

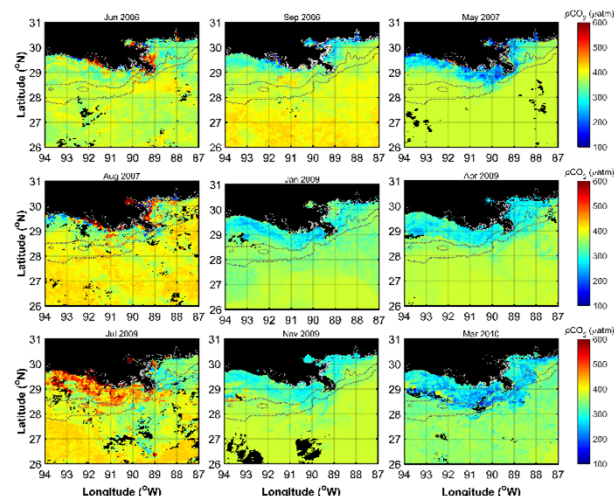
Satellite Estimation of Coastal $p\text{CO}_2$ and Air-sea Flux of Carbon Dioxide in the Northern Gulf of Mexico

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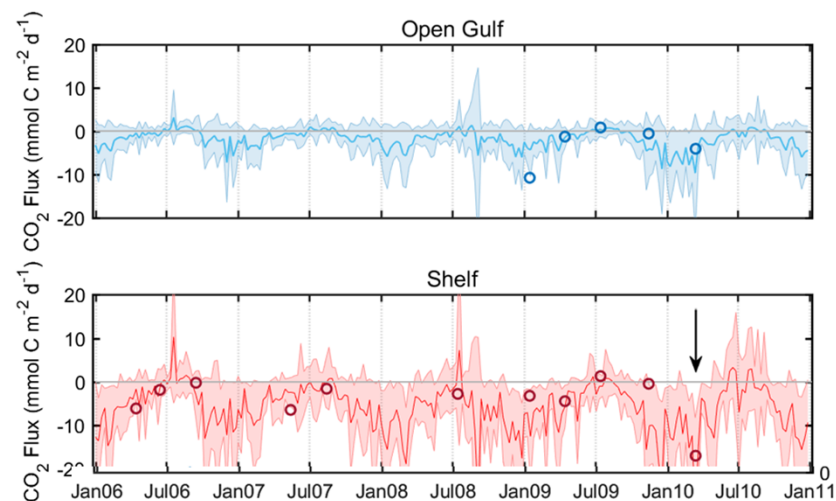
Challenge: A contributing factor in uncertainties in coastal carbon fluxes stems from the under sampling of seasonality and spatial heterogeneity. Our objectives were to i) assess satellite-based approaches that would expand the spatial and temporal coverage of the surface ocean $p\text{CO}_2$ and sea-air CO_2 flux for the northern Gulf of Mexico, and ii) investigate the seasonal and interannual variations in CO_2 dynamics and possible environmental drivers.

Methods: Regression tree analysis was effective in directly relating surface ocean $p\text{CO}_2$ to satellite-retrieved (MODIS Aqua) products including chlorophyll, sea surface temperature, and dissolved/detrital absorption. Satellite-based assessments of sea surface $p\text{CO}_2$ were made spanning the period from 2006-2010 and were used in conjunction with estimates of wind fields and atmospheric $p\text{CO}_2$ to produce regional-scale estimates of air-sea fluxes.

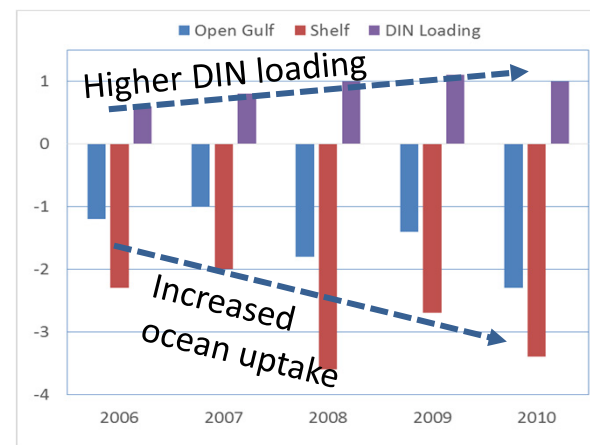
Key Findings: Seasonality was evident in air-sea fluxes of CO_2 , with an estimated annual average CO_2 flux for the study region of $-4.3 \pm 1.1 \text{ Tg C y}^{-1}$, confirming prior findings that the Gulf of Mexico was a net CO_2 sink. Interannual variations in fluxes were evident and related to Mississippi River dissolved inorganic nitrogen (DIN) loading.



Satellite-derived $p\text{CO}_2$ monthly images.



Satellite-based estimates of sea-to-air flux of CO_2 (shaded areas represent plus or minus one standard deviation). The circle symbols are results from ship-based estimates. Arrow indicates strongest negative fluxes (ocean uptake) during March 2010.



Annual CO_2 flux (Tg C y^{-1}) and DIN loading (Tg N y^{-1}) for the region.

Significance: This is the first multi-year assessment of $p\text{CO}_2$ and air-sea flux of CO_2 using satellite-derived environmental data for the northern Gulf of Mexico. Interannual variability in fluxes was related to Mississippi River DIN inputs, an indication that human- and climate-related changes in river exports will impact coastal carbon budgets.

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