A novel approach to estimating monthly salt marsh contributions to oxygen deficit in the Murderkill Estuary from hourly sensor data

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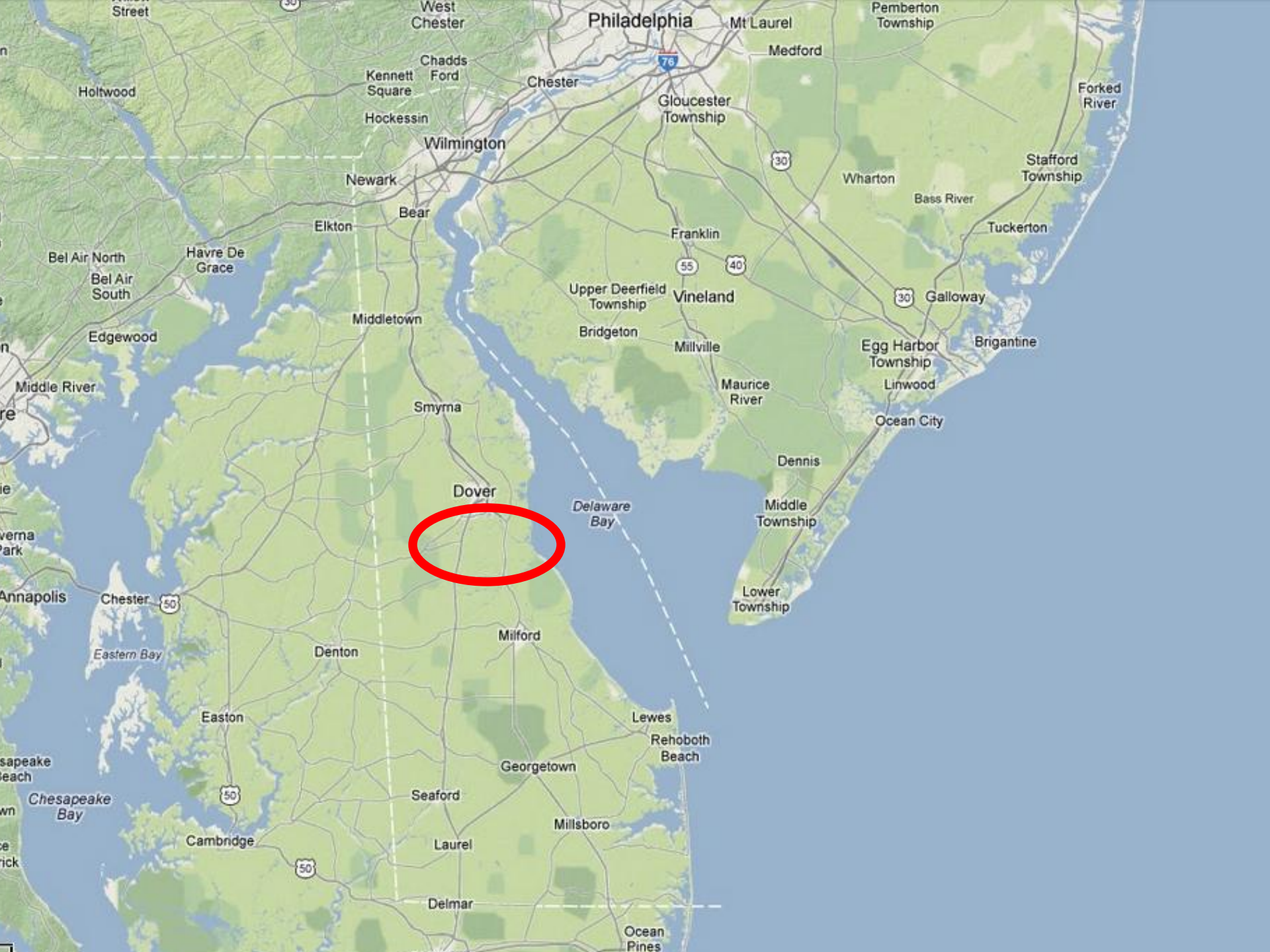
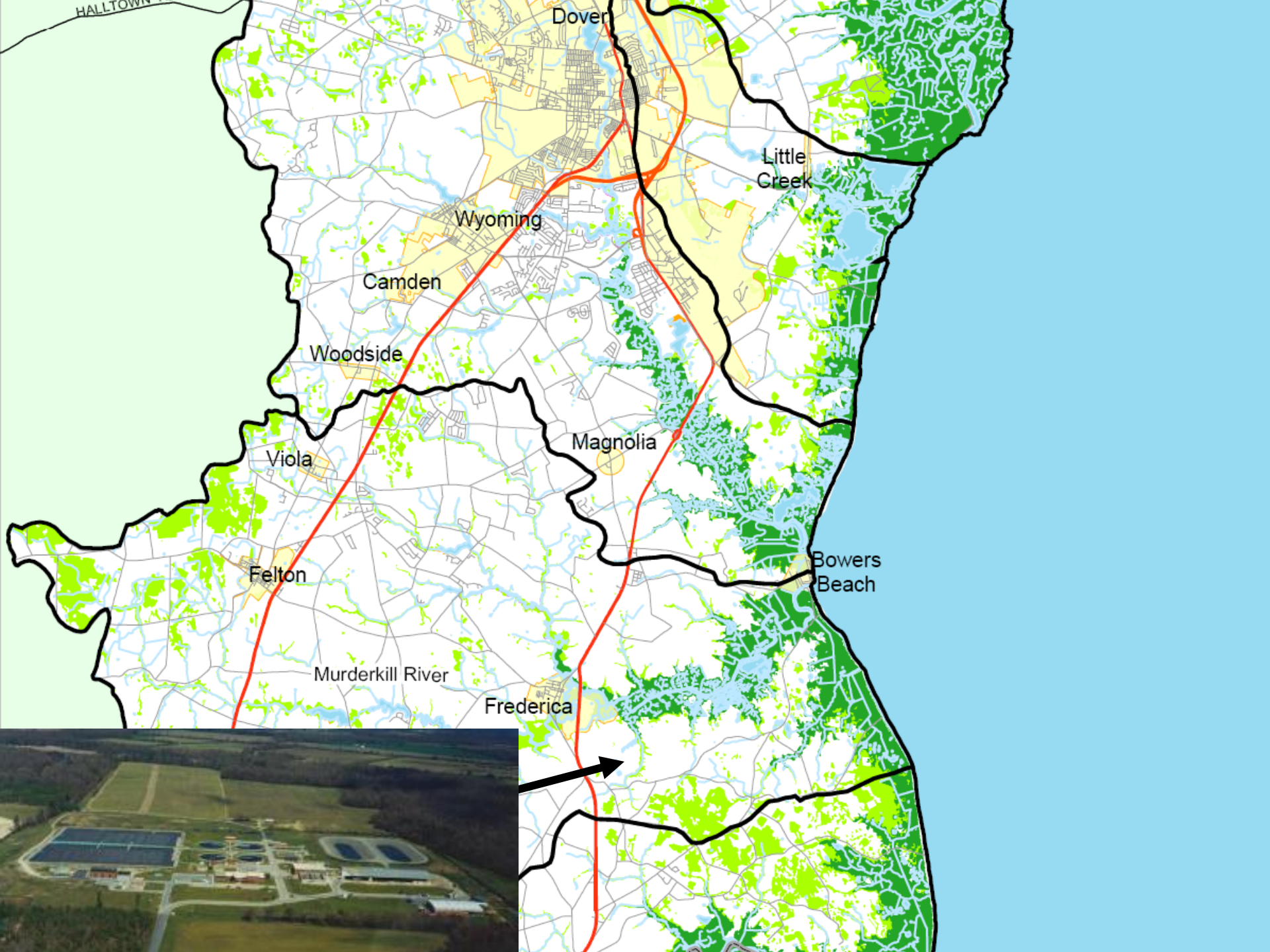

Philadelphia
West Chester
Mt Laurel
Pemberton Township
Medford
Chadds Ford
Kennett Square
Chester
Holtwood
Hockessin
Gloucester Township
Forked River
Wilmington
Newark
Wharton
Stafford Township
Bass River
Elkton
Bear
Tuckerton
Franklin
Bel Air North
Havre De Grace
Bel Air South
Upper Deerfield Township
Vineland
Galloway
Middletown
Edgewood
Bridgeton
Millville
Egg Harbor Township
Brigantine
Middle River
Maurice River
Linwood
Smyrna
Ocean City
Dennis
Dover
Delaware Bay
Middle Township
Annapolis
Chester
Lower Township
Milford
Eastern Bay
Denton
Easton
Lewes
Rehoboth Beach
Georgetown
Chesapeake Bay
Seaford
Millsboro
Cambridge
Laurel
Delmar
Ocean Pines


Dover
Little Creek
Wyoming
Camden
Woodside
Magnolia
Viola
Felton
Bowers Beach
Murderkill River
Frederica


Irish Hill Road
Clapham Road
Bowers Beach
Bowers, DE
Bowers Beach Road
113
Frederica
Frederica Road
12
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16-18 July, 2007

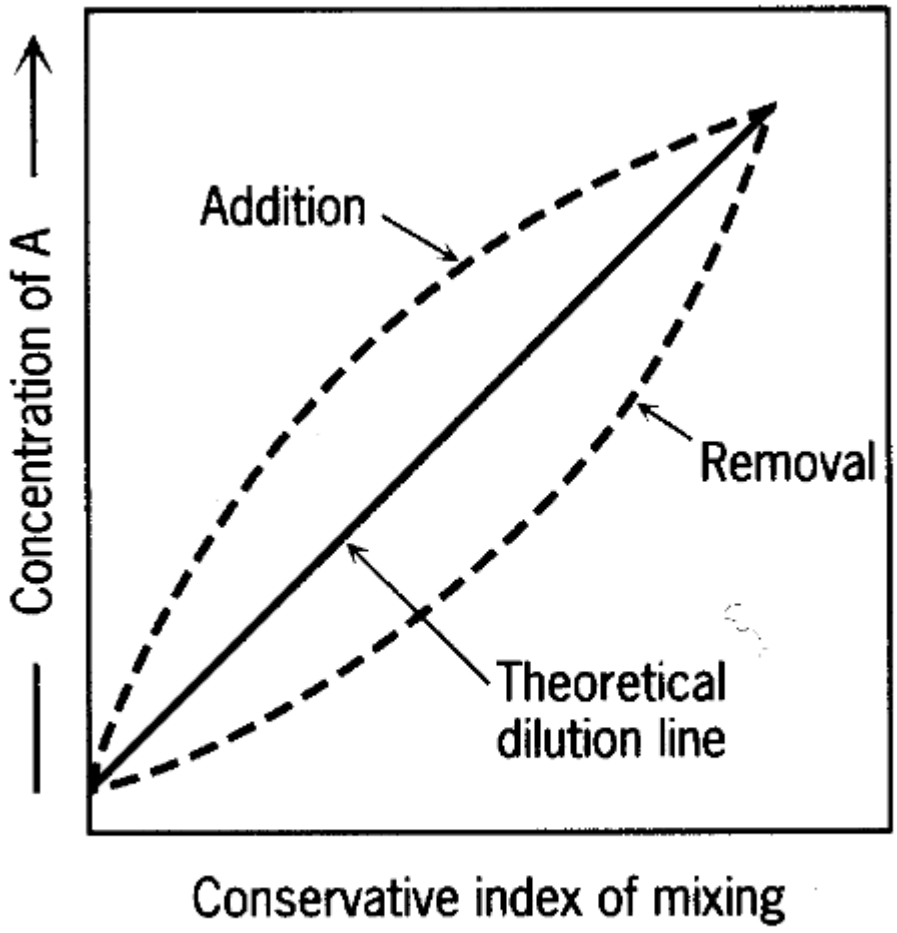
16-18 October, 2007

31 March – 2 April, 2008

Parameters

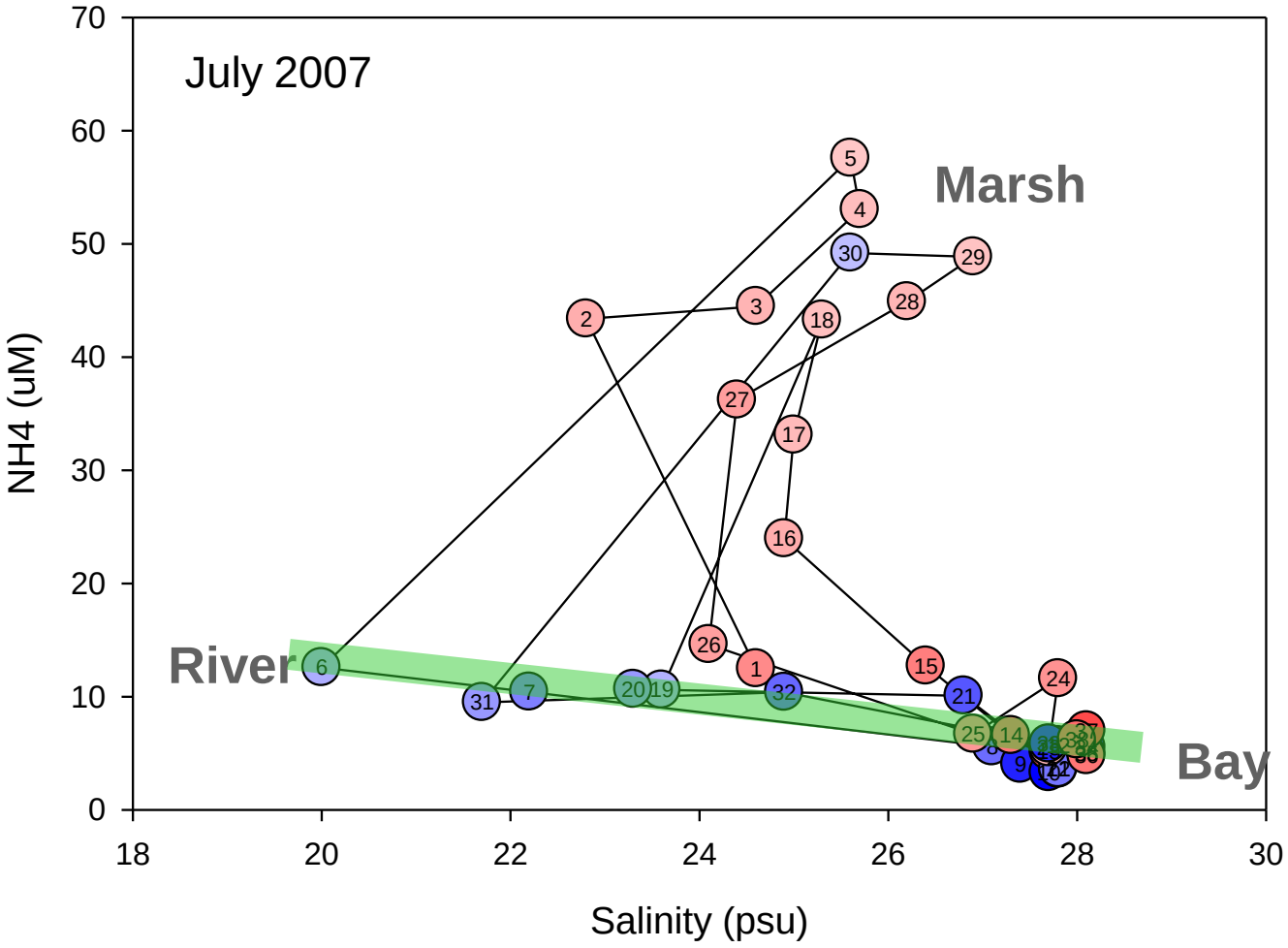
- Dissolved
  - Nitrate + Nitrite
  - Ammonium
  - Total Dissolved N (TDN, DON by difference)
  - Phosphate
  - Total Dissolved P (TDP)
  - Organic C (DOC)
  - Inorganic C (DIC)
  - Alkalinity
- Particulate (Fine & Coarse)
  - Organic Carbon
  - Nitrogen
  - Phosphorus
- Stable Isotopes
  - $\delta^{15}N$ & $\delta^{13}C$ on as many species as possible

Mixing Curve Approach



(a)

Mixing Curve Approach



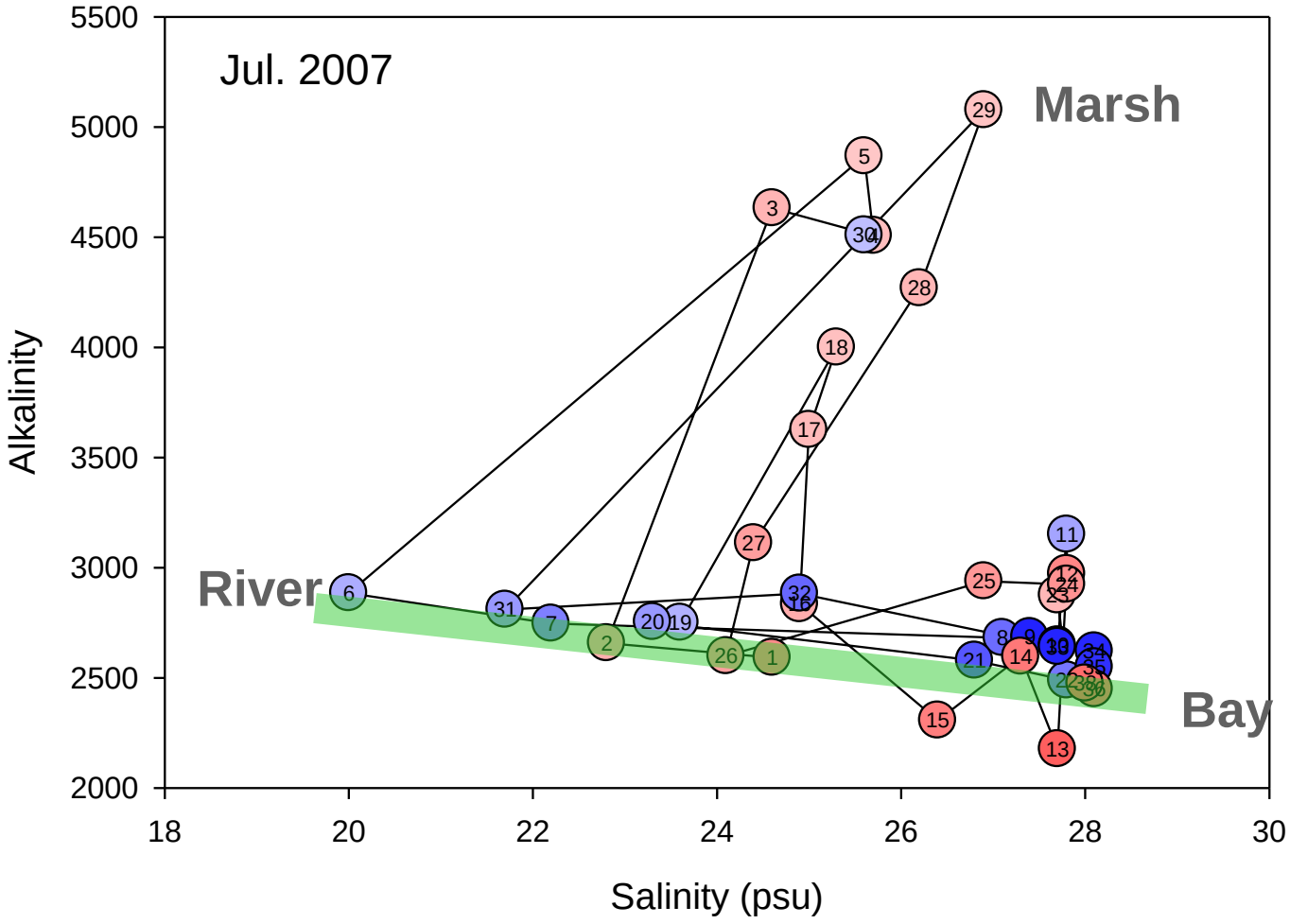
- Marsh is a clear source of NH4

Blue = upstream into marsh

Red = downstream out of marsh

shaded proportional to discharge

Mixing Curve Approach



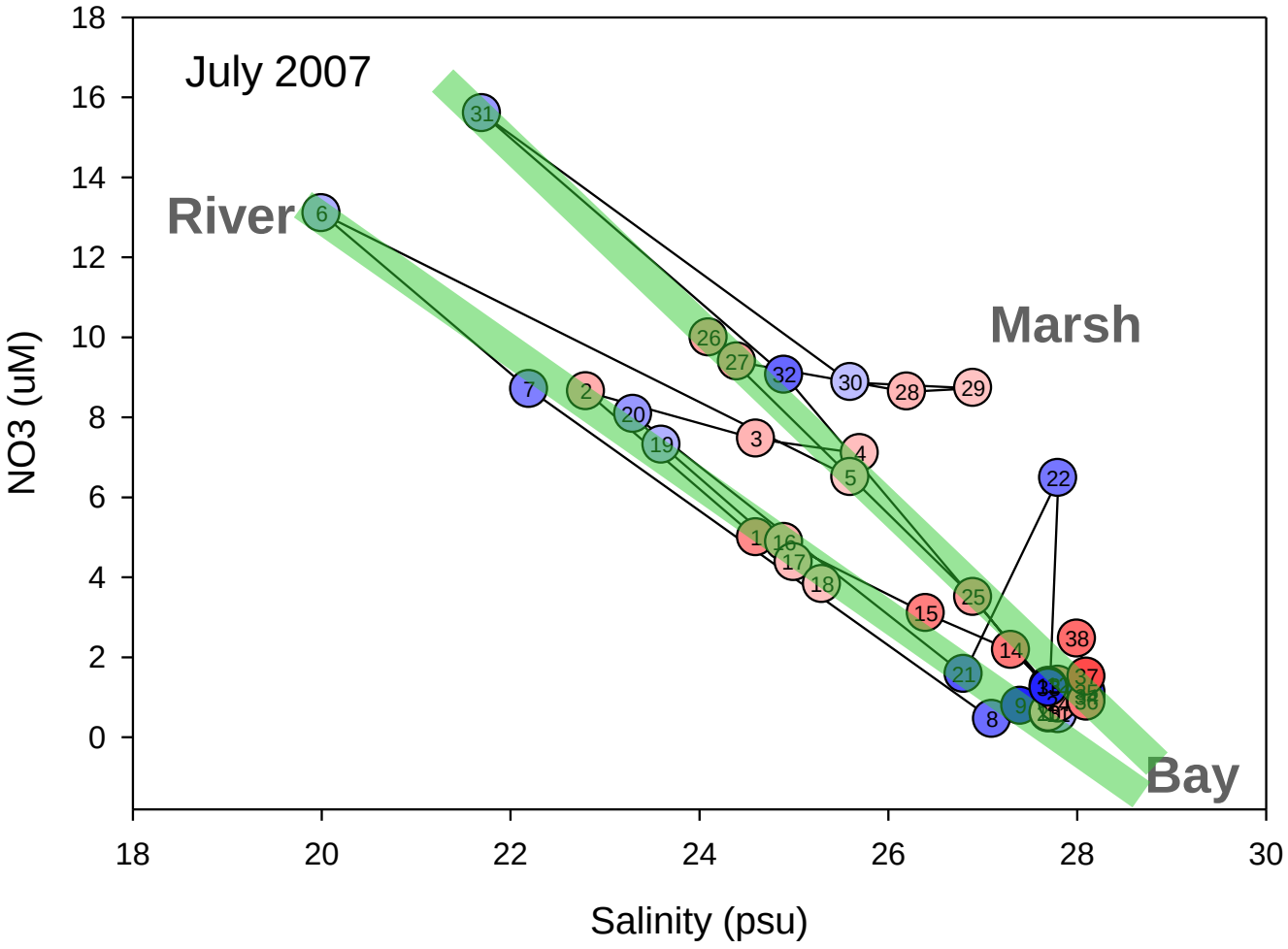
- Alkalinity & silicate from dissolution of minerals in porewaters

Blue = upstream into marsh

Red = downstream out of marsh

shaded proportional to discharge

Mixing Curve Approach



- Marsh appears to export small amounts of nitrate (in July 2007)

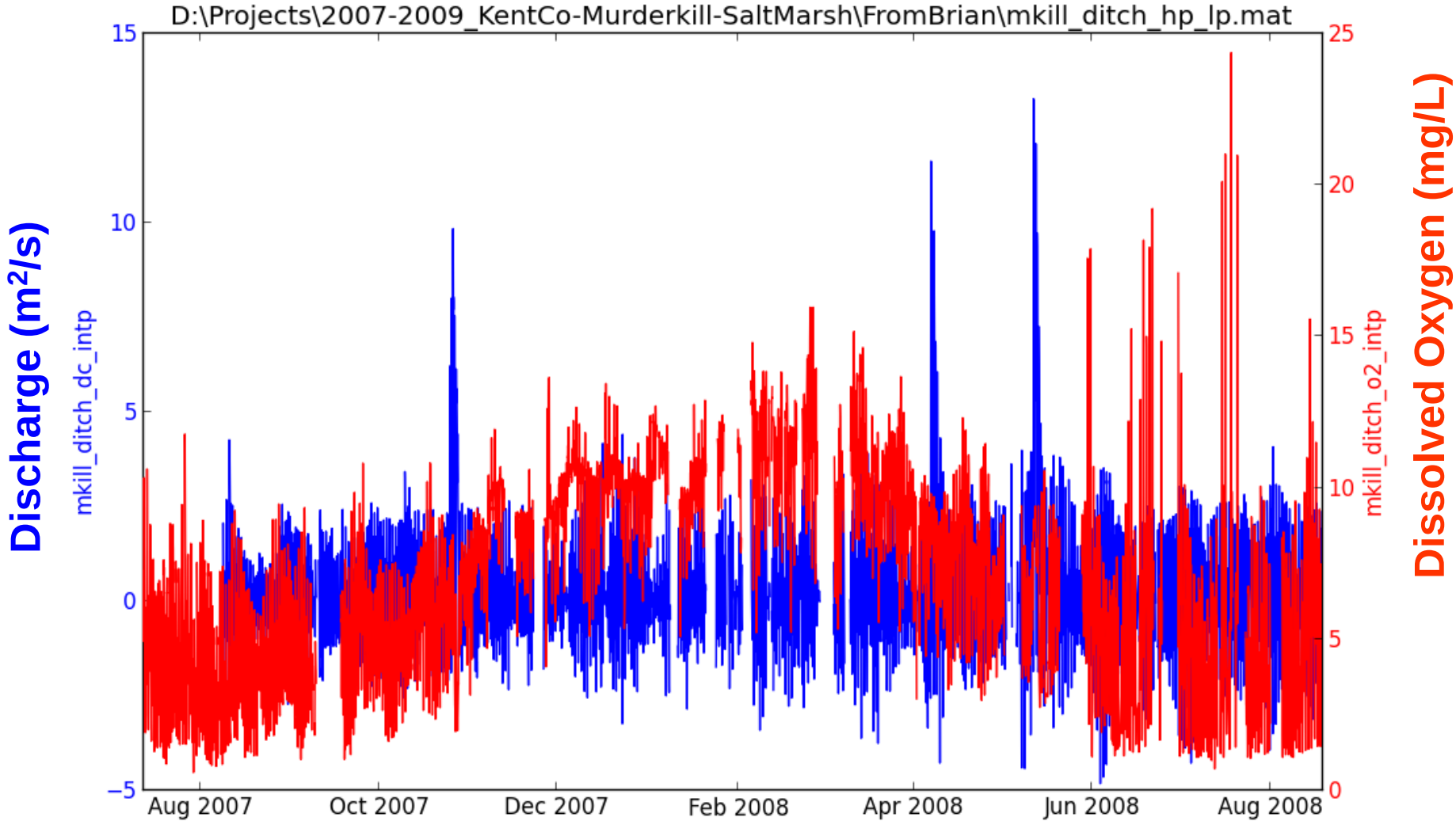
Blue = upstream into marsh

Red = downstream out of marsh

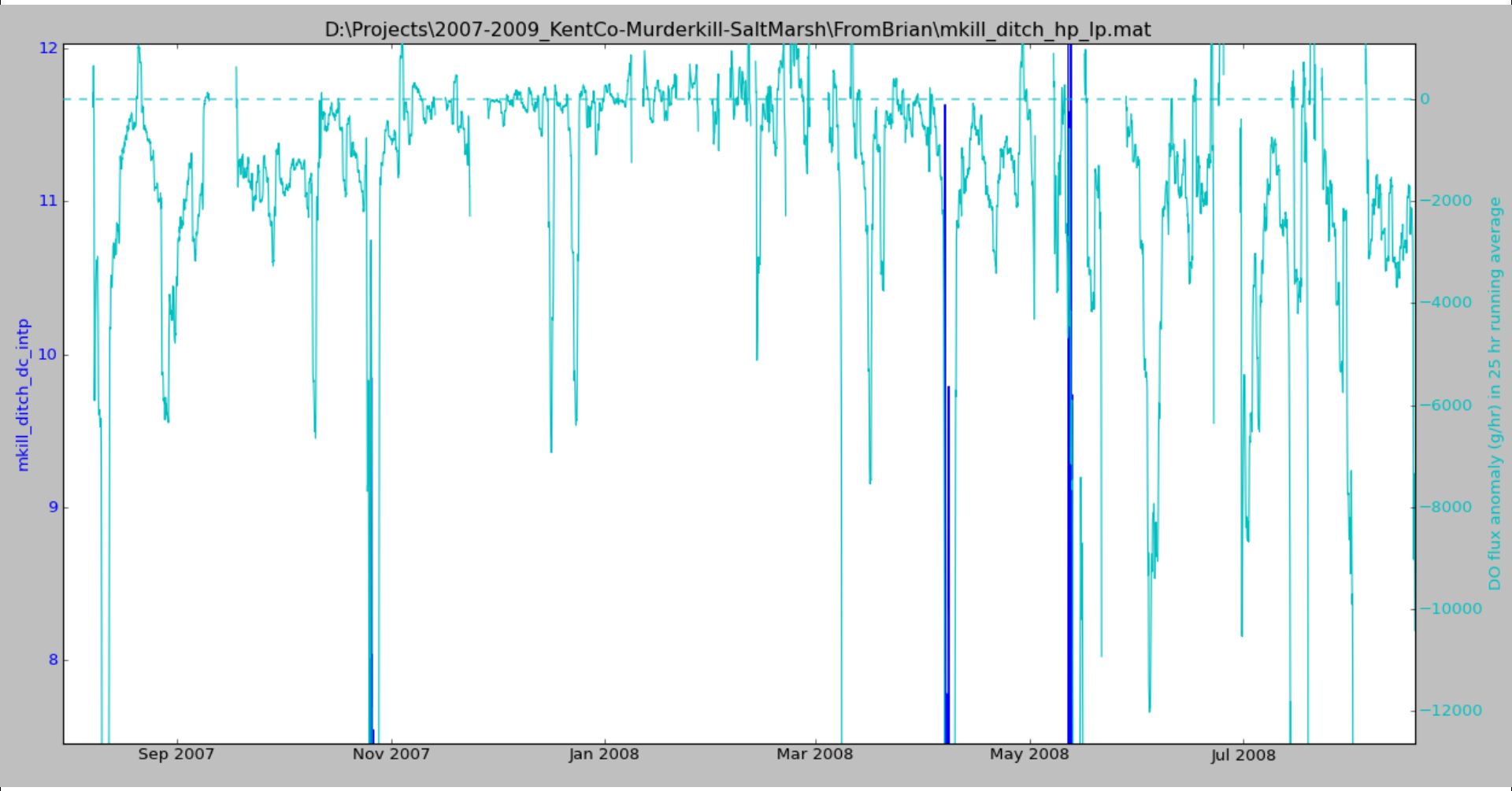
shaded proportional to discharge

Mean Flux (g/h) Positive Downstrem per 0.64 km^2 marsh	**MKA** Jul **Jul. 16-18, 2007** g/m^2/y	**MKB** Oct **Oct. 17-18, 2007** g/m^2/y	**MKC** Apr **Apr. 1-2, 2008** g/m^2/y	**MKD** May **May 2008** g/m^2/y	**MKE** Aug **Aug. 2008** g/m^2/y	**Average Excl. D** **g/m^2/y**
Total N (g N/hr)	5.6 ± 19%	0.5 ± 187%	-3.7 ± 41%	13.3 ± 45%	2.2 ± 48%	**1.2** ± 201%
NO3 + NO2	0.4 ± 13%	-0.1 ± 92%	-2.3 ± 28%	-4.7 ± 19%	-0.2 ± 14%	**-0.5** ± 123%
NH4	1.2 ± 6%	0.3 ± 40%	0.9 ± 4%	2.1 ± 130%	-0.3 ± 41%	**0.5** ± 38%
DON	4.1 ± 19%	0.1 ± 1438%	2.1 ± 57%	17.0 ± 28%	2.0 ± 49%	**2.1** ± 96%
FPON	-1.0 ± 69%	0.2 ± 72%	-4.1 ± 13%	-2.0 ± 106%	0.2 ± 166%	**-1.2** ± 83%
CPON	0.9 ± 15%	0.0 ± 140%	-0.2 ± 14%	1.0 ± 65%	0.5 ± 6%	**0.3** ± 52%
Total P (g P/hr)	0.6 ± 16%	1.0 ± 7%	0.2 ± 23%	1.8 ± 4%	2.5 ± 3%	**1.1** ± 13%
PP, total	0.1 ± 104%	0.0 ± 114%	0.0 ± 0%	0.6 ± 56%	0.0 ± 164%	**0.0** ± 299%
PO4	0.6 ± 13%	0.5 ± 10%	0.1 ± 19%	0.1 ± 84%	1.0 ± 15%	**0.5** ± 32%
TDP (PO4+DOP	0.5 ± 9%	0.4 ± 4%	0.1 ± 23%	1.1 ± 39%	1.5 ± 27%	**0.7** ± 64%
Total OC (gC/hr)	33.4 ± 16%	5.0 ± 44%	-20.8 ± 23%	268.1 ± 7%	13.2 ± 22%	**7.7** ± 103%
DOC	11.4 ± 3%	2.9 ± 69%	5.3 ± 31%	225.2 ± 11%	8.5 ± 24%	**7.0** ± 47%
FPOC	9.0 ± 54%	2.2 ± 33%	-23.2 ± 19%	-0.1 ########	1.0 ± 215%	**2.7** ± 252%
CPOC	13.1 ± 15%	-0.1 ± 319%	-2.9 ± 10%	12.7 ± 64%	3.7 ± 9%	**3.4** ± 60%
DO (gO2/hr)	-23.9 ± 6%	-16.6 ± 8%	12.5 ± 15%	-217.0 ± 33%	-39.7 ± 6%	**-16.9** ± 21%
free CO2 (gC/hr)	27.9 ± 26%	16.6 ± 8%	1.6 ± 79%	243.1 ± 41%	19.8 ± 8%	**16.5** ± 47%
Chla, total (g/hr)	-0.3 ± 4%	-0.1 ± 14%	-0.2 ± 19%	-0.7 ± 25%	-0.1 ± 13%	**-0.2** ± 27%
FSS	119.3 ± 56%	43.5 ± 71%	-628.2 ± 12%	-15.1 ± 1990%	33.6 ± 110%	**-107.9** ± 104%
CSS	111.6 ± 3%	-0.7 ± 576%	-11.6 ± 27%	122.6 ± 60%	36.2 ± 7%	**33.9** ± 20%

Continuous DO



Monthly DO Anomalies



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Monthly DO Anomalies

Marsh DO Deficit Load calculated from continous USGS data from Aug. 8, 2007 to Aug 18, 2008.

time interval	kgO2/m2/d	gO2/m2/yr
Aug-07	-1.51E-04	-54.97
Sep-07	-6.40E-05	-23.35
Oct-07	-1.32E-04	-48.32
Nov-07	-9.59E-06	-3.50
Dec-07	-2.41E-05	-8.78
Jan-08	3.57E-06	1.30
Feb-08	-2.65E-06	-0.97
Mar-08	-3.54E-05	-12.93
Apr-08	-1.39E-04	-50.85
May-08	-1.99E-04	-72.48
Jun-08	-1.08E-04	-39.32
Jul-08	-1.16E-04	-42.17
Aug-08	-1.27E-04	-46.49
average	-8.49E-05	-30.99
annual average	-8.04E-05	-29.34

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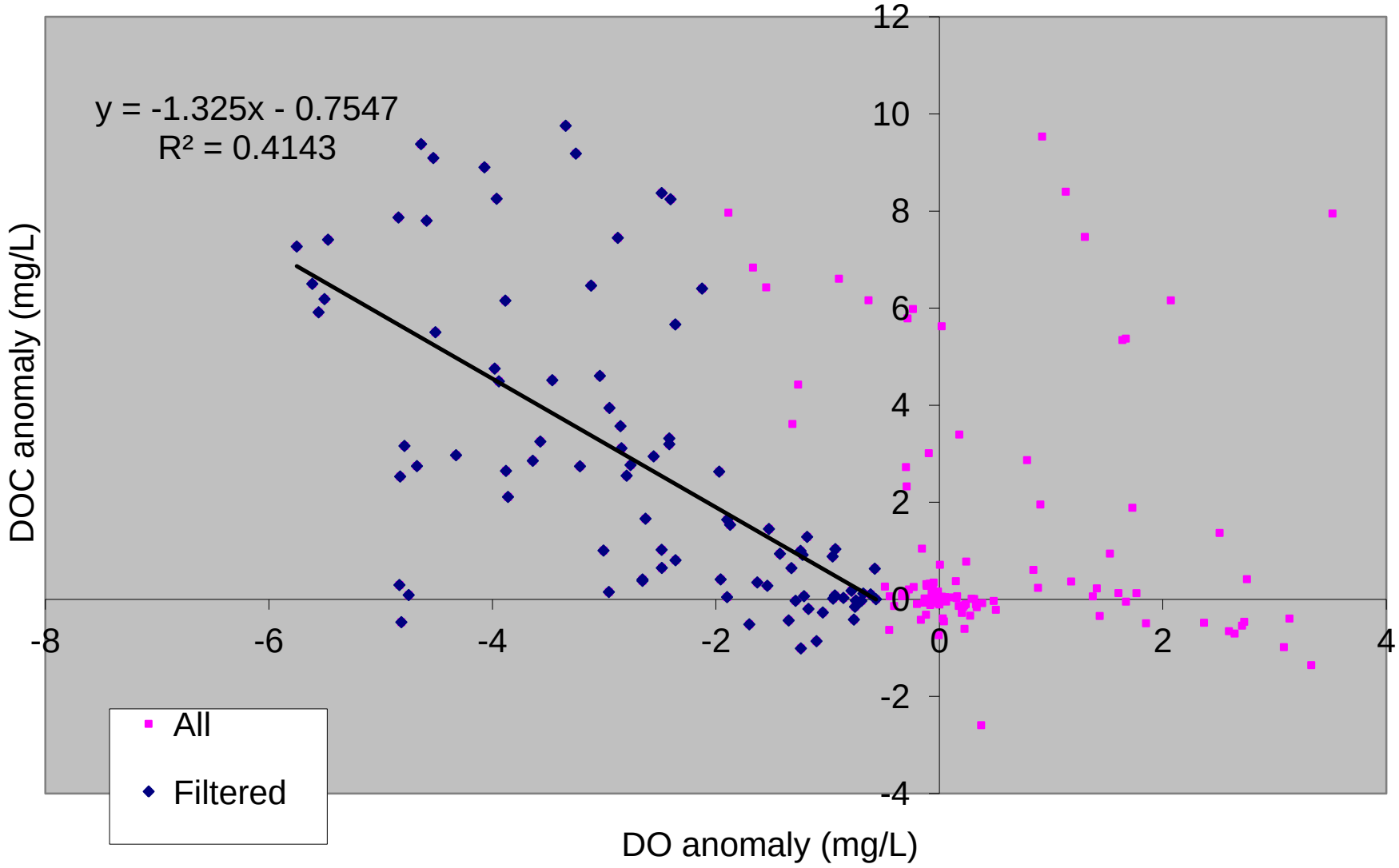
Monthly DOC Anomalies

Filtered out DO anomaly > -0.3 due to phase shift for 1 period



Monthly DOC Anomalies

time interval	kgDOC/m2/d	gDOC/m2/yr
Aug-07	1.61E-04	58.85
Sep-07	5.19E-05	18.96
Oct-07	1.33E-04	48.51
Nov-07	4.47E-06	1.63
Dec-07	2.25E-05	8.21
Jan-08	1.43E-06	0.52
Feb-08	1.95E-05	7.13
Mar-08	4.21E-05	15.37
Apr-08	1.34E-04	48.84
May-08	1.96E-04	71.61
Jun-08	1.21E-04	44.28
Jul-08	1.28E-04	46.77
Aug-08	1.25E-04	45.62
average	8.77372E-05	32.02
annual average	8.31227E-05	30.34

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Considerations regarding the use of grab sample DO concentrations for calibrating water quality model

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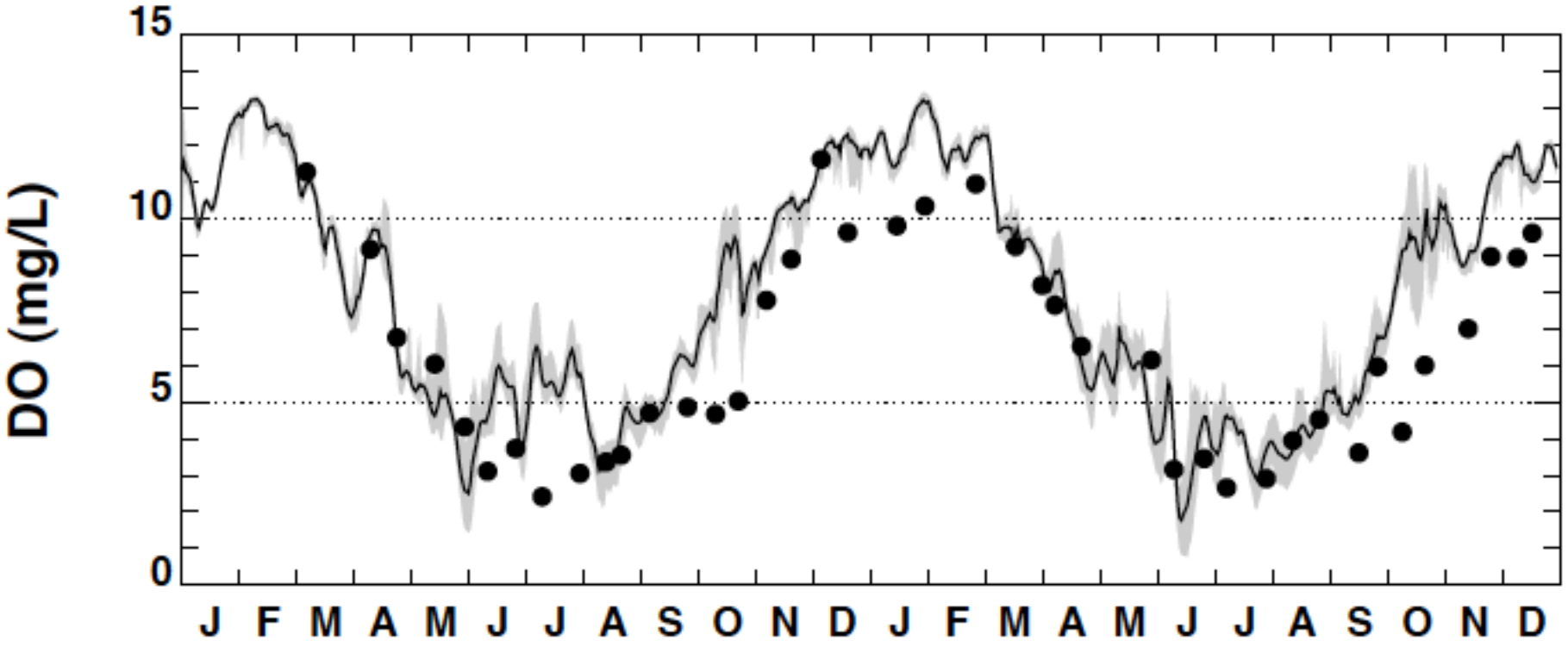
Calibrating Model



RUN0708-044_RUN0708-043 - new bay BC
Station 206231, Murderkill River at Confluence of Kent County WWTF

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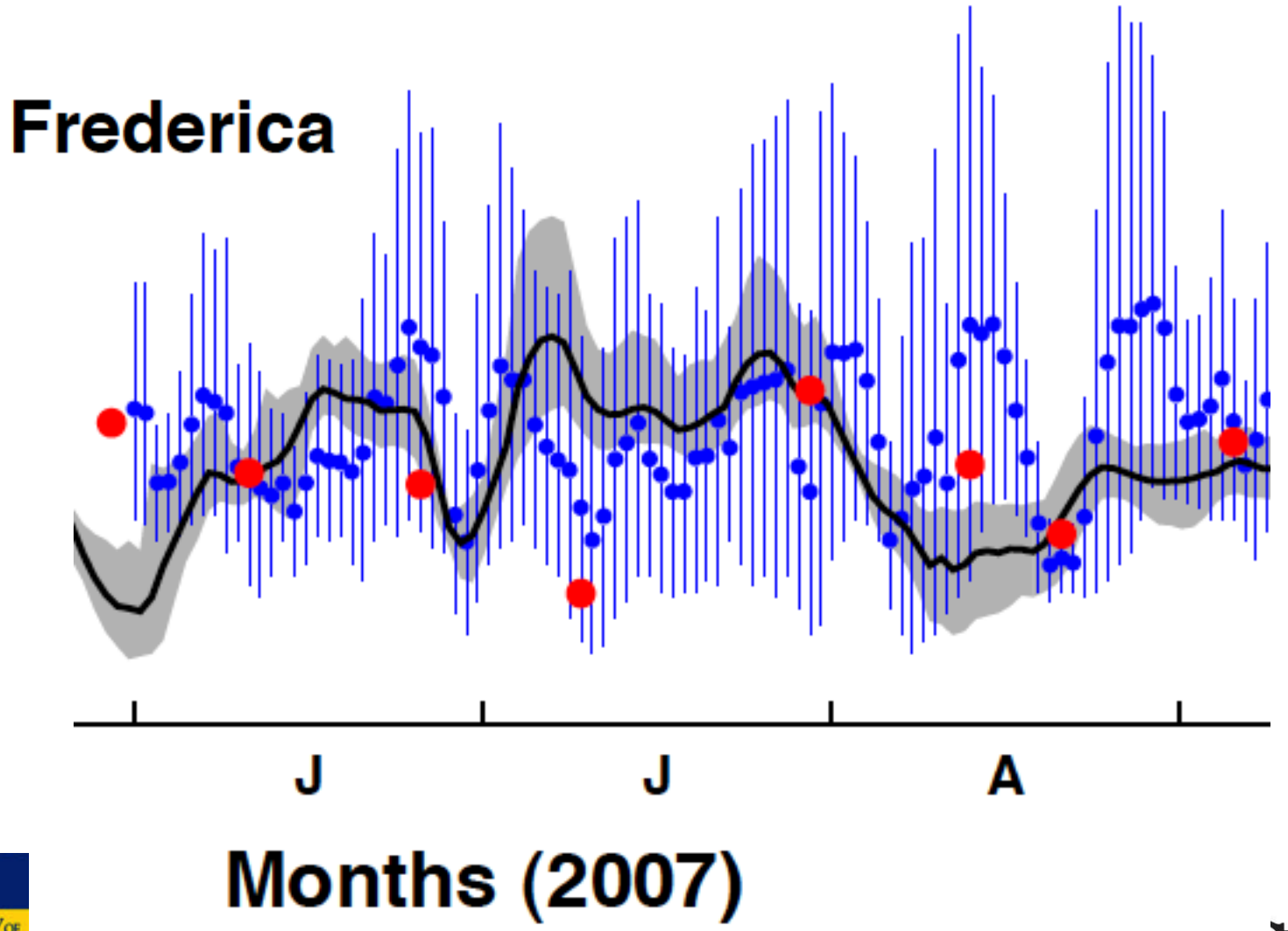
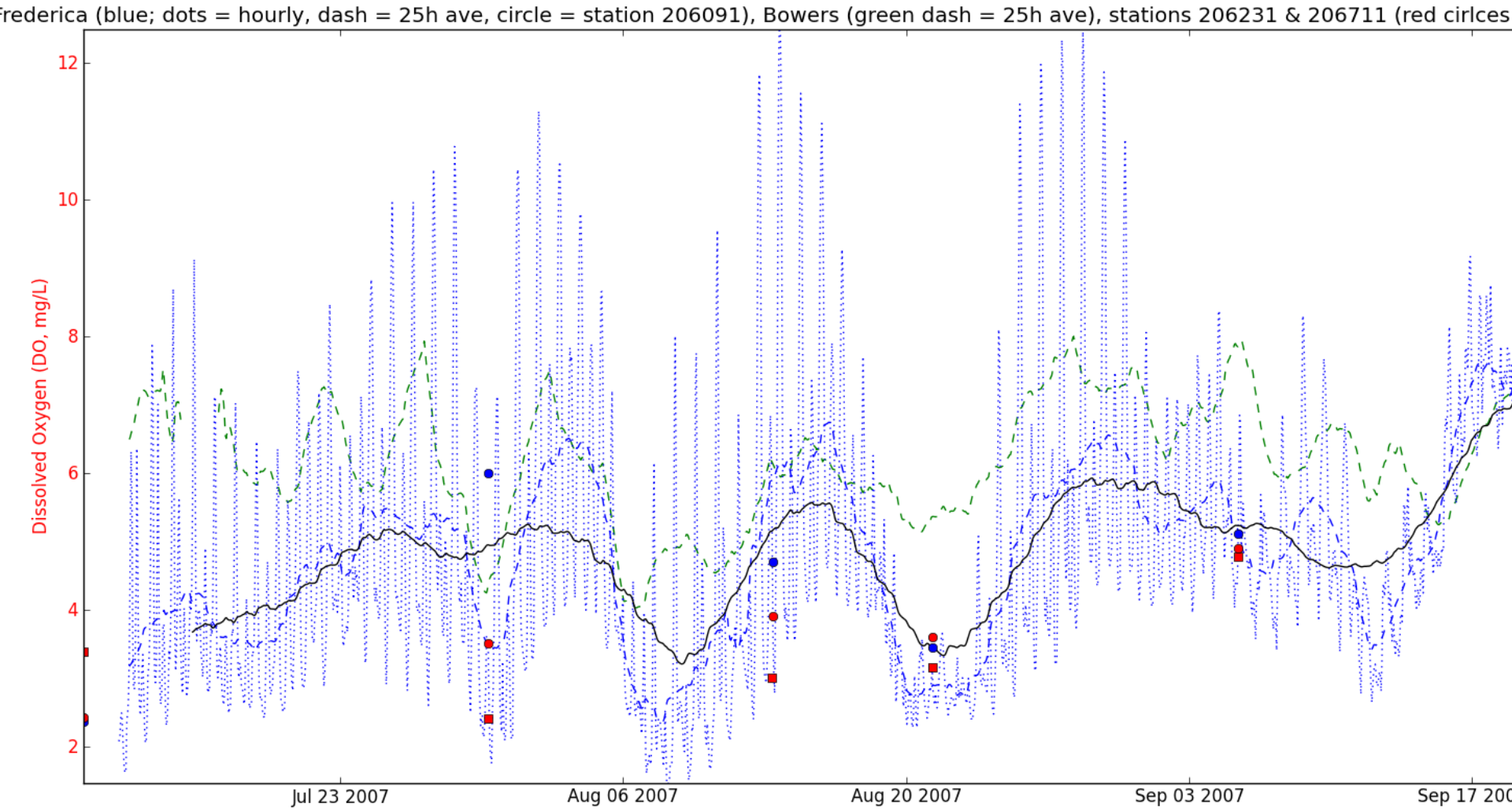
Calibrating Model



Grab vs. Continuous Data



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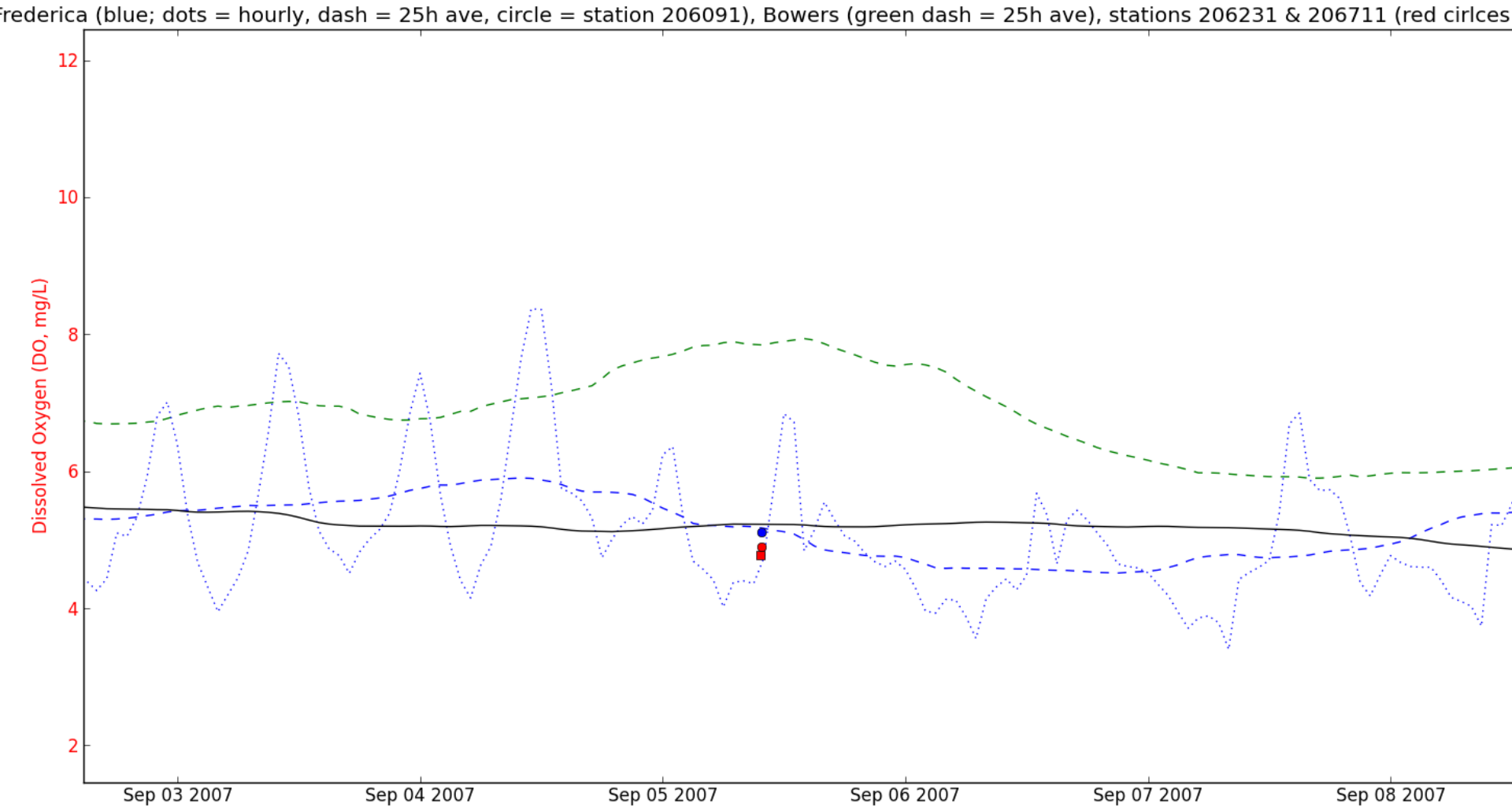

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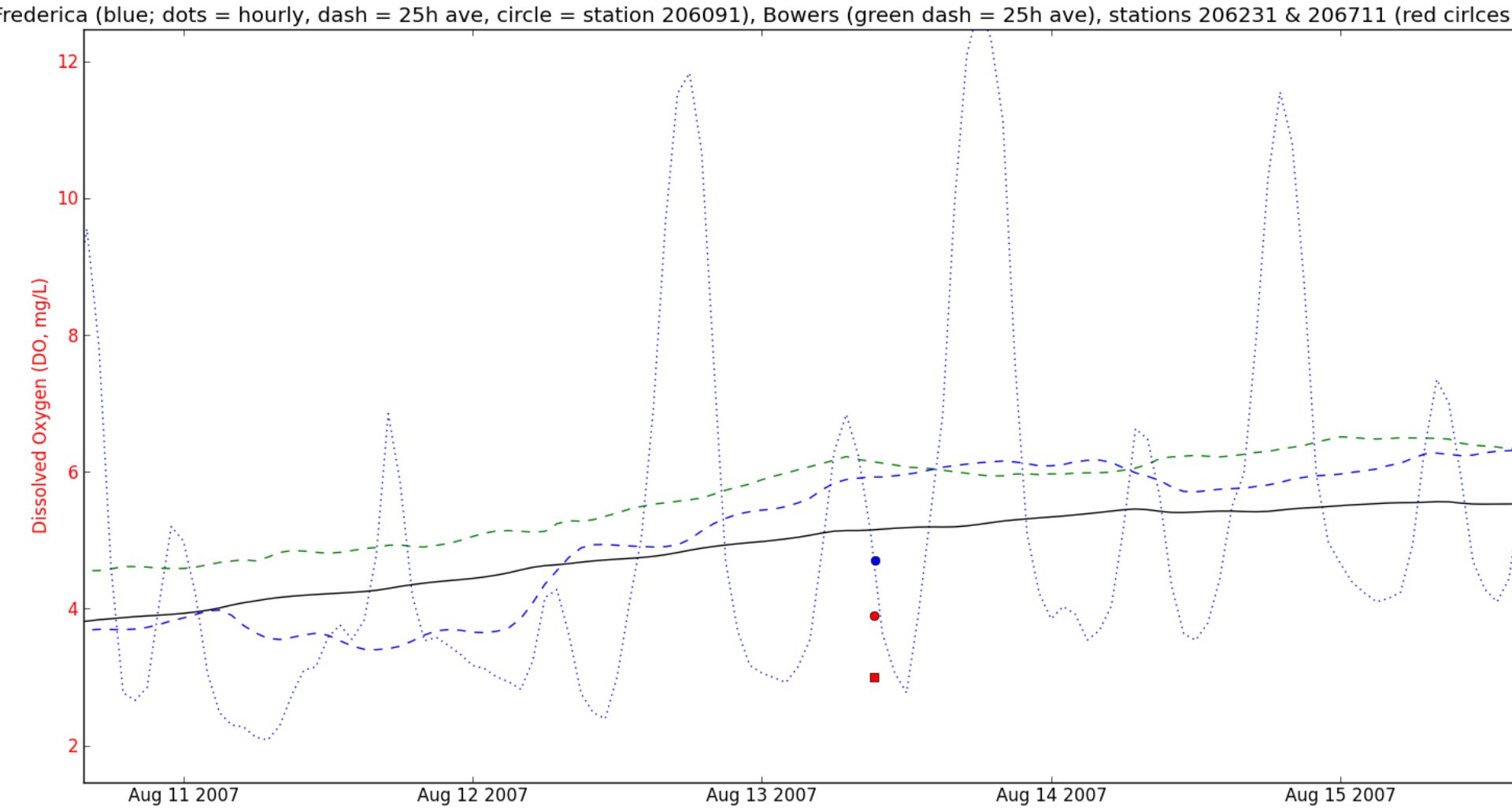

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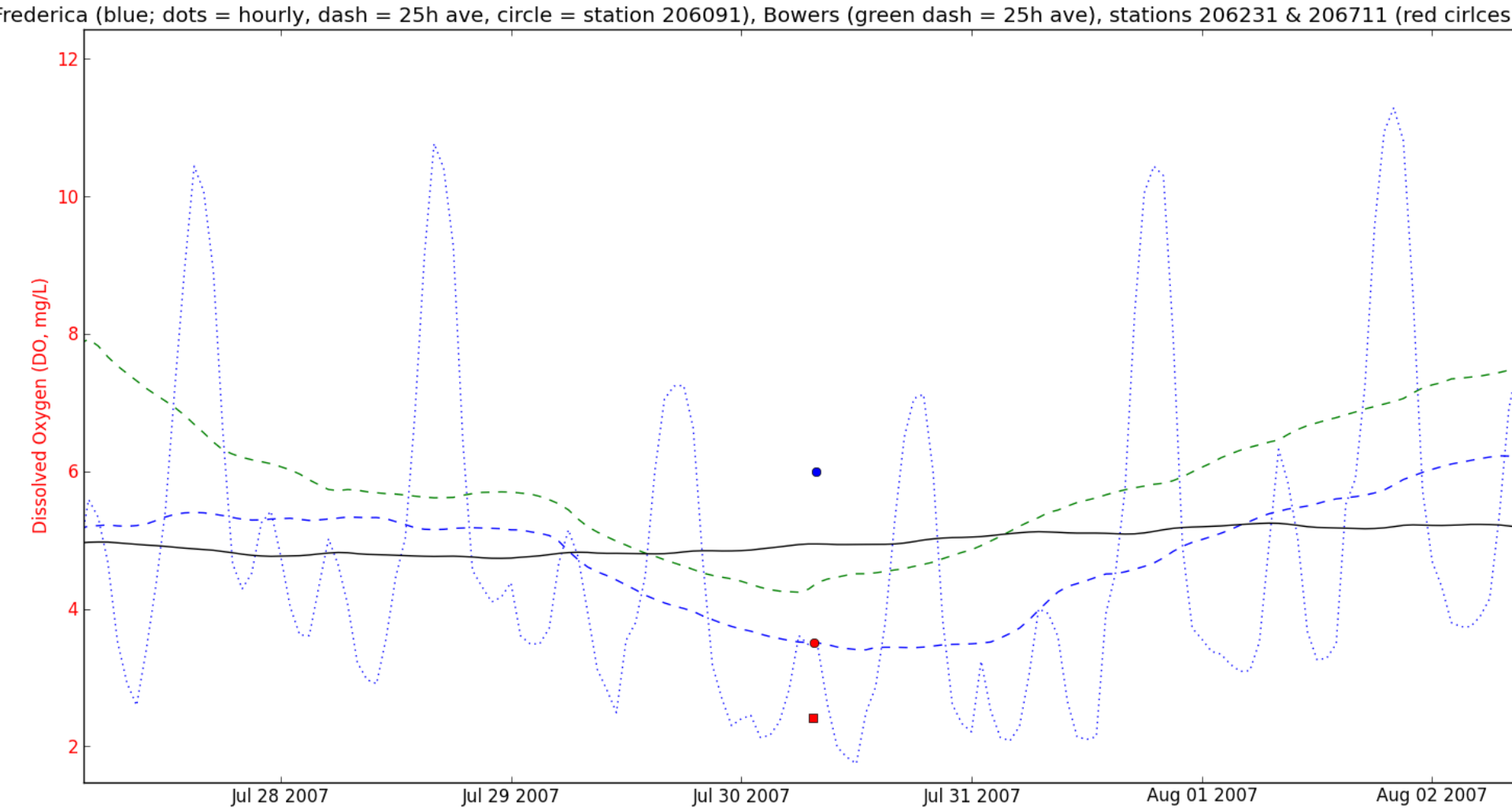

Thank You

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