FCE ASM 2011

BIOGEOCHEMICAL CYCLING WG

PARTICIPANTS

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CENTRAL QUESTION #4

How do water residence time and the magnitude of nutrient inputs, from freshwater inflows, marine exchange, and groundwater control local nutrient concentrations and cycling rates in the oligohaline ecotone?

GENERAL APPROACH

The overall effect (measured as phytoplankton biomass/productivity) of nutrient loading is strongly controlled by estuarine water residence time.

STATUS (PARTIALLY COMPLETED)

Presented this comparison for Florida Bay. Still need to analyze Shark River Estuary. Some work done in conjunction with Henry Briceño and Val Smith. Major analysis of estuarine stressor–response approach (nutrient–CHLA) as part of EPA-mandated Numeric Nutrient Criteria Development for Florida Estuaries and Coastal Waters.

SPECIFIC RESEARCH QUESTION 4-1

What are the mechanisms by which P availability acts to regulate N cycling rates in marshes and mangroves of the southern Everglades?

APPROACH 1

Measurement of P-amended nutrient fluxes along lower Taylor River and Little Madeira Bay.

Steve Davis and Victor Rivera-Monroy

STATUS (COMPLETED)

Goal: to understand the role of season and increased P on the exchange of C, N and P between the soil/sediment and water column

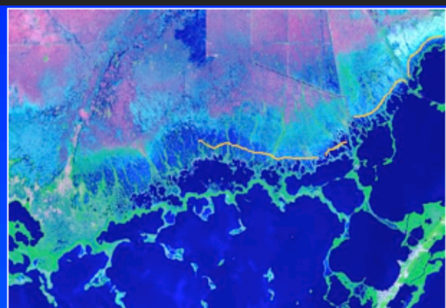
Benthic fluxes of DO, DIN, DIP, and DOC measured at four stations from 2006-2008.

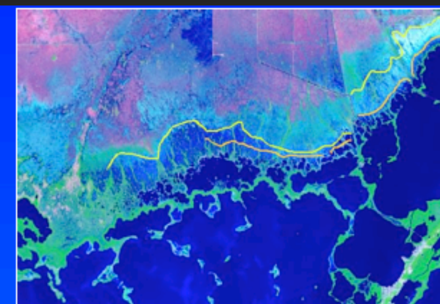
APPROACH 2

Nitrogen cycling of estuarine wetlands of Taylor River, Florida, USA

Victor H. Rivera-Monroy, Robert R. Twilley, Edward Castañeda-Moya, Peter Lenaker, Daniel Childers

STATUS (COMPLETED)





- Low NO_3^- concentrations in the water column limit direct denitrification in ponds, mangrove and tree island sediments,

- Denitrification rates obtained with the IPT and ^{15}N chamber incubation techniques were within the same order of magnitude and ranged from 1-19 umol m^2 d^{-1} ; average total denitrification rate for the region was 4 umol m^2 d^{-1} ; a low rate in comparison to other systems

SUPPLEMENTAL RESEARCH QUESTION

Soil organic carbon dynamics in tropical peatlands are a product of interacting effects among hydrological, chemical and biological factors. Anthropogenic drivers such as climate change, nutrient inputs and hydrologic modifications act synergistically to shift the SOC balance from C sink to C source in tropical peatlands.

(LTER Supplement to Troxler)

APPROACH 3

Measure CO2 flux as function of tidal inundation.

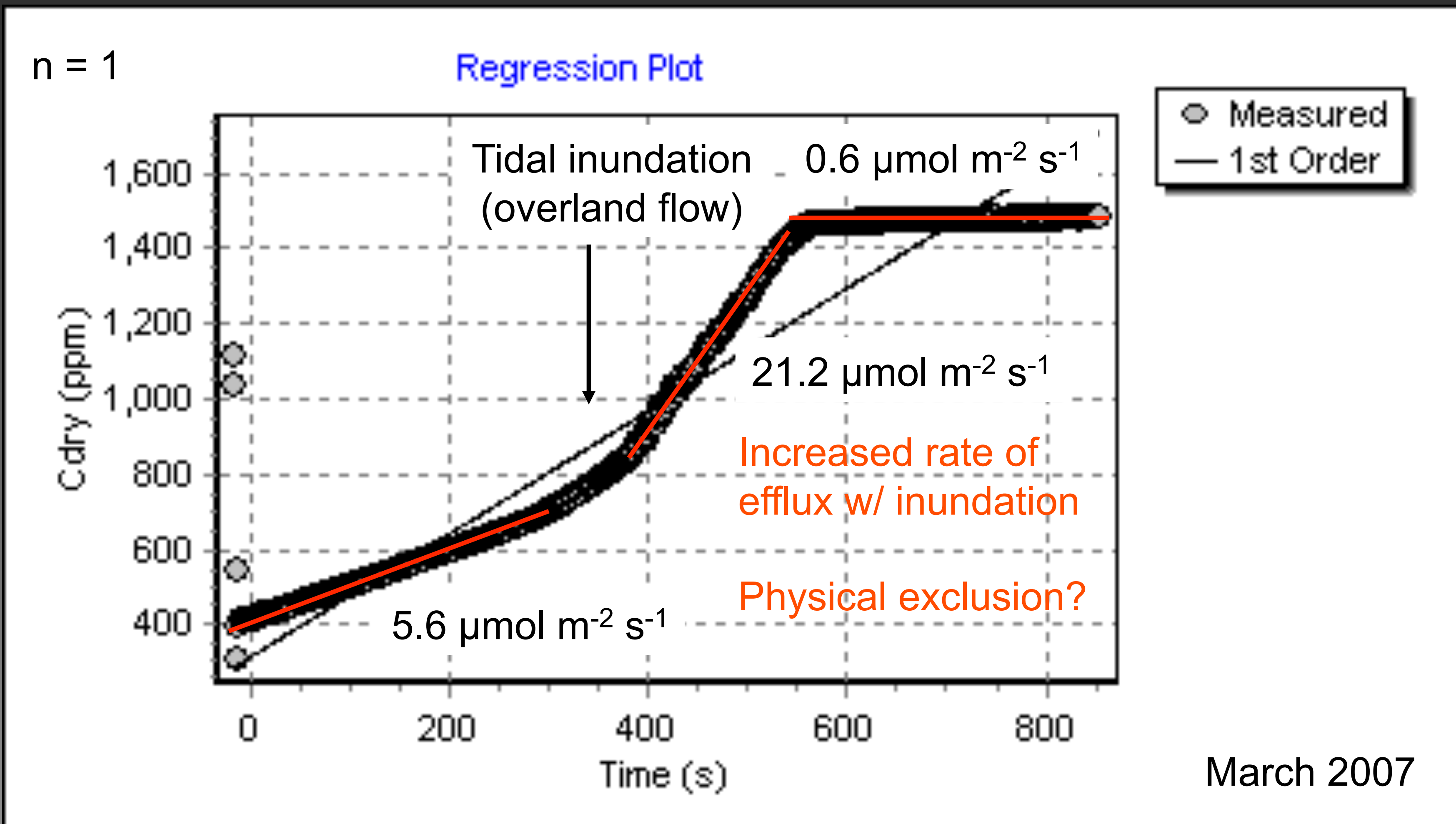
- to determine the relative influence of plant and microbial community structure and metabolism on C storage in tropical peatlands

- framework for evaluating the relative influence of drivers of plant production and microbial respiration on C storage because of differential controls on carbon dynamics that occur along natural nutrient gradients

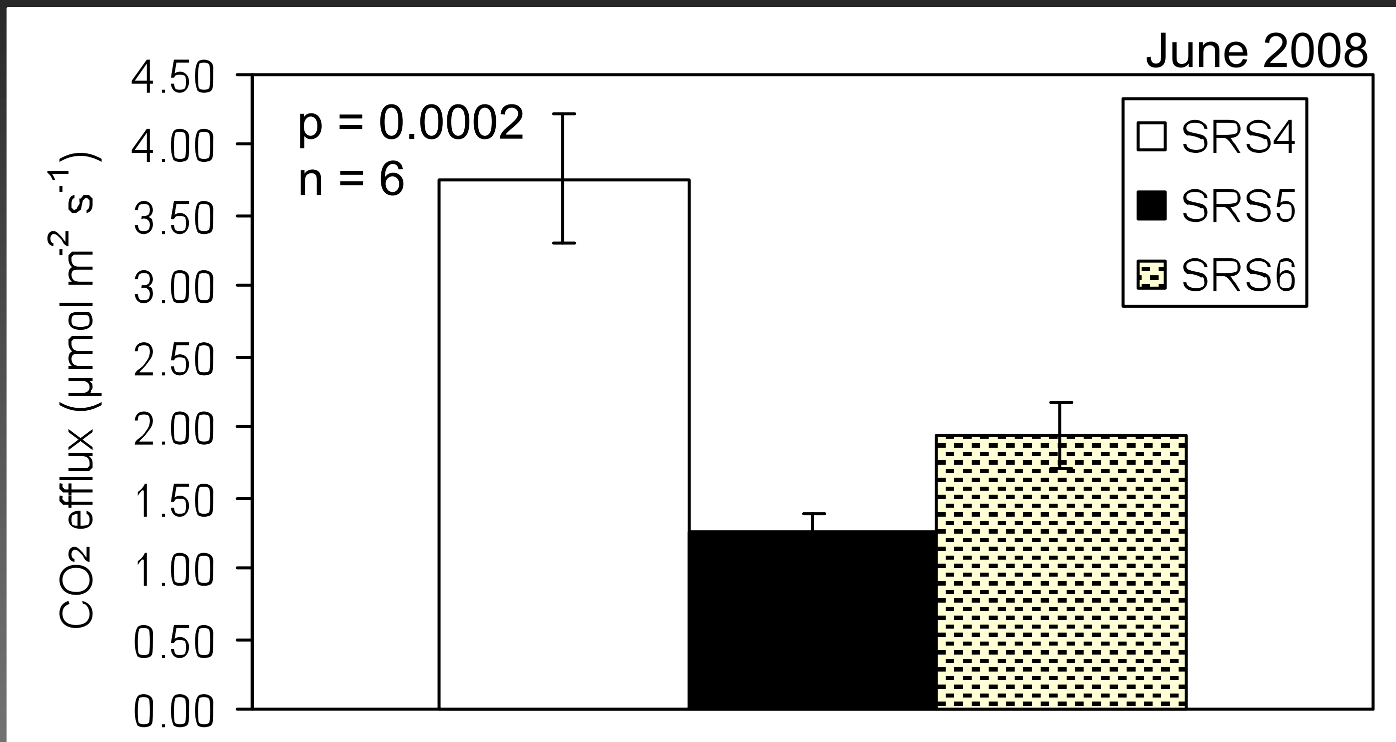
Troxler et al.

STATUS (COMPLETED?)

Temporal variability in carbon dioxide efflux with tidal inundation at SRS 6



Carbon dioxide efflux at SRS 4, 5 & 6



- Tidal inundation contributes to high temporal variability in flux rates
- SRS 4 among highest reported efflux rates for mangrove systems (see Lovelock 2008); SRS 5 & 6 within range of other systems

SPECIFIC RESEARCH QUESTION 4-2

How is the bacterial community influenced by temporal changes in water source in the oligohaline ecotone, and how are these community shifts reflected in ecosystem processes, such as those of the N cycle?

APPROACH

- Bacterial Metagenomics - T-RFLP analysis
- Yeast/Fungi Community Structure - Luminex xMAP
- Pyrosequencing - part of XLTER MIRADA project using 454 pyrosequencing
- Cyanobacterial Metagenomics – T-RFLP analysis

STATUS (ACTIVE AND COMPLETED)

- Bacterial Metagenomics of Soils and Sediments – Much work already done and published.
- Yeasts and Fungi – Still working with Jack Fell on yeast publication.
- Bacterial Metagenomics of Floc – Rafa Guevara is continuing previous work. Need to write up.
- Microbial Pyrosequencing - MIRADA project completed, submitted renewal
- Cyanobacterial Metagenomics and Nutrient Response – see Rafa's poster

WHERE WE ARE

- Beginning to unravel residence time/productivity issue
- On the way towards better understanding of N cycle
- Defining microbial community structure dynamics
- Not there yet with functional attributes of metagenomics (gene expression, etc.)

PRODUCTS TO DATE

- Lots of presentations
- Some proposals submitted
- Few manuscripts in review
- Couple pubs out

WHERE WE NEED TO BE

- What are the "gaps" we need to address to answer our central questions by the end of FCE II.
- List steps and dates for moving toward meeting that goal, including data needs, gathering data from other working groups and mechanisms.
- Also include names of people responsible for each step.

WG data: N cycling rates, bioavailability of floc, floc fungal community dynamics,

FCE data: Mass flows to the estuaries, nutrient loading, soil chemistry, ISCO data synthesis, etc.