Inter-Annual Variability in Under Ice Biogeochemistry in Missisquoi Bay Driven by Winter Weather

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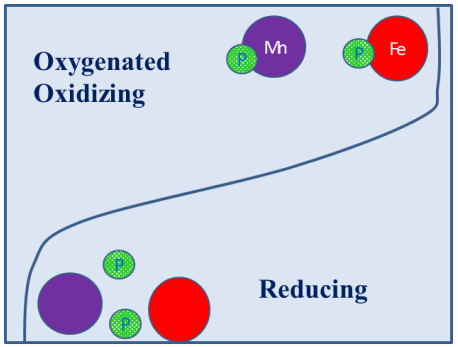
RACC Research on Adaptation to Climate Change in the Lake Champlain Basin

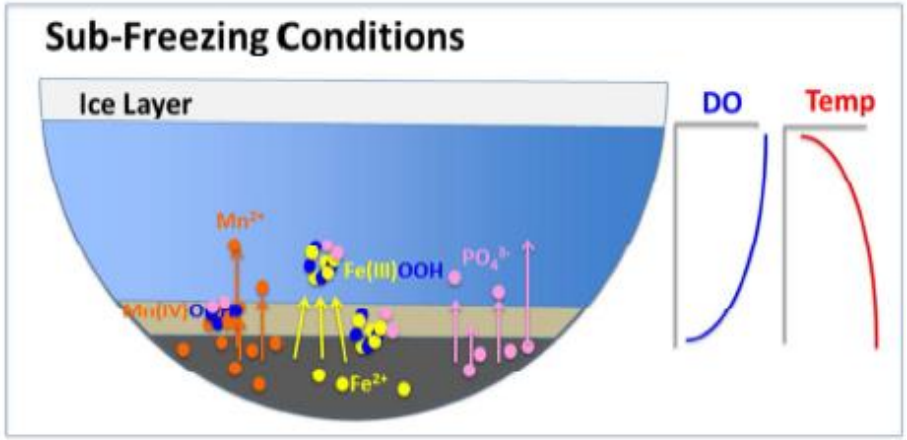
NSF

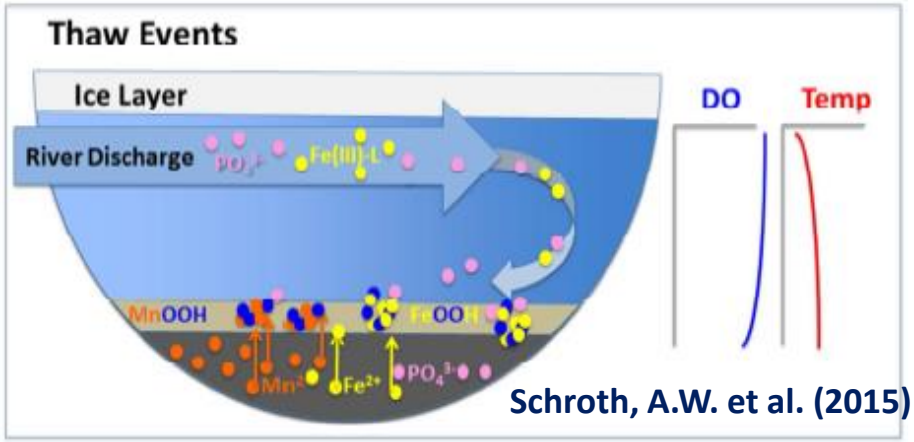
Research Objectives

- Wintertime metal/nutrient dynamics could impact water quality and algal ecosystems.

- Drivers of inter-annual variability in dynamics of Fe, Mn and P in water and sediment under ice



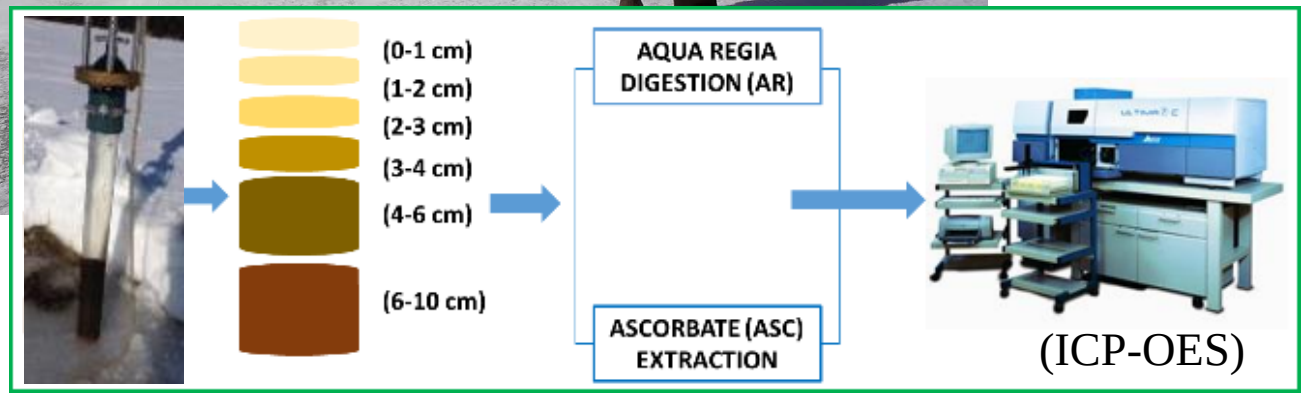




Schroth, A.W. et al. (2015)

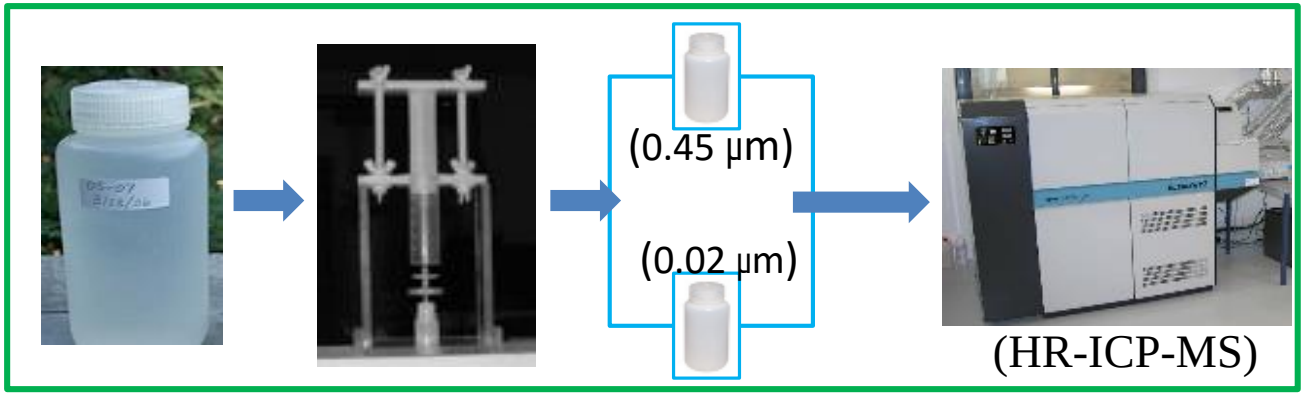
Methods

(YSI sensor)

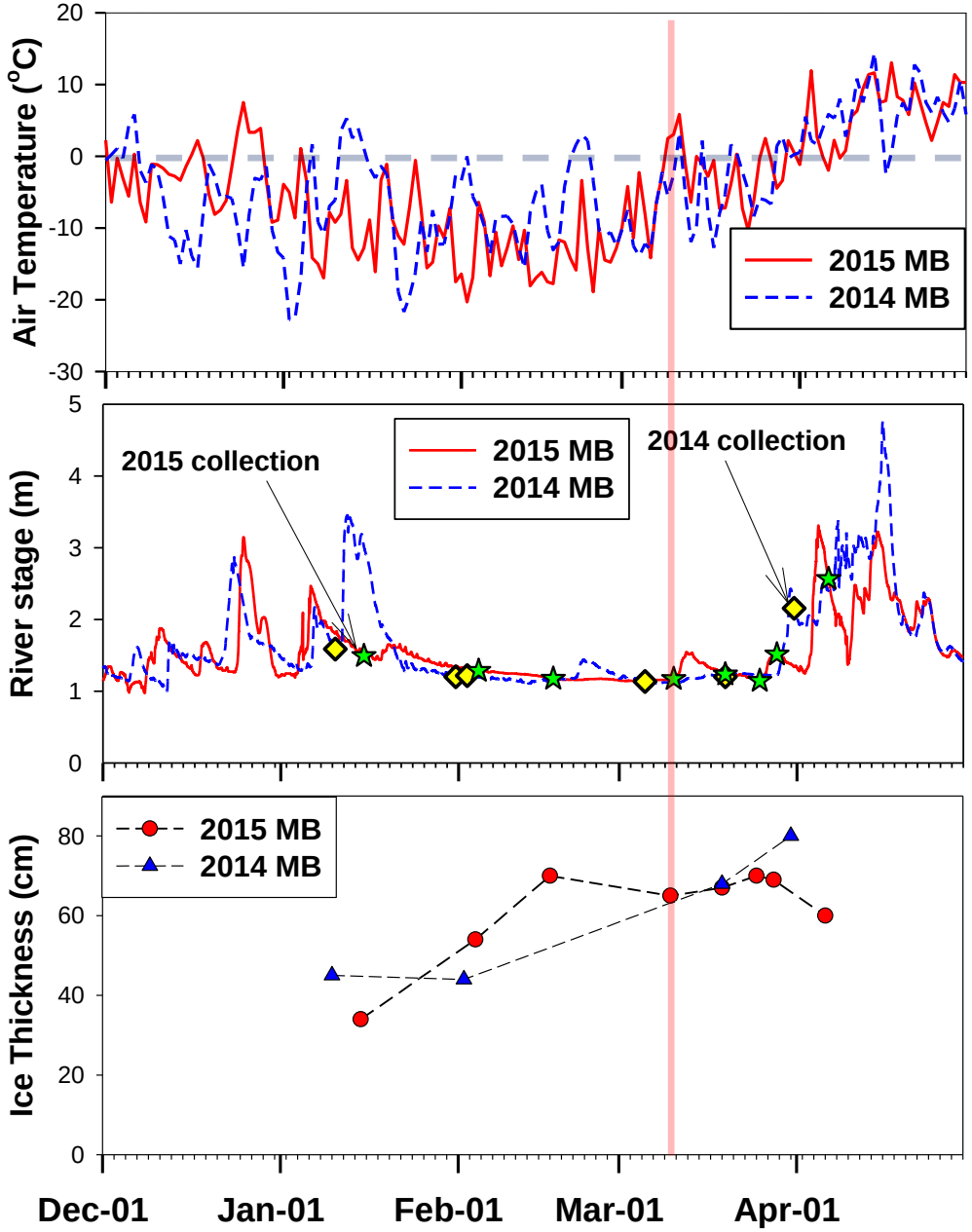


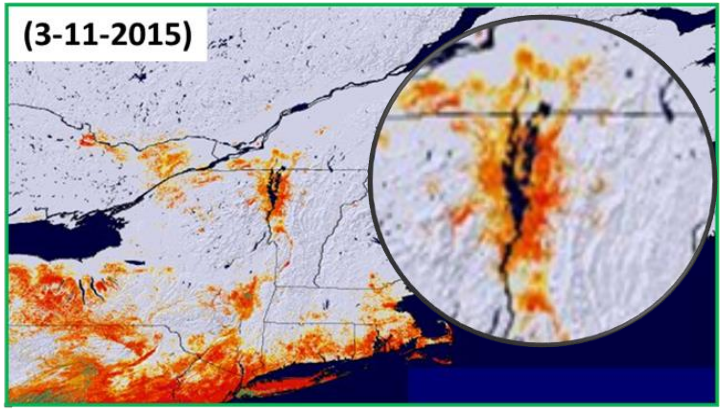
2014 Data

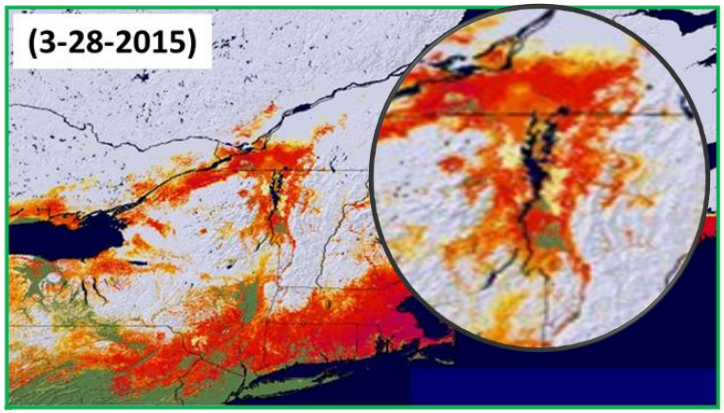
Schroth, A.W. et al. (2015). ES&T. 49 (16), DOI: 10.1021/acs.est.5b02057

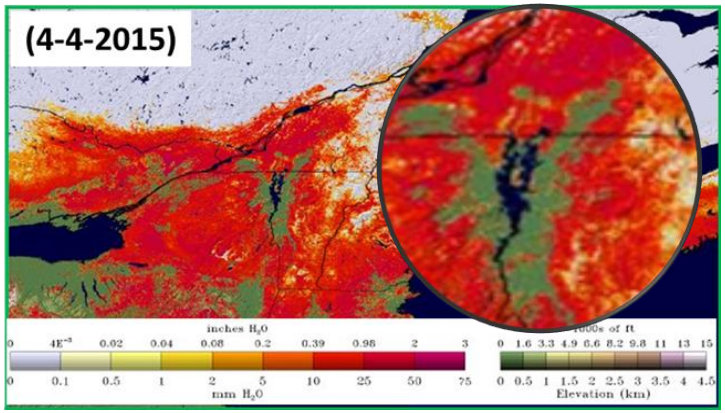


Climates

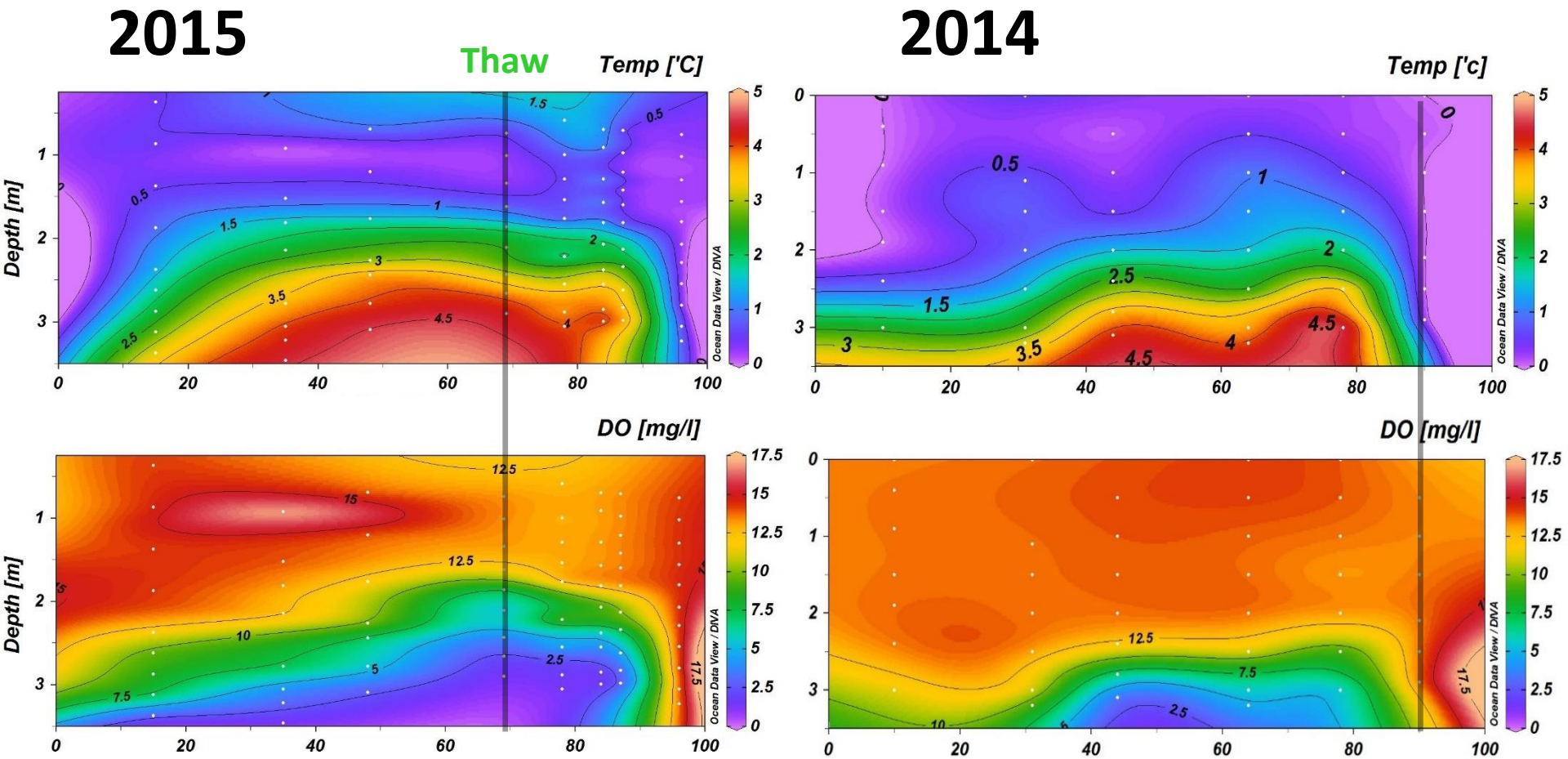

Air Temperature (°C)
20
10
0
-10
-20
-30
2015 MB
2014 MB
River stage (m)
5
4
3
2
1
0
2015 collection
2014 collection
2015 MB
2014 MB
Ice Thickness (cm)
80
60
40
20
0
2015 MB
2014 MB
Dec-01
Jan-01
Feb-01
Mar-01
Apr-01


(3-11-2015)


(3-28-2015)


(4-4-2015)
inches H2O
mm H2O
Elevation (km)

Water Column Environmental Parameters



During Persistent subfreezing Air-T

-Thermal stratification 2015 > 2014

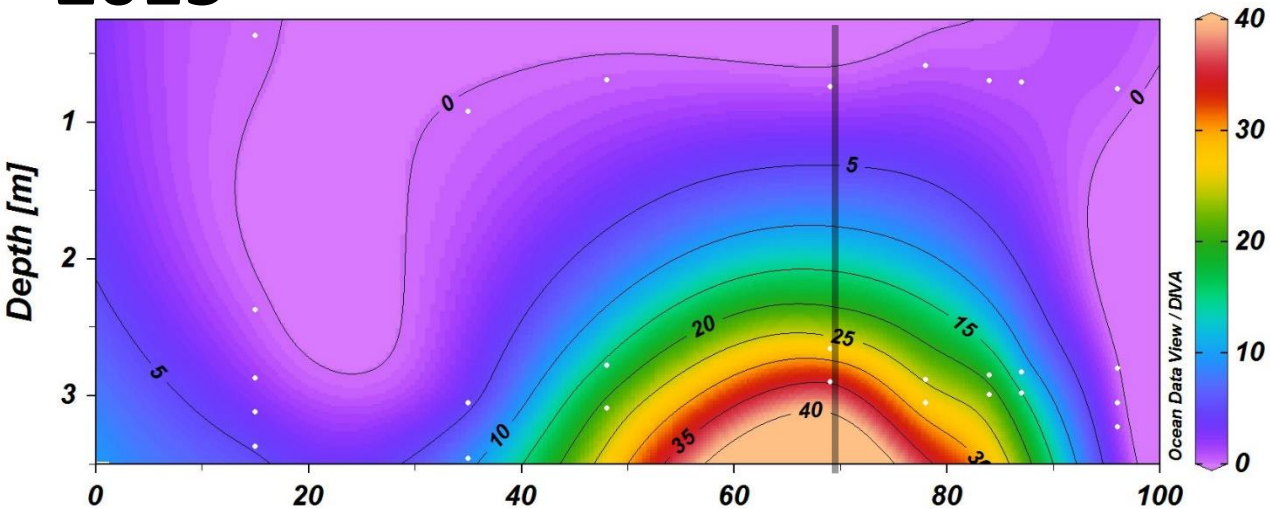
-DO stratification: 2015 >> 2014

Thaw

-T&DO strat. Persistent during March

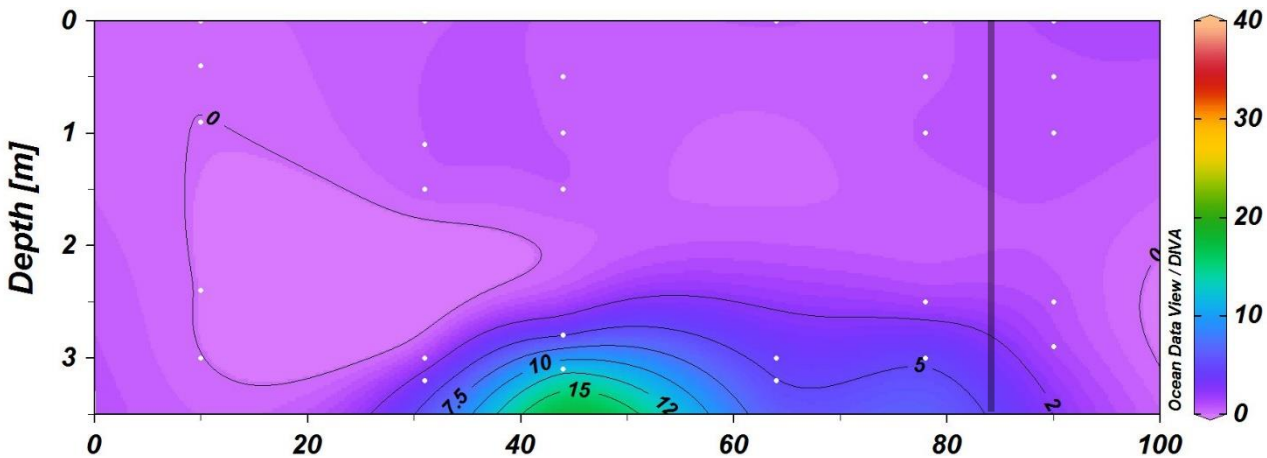
Water Column Dissolved Mn

2015



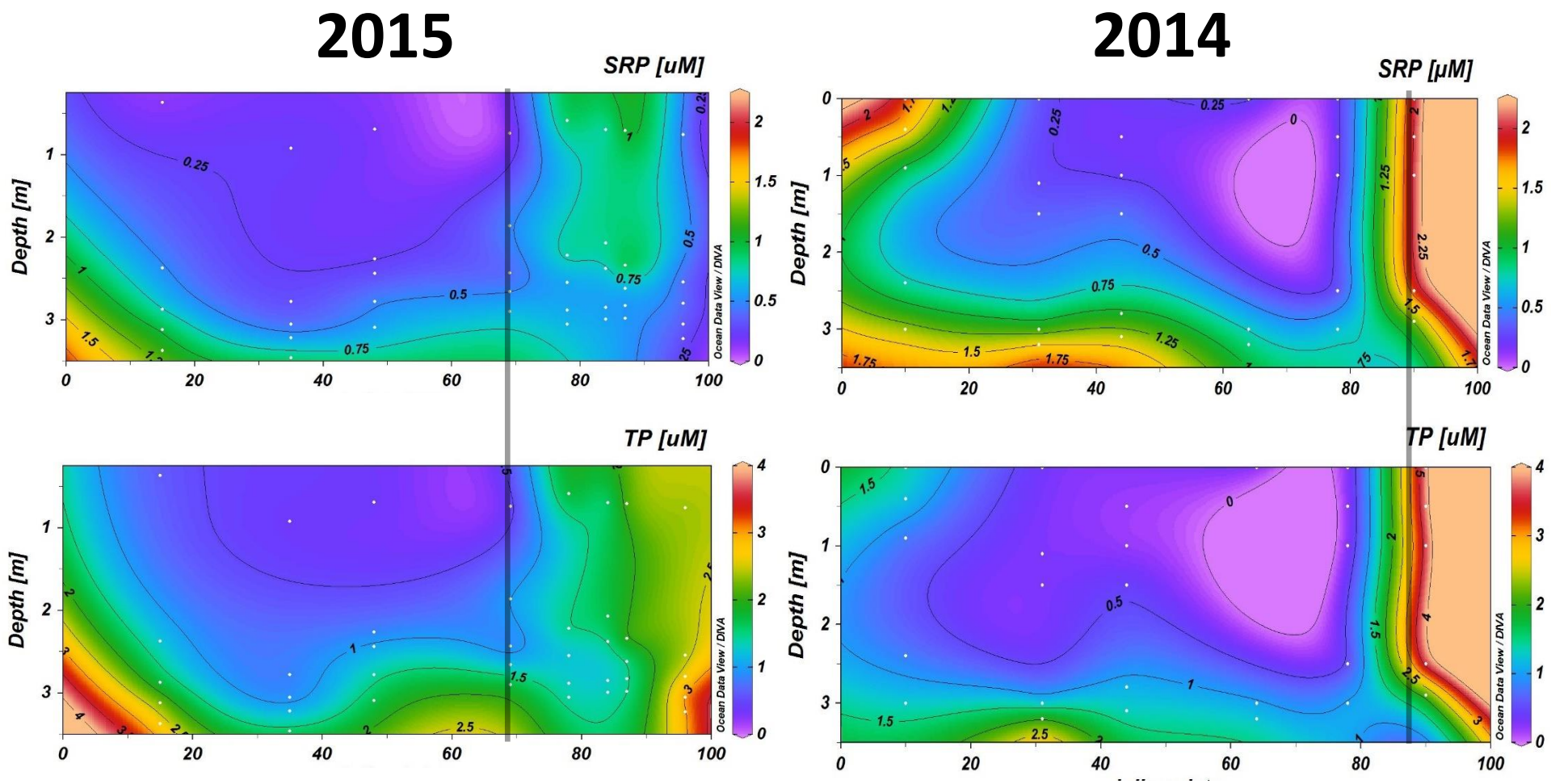
Dissolved Mn enrichment 2015 >> 2014

2014



Good Proxy for P: Giles et al., 2015, Schroth et al., 2015; Pearce et al., 2013

Water column P partitioning



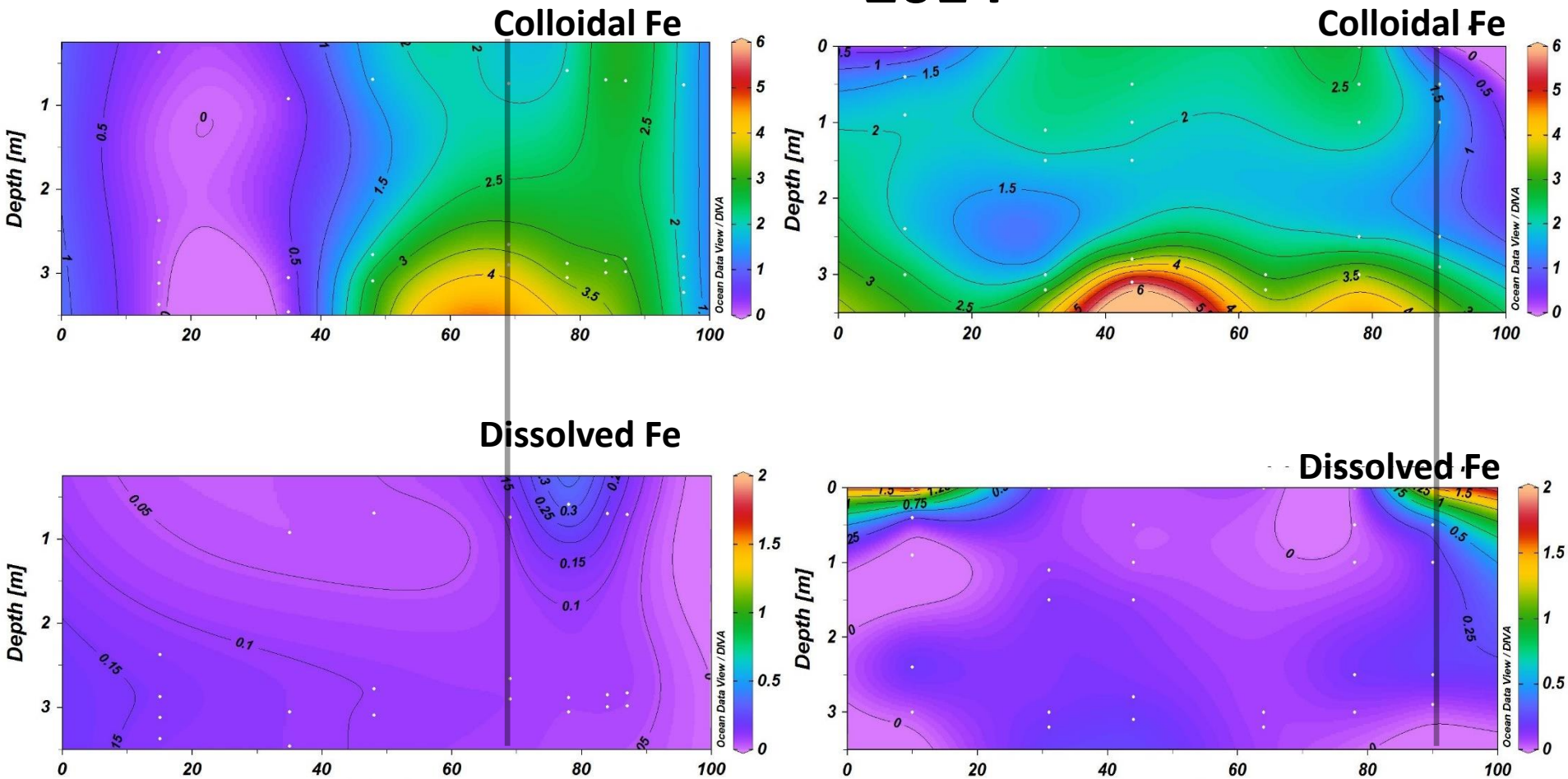
Low SRP, higher TP in 2015 relative to 2014 ➔ Partitioning into particulate P

Thaw events,
Surface SRP and TP increased in mid-March, lower SRP in early April thaw event
➔ different source areas of snow melting

Water Column Fe

2015

2014

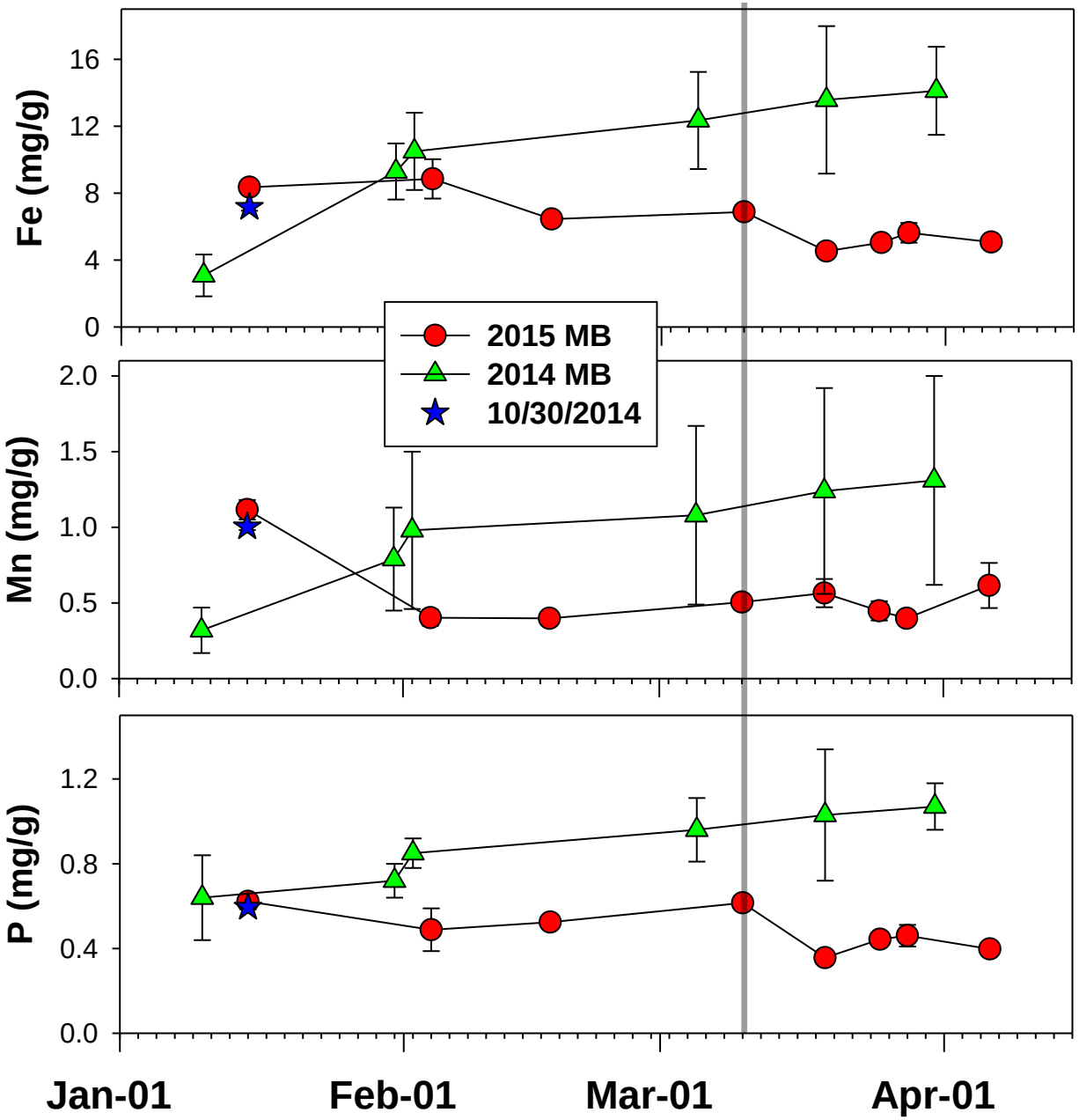


Fe oxidation under low O2, when nitrate presents
Less sedimentary diffusive flux

Sedimentary Labile Fe, Mn vs P

-Coincide with water column Fe, Mn and P distribution

-Decrease labile in 2015 VS Accumulation in 2014
➔Winter weather affects quality of sedimentary Fe, Mn and P



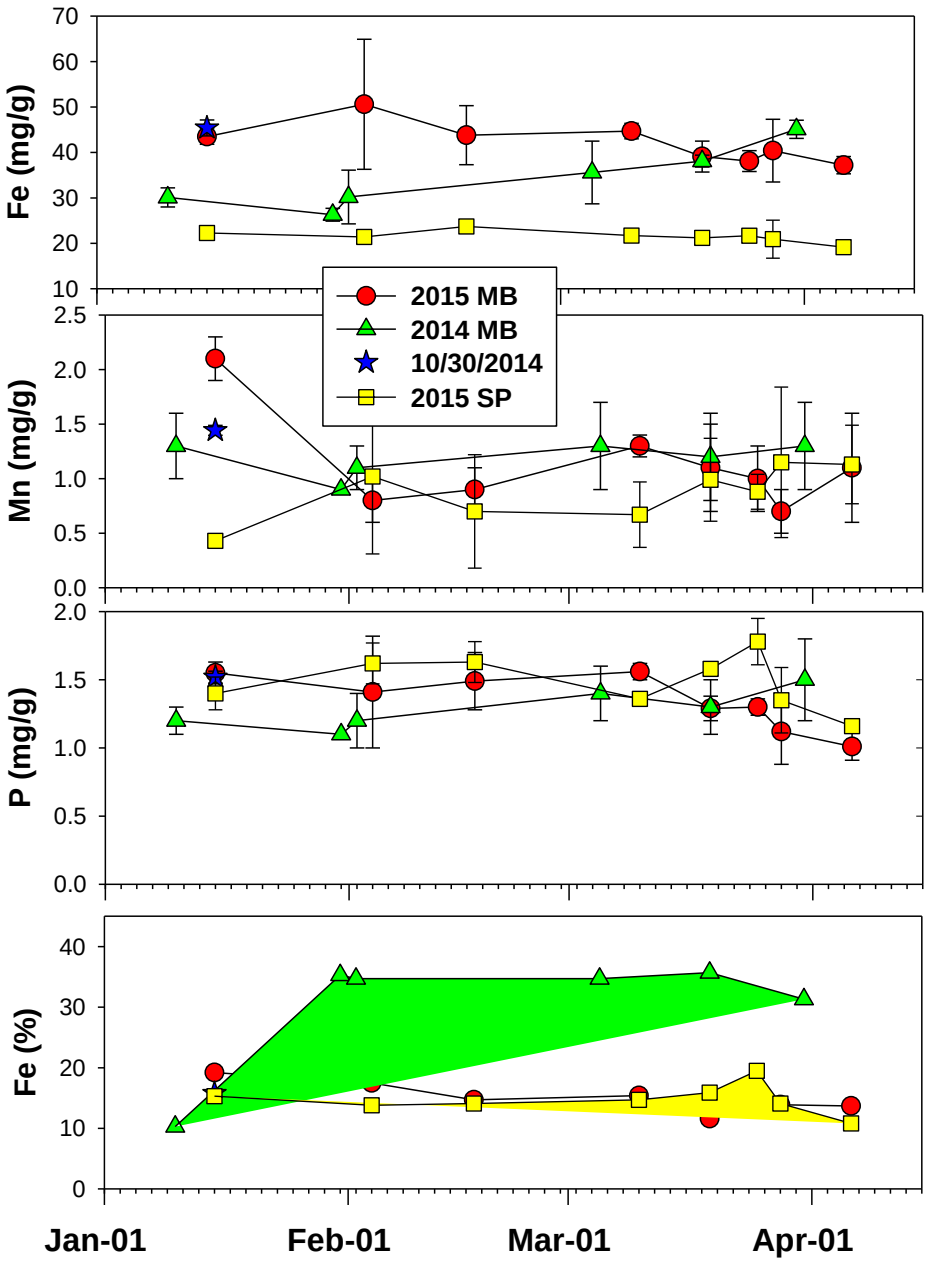
Take Home Points

- **SWI Redox chemistry**

- **Inter-annual variability: Winter weather (duration of stable periods) ➔ affecting water column as well as sediment quality**

- **Sources and severity of thaw control its impact on biogeochemistry**

- **Threshold affecting entire water column biogeochemistry**


Fe (mg/g)
70
60
50
40
30
20
10
2015 MB
2014 MB
10/30/2014
2015 SP
Mn (mg/g)
2.5
2.0
1.5
1.0
0.5
0.0
P (mg/g)
2.0
1.5
1.0
0.5
0.0
Fe (%)
40
30
20
10
0
Jan-01
Feb-01
Mar-01
Apr-01