An update on the North American Coastal CARbon Synthesis (CCARS)

EAST COAST REGION

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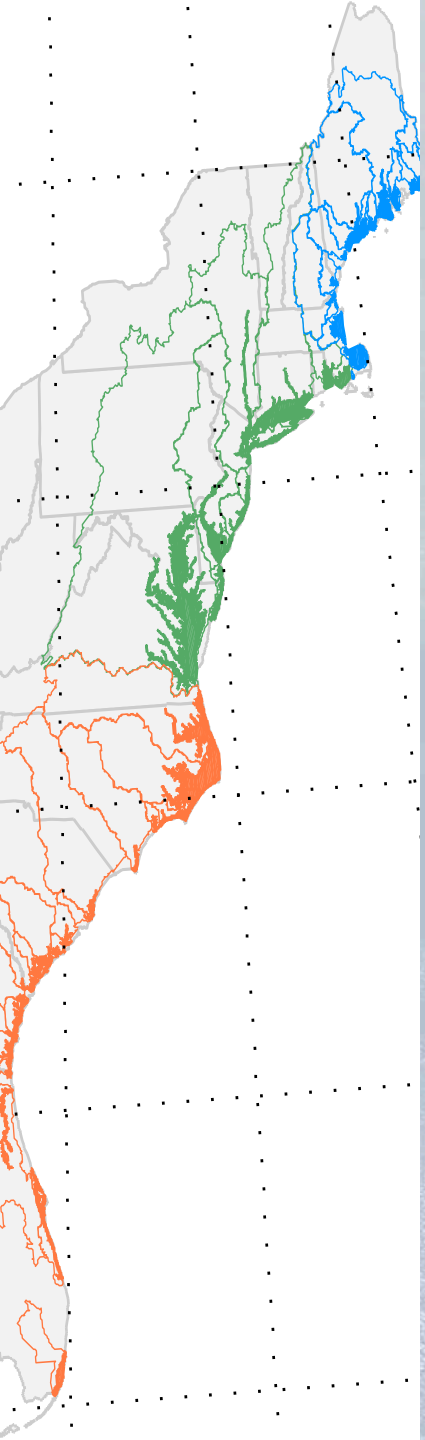
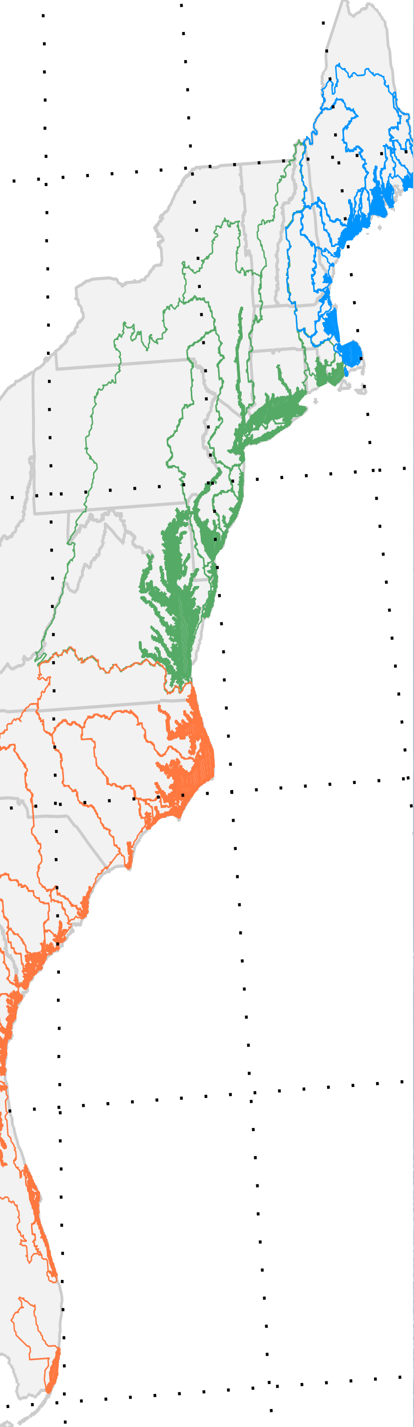


River DIC input, Tg C yr^{-1}

	LOADEST (Stets and Striegl 2012)*	DLEM (Tian et al. subm.)
GoM	**0.30**	**0.76**
MAB	**1.6**	**0.77**
SAB	**0.6**	**0.82**
E. Coast	**2.5**	**2.4**

* Scaled by watershed area



River TOC input, Tg C yr^{-1}

	SPARROW (Shih et al. 2010)	SPARROW + wetlands (Herrmann et al. subm.)	DLEM (Tian et al. subm.)
GoM	**0.57***	**0.64***	**0.95**
MAB	**1.5**	**2.0**	**1.3**
SAB	**1.9**	**3.1**	**1.3**
E. Coast	**3.9**	**5.8**	**3.5**

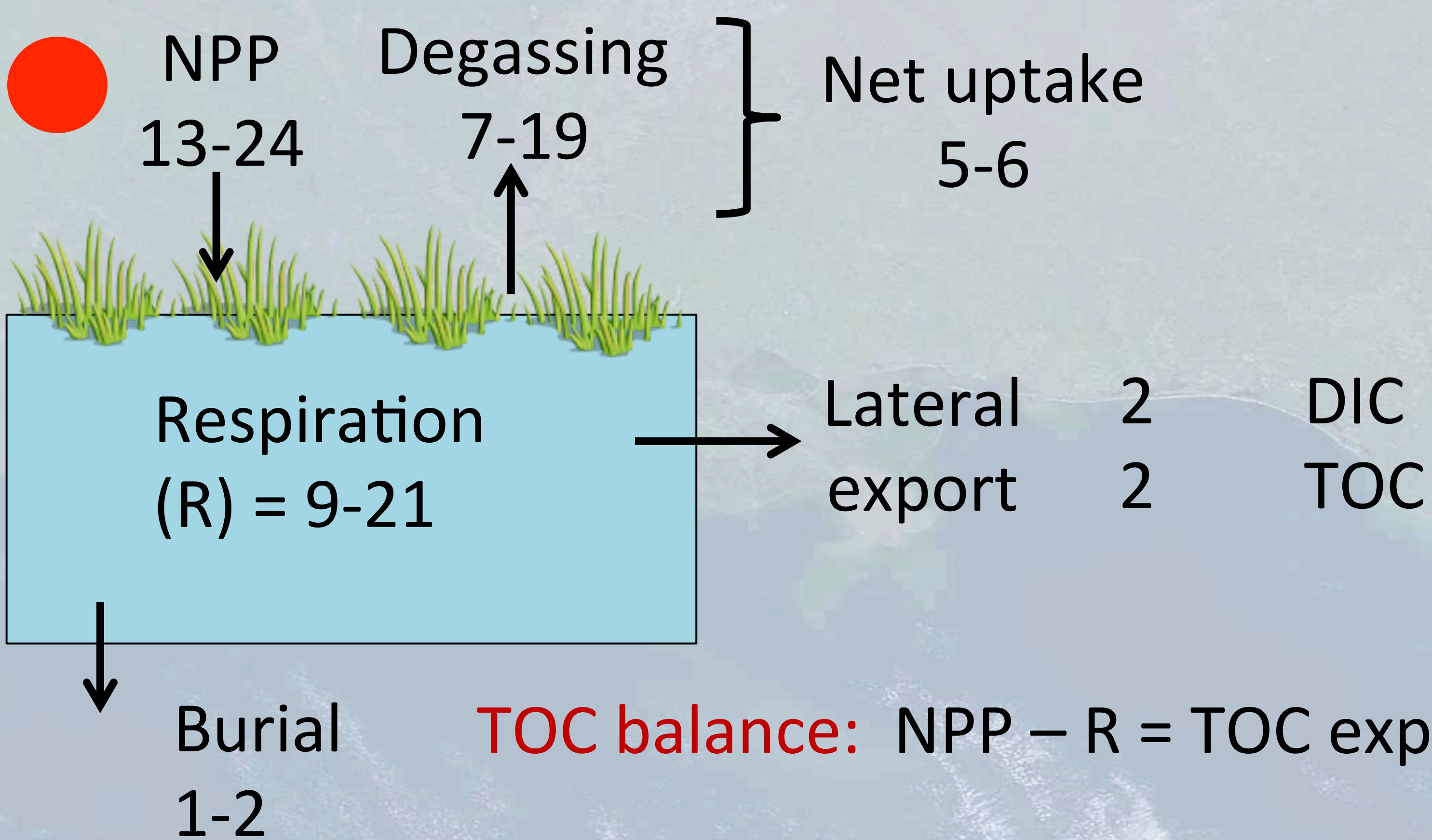
*Does not include Canadian watersheds

Tidal wetland lateral TOC export

- Kroeger compilation of 12 studies
- Export estimates range from 4 to 38 mol C m^{-2} y^{-1}
- Mean = 15 mol C m^{-2} y^{-1}
- Combine with estimates of tidal wetland area

- Similar approach to lateral DIC export and burial

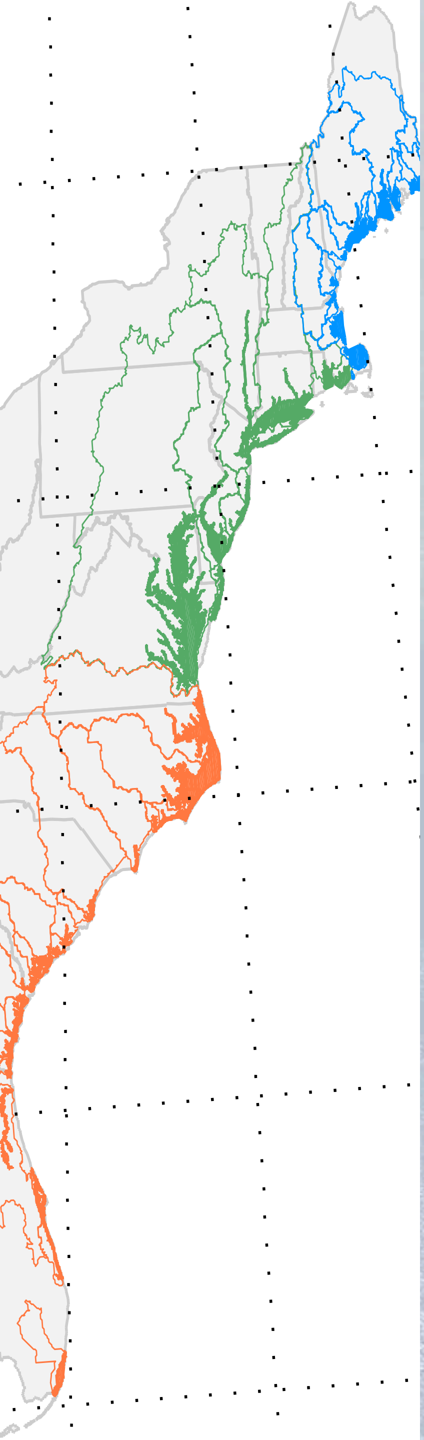
Fluxes in tidal wetlands, Tg C yr^{-1}



TOC balance: NPP – R = TOC export + Burial

DIC balance: R = DIC export + Degassing

TC balance: Net uptake = TC export + burial

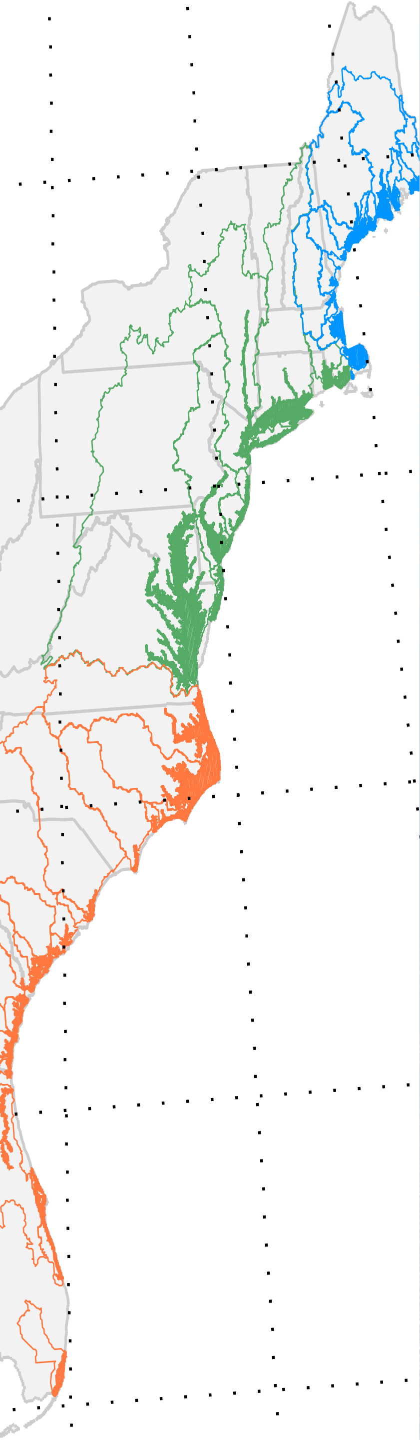


Estuarine TOC budget, Tg C yr^{-1}

Input from upland sources	NEP	Burial	Export to shelf*
0.52	-0.30	0.03	0.19
1.8	+0.06	0.4	1.4
3.1	-1.4	0.07	1.7
5.4	**-1.6**	**0.5**	**3.3**

Herrmann et al. (subm.)

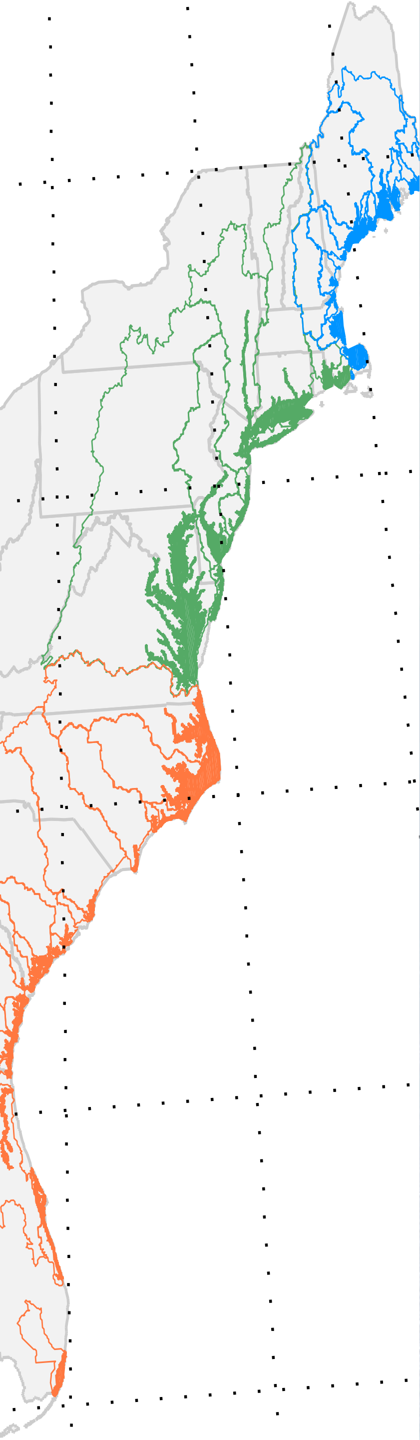
*computed as residual



Estuarine air-sea flux: - 5 Tg C yr^{-1} (outgassing)

	N systems from literature review	CO_2 flux per unit area (mean ± σ, mol m^{-2} y^{-1})	Area-integrated CO_2 flux
GoM	**6**	**-3 ± 0.4**	**-0.2 ± 0.03**
MAB	**1**	**-6 ± ?**	**-1.5 ± ?**
SAB	**5**	**-25 ± 6**	**-3.6 ± 0.6**
E. Coast	**12**		**-5.3 ± ?**

Herrmann literature synthesis: Laurelle et al. (2014) and references therein; Cai and coworkers

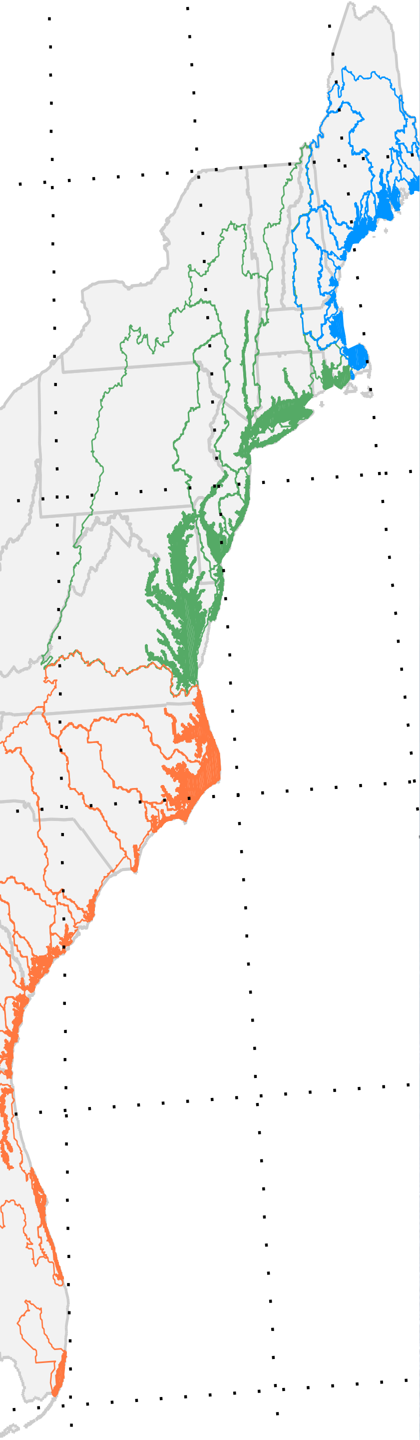


Estuarine DIC budget, Tg C yr^{-1}

	River + wetland input	NEP	Out-gassing	Export to shelf*
GOM	**0.3 + 0.1**	**0.3**	**-0.2**	**0.5**
MAB	**1.6 + 0.9**	**-0.06**	**-1.5**	**0.9**
SAB	**0.6 + 1.2**	**1.4**	**-3.6**	**-0.4**
E. Coast	**2.5 + 2.0**	**1.6**	**-5.3**	**0.8**

*calculated as a residual

Estuarine Net Primary Production: 10 ± 1 Tg C yr^{-1}

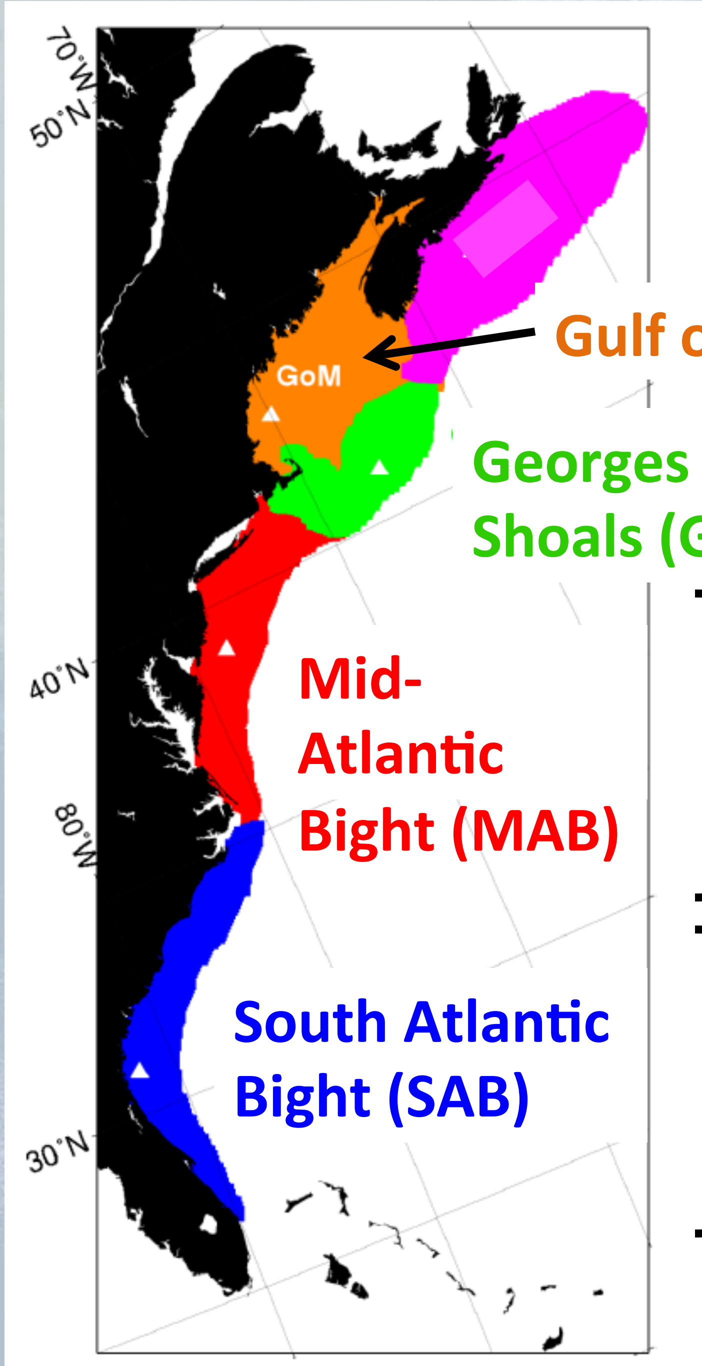


	N systems from literature review	NPP per unit area (mean ± σ, mol m^{-2} y^{-1})	Area-integrated NPP
GoM	**4**	**30 ± 6**	**2 ± 0.4**
MAB	**14**	**18 ± 4**	**4 ± 0.9**
SAB	**6**	**24 ± 7**	**4 ± 1**
E. Coast	**24**		**10 ± 1**

Based on synthesis in Cloern et al. (2014)

Shelf primary production:

120 ± 30 Tg C yr^{-1}



Gulf of Maine (GoM)

Georges Bank + Nantucket Shoals (GB + NS)

47 ± 20

Mid-Atlantic Bight (MAB)

34 ± 10

South Atlantic Bight (SAB)

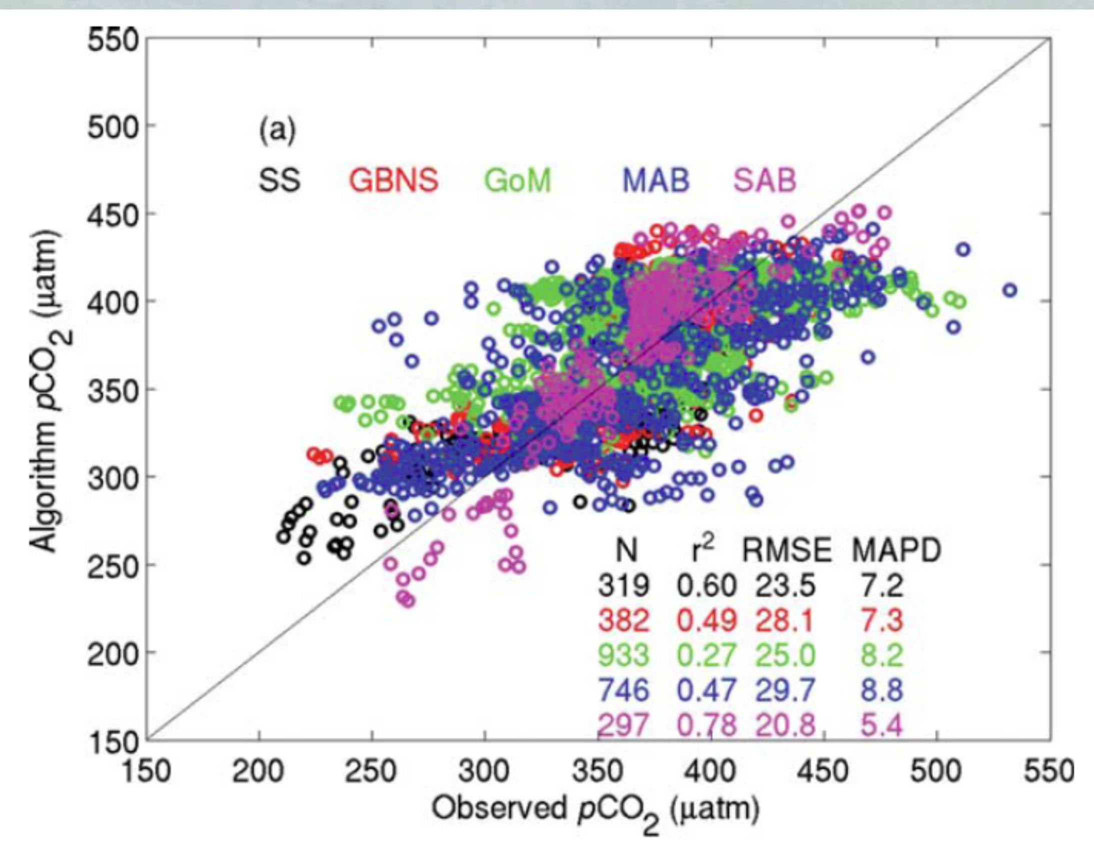
35 ± 10

Based on a literature synthesis

Continental shelf air-sea exchange
(Signorini et al., 2013)

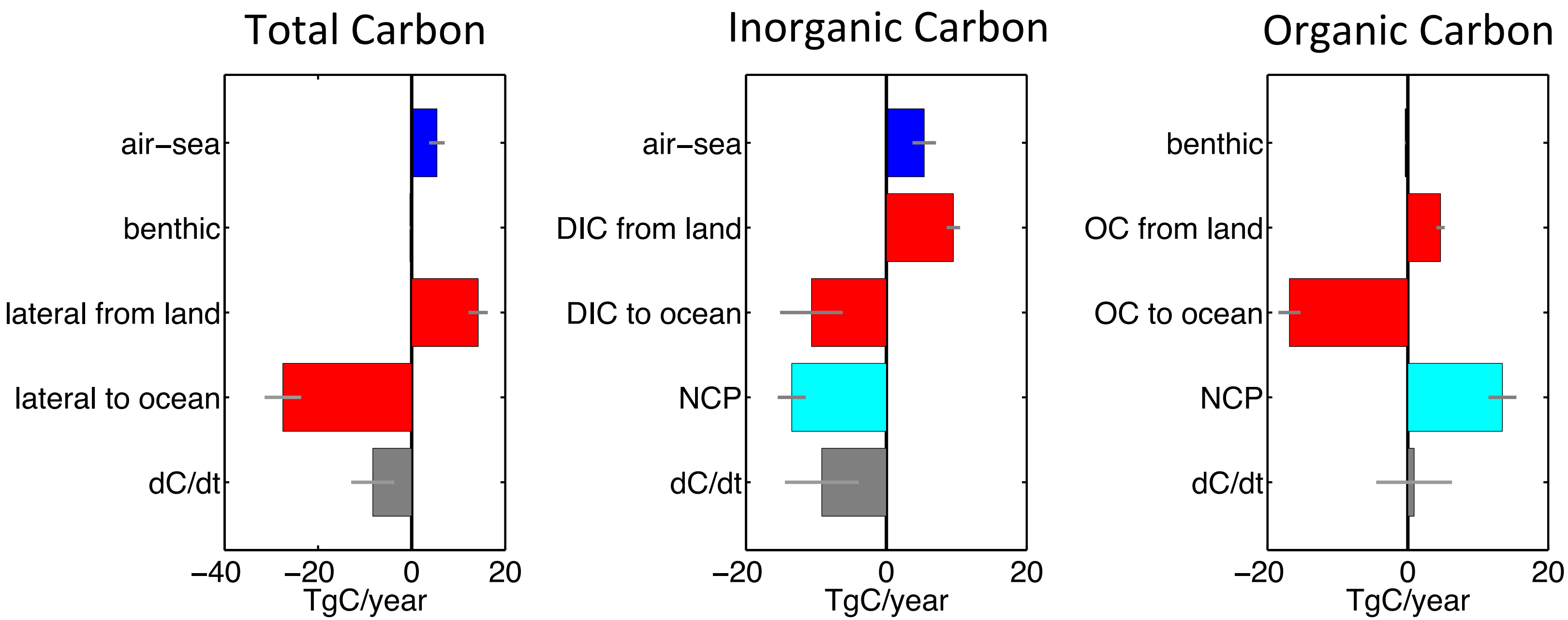
Surface pCO_2 algorithm exploiting satellite data

Flux = f(ΔpCO_2, wind, SST)



	Uptake Tg C yr^{-1}
GoM	0.0
GB+NS	1.0
MAB	2.1
SAB	0.9
East Coast	4.0

USECoS: Lateral carbon fluxes on the U.S. eastern continental shelf

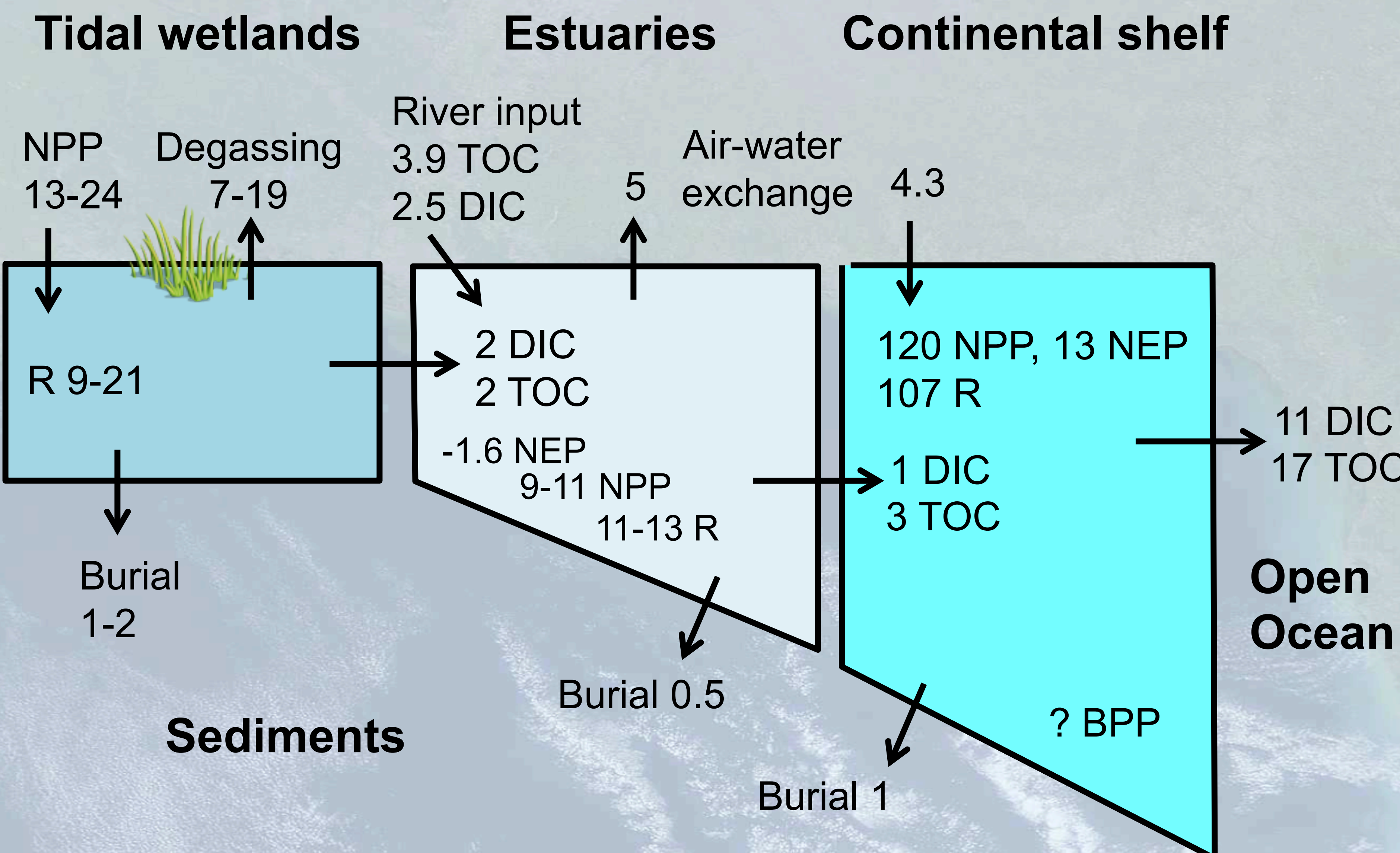


mean over 2004-2007

- Lateral exchange is large term in the US East Coast carbon budgets
- Large interannual variability of lateral DIC flux

Friedrichs & USECoS modeling team

Overall East Coast Carbon Budget



Summary

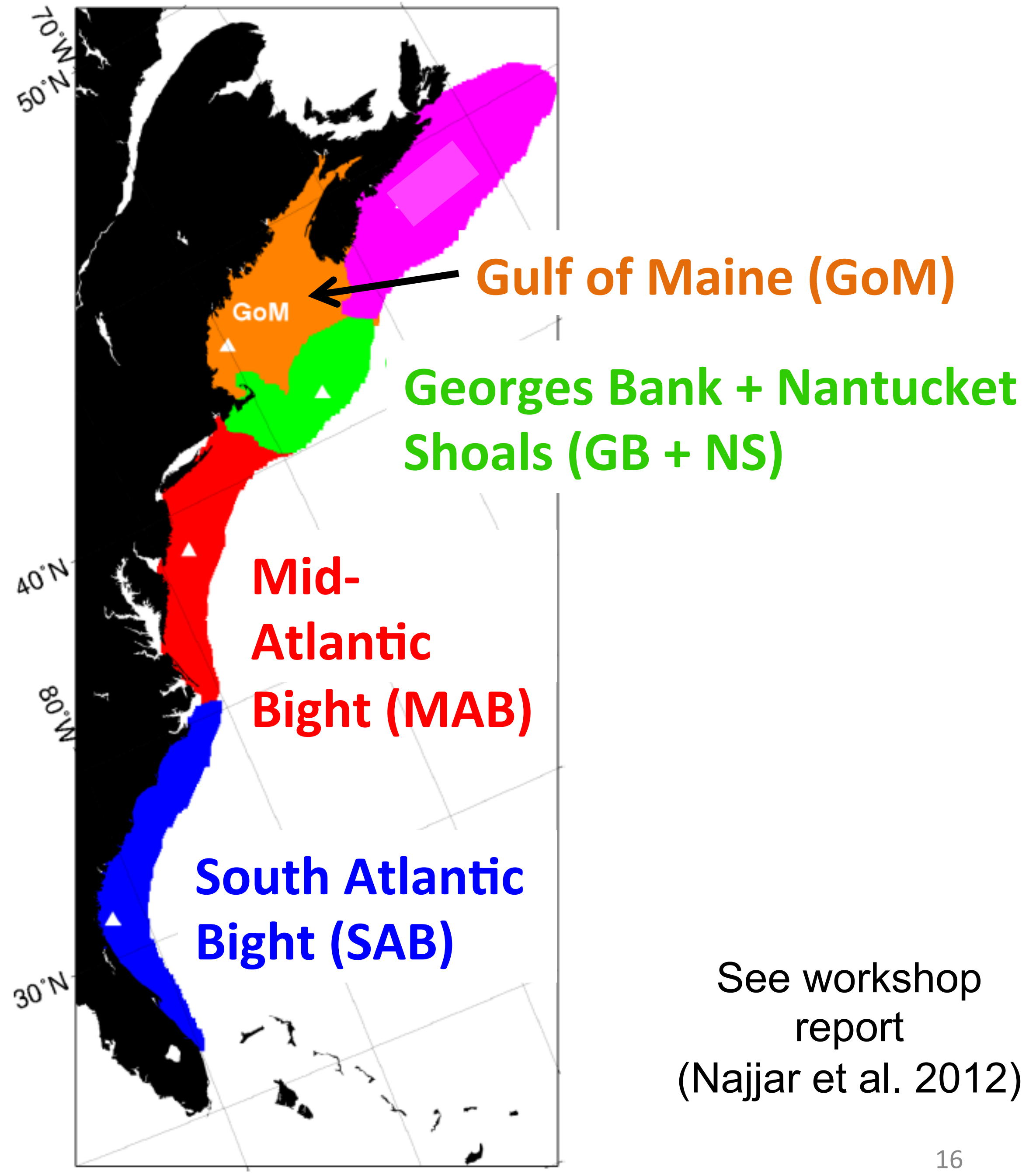
- Best constraints on riverine fluxes
- Poorest constraints on sedimentary processes, respiration, tidal wetland NPP
- Additional data mining, modeling can take us further
- But a new suite of observations are needed

ADDITIONAL SLIDES

East Coast

Head-of-tide to shelf break (~200 m)

	% Area
Tidal wetlands	2
Estuaries	19
Shelf waters	78



See workshop report (Najjar et al. 2012)

Tidal wetland TOC export:

Study location	TOC (mol C m^{-2} yr^{-1})	Source
Ware Creek, VA	10	*Axelrad et al.*, 1976
Carter Creek, VA	12	*Axelrad et al.*, 1976
Sapelo Island, Ga	22	*Chalmers et al.*, 1985
Synthesis of multiple studies	20	*Childers et al.*, 2000
North Inlet, SC	38	*Dame*, 1995
Hudson River, NY	27	*Findlay et al.*, 1998
Crab Haul Creek, North Inlet, SC	11	*Gardner and Kjerfve*, 2006
Bay Creek, North Inlet, SC	19	*Gardner and Kjerfve*, 2006
High Marsh, MD	4	*Jordan and Correll*, 1991
Kirkpatrick Marsh, Chesapeake Bay, MD	4	*Jordan and Correll*, 1991
Rhode River, MD	5	*Jordan et al.*, 1983