

The use of remote sensing to monitor lake water quality in New England lakes:
Where are we now and what's next?



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Cyanobacteria Monitoring and Analysis Workshop USEPA Regional Laboratory
Chelmsford, MA - June 26, 2013

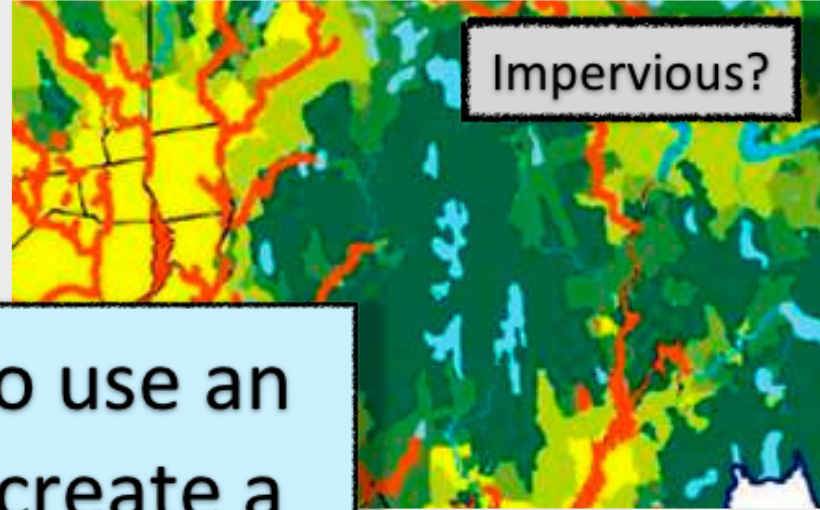


Just a pretty picture?

Landcover?

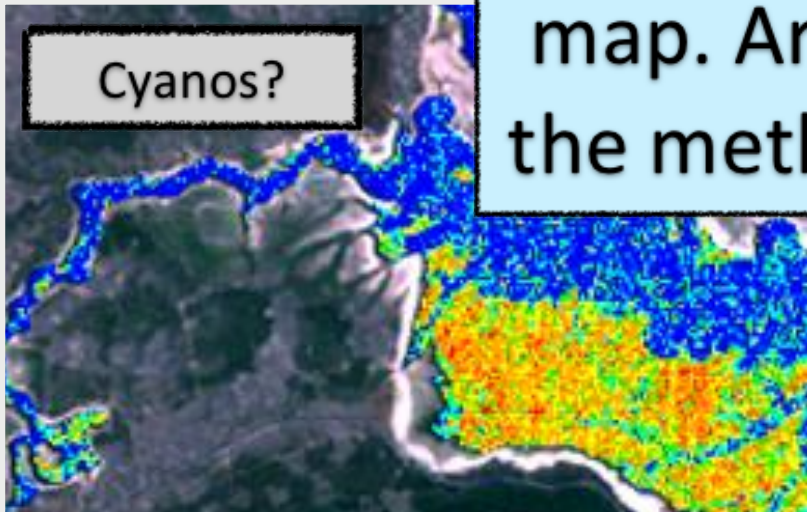


Impervious?

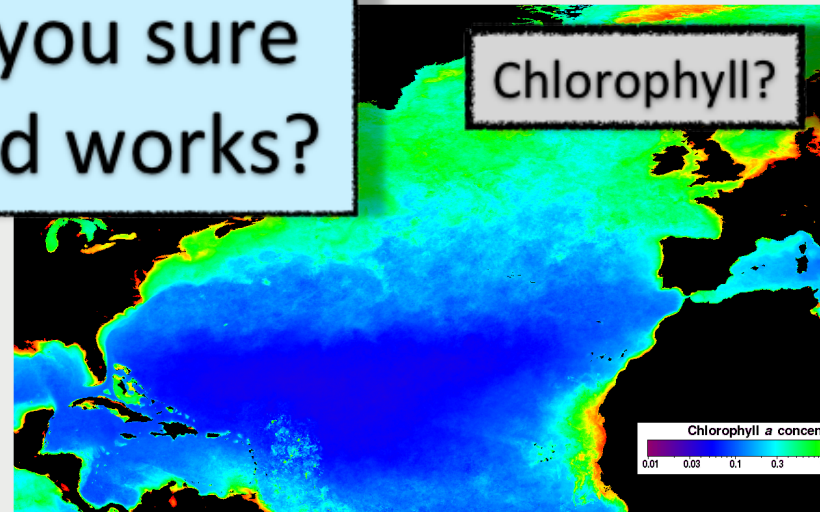


It's easy to use an image to create a map. Are you sure the method works?

Cyanos?



Chlorophyll?



Approach

Collect data at the same time
satellites are flying over
gathering images

Clouds obscure lake

Atmospheric correction

Pixel size

Satellite spectral bands



Approach

Bring sensor with you on the boat to make “satellite” measurements

Close **SOLVED!** lake

Atm **SOLVED!** ection

SOLVED!

Sate **SOLVED!** bands

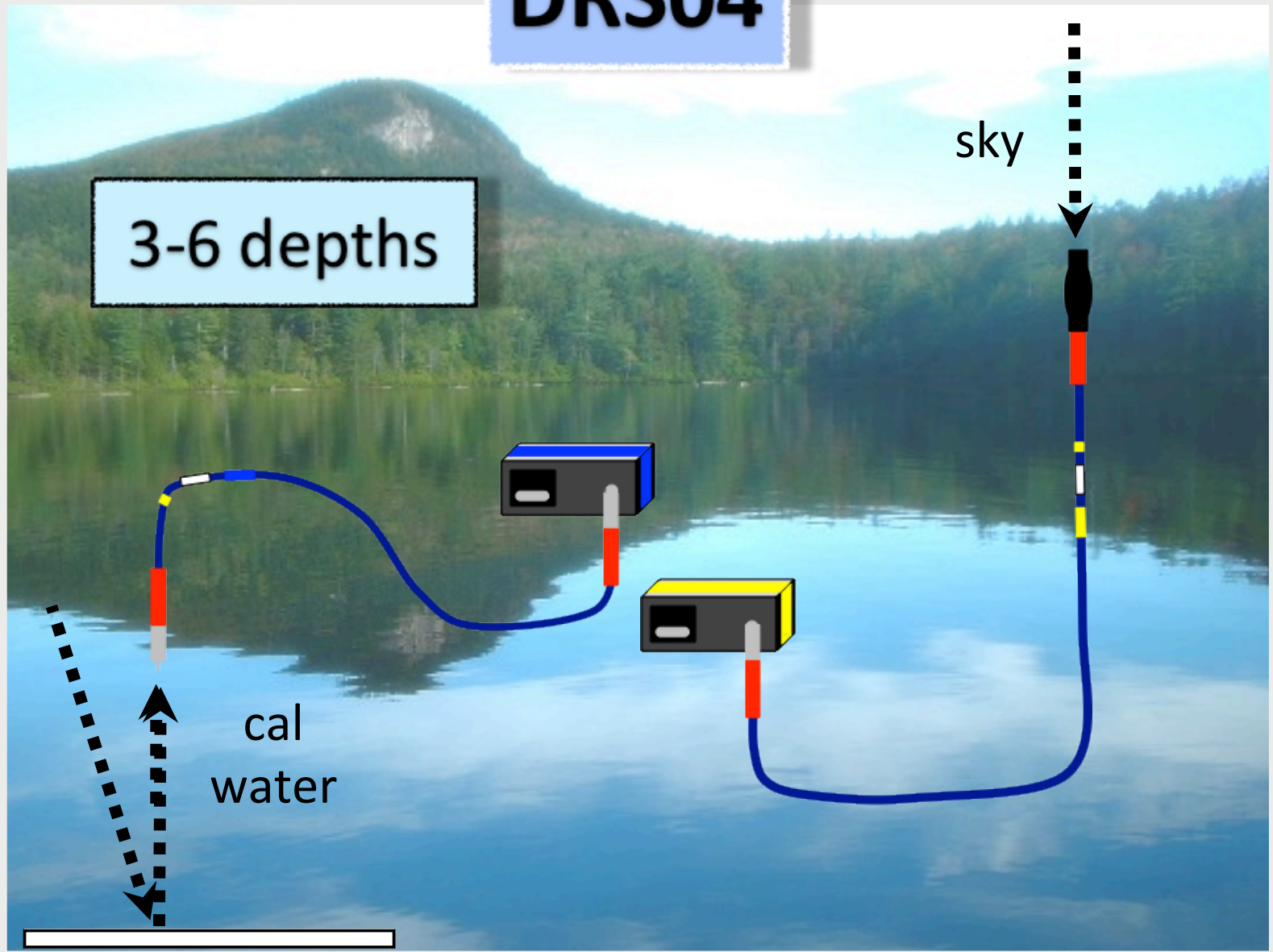


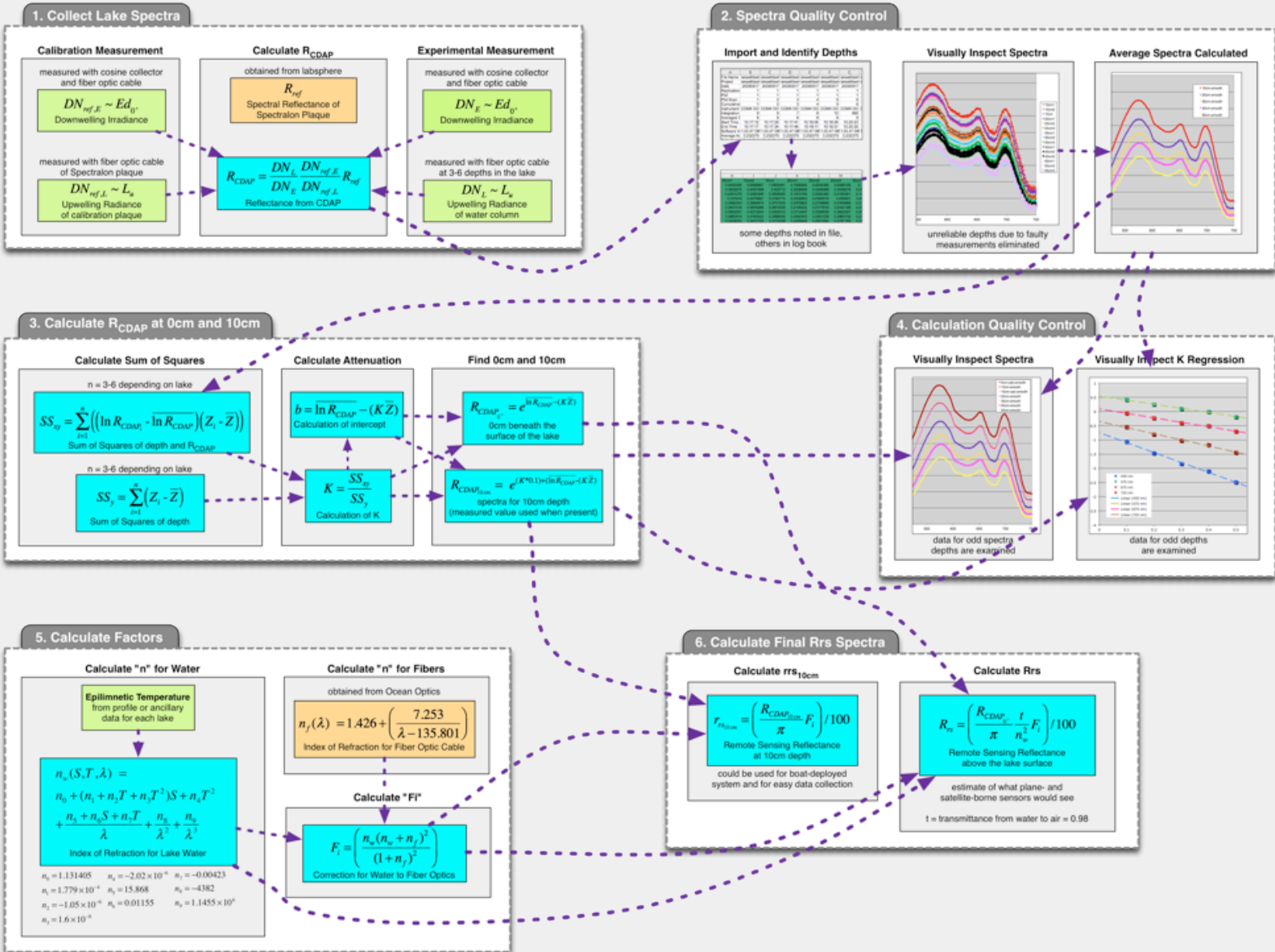
DRS04

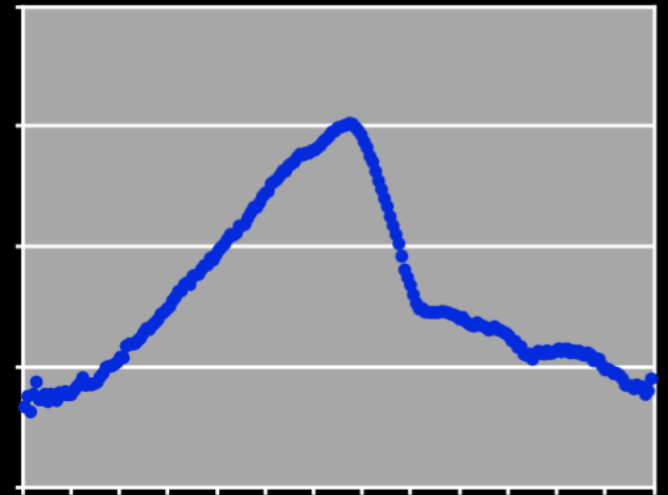
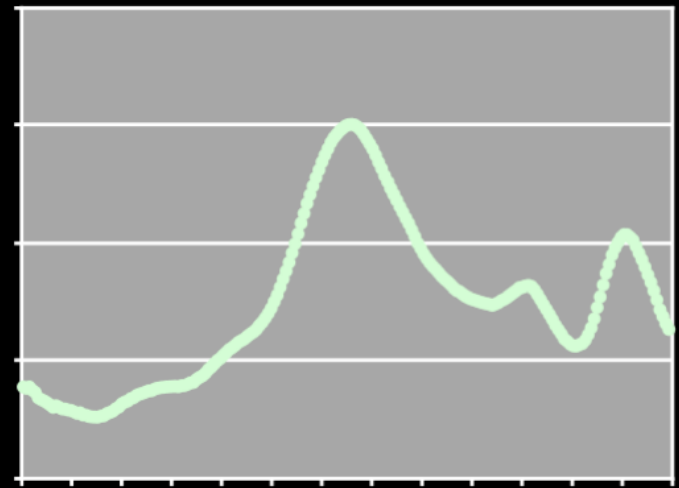
3-6 depths

sky

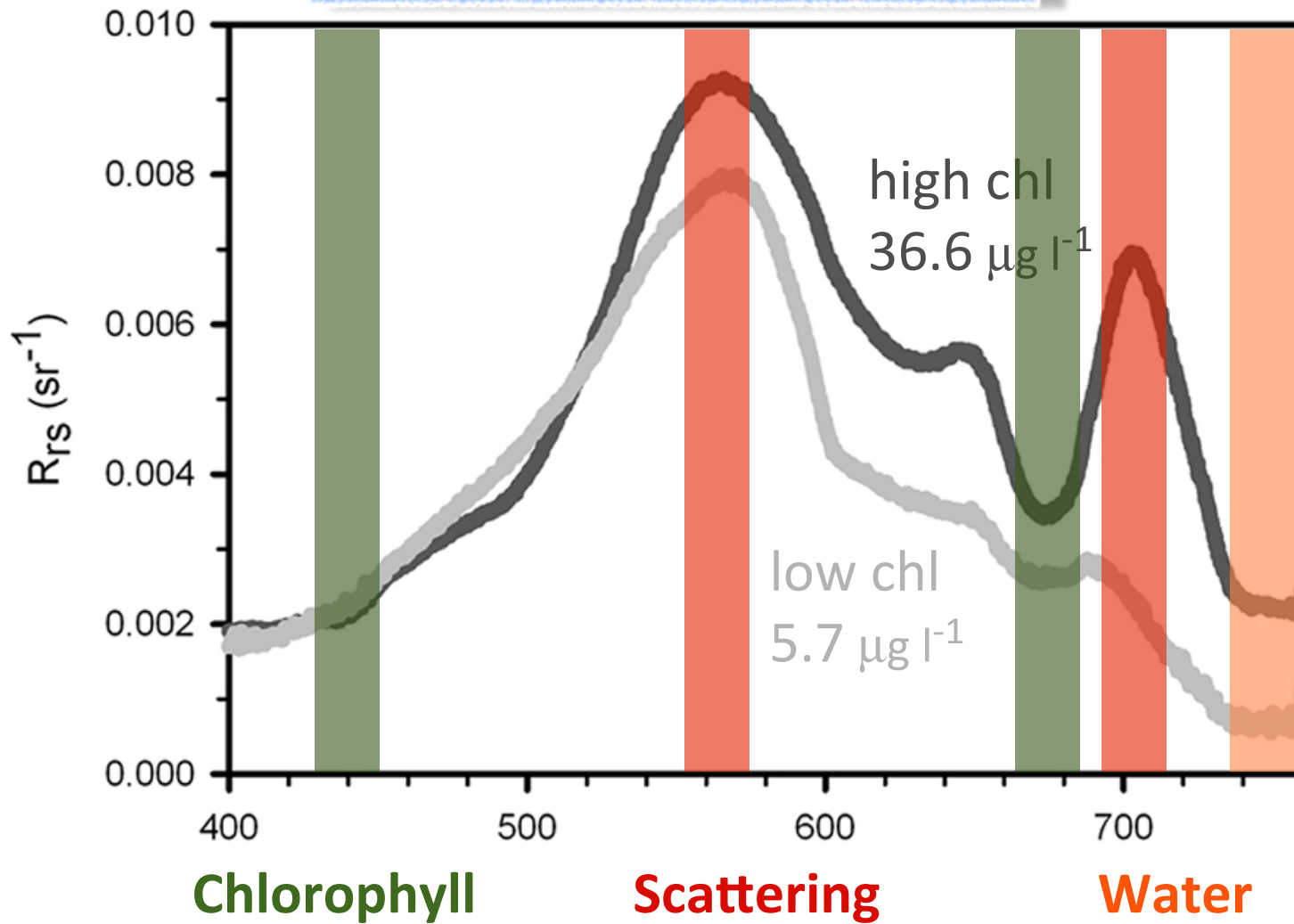
cal
water



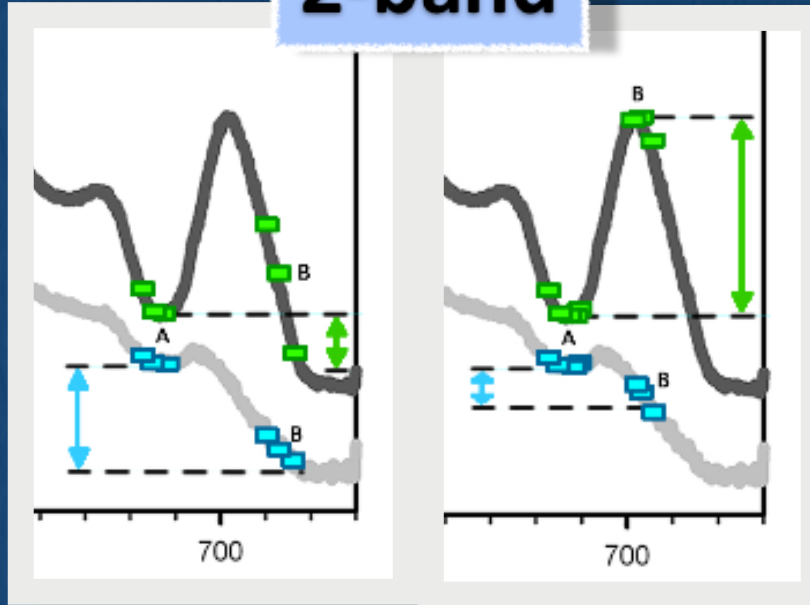




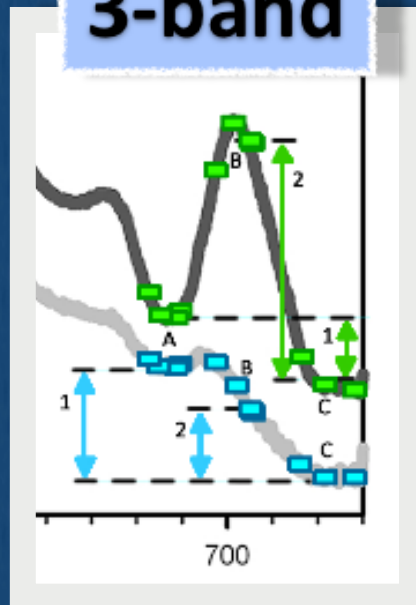
Typical spectra



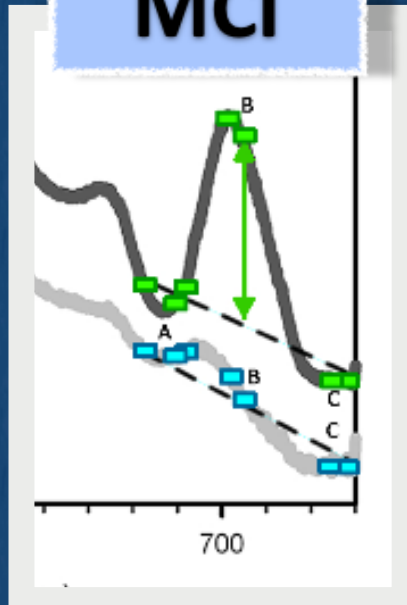
2-band



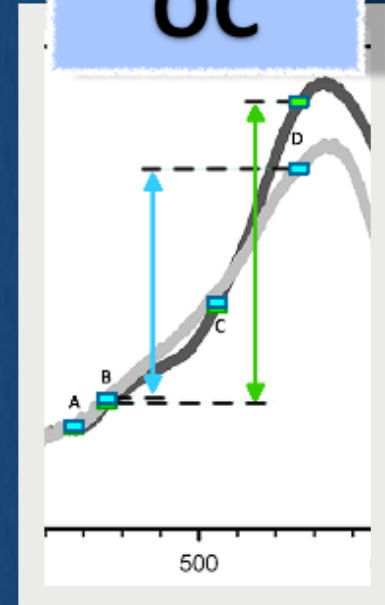
3-band



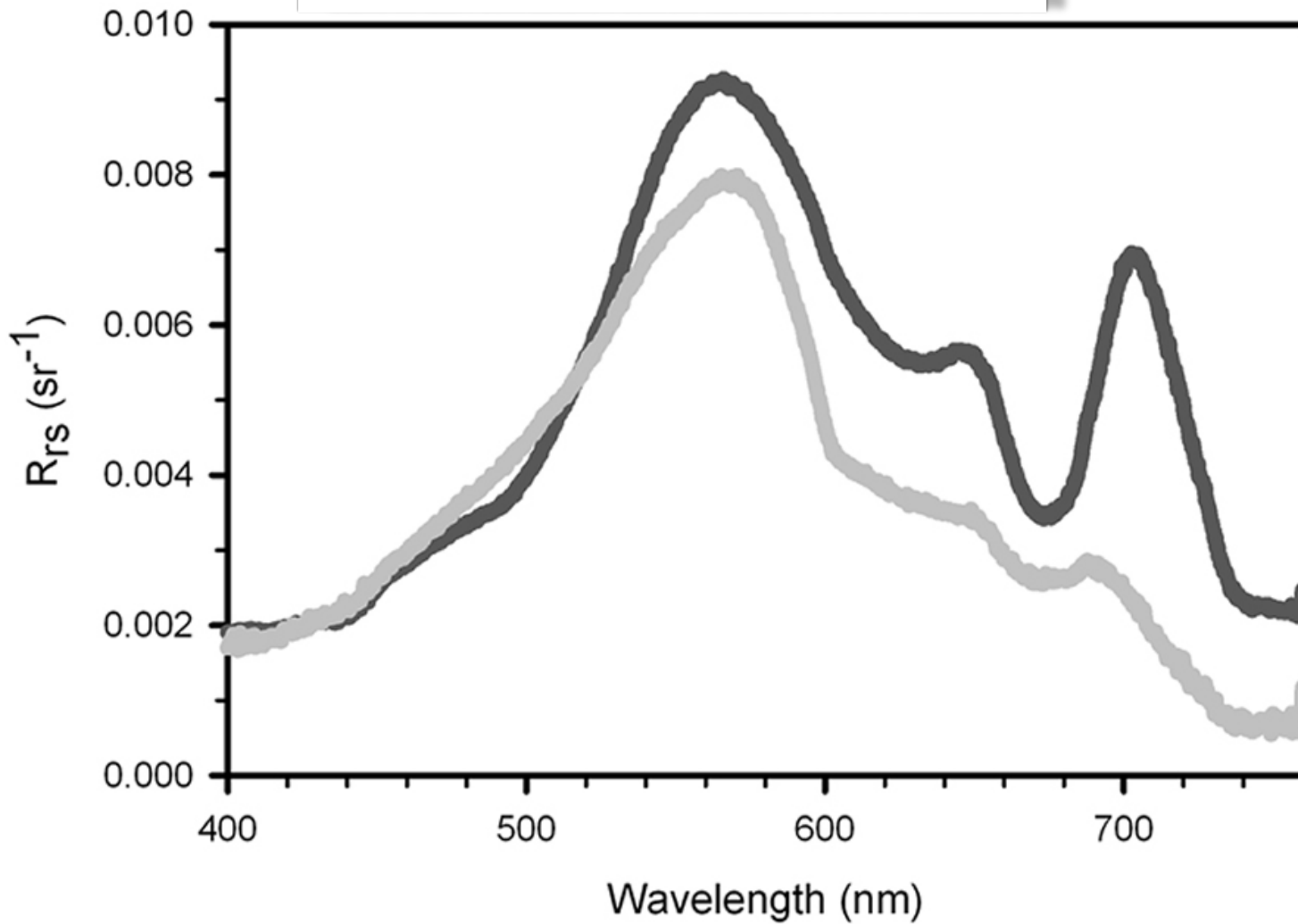
MCI



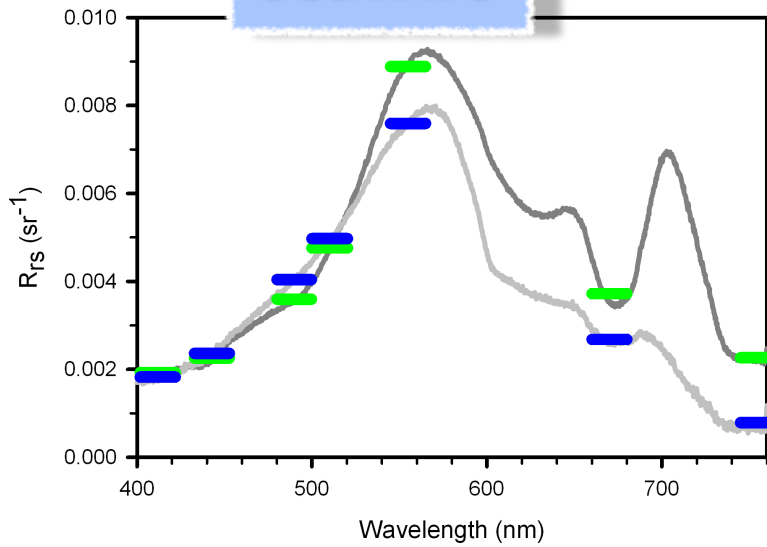
OC



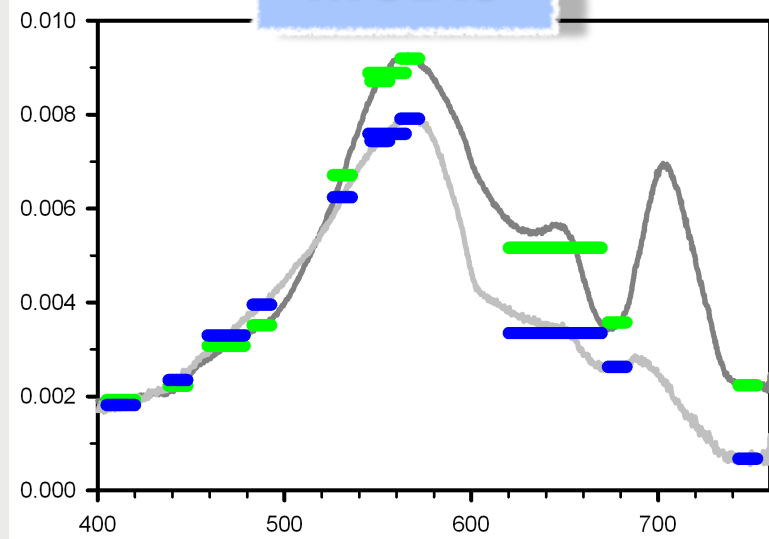
Hyperspectral



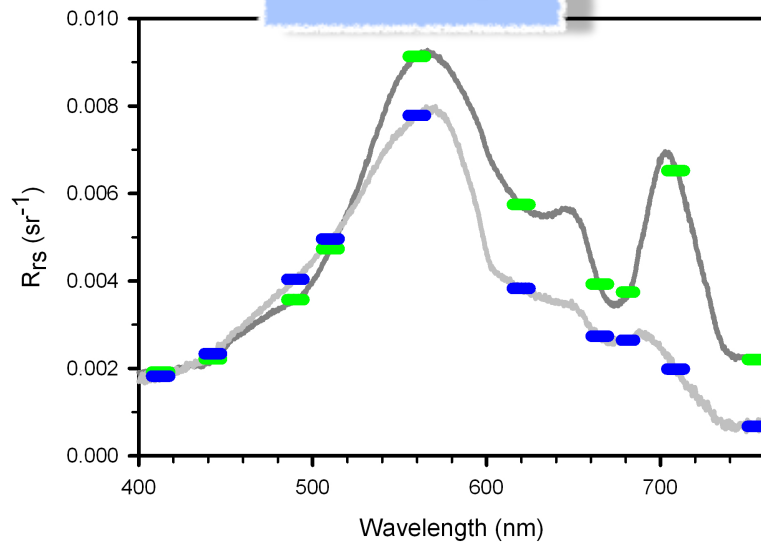
SeaWiFS



MODIS



MERIS



Hyperspectral

“on lake”
shore

airbo

lake su
targeted
inform futu

What is the best way
to use RS signal to
estimate chlorophyll
with each sensor

“WATER” SATELLITES

MERIS

MODIS

SeaWiFS

monitoring

monitoring

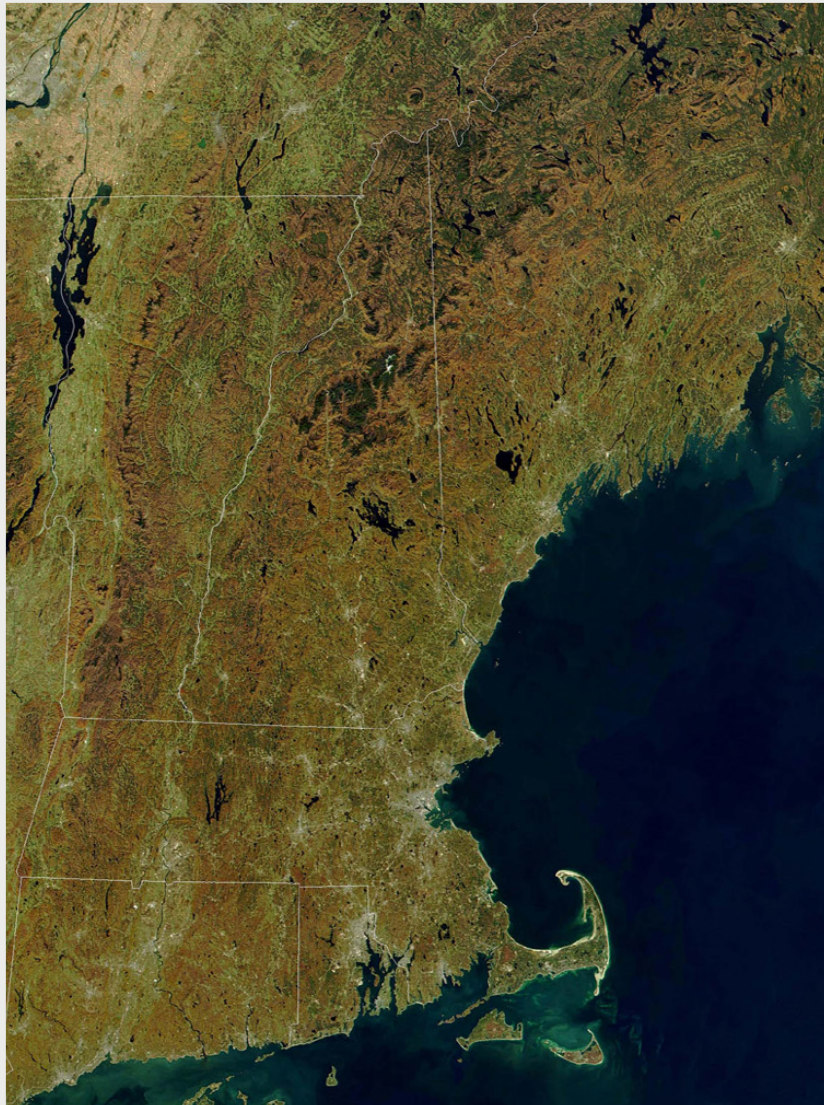
lake trends

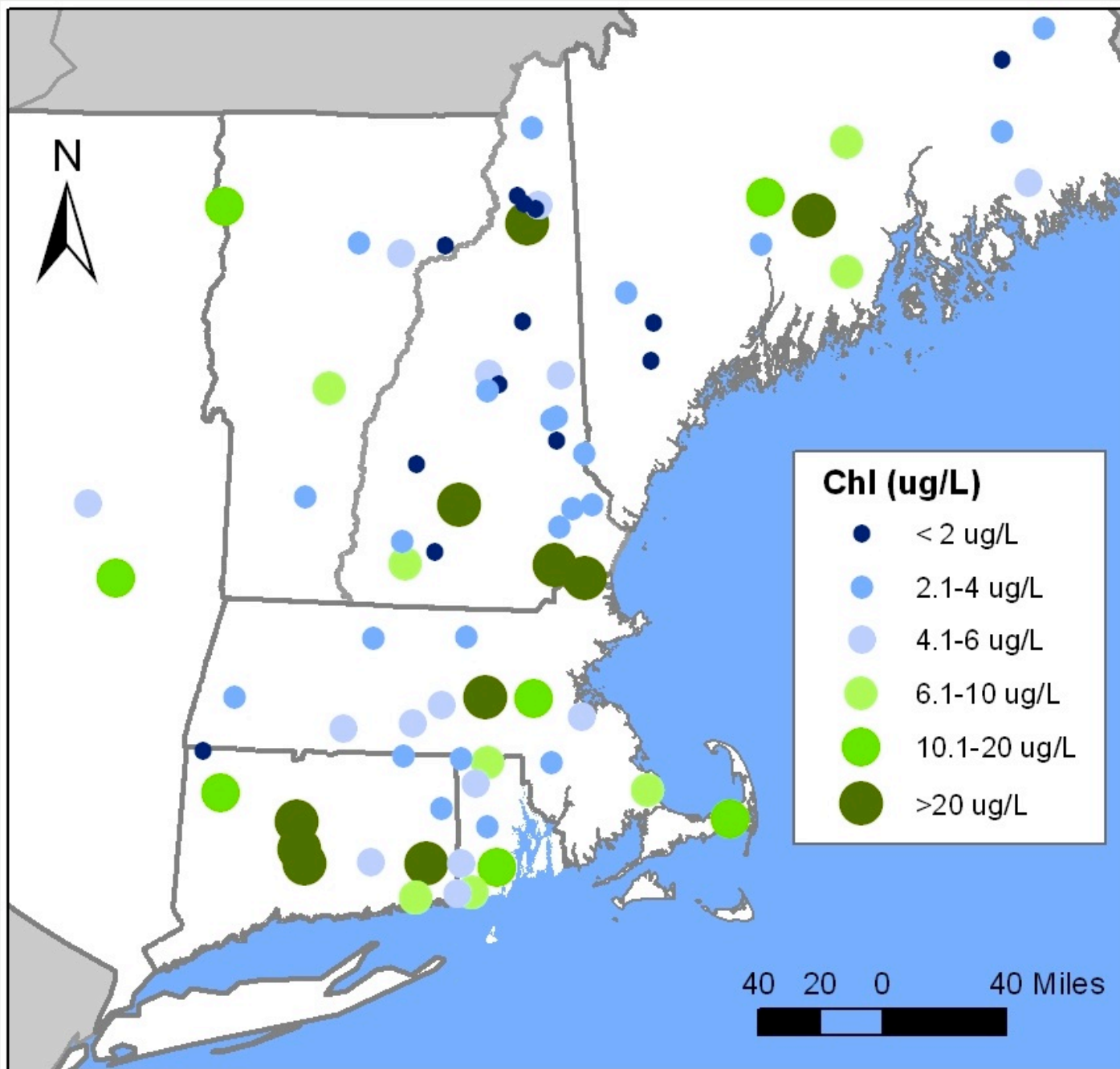
environment

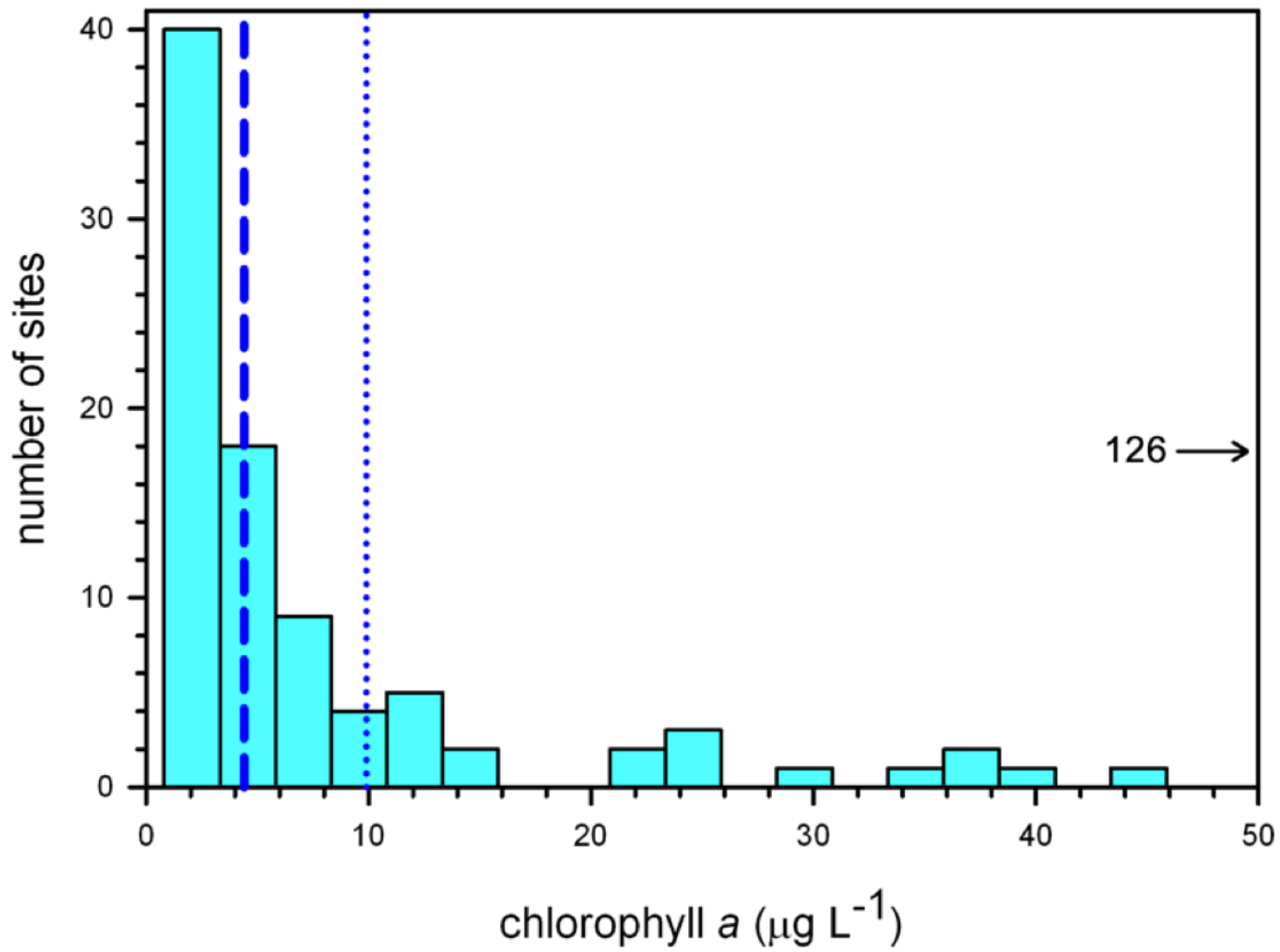
-nutrient loading

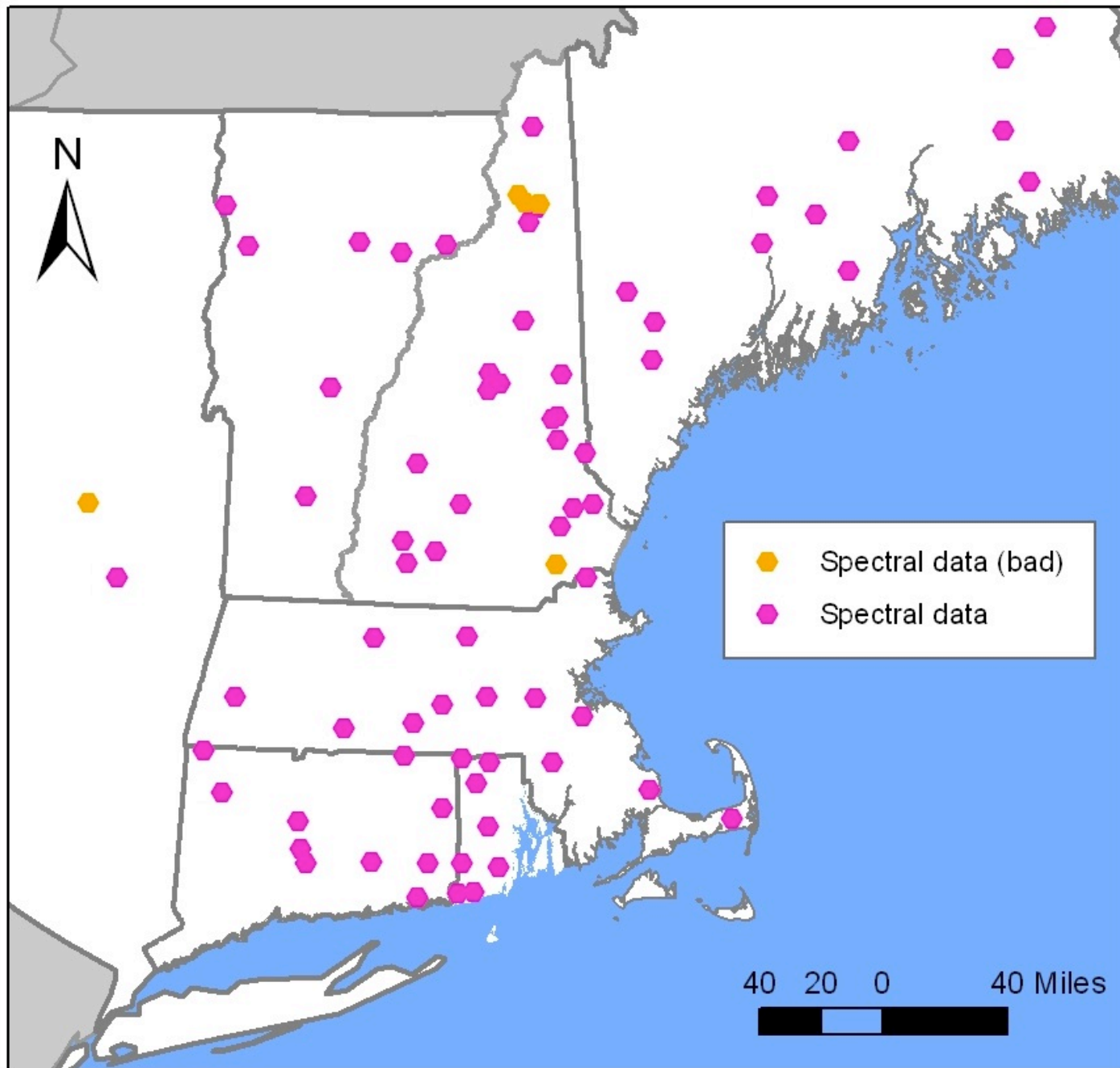
-climate change

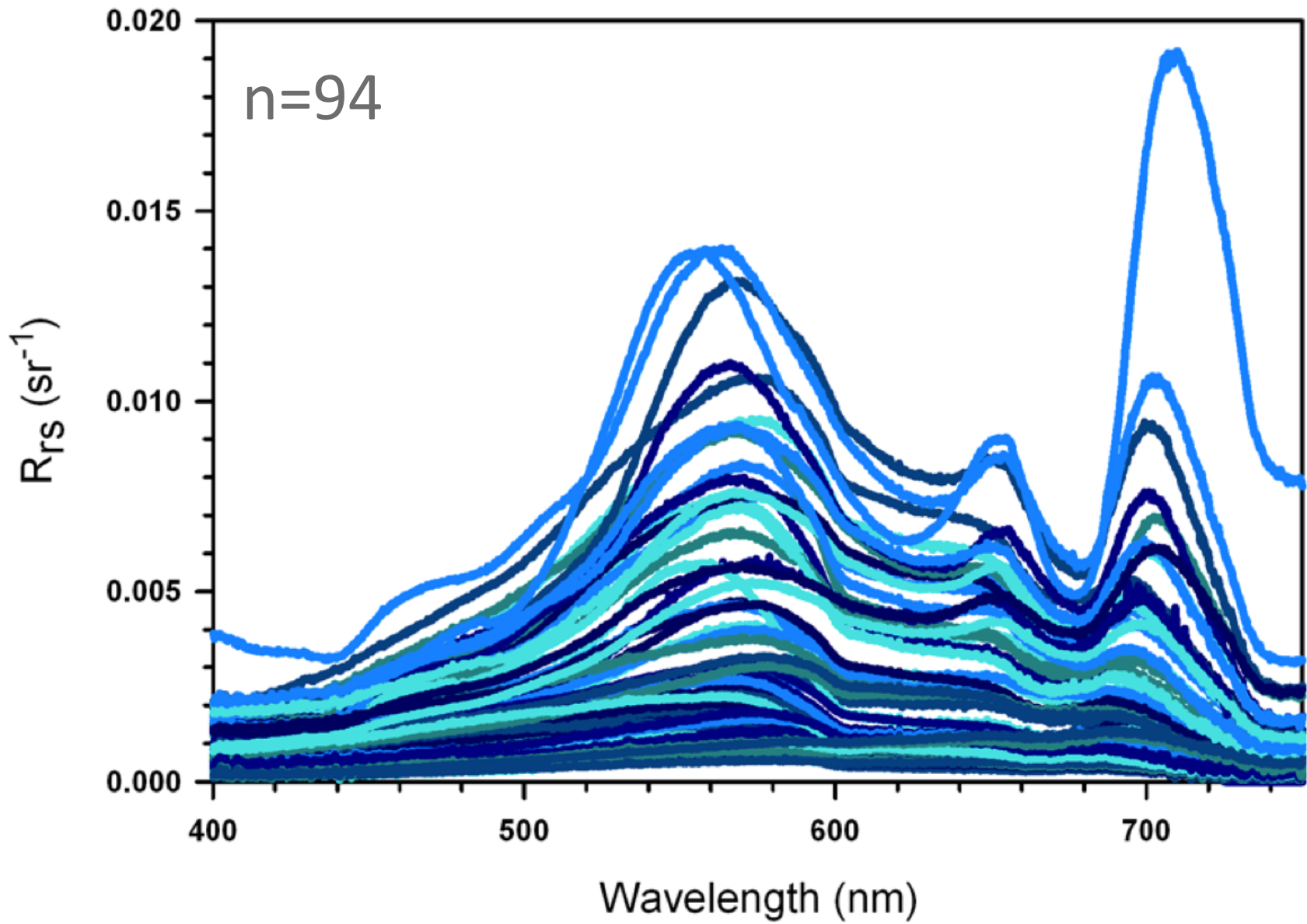
New England Lakes







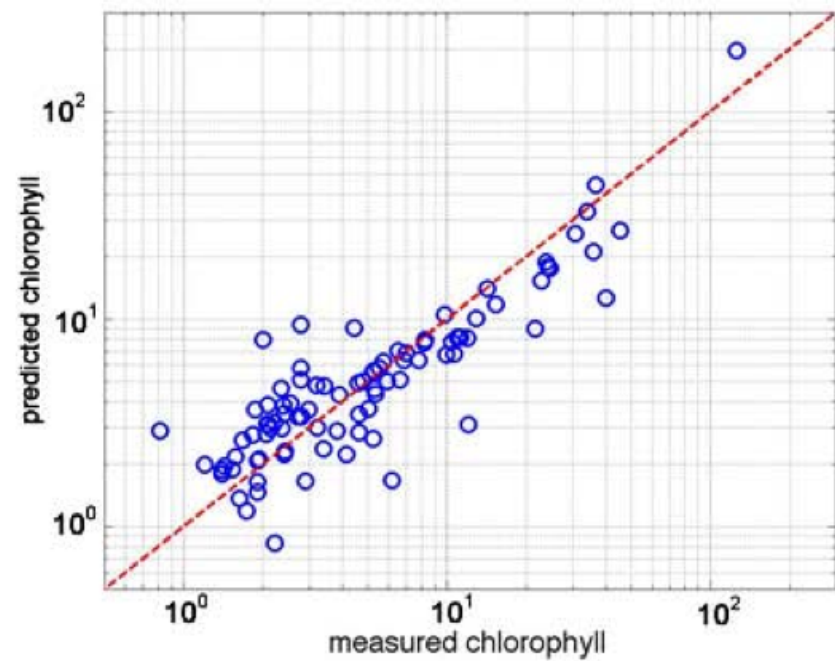
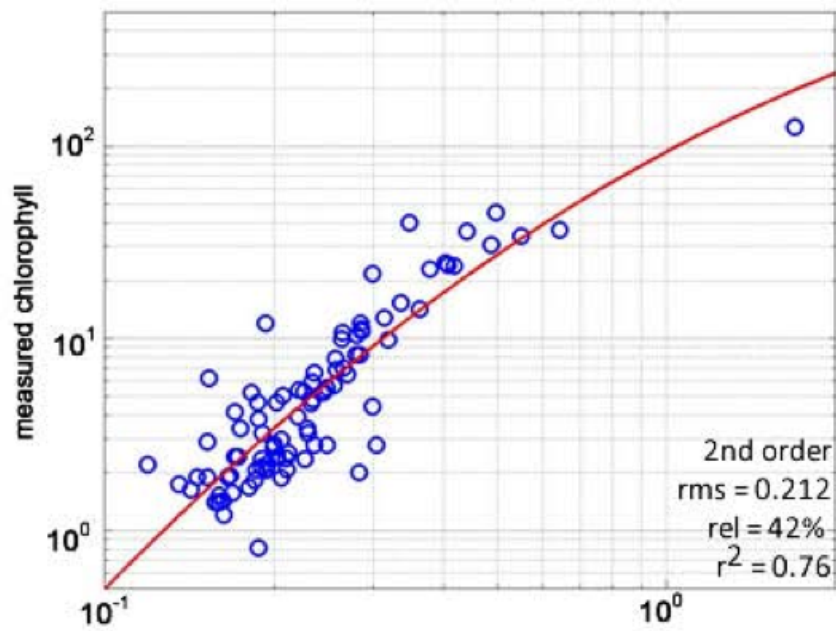




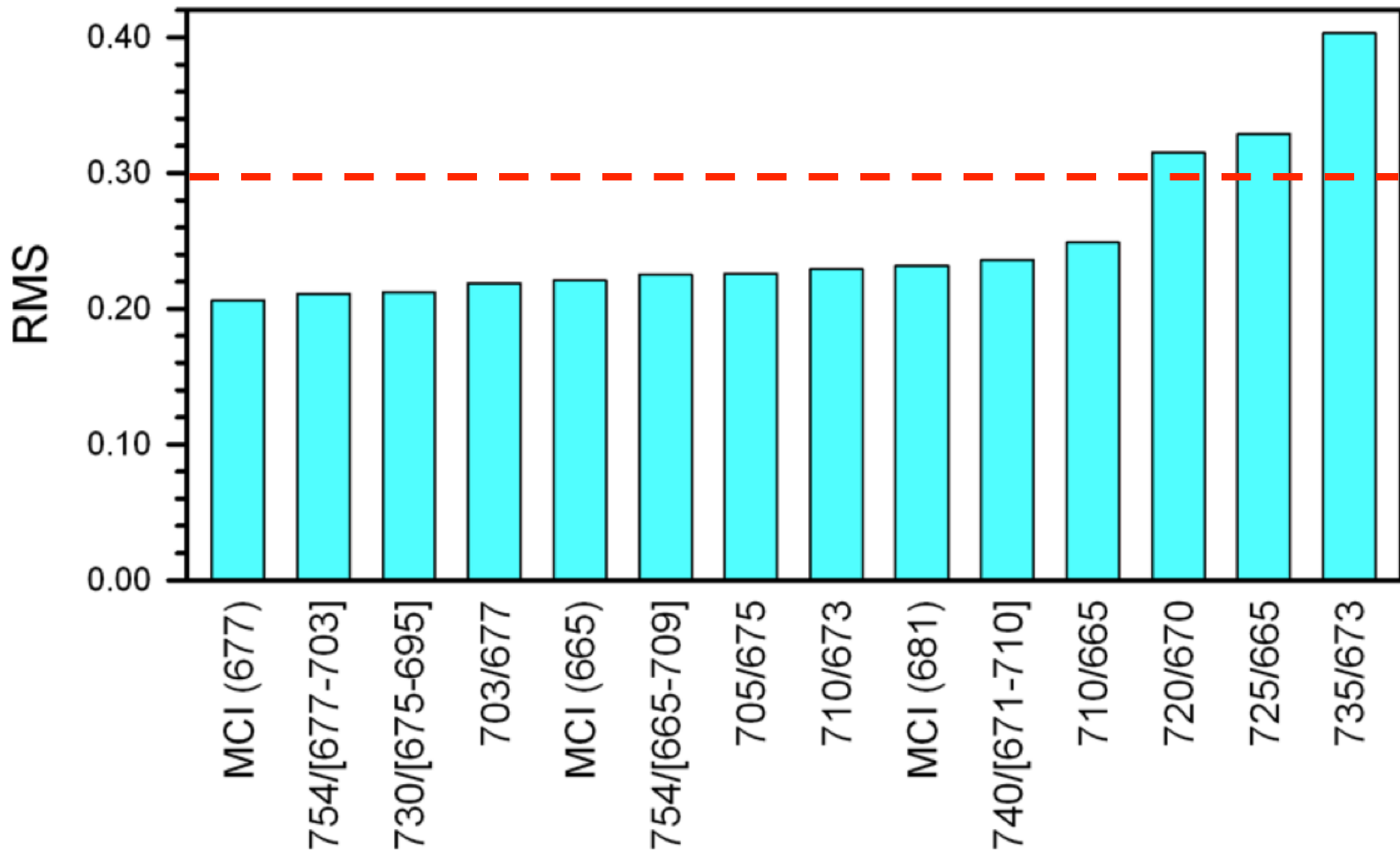
Type	Algorithm	log-log								linear			
		1st		2nd		3rd		4th		linear			
		all	>5	all	>5	all	>5	all	>5	all	>5	<50	5-50
Hyper	703/677	○	○	○	○	○	○	○	○	○	○	○	○
	705/675	○	○	○	○	○	○	○	○	○	○	○	○
	710/665	○	○	○	○	○	○	○	○	○	○	○	○
	710/673	○	○	○	○	○	○	○	○	○	○	○	○
	720/670	○	○	○	○	○	○	○	○	○	○	○	○
	725/665	●	●	●	●	●	●	●	●	●	●	●	●
	735/673	●	●	●	●	●	●	●	●	●	●	●	●
	730/[675-695]	●	●	●	●	●	●	●	●	●	●	●	●
	740/[671-710]	●	●	●	●	●	●	●	●	●	●	●	●
	754/[665-709]	●	●	●	●	●	●	●	●	●	●	●	●
	754/[677-703]	●	●	●	●	●	●	●	●	●	●	●	●
													○
													●
												○	
												●	
MERIS	754/[665-709]	●	●	●	●	●	●	●	●	●	●	●	●
	MCI (665)	●	●	●	●	●	●	●	●				
	MCI (681)	●	●	●	●	●	●	●	●				
	OC4E (443)	○	○	○	○	○	○	○	○				
OC4E (489)	○	○	○	○	○	○	○	○					
OC4E (510)	○	○	○	○	○	○	○	○					
MODIS	709s/667	○	○	○	○	○	○	○	○	○	○	○	○
	709s/678	●	●	●	●	●	●	●	●	●	●	●	●
	709s/(667:678)	○	○	○	○	○	○	○	○	○	○	○	○
	748/[667-709s]	○	○	○	○	○	○	○	○	○	○	○	○
	MCI (667)	●	●	●	●	●	●	●	●				
	MCI (678)	●	●	●	●	●	●	●	●				
	OC3 (443)	○	○	○	○	○	○	○	○				
	OC3 (488)	○	○	○	○	○	○	○	○				
SeaWiFS	OC4 (489)	○	○	○	○	○	○	○	○				
	OC4 (510)	○	○	○	○	○	○	○	○				
	OC4 (443)	○	○	○	○	○	○	○	○				

540 runs

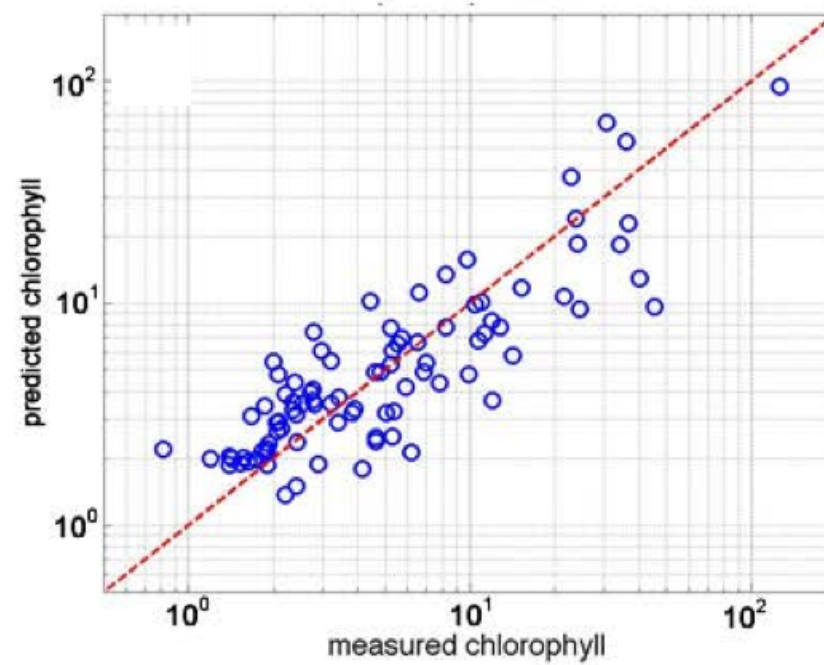
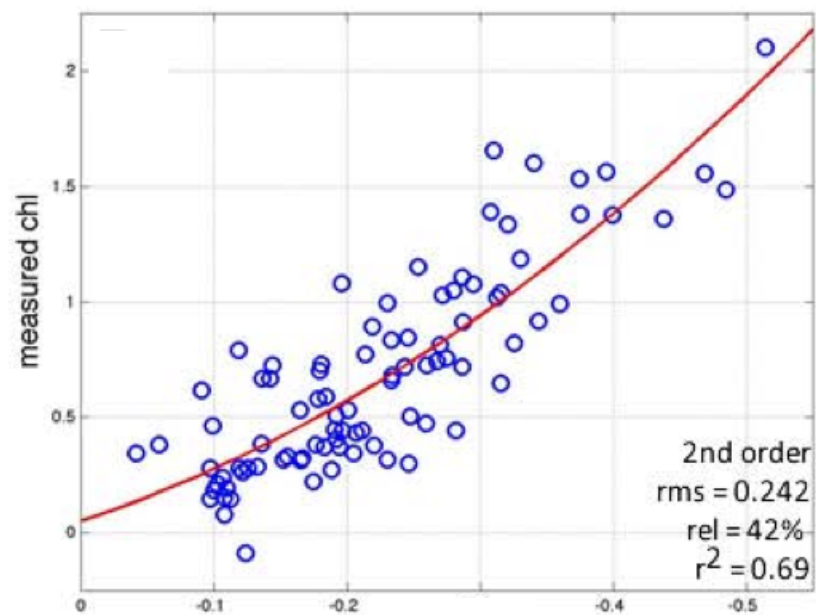
Hyperspectral



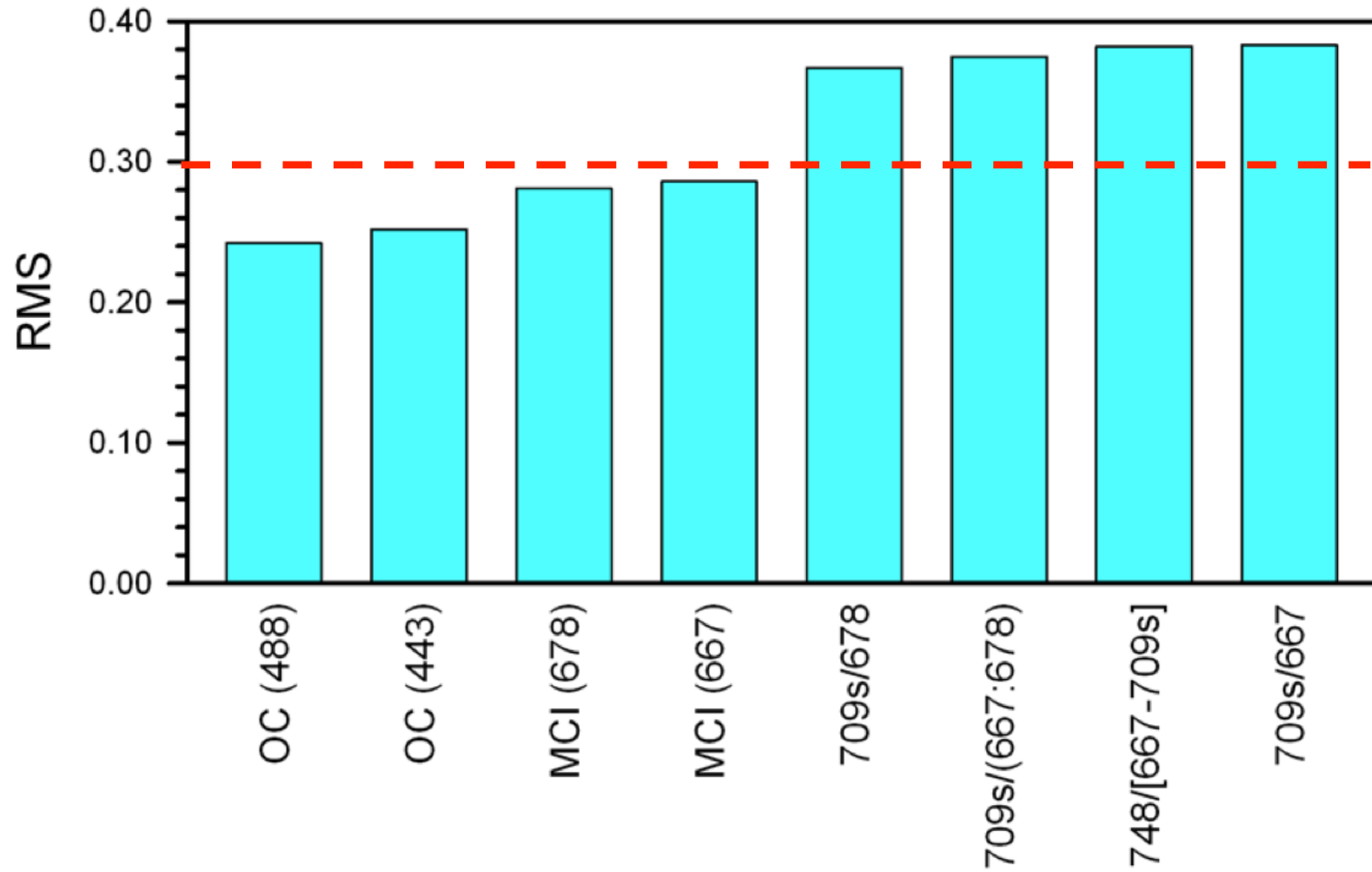
Hyperspectral



MODIS



MODIS



Where we are

NE spectral library with
paired lake data

NE hyperspectral algos

NE satellite algos

One aircraft survey

Few satellite images

What's next?

Compare spectra
aircraft vs. lake

Apply algos to satellites
for select NE lakes to
gauge effectiveness

Determine potential for
real-world use

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