Toward Dissolved Organic Carbon Export From A Tidal Salt Marsh, Groves Creek, Savannah, Ga

Aron Stubbins
aron.stubbins@skio.uga.edu

PIs: Jay Brandes, Catherine Edwards, William Savidge, Aron Stubbins

Team: Thais Beraldo Bittar, Charles Robertson, Zac Tait, Megan Thompson

Funding: National Science Foundation – Chemical Oceanography

Skidaway Institute of Oceanography

Project goals:

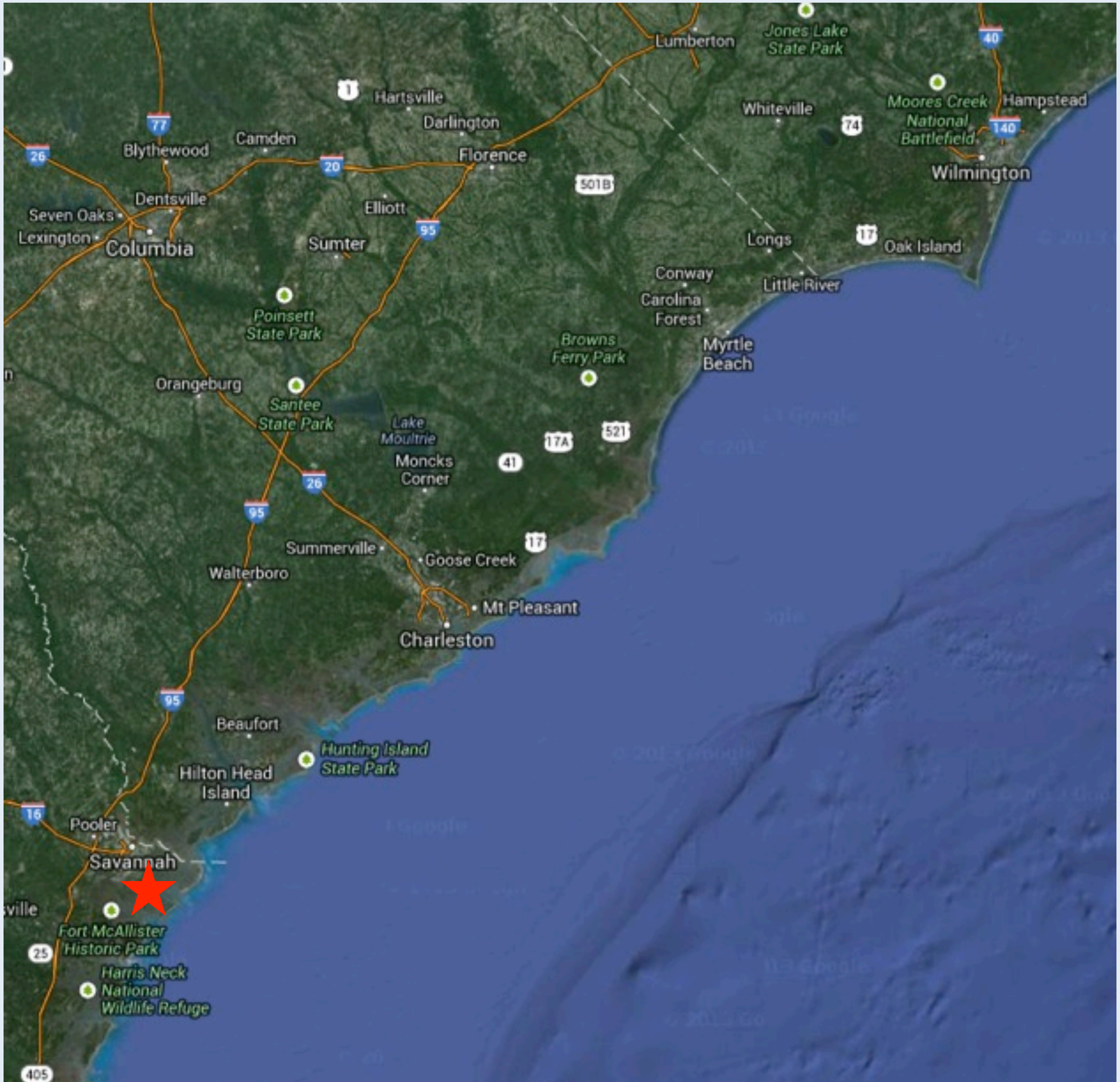
Determine whether Groves Creek is a net importer or exporter of organic carbon

Assess diurnal, tidal (neap to spring), and seasonal cycles in organic carbon quantity and quality

Assess the importance of events (e.g. storms) in seasonal and annual carbon fluxes

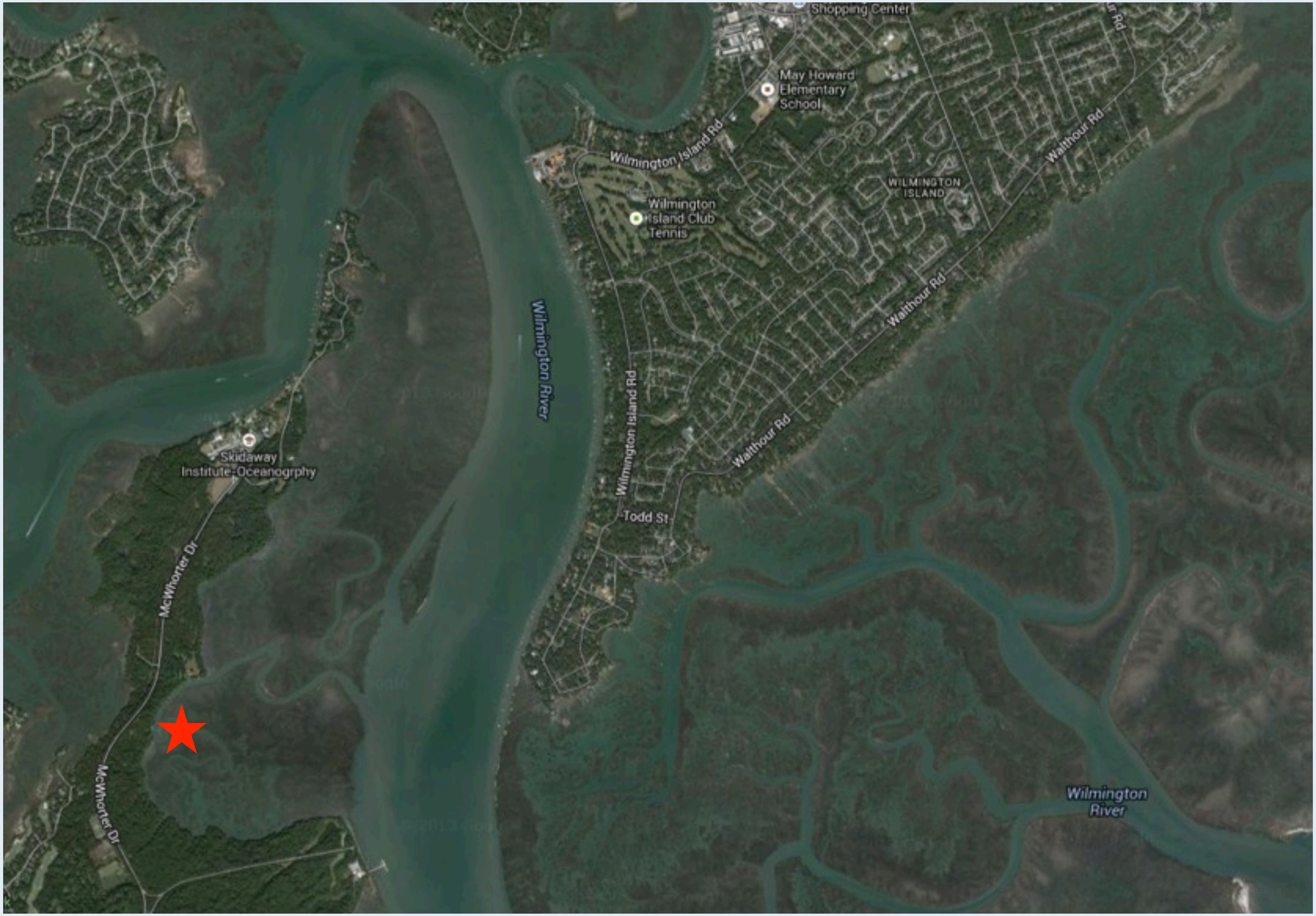
Study Site:

Groves Creek – Skidaway Island, Savannah, Georgia



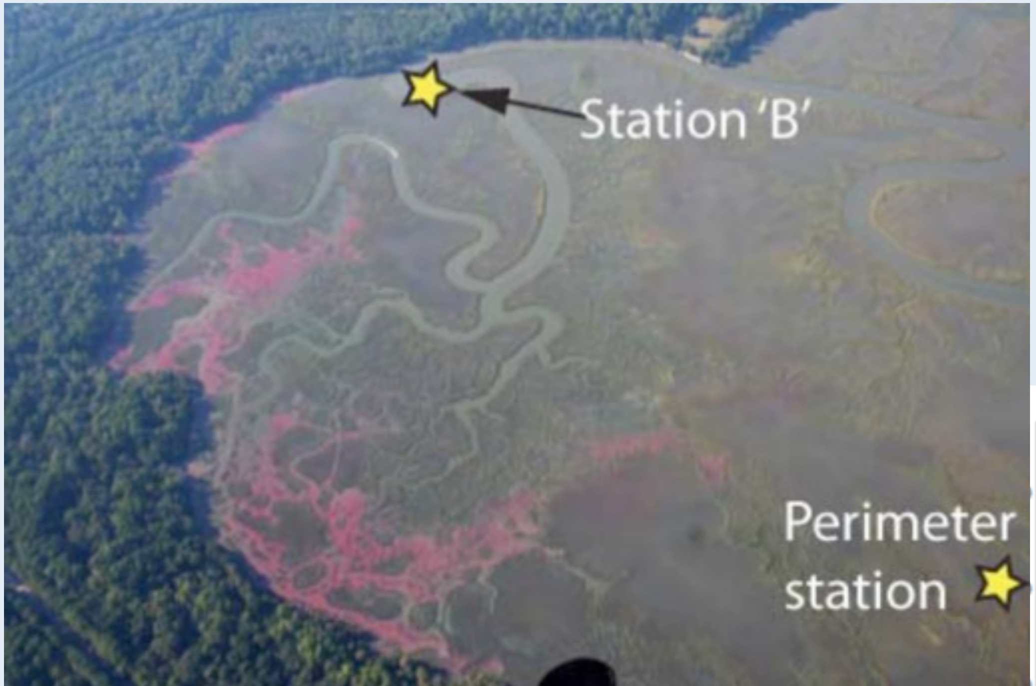
Study Site:

Groves Creek – Skidaway Island, Savannah, Georgia

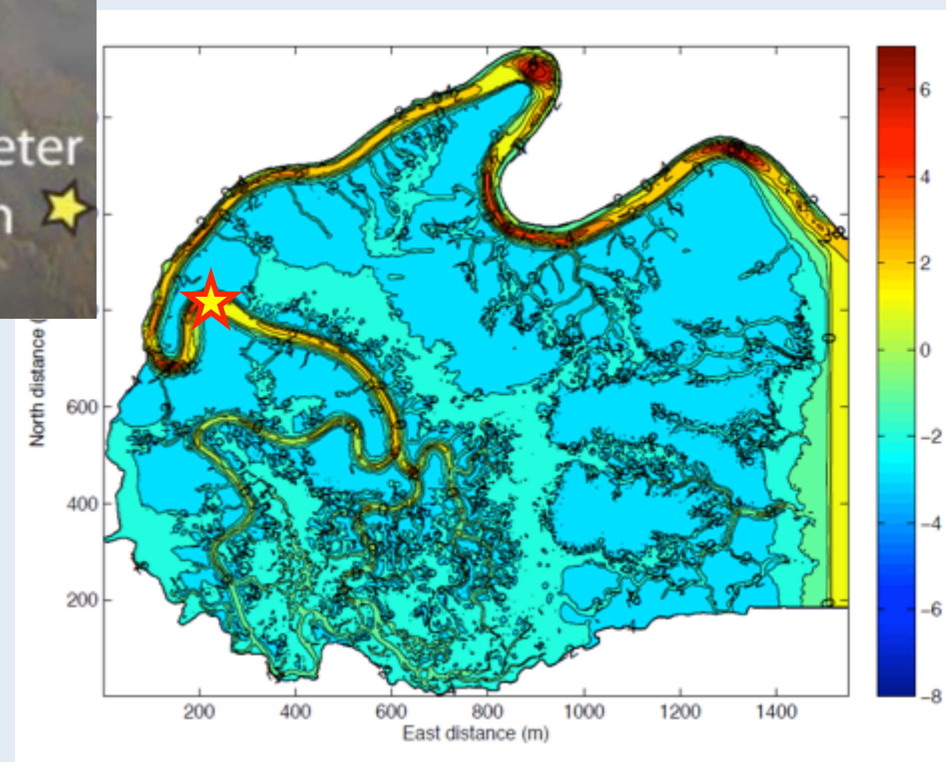


Groves Creek - past work

Tracer dye release to tune physical models



Detailed bathymetry



Current Hydrology:

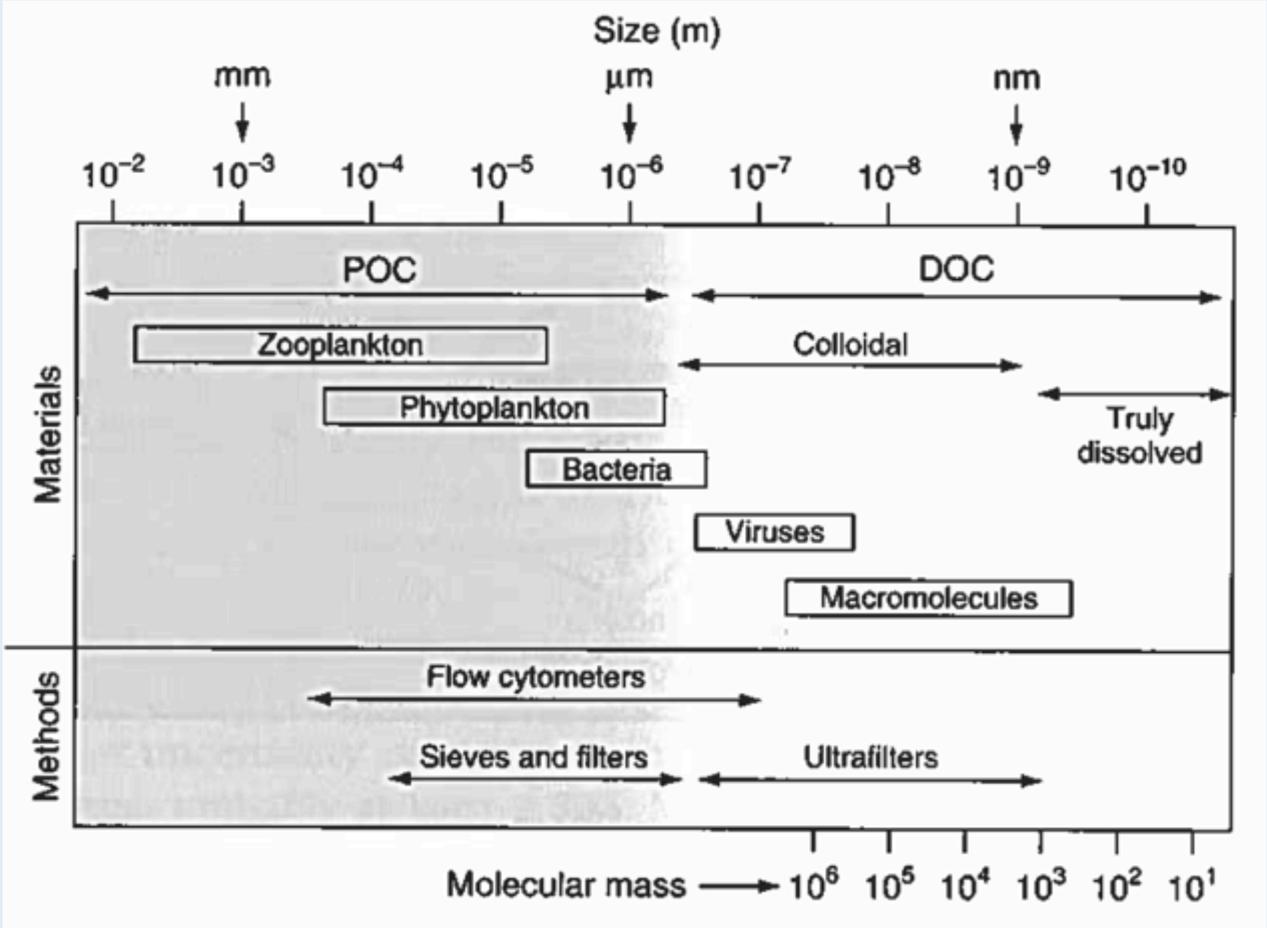
Catherine Edwards

Continuous physical measurements

Physical modeling

Dissolved Organic Carbon

Organics that pass through a filter of <0.5 μm (dependant upon the filter you use)



Marine organic geochemistry, Emerson. Hedges, Whitehead. *In* Chemical oceanography and the marine carbon cycle (2008)

Why dissolved organic carbon

- **A major pool of global carbon**
  - **Equivalent to:**

    the atmospheric CO_2 pool in size

    all living biomass on the planet

  - **Underpins the microbial foodweb in aquatic environments**

- **An information rich set of tracers**
  - **Source and process specific indicators**

    These include optical signatures - CDOM

In many estuaries we find a strong correlation between color (CDOM) and carbon (DOC)

Estuaries and coastal waters

Rivers:
High CDOM and DOC

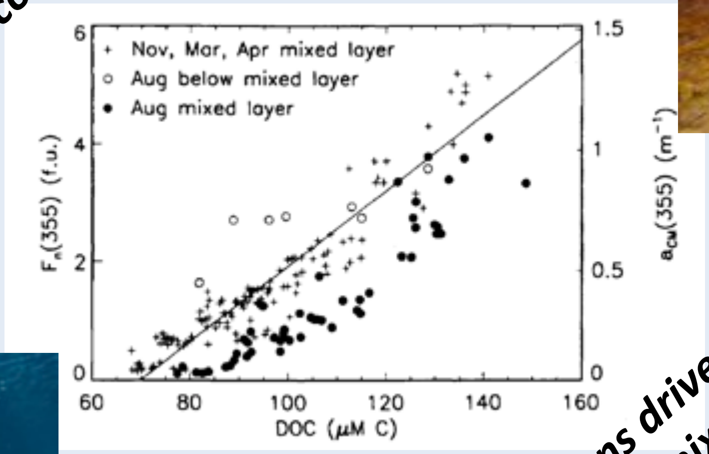
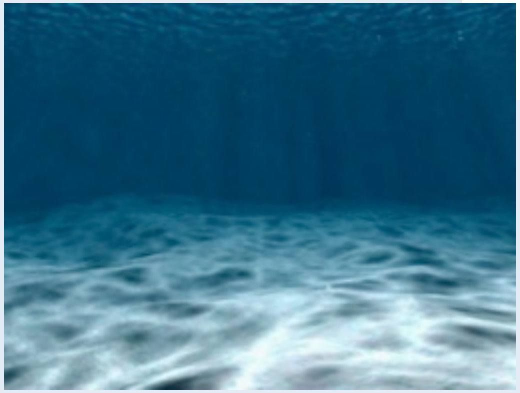


Figure from Vodacek et al. 1997

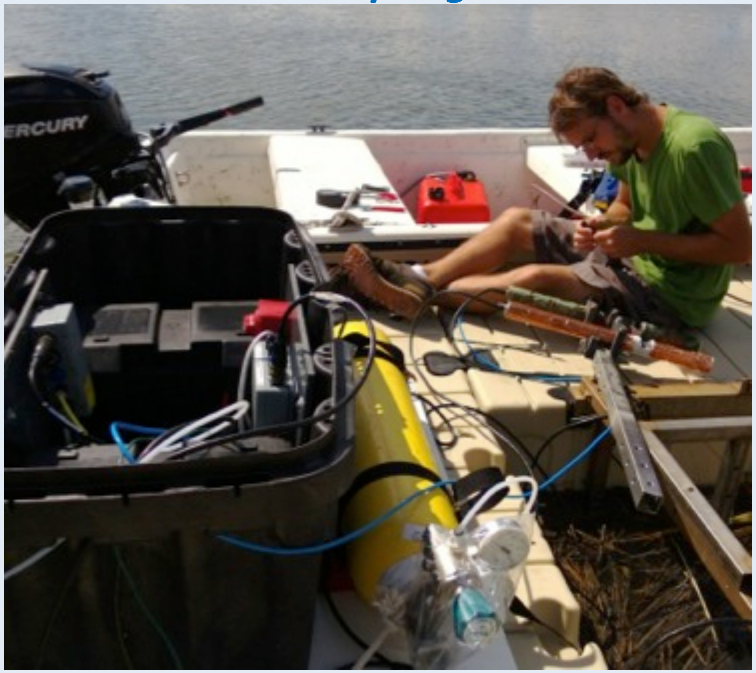
Strong correlations driven predominantly by mixing

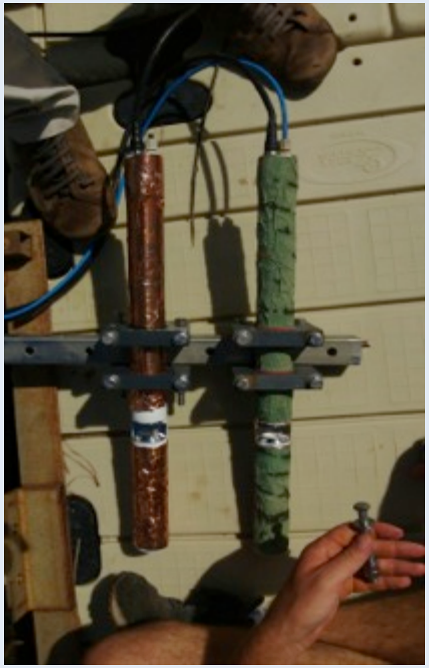


Ocean:
Low CDOM and DOC

Instrumentation for CDOM

Marsh in situ sampling and measurement platform





S-CAN in situ absorbance

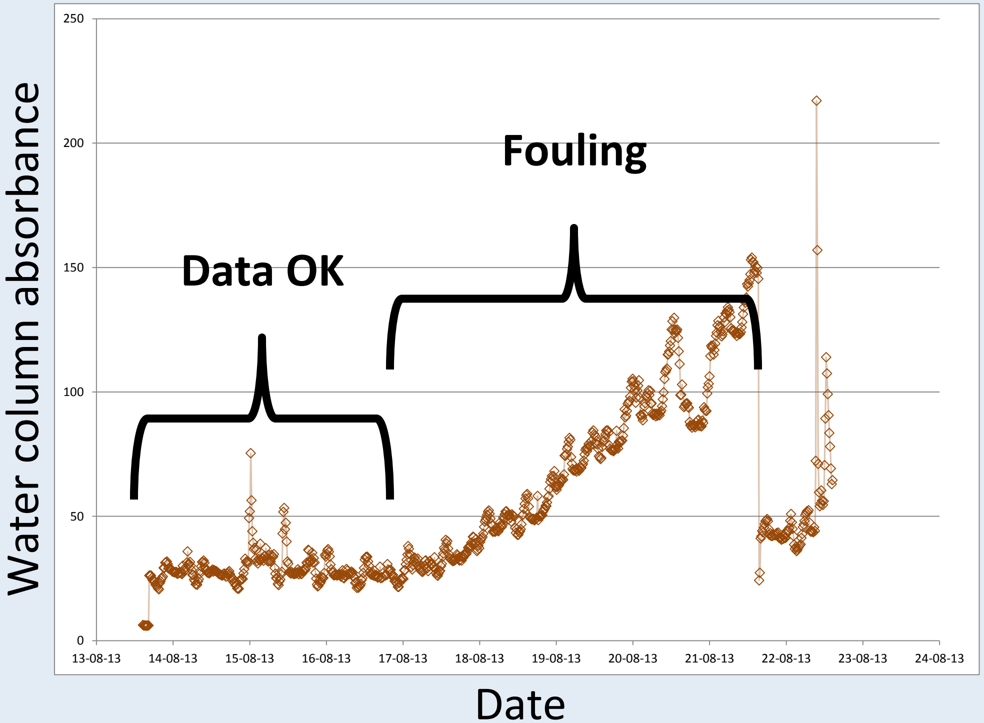
- *Collects full UV-visible spectra*
- *1.5 cm pathlength*
- *Spectra every 15 minutes*
- *Co-locate for 1 day every 2 weeks*
- *Develop algorithms to go from in situ absorbance to lab CDOM, DOC and other parameters*

ISCO Automated sampler

- *14 x 800 mL bottles*
- *Chilled to $3^{o}C$*
- *Collect a diurnal cycle every 2 weeks*
- *Process and analyze in lab*

Instrumentation for CDOM

Teething problems: S-CAN Chemical Fouling

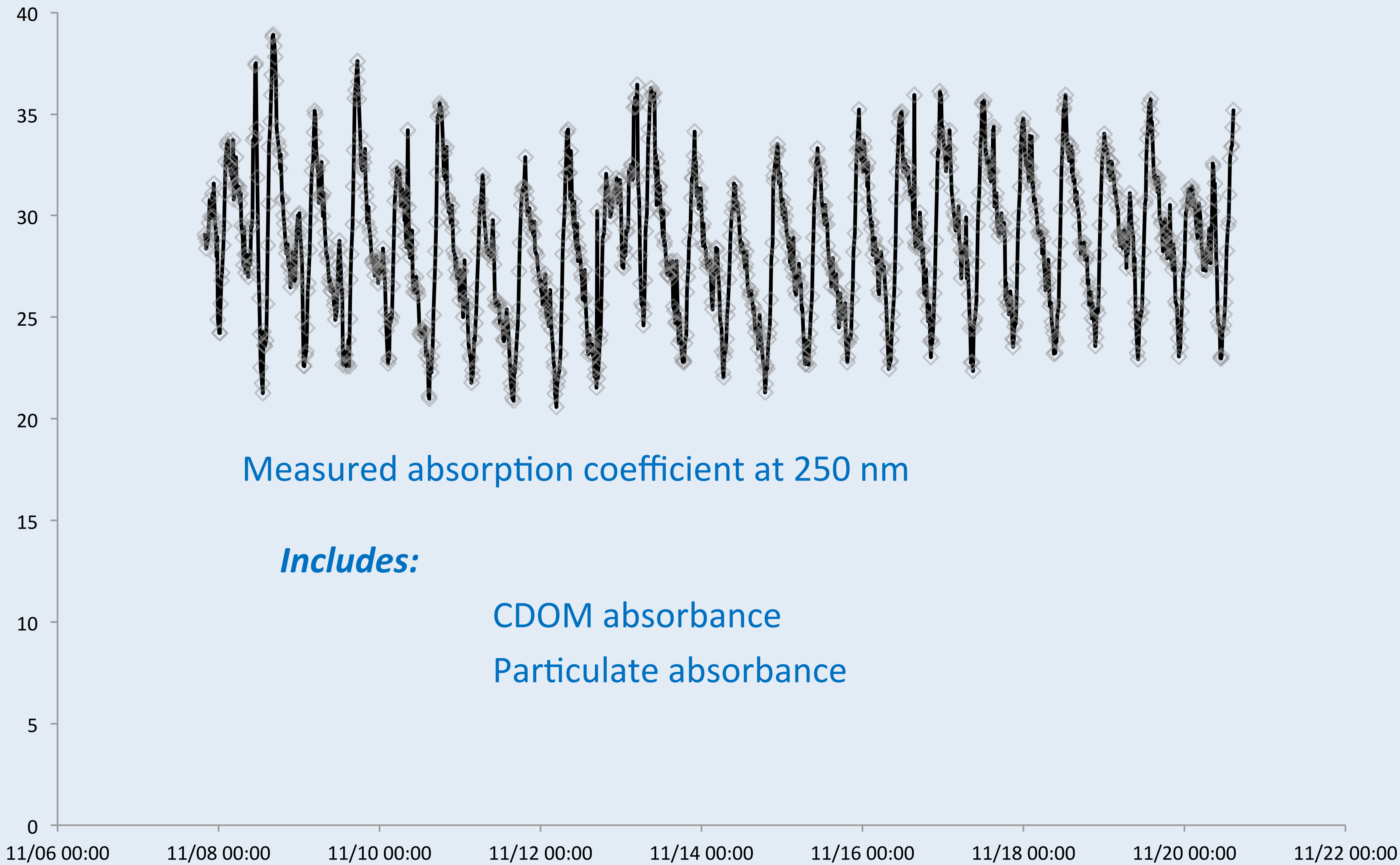


Temporary Fix: *Disassemble and acid clean optical window*

Permanent Fix: *Attach a zinc rod to limit rust*
Use provided bubble cleaning
Clean between deployments

In Situ Color

Data with zinc rod attached – no fouling



Measured absorption coefficient at 250 nm

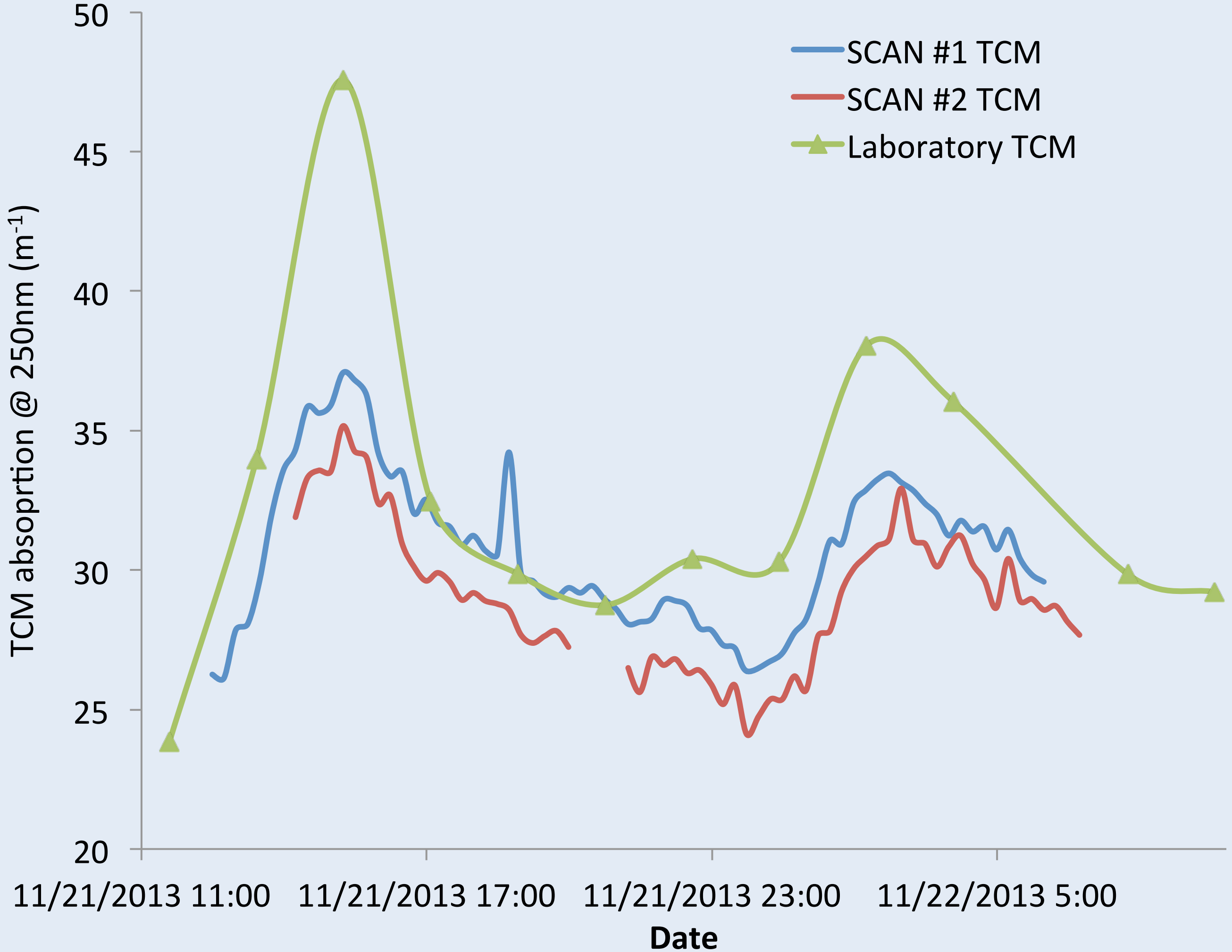
Includes:

CDOM absorbance

Particulate absorbance

In Situ Color

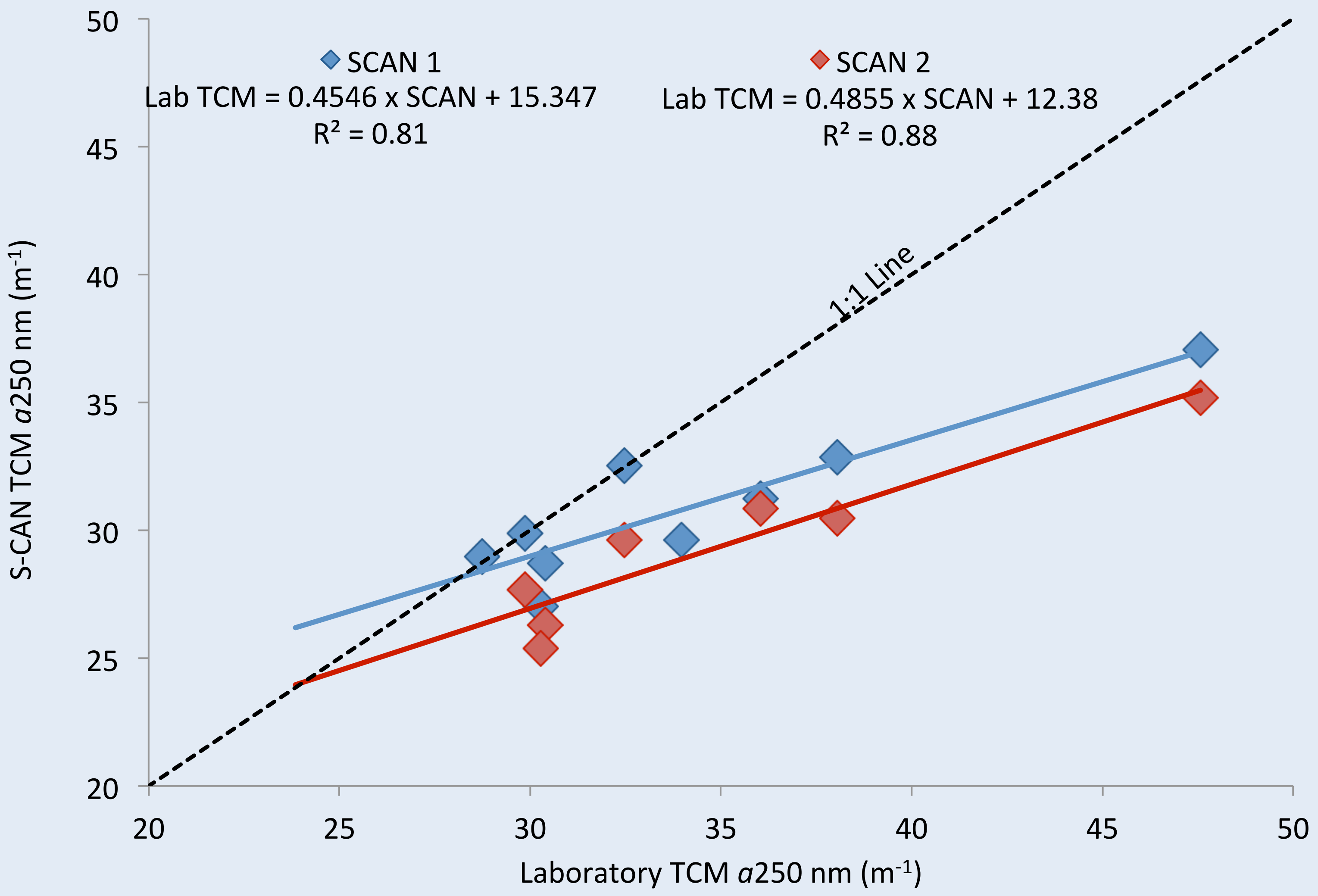
S-CAN and laboratory measurements of Total Colored Material



In Situ Color

S-CAN and laboratory measurements of Total Colored Material

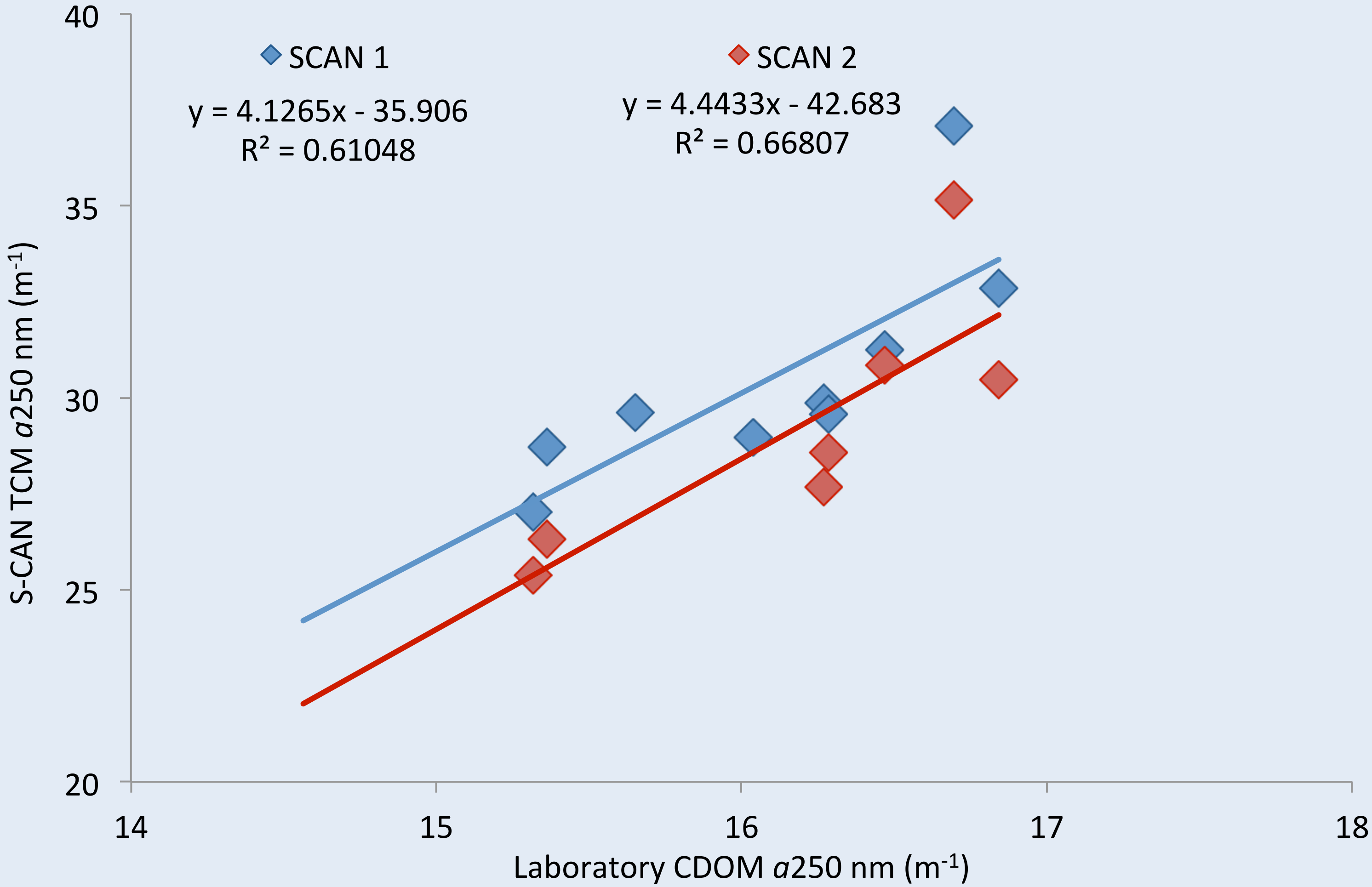
i.e. lab samples were unfiltered so should = in situ S-CAN data



In Situ Color

S-CAN Total Color versus lab Colored Dissolved Organic Matter (CDOM)

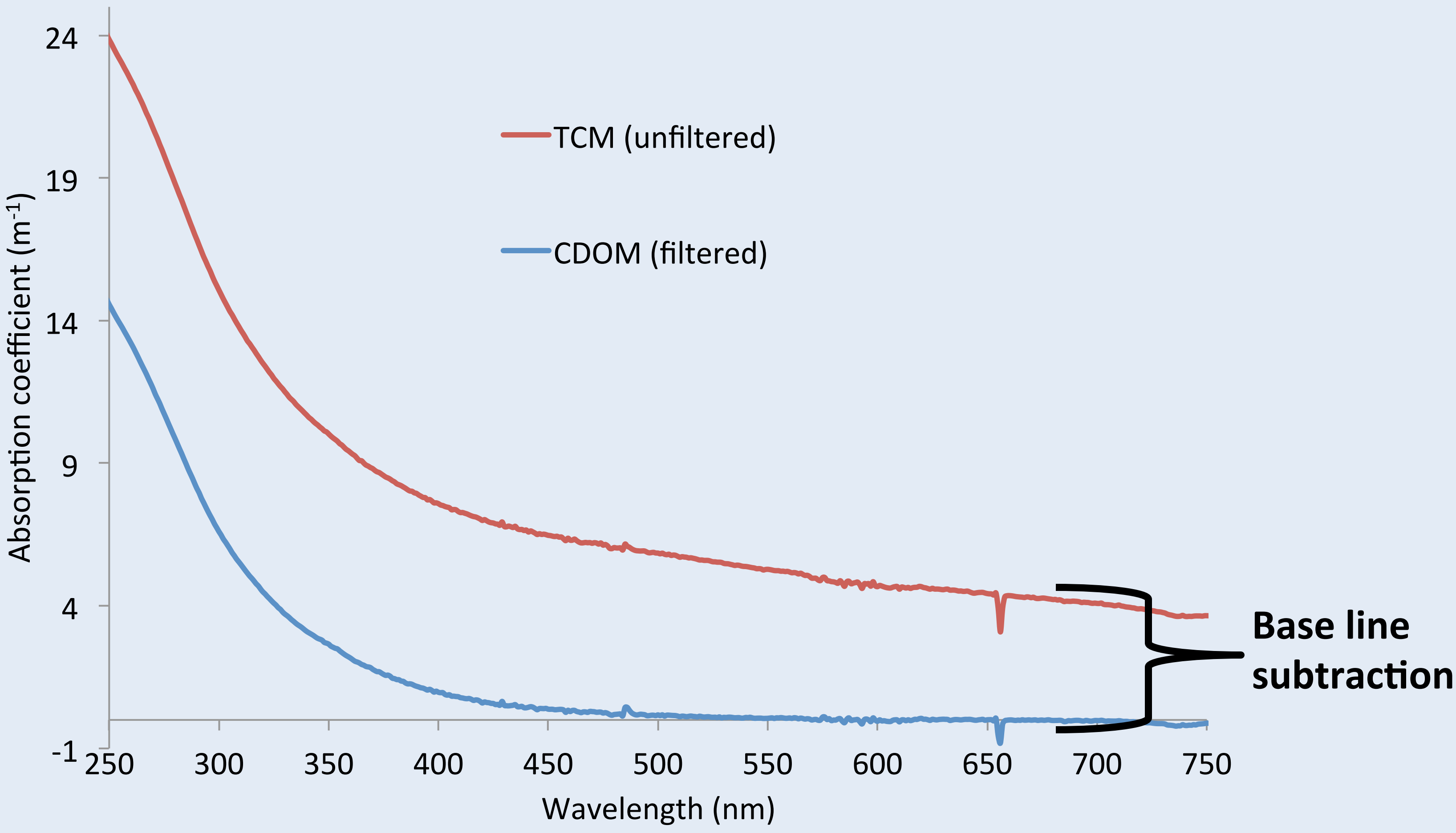
Lab data is for filtered samples now…..requires correction



In Situ Color

Total Colored Material and Colored Dissolved Organic Matter (CDOM)

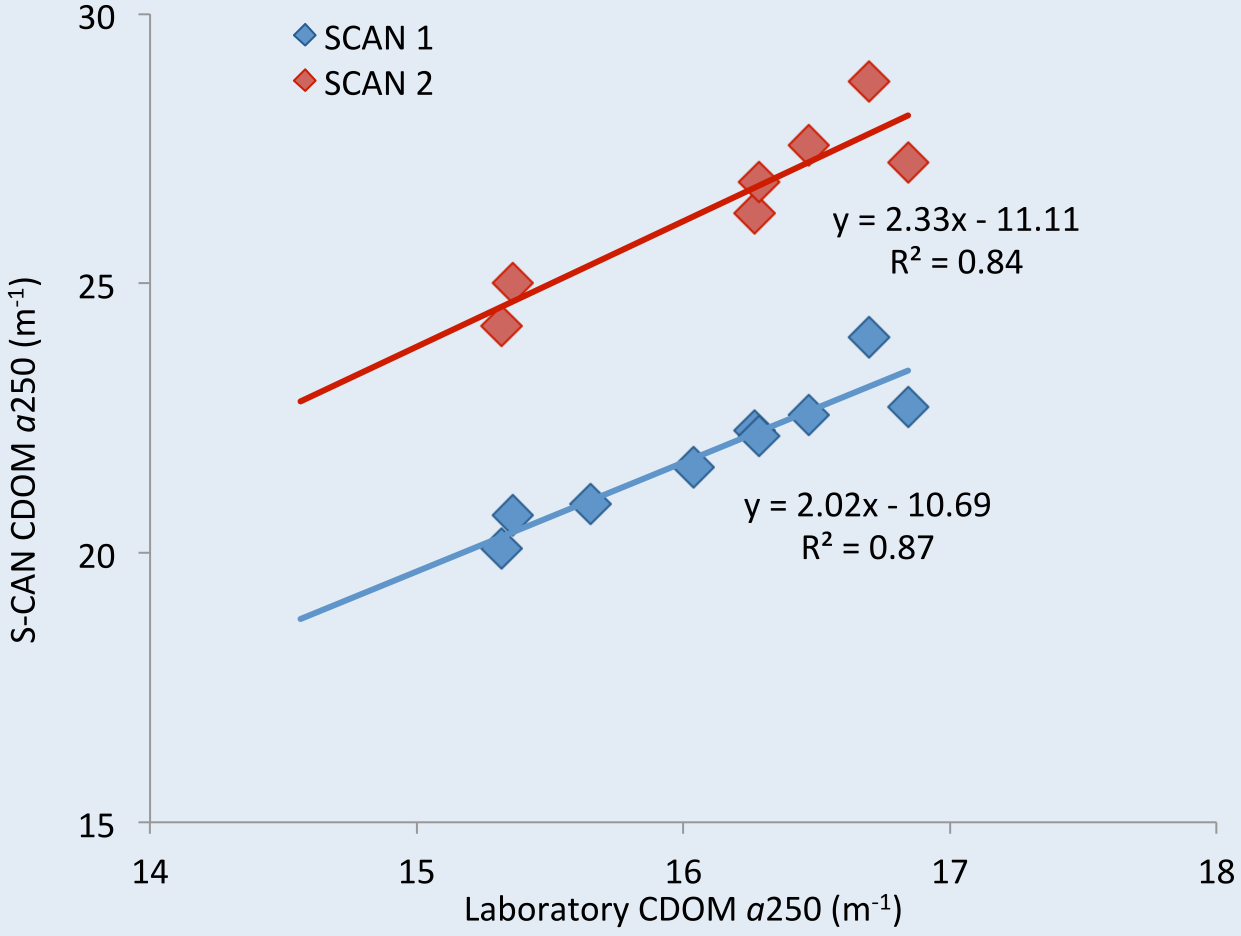
Lab data for unfiltered (TCM) and filtered (CDOM) samples



In Situ Color

Total Colored Material and Colored Dissolved Organic Matter (CDOM)

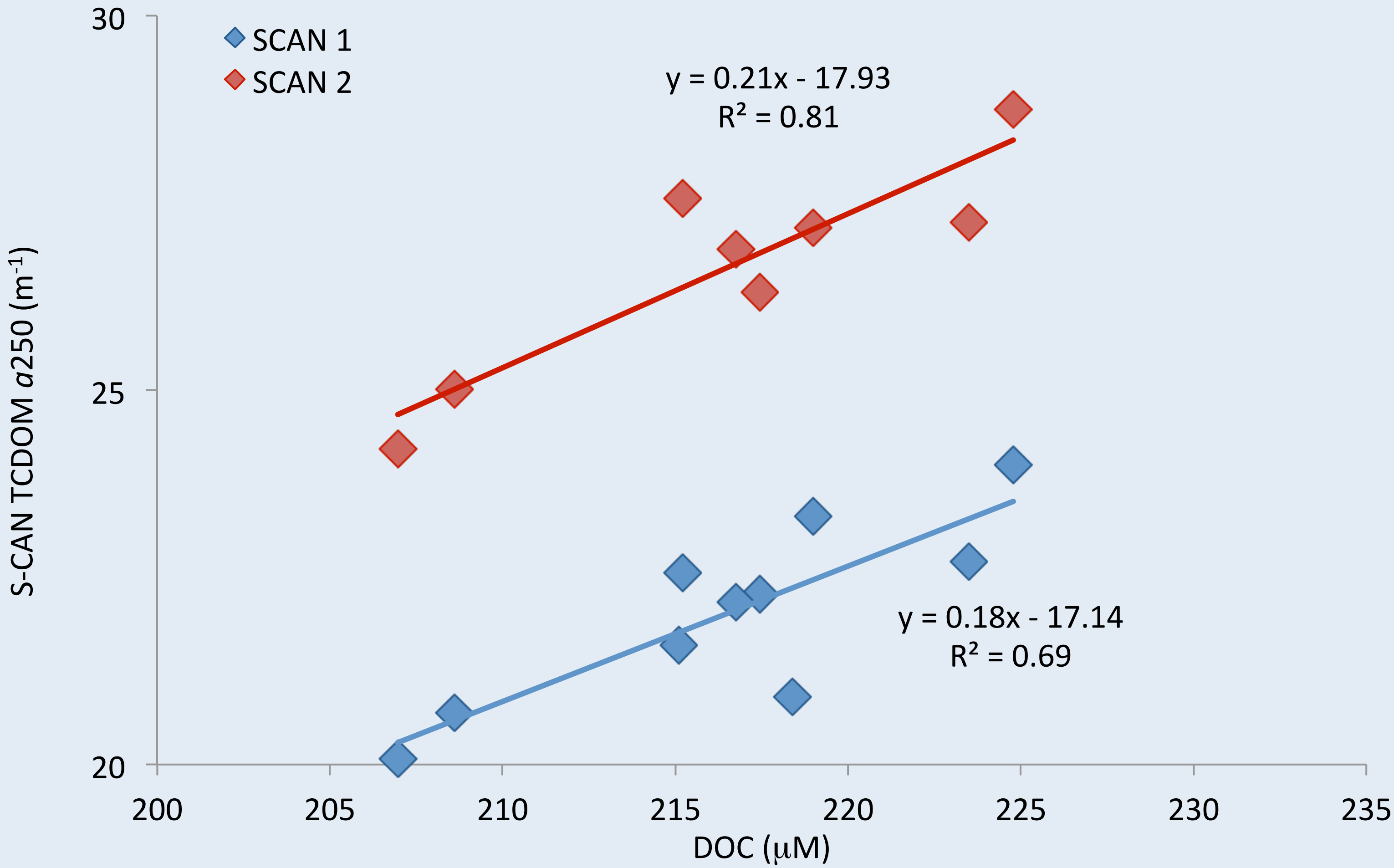
Baseline corrected S-CAN data and lab CDOM data



In Situ Color to DOC

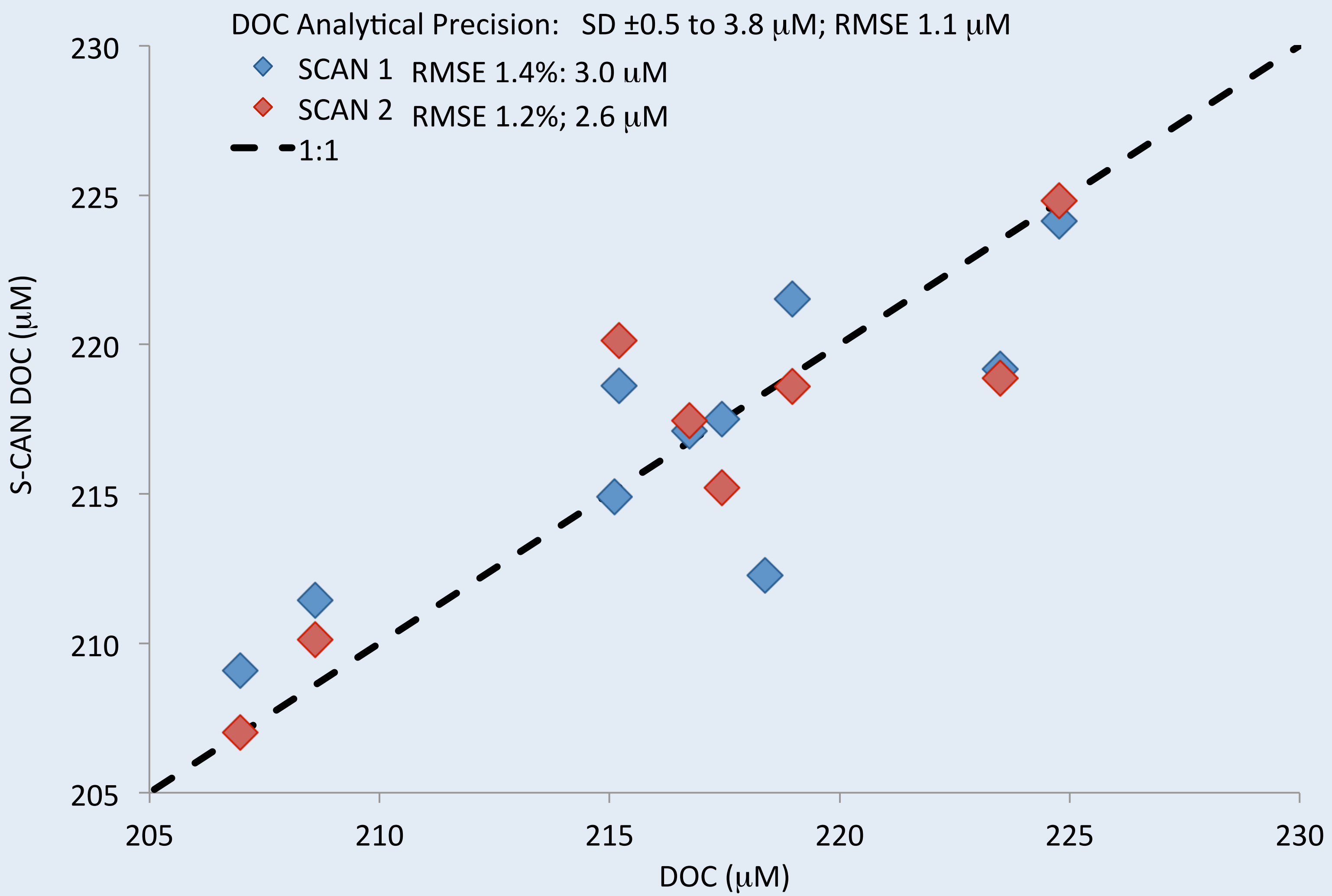
S-CAN data and Dissolved Organic Carbon (DOC)

Baseline corrected S-CAN data and lab DOC data

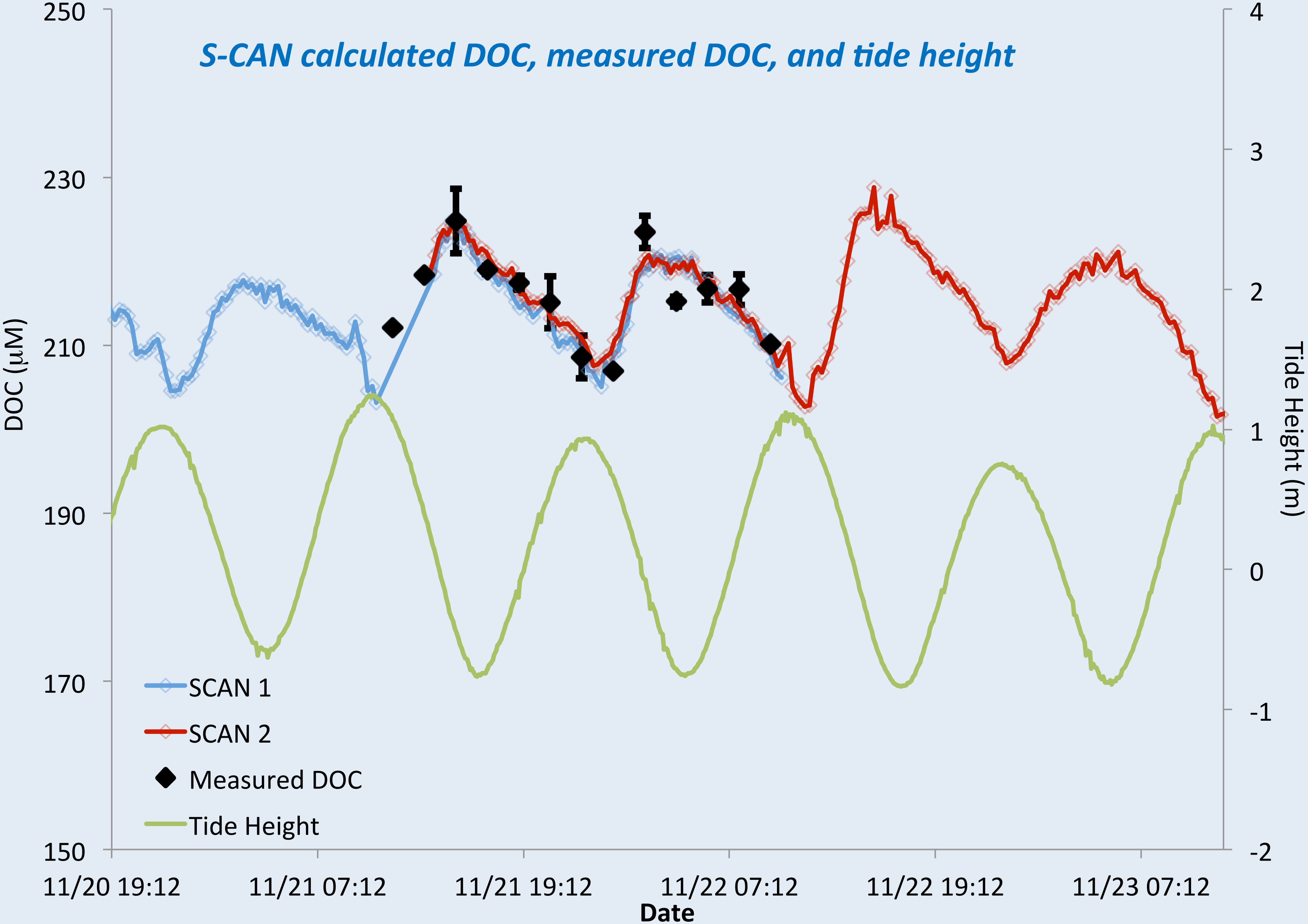


In Situ Color to DOC

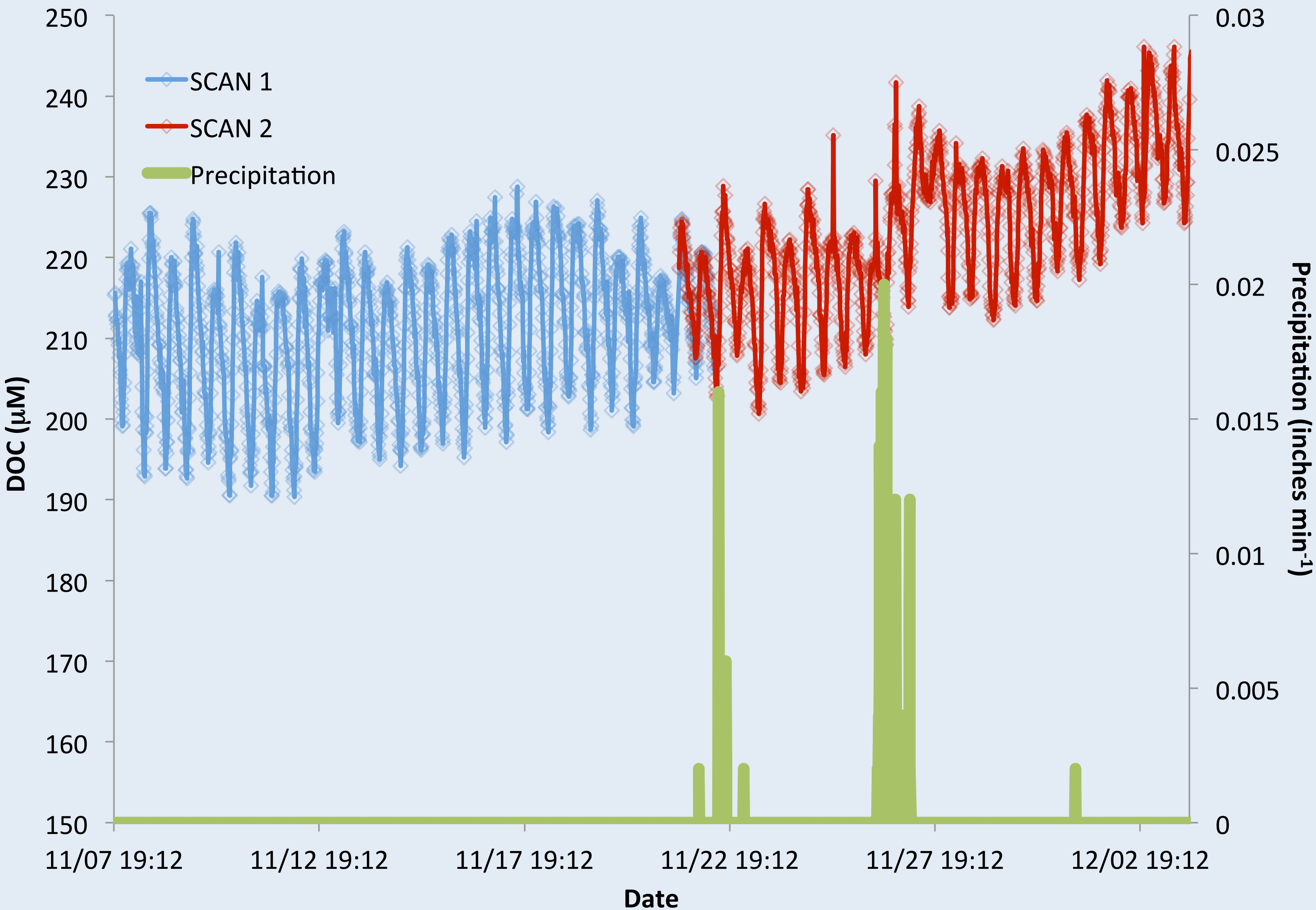
S-CAN calculated and lab measured and Dissolved Organic Carbon (DOC)



In Situ Color to DOC

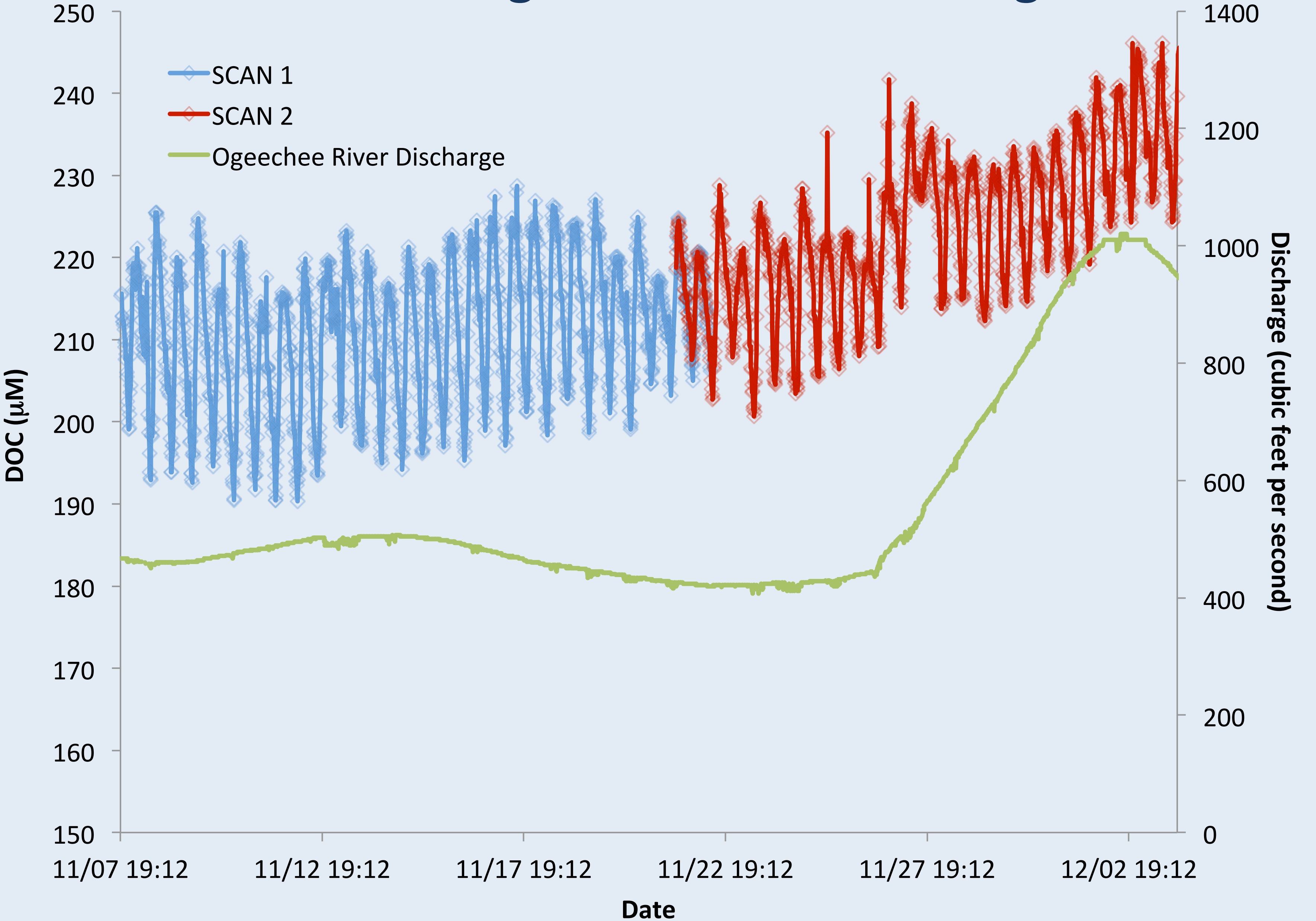


DOC and Rain



250
240
230
220
210
200
190
180
170
160
150
DOC (μM)
0.03
0.025
0.02
0.015
0.01
0.005
0
Precipitation (inches min-1)
SCAN 1
SCAN 2
Precipitation
11/07 19:12
11/12 19:12
11/17 19:12
11/22 19:12
11/27 19:12
12/02 19:12
Date

DOC and Ogeechee River Discharge



Future work:

Run for 1 year

Refine and assess variability in algorithms linking S-CAN data to DOC concentration

Couple S-CAN derived DOC to physical model to determine whether Groves Creek is a net importer or exporter of DOC

Assess diurnal, tidal (neap to spring), and seasonal cycles in DOC quantity and quality

Assess the importance of events (e.g. storms) in seasonal and annual carbon fluxes

Dissolved Organic Matter Export From A Tidal Salt Marsh, Groves Creek, Savannah, Ga

Aron Stubbins
aron.stubbins@skio.uga.edu

PIs: Jay Brandes, Catherine Edwards, William Savidge, Aron Stubbins

Team: Thais Beraldo Bittar, Charles Robertson, Zac Tait, Megan Thompson

Funding: National Science Foundation – Chemical Oceanography

Skidaway Institute of Oceanography