



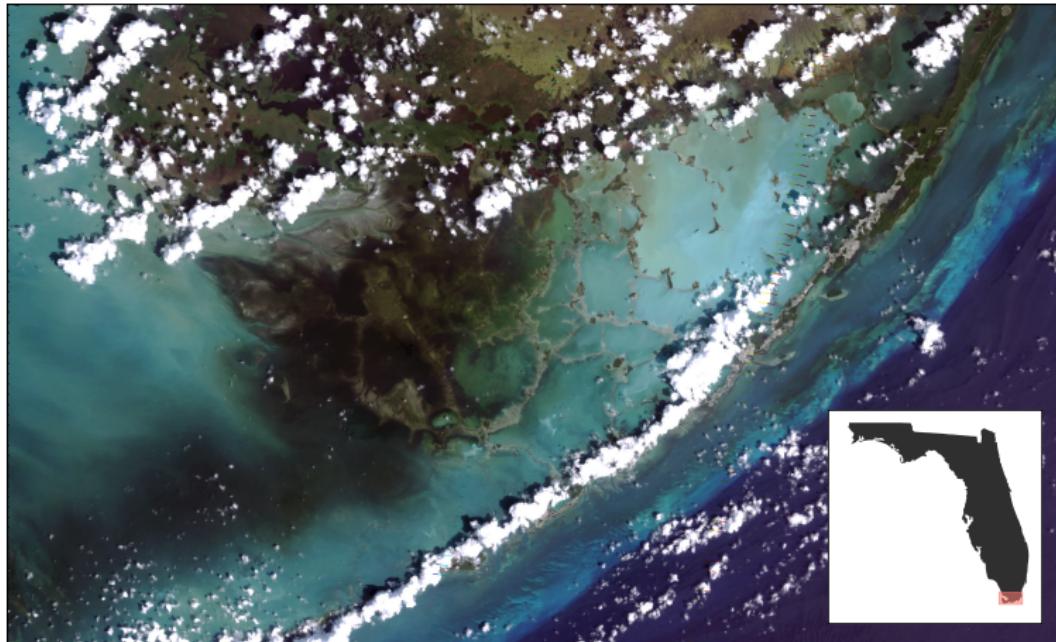
FINE-SCALE SPATIAL PATTERNING OF PHYTOPLANKTON ABUNDANCE IN A COASTAL ESTUARY

August 2016

Joseph Stachelek, Christopher Madden, Stephen P. Kelly, Michelle Blaha

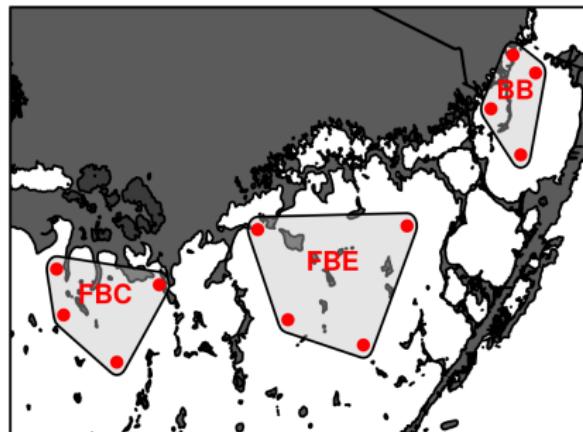
Michigan State University South Florida Water Management District

QUANTIFYING PHYTOPLANKTON ABUNDANCE

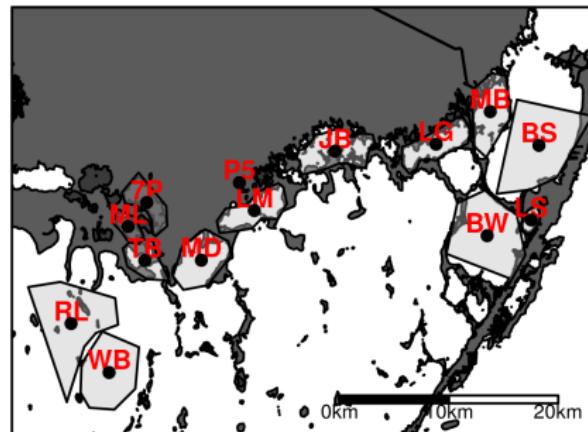


THE DISCRETE APPROACH

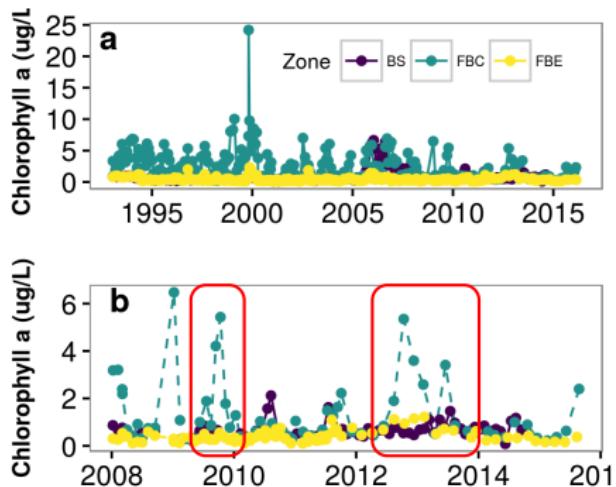
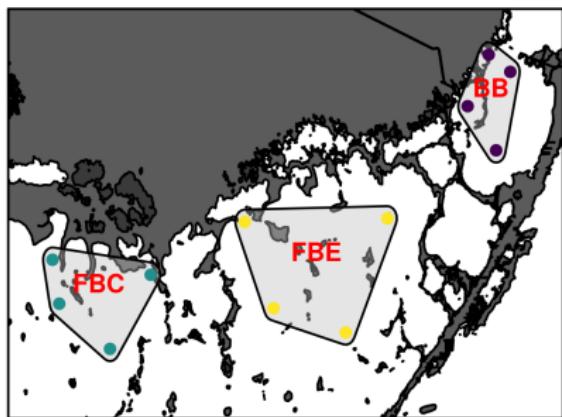
Bay-Wide Network
(Monthly, 1993 - 2015)



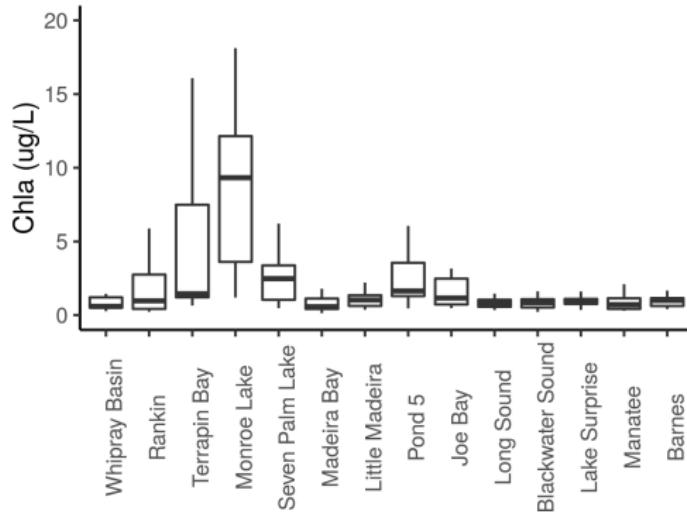
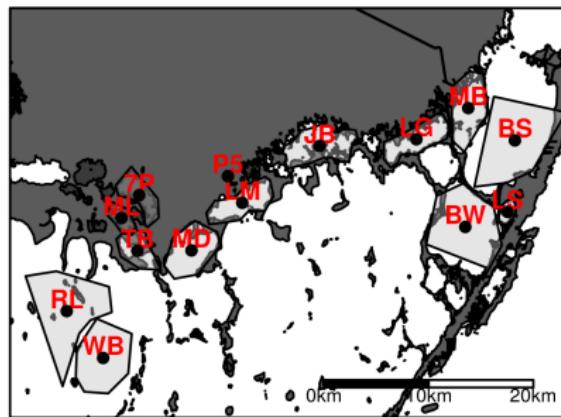
Coastal Network
(Quarterly, 2008 - 2015)



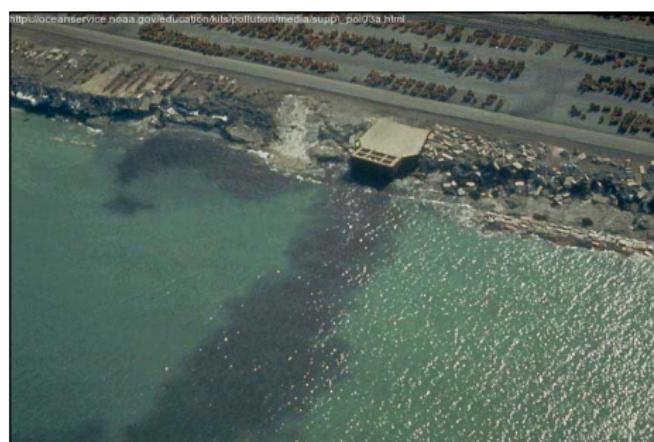
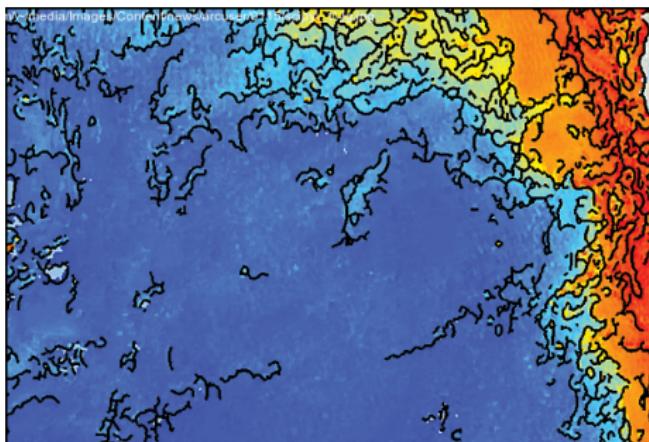
BAY-WIDE NETWORK



COASTAL NETWORK



WHAT DO WE MISS WITH THE DISCRETE APPROACH?



- ▶ Spatial Gradients
- ▶ Point Source Extent

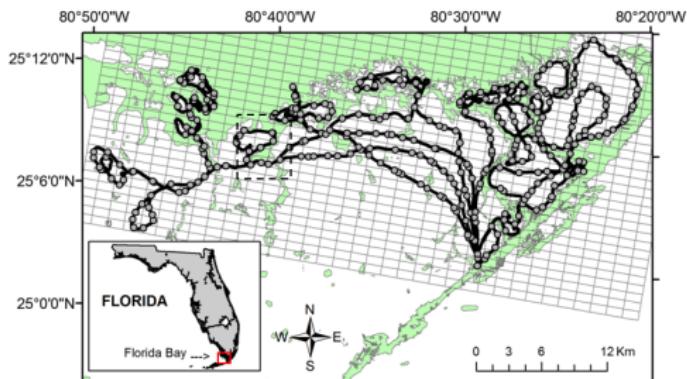
GUESSING AT WATER QUALITY BOUNDARIES



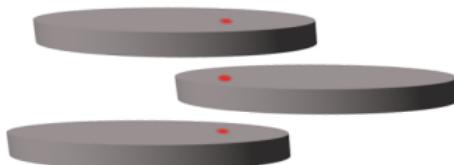
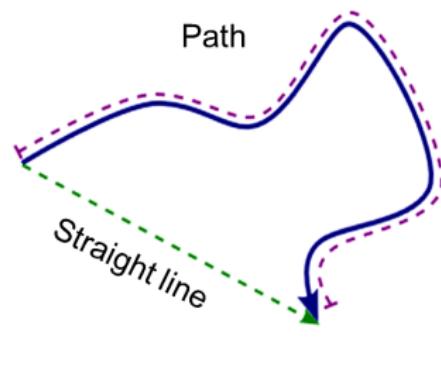
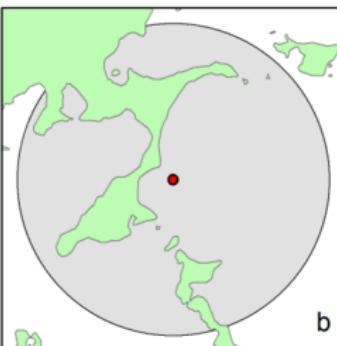
¹Adams and Blair 2014

AN ALTERNATIVE - THE UNDERWAY APPROACH

- ▶ Quarterly surveys
- ▶ Measurements every 50m
- ▶ Emphasis on freshwater discharge



INVERSE PATH DISTANCE WEIGHTING (IPDW)



Project-specific optimization
for:

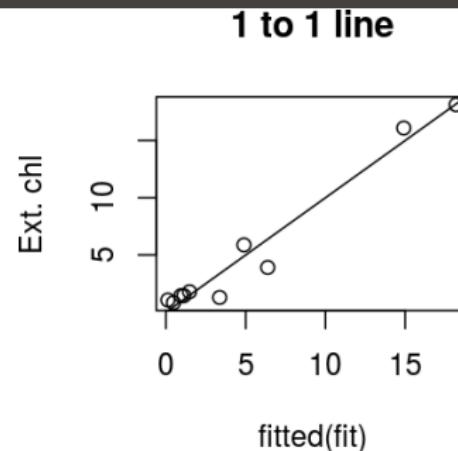
- ▶ Max Neighborhood Distance
- ▶ Spatial Grain

²Little et al. 1997

³Suominen et al. 2010

CHLOROPHYLL MODELLING^{1,2}

Instrument Package	Parameter
Optical 1	CDOM
...	Chlorophyll
Optical 2	CDOM
...	Chlorophyll
...	Phycocyanin
...	Phycoerytherin

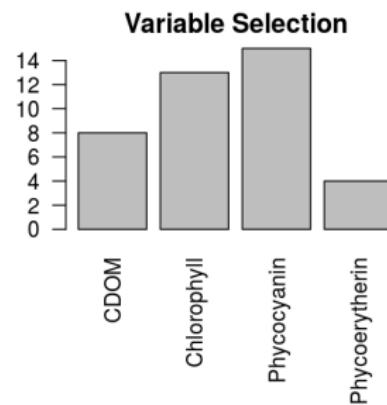
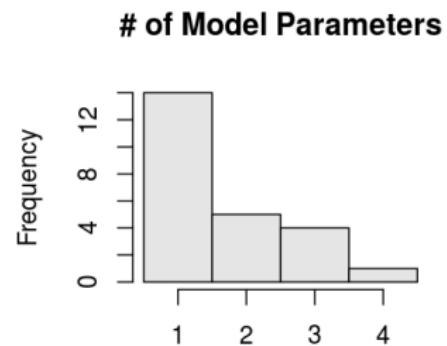
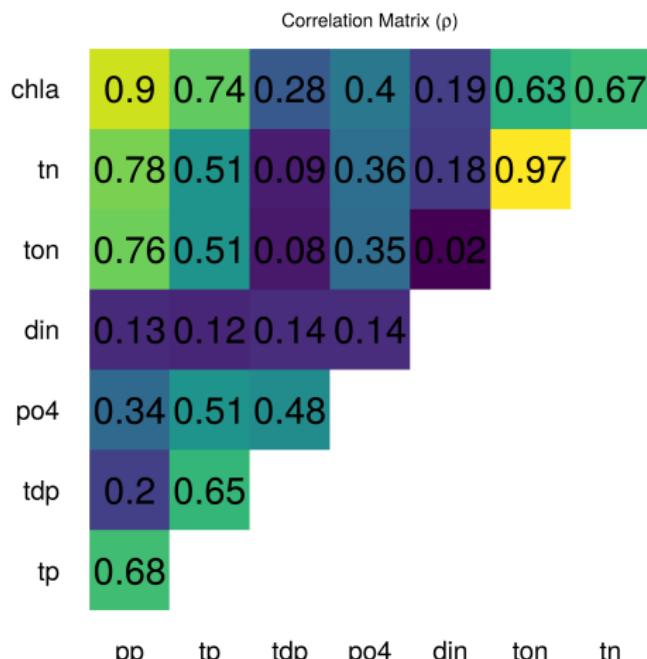


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DataflowR::chlcoef(201509)
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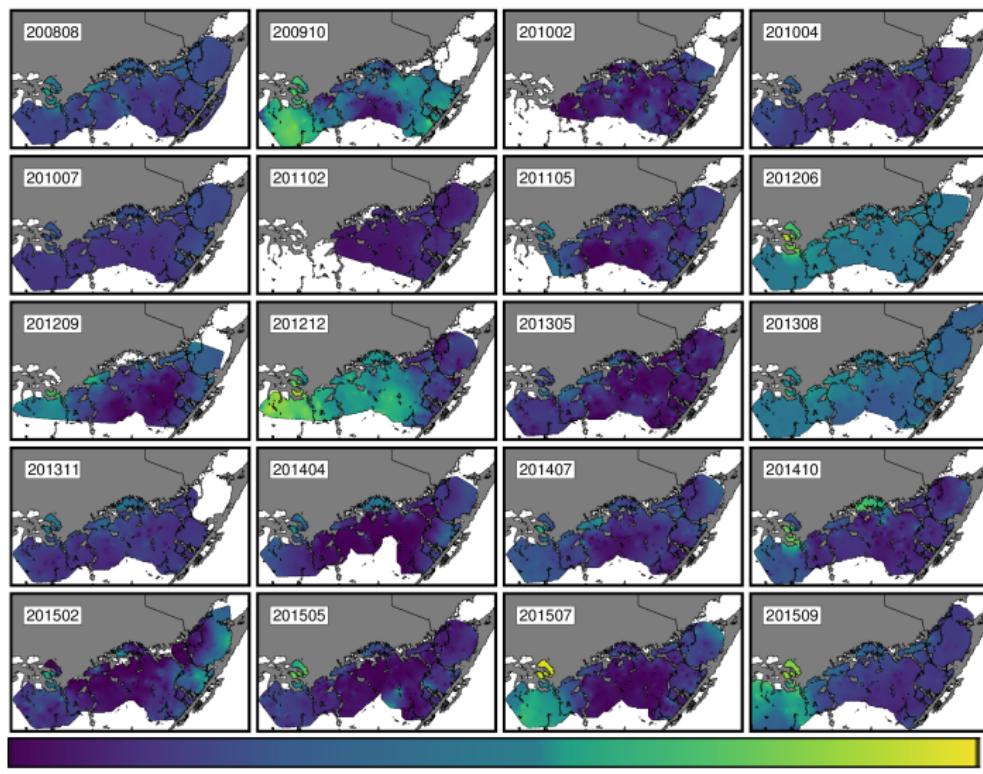
- > Initial correlation matrix
- > MLR with all variables...
- > Checking for redundancy in variable pairs
- > Generate AIC for candidate models
- > Checking VIF...

⁴Seppälä et al. 2007 ⁵Venables and Ripley 2002

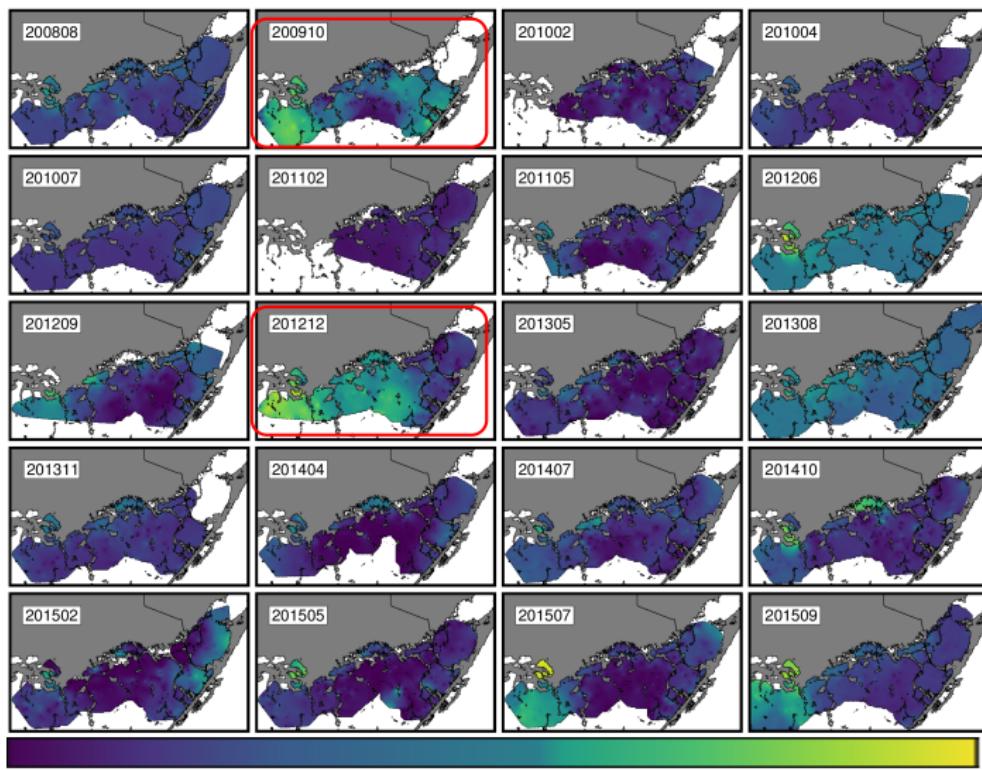
WHAT DID WE LEARN FROM CHL MODELLING?



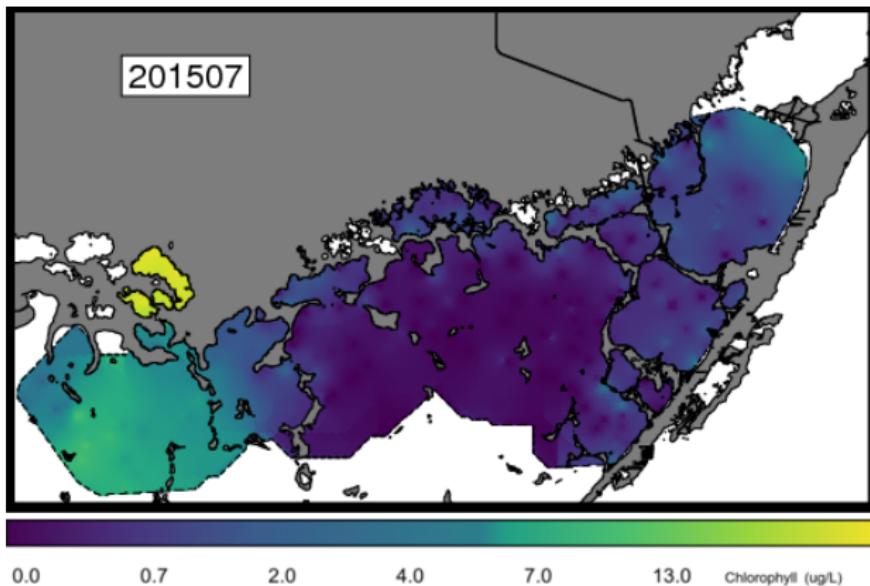
UNDERWAY CHLOROPHYLL



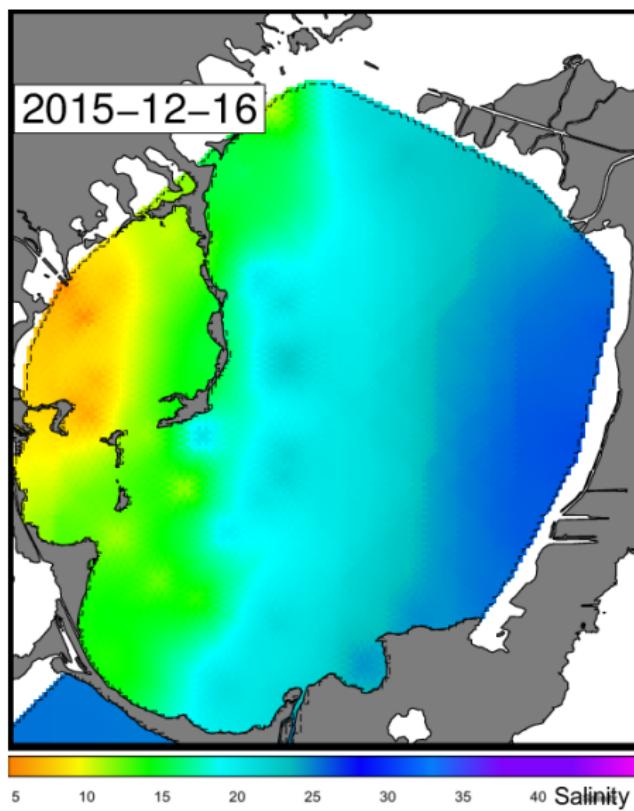
UNDERWAY CHLOROPHYLL



WATER QUALITY BOUNDARIES



POINT SOURCE EXTENT



SUMMARY

Florida Bay

- ▶ Florida Bay phytoplankton are phosphorus limited
- ▶ Elevated chlorophyll is strongly associated with cyanobacteria pigment fluorescence

Underway Sampling

- ▶ Discrete sampling networks are suited to resolve temporal variability
- ▶ Underway sampling can identify landscape features, water quality boundaries, and point source extent

RESOURCES

<http://cran.r-project.org/package=ipdw>

-  Stachelek J.,C. J. Madden. 2015. Application of Inverse Path Distance Weighting for high-density spatial mapping of coastal water quality patterns
»Int. J. Geographical Information Science«
-  Stachelek J.,C. J. Madden,S. P. Kelly,M. Blaha (in prep). Fine-scale relationships between phytoplankton abundance and environmental drivers in Florida Bay, USA.

stachel2@msu.edu
<http://doi.org/bcsg>

HURRICANE IRENE (1999)

