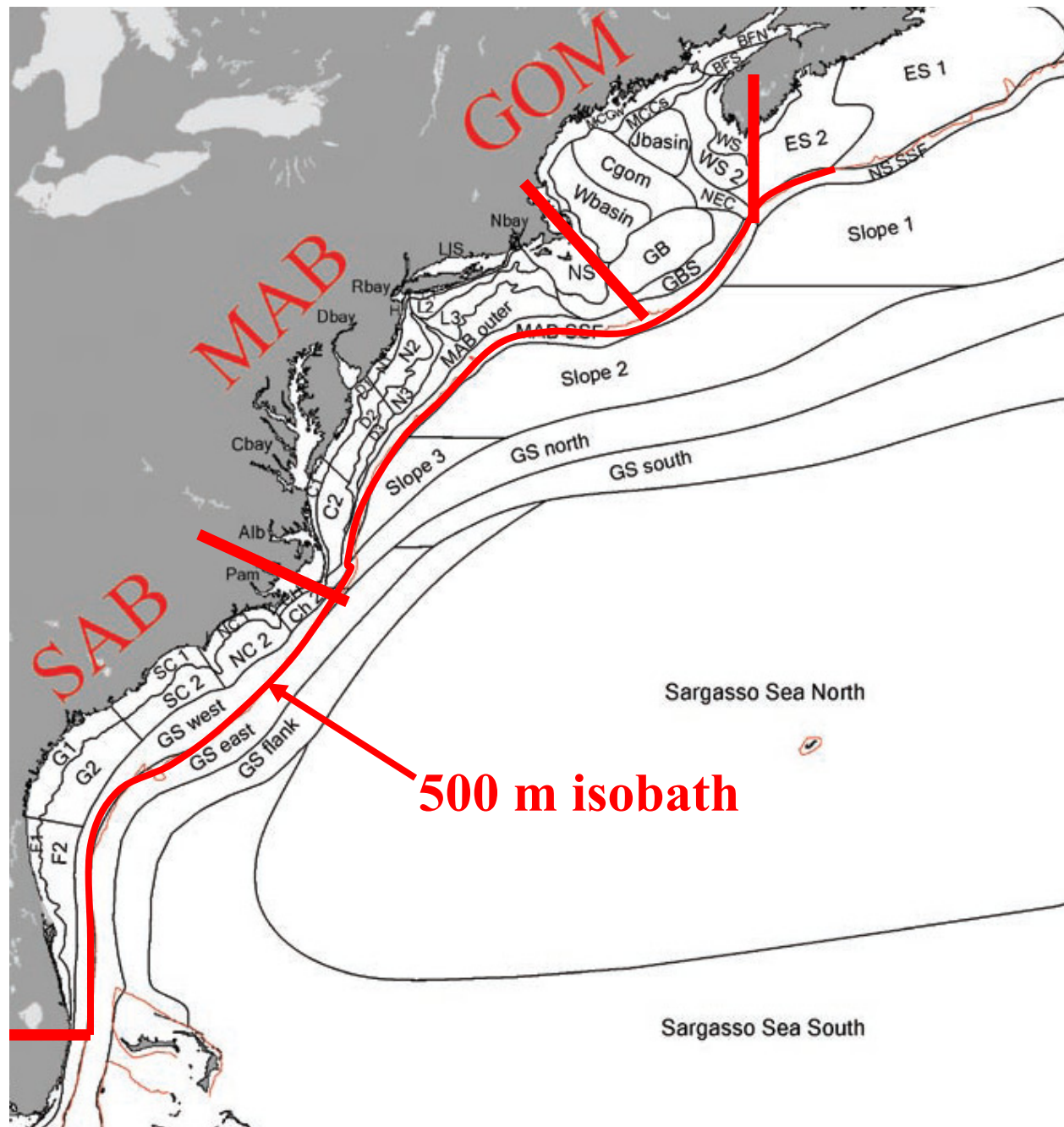


Carbon budget for the continental shelf of the Eastern United States

R. Najjar, D. Butman, W.-J. Cai, M. Friedrichs,
A. Mannino, P. Raymond, J. Salisbury,
and D. Vandemark

Ocean Carbon and Biogeochemistry Meeting
July 20-24, 2009



Fluxes of interest

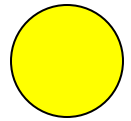
Interfacial fluxes:

- Inputs from land of DOC, POC, and DIC
- Air-sea: Exchange of CO₂, rainwater DOC
- Sedimentary fluxes: POC deposition, DOC & DIC exchange
- Shelf-break exchange: DIC, DOC, POC
- Convention: >0 when input to water column

Internal fluxes:

- Primary production
- Respiration
- Net community production

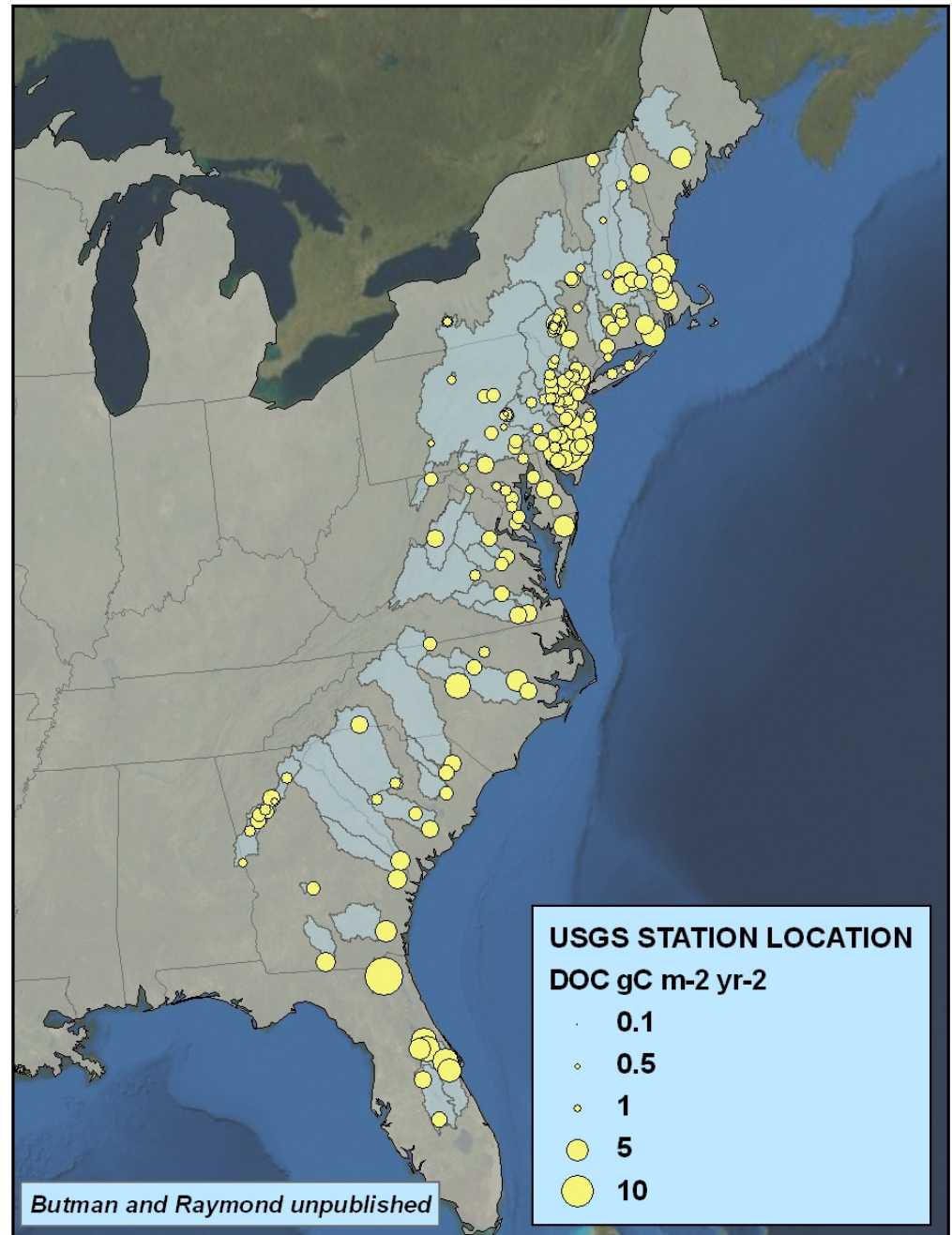
Input from land (10^{12} g C yr⁻¹)



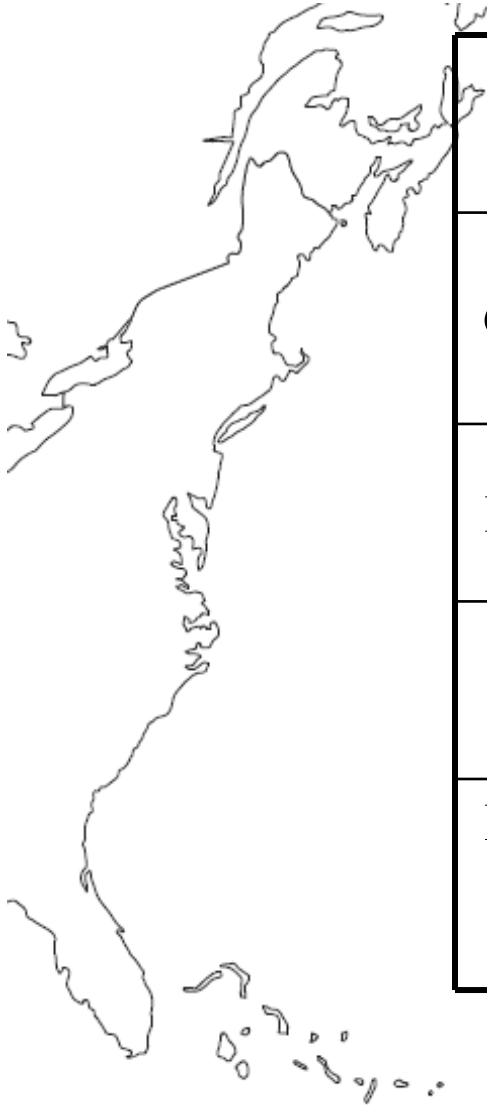
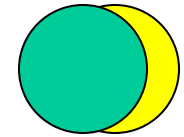
	DIC	DOC	POC	Reference
GOM	0.5	NA	0.1	DIC, POC: Friedrichs
MAB	1.1	0.59 ± 0.09 (estuary) 0.56 (river) 1-1.5 (TOC)	0.5	DOC: Vlahos et al. (2002), Raymond and Bauer (2000) TOC: Bauer et al. (2008)
SAB	0.6 (river) 0.7 (marsh)	0.75 (river) 2-2.5 (TOC)	0.1- 0.15 (river)	DIC: Wang (2003), Cai and Wang (2008) DOC & POC: Cai et al. (2003) TOC: Bauer et al. (2008)
Total	2.9	>~1.6	~0.7	Total C input from land >~ 5

East Coast DOC Sites

- 257 USGS gauging stations with DOC concentrations
- Watersheds delineated from the NHDPlus dataset
- Yields calculated using LOADEST model
- Will also look at POC, DIC & Alk



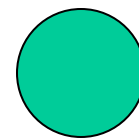
Air-to-sea CO₂ fluxes



	10 ¹² g C yr ⁻¹	mol m ⁻² yr ⁻¹	Reference
GOM	NA	-0.45 ± 0.55 (western GOM)	Vandemark and Salisbury (in prep.)
MAB	1.6 ± 1.0	1.1 ± 0.7	DeGrandpre et al. (2002) ¹
SAB	0.52 ± 0.23	0.48 ± 0.21	Jiang et al. (2008)
MAB + SAB	2.1 ± 1.0	0.81 ± 0.39	

¹Recomputed by Fennel et al. (2008) using different areas.

Global mean ~0.5 mol m⁻² yr.



Rainwater DOC fluxes

- GoM, MAB precip. $\sim 1 \text{ m yr}^{-1}$
- [DOC] in rain $\sim 50\text{-}100 \text{ mmol m}^{-3}$
- Fluxes $\sim 0.05 - 0.1 \text{ mol C m}^{-2} \text{ yr}^{-1}$
- Total flux to shelf $\sim 0.28 \pm 0.09 \times 10^{12} \text{ g C yr}^{-1}$
- DOC in rain has marine component

Sediment-water interface (10^{12} g C yr⁻¹) ●



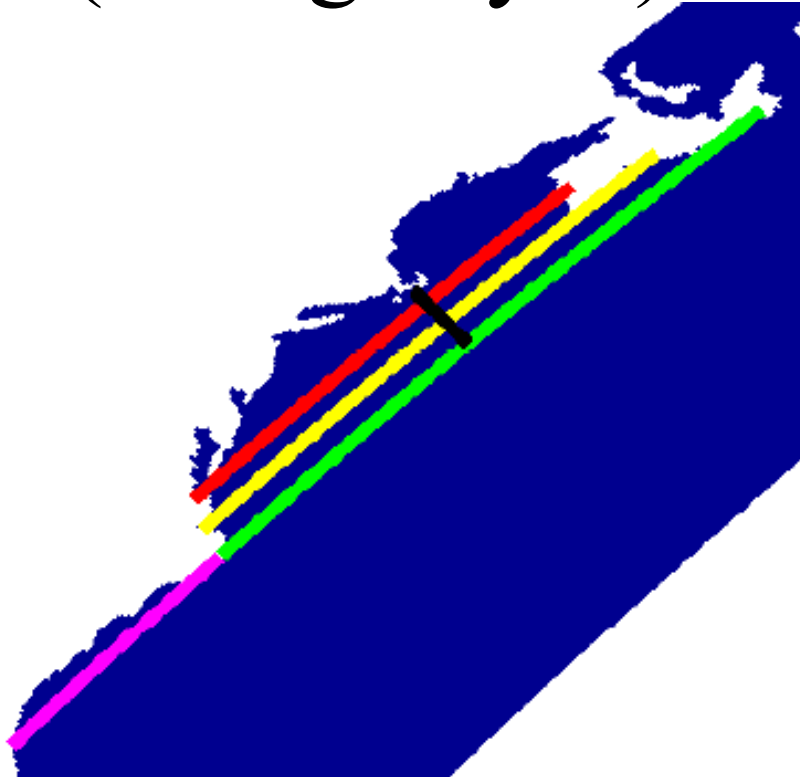
	DIC	DOC	POC (burial)	
GOM	NA	NA	-0.72 ± 0.22	Charette et al. (2001)
MAB	NA	NA	NA	
SAB	8 ± 11	NA	NA	Jahnke et al. (2005)

Cross-shelf exchange (10^{12} g C yr⁻¹) ●



	DIC	DOC	POC	
GOM	NA	-1.3 ± 2.9 (TOC)	NA	Charette et al. (2001)
MAB	NA	-6.5	-4.8	Vlahos et al. (2002) Falkowski et al. (1994)
SAB	-2.6	NA	NA	

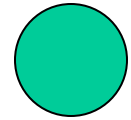
USECoS Model fluxes from open ocean (10^{12} g C yr⁻¹)



Transect	POC	DIC
Inner GOM	-0.1 ± 0.1	-10 ± 2
Inner MAB	-0.2 ± 0.03	-30 ± 5
Middle GOM	-0.0 ± 0.1	100 ± 10
Middle MAB	-0.8 ± 0.6	-100 ± 150
Outer GOM	-0.7 ± 0.2	200 ± 100
Outer MAB	-1.2 ± 0.3	-150 ± 400
SAB	-0.8 ± 0.2	-0.3 ± 0.7

M. Friedrichs analysis of NENA1 simulation, 2004-2006

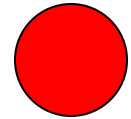
Water column primary production



	$10^{12} \text{ g C yr}^{-1}$	$\text{mol m}^{-2} \text{ yr}^{-1}$	
GOM	27 34	22	O'Reilly et al. (1987) Balch et al. (2008)
MAB	39	26	O'Reilly et al. (1987)
SAB ¹	35	32	Menzel et al. (1993)
Total	100	26	

(0.2% of global primary production,
global areal mean = $12 \text{ mol m}^{-2} \text{ yr}^{-1}$)

f -ratios

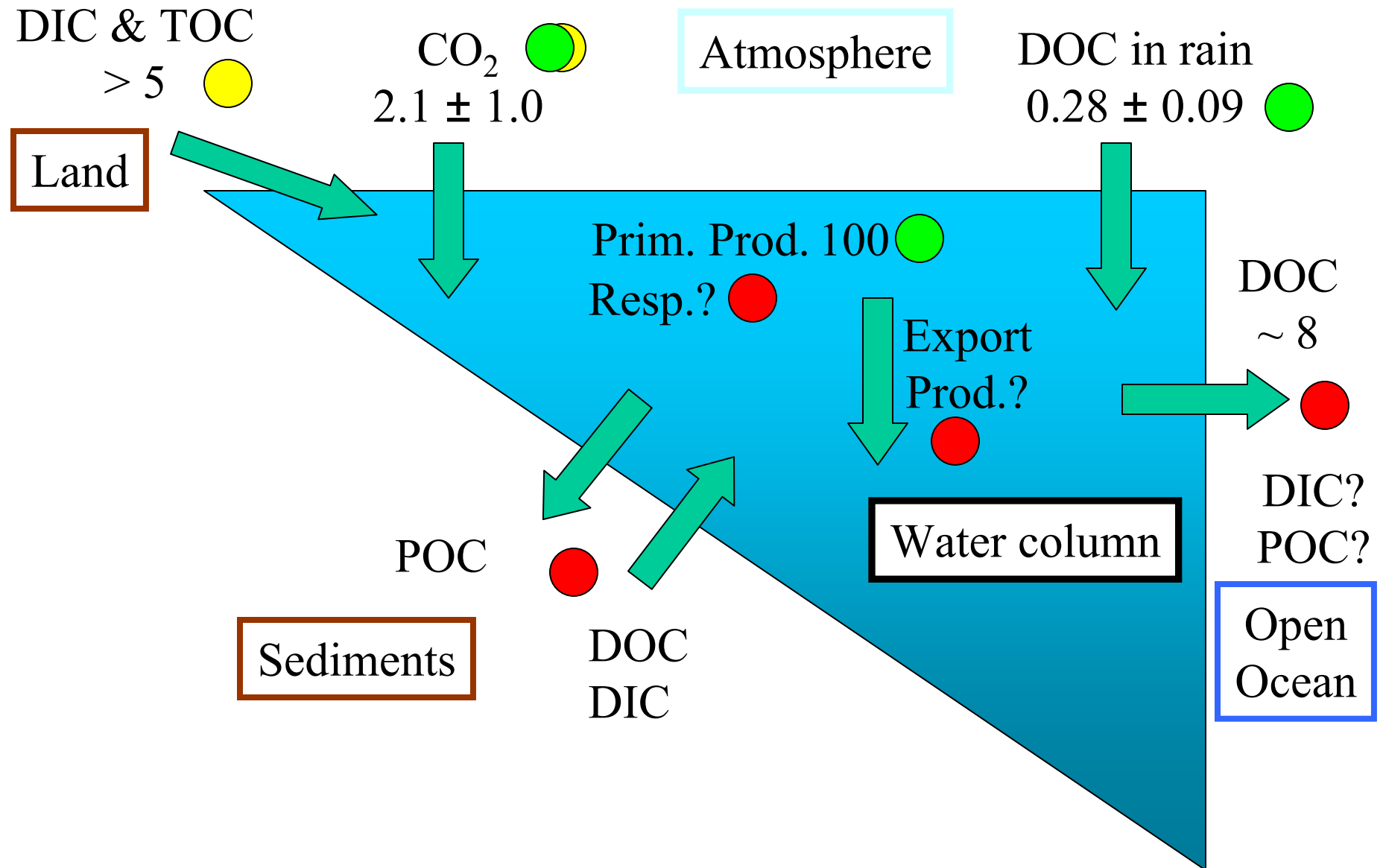


GOM	0.20 0.09-0.49, southwest 0.11-0.25 0.25 spring, west 0.30, central	Townsend (1998) Benitez-Nelson et al. (2000) Charette et al. (2001) Salisbury et al. (2009) Najjar et al. (in prep)
MAB	NA	
SAB	NA	

Respiration

- SAB, about the same as primary production (Jiang et al. 2009)
- Few measurements in MAB, GoM

Shelf-wide budget (10^{12} g C yr⁻¹)

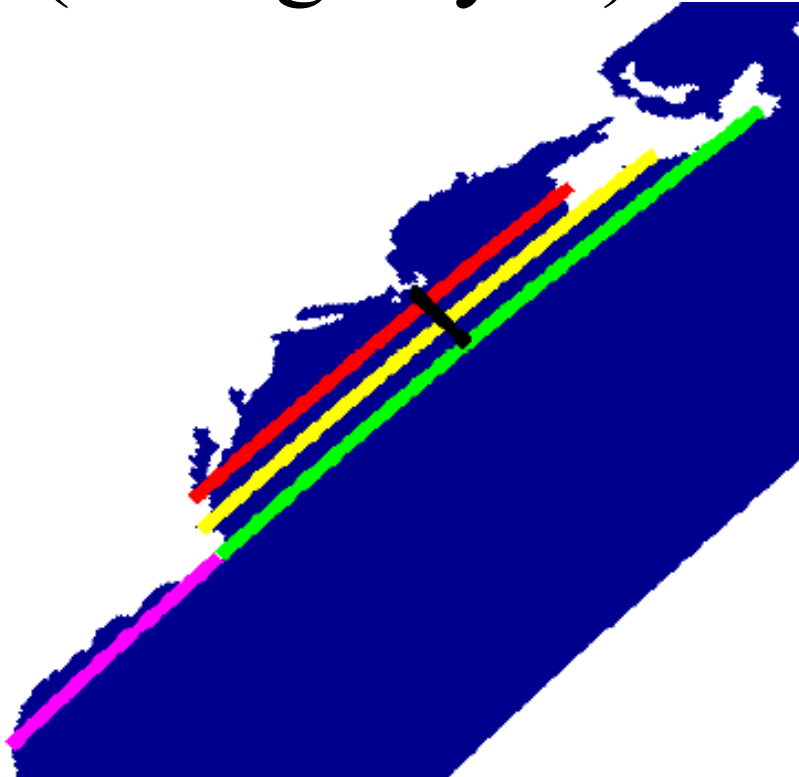


Important but poorly known

- Cross shelf water & C budgets
- Estuarine/marsh processing of C
- Water column respiration (SAB OK)
- Shelf sediment fluxes (better on slope!), including groundwater

Thank you

USECoS Model fluxes from open ocean (10^{12} g C yr⁻¹)



Transect	POC	DIC
Inner GOM/MAB	-0.28 to -0.44	-38 to -44
Middle GOM/MAB	-0.51 to 1.48	-187 to +152
Outer GOM/MAB	-1.3 to -2.2	-232 to +472
SAB	-0.55 to -0.84	-1.1 to +0.1

M. Friedrichs analysis of NENA1 simulation, 2004-2006

