

Appendix 2.4A: Example GAM Models

TF5.5A

Total Phosphorus - Linear Trend with Seasonality

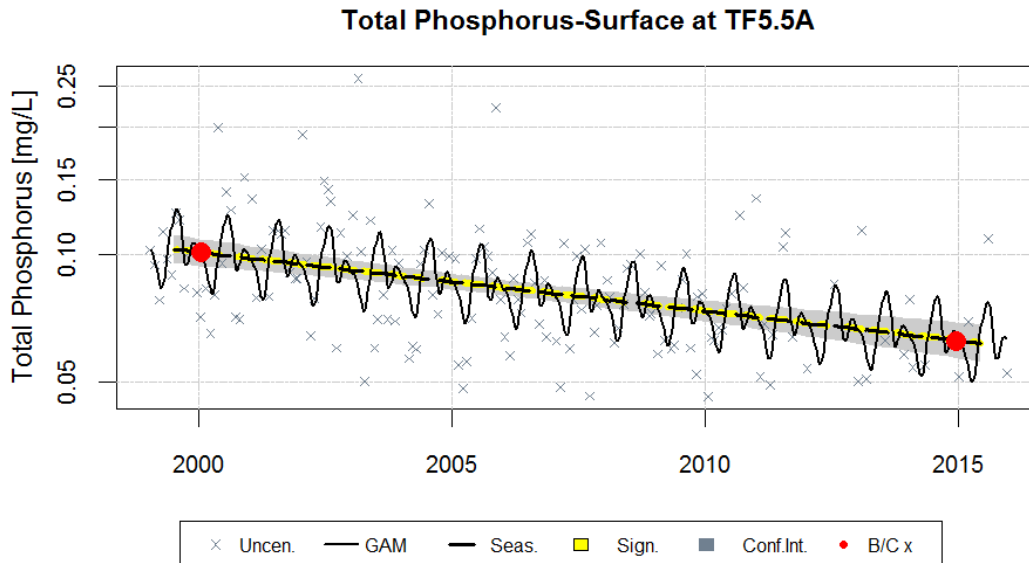


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	39.8513	<0.0001
smoothed terms	s(doy)	6.05	4.3454	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	-2.533925	0.022513	-112.5552	<0.0001
cyear	-0.032019	0.005072	-6.3128	<0.0001

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
41.04	0.2674	0.3121

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	-2.2935 (0.1009)
Current log mean (geometric mean)	-2.7738 (0.0624)
Estimated log difference	-0.4803
Std. Err. log difference	0.0761
95% Confidence interval for log difference	(-0.6294 , -0.3312)
Difference p-value	<0.0001
Period of Record Percent Change Estimate (%)	-38.14%

Total Phosphorus - Non-linear Trend with Seasonality

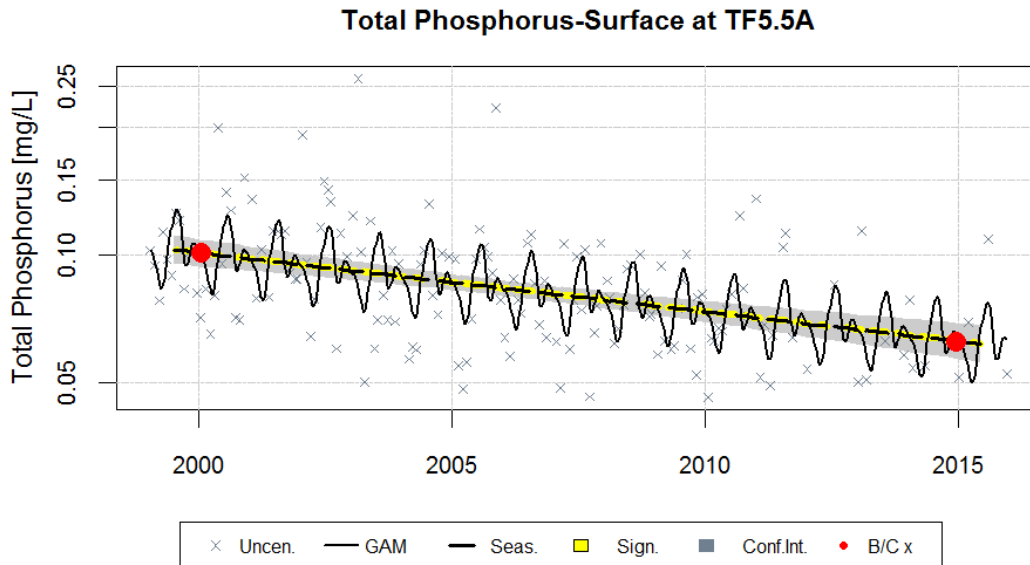


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	0.0039	0.9504
smoothed terms	s(cyear)	0.00	0.0000	0.8461
" "	s(doy)	6.05	4.3454	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	-2.533925	0.704786	-3.5953	0.0004
cyear	-0.032019	0.513656	-0.0623	0.9504

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
41.04	0.2674	0.3121

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	-2.2935 (0.1009)
Current log mean (geometric mean)	-2.7738 (0.0624)
Estimated log difference	-0.4803
Std. Err. log difference	0.0761
95% Confidence interval for log difference	(-0.6294 , -0.3312)
Difference p-value	<0.0001
Period of Record Percent Change Estimate (%)	-38.14%

Total Phosphorus - Non-linear trend with Seas+Int

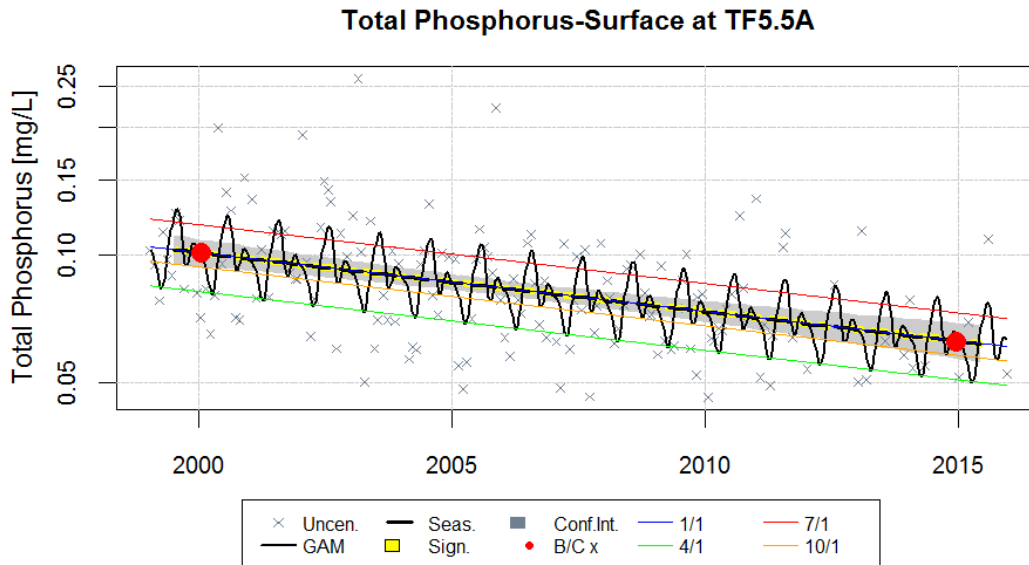


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	0.7422	0.3904
smoothed terms	s(cyear)	0.00	0.0000	0.8416
" "	s(doy)	6.09	4.3629	<0.0001
" "	ti(cyear,doy)	0.00	0.0000	0.6255

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	-2.533933	0.055294	-45.8266	<0.0001
cyear	-0.032025	0.037173	-0.8615	0.3904

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
41.04	0.2674	0.3123

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	-2.2935 (0.1009)
Current log mean (geometric mean)	-2.7738 (0.0624)
Estimated log difference	-0.4804
Std. Err. log difference	0.0761
95% Confidence interval for log difference	(-0.6295 , -0.3313)
Difference p-value	<0.0001
Period of Record Percent Change Estimate (%)	-38.14%

CB4.1E

Secchi Depth - Linear Trend with Seasonality

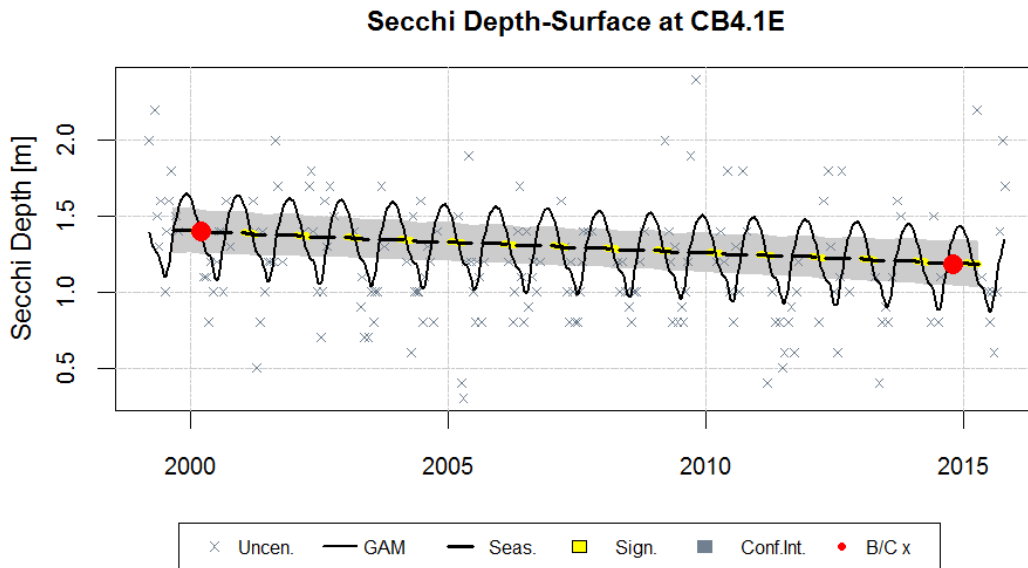


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	6.6221	0.0109
smoothed terms	s(doy)	4.08	3.9462	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	1.169588	0.025777	45.3740	<0.0001
cyear	-0.014192	0.005515	-2.5733	0.0109

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
138.64	0.3458	0.1615

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline mean	1.4008
Current mean	1.1879
Estimated difference	-0.2129
Std. Err. difference	0.0827
95% Confidence interval for difference	(-0.375 , -0.0507)
Difference p-value	0.0109
Period of Record Percent Change Estimate (%)	-15.2%

Secchi Depth - Non-linear Trend with Seasonality

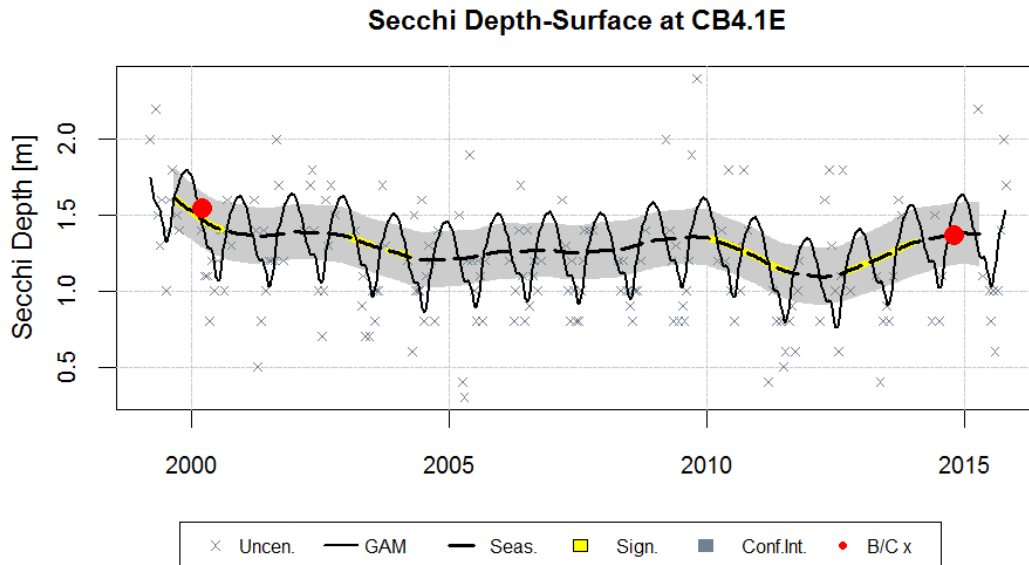


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	3.1000	0.0801
smoothed terms	s(cyear)	7.08	2.6745	0.0036
" "	s(doy)	4.67	4.5861	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	1.074828	0.063547	16.9138	<0.0001
cyear	-0.171406	0.097352	-1.7607	0.0801

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
128.79	0.33	0.2362

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline mean	1.5475
Current mean	1.3658
Estimated difference	-0.1817
Std. Err. difference	0.1017
95% Confidence interval for difference	(-0.381, 0.0176)
Difference p-value	0.0756
Period of Record Percent Change Estimate (%)	-11.74%

Secchi Depth - Non-linear trend with Seas+Int

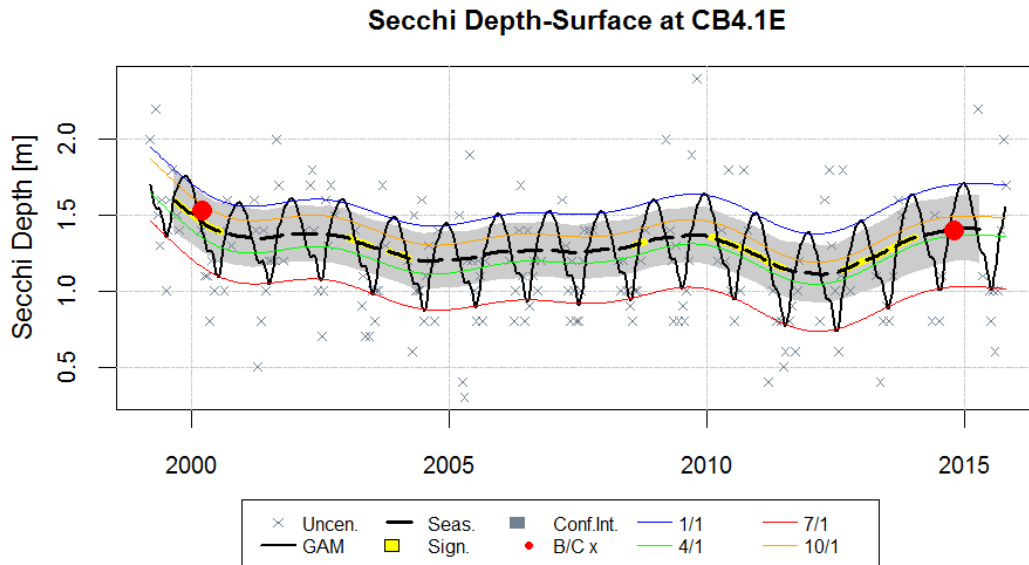


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	3.8080	0.0527
smoothed terms	s(cyear)	7.12	2.7721	0.0028
" "	s(doy)	4.69	4.5840	<0.0001
" "	ti(cyear,doy)	0.88	0.1082	0.2498

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	1.073406	0.059560	18.0222	<0.0001
cyear	-0.175714	0.090045	-1.9514	0.0527

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
128.42	0.3289	0.2414

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline mean	1.5303
Current mean	1.4008
Estimated difference	-0.1295
Std. Err. difference	0.1164
95% Confidence interval for difference	(-0.3577 , 0.0986)
Difference p-value	0.2673
Period of Record Percent Change Estimate (%)	-8.46%

CB6.2

Chlorophyll a (Corrected) - Linear Trend with Seasonality

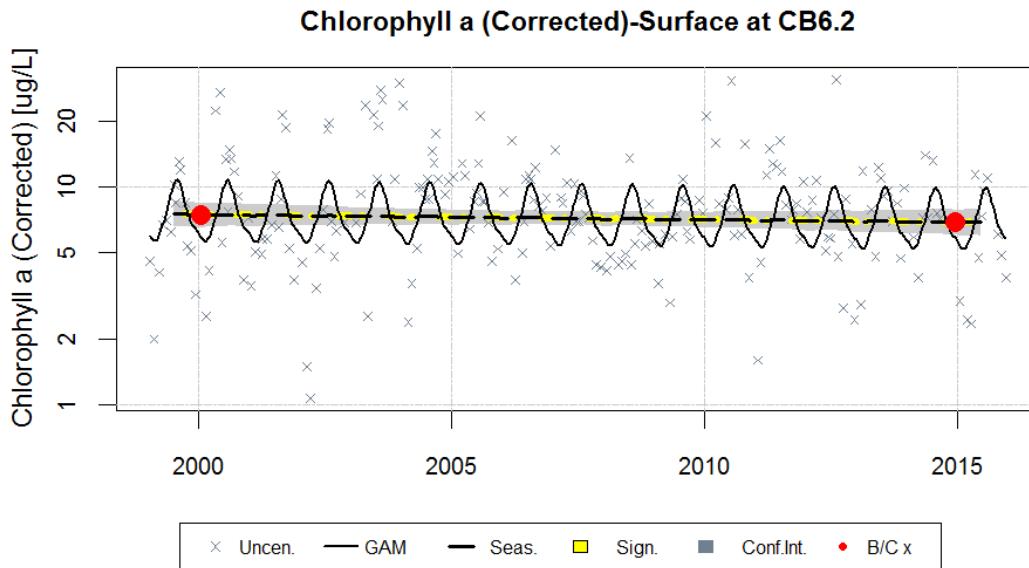


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	0.5036	0.4787
smoothed terms	s(doy)	3.64	5.3451	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	2.023331	0.035806	56.5077	<0.0001
cyear	-0.005341	0.007525	-0.7097	0.4787

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
347.59	0.5278	0.1621

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	2.0086 (7.4525)
Current log mean (geometric mean)	1.9284 (6.8788)
Estimated log difference	-0.0801
Std. Err. log difference	0.1129
95% Confidence interval for log difference	(-0.3014 , 0.1411)
Difference p-value	0.4787
Period of Record Percent Change Estimate (%)	-7.7%

Chlorophyll a (Corrected) - Non-linear Trend with Seasonality

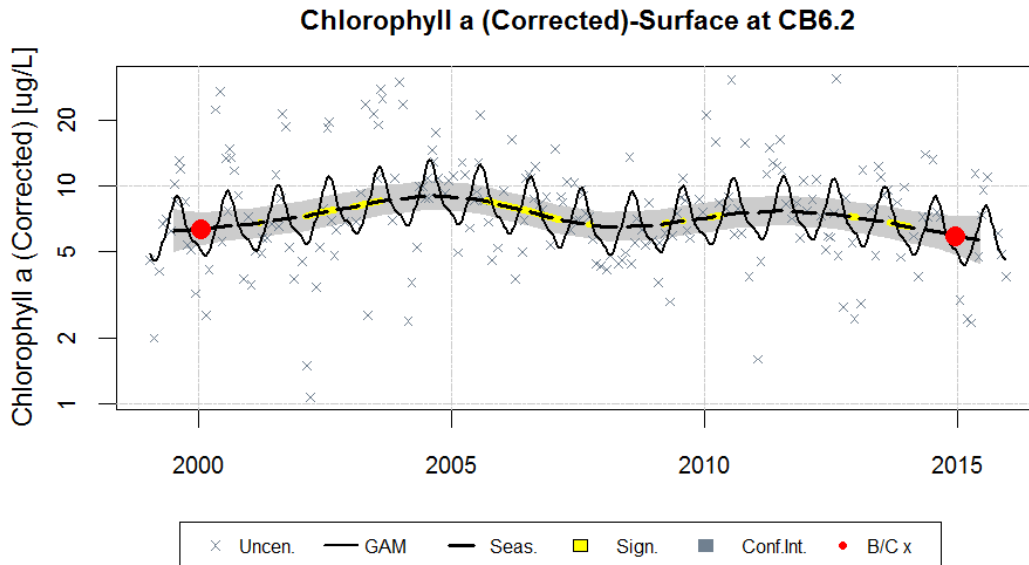


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	0.0995	0.7528
smoothed terms	s(cyear)	4.55	1.8782	0.0044
" "	s(doy)	4.01	5.6885	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	2.017516	0.041634	48.4585	<0.0001
cyear	-0.026478	0.083951	-0.3154	0.7528

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
338.62	0.5115	0.2131

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	1.8457 (6.3326)
Current log mean (geometric mean)	1.7744 (5.8968)
Estimated log difference	-0.0713
Std. Err. log difference	0.1391
95% Confidence interval for log difference	(-0.344 , 0.2013)
Difference p-value	0.6088
Period of Record Percent Change Estimate (%)	-6.88%

Chlorophyll a (Corrected) - Non-linear trend with Seas+Int

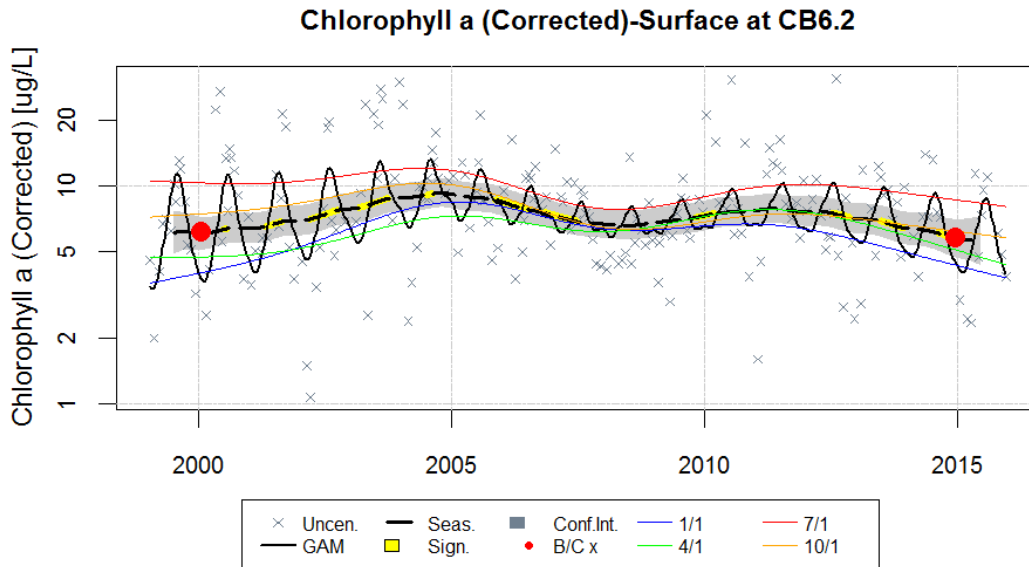


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	0.0390	0.8437
smoothed terms	s(cyear)	4.76	2.1028	0.0023
" "	s(doy)	3.90	5.9396	<0.0001
" "	ti(cyear,doy)	4.85	1.3595	0.0013

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	2.014683	0.063635	31.6602	<0.0001
cyear	-0.038909	0.197043	-0.1975	0.8437

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
326.43	0.4921	0.2715

Table: Estimates of Change from 1999-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	1.8143 (6.1368)
Current log mean (geometric mean)	1.7633 (5.8315)
Estimated log difference	-0.051
Std. Err. log difference	0.1364
95% Confidence interval for log difference	(-0.3183 , 0.2162)
Difference p-value	0.7086
Period of Record Percent Change Estimate (%)	-4.97%

Total Suspended Solids -- Surface

ET2.3

Total Suspended Solids - Linear Trend with Seasonality

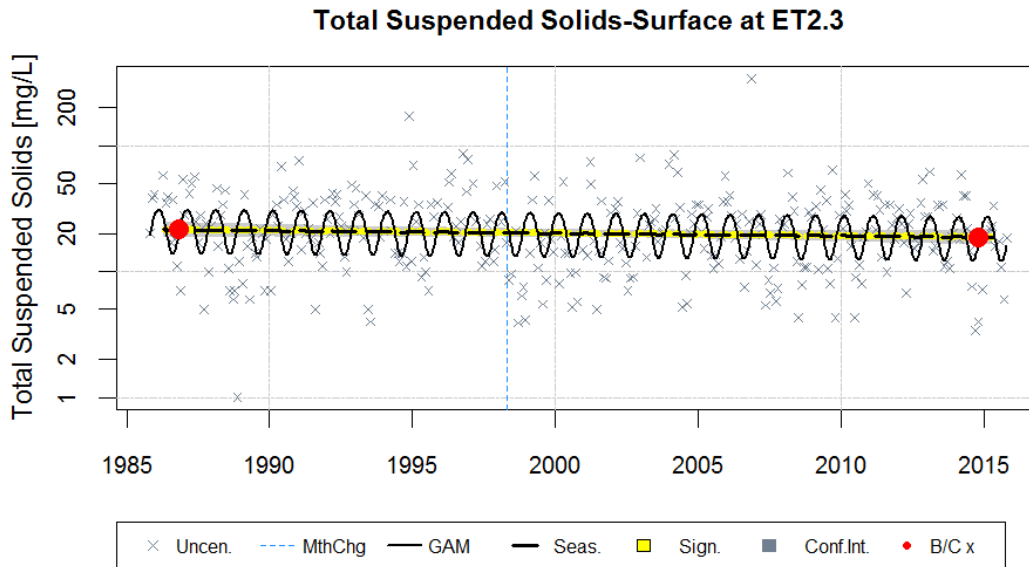


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1	1.2526	0.2639
smoothed terms	s(doy)	3	8.0492	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	2.977788	0.036770	80.9851	<0.0001
cyear	-0.004718	0.004215	-1.1192	0.2639

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
677.08	0.6679	0.1702

Table: Estimates of Change from 1985-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	3.0697 (21.5355)
Current log mean (geometric mean)	2.9329 (18.7819)
Estimated log difference	-0.1368
Std. Err. log difference	0.1222
95% Confidence interval for log difference	(-0.3764 , 0.1028)
Difference p-value	0.2639
Period of Record Percent Change Estimate (%)	-12.79%

Total Suspended Solids - Non-linear Trend with Seasonality

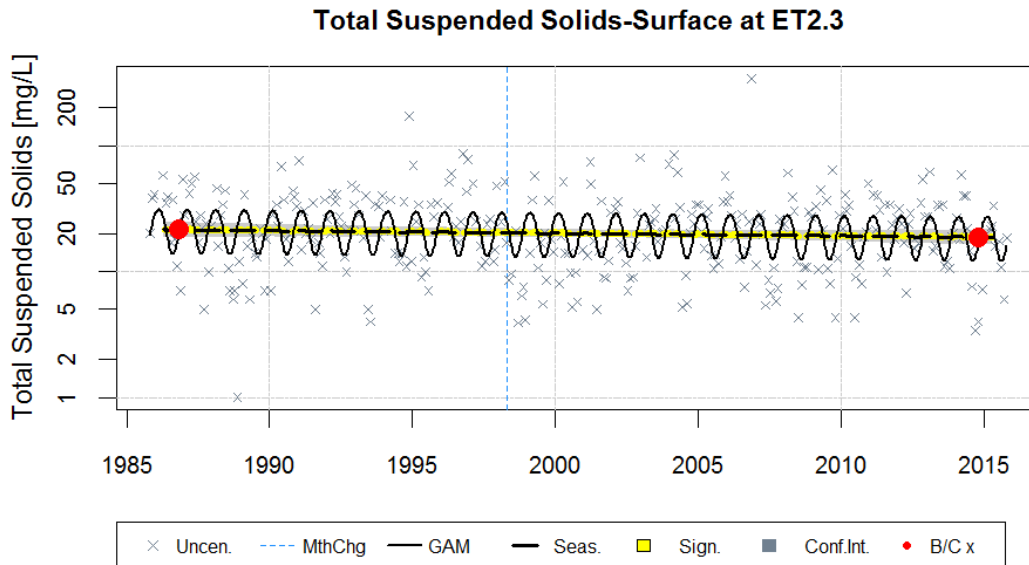


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	0.769	0.3812
smoothed terms	s(cyear)	0.00	0.000	0.8256
" "	s(doy)	3.03	8.074	<0.0001

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	2.977788	0.036769	80.9856	<0.0001
cyear	-0.004717	0.005379	-0.8769	0.3812

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
677.08	0.6679	0.1703

Table: Estimates of Change from 1985-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	3.0697 (21.5358)
Current log mean (geometric mean)	2.9329 (18.7824)
Estimated log difference	-0.1368
Std. Err. log difference	0.1222
95% Confidence interval for log difference	(-0.3764 , 0.1028)
Difference p-value	0.2639
Period of Record Percent Change Estimate (%)	-12.79%

Total Suspended Solids - Non-linear trend with Seas+Int

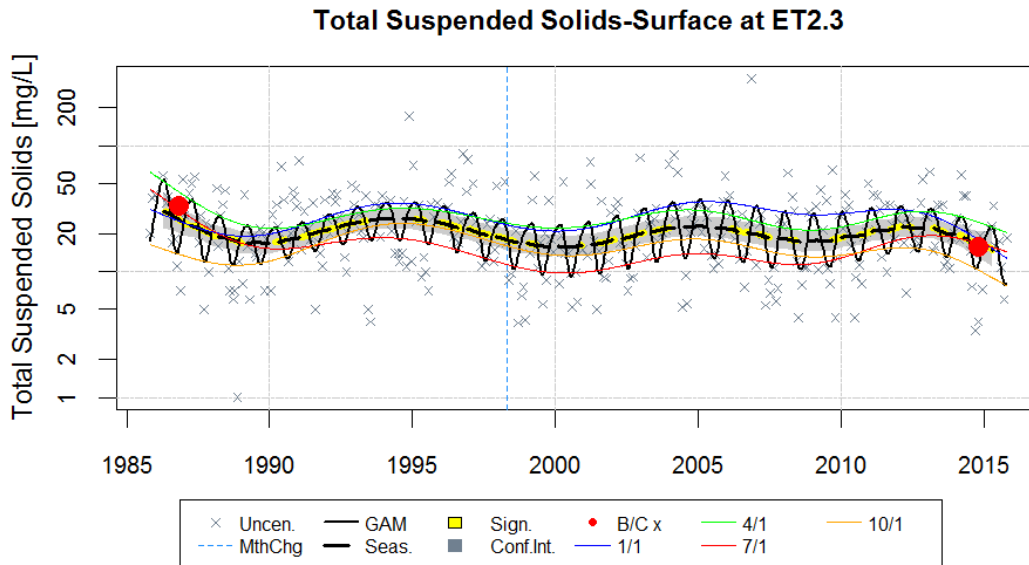


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	cyear	1.00	10.9521	0.0010
smoothed terms	s(cyear)	7.05	3.0362	0.0009
" "	s(doy)	2.95	8.5695	<0.0001
" "	ti(cyear,doy)	8.21	2.0124	0.0012

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	3.004954	0.035636	84.3245	<0.0001
cyear	-0.264432	0.079904	-3.3094	0.0010

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
653.92	0.6308	0.26

Table: Estimates of Change from 1985-2015.

Calculation	Estimate
Baseline log mean (geometric mean)	3.5074 (33.3601)
Current log mean (geometric mean)	2.7543 (15.7107)
Estimated log difference	-0.753
Std. Err. log difference	0.2401
95% Confidence interval for log difference	(-1.2237 , -0.2823)
Difference p-value	0.0019
Period of Record Percent Change Estimate (%)	-52.91%

Total Suspended Solids - Non-linear trend with Seas+Int. & Intervention

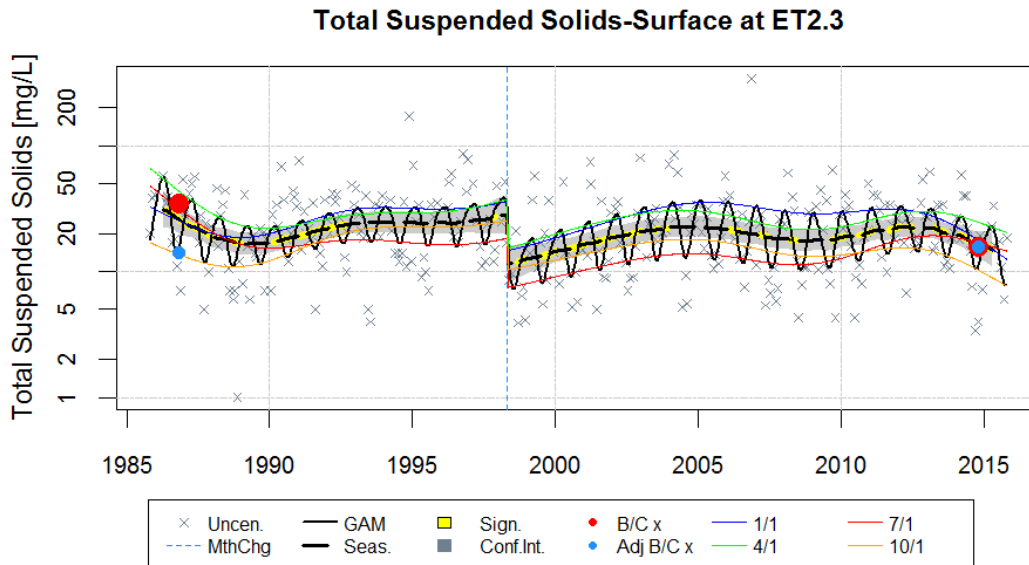


Table: GAM Analysis of Variance.

Type	Source	edf	F-stat	p-value
parametric terms	intervention	1.00	8.6706	0.0035
" "	cyear	1.00	13.4087	0.0003
smoothed terms	s(cyear)	6.96	3.2053	0.0005
" "	s(doy)	2.95	8.4719	<0.0001
" "	ti(cyear,doy)	8.36	2.0938	0.0010

Table: GAM Parameter Coefficients.

Parameter	Estimate	Std. Err.	t value	p-value
(Intercept)	3.539225	0.184741	19.1578	<0.0001
interventionB	-0.900829	0.305927	-2.9446	0.0035
cyear	-0.287998	0.078649	-3.6618	0.0003

Table: GAM Diagnostics.

AIC	RMSE	Adj. R-squared
647.08	0.6233	0.2773

Table: Estimates of Change from 1985-2015.

Calculation	Estimate	Adj. Estimate
Baseline log mean (geometric mean)	3.5512 (34.8554)	2.6504 (14.1594)
Current log mean (geometric mean)	2.7524 (15.6801)	2.7524 (15.6801)
Estimated log difference	-0.7988	0.102
Std. Err. log difference	0.2383	0.3776
95% Confidence interval for log difference	(-1.2658 , -0.3318)	(-0.6381 , 0.8421)
Difference p-value	0.0009	0.7872
Period of Record Percent Change Estimate (%)	-55.01%	10.74%