

# Blue Carbon in Coastal Wetlands: Consideration of Lateral and Vertical Carbon and Greenhouse Gas Fluxes

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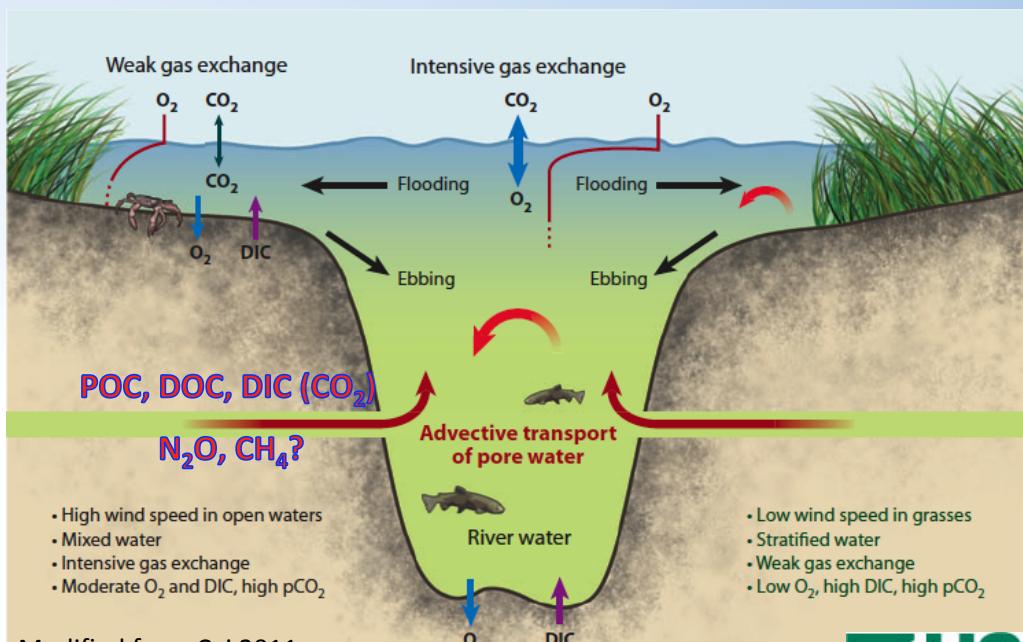
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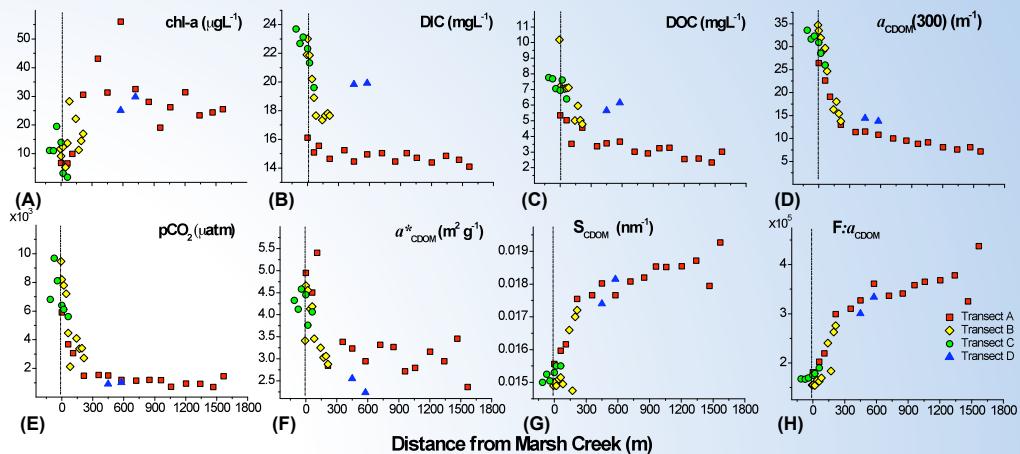
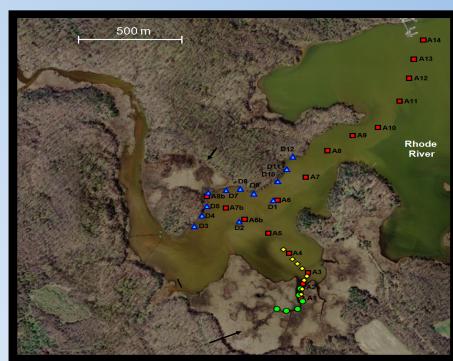


In tidal wetland carbon and GHG budgets we also need to consider the lateral fluxes: C fluxes may be large...



**Strong spatial gradients in estuarine and coastal optical and biogeochemical variables, associated with tidal export of dissolved carbon from freshwater and salt marshes**

Maria Tzortziou, Patrick J Neale, J Patrick Megonigal

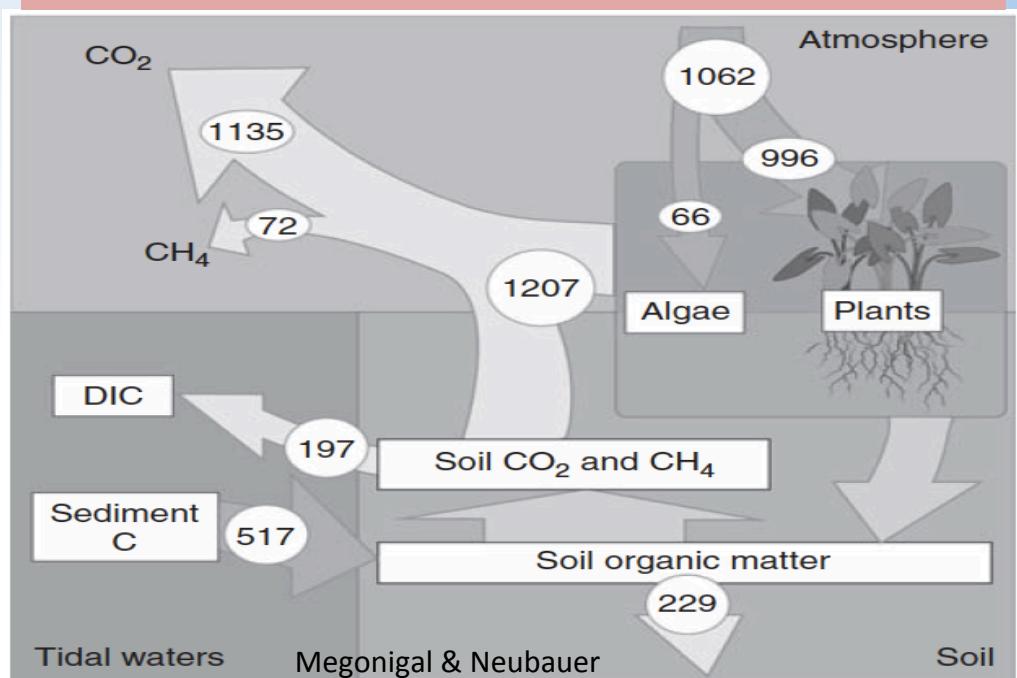


**Net ecosystem C balance (NECB)**

$$\text{NECB} = \text{NEP} - \text{RCH}_4 - \text{FL}$$

NEP: net ecosystem production, closed transparent chamber

RCH<sub>4</sub>: CH<sub>4</sub> flux measured simultaneously with NEP; FL: net lateral flux





### Sage Lot Pond: Lowest N site

The most intensive work has been at the Sage Lot Pond site.

WBNERR staff installed a boardwalk, bridges and other infrastructure.

The site is their Salt Marsh Observatory, and there is continuous monitoring of many parameters.

Lateral flux measurements are made at the mouth of this creek.

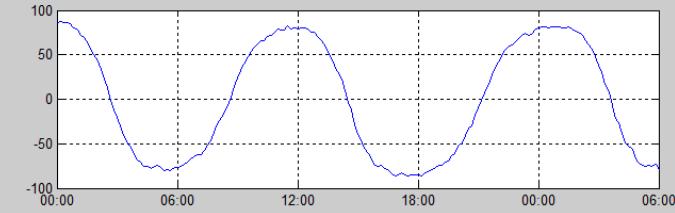
Photo provided by Jim Rassman (WBNERR)



### Conceptual approach to lateral flux measurements

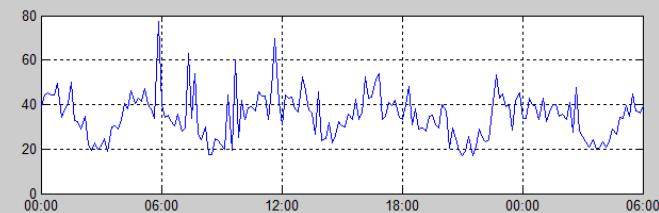
Water flux ( $u \times A$ ),  $\text{m}^3/\text{s}$ :

- High-frequency measurements to reduce error
- Maximum channel coverage
- Consistent procedure



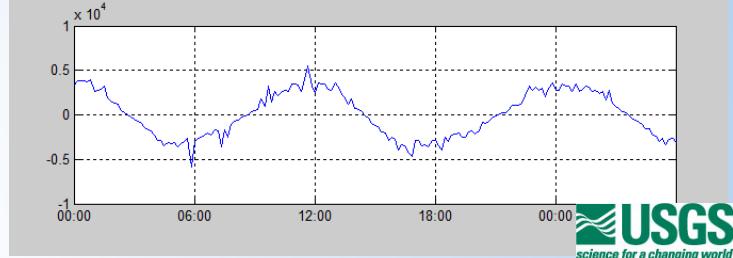
Concentration (c),  $\text{g}/\text{m}^3$ :

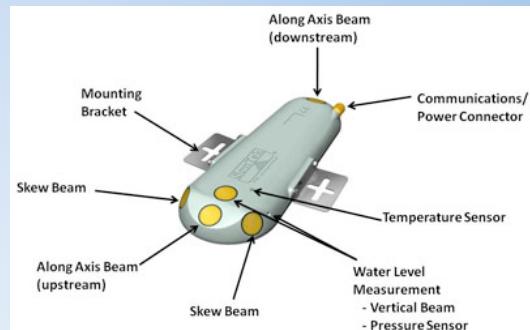
- Sufficient vertical/lateral sampling
- Look for proxy parameters that we can measure continuously



Total flux ( $u \times A \times c$ ),  $\text{g}/\text{s}$

Analytes:  $\text{CO}_2$ ,  $\text{DIC}$ ,  $\text{DOC}$ ,  $\text{CH}_4$ ,  $\text{POC}$ ,  $\text{N}_2\text{O}$ ,  $\text{N}$ ,  $\text{P}$



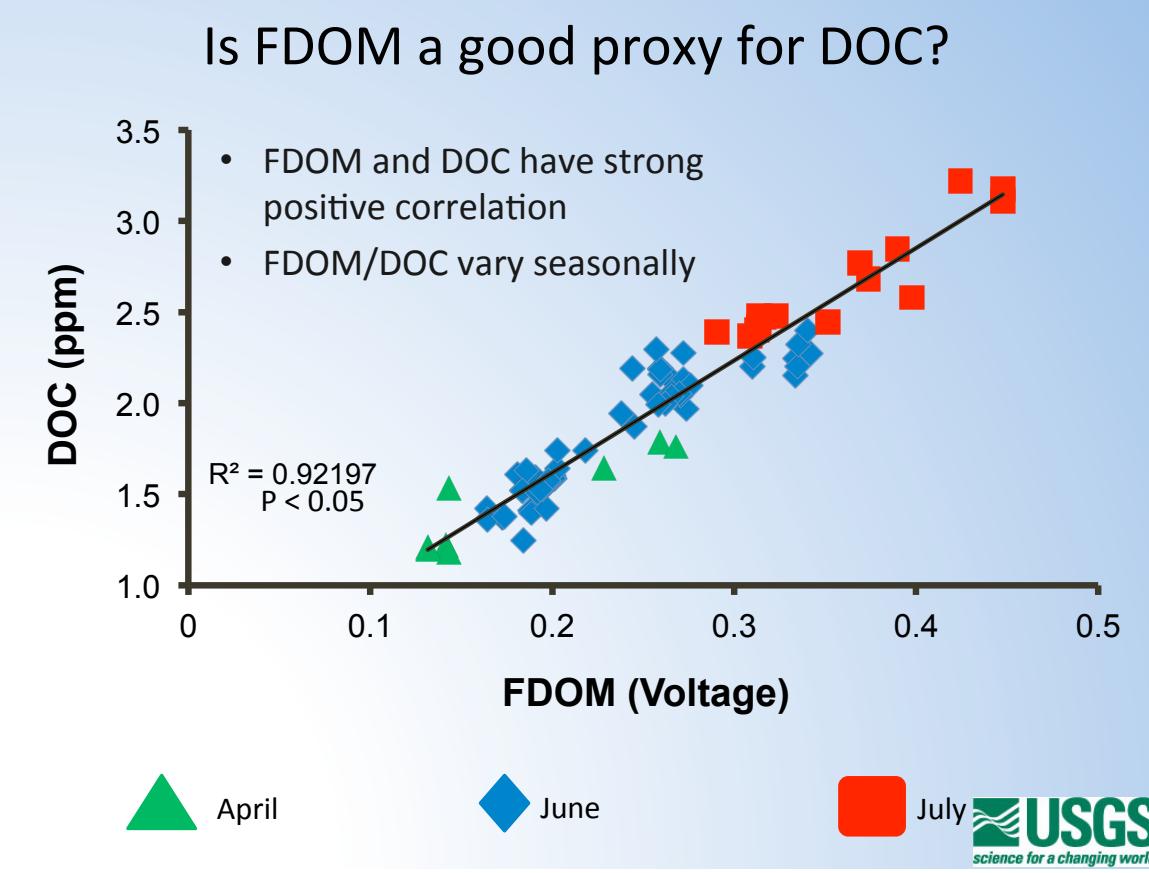


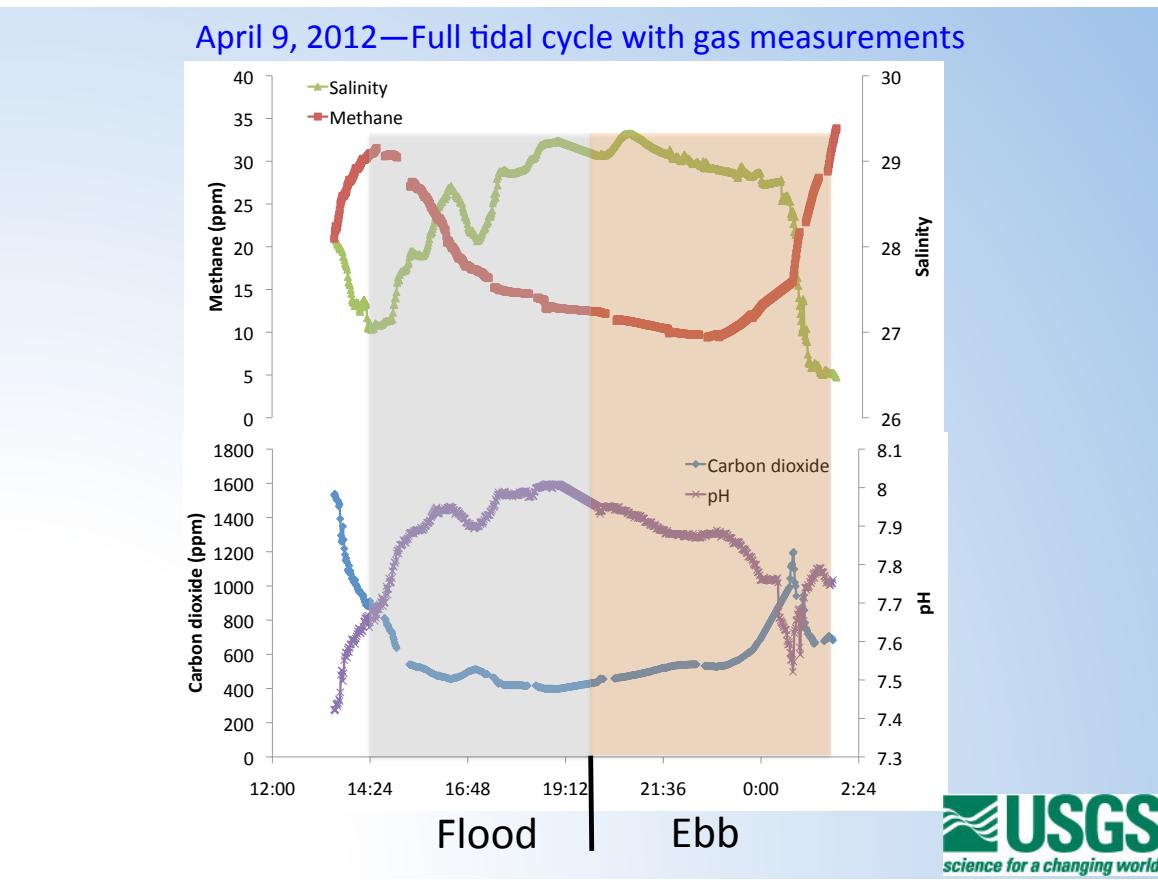
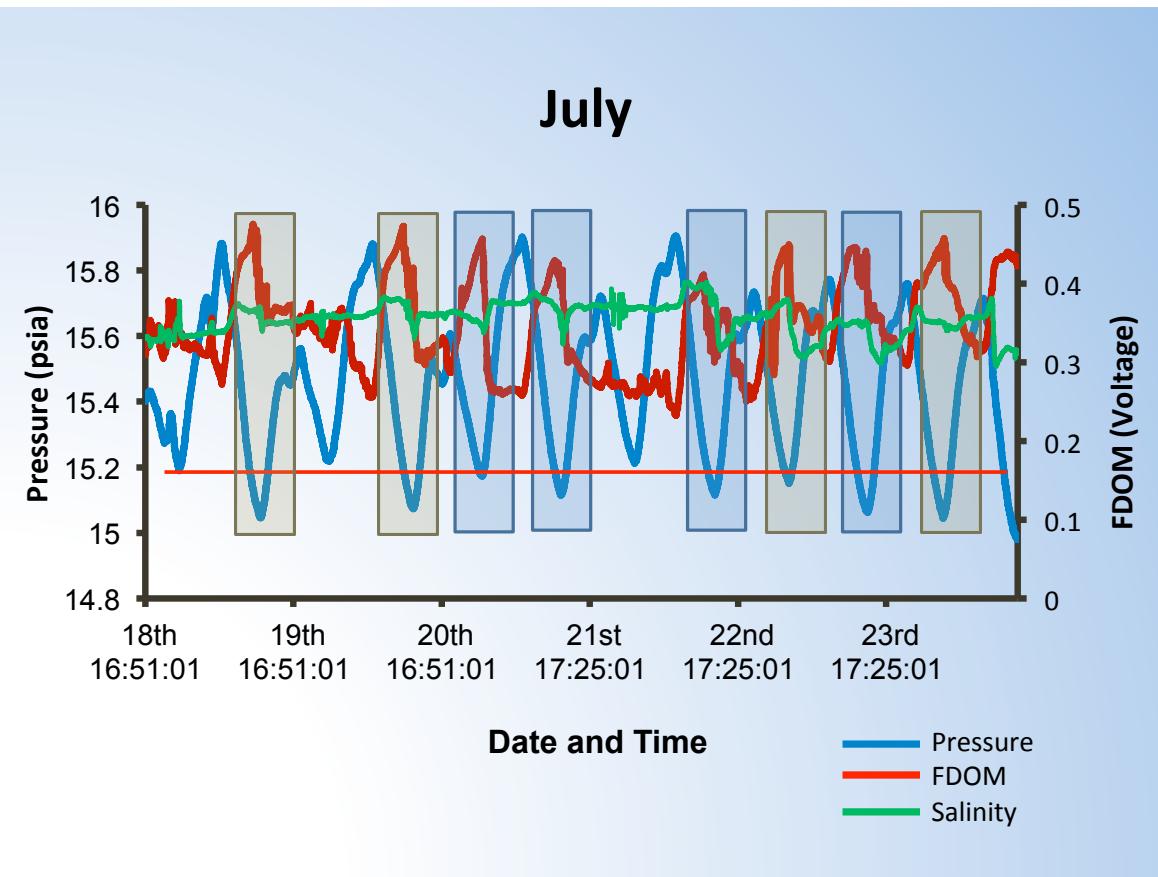


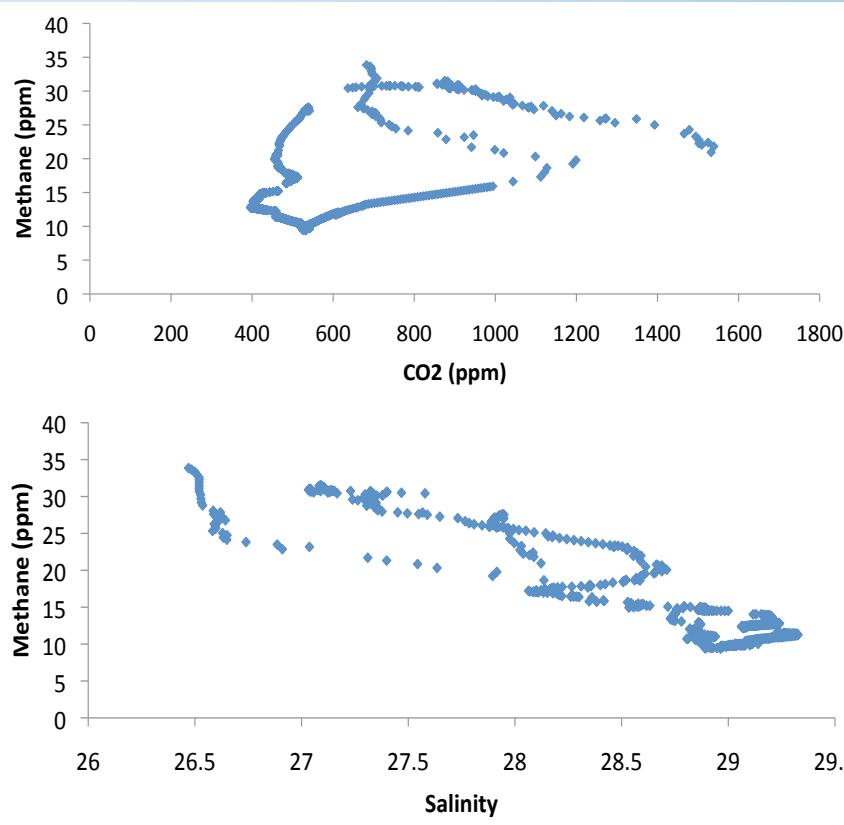
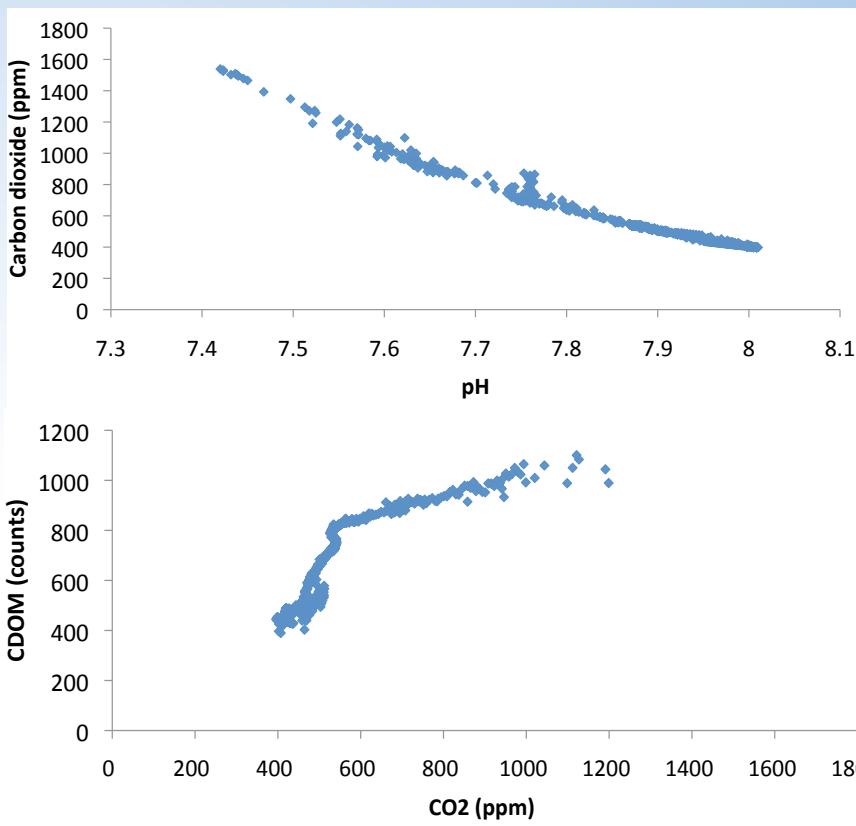
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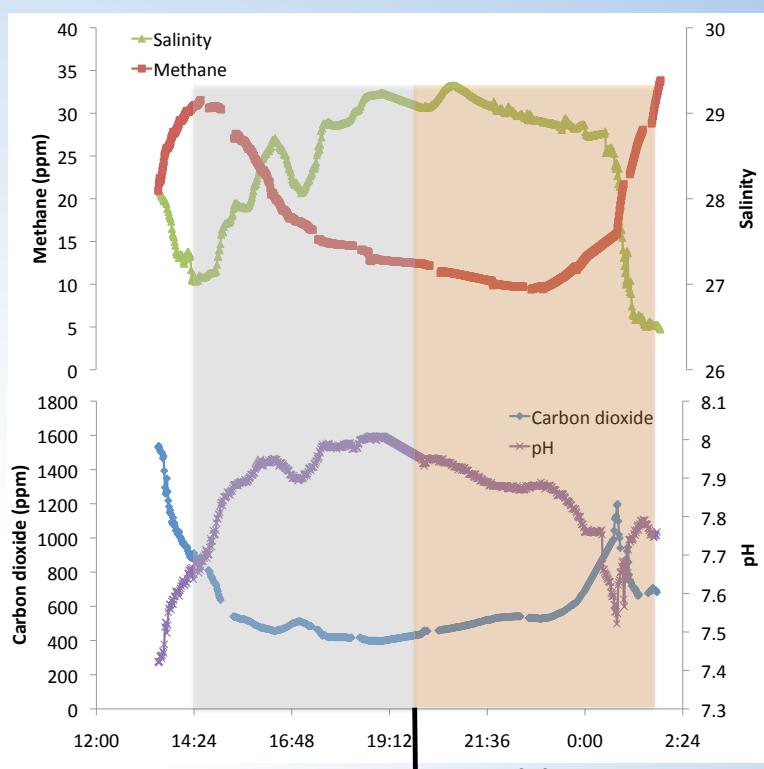
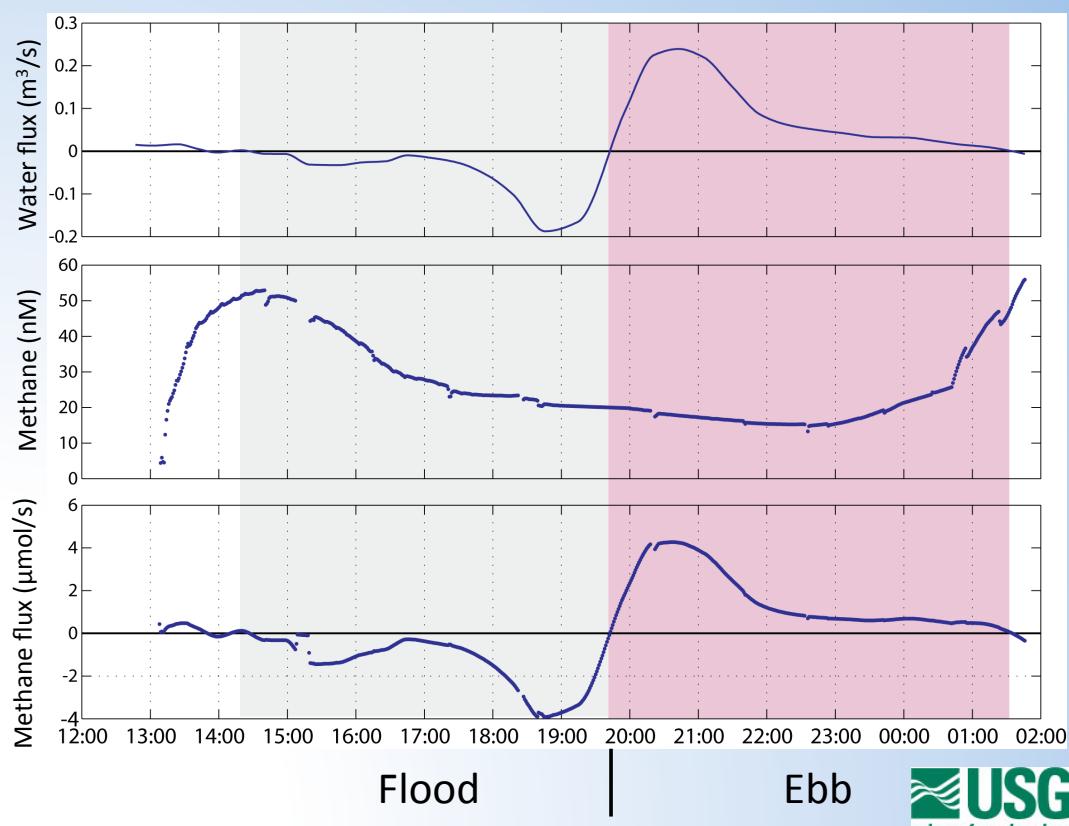


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# Interpretations and Comments on Methods

- Measurements and understanding of lateral fluxes are critical to calculations of carbon budgets, and to interpretations of C sequestration and GHG flux rates.
- Saline wetland porewater may be the major source for CO<sub>2</sub>, DIC and DOC, with flux rates influenced by tidal amplitude.
- Reduced salinity (groundwater-influenced) porewater is likely the major source for high CH<sub>4</sub> concentrations at low tide.
- High sensitivity of flux calculations to small differences in concentration at times of major water flux is a critical feature and limitation: Insufficient frequency of measurements or insufficient accuracy could contribute to the lack of consensus in the literature about the role of coastal wetlands as exporters or importers of carbon.
- Continuous data appears to be necessary, given the high degree of variability on daily timescales and sensitivity of calculations to small differences in concentration between flood and ebb tide, and to temporal variations in the water budget.



## Primary collaborators and contributors

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