Appendix 1.7. Model Archive Summary for Calcium Concentration at U.S. Geological Survey site 07143672; Little Arkansas River at Highway 50 near Halstead, Kansas, during May 1998 through December 2019

This model archive summary summarizes the calcium model developed to compute hourly or daily calcium. Model development methods follow U.S. Geological Survey (USGS) guidance from Office of Surface Water/Office of Water Quality Technical Memoranda and USGS Techniques and Methods, book 3, chap. C4 (Rasmussen and others, 2009).

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Site and Model Information

Site Number: 07143672

Site Name: Little Arkansas River at Highway 50 near Halstead, Kansas

Location: Latitude 38°01'43", longitude 97°32'25" referenced to North American Datum of 1927, in NW 1/4 NE 1/4 NE 1/4 sec.28, T.23 S., R.2 W., Harvey County, Kansas, hydrologic unit 11030012.

Equipment: A Sutron Satlink II High Data Rate Collection Platform and a Design Analysis Water Log H350/355 nonsubmersible pressure transducer transfers real-time stage and water-quality data via satellite. The primary reference gage is a Type-A wire-weight gage located on the downstream bridge guardrail. Check-bar elevation is 33.396 feet. The orifice tube is enclosed in 1.25-inch steel conduit trenched into the ground down to the edge of water, where the orifice emerges from the bank and culminates in a 2-inch open-end orifice tethered to a steel fencepost near the left edge of water. Gage height was measured during May 1998 through December 2019. A YSI 6600 water-quality monitor equipped with water temperature, specific conductance, pH, dissolved oxygen, and turbidity (a YSI Model 6026 [December 1998 through December 2006] and YSI Model 6136 [July 2004 through December 2017]) sensors collected data during May 1998 through December 2017. A YSI EXO2 water-quality monitor equipped with water temperature, specific conductance, pH, dissolved oxygen, turbidity, and fluorescent dissolved organic matter sensors collected data during January 2017 through December 2019. A Hach Nitratax monitor collected nitrate data during February 2017 through December 2019.

Date model was developed: June 1, 2020

Model calibration data period: May 12, 1998 through December 10, 2019

Model Data

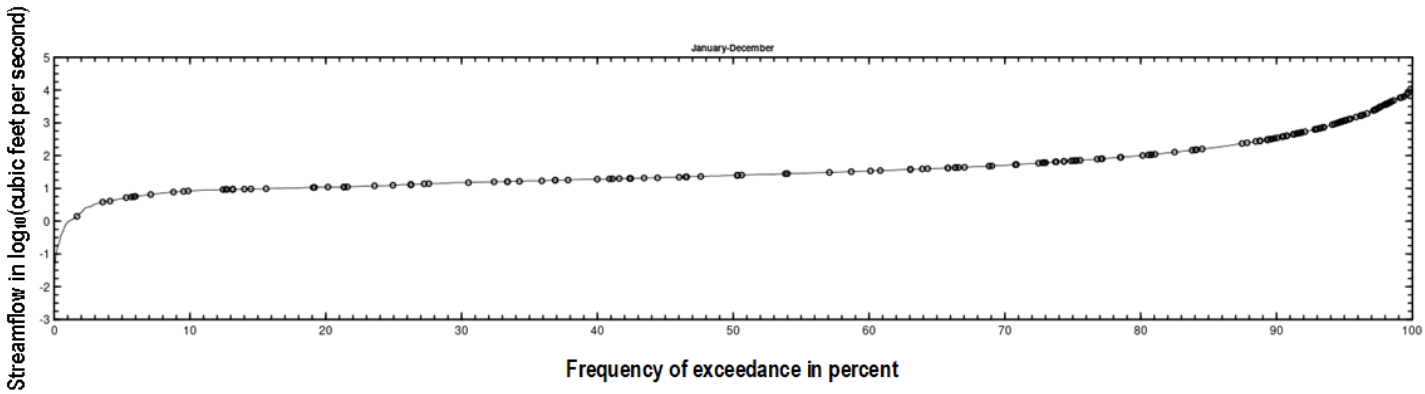
All data were collected using USGS protocols (U.S. Geological Survey, variously dated; Wagner and others, 2006; Sauer and Turnipseed, 2010; Turnipseed and Sauer, 2010) and are stored in the National Water Information System (NWIS) database (U.S. Geological Survey, 2021). Explanatory variables were evaluated individually and in combination. Potential explanatory variables included streamflow, water temperature, specific conductance, pH, dissolved oxygen, YSI EXO2 turbidity, nitrate, and fluorescent dissolved organic matter. Seasonal components (sine and cosine variables) also were evaluated as explanatory variables.

The regression model is based on 190 concomitant values of discretely collected calcium and continuously measured specific conductance during May 1998 through December 2019. Discrete samples were collected over a range of streamflow and specific conductance conditions. No samples had concentrations that were below laboratory detection limits. Summary statistics and the complete model-calibration dataset are provided below. Outliers and influential points were identified using studentized residuals, DFITS, Cook’s D (Cook, 1977), and leverage. Outliers in previously published versions of this model (Christensen and others, 2003; Rasmussen and others, 2016) were examined and retained in the dataset if there were no clear issues, explanations, or conditions that would cause a result to be invalid for model calibration. All samples were retained in the dataset.

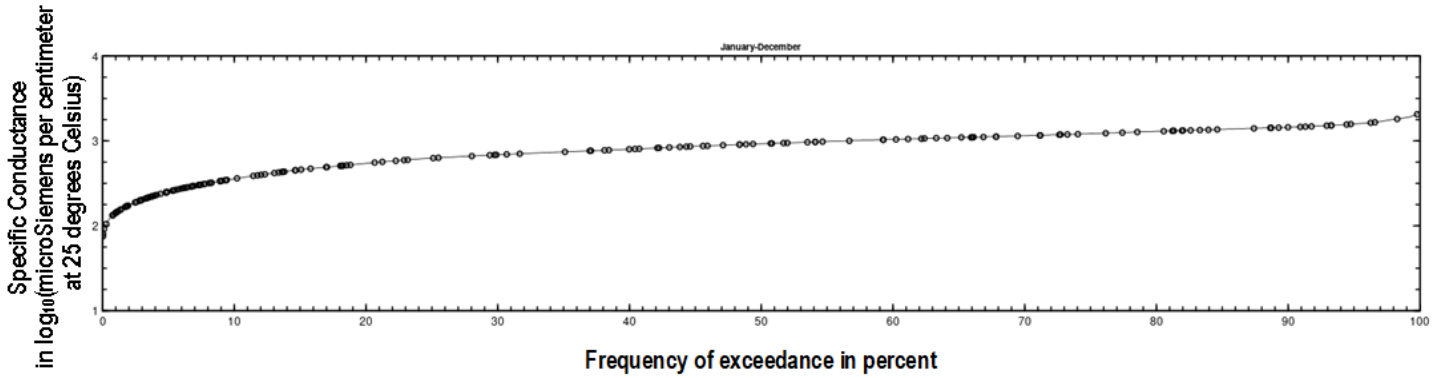
Calcium

Discrete samples were collected from the downstream side of the bridge or instream within 50 feet of the bridge using equal-width-increment, multi-vertical, single vertical or grab-dip methods following U.S. Geological Survey (variously dated) and Rasmussen and others (2014). Discrete samples were collected on a semifixed to event-based schedule ranging from 4 to 13 samples per year with a FISP US DH–95 or D–95 with a Teflon bottle, cap, and nozzle depth-integrating sampler, a DH–81 with a Teflon bottle, cap, and nozzle hand sampler or a grab sample with a Teflon bottle depending on sample location. Samples were analyzed for calcium by the Wichita Municipal Water and Wastewater Laboratory in Wichita, Kansas, or the USGS National Water Quality Laboratory according to standard methods (American Public Health Association and others, 1995).

Calcium Samples Plotted on Streamflow Duration Curve



Calcium Samples Plotted on Specific Conductance Duration Curve



Continuous Data

Concomitant specific conductance values were time interpolated. If no concomitant continuous data were available within 2 hours of sample collection, the sample was not included in the dataset.

Model Development

Ordinary least squares regression analysis was done using R (version 4.0.0) programming language (R Core Team, 2020) to relate discretely collected calcium to specific conductance and other continuously measured data. The distribution of residuals was examined for normality and plots of residuals (the difference between the measured and model-calculated values) compared to model-computed calcium were examined for homoscedasticity (departures from zero did not change substantially over the range of model-calculated values). Previously published explanatory variables were also strongly considered for continuity; however, the best explanatory variable(s) were ultimately selected.

Specific conductance was selected as the best predictor of calcium based on residual plots, high coefficient of determination (R^2), and low model standard percentage error (MSPE). Specific conductance was positively related to calcium because it measures water's capacity to conduct an electrical current and is related to the concentration of ionized substances in water (Hem, 1992).

Model Summary

Summary of final calcium regression analysis at USGS site number 07143672:

Calcium-based model:

$$\log_{10}(CA) = 1.03 \times \log_{10}(SC) - 1.12$$

where,

$\log_{10}$ = logarithm base 10;
CA = calcium, in milligrams per liter (mg/L); and
SC = specific conductance, in microsiemens per centimeter at 25 degrees Celsius (µS/cm)

The log-transformed model may be retransformed to original units so that CA can be calculated directly. The retransformation introduces a bias in the calculated constituent. This bias may be corrected using Duan's bias correction factor (BCF; Duan, 1983). For this model, the calculated BCF is 1.01. The retransformed model, accounting for BCF is:

$$CA = 0.0766 \times SC^{1.03}$$

Model Statistics, Data, and Plots

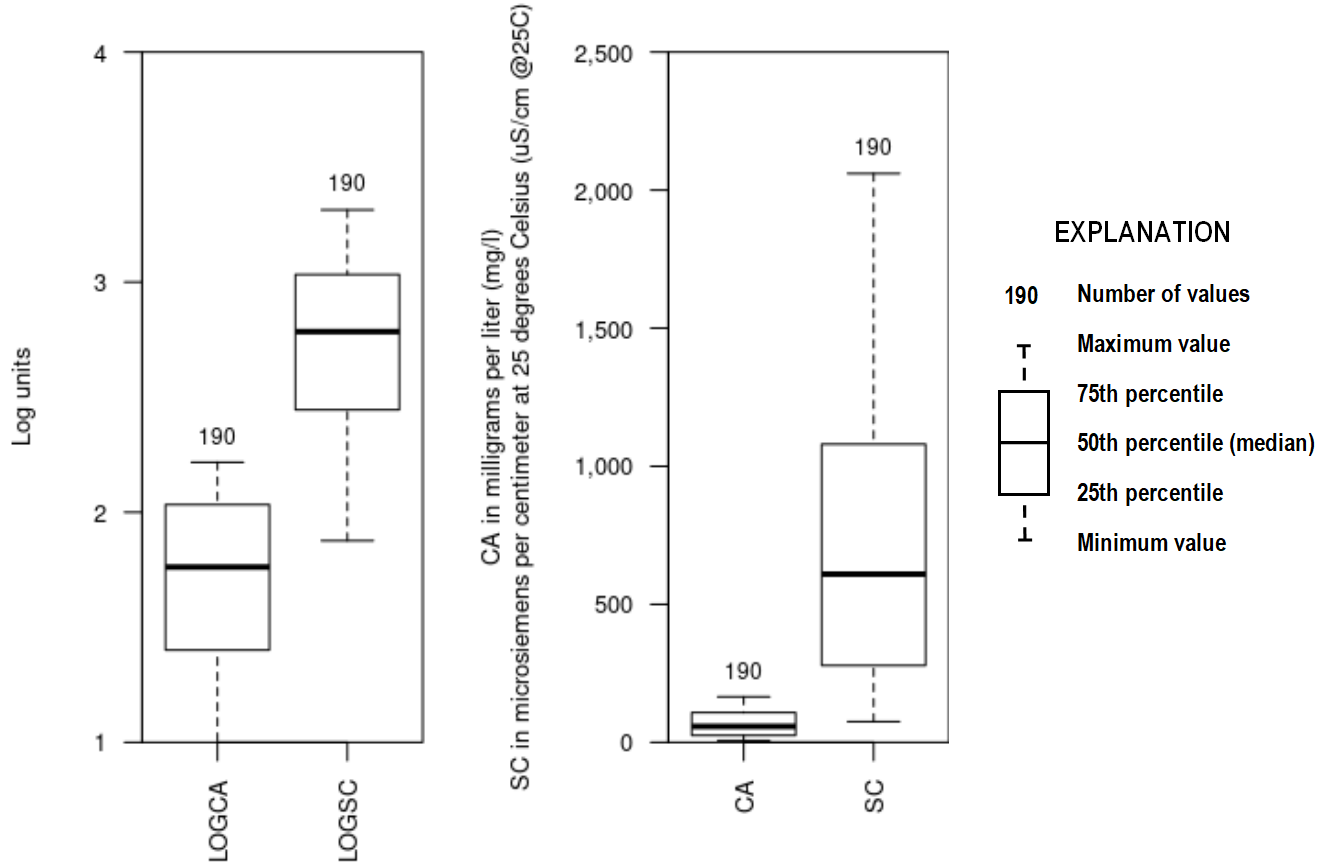
Model

LOGCA = + 1.03 * LOGSC - 1.12

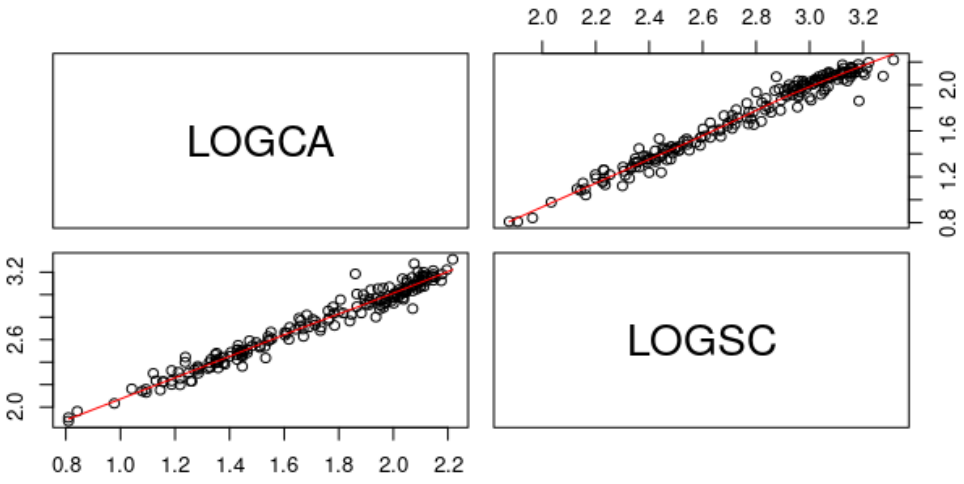
Variable Summary Statistics

	LOGCA	CA	LOGSC	SC
Minimum	0.81	6.45	1.88	75.2
1st Quartile	1.40	25.20	2.45	279.0
Median	1.76	57.70	2.78	609.0
Mean	1.70	66.40	2.74	706.0
3rd Quartile	2.03	108.00	3.03	1080.0
Maximum	2.22	165.00	3.31	2060.0

Box Plots



Exploratory Plots



Basic Model Statistics

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Number of Observations                                190
Standard error (RMSE)                               0.0631
Average Model standard percentage error (MSPE)      14.6
Coefficient of determination (R²)                   0.968
Adjusted Coefficient of Determination (Adj. R²)     0.968
Bias Correction Factor (BCF)                         1.01
```

Explanatory Variables

	Coefficients	Standard Error	t value	Pr(>|t|)
(Intercept)	-1.12	0.0376	-29.7	7.43e-73
LOGSC	1.03	0.0137	75.4	1.71e-142

Correlation Matrix

	Intercept	E.vars
Intercept	1.000	-0.993
E.vars	-0.993	1.000

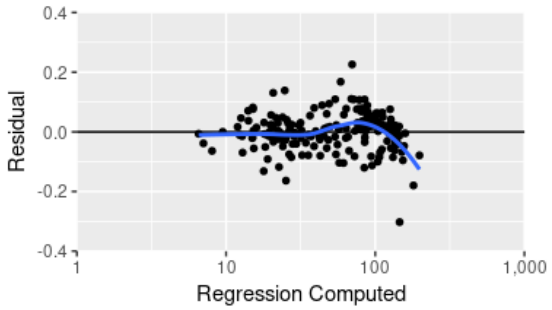
Outlier Test Criteria

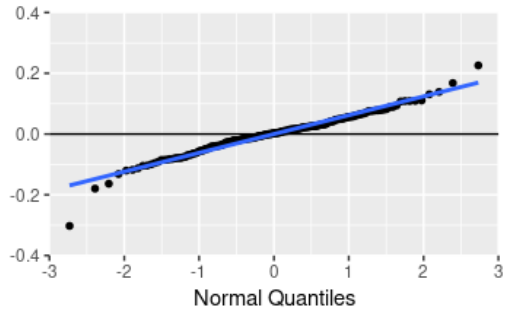
Leverage	Cook's D	DFFITS
0.0316	0.1946	0.2052

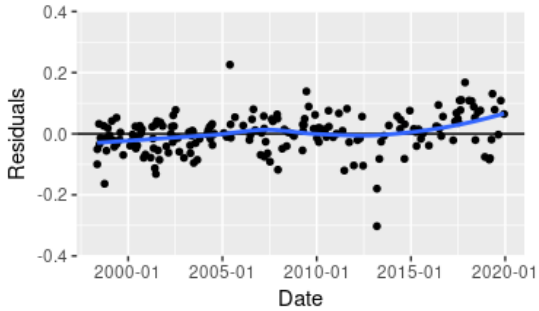
Flagged Observations

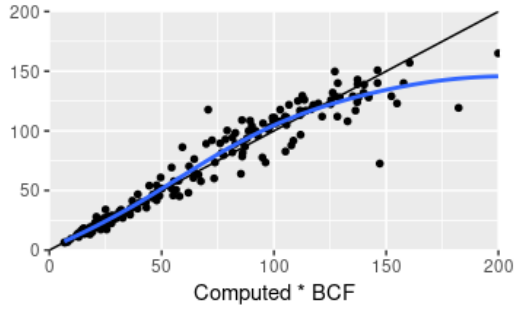
	LOGCA	Estimate	Residual	Standard Residual	Studentized Residual	Leverage	Cook's D	DFFITS
10/1/1998 11:20	1.240	1.400	-0.16400	-2.600	-2.650	0.00921	0.031500	-0.2550
6/22/2001 10:35	1.120	1.250	-0.13200	-2.100	-2.120	0.01410	0.031700	-0.2540
5/26/2005 12:00	2.070	1.850	0.22600	3.590	3.710	0.00619	0.040200	0.2930
5/25/2007 10:20	0.842	0.906	-0.06400	-1.030	-1.030	0.03310	0.018200	-0.1910
6/16/2009 10:20	1.530	1.390	0.13900	2.210	2.230	0.00942	0.023200	0.2180
3/12/2013 9:30	1.860	2.160	-0.30300	-4.830	-5.150	0.01470	0.174000	-0.6290
3/13/2013 11:50	2.080	2.260	-0.18000	-2.880	-2.930	0.01890	0.079700	-0.4070
7/30/2013 10:15	0.810	0.816	-0.00653	-0.106	-0.105	0.03980	0.000231	-0.0214
12/14/2015 10:35	0.810	0.848	-0.03850	-0.623	-0.622	0.03730	0.007520	-0.1220
4/29/2019 13:05	1.450	1.320	0.13100	2.090	2.100	0.01180	0.025900	0.2300

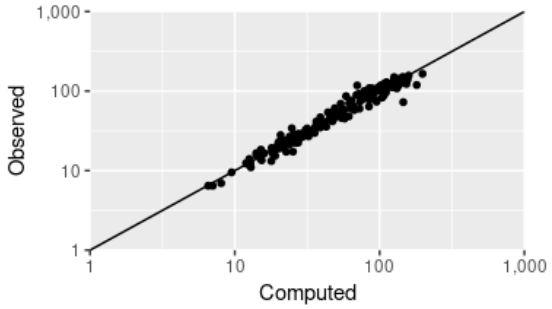
Statistical Plots

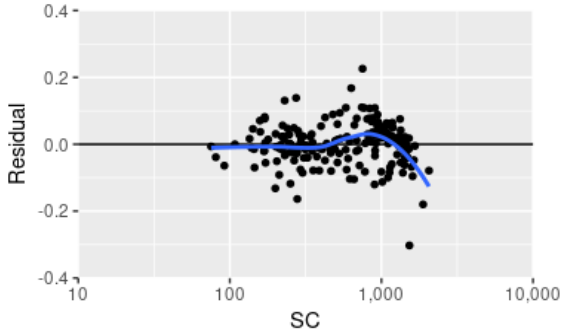


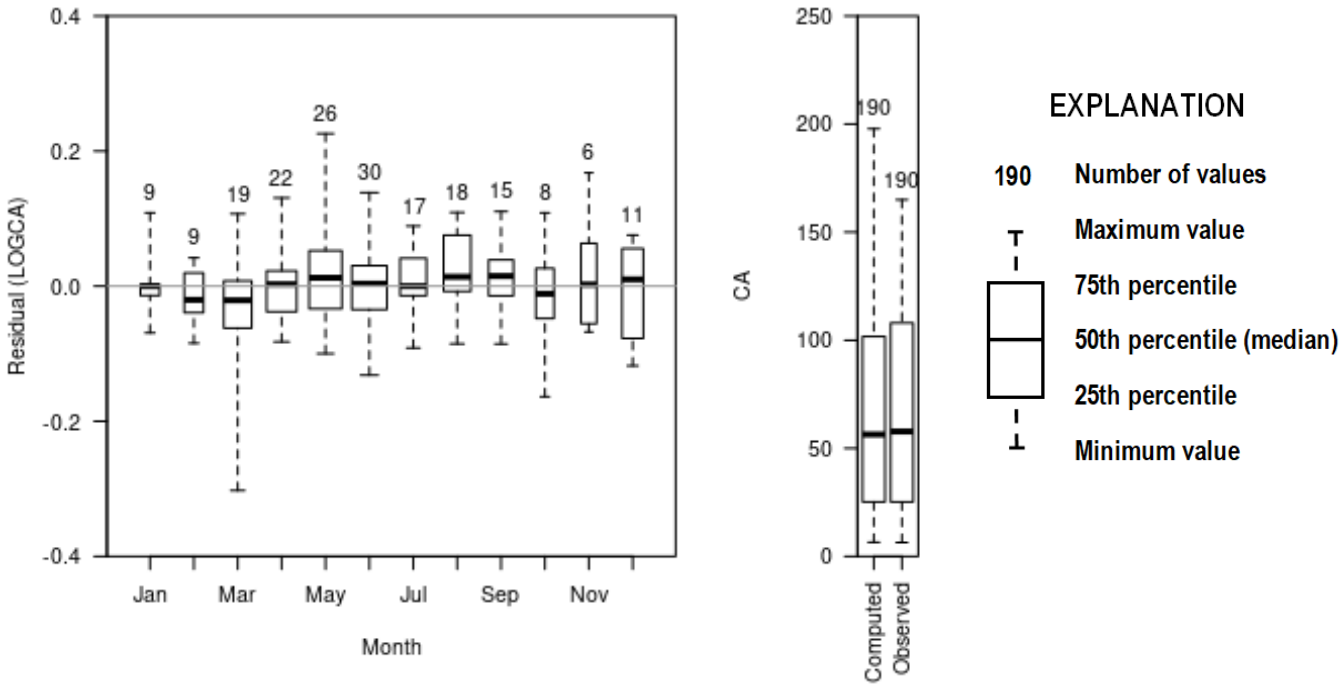


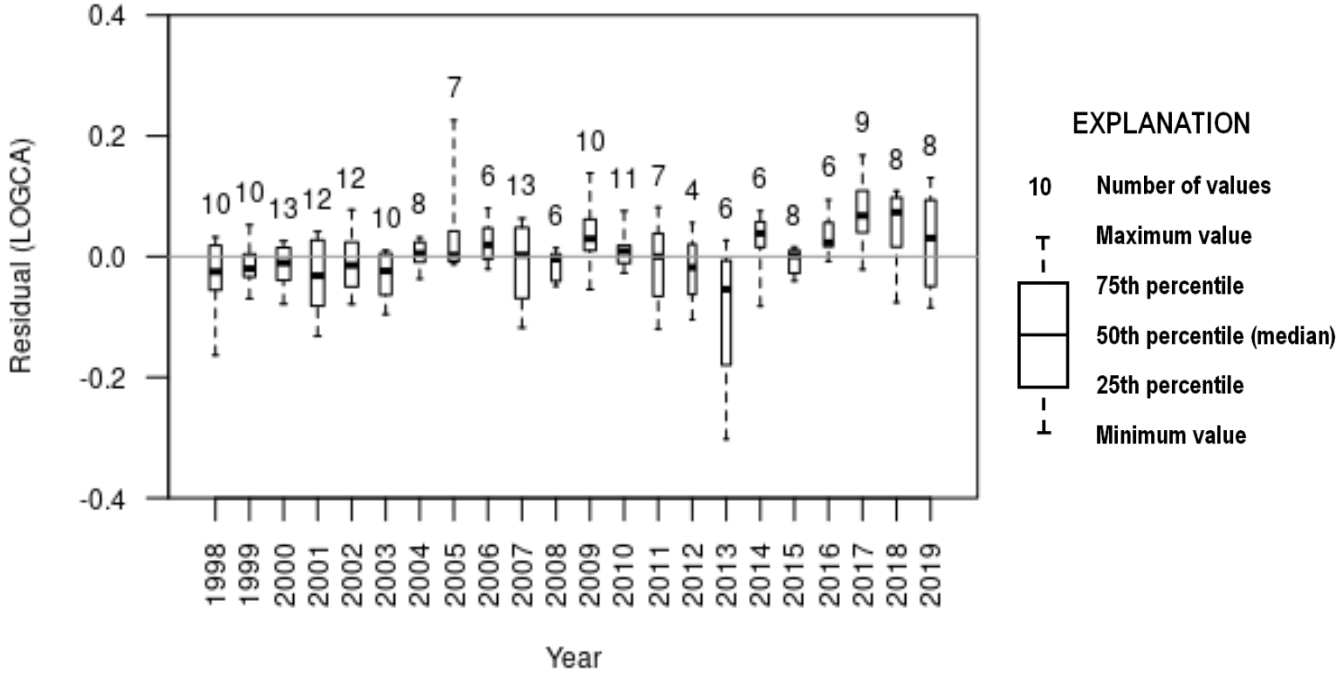









Residual (LOGCA)
0.4
0.2
0.0
-0.2
-0.4
9
9
19
22
26
30
17
18
15
8
6
11
Jan
Mar
May
Jul
Sep
Nov
Month
CA
250
200
150
100
50
0
190
190
Computed
Observed
EXPLANATION
190 Number of values
Maximum value
75th percentile
50th percentile (median)
25th percentile
Minimum value


Residual (LOGCA)
0.4
0.2
0.0
-0.2
-0.4
10
10
13
12
12
10
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7
6
13
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10
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9
8
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1998
1999
2000
2001
2002
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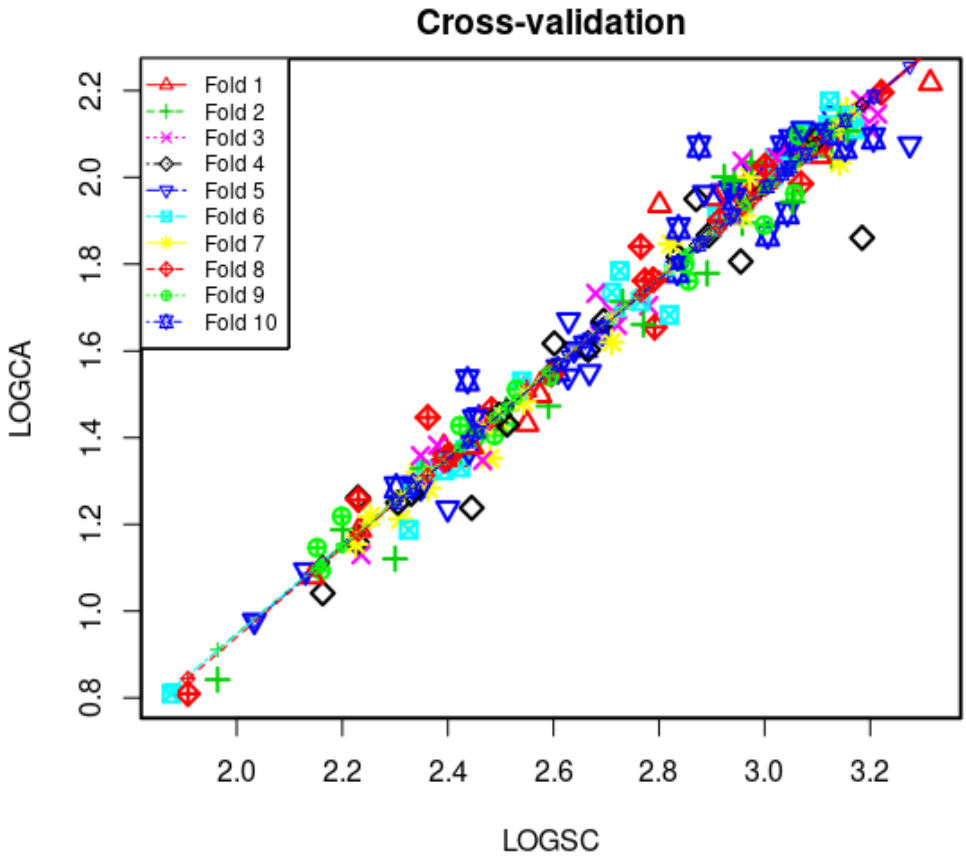
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year
EXPLANATION
10 Number of values
Maximum value
75th percentile
50th percentile (median)
25th percentile
Minimum value

Cross Validation




```
              Minimum MSE of folds:  0.00175
                 Mean MSE of folds:  0.00400
               Median MSE of folds:  0.00306
              Maximum MSE of folds:  0.00876
 (Mean MSE of folds) / (Model MSE):  1.00000
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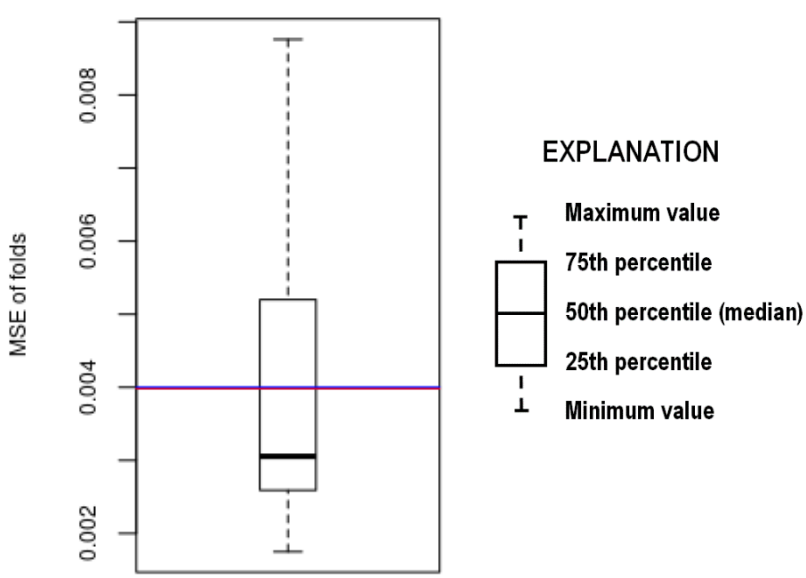


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Red line - Model MSE

Blue line - Mean MSE of folds
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Model-Calibration Dataset

	Date	LOGCA	LOGSC	CA	SC	Computed LOGCA	Computed CA	Residual	Normal Quantiles
1	5/12/1998	1.92	3.04	82.7	1100	2.02	105	-0.0998	-1.64
2	5/14/1998	1.21	2.31	16.3	204	1.26	18.5	-0.0507	-0.928
3	6/15/1998	2.05	3.04	112	1100	2.02	105	0.0324	0.69
4	6/25/1998	1.89	2.96	78.5	907	1.93	85.9	-0.0346	-0.69
5	7/13/1998	1.61	2.66	40.7	458	1.62	42.5	-0.014	-0.329
6	9/14/1998	2.01	3.01	103	1030	1.99	98	0.0261	0.547
7	10/1/1998	1.24	2.45	17.3	279	1.4	25.5	-0.164	-2.21
8	10/22/1998	1.56	2.61	35.9	406	1.57	37.6	-0.0151	-0.371
9	11/6/1998	1.13	2.24	13.5	172	1.19	15.5	-0.0555	-0.991
10	12/3/1998	1.98	2.99	95.9	978	1.96	92.8	0.0186	0.343
11	1/6/1999	2.2	3.22	157	1660	2.2	160	-0.00493	-0.152
12	2/1/1999	1.36	2.42	22.9	266	1.38	24.2	-0.0203	-0.472
13	2/19/1999	2.15	3.13	140	1340	2.1	128	0.0419	0.794
14	3/11/1999	2.12	3.16	132	1460	2.14	140	-0.0209	-0.531
15	4/7/1999	1.7	2.78	50.6	603	1.75	56.4	-0.0428	-0.85
16	5/20/1999	2.05	3.02	111	1040	1.99	99.4	0.0526	0.928
17	5/24/1999	1.28	2.36	19.2	231	1.32	21	-0.0334	-0.674
18	7/19/1999	1.16	2.23	14.4	169	1.18	15.2	-0.0194	-0.457
19	8/4/1999	1.19	2.23	15.4	171	1.18	15.4	0.00431	0.0461
20	9/28/1999	1.04	2.16	11	145	1.11	13	-0.0696	-1.15
21	2/8/2000	2.09	3.15	124	1430	2.13	137	-0.0392	-0.777
22	3/6/2000	1.32	2.39	21.1	247	1.35	22.5	-0.0243	-0.562
23	3/27/2000	1.35	2.4	22.6	252	1.36	23	-0.00253	-0.112
24	5/19/2000	2.12	3.12	132	1320	2.1	126	0.0241	0.457
25	5/30/2000	1.54	2.63	34.8	424	1.59	39.3	-0.0482	-0.888
26	6/26/2000	1.43	2.51	26.9	323	1.47	29.7	-0.0386	-0.759
27	7/19/2000	2	3.01	101	1030	1.98	97.6	0.0195	0.357
28	7/27/2000	1.55	2.6	35.2	394	1.56	36.4	-0.0104	-0.246
29	8/15/2000	2.03	3.03	108	1080	2.01	103	0.0259	0.531
30	9/7/2000	2.02	3.04	105	1110	2.02	106	0.00199	-0.0198
31	9/25/2000	2.07	3.08	117	1200	2.05	114	0.015	0.246
32	10/27/2000	1.47	2.59	29.7	389	1.55	36	-0.0786	-1.26
33	11/30/2000	2.11	3.2	129	1580	2.18	152	-0.0677	-1.1
34	3/13/2001	1.43	2.55	27	355	1.51	32.7	-0.0782	-1.24
35	4/12/2001	1.76	2.77	57.8	593	1.74	55.4	0.0227	0.413
36	4/26/2001	2.11	3.15	129	1410	2.13	135	-0.0157	-0.385
37	5/9/2001	2.15	3.21	140	1640	2.19	158	-0.0474	-0.869
38	6/1/2001	1.87	3.01	73.5	1010	1.98	96.2	-0.113	-1.82
39	6/11/2001	1.38	2.39	23.8	247	1.35	22.5	0.0292	0.609
40	6/22/2001	1.12	2.3	13.2	200	1.25	18.1	-0.132	-2.08
41	7/12/2001	2	2.99	100	968	1.96	91.8	0.0415	0.777
42	8/1/2001	2.05	3.13	112	1340	2.1	128	-0.0544	-0.949
43	8/30/2001	2.03	3.14	108	1380	2.12	133	-0.0853	-1.46
44	9/18/2001	1.19	2.2	15.4	159	1.15	14.3	0.0373	0.724

45	10/30/2001	2.05	3.05	111	1110	2.02	106	0.0256	0.501
46	1/9/2002	2.11	3.17	128	1480	2.15	142	-0.0412	-0.831
47	2/20/2002	2.07	3.15	117	1420	2.13	136	-0.062	-1.03
48	4/10/2002	2.11	3.13	128	1350	2.11	129	-9.48E-05	-0.0725
49	4/22/2002	1.32	2.34	20.9	221	1.3	20	0.0231	0.428
50	5/14/2002	1.66	2.72	45.6	526	1.69	49	-0.0271	-0.625
51	5/23/2002	1.73	2.71	54.3	513	1.67	47.8	0.0602	1.08
52	6/6/2002	2.07	3.07	117	1170	2.04	112	0.0249	0.486
53	6/17/2002	1.09	2.16	12.4	144	1.11	13	-0.0145	-0.343
54	7/9/2002	1.97	2.92	92.8	830	1.89	78.4	0.0778	1.39
55	8/20/2002	1.64	2.69	43.9	493	1.66	45.8	-0.0139	-0.301
56	9/18/2002	1.99	3.07	96.7	1170	2.04	112	-0.0588	-1.01
57	12/17/2002	2.22	3.31	165	2060	2.3	200	-0.0788	-1.29
58	3/24/2003	1.51	2.55	32.4	351	1.51	32.3	0.00518	0.0725
59	4/16/2003	2.11	3.17	129	1480	2.15	142	-0.0378	-0.724
60	4/22/2003	1.76	2.86	57.7	718	1.82	67.5	-0.0635	-1.06
61	5/15/2003	1.45	2.5	28.2	315	1.46	28.9	-0.00618	-0.179
62	5/28/2003	1.67	2.7	46.7	496	1.66	46.1	0.0103	0.165
63	6/10/2003	1.91	2.94	82	862	1.91	81.5	0.00708	0.099
64	6/24/2003	2.09	3.21	123	1610	2.19	155	-0.0955	-1.59
65	7/30/2003	2.05	3.1	112	1270	2.08	121	-0.0308	-0.657
66	9/2/2003	1.35	2.48	22.5	302	1.44	27.7	-0.0854	-1.5
67	10/15/2003	1.29	2.35	19.3	223	1.3	20.3	-0.0168	-0.428
68	3/9/2004	1.29	2.33	19.3	216	1.29	19.6	-0.00186	-0.099
69	3/29/2004	2.05	3.07	113	1170	2.04	112	0.0105	0.179
70	4/26/2004	2.16	3.16	143	1430	2.13	137	0.0221	0.385
71	5/13/2004	1.71	2.76	51.8	581	1.73	54.3	-0.0163	-0.399
72	5/26/2004	1.96	2.96	90.2	907	1.93	85.9	0.0258	0.516
73	6/16/2004	1.97	2.97	93.7	928	1.94	88	0.0321	0.674
74	6/21/2004	1.5	2.57	31.5	375	1.53	34.6	-0.0368	-0.707
75	7/26/2004	0.978	2.03	9.5	108	0.978	9.6	4.02E-05	-0.0461
76	1/28/2005	1.6	2.64	40.2	435	1.6	40.3	0.00238	-0.00659
77	3/25/2005	1.44	2.5	27.7	313	1.45	28.7	-0.0103	-0.233
78	5/11/2005	2.09	3.12	122	1310	2.09	125	-0.00589	-0.165
79	5/26/2005	2.07	2.88	118	751	1.85	70.7	0.226	2.73
80	6/7/2005	1.53	2.54	33.9	347	1.5	31.9	0.0304	0.641
81	6/14/2005	1.27	2.33	18.6	214	1.28	19.4	-0.0131	-0.287
82	8/31/2005	1.62	2.6	41.4	400	1.56	36.9	0.0542	0.97
83	2/7/2006	2.04	3.04	110	1100	2.02	105	0.0269	0.562
84	6/8/2006	1.78	2.83	60.5	683	1.8	64.1	-0.0206	-0.501
85	6/26/2006	1.46	2.51	29.1	324	1.47	29.8	-0.00439	-0.139
86	7/28/2006	1.38	2.38	24.1	240	1.33	21.8	0.0474	0.831
87	8/23/2006	1.67	2.63	46.8	425	1.59	39.4	0.0801	1.46
88	9/27/2006	1.82	2.84	65.6	686	1.8	64.4	0.0119	0.192
89	1/10/2007	1.96	3.06	91.7	1140	2.03	109	-0.0691	-1.13
90	1/30/2007	1.94	2.96	86.8	920	1.94	87.1	0.00271	0.0198
91	3/12/2007	1.85	2.82	70.3	663	1.79	62.2	0.0576	1.03
92	3/21/2007	1.71	2.73	51.7	538	1.7	50.2	0.0171	0.315

93	3/27/2007	1.35	2.47	22.3	292	1.42	26.8	-0.0754	-1.18
94	4/18/2007	1.35	2.42	22.4	263	1.38	24	-0.0261	-0.593
95	5/25/2007	0.842	1.96	6.95	92	0.906	8.14	-0.064	-1.08
96	7/11/2007	1.19	2.33	15.4	212	1.28	19.2	-0.0915	-1.55
97	8/13/2007	2	2.98	99.8	952	1.95	90.3	0.0481	0.85
98	9/5/2007	2.03	3.02	108	1050	1.99	99.6	0.0408	0.759
99	11/27/2007	2.07	3.03	118	1080	2.01	103	0.0634	1.13
100	12/4/2007	2.1	3.08	126	1190	2.05	114	0.0495	0.888
101	12/12/2007	1.24	2.4	17.3	251	1.35	22.9	-0.118	-1.89
102	3/4/2008	1.33	2.42	21.5	266	1.38	24.3	-0.0488	-0.908
103	4/14/2008	1.69	2.71	49	515	1.68	47.9	0.0143	0.206
104	5/29/2008	1.41	2.49	25.4	308	1.45	28.2	-0.0406	-0.813
105	6/30/2008	1.43	2.47	26.8	293	1.42	26.8	0.00443	0.0593
106	9/16/2008	1.36	2.4	22.8	253	1.36	23.1	-0.000869	-0.0858
107	10/17/2008	1.25	2.31	17.8	202	1.26	18.3	-0.00754	-0.206
108	4/1/2009	1.62	2.71	41.7	513	1.67	47.8	-0.0545	-0.97
109	4/6/2009	1.91	2.91	81.5	813	1.88	76.7	0.0304	0.625
110	4/13/2009	1.76	2.79	58.1	615	1.76	57.6	0.00866	0.112
111	4/30/2009	1.44	2.46	27.8	287	1.42	26.3	0.0289	0.593
112	5/12/2009	1.43	2.42	26.8	265	1.38	24.2	0.0489	0.869
113	6/16/2009	1.53	2.44	34	274	1.39	25	0.139	2.21
114	7/30/2009	1.73	2.68	54	478	1.64	44.5	0.0891	1.59
115	11/2/2009	1.45	2.47	27.9	296	1.43	27.1	0.0165	0.287
116	12/1/2009	2.09	3.05	122	1120	2.02	107	0.0619	1.1
117	12/17/2009	2.14	3.16	139	1430	2.13	137	0.0101	0.152
118	1/6/2010	2.15	3.18	140	1520	2.16	146	-0.0139	-0.315
119	1/19/2010	2.18	3.18	151	1520	2.16	146	0.018	0.329
120	2/11/2010	2.11	3.16	128	1430	2.13	138	-0.027	-0.609
121	2/23/2010	2.09	3.09	122	1230	2.07	118	0.0195	0.371
122	4/13/2010	2.11	3.12	129	1330	2.1	127	0.00919	0.126
123	6/1/2010	1.87	2.89	73.5	782	1.86	73.7	0.00311	0.033
124	6/15/2010	1.33	2.36	21.2	228	1.31	20.7	0.0149	0.233
125	7/7/2010	1.08	2.14	12	139	1.09	12.4	-0.0106	-0.26
126	8/19/2010	1.95	2.91	89.5	806	1.88	76	0.0755	1.26
127	8/25/2010	1.33	2.35	21.3	225	1.31	20.4	0.0234	0.442
128	11/16/2010	1.54	2.59	34.8	391	1.55	36.1	-0.0113	-0.274
129	1/19/2011	2.14	3.16	139	1460	2.14	140	0.000114	-0.033
130	3/7/2011	2.02	2.98	104	951	1.95	90.2	0.0669	1.18
131	5/16/2011	2.07	3.09	118	1220	2.06	117	0.00986	0.139
132	6/20/2011	1.81	2.95	64	901	1.93	85.3	-0.12	-1.97
133	8/11/2011	1.26	2.23	18.3	170	1.18	15.3	0.0818	1.5
134	9/22/2011	1.37	2.44	23.4	275	1.4	25.2	-0.0275	-0.641
135	12/21/2011	1.65	2.79	45.2	619	1.76	57.9	-0.104	-1.69
136	3/1/2012	1.15	2.23	14.3	168	1.18	15.1	-0.0209	-0.516
137	4/18/2012	1.44	2.5	27.6	315	1.46	28.9	-0.0148	-0.357
138	5/29/2012	2	2.97	100	936	1.94	88.7	0.0562	0.991
139	6/18/2012	1.68	2.82	48.2	660	1.79	61.9	-0.105	-1.75
140	3/12/2013	1.86	3.18	72.6	1530	2.16	147	-0.303	-2.73

141	3/13/2013	2.08	3.27	119	1880	2.26	182	-0.18	-2.39
142	4/29/2013	1.89	3	77.7	999	1.97	94.9	-0.0823	-1.39
143	6/3/2013	1.6	2.67	40.1	463	1.63	43	-0.0259	-0.577
144	7/30/2013	0.81	1.88	6.45	75.2	0.816	6.62	-0.00653	-0.192
145	10/30/2013	2.03	3.03	106	1060	2	101	0.0271	0.577
146	4/9/2014	2.1	3.06	125	1160	2.04	111	0.0577	1.06
147	6/4/2014	1.9	2.91	79.6	822	1.89	77.6	0.0156	0.26
148	6/12/2014	1.15	2.15	14	142	1.1	12.7	0.046	0.813
149	8/28/2014	1.78	2.89	60.1	778	1.86	73.4	-0.0821	-1.36
150	9/4/2014	1.29	2.3	19.3	201	1.25	18.1	0.0309	0.657
151	12/10/2014	2.18	3.12	150	1330	2.1	127	0.0756	1.29
152	2/25/2015	2.09	3.1	123	1250	2.07	120	0.0159	0.274
153	4/7/2015	2.1	3.12	126	1310	2.09	125	0.00572	0.0858
154	4/20/2015	1.43	2.51	26.9	325	1.47	29.9	-0.0403	-0.794
155	5/28/2015	1.22	2.25	16.5	179	1.2	16.1	0.0146	0.219
156	7/14/2015	1.8	2.85	63.2	706	1.82	66.4	-0.0166	-0.413
157	8/6/2015	1.35	2.39	22.3	247	1.35	22.5	3.11E-05	-0.0593
158	8/27/2015	1.35	2.39	22.5	248	1.35	22.6	0.0027	0.00659
159	12/14/2015	0.81	1.91	6.45	80.8	0.848	7.12	-0.0385	-0.741
160	5/2/2016	1.46	2.48	29.1	304	1.44	27.9	0.0241	0.472
161	6/1/2016	1.51	2.53	32.4	339	1.49	31.1	0.0224	0.399
162	6/16/2016	1.78	2.73	60.9	532	1.69	49.5	0.0941	1.64
163	7/5/2016	1.09	2.13	12.4	135	1.08	12.1	0.0166	0.301
164	8/10/2016	1.4	2.45	25.2	283	1.41	25.9	-0.00769	-0.219
165	9/12/2016	1.36	2.35	22.8	223	1.3	20.2	0.0563	1.01
166	3/30/2017	1.38	2.44	24	279	1.4	25.5	-0.0213	-0.547
167	5/3/2017	1.45	2.45	28	282	1.41	25.8	0.0401	0.741
168	5/30/2017	1.97	2.94	94.3	862	1.91	81.5	0.0679	1.21
169	6/27/2017	2.05	3.02	111	1050	2	100	0.0495	0.908
170	7/12/2017	1.95	2.94	89.1	876	1.91	82.8	0.0362	0.707
171	8/1/2017	1.84	2.77	69.3	583	1.73	54.4	0.109	1.89
172	8/17/2017	1.88	2.84	76.3	687	1.81	64.5	0.0776	1.36
173	9/5/2017	1.95	2.87	89.1	742	1.84	69.8	0.11	1.97
174	11/14/2017	1.94	2.8	86.3	632	1.77	59.2	0.168	2.39
175	1/30/2018	1.96	2.89	92.1	769	1.86	72.4	0.109	1.82
176	3/21/2018	2	2.92	100	838	1.89	79.2	0.107	1.69
177	5/1/2018	2.04	2.97	108	943	1.95	89.4	0.0886	1.55
178	5/22/2018	2.03	3	106	1000	1.97	95.1	0.0526	0.949
179	6/2/2018	1.48	2.54	30.4	350	1.5	32.2	-0.0205	-0.486
180	7/18/2018	1.22	2.2	16.5	158	1.15	14.2	0.0707	1.24
181	9/6/2018	1.26	2.23	18.1	170	1.18	15.3	0.0764	1.33
182	12/3/2018	1.66	2.77	45.8	589	1.74	55.1	-0.0758	-1.21
183	2/26/2019	1.94	3.05	87.8	1130	2.03	108	-0.0844	-1.43
184	3/14/2019	1.55	2.67	35.6	466	1.63	43.2	-0.0799	-1.33
185	4/10/2019	1.91	2.96	81.6	909	1.93	86.1	-0.0188	-0.442
186	4/29/2019	1.45	2.36	28	230	1.32	20.9	0.131	2.08
187	6/11/2019	1.99	2.94	98.3	876	1.91	82.8	0.0788	1.43
188	8/21/2019	1.45	2.5	28.3	314	1.46	28.8	-0.00293	-0.126

189	10/8/2019	2.04	2.96	109	906	1.93	85.8	0.109	1.75
190	12/10/2019	2.11	3.07	129	1180	2.05	113	0.0646	1.15

Definitions

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CA: Calcium in mg/L (00915)
SC: Specific conductance in µS/cm @25C (00095)
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