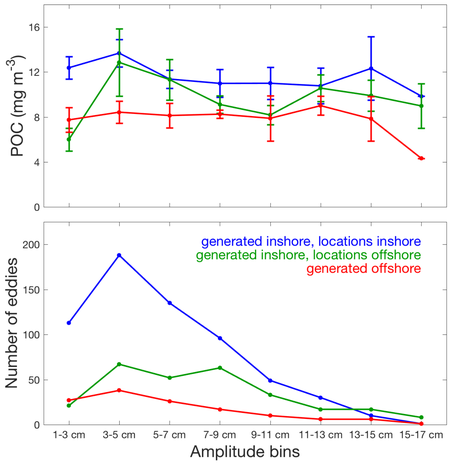

Figure 5. (top) Mean POC anomalies (mg m^{-3}) and standard error calculated within 1 eddy radius and (bottom) number of cyclonic eddies grouped into 2 cm amplitude bins

Acknowledgements

Support for this research provided by NASA (NNX13AD80G and NNX14AM70G) is gratefully acknowledged.

Conclusions

Cyclonic eddies found offshore but that were generated inshore have higher concentrations of particulate organic carbon on average than eddies of the same amplitude generated offshore, indicating that eddies are playing an important role in redistributing POC, and other materials, into offshore regions.

Future work

- Extend analyses to anticyclonic eddies
- Quantify POC flux

References

Chelton, D. B., M. G. Schlax, and R. M. Samelson (2011), Global observation of nonlinear mesoscale eddies, *Prog. Oceanogr.*, *91*(2), 167-216.

Stramski, D., et al. (2008), Relationships between the surface concentration of particulate organic carbon and optical properties in the eastern South Pacific and eastern Atlantic Oceans, *Biogeosciences*, *5*, 171-201.