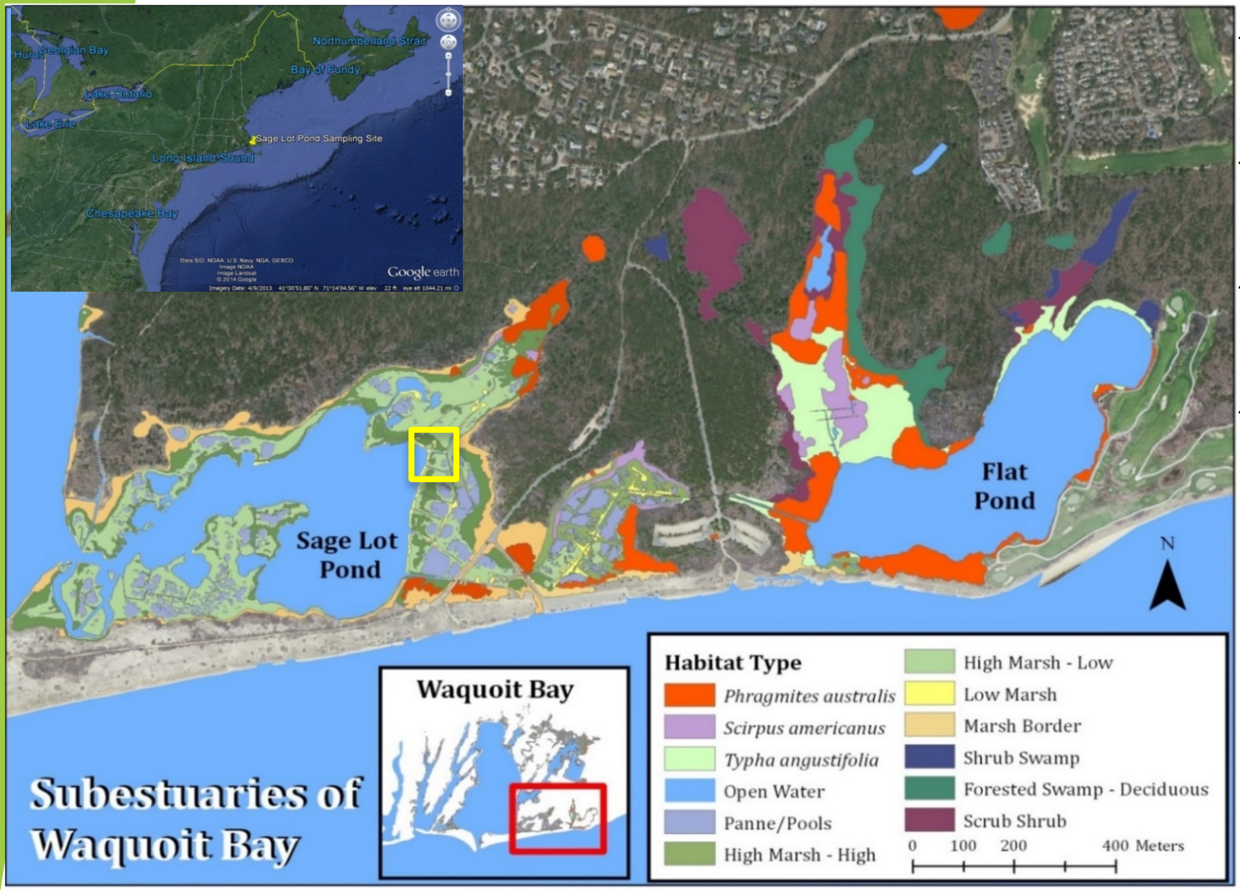


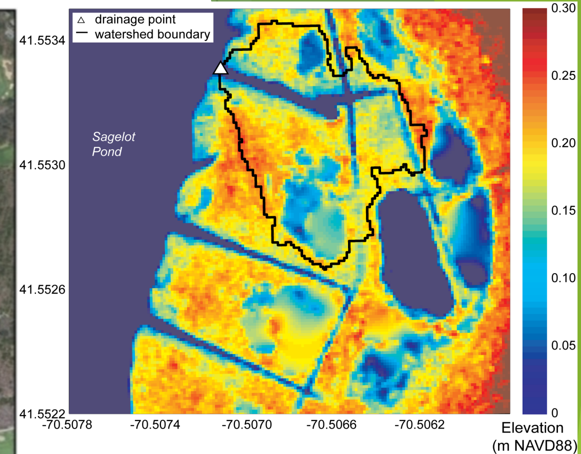


# Intertidal Salt Marshes as an Important Source of Inorganic Carbon to the Coastal Ocean

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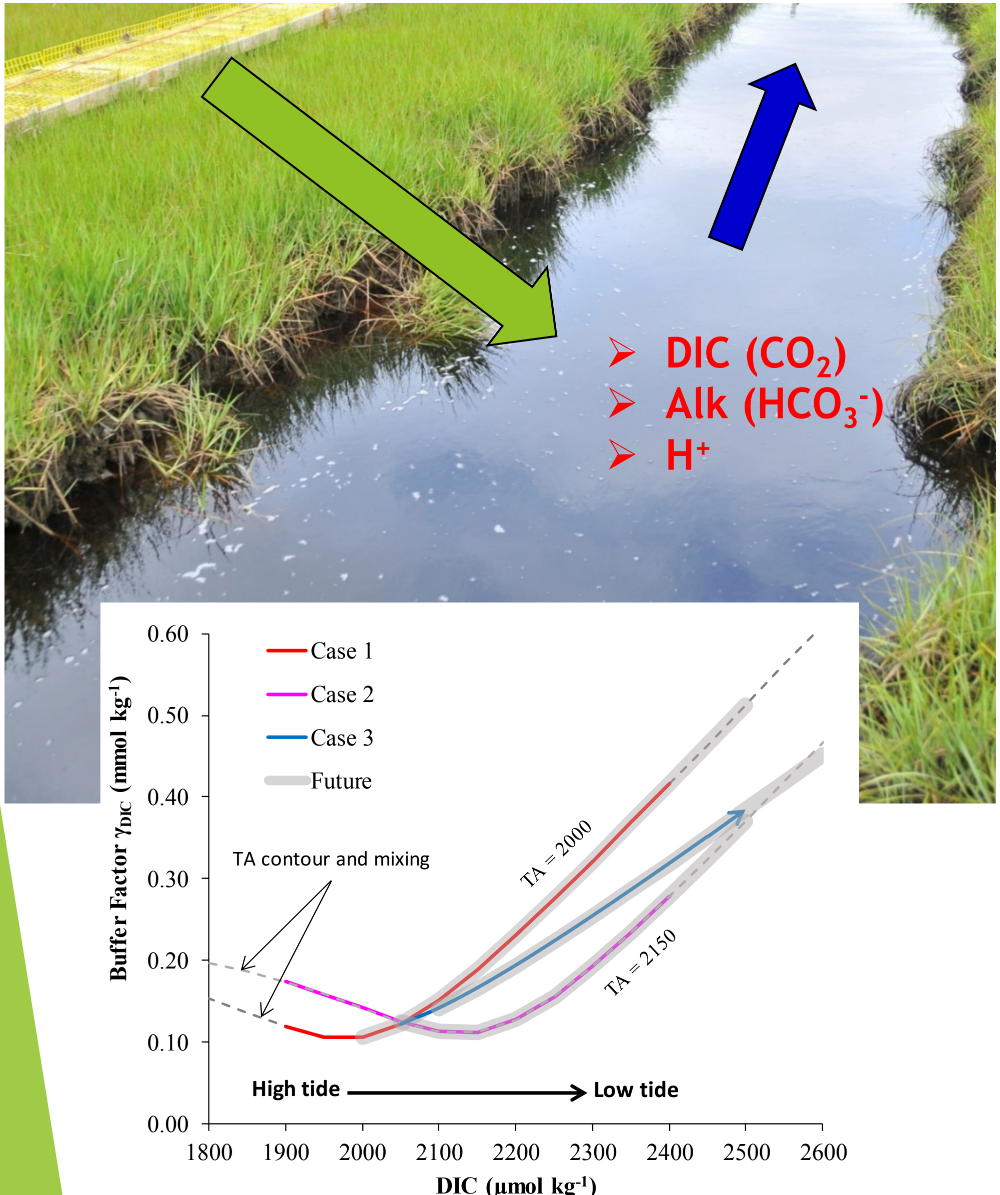
# Take home messages




- ✓ Tidal marshes exports both DIC ($CO_2$ *acidification*) and alkalinity (*alkalization*) via tidal exchange: *Significant changes of seawater chemistry and buffer capacity*

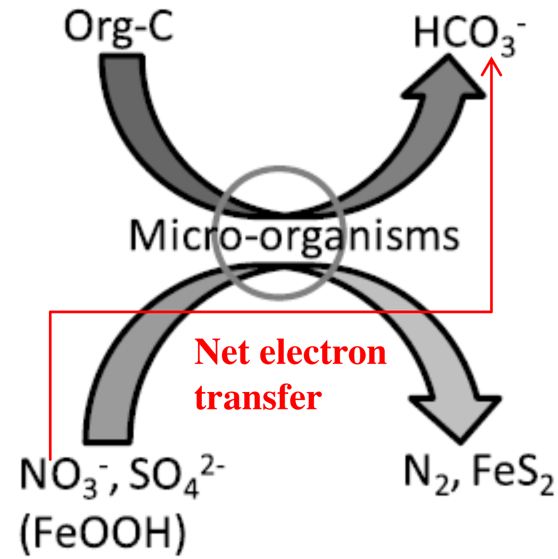
- ✓ Main drivers for DIC/Alk Production: Aerobic and aerobic respiration, marsh production cycle

- ✓ Tidal water flux plays a key role in DIC export

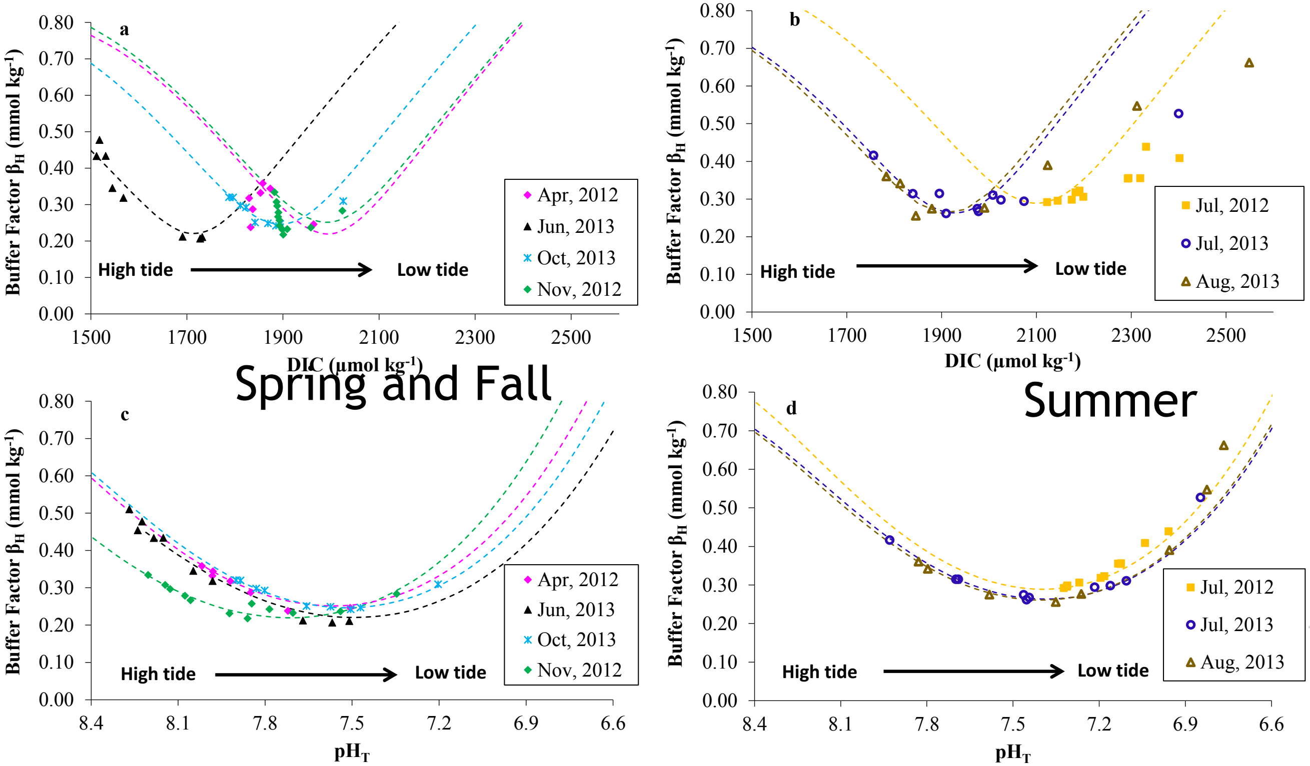
- ✓ Tidal marsh DIC export is a major term in the marsh carbon cycle, and potentially a large term in the US coastal carbon cycle

Generation of DIC, Alk, and $H^+$ through respiration in marsh sediment

- Aerobic (mostly DIC/$CO_2$, small Alk consumption
- Anaerobic: Sulfate reduction and denitrification




**Effects on carbonate chemistry: acidification and alkalization**




Complex results from tidal exchange:

- DIC increases and pH decreases
- Alk increases in summer
- Buffer capacity can first decrease then increase

# Quantify DIC lateral export fluxes from tidal marshes

## Method 1: Multiple Linear Regression

Bottle DIC measurements over tidal and seasonal cycles
+
Continuous sensor measurements (S, t, pH, $O_2$, ORP etc.)

→ Multiple Linear Regression (MLR) Model for DIC Concentration

+

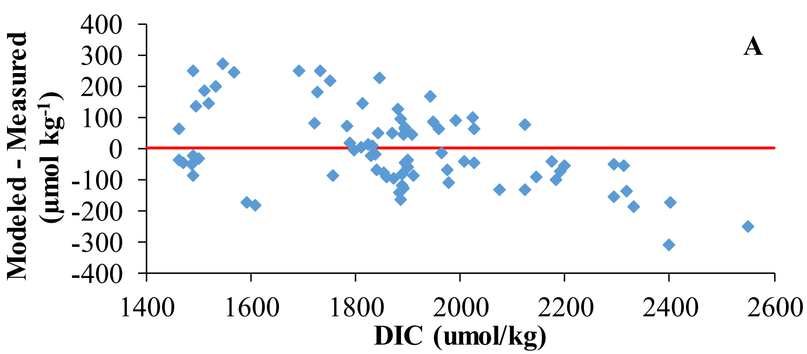
Continuous sensor measurements
+
ADCP and hydrodynamic Model (water flux/budget)

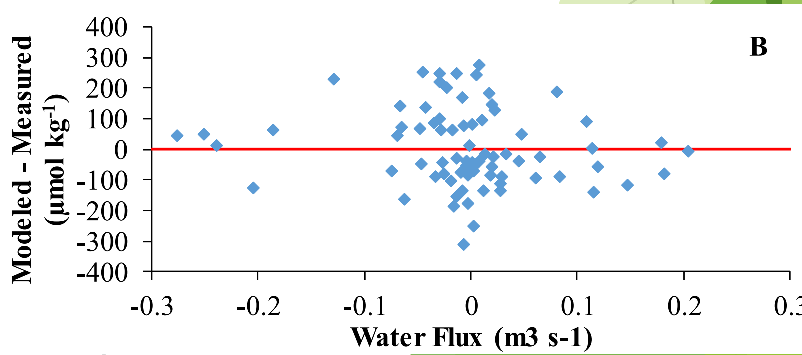
→ DIC lateral flux
= Water flux * [DIC]

**DIC(umol/kg$^{-1}$) = 4262.2855 + (90.0773 * Day') + (17.6376 * Sal) - (367.2241 * pH) - (0.4730 * ORP)**

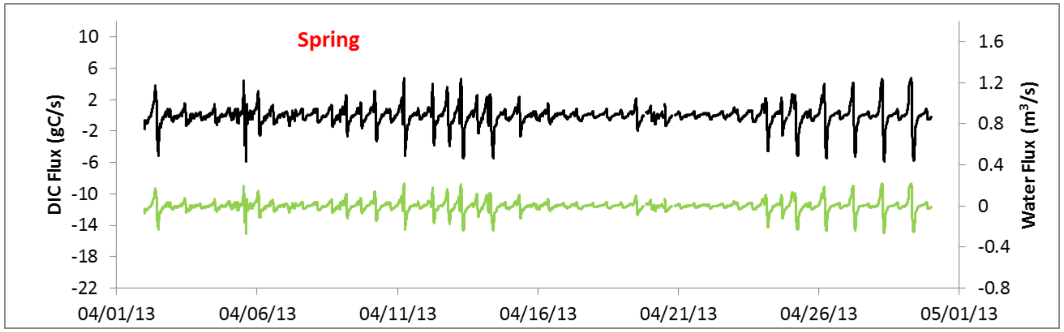
Day' = cos(2π*(Julian Day – γ)/365), ORP: Oxidation-Reduction Potential

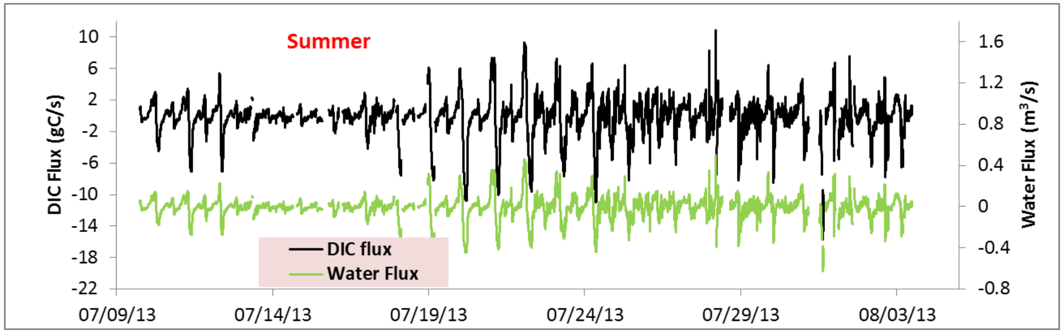
N = 80, R = 0.86165, Rsqr = 0.74244, Standard Error of Estimate = 131.26126



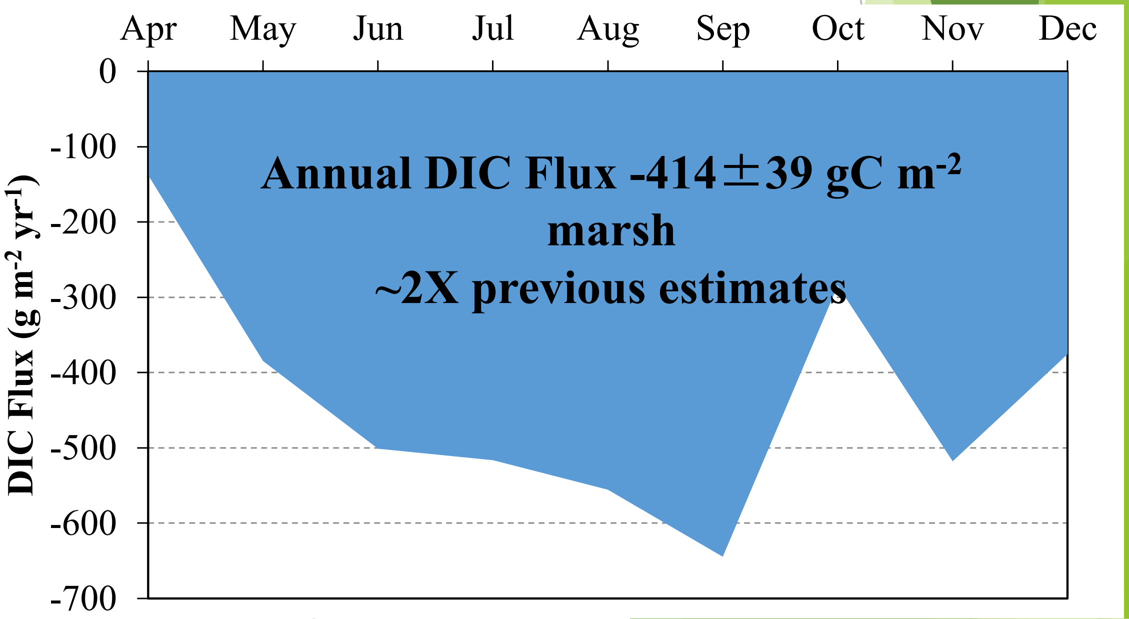
# High-resolution water flux, DIC, and DIC flux (Negative flux, to the ocean)



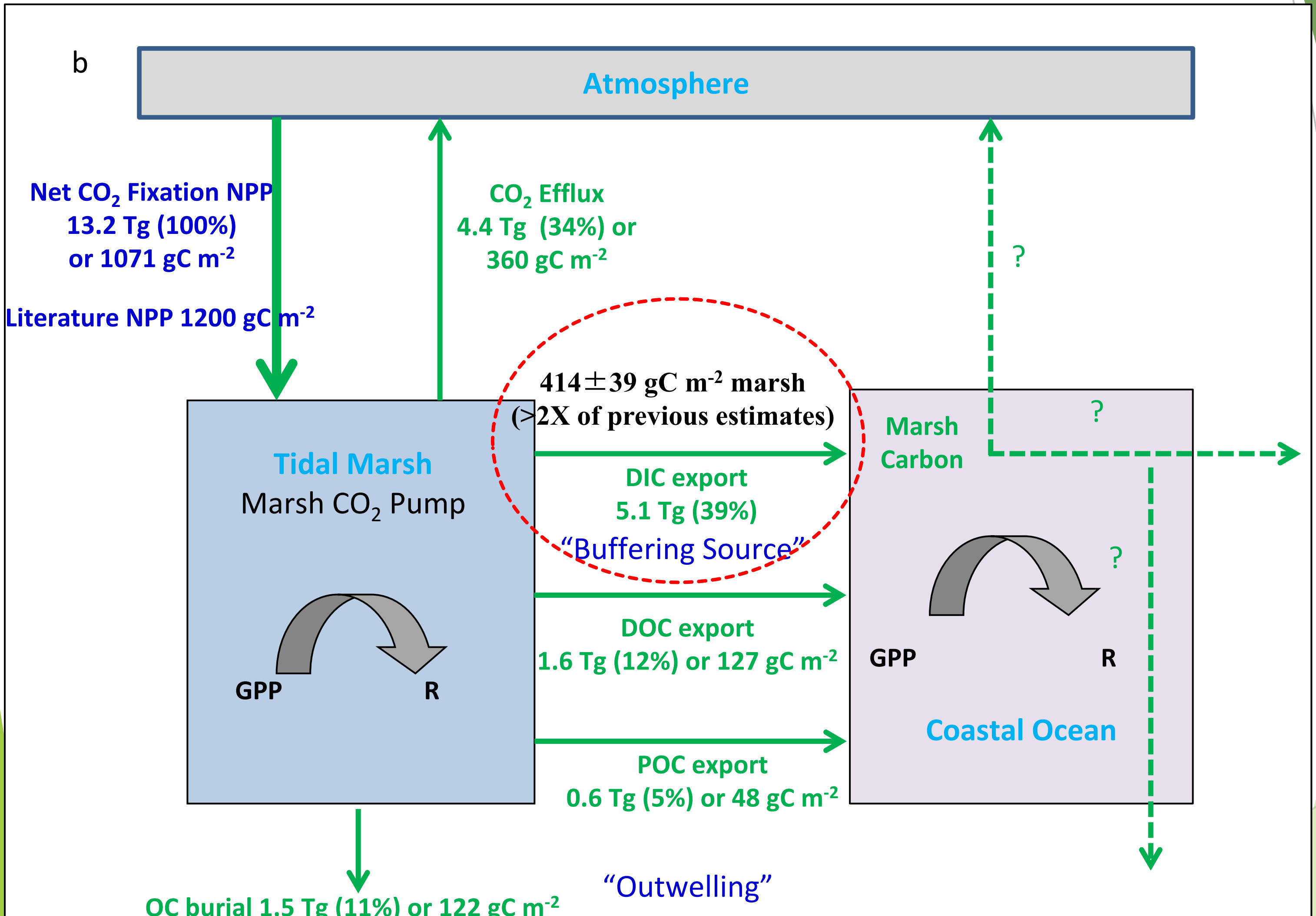




Monthly Mean
>70% export in summer and fall

Seasonality
Water flux plays a major role



# Marsh Carbon Budget (U.S. East Coast)




Modified from Wang et al. 2016, L&O

(Najjar et al. 2012; Kroeger et al. 2012; Cai 2011; Wang and Cai 2004; Neubauer and Anderson 2003)