engineering proceedings

Supplementary Materials

Effect of Temperature, Nutrients and Diuron on Freshwater River Biofilms: A Statistical Approach †

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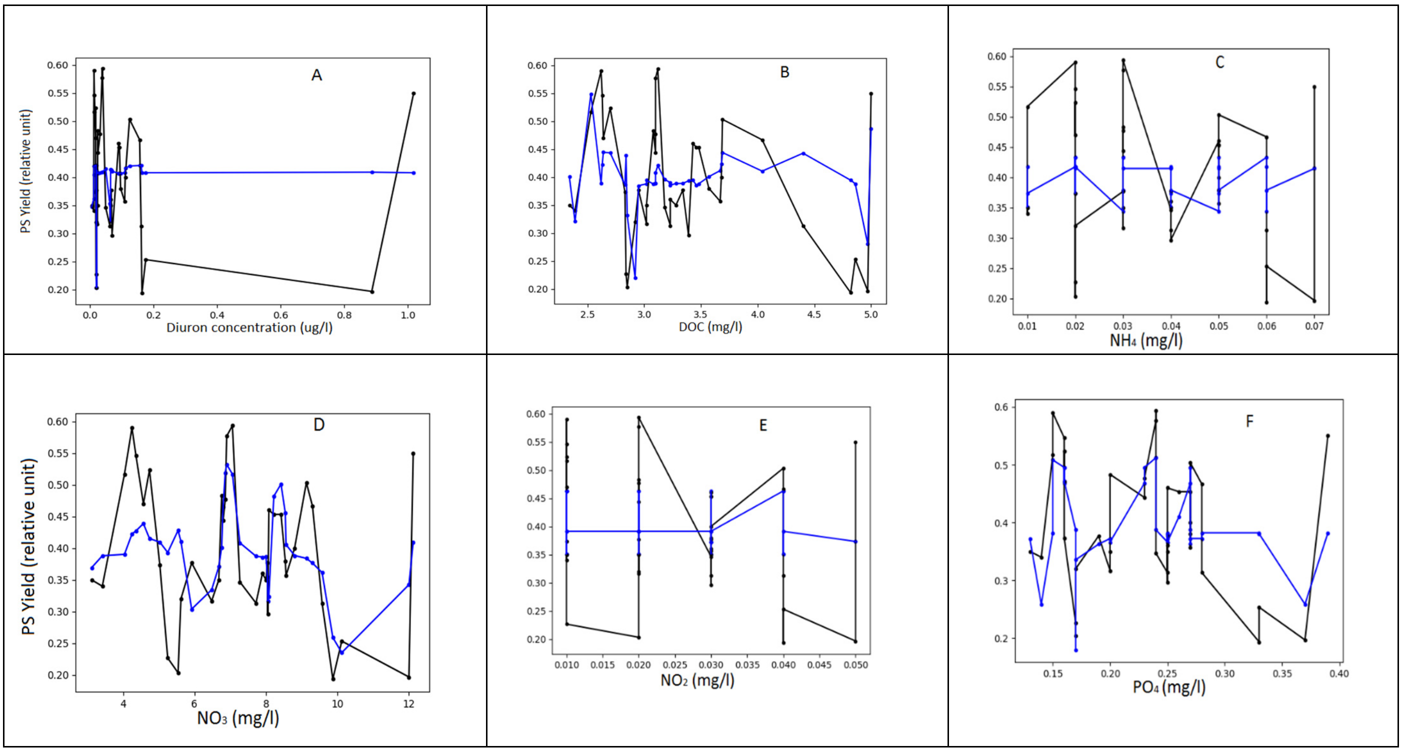
Sampling Details: Biofilm and water samples were collected from intermediate and downstream stations (~4 km apart) of the Morcille River in France [22] draining watershed areas of which 52% and 72% respectively were vineyards. Biofilm chlorophyll *a*, PS yield and dry weight were measured every month. Water temperature, suspended matter (SM), dissolved organic carbon (DOC), nutrients (NH_4, NO_2, NO_3, PO_4, Si) and diuron concentrations in the water were expressed as monthly average except in September and December 2008, December 2010 and November 2011 [13,14].



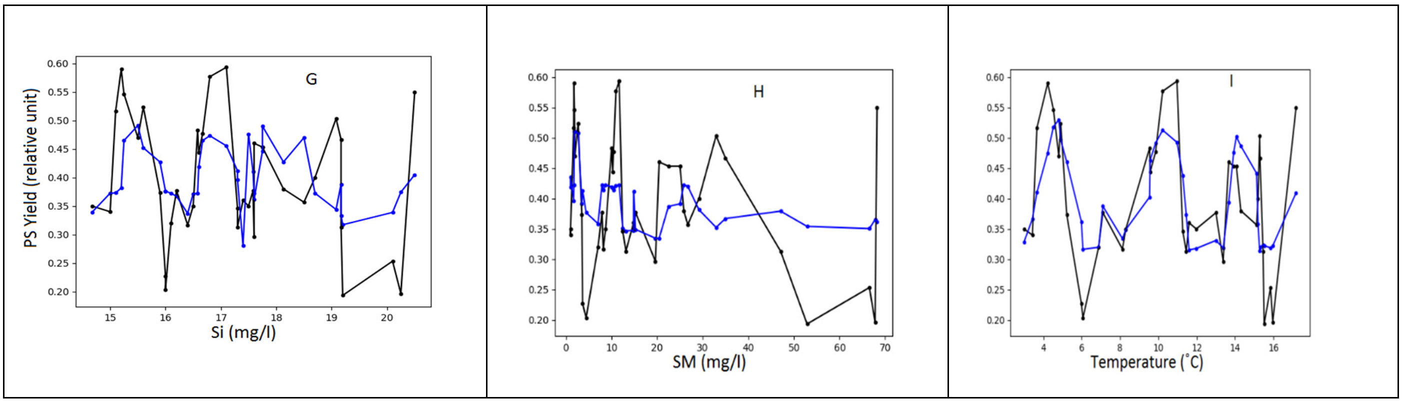
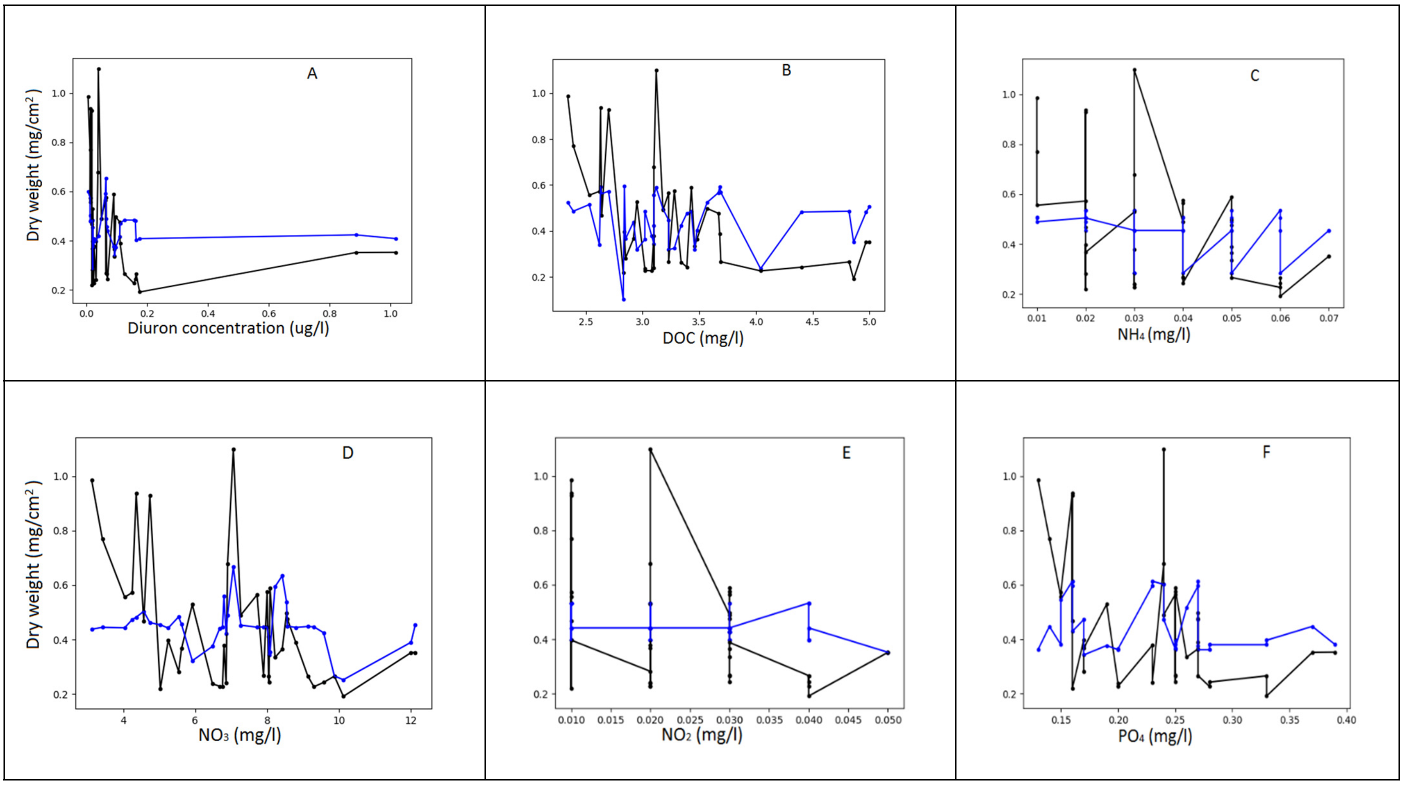


Figure S1. Dependent variable (PS Yield) of intermediate station plotted against the independent variables A. Diuron concentration, B. Dissolved Organic Carbon (DOC), C. NH_4 concentration, D. NO_3 concentration, E. NO_2 concentration, F. PO_4 concentration, G. Si concentration, H. Suspended Matter (SM) and I. Temperature as black lines. Blue lines are plotted after applying basis functions to reduce the effects of non-linearity and understand the relationship between the dependent variable and independent variables.



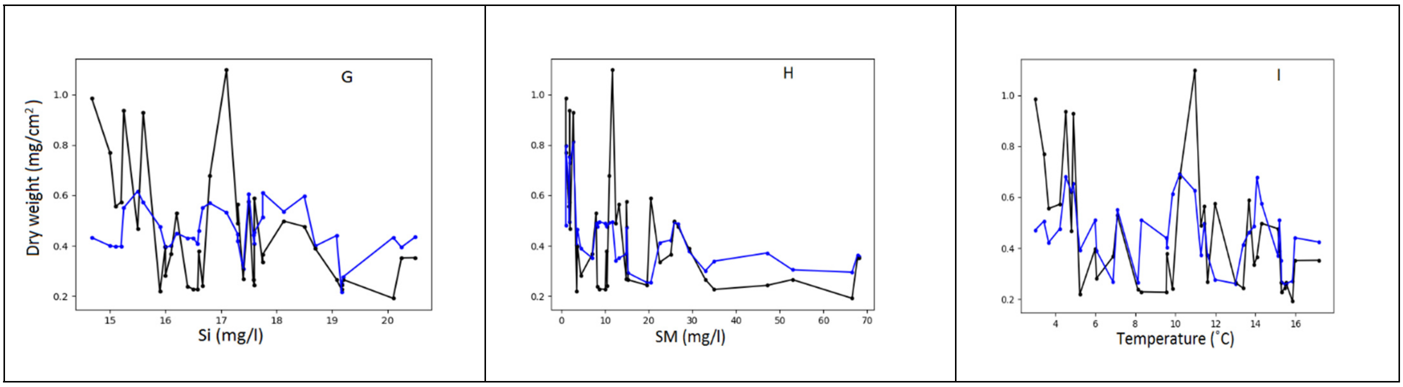


Figure S2. Dependent variable (dry weight) of intermediate station plotted against the independent variables A. Diuron concentration, B. Dissolved Organic Carbon (DOC), C. NH_4 concentration, D. NO_3 concentration, E. NO_2 concentration, F. PO_4 concentration, G. Si concentration, H. Suspended Matter (SM) and I. Temperature as black lines. Blue lines are plotted after applying basis functions to reduce the effects of non-linearity and understand the relationship between the dependent variable and independent variables.

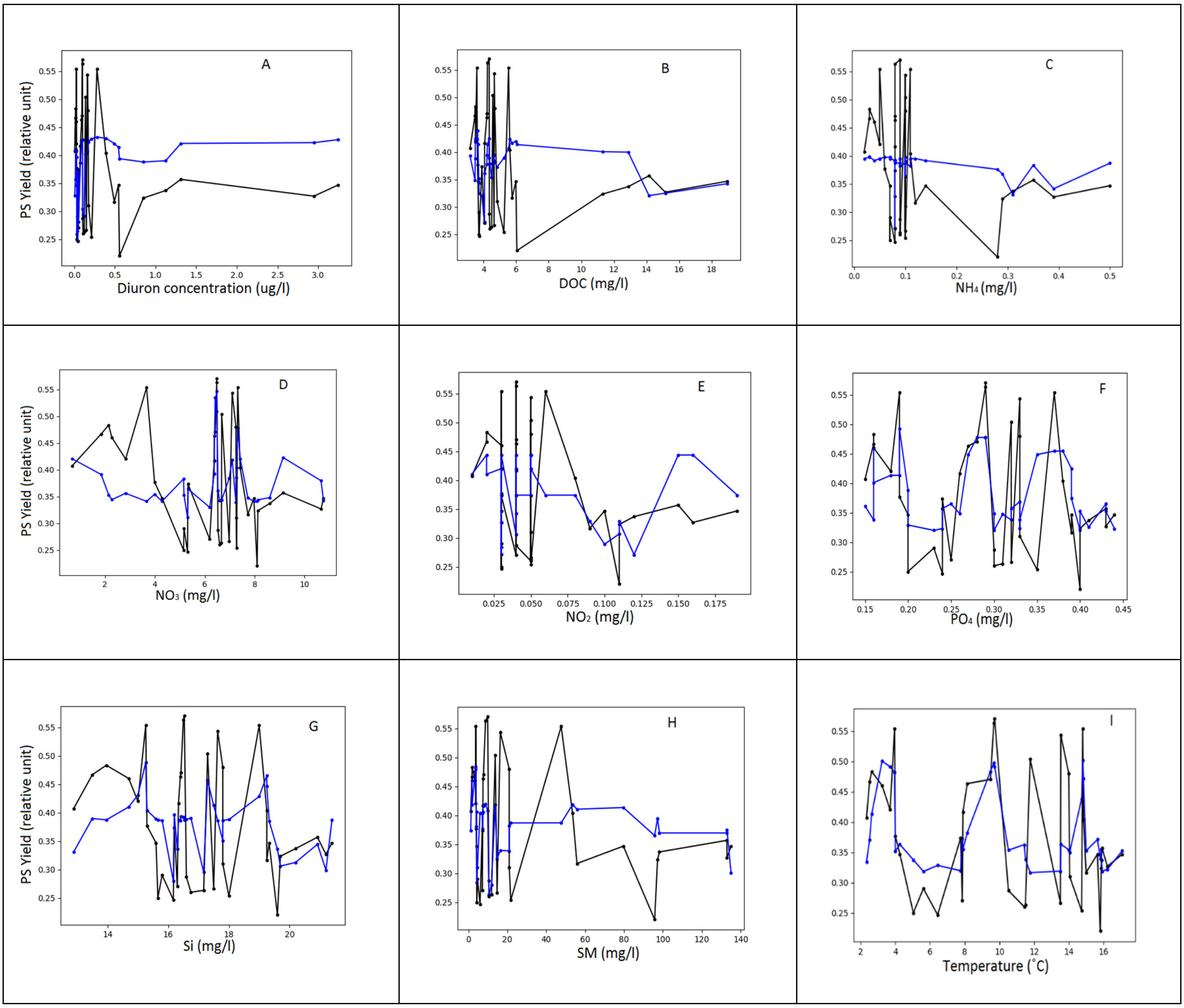


Figure S3. Dependent variable (PS Yield) of downstream station plotted against the independent variables A. Diuron concentration, B. Dissolved Organic Carbon (DOC), C. NH_4 concentration, D. NO_3 concentration, E. NO_2 concentration, F. PO_4 concentration, G. Si concentration, H. Suspended Matter (SM) and I. Temperature as black lines. Blue lines are plotted after applying basis functions to reduce the effects of non-linearity and understand the relationship between the dependent variable and independent variables.

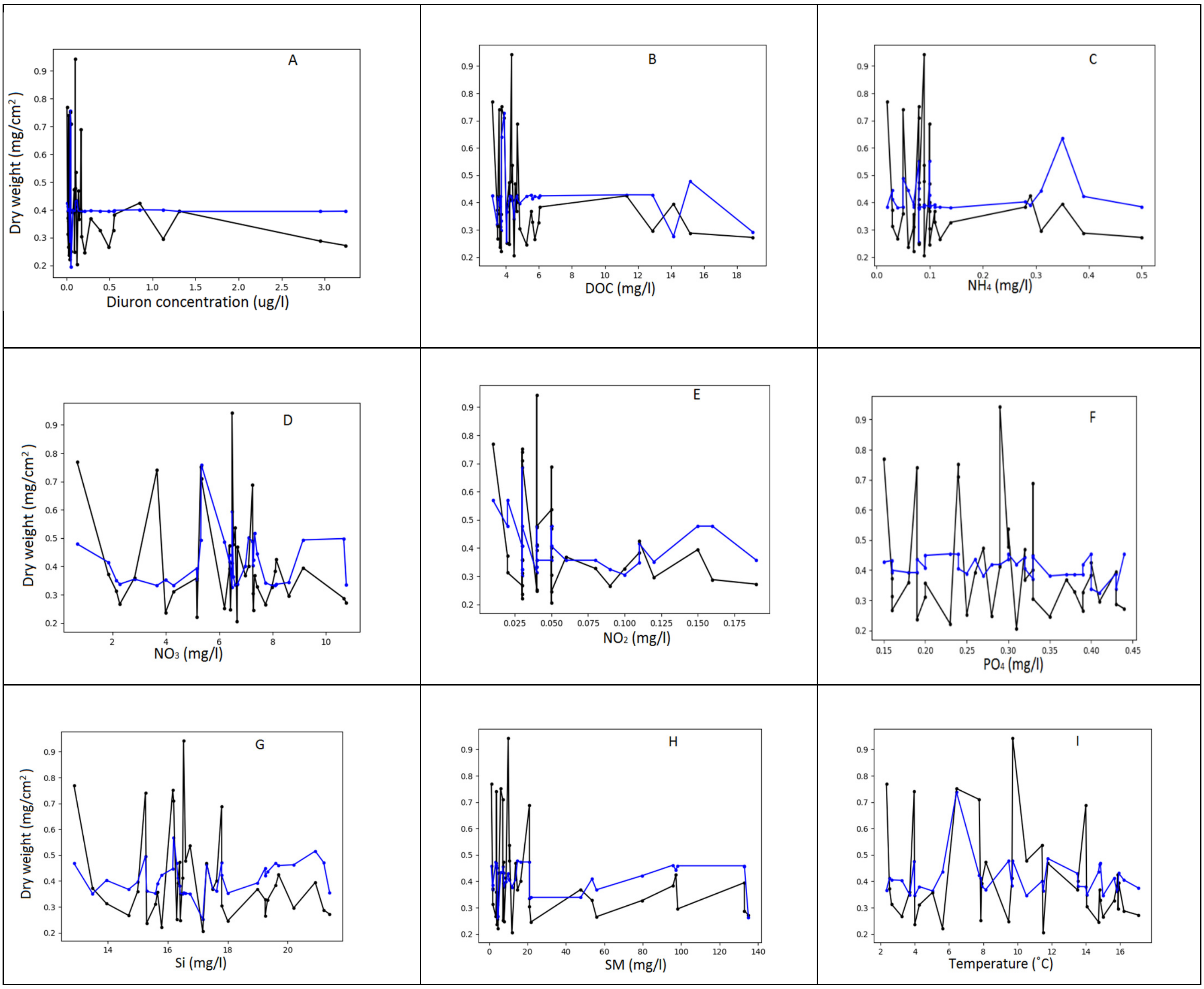


Figure S4. Dependent variable (dry weight) of downstream station plotted against the independent variables A. Diuron concentration, B. Dissolved Organic Carbon (DOC), C. NH_4 concentration, D. NO_3 concentration, E. NO_2 concentration, F. PO_4 concentration, G. Si concentration, H. Suspended Matter (SM) and I. Temperature as black lines. Blue lines are plotted after applying basis functions to reduce the effects of non-linearity and understand the relationship between the dependent variable and independent variables.

Table S1. Coefficients of basis functions (dependent variable: dry weight).

Intermediate station									
Coefficients	y(1)	y(2)	y(3)	y(4)	y(5)	y(6)	y(7)	y(8)	y(9)
a_0	3.4018	−21.184	−7370.63	−154.52	0.191451	2.7752	−0.7155	0.308018	−2.6842
a_1	−3.07e+00	455.47	2.07e+03	2.08e+02	6.617e−02	-4.37e+02	1.95e+02	6.5941	2.52e+00
a_2	1.10e+00	−3643.36	−2.32e+02	−1.10e+02	−4.61e−03	2.70e+04	−1.06e+04	−88.533	−6.79e−01
a_3	−1.81e−01	13942.62	1.30e+01	2.85e+01	1.085e−04	−7.34e+05	2.34e+05	473.033	8.13e−02
a_4	1.39e−02	−25694.98	−3.62e−01	−3.64e+00	−7.34e−07	9.13e+06	−1.81e+06	−733.60	−4.45e−03
a_5	−4.06e−04	18334.64	4.02e−03	1.83e−01	−6.95e−10	−4.25e+07	−2.74e+05	341.98	9.08e−05
Downstream station									
Coefficients	y(1)	y(2)	y(3)	y(4)	y(5)	y(6)	y(7)	y(8)	y(9)
a_0	1.2864	0.38986	−996.76	−1.3602	0.4873	0.8732	0.8219	0.39736	−1.117
a_1	−1.09e+00	10.668	2.948e+02	1.188e+00	−7.41e−03	−14.725	−1.46e+01	−0.0977	1.205e+00
a_2	5.525e−01	−151.36	−3.45e+01	−2.73e−01	−2.56e−05	153.033	9.60e+01	0.91326	−3.30e−01
a_3	−1.25e−01	765.26	2.014e+00	2.58e−02	2.33e−06	−666.487	5.47e+02	−1.4842	4.051e−02
a_4	1.26e−02	−1628.75	−5.82e−02	−1.028e−03	−1.40e−08	1287.328	−7.48e+03	0.7107	−2.28e−03
a_5	−4.61e−04	1237.23	6.68e−04	1.38e−05	6.25e−12	−917.194	1.98e+04	−0.1030	4.845e−05

Table S2. Coefficients of basis functions (dependent variable: PS yield).

Intermediate station									
Coefficients	y(1)	y(2)	y(3)	y(4)	y(5)	y(6)	y(7)	y(8)	y(9)
a_0	0.38276	−15.3727	−4769.31	−81.308	0.3109	0.3482	−0.4467	0.4072	0.7184
a_1	−3.70e−01	365.056	1.35e+03	123.16	2.55e−02	−3.57e+00	1.37e+02	−1.51e−01	−1.12e−01
a_2	1.90e−01	−3224.589	−1.54e+02	−73.209	−1.89e−03	3.76e+02	−7.168e+03	1.16e+01	2.23e−02
a_3	−3.65e−02	13684.17	8.683e+00	21.462	5.061e−05	−5.79e+03	1.502e+05	−1.07e+02	−2.21e−03
a_4	3.06e−03	−28036.67	−2.447e−01	−3.1037	−5.435e−07	−2.55e+04	−1.098e+06	1.86e+02	8.90e−05
a_5	−9.38e−05	22241.97	2.753e−03	0.177	2.004e−09	5.99e+05	−1.66e+05	−9.02e+01	−1.00e−06
Downstream station									
Coefficients	y(1)	y(2)	y(3)	y(4)	y(5)	y(6)	y(7)	y(8)	y(9)
a_0	0.6131	4.6599	−723.611	0.6405	0.2988	0.3611	−0.0356	0.4335	0.0637
a_1	−5.61e−01	−85.30	2.15e+02	−7.705e−02	2.376e−02	1.3911	4.17e+01	−0.24177	3.82e−01
a_2	3.368e−01	−681.18	−2.54e+01	3.196e−03	−1.47e−03	−15.38	−1.24e+03	−0.2514	−1.14e−01
a_3	−7.98e−02	−2646.66	1.49e+00	4.369e−04	3.11e−05	41.25	1.50e+04	0.5380	1.38e−02
a_4	8.116e−03	4943.646	−4.36e−02	−3.94e−05	−2.61e−07	−2.71	−7.97e+04	−0.2579	−7.54e−04
a_5	−2.93e−04	−3548.46	5.061e−04	8.417e−07	7.54e−10	−61.65	1.54e+05	0.0377	1.505e−05

Table S3. Multiple linear regression model parameters for intermediate station data (dependent variable: dry weight).

Coefficients	**Estimate**	**Standard Error**	**t Value**	**Pr(>|t|)**
A	−0.9910	0.380	−2.607	0.014
B (NO_3)	0.3661	0.437	0.837	0.410
C (PO_4)	−0.2816	0.509	−0.553	0.585
D (Si)	0.4538	0.414	1.096	0.282
E (DOC)	0.6047	0.280	2.157	0.040
F (SM)	0.4058	0.300	1.351	0.188

G (NH_4)	0.5150	0.346	1.489	0.148
H (NO_2)	0.0258	0.569	0.045	0.964
I (Diuron)	0.8068	0.442	1.827	0.078
J (Temp.)	0.3134	0.356	0.880	0.387
dF Residuals	28			
Multiple R squared	0.601			
Adjusted R squared	0.472			
Residual standard error	0.1724			
F statistics	4.678			
p value	0.000765			

Table S4. Multiple linear regression model parameters for downstream station data (dependent variable: dry weight).

Coefficients	Estimate	Standard Error	t Value	Pr(>|t|)
A	−1.4242	0.453	−3.142	0.004
B (NO_3)	0.6483	0.312	2.076	0.048
C (PO_4)	1.8391	0.819	2.246	0.033
D (Si)	0.2286	0.492	0.465	0.646
E (DOC)	0.2887	0.745	0.387	0.701
F (SM)	0.8679	0.483	1.796	0.084
G (NH_4)	0.1028	0.569	0.180	0.858
H (NO_2)	0.2745	0.375	0.731	0.471
I (Diuron)	−0.0205	0.770	−0.027	0.979
J (Temp.)	0.2443	0.417	0.586	0.563
dF Residuals	27			
Multiple R squared	0.531			
Adjusted R squared	0.375			
Residual standard error	0.1421			
F statistics	3.396			
p value	0.00656			

Table S5. Multiple linear regression model parameters for intermediate station data (dependent variable: PS yield).

Coefficients	Estimate	Standard Error	t Value	Pr(>|t|)
A	−0.6479	0.247	−2.624	0.014
B (NO_3)	0.7198	0.320	2.246	0.033
C (PO_4)	0.4172	0.320	1.305	0.203
D (Si)	−0.4817	0.437	−1.103	0.279
E (DOC)	0.5038	0.251	2.004	0.055
F (SM)	−0.1507	0.336	−0.448	0.657
G (NH_4)	0.1421	0.538	0.264	0.793
H (NO_2)	0.8462	0.286	2.958	0.006
I (Diuron)	0.3746	0.430	0.872	0.391
J (Temp.)	0.2594	0.390	0.665	0.511
dF Residuals	28			
Multiple R squared	0.714			

Adjusted R squared	0.622
Residual standard error	0.0681
F statistics	7.774
p value	1.21e−05

Table S6. Multiple linear regression model parameters for downstream station data (dependent variable: PS yield).

Coefficients	Estimate	Standard Error	t Value	Pr(>|t|)
A	−0.5283	0.206	−2.563	0.016
B (NO_3)	0.5727	0.324	1.769	0.088
C (PO_4)	0.2116	0.383	−0.553	0.585
D (Si)	0.2680	0.335	0.800	0.431
E (DOC)	0.1210	0.546	0.222	0.826
F (SM)	0.5933	0.294	2.017	0.054
G (NH_4)	0.2020	0.622	0.325	0.748
H (NO_2)	0.4753	0.290	1.637	0.113
I (Diuron)	0.0887	0.337	0.263	0.795
J (Temp.)	0.2746	0.338	0.813	0.424
dF Residuals	27			
Multiple R squared	0.629			
Adjusted R squared	0.505			
Residual standard error	0.0734			
F statistics	5.087			
p value	0.000464			