# Carbon budget of eastern North American tidal wetlands and estuaries

Raymond Najjar
The Pennsylvania State University

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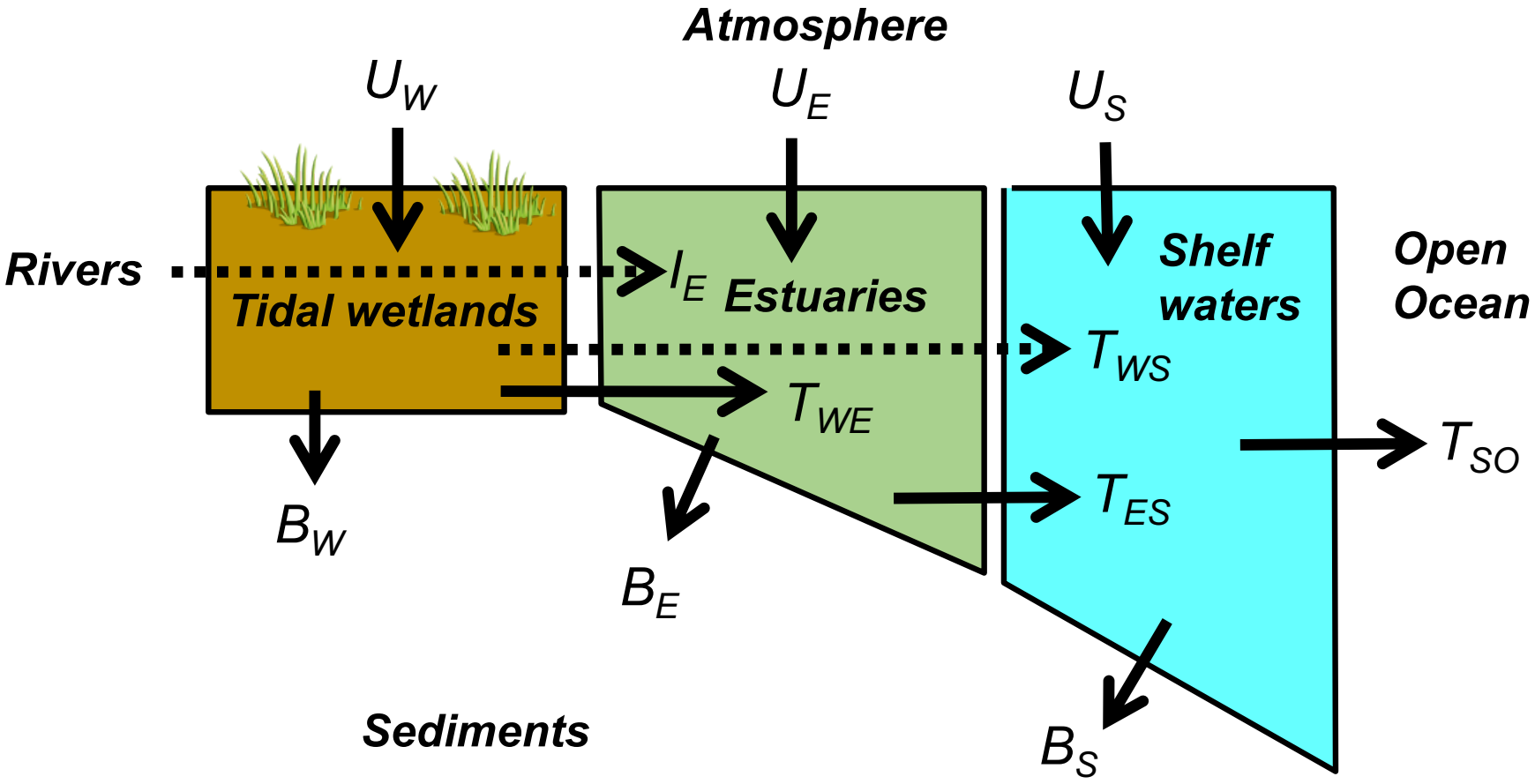
# Carbon is a common currency for multiple issues in the coastal zone

- *Carbon sequestration*
- *Eutrophication*
- *Harmful algae*
- *Hypoxia*
- *Acidification*
- *Wetlands Loss*
- *Fisheries*

# Carbon transfers in coastal ecosystems



# Main objective:

- Develop a carbon budget for tidal wetlands and estuaries of Eastern North America

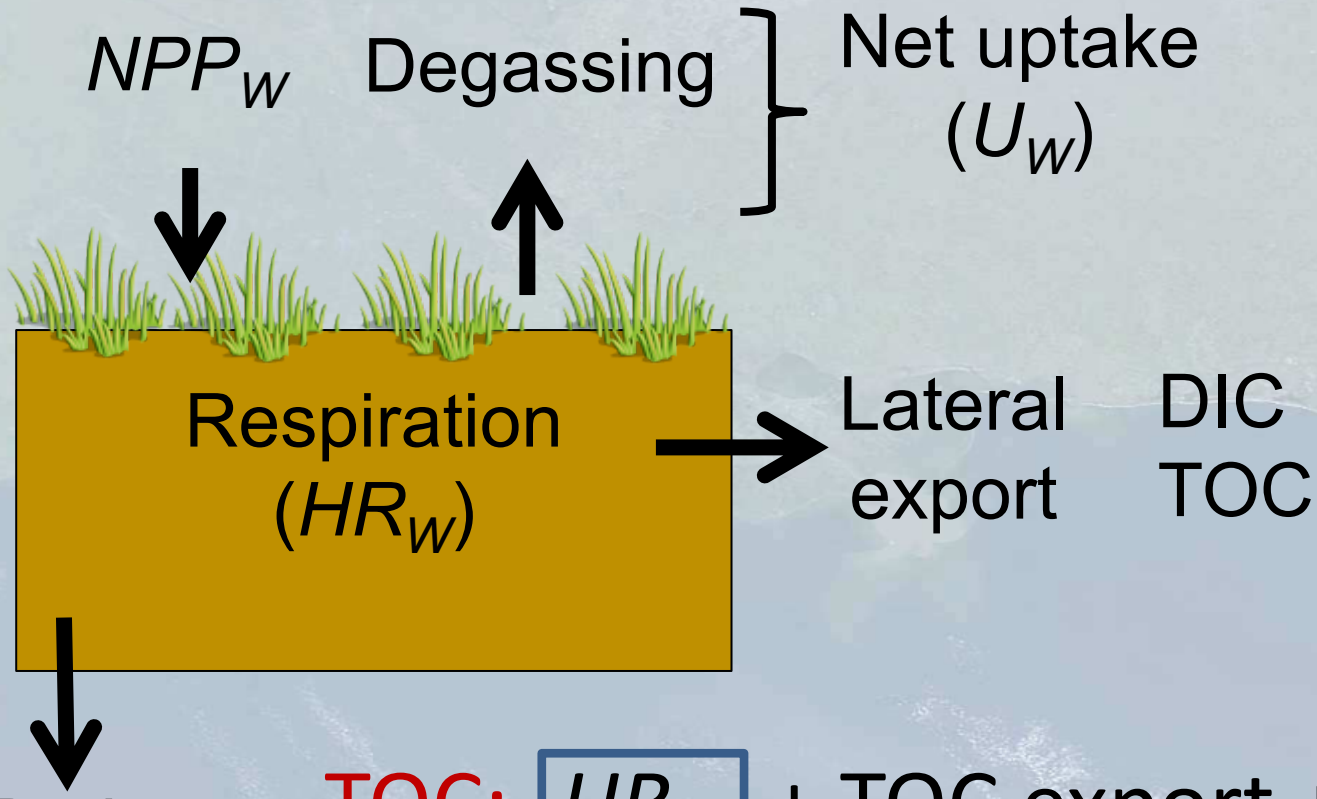
# A few of many research questions:

- How much C is fixed in the region?
- What is the metabolic poise of the region?
- Is the region a source or sink of atmospheric $CO_2$?
- How much C is buried in the region?

# Methods

- Historical data compilation
- Semi-empirical models
- Numerical modeling
- Mass balance

# Mass balance approach in wetlands




TOC: $HR_W$ + TOC export + $B_W$ = $NPP_W$

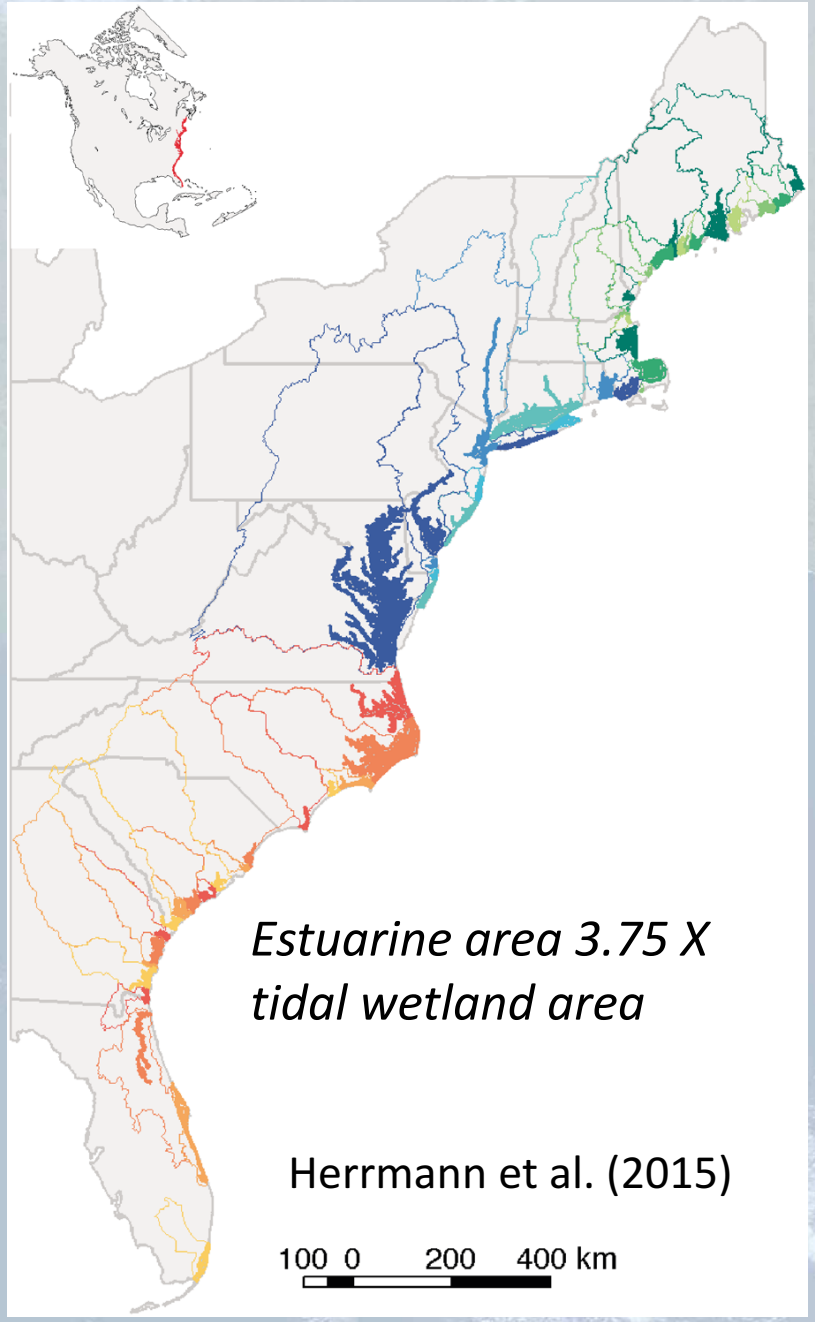
DIC: Degassing + DIC export = $HR_W$

TC: TC export + $B_W$ = $U_W$

# Estuaries of the Eastern U.S.

52 systems from NOAA's National Estuarine Eutrophication Assessment

*Plus St. John River Estuary for Gulf of Maine budget*




## Wetland area

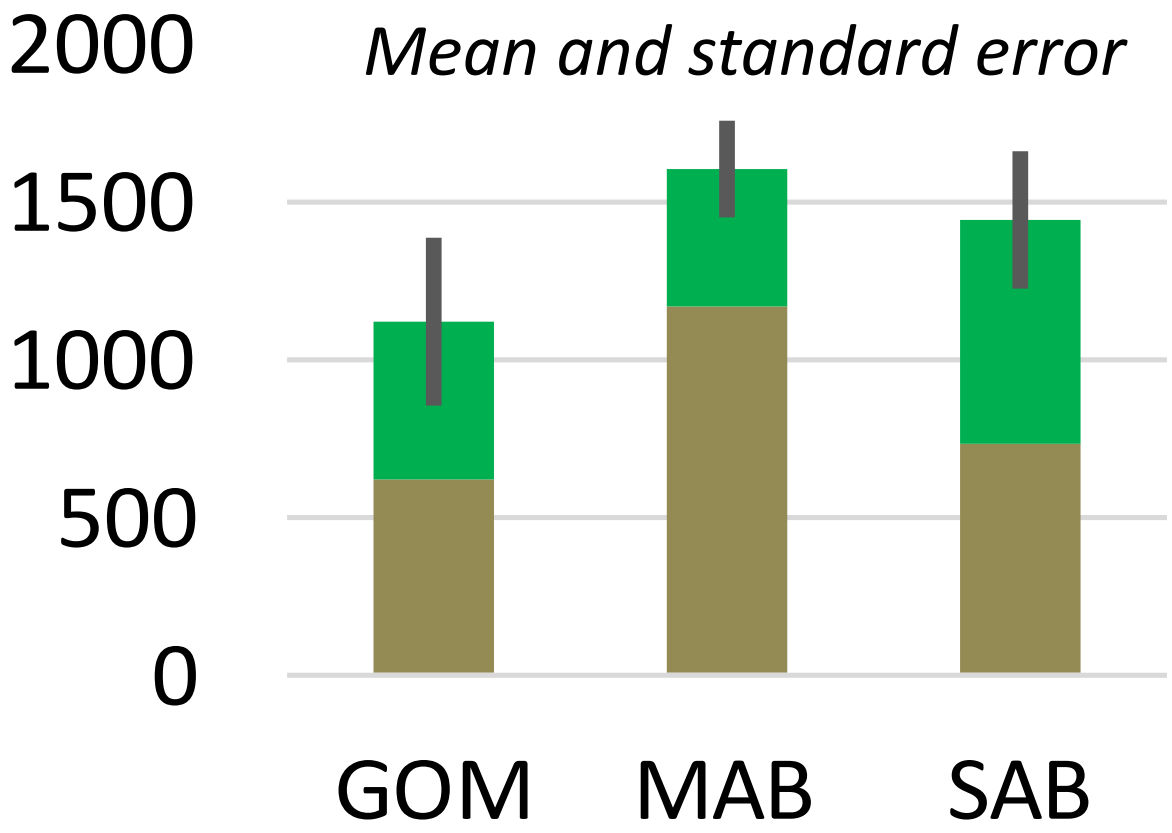
**GOM: 5%**

**MAB: 36%**

**SAB: 59%**

Hinson et al. (2017)

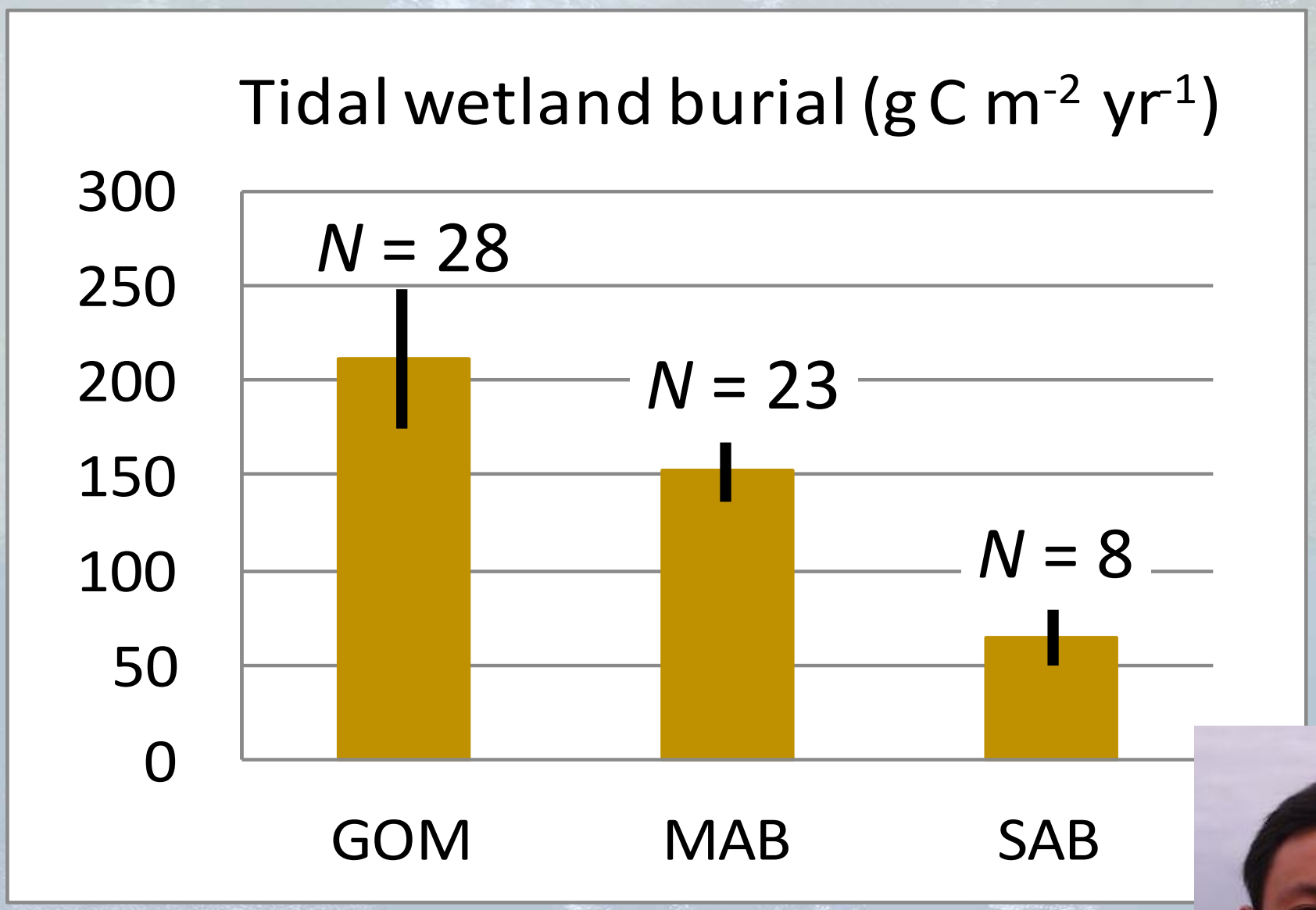
# Tidal Wetland NPP (g C $m^{-2}$ $yr^{-1}$)



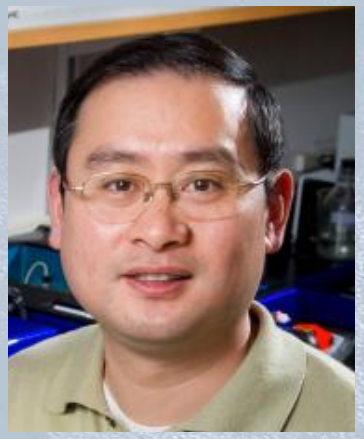

**Aboveground (*N* = 137)**

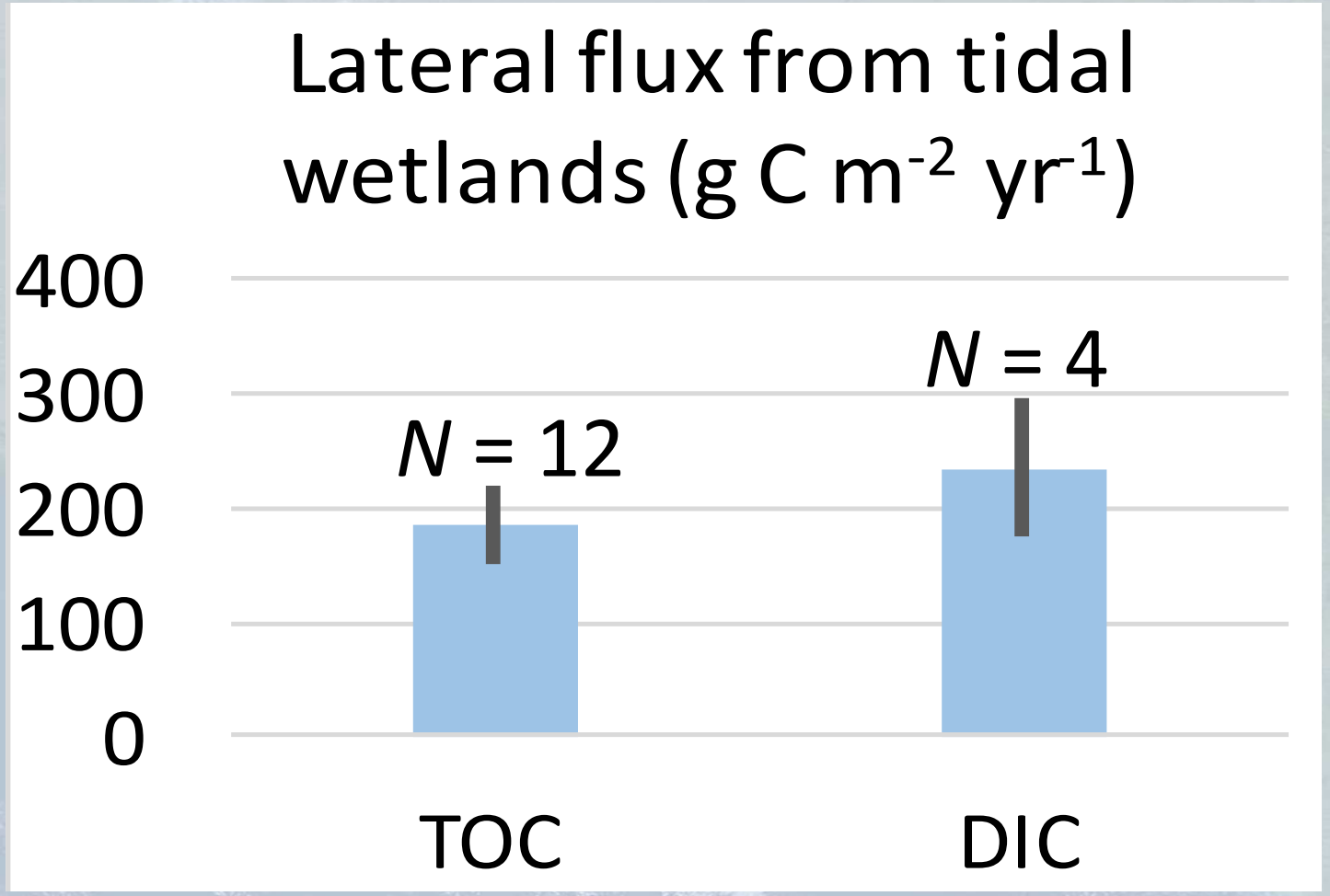
**Belowground (*N* = 45)**

Mendelssohn and Morris (2000) & Continental Shelf Associates (1991)



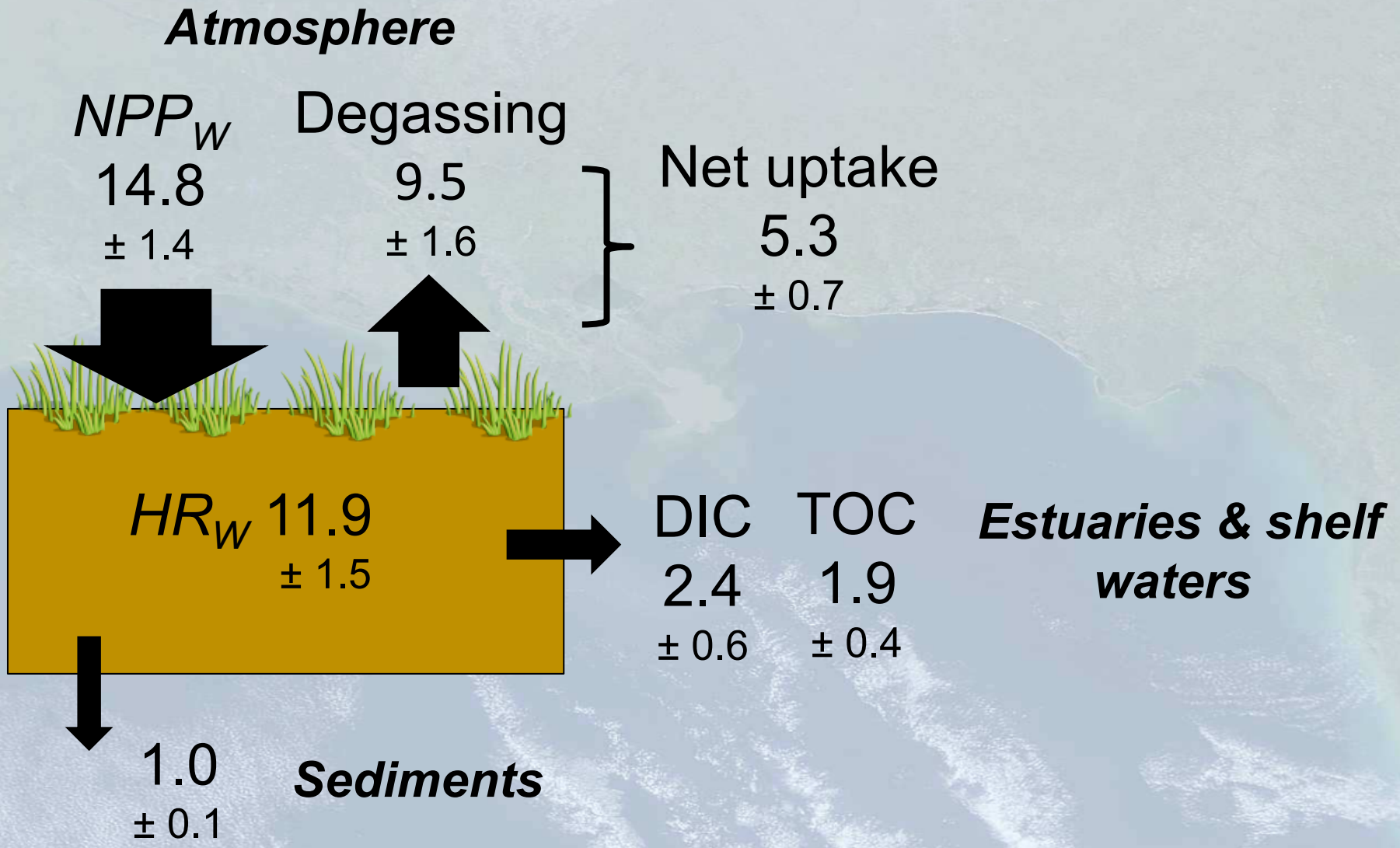

From Ouyang and Lee (2014)



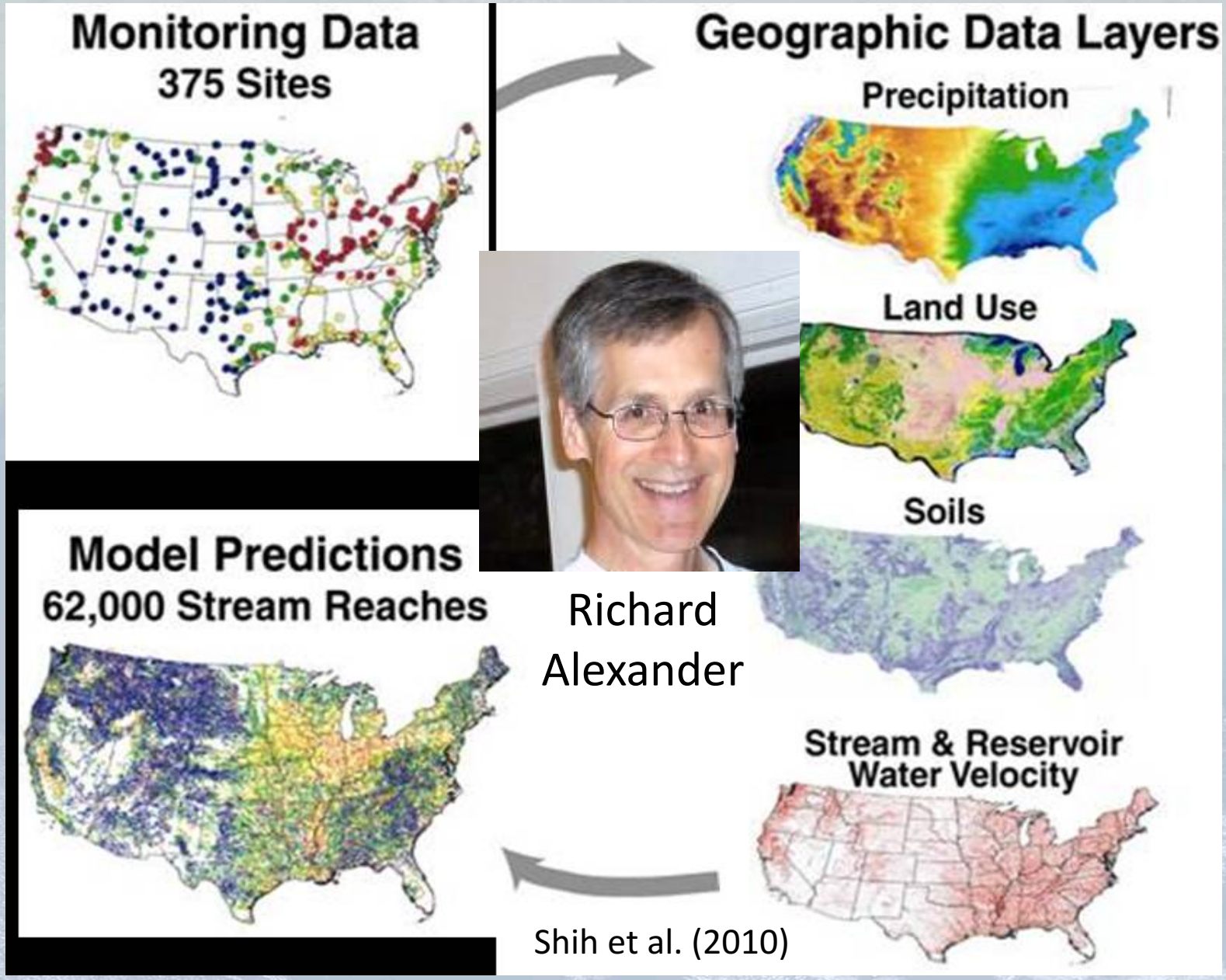



Synthesis by Maria Tzortziou, Kevin Kroeger, and Aleck Wang

# Fluxes in tidal wetlands, Tg C $yr^{-1}$

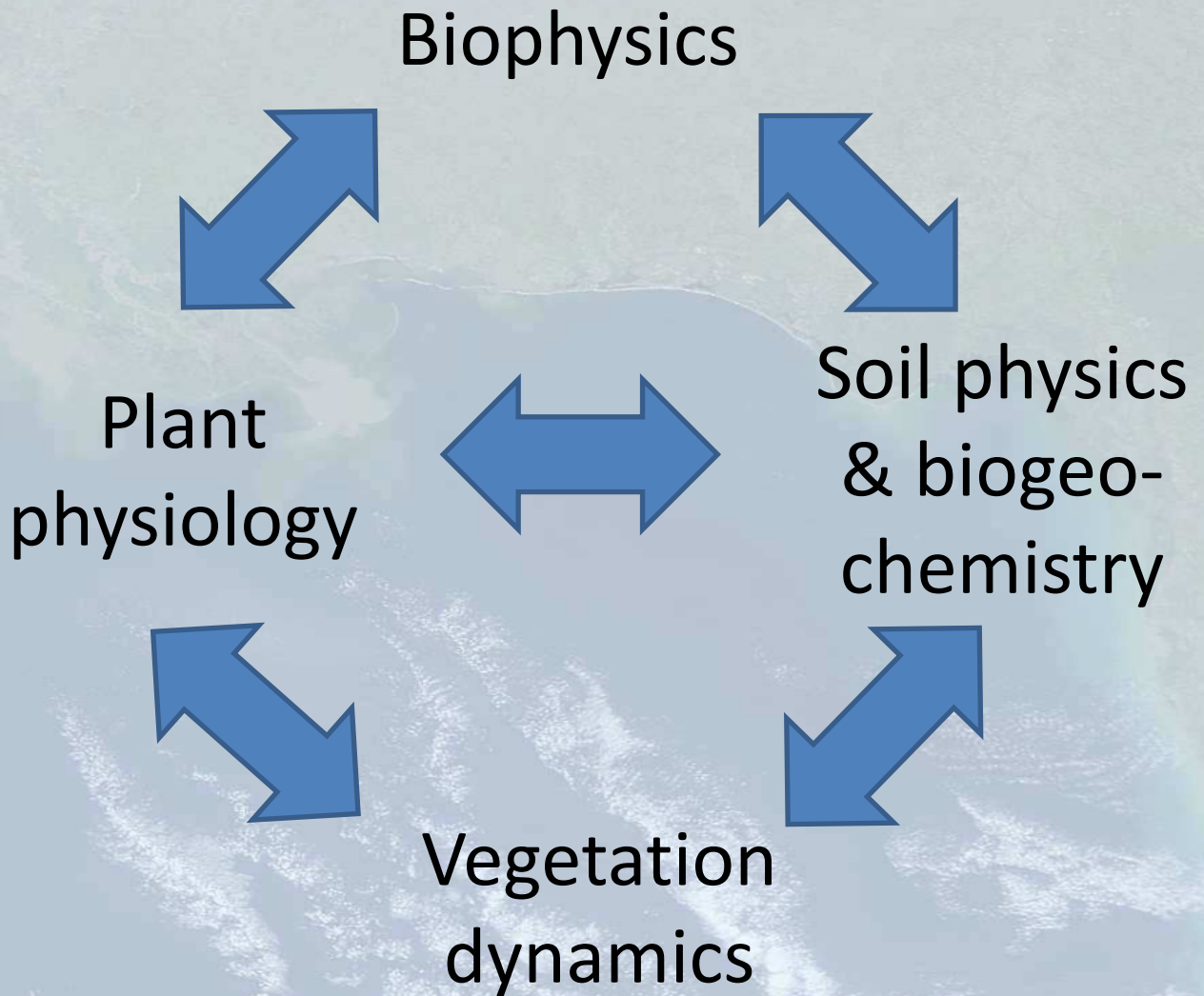


# Riverine TOC input based on SPARROW



# Riverine DIC input based on DLEM (Tian et al., 2015)

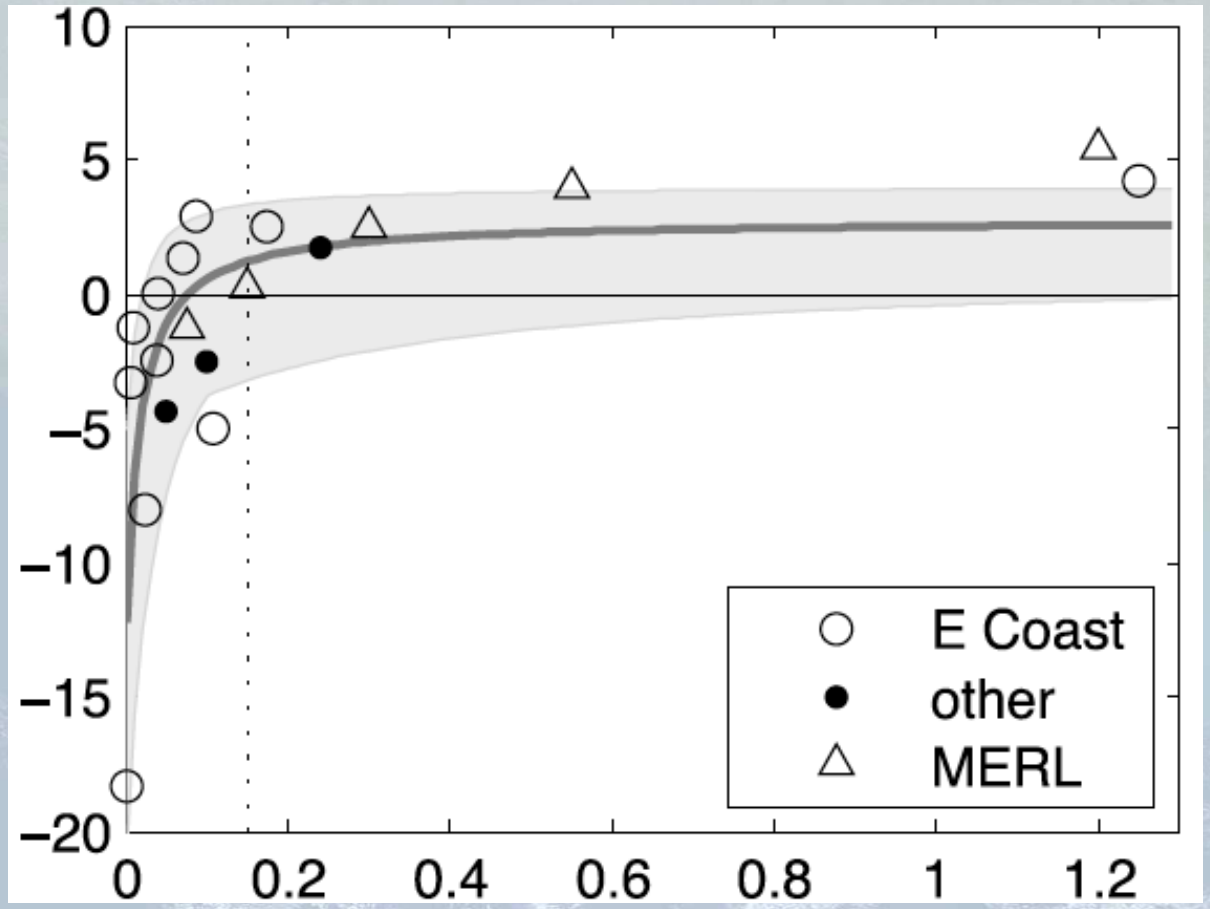
Hanqin Tian



# Estuarine net ecosystem production depends on riverine DIN and TOC

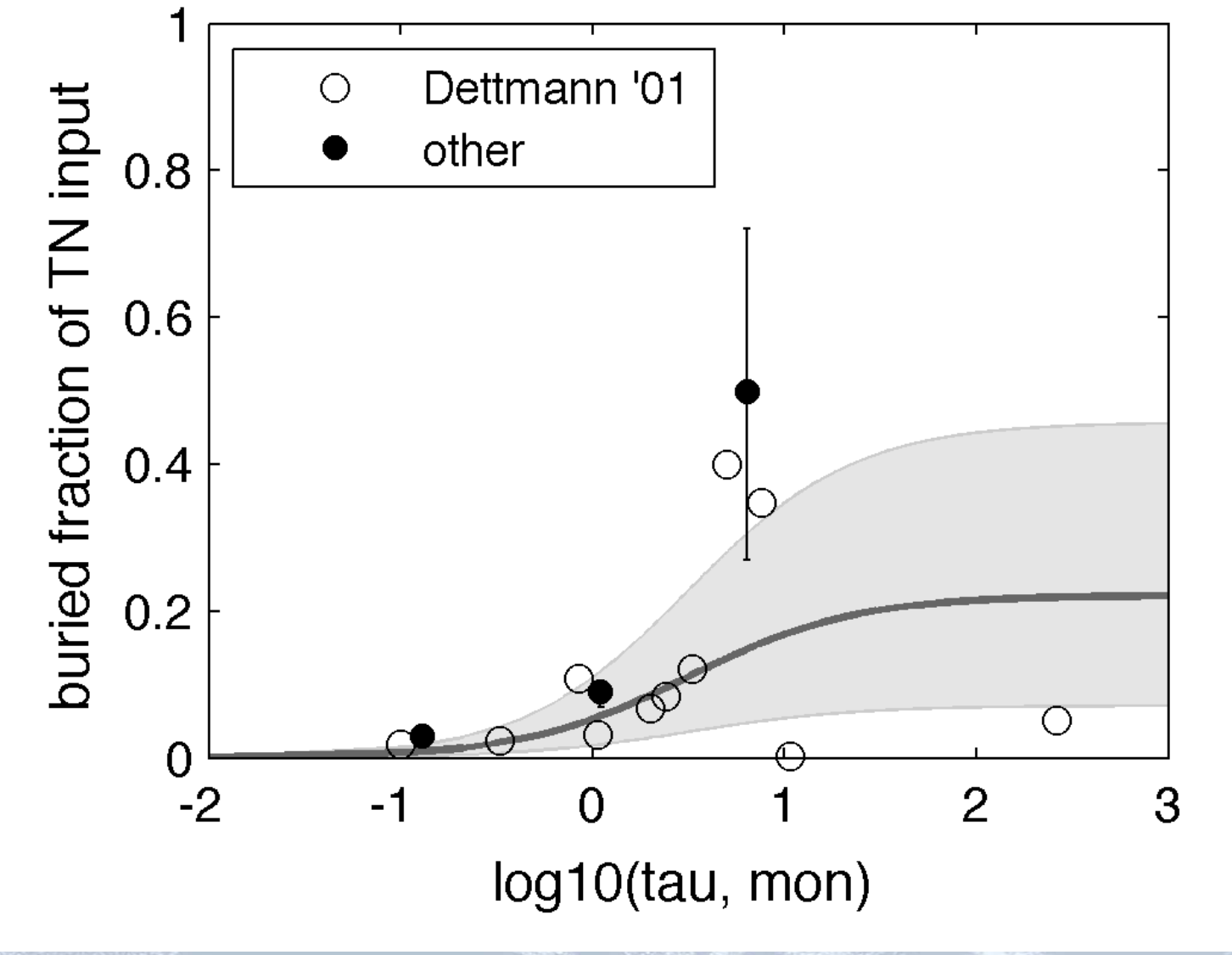
$NEP_E$
(mol C $m^{-2}$ $yr^{-1}$)

Herrmann et al. (2015)

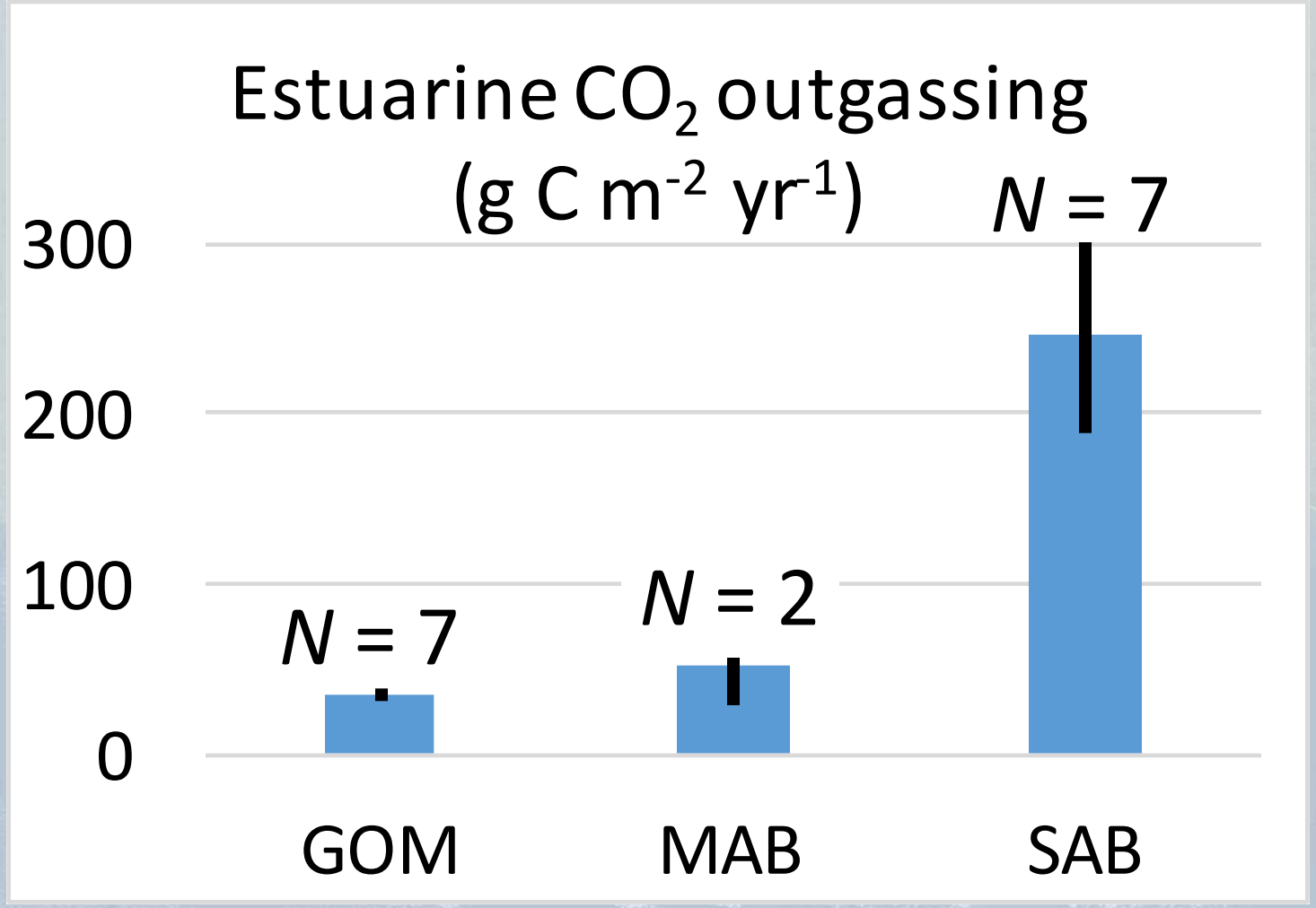



Riverine molar flux ratio
inorganic N : organic C

# Estuarine burial model

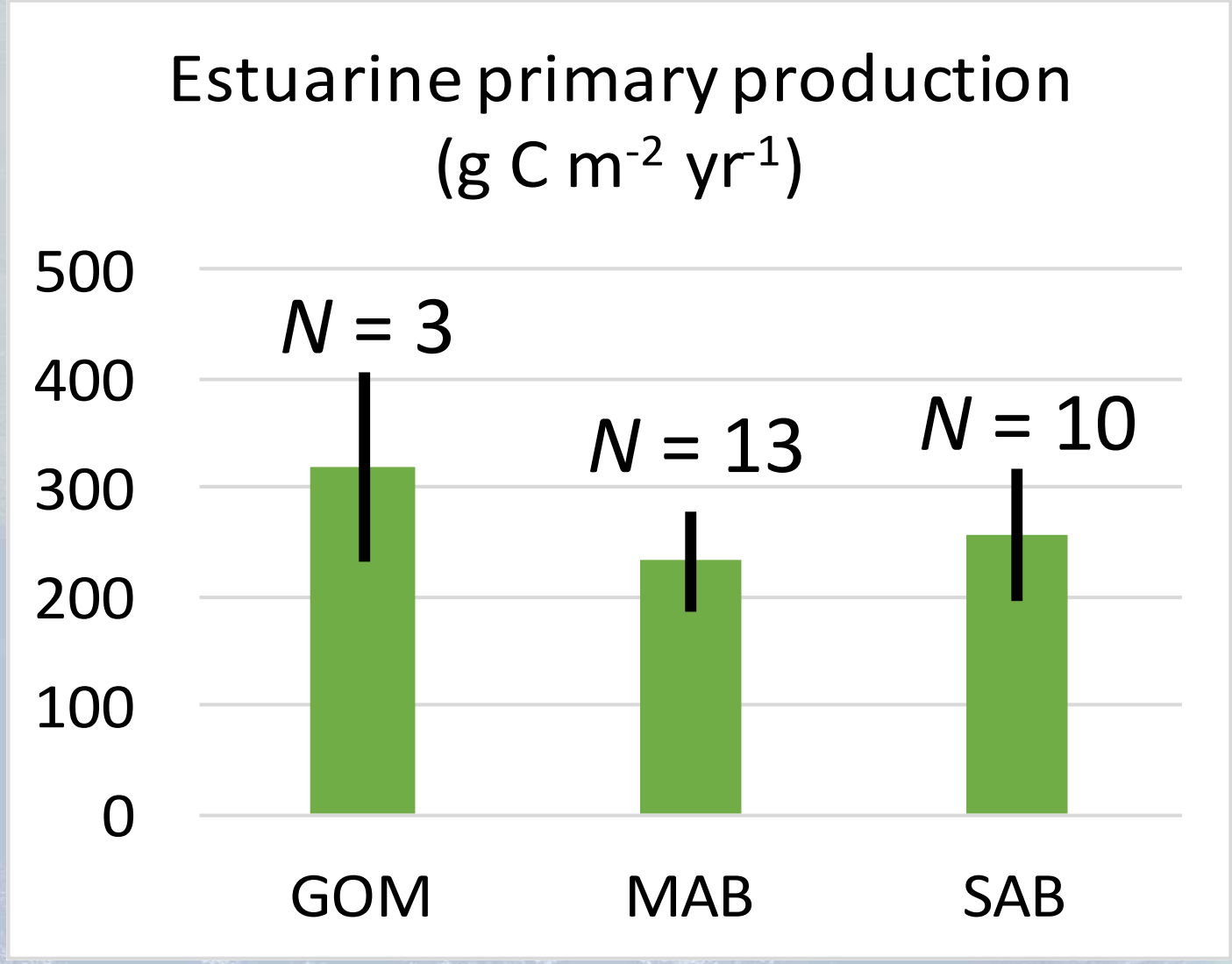



Herrmann et al. (2015)



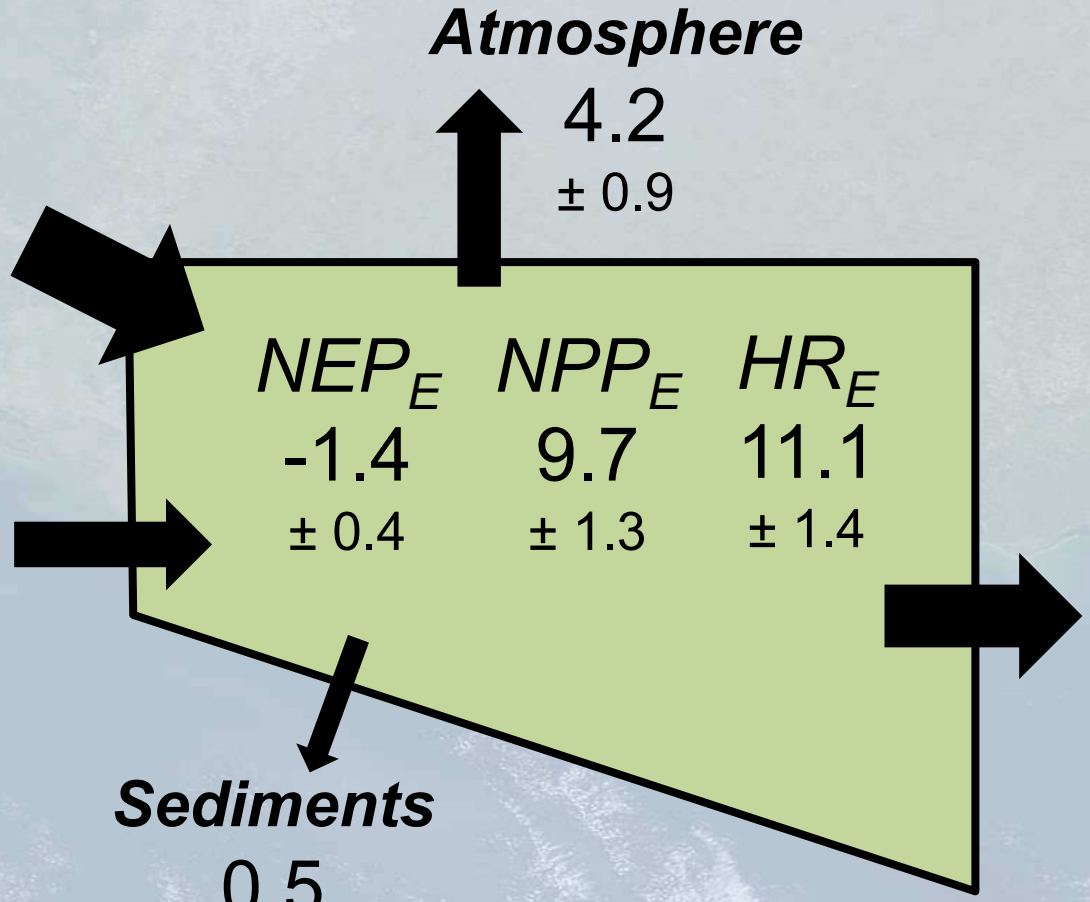

Based on Laruelle et al. (2015) synthesis, and input from Wei-Jun Cai and Joe Salisbury

James Cloern

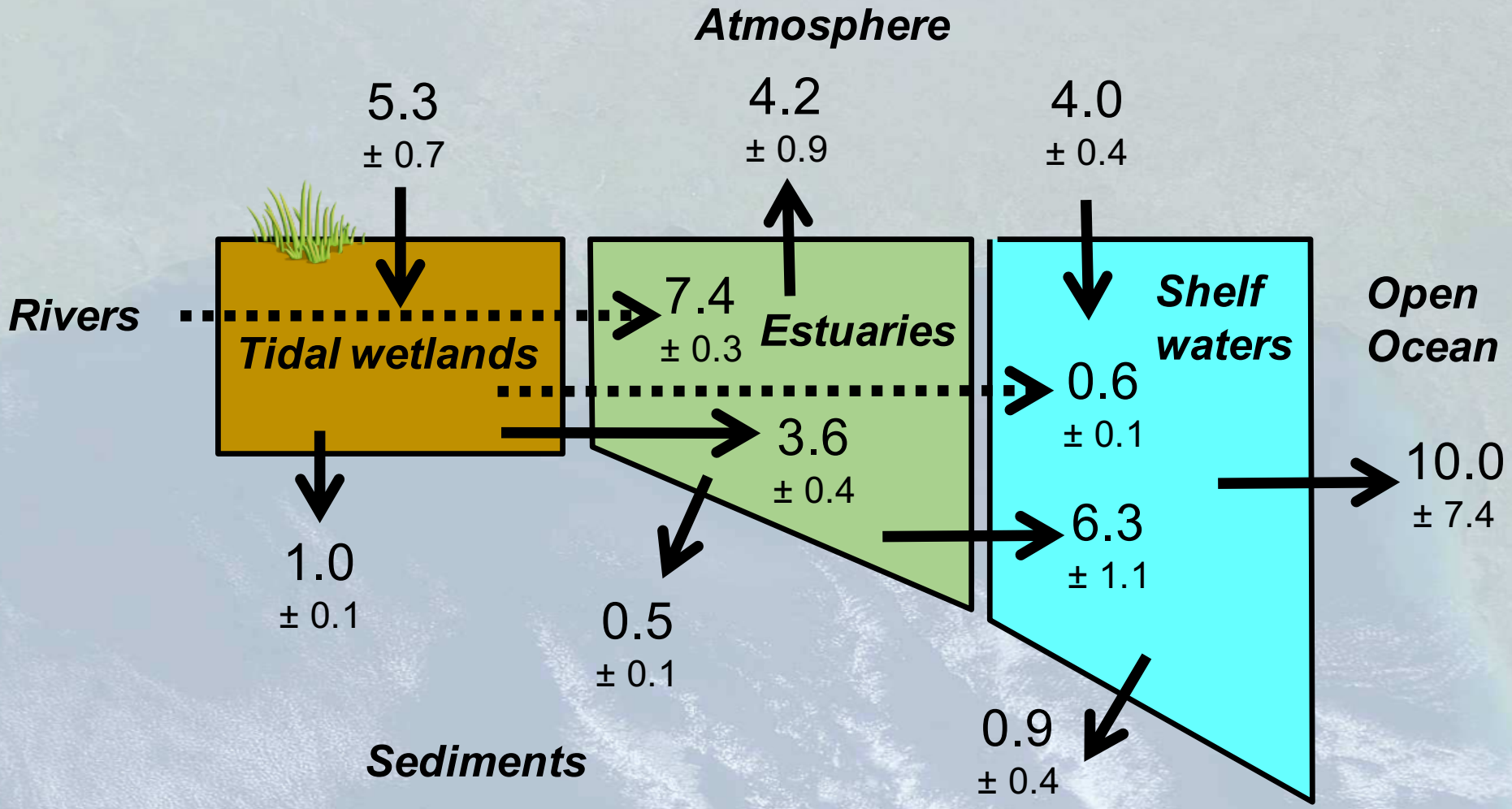



Based on syntheses of Cloern et al. (2014) and Dame et al. (2000)

# Fluxes in estuaries, Tg C $yr^{-1}$



# ENA Total Carbon Budget, Tg C $yr^{-1}$



# Summary

The first C budget for tidal wetlands and estuaries of Eastern North America has been developed

How much C is fixed in the region?

***24.5 ± 1.9 Tg C $yr^{-1}$***

What is the metabolic poise of the region?

***Net autotrophic by 1.5 ± 0.5 Tg C $yr^{-1}$***

How much C does the region bury?

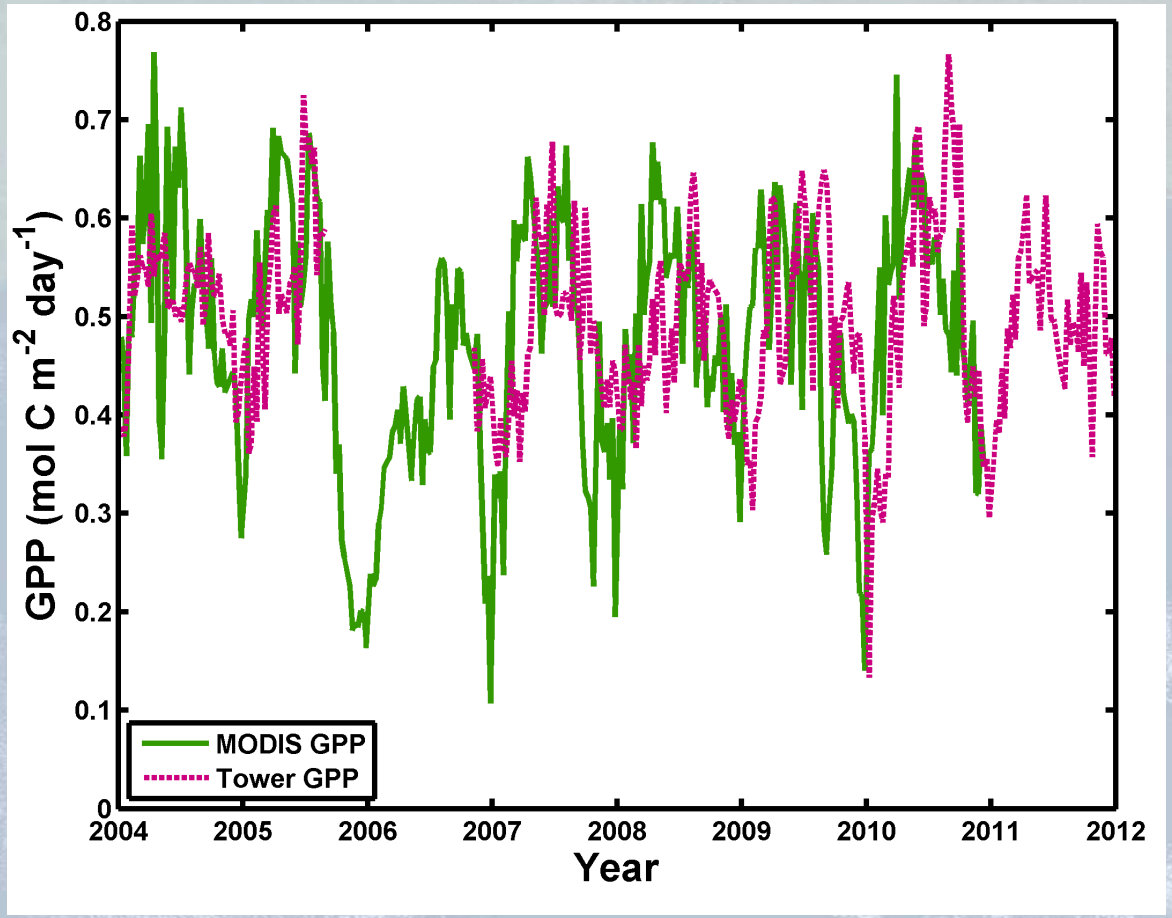
***1.6 ± 0.2 Tg C $yr^{-1}$***

Is the region a source or sink of atmospheric $CO_2$?

***A sink of 1.1 ± 1.1 Tg C $yr^{-1}$***

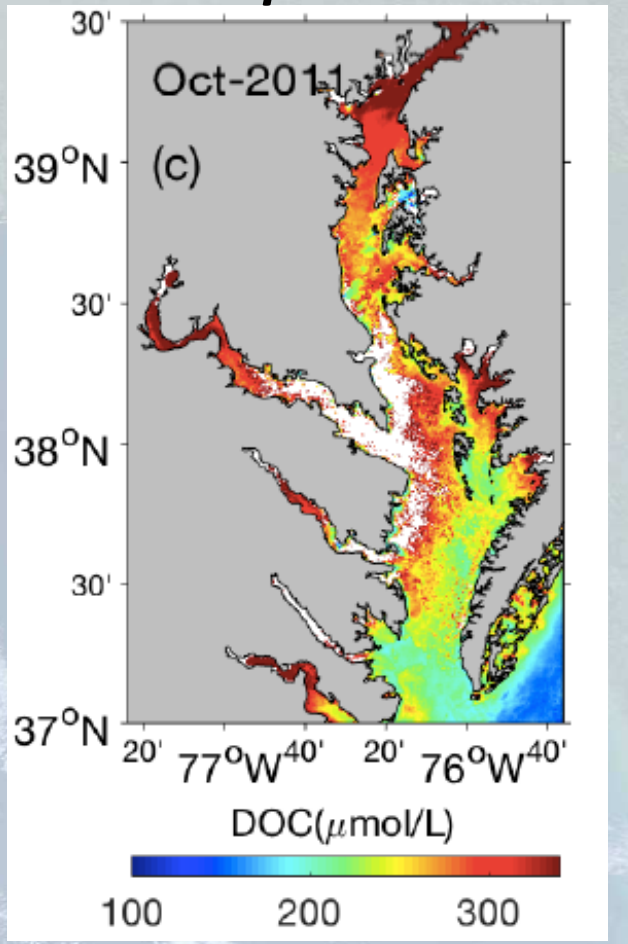
# Ongoing work: remote sensing of tidal wetland GPP and estuarine DOC

***Everglades mangrove in situ and satellite GPP***




Wells et al. (2015)

***Chesapeake DOC***




Cao et al. (2017)

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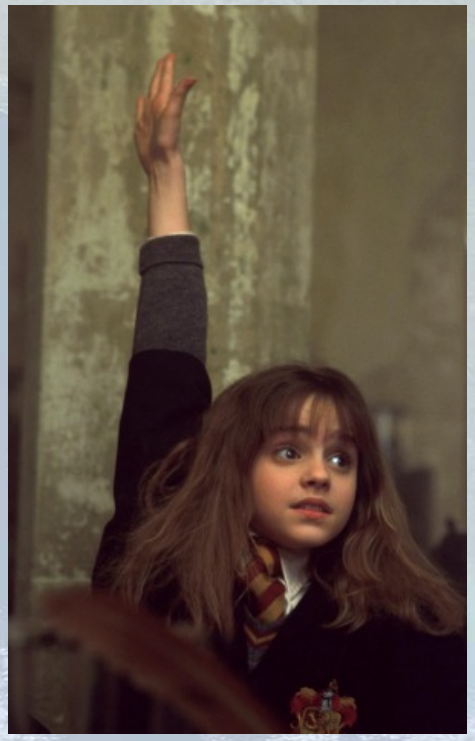
Questions?



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