DATA QUALITY AND SUMMARY STATISTICS

FLUME DATA

Annual Report 2019

This report complements the data available on the data portal and is designed to help users by giving an overview of the quality and key statistics of the flume data.

Data Version: 3

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BBSRC bioscience for the future

ROTHAMSTED RESEARCH

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1 15 MINUTE DATA

- Catchments arranged from largest to smallest across tables (left to right) for each farmlet.
- Where PLC switch = 0, this refers to timesteps when flume flow was <0.2 l/s (flow conditions not met) and so the pump is not activated to fill the by-pass flow cell. Therefore, flume data are considered invalid and are classified as missing values ('NA') in the quality control process.
- Where PLC switch = 1, flume flow is >0.2 l/s (flow conditions met) and so the pump is activated to fill the by-pass flow cell.
- For further explanation, refer to Sections 3.3 & 7.1.2 in the 'User Guide to 15 Minute Data' (FP_UG.Doc.002_15MinData) available on the Farm Platform website: http://resources.rothamsted.ac.uk/farm-platform-national-capability/data-portal-guides-and-information

1.1 Counts of PLC switch settings

	Catchment Number														
Variable	**Green**					**Blue**					**Red**				
	4	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
PLC Switch = NA (missing)	81	10906	1064	6	7536	13903	3042	574	7	186	10350	8808	13478	301	8
PLC Switch = 0 (no flow)	15138	8082	21975	30412	21731	6454	19123	21338	29373	29068	10070	9274	4604	24676	22126
PLC Switch = 1 (flow)	19820	16051	12000	4621	5772	14682	12874	13127	5659	5785	14619	16957	16957	10062	12905

Table 1: Counts of PLC switch settings - missing data, no flow, flow

1.2 Zero values

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Flow	l/s	25724	29098	31185	34519	33200	18077	28921	32687	34149	33454	21425	19596	27025	33864	32420
Nitrate+nitrite	mg/l	417	657	514	598	678	1090	6599	1859	278	2631	524	1639	148	262	1360
Ammonia	mg/l	19366	15204	11989	4610	5500	14679	12869	12637	5617	5734	14045	16950	14258	10053	12843
Ammonium	mg/l	18086	14689	11986	4520	5499	14345	11954	12473	5456	5696	13700	16474	13345	9859	11115
Conductivity	uS/cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved oxygen	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pH	unitless	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flow cell water temperature	°C	0	0	0	0	0	1	0	1	8	0	0	1	0	0	0
Turbidity	FNU	2260	0	118	1	0	73	10	1	125	1	1068	91	206	840	1895
Total phosphorus	mg/l	NA	8661	NA	NA	NA	NA	4555	NA	NA	NA	NA	9790	NA	NA	NA
Dissolved organic matter	ug/l QSU	4	0	1	3	0	2	2	2	10	0	9	21	1	1	43
Ortho-phosphorus	mg/l	NA	8661	NA	NA	NA	NA	4555	NA	NA	NA	NA	9924	NA	NA	NA

Table 2: Number of zero values (out of 35039)

1.3 Missing values

1.3.1 Total number of missing values

	Catchment Number														
Variable	**Green**					**Blue**					**Red**				
	4	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Flow	0	0	719	6	682	12685	1649	484	7	0	8160	8449	1166	197	10
Nitrate+nitrite	17795	19176	23398	31191	30480	21299	22537	23402	29631	29660	21592	19869	19327	25230	26822
Ammonia	15673	19835	23050	30429	29539	20360	22170	22402	29422	29305	20994	18089	20781	24986	22196
Ammonium	15673	19835	23050	30429	29539	20360	22170	22402	29422	29305	20994	18089	20781	24986	22196
Conductivity	15233	18994	23050	30429	29271	20376	22172	21932	29430	29256	20428	18089	20781	24982	22192
Dissolved oxygen	15224	18994	23254	30429	29539	20361	22170	22298	29430	29431	20428	18087	20781	24982	22190
pH	15224	18994	23048	30429	29271	20361	22171	22689	29430	29256	20428	18086	20781	24982	22190
Flow cell water temperature	15224	18994	23048	30429	29271	20360	22170	21931	29422	29256	20428	18085	20781	24982	22190
Turbidity	15224	18994	23048	30429	29271	20360	22170	21931	29423	29256	20479	18086	20781	24988	23503
Total phosphorus	35039	26378	35039	35039	35039	35039	30484	35039	35039	35039	35039	25115	35039	35039	35039
Dissolved organic matter	15227	18995	23048	30432	29539	20360	22170	21942	29423	29256	20448	18102	20781	24982	22381
Ortho-phosphorus	35039	26378	35039	35039	35039	35039	30484	35039	35039	35039	35039	25115	35039	35039	35039

Table 3: Total number of missing values (out of 35039)

1.3.2 Total number of missing values as a percentage

	Catchment Number														
Variable	**Green**					**Blue**					**Red**				
	4	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Flow	0	0	2	0	2	36	5	1	0	0	23	24	3	1	0
PLC Switch	0	31	3	0	22	40	9	2	0	1	30	25	38	1	0
Nitrate+nitrite	51	55	67	89	87	61	64	67	85	85	62	57	55	72	77
Ammonia	45	57	66	87	84	58	63	64	84	84	60	52	59	71	63
Ammonium	45	57	66	87	84	58	63	64	84	84	60	52	59	71	63
Conductivity	43	54	66	87	84	58	63	63	84	83	58	52	59	71	63
Dissolved oxygen	43	54	66	87	84	58	63	64	84	84	58	52	59	71	63
pH	43	54	66	87	84	58	63	65	84	83	58	52	59	71	63
Flow cell water temperature	43	54	66	87	84	58	63	63	84	83	58	52	59	71	63
Turbidity	43	54	66	87	84	58	63	63	84	83	58	52	59	71	67
Total phosphorus	100	75	100	100	100	100	87	100	100	100	100	72	100	100	100
Dissolved organic matter	43	54	66	87	84	58	63	63	84	83	58	52	59	71	64
Ortho-phosphorus	100	75	100	100	100	100	87	100	100	100	100	72	100	100	100

Table 4: Total number of missing values as a percentage

1.3.3 Total number of missing values when PLC switch = 1

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2
Nitrate+nitrite	2576	188	359	773	1213	942	372	1490	251	406	1172	1787	1245	253	4688
Ammonia	454	847	11	11	272	3	5	490	42	51	574	7	2699	9	62
Ammonium	454	847	11	11	272	3	5	490	42	51	574	7	2699	9	62
Conductivity	14	6	11	11	4	19	7	20	50	2	8	7	2699	5	58
Dissolved oxygen	5	6	215	11	272	4	5	386	50	177	8	5	2699	5	56
pH	5	6	9	11	4	4	6	777	50	2	8	4	2699	5	56
Flow cell water temperature	5	6	9	11	4	3	5	19	42	2	8	3	2699	5	56
Turbidity	5	6	9	11	4	3	5	19	43	2	59	4	2699	11	1369
Dissolved organic matter	8	7	9	14	272	3	5	30	43	2	28	20	2699	5	247
Ortho-phosphorus	19820	7425	12000	4621	5772	14682	9271	13127	5659	5785	14619	7810	16957	10062	12905

Table 5: Total number of missing values when PLC switch = 1 (flow >0.2 l/s)

1.3.4 Total number of measured values in flume data as a percentage of possible values when PLC switch = 1

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	177	218	286	758	595	152	259	263	619	606	184	157	200	346	271
Nitrate+nitrite	87	99	97	83	79	94	97	89	96	93	92	89	93	97	64
Ammonia	98	95	100	100	95	100	100	96	99	99	96	100	84	100	100
Ammonium	98	95	100	100	95	100	100	96	99	99	96	100	84	100	100
Conductivity	100	100	100	100	100	100	100	100	99	100	100	100	84	100	100
Dissolved oxygen	100	100	98	100	95	100	100	97	99	97	100	100	84	100	100
pH	100	100	100	100	100	100	100	94	99	100	100	100	84	100	100
Flow cell water temperature	100	100	100	100	100	100	100	100	99	100	100	100	84	100	100
Turbidity	100	100	100	100	100	100	100	100	99	100	100	100	84	100	89
Dissolved organic matter	100	100	100	100	95	100	100	100	99	100	100	100	84	100	98
Ortho-phosphorus	0	54	0	0	0	0	35	0	0	0	0	59	0	0	0

Table 6: Total number of measured values in flume data as a percentage of possible values when PLC switch = 1 (flow >0.2 l/s)

1.3.5 Timesteps of missing 15 minute data when PLC switch = 1 (flow >0.2 l/s)

- Data are in farmlet/catchment/triplet order with catchments arranged from largest to smallest down the page.
- Colour bars represent missing 15 minute timestep water quality data for each farmlet when flow >0.2 l/s and may reflect data loss due to sensor downtime or where data failed the quality control process.
- NB. Total phosphorus, ortho-phosphorus and flume temperature not included as sampling and measurement are not influenced by the PLC switch values.

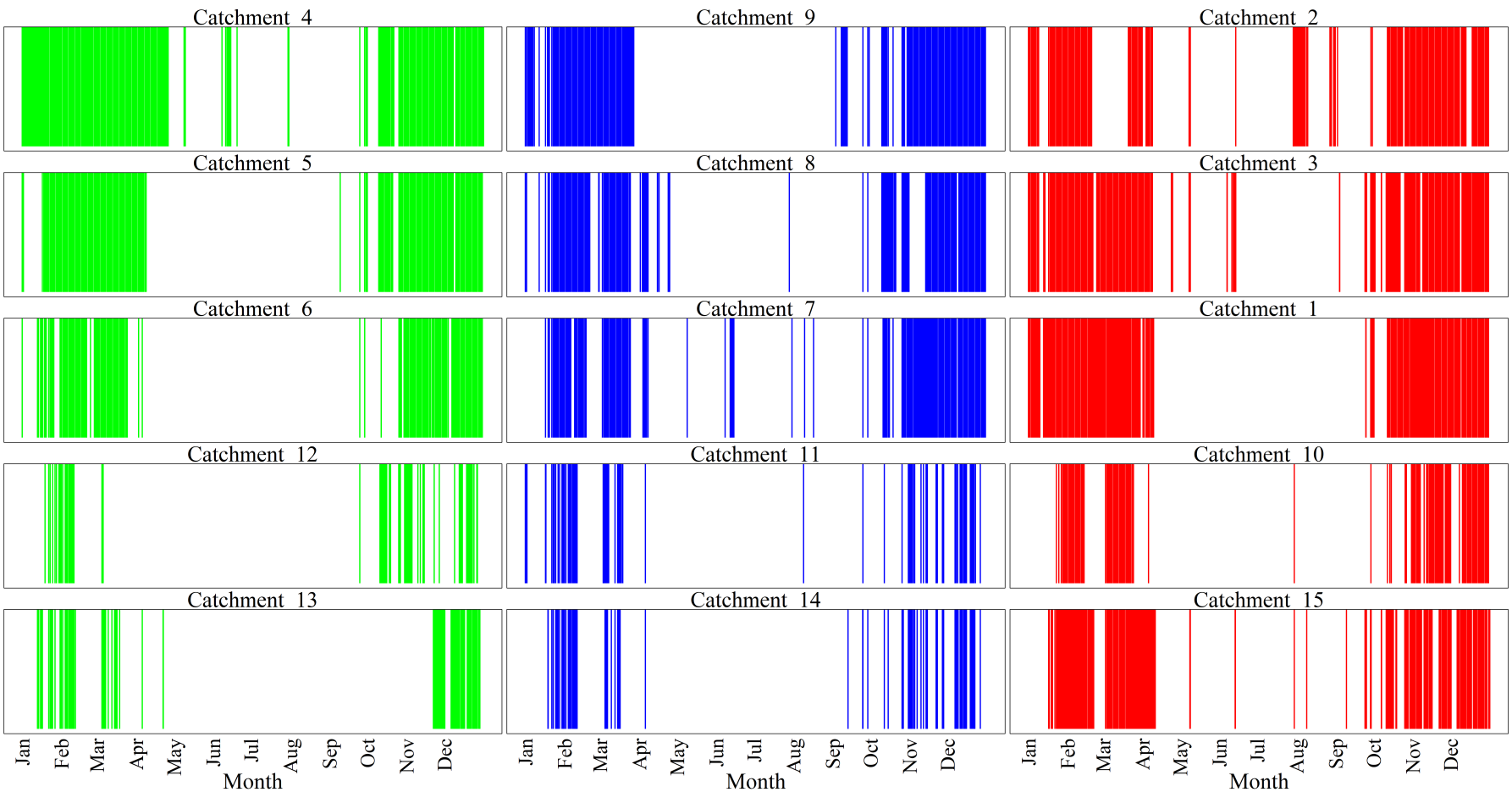


Figure 1: Timesteps of missing nitrate+nitrite data

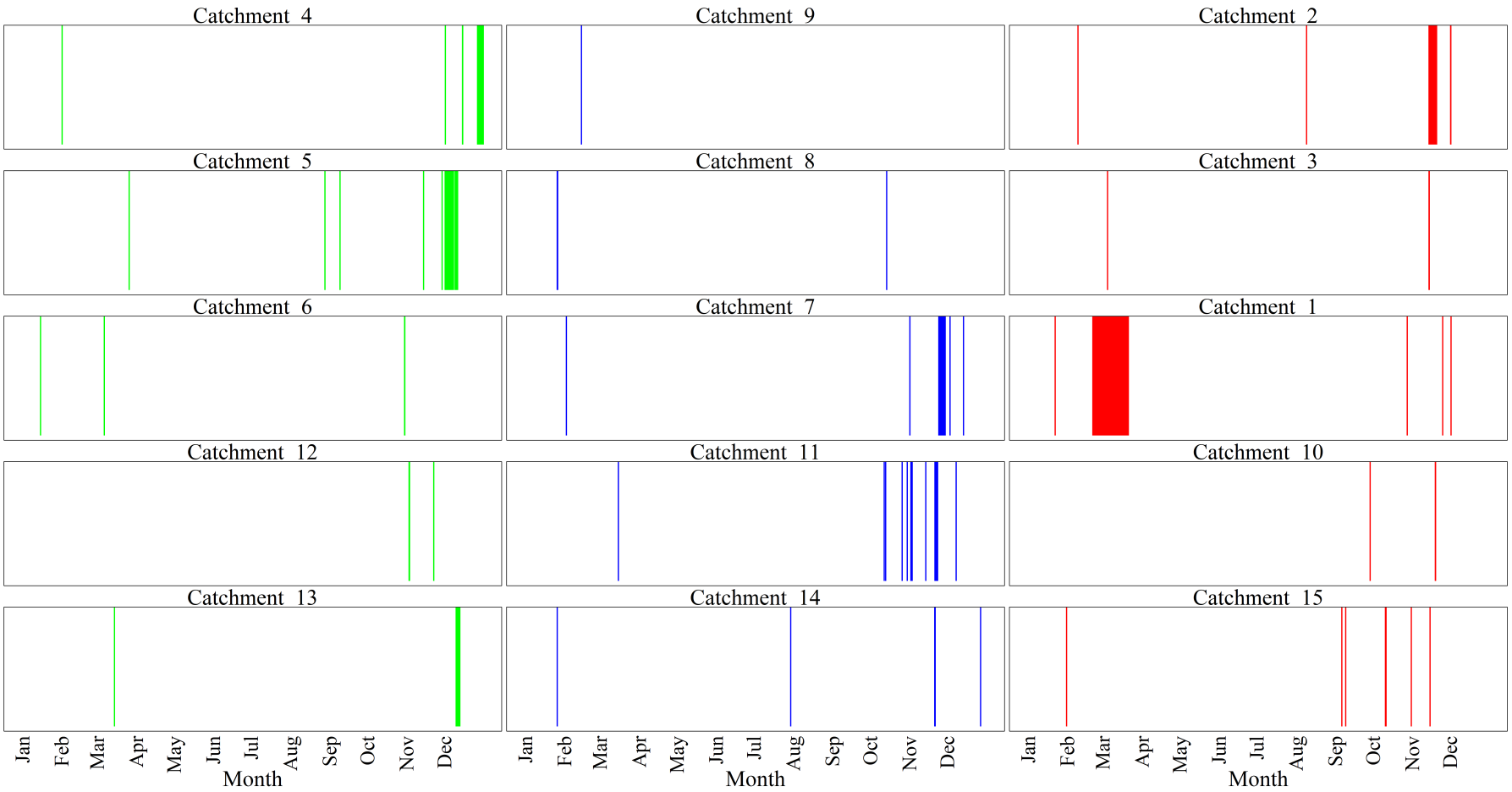


Figure 2: Timesteps of missing ammonia data

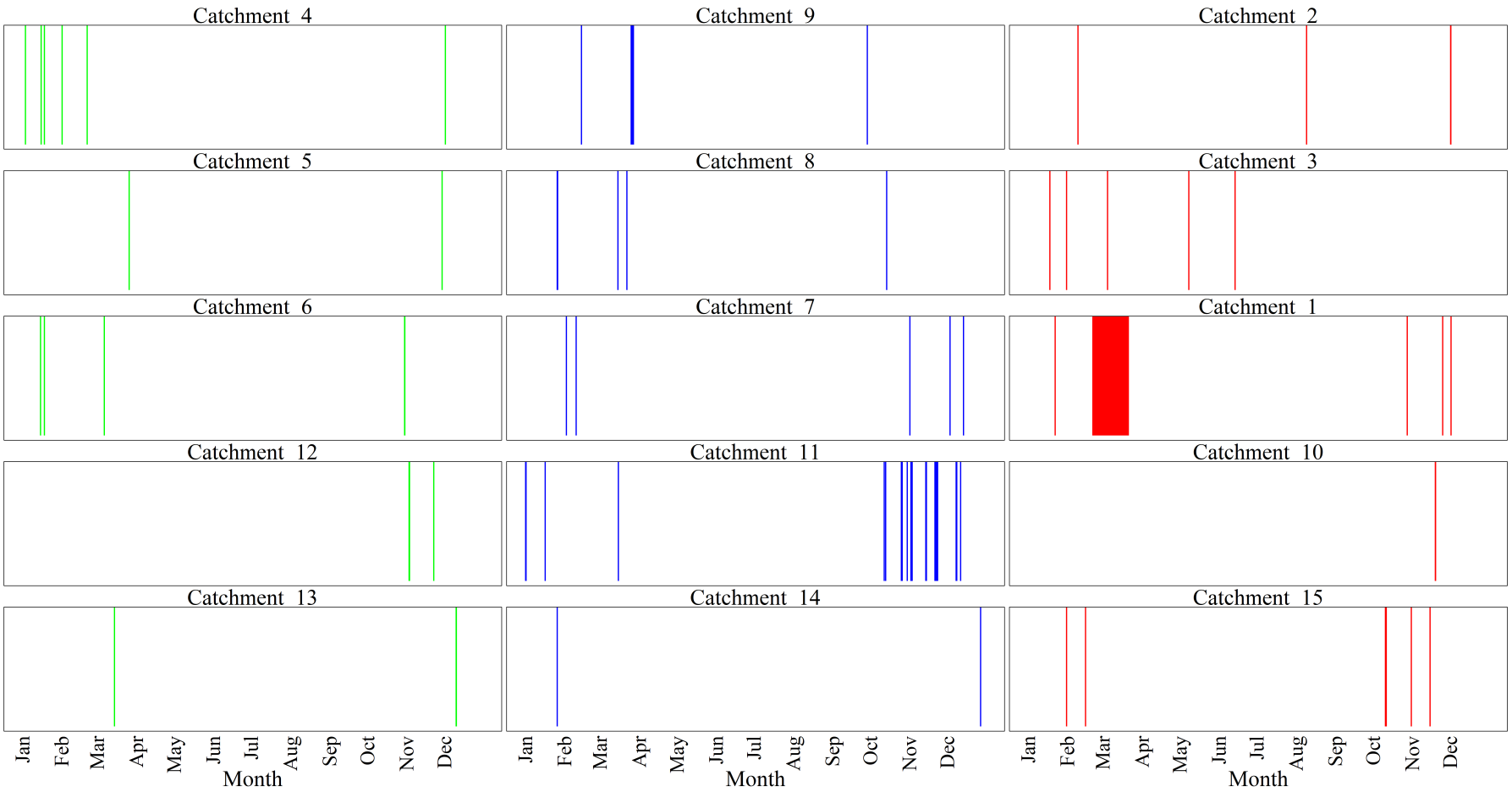


Figure 3: Timesteps of missing ammonium data

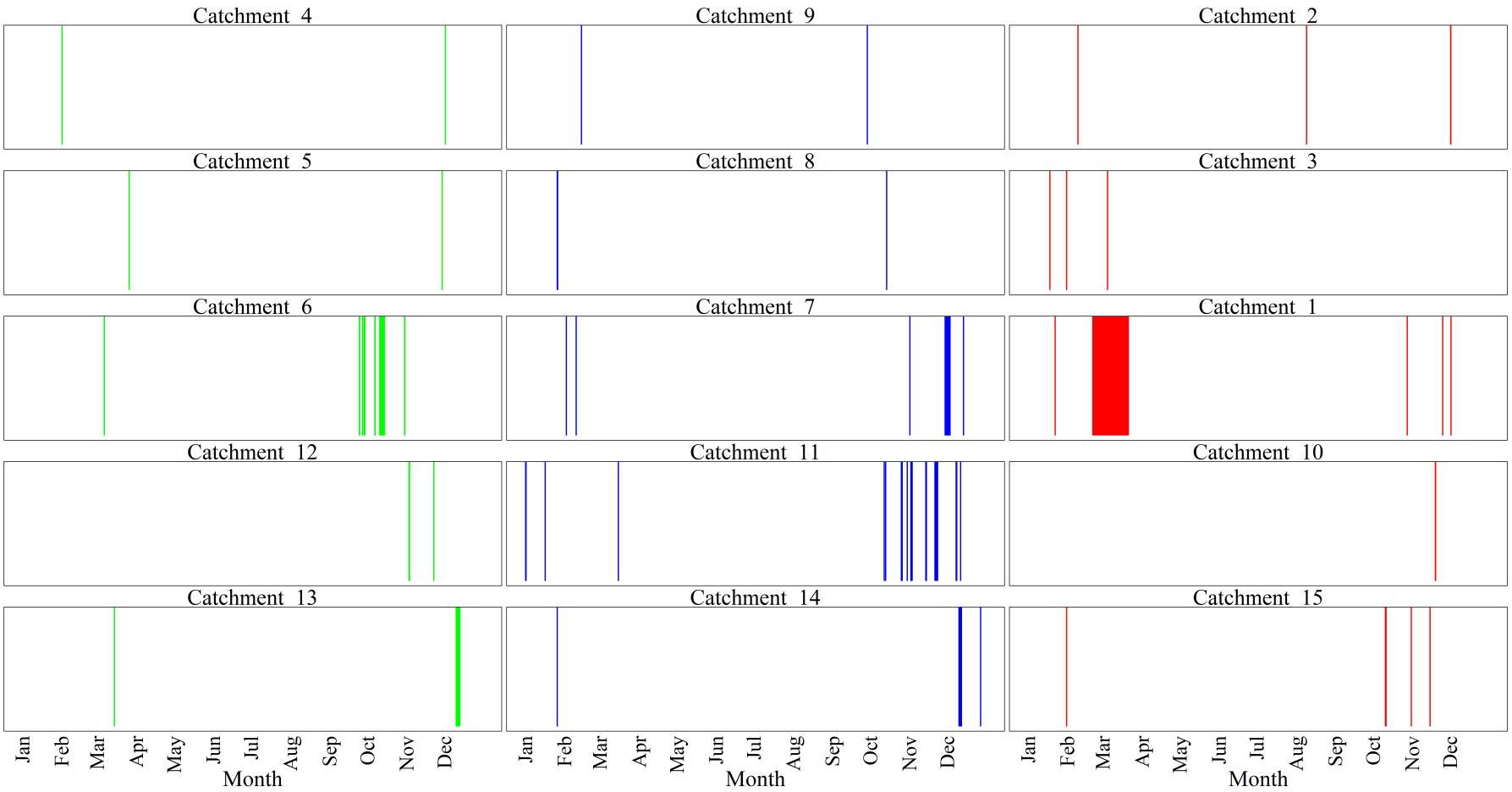


Figure 4: Timesteps of missing conductivity data

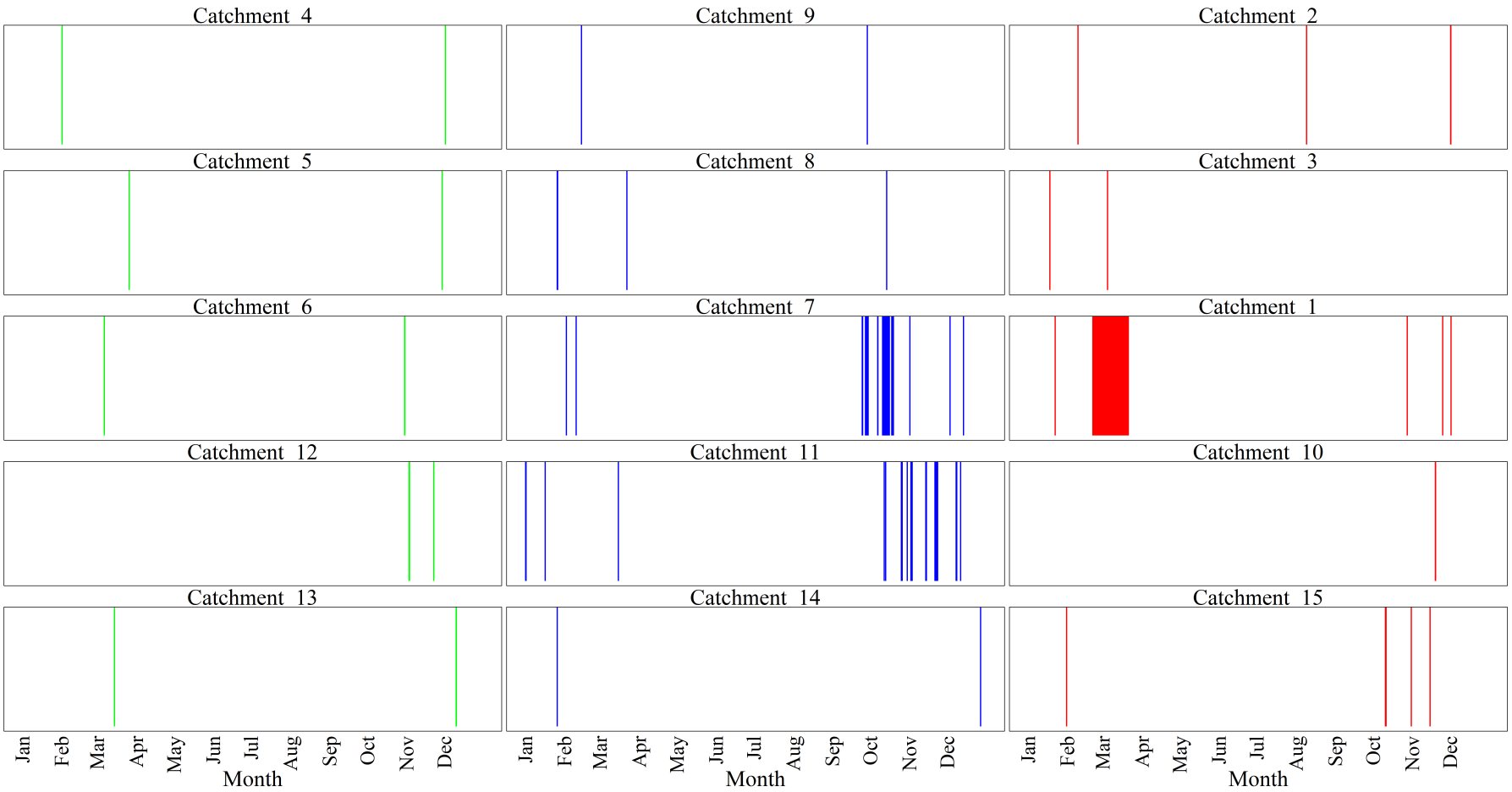


Figure 5: Timesteps of missing dissolved oxygen data

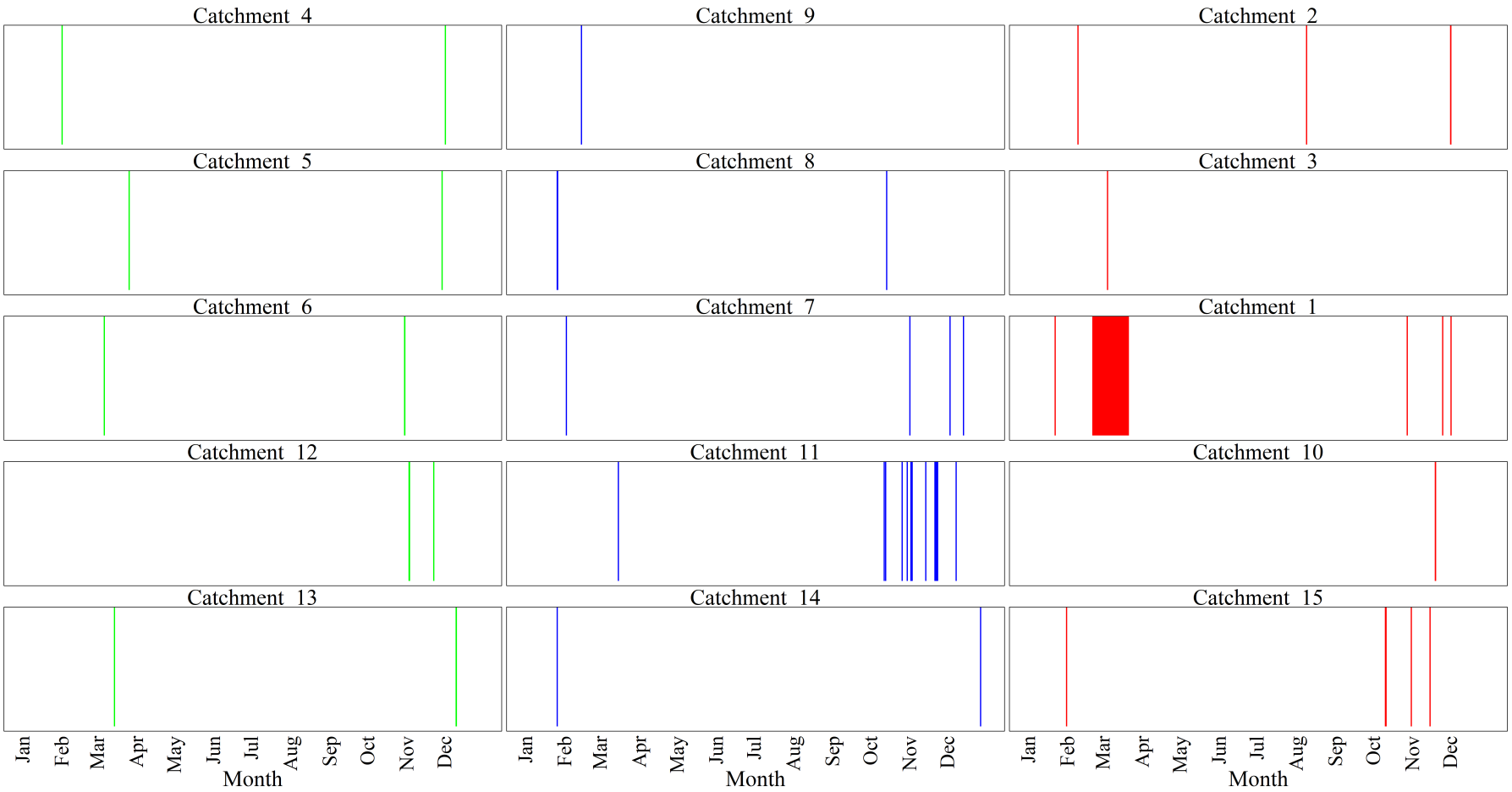


Figure 6: Timesteps of missing pH data

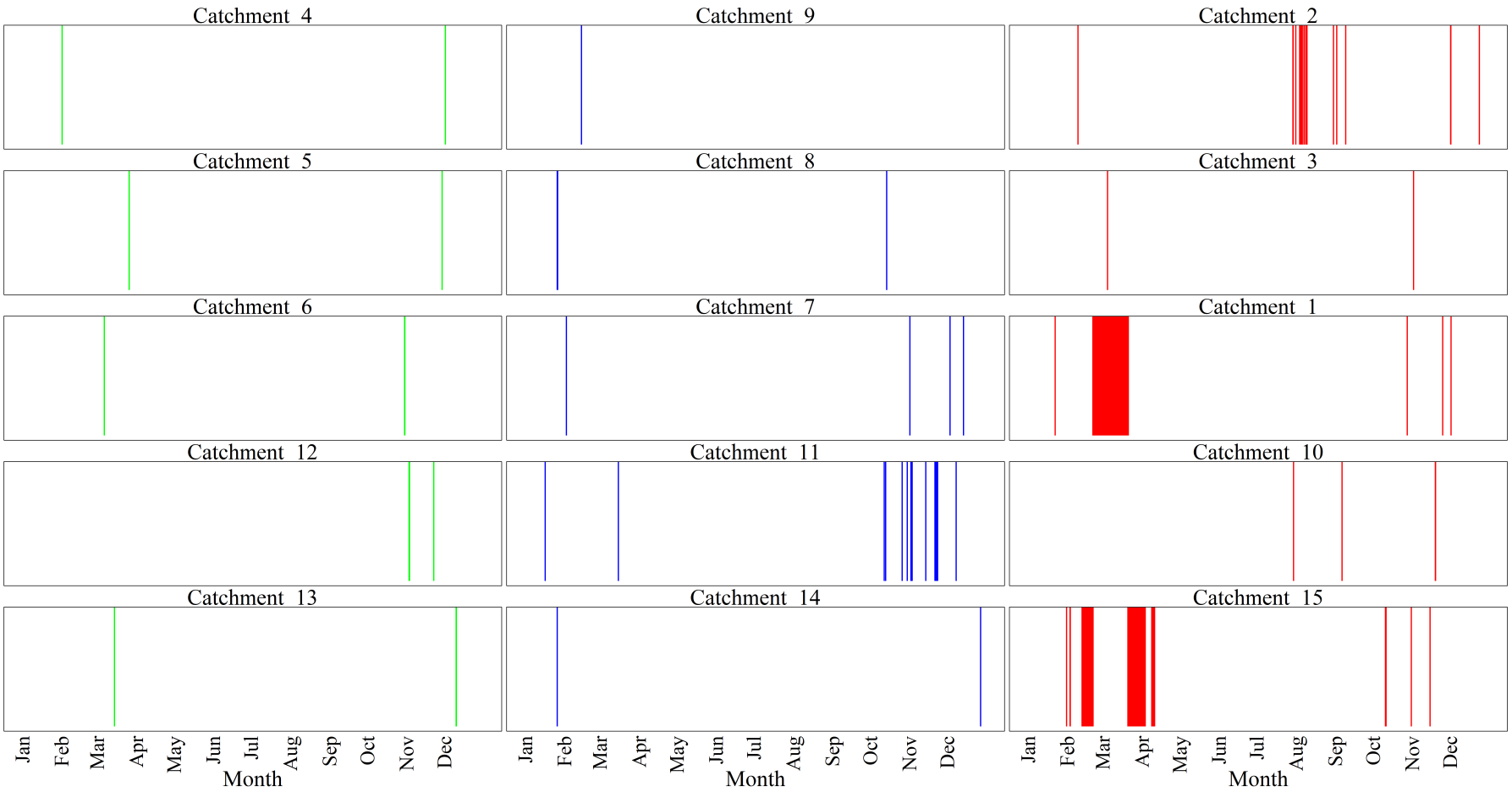


Figure 7: Timesteps of missing flow cell water temperature data

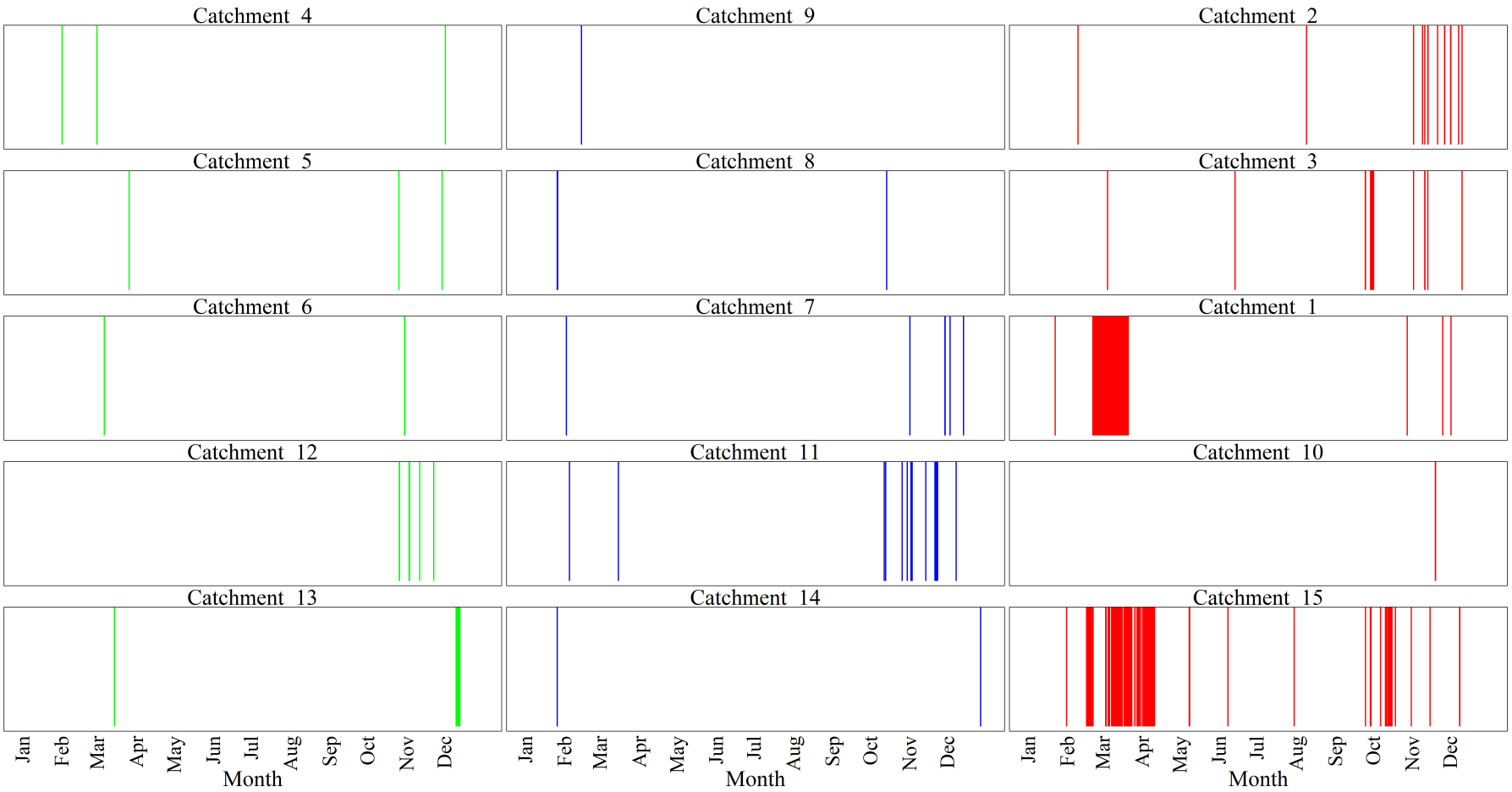


Figure 8: Timesteps of missing turbidity data

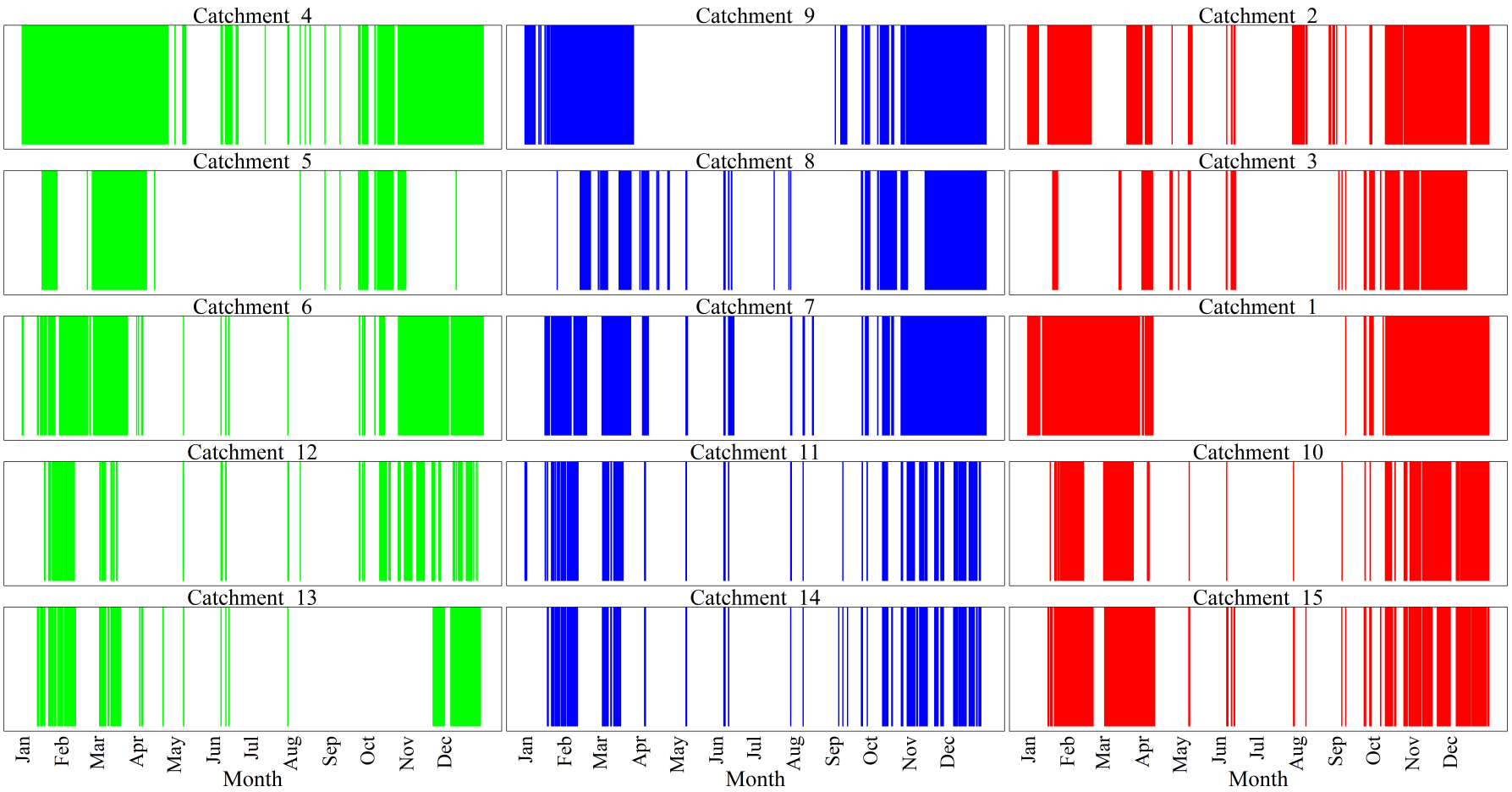


Figure 9: Timesteps of missing dissolved organic matter data

1.4 Histograms of 15 minute data distribution

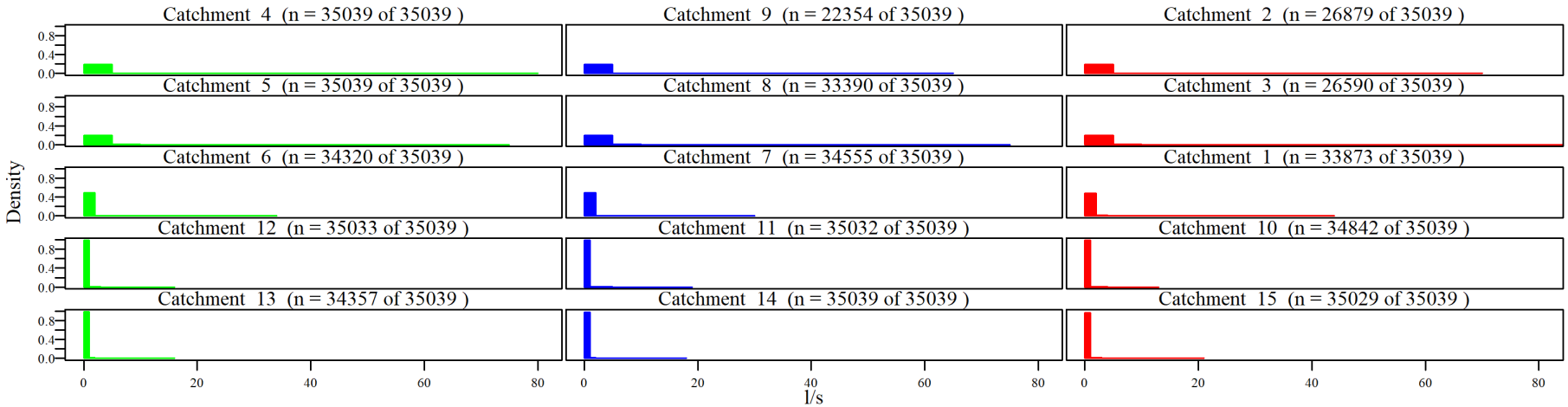


Figure 10: Distribution of data - flow

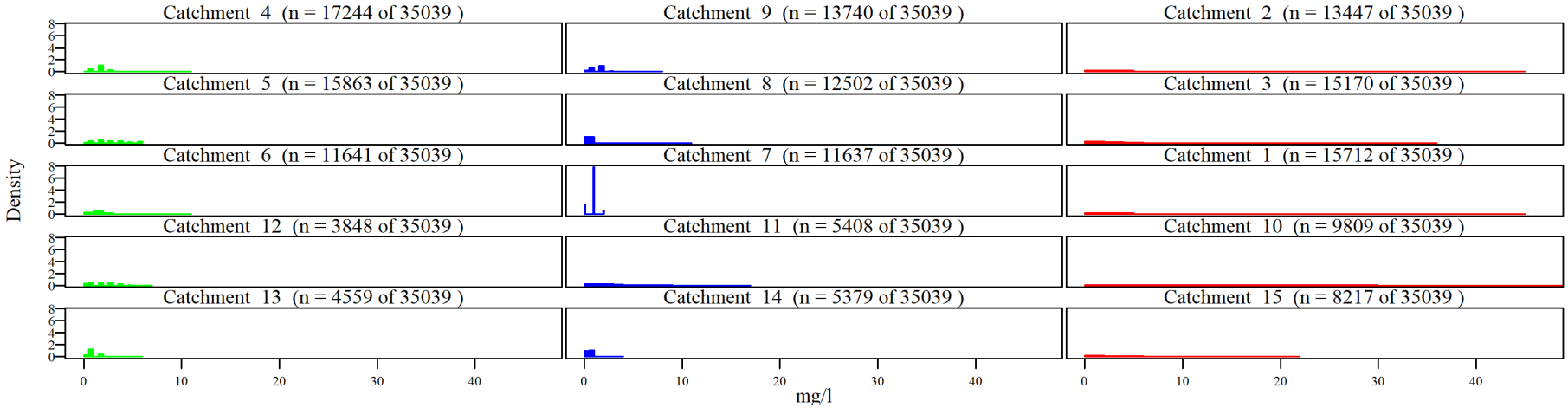


Figure 11: Distribution of data - nitrate+nitrite

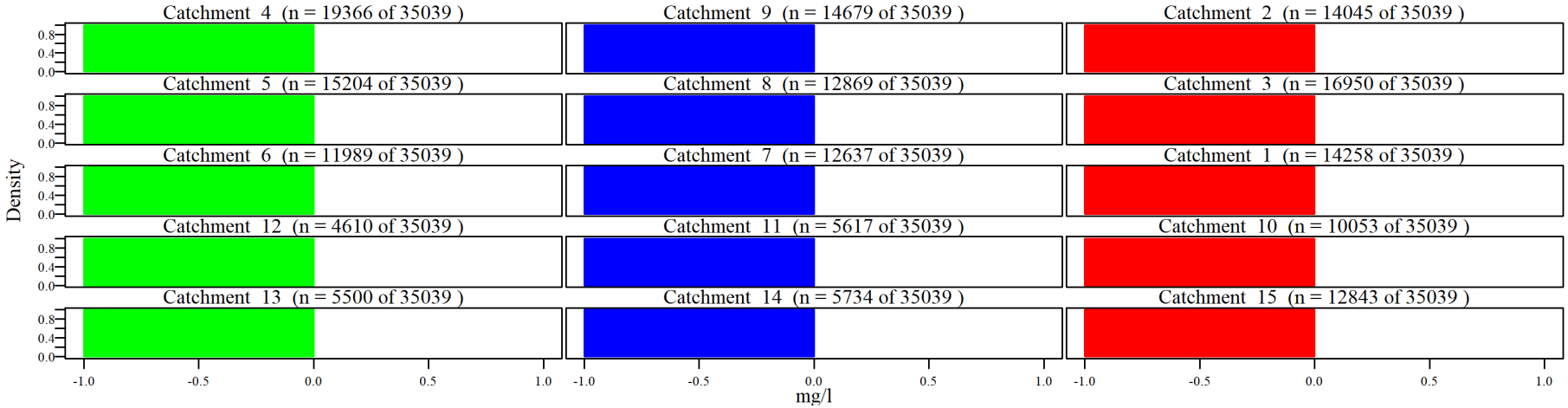


Figure 12: Distribution of data - ammonia

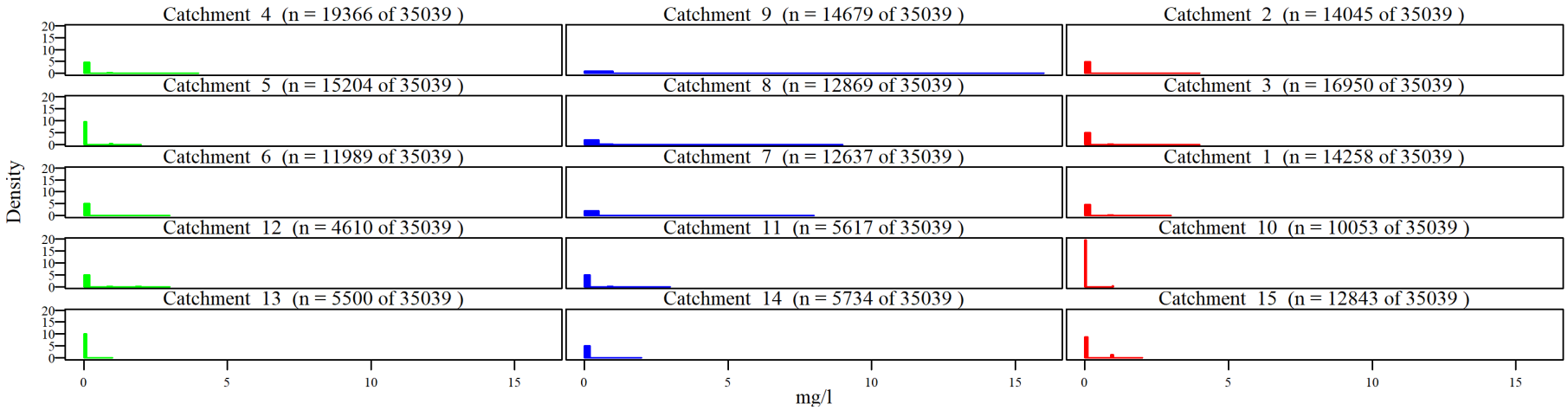


Figure 13: Distribution of data - ammonium

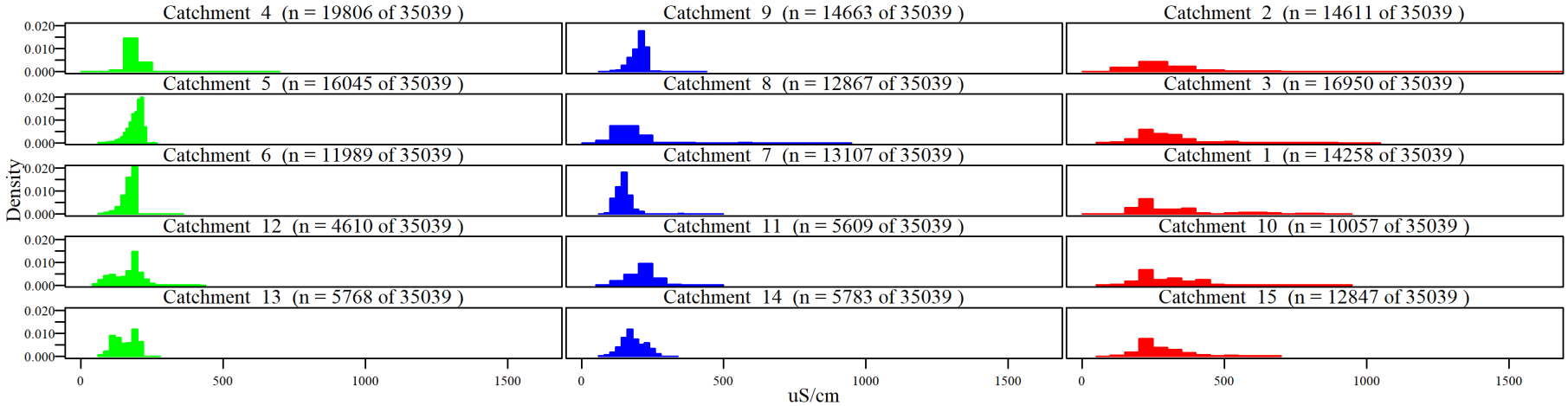


Figure 14: Distribution of data - conductivity

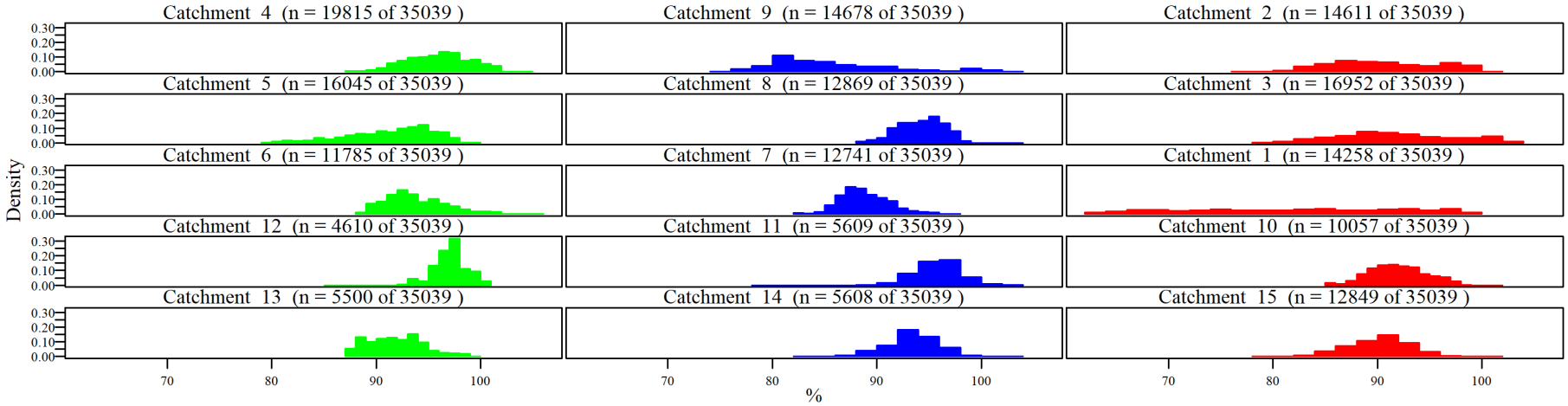


Figure 15: Distribution of data - dissolved oxygen

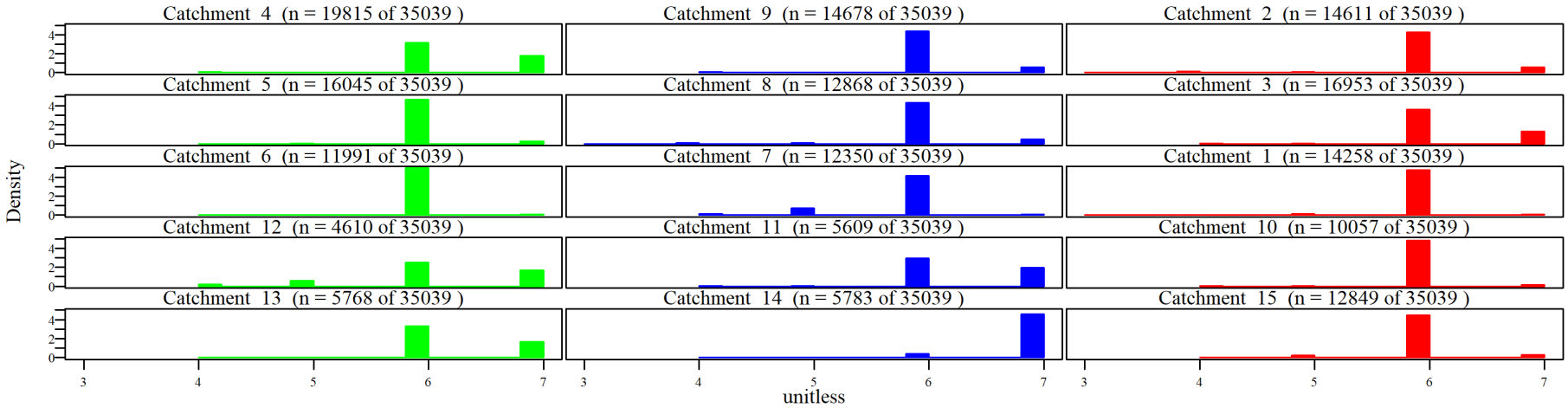


Figure 16: Distribution of data - pH

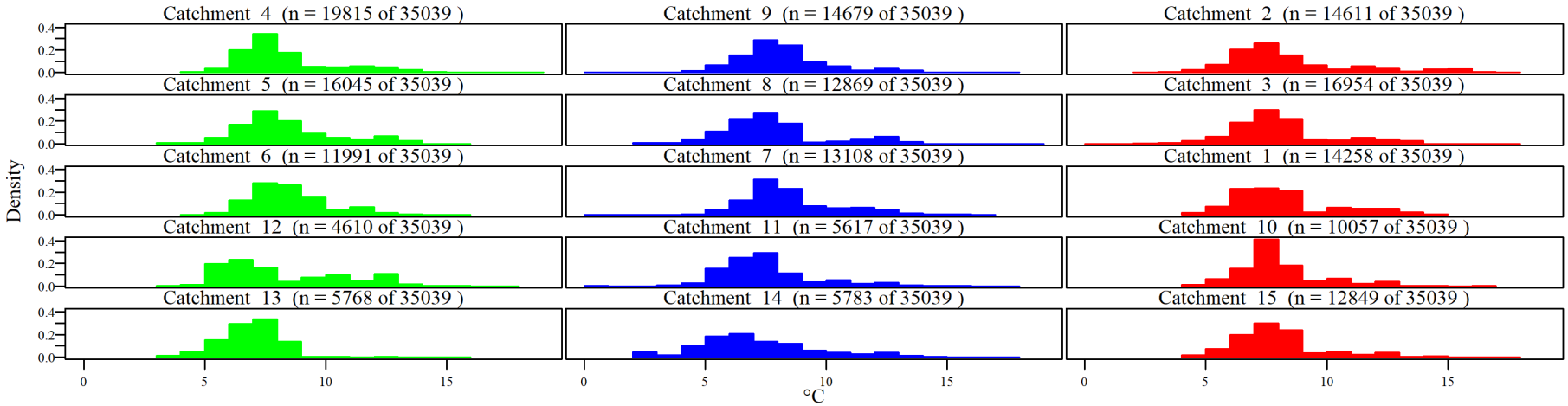


Figure 17: Distribution of data - flow cell water temperature

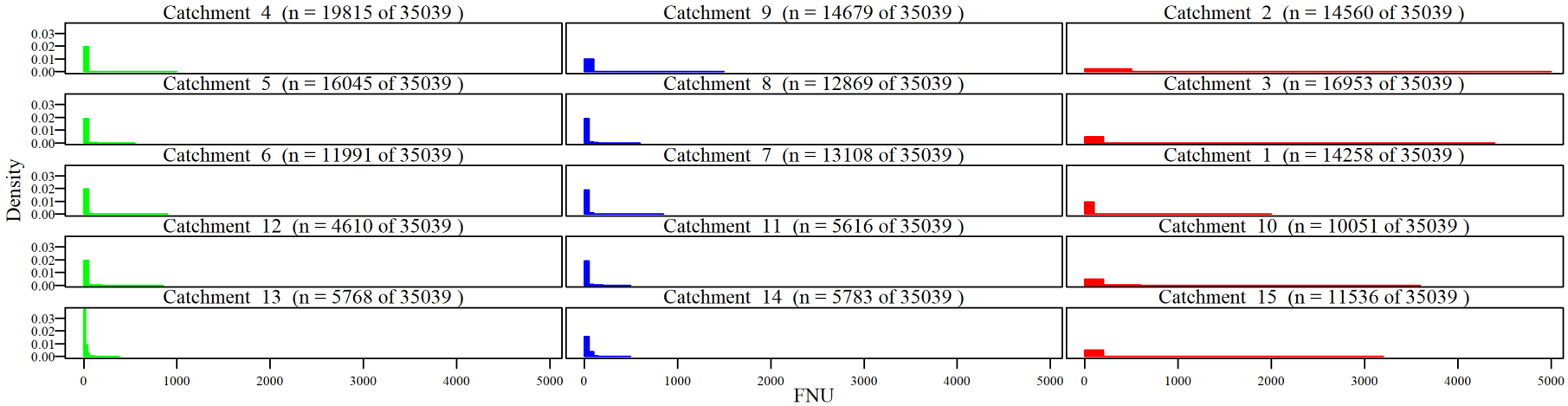


Figure 18: Distribution of data - turbidity

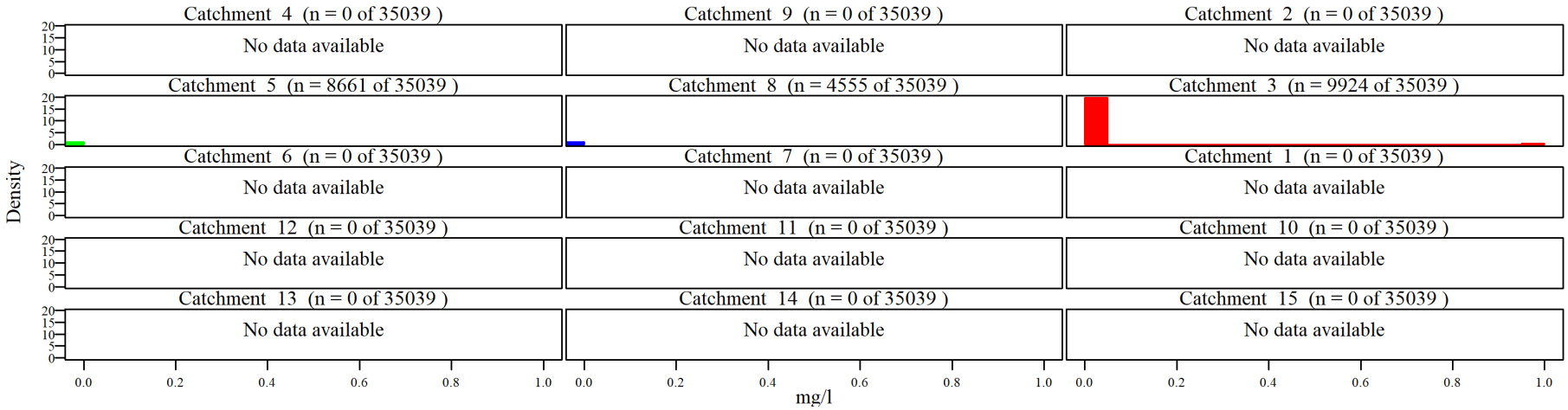


Figure 19: Distribution of data - total phosphorus

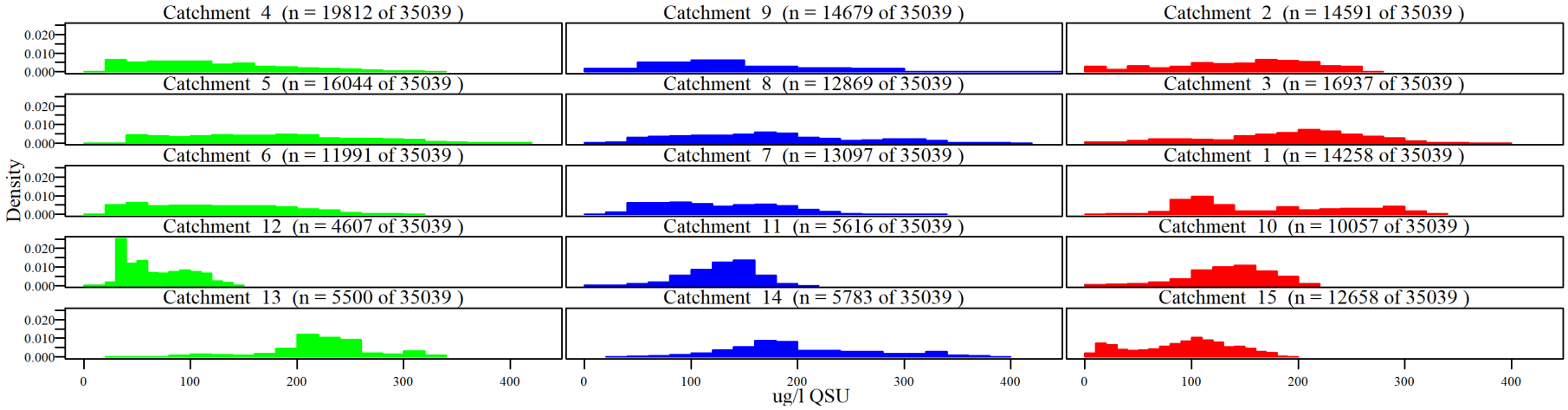


Figure 20: Distribution of data - dissolved organic matter

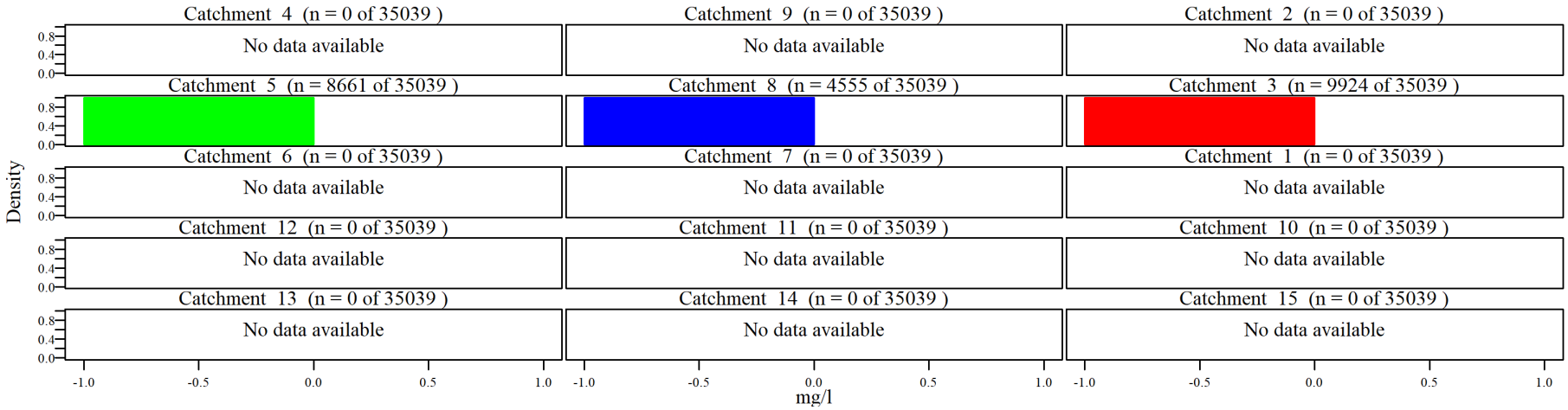


Figure 21: Distribution of data - ortho-phosphorus

1.5 Time series

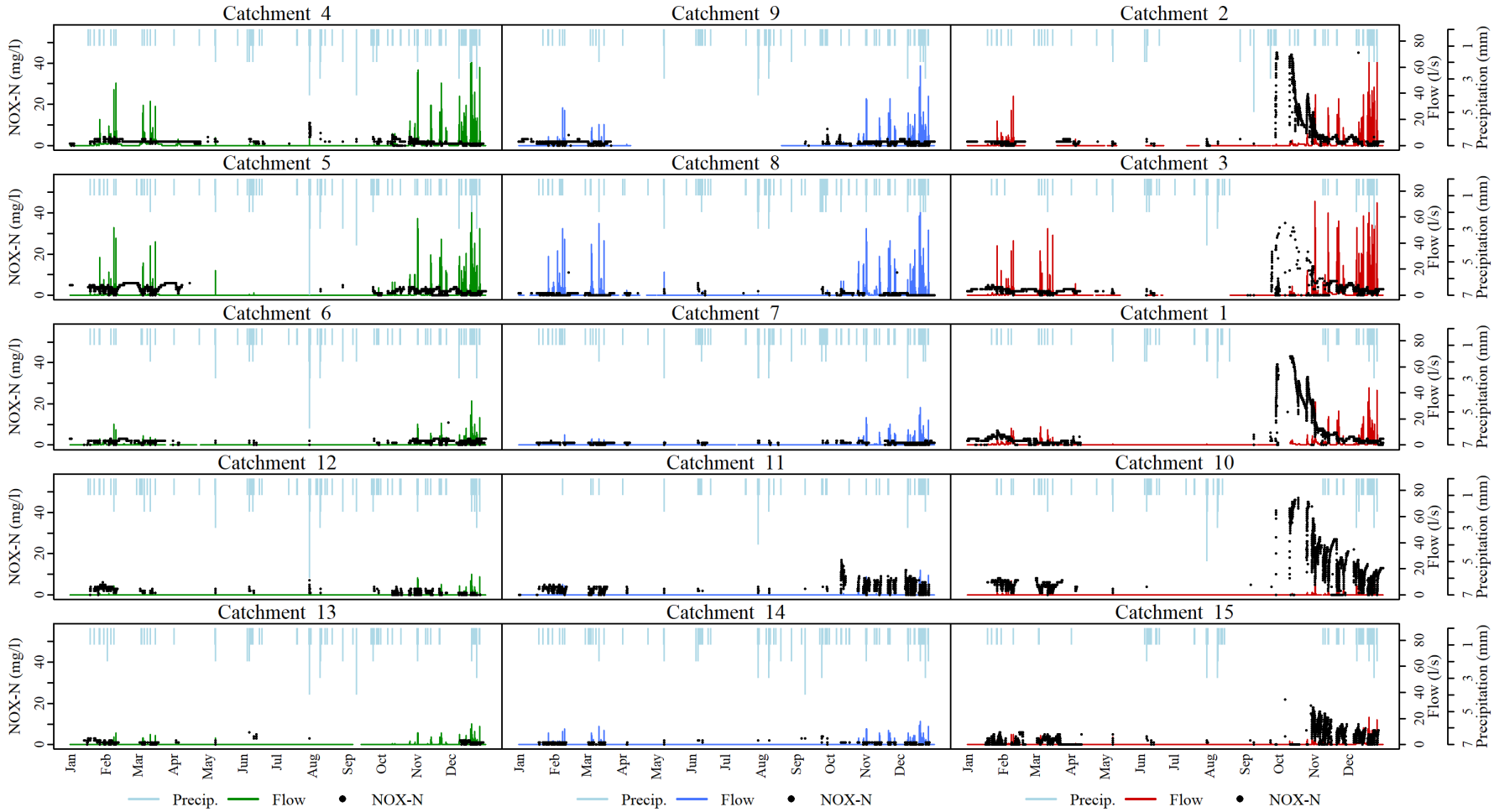


Figure 22: Time series of precipitation, flow and nitrate+nitrite (NOX-N)

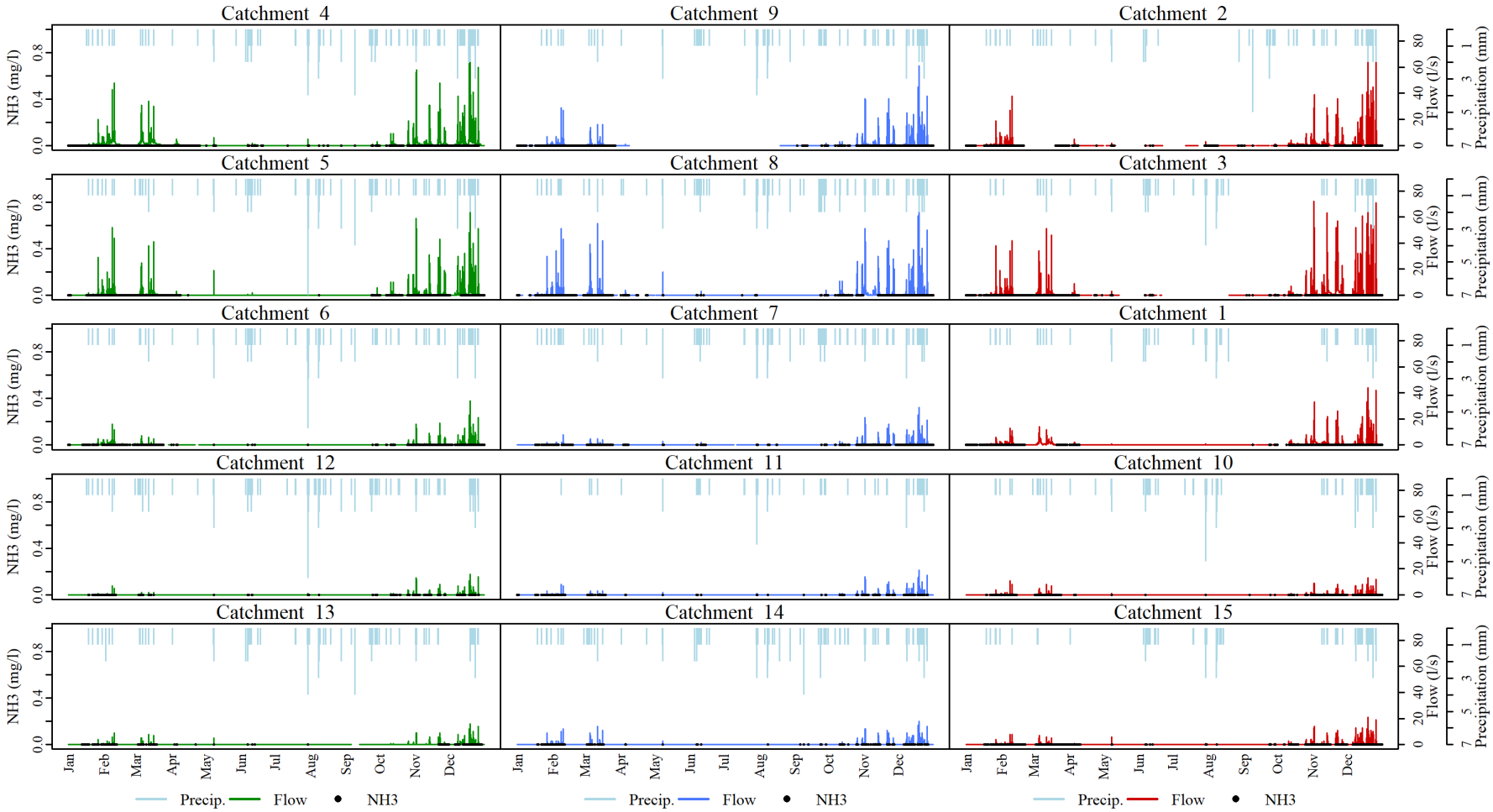


Figure 23: Time series of precipitation, flow and ammonia (NH3)

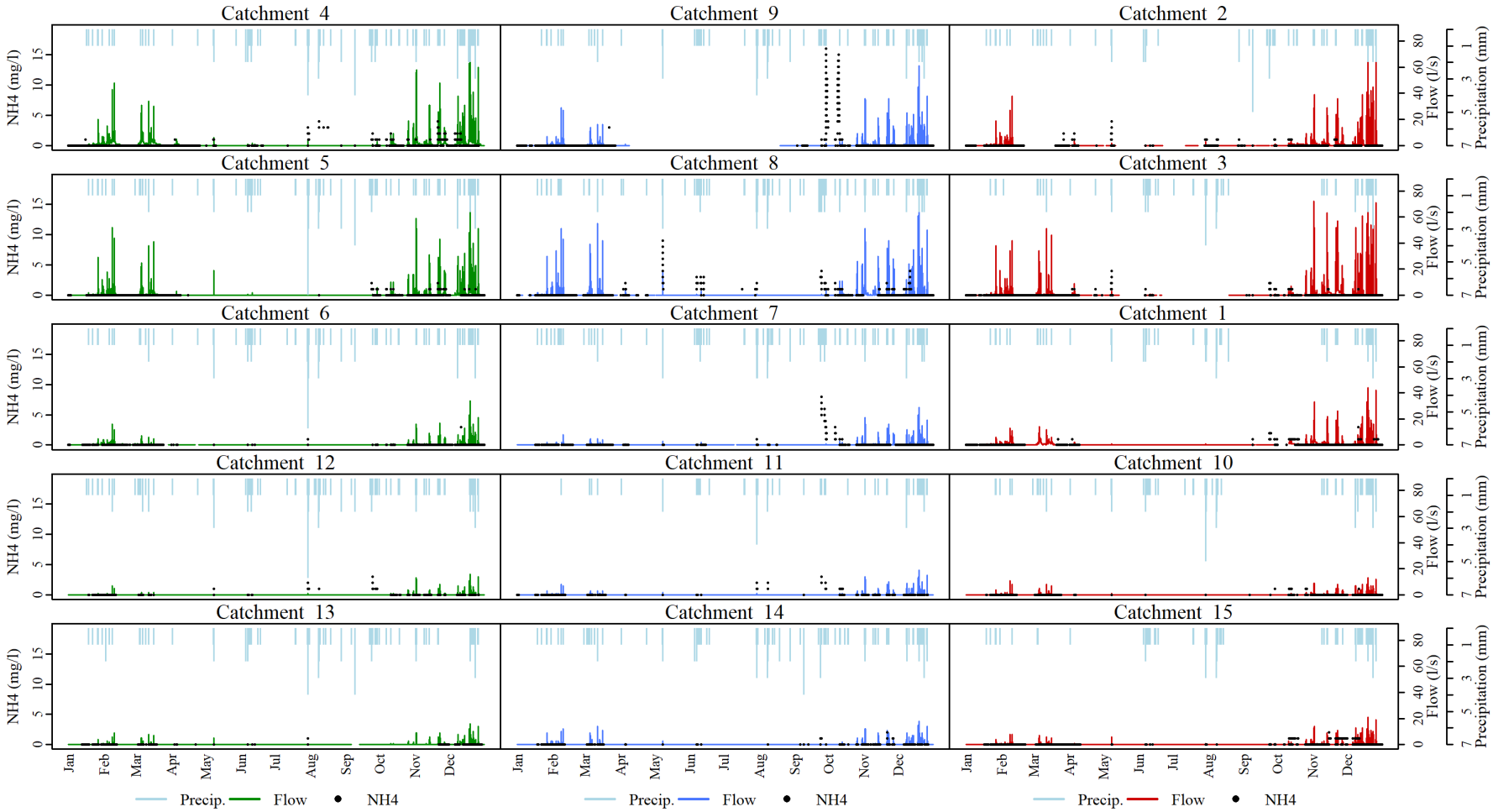


Figure 24: Time series of precipitation, flow and ammonium (NH4)

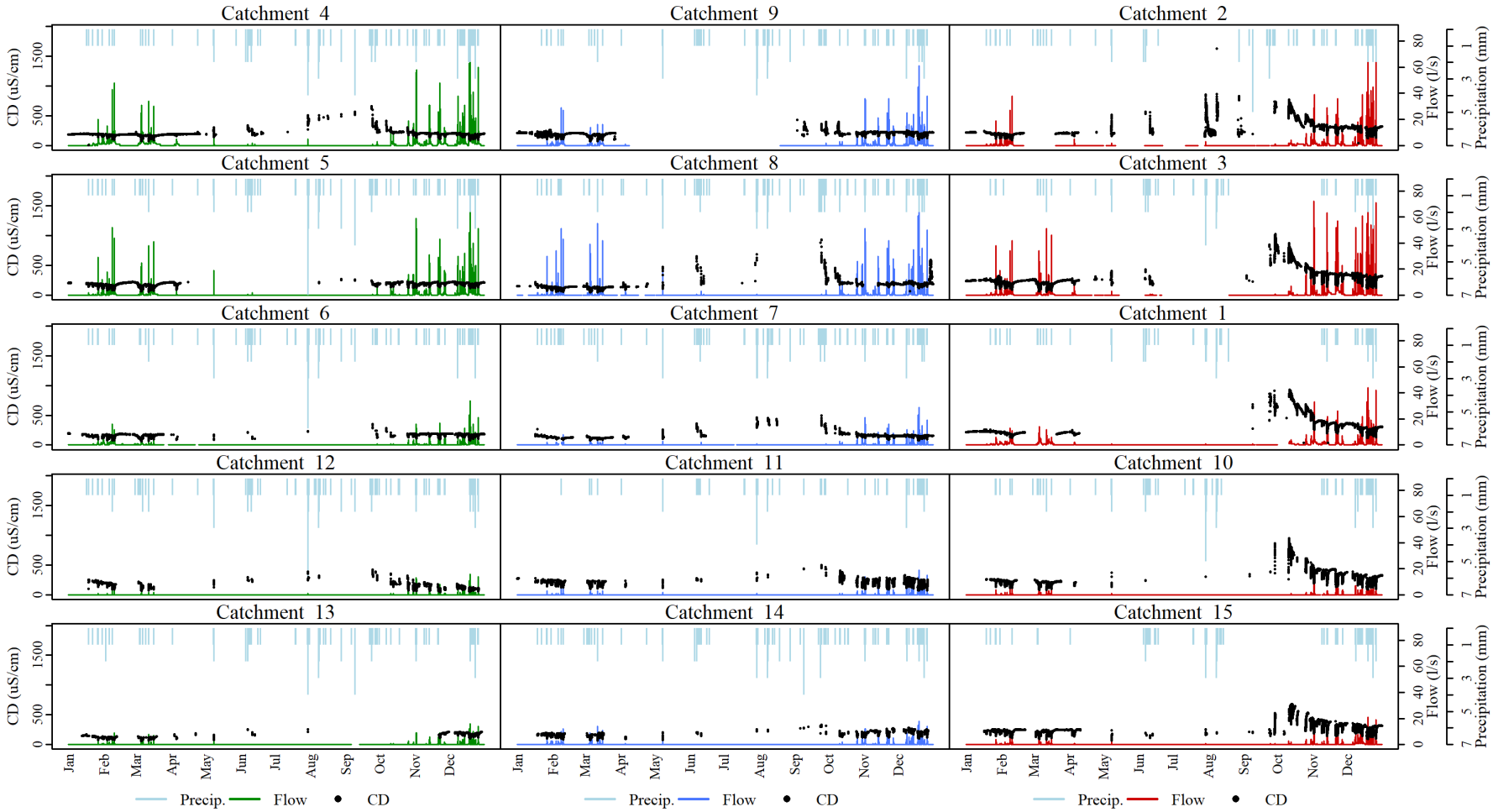


Figure 25: Time series of precipitation, flow and conductivity (CD)

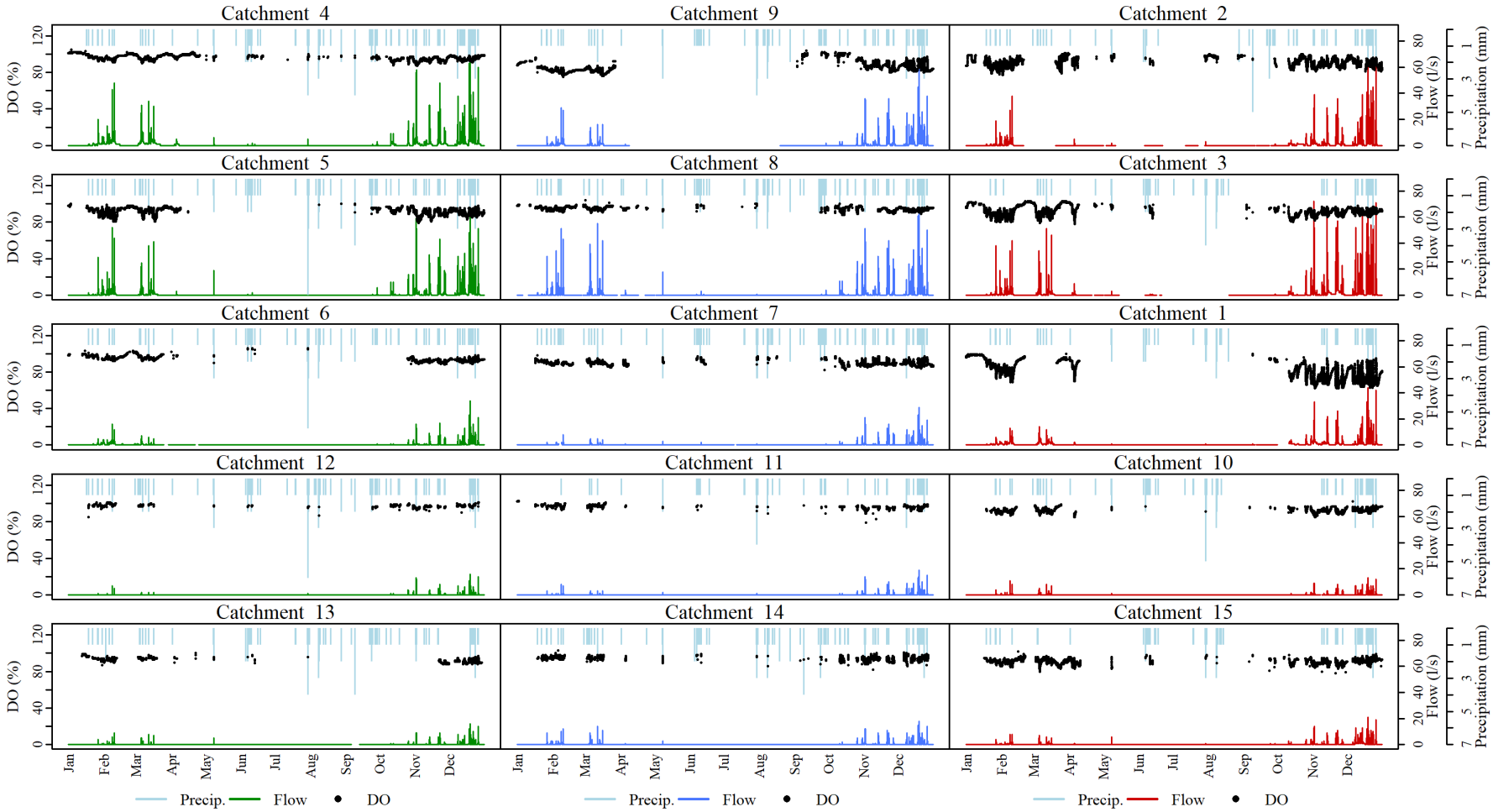


Figure 26: Time series of precipitation, flow and dissolved oxygen (DO)

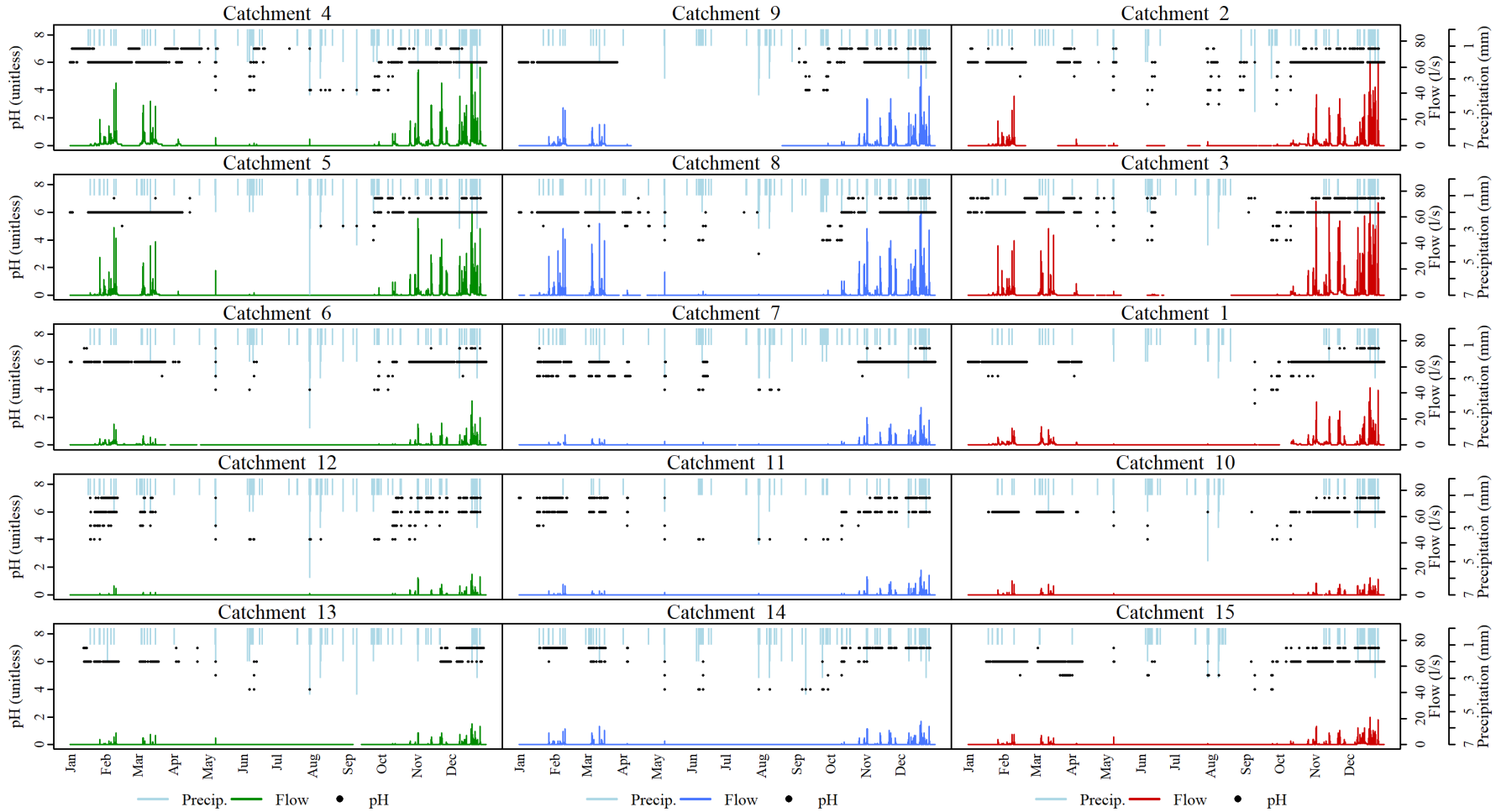


Figure 27: Time series of precipitation, flow and pH (pH)

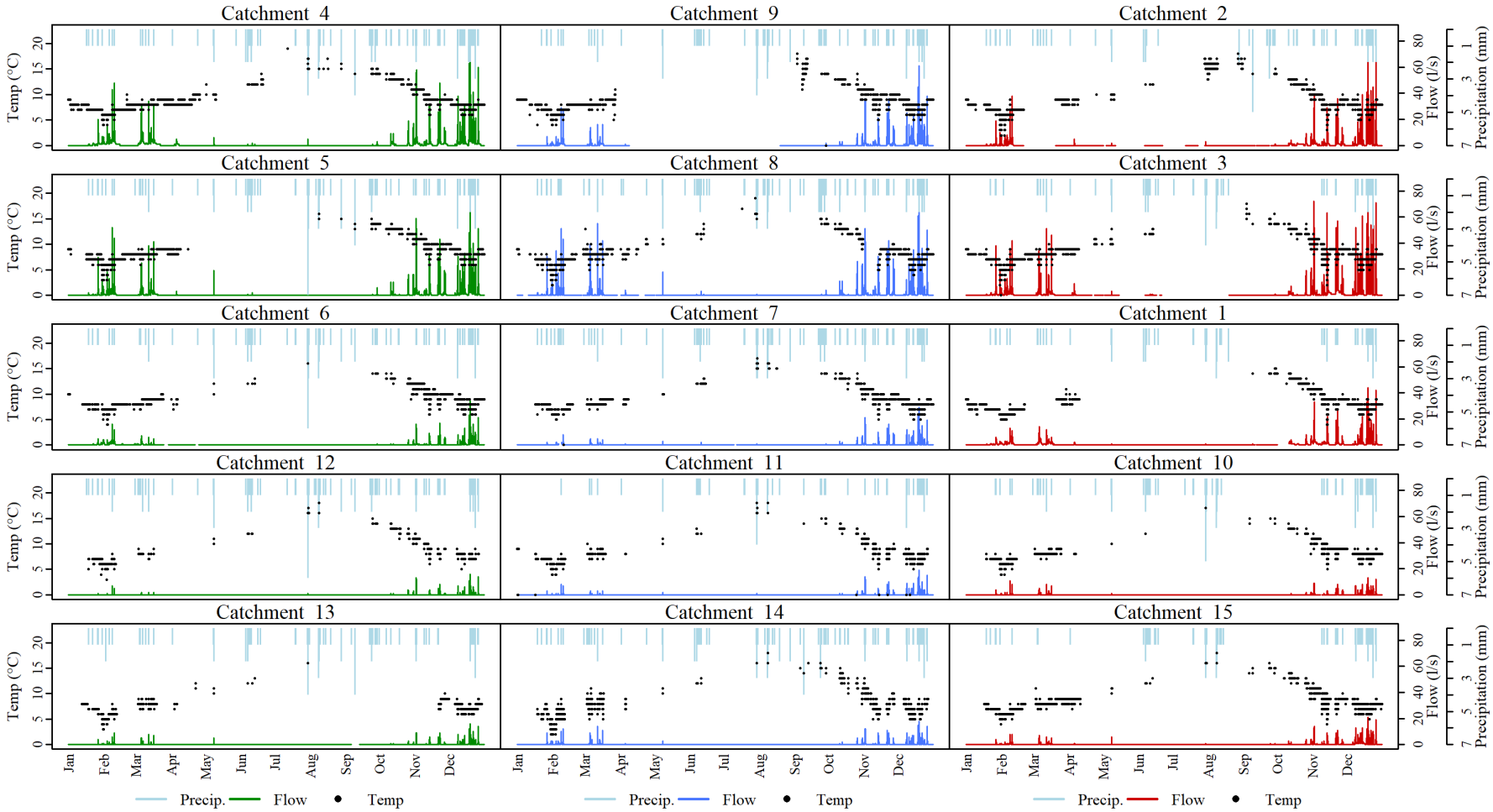


Figure 28: Time series of precipitation, flow and flow cell water temperature (Temp)

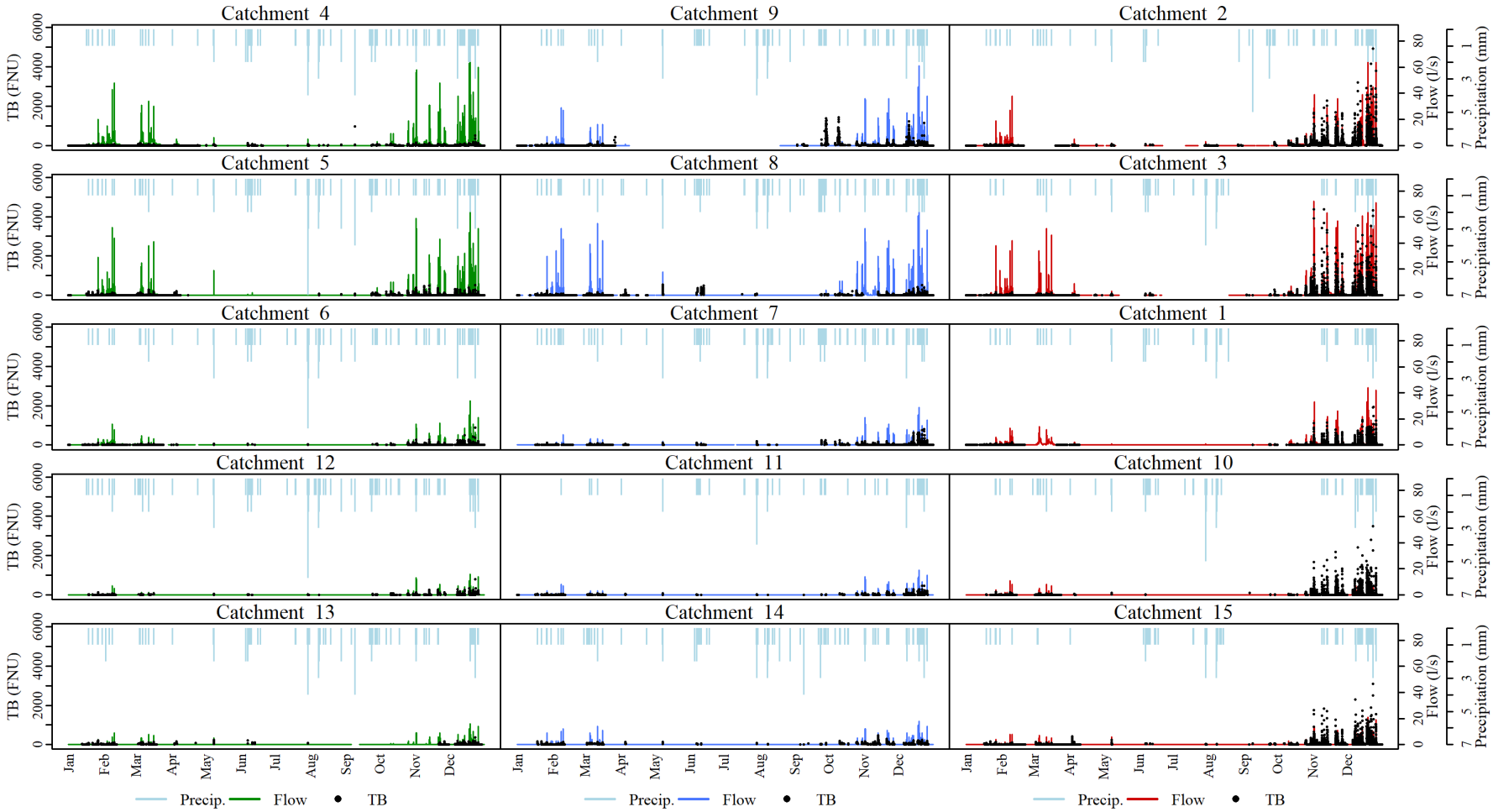


Figure 29: Time series of precipitation, flow and turbidity (TB)

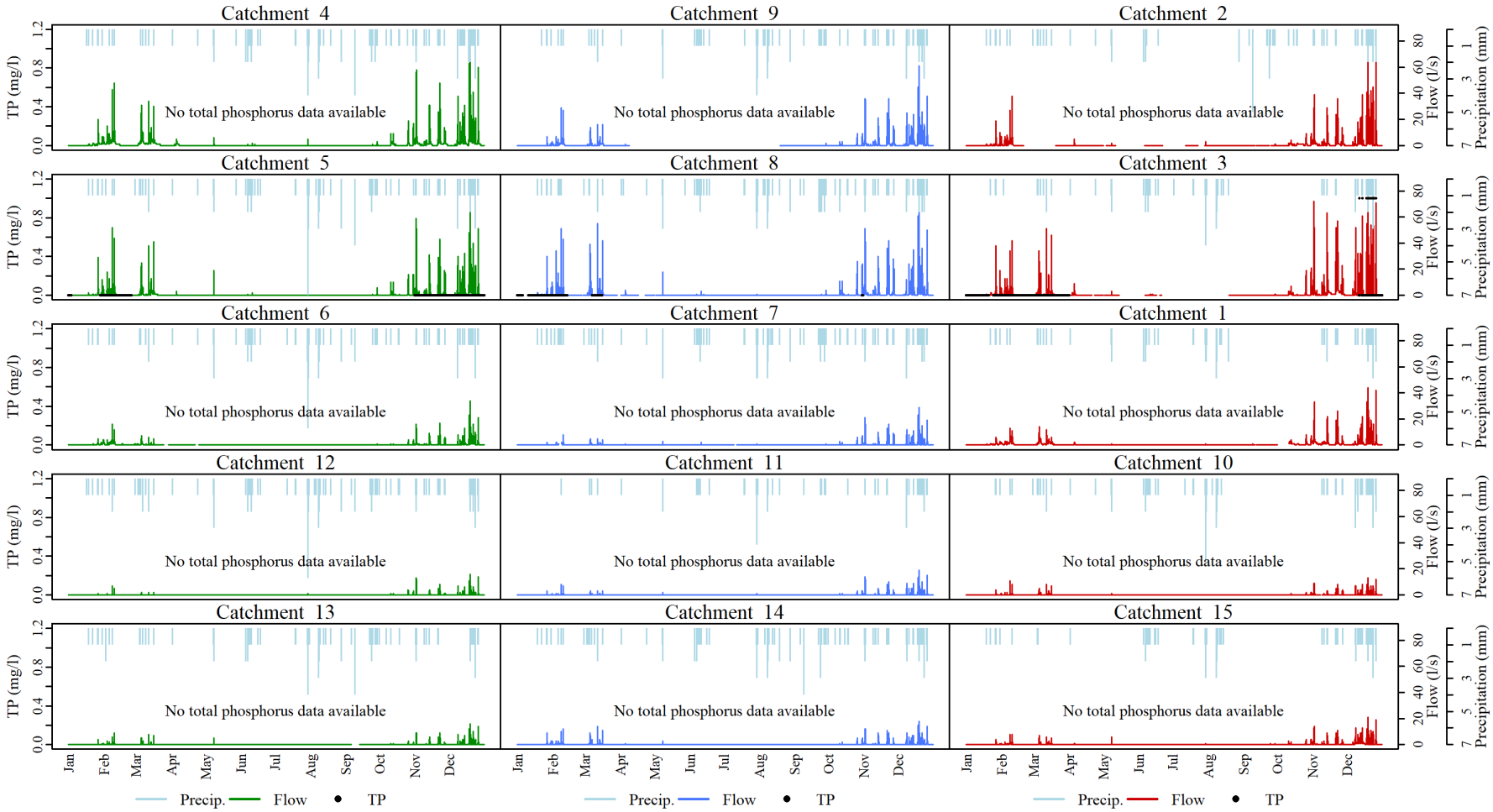


Figure 30: Time series of precipitation, flow and total phosphorus (TP)

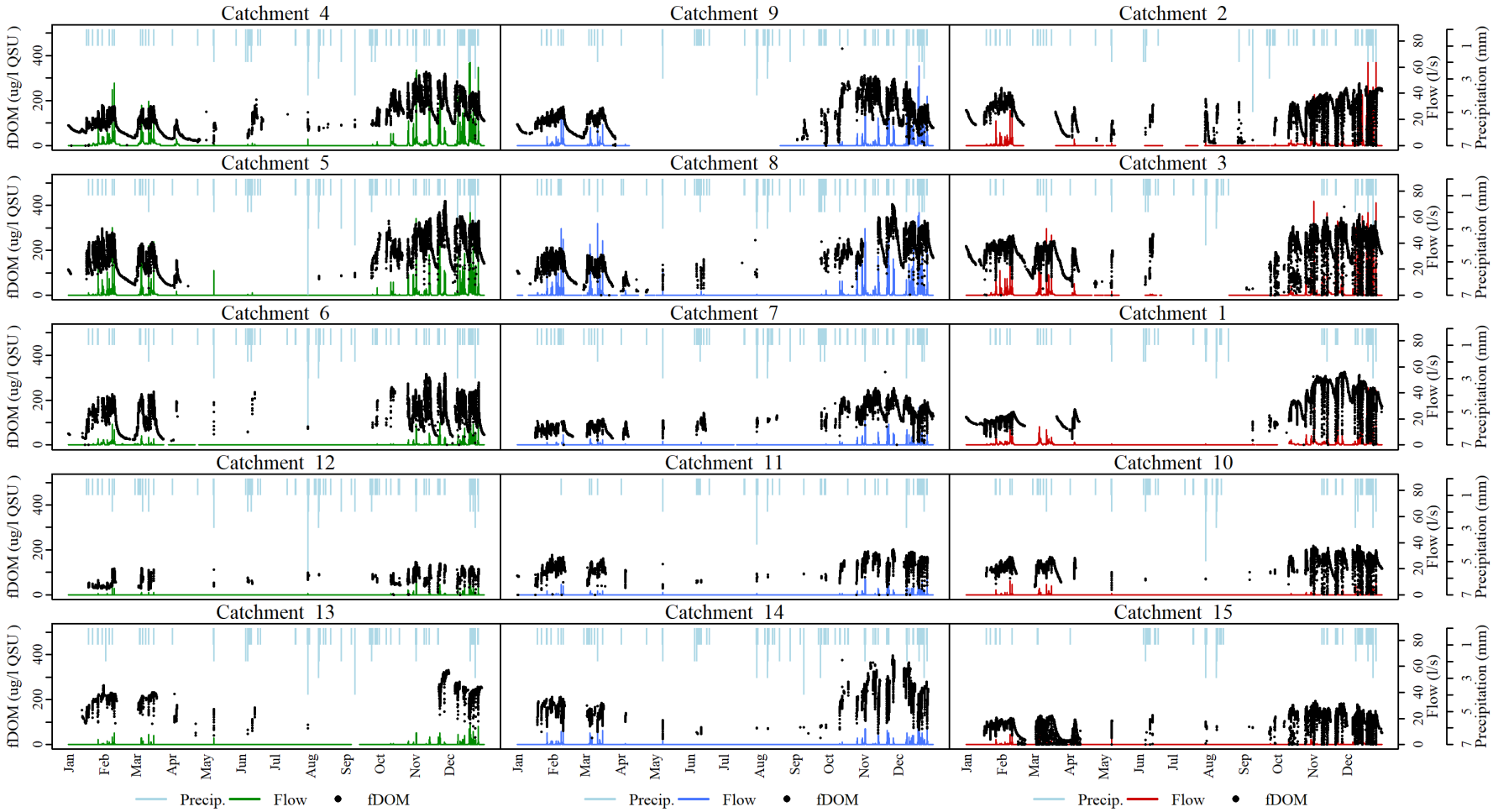


Figure 31: Time series of precipitation, flow and dissolved organic matter (fDOM)

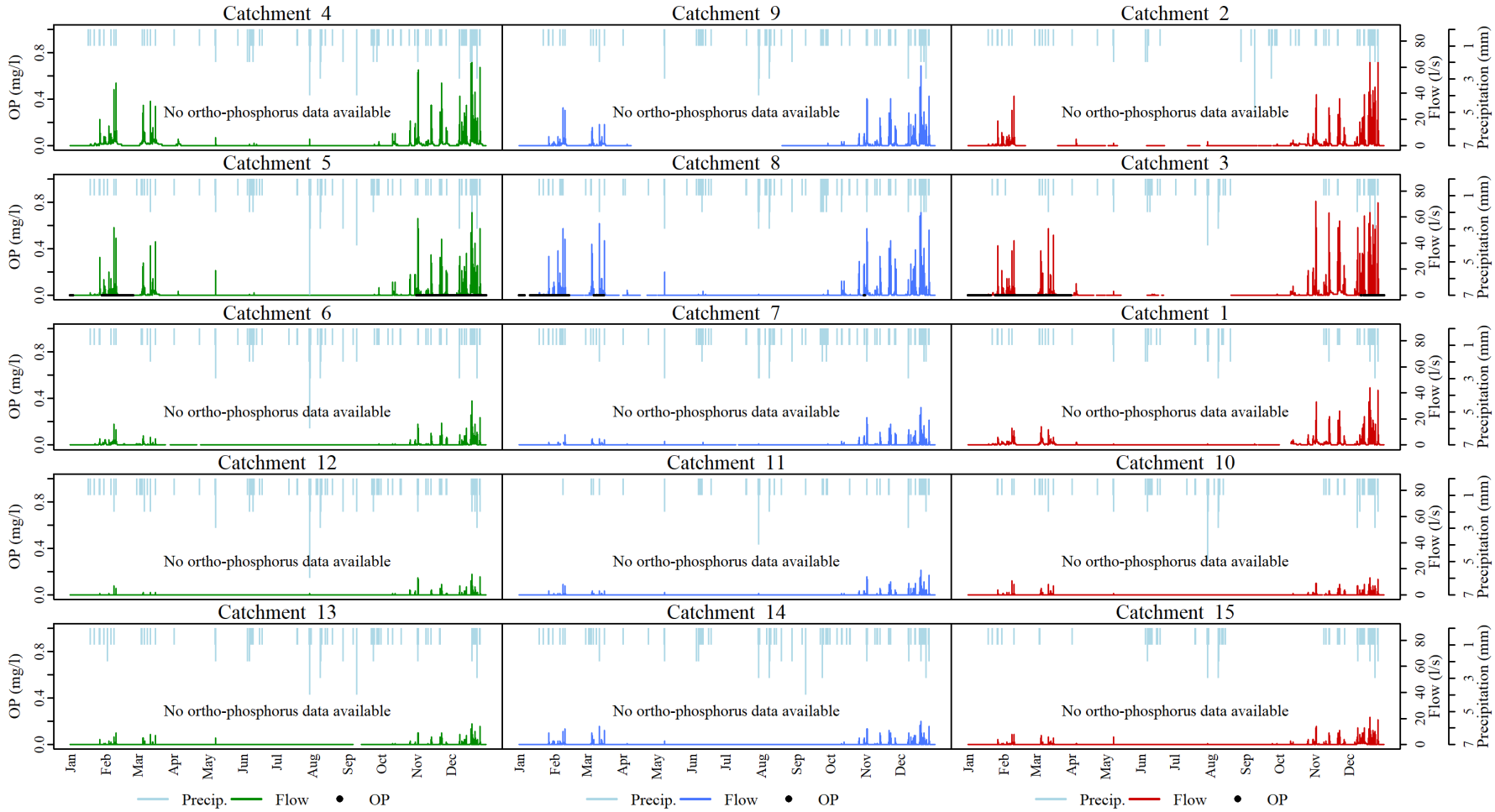


Figure 32: Time series of precipitation, flow and ortho-phosphorus (OP)

1.6 Correlations

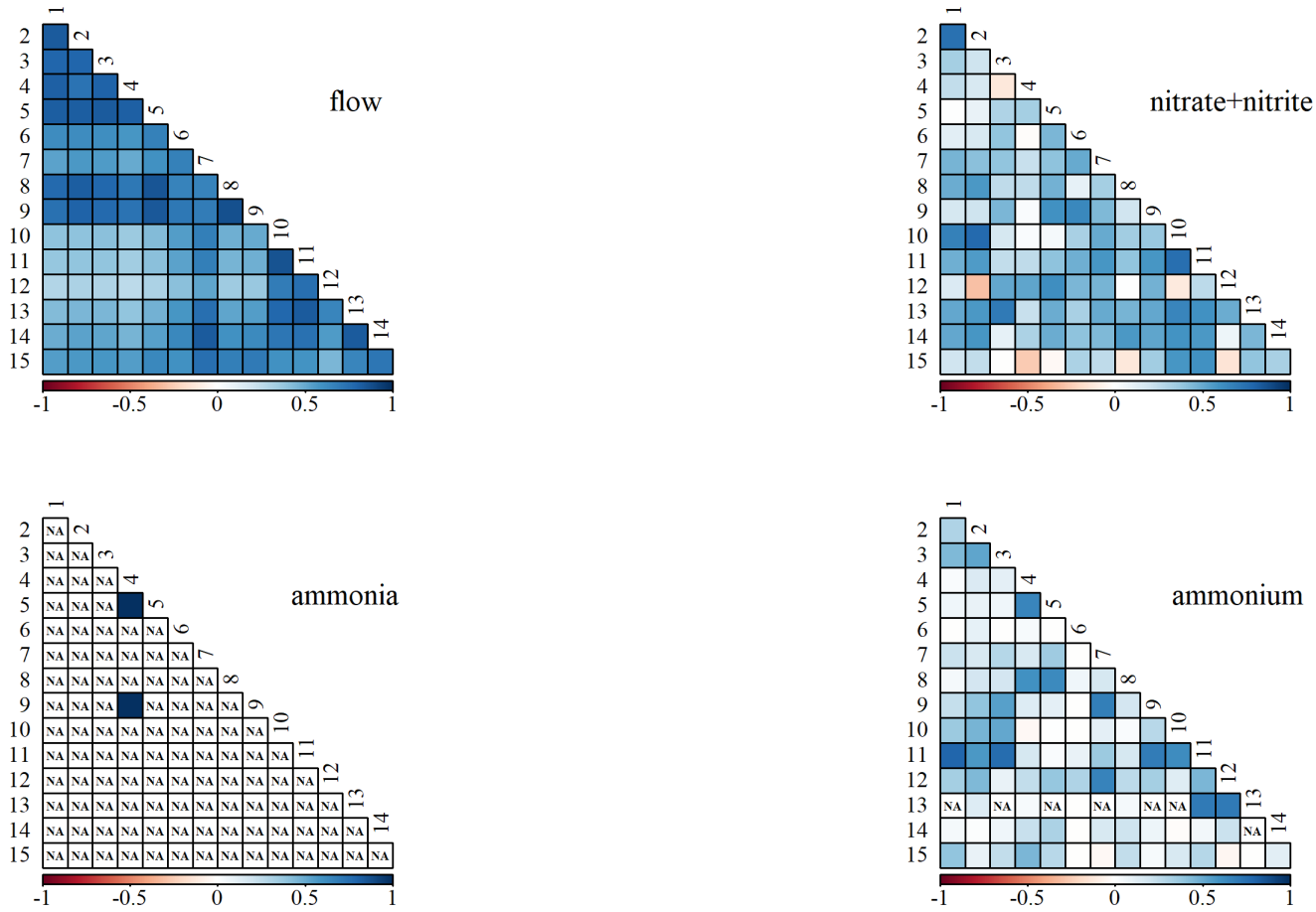


Figure 33: Correlations between catchments - flow, nitrate+nitrite, ammonia, ammonium

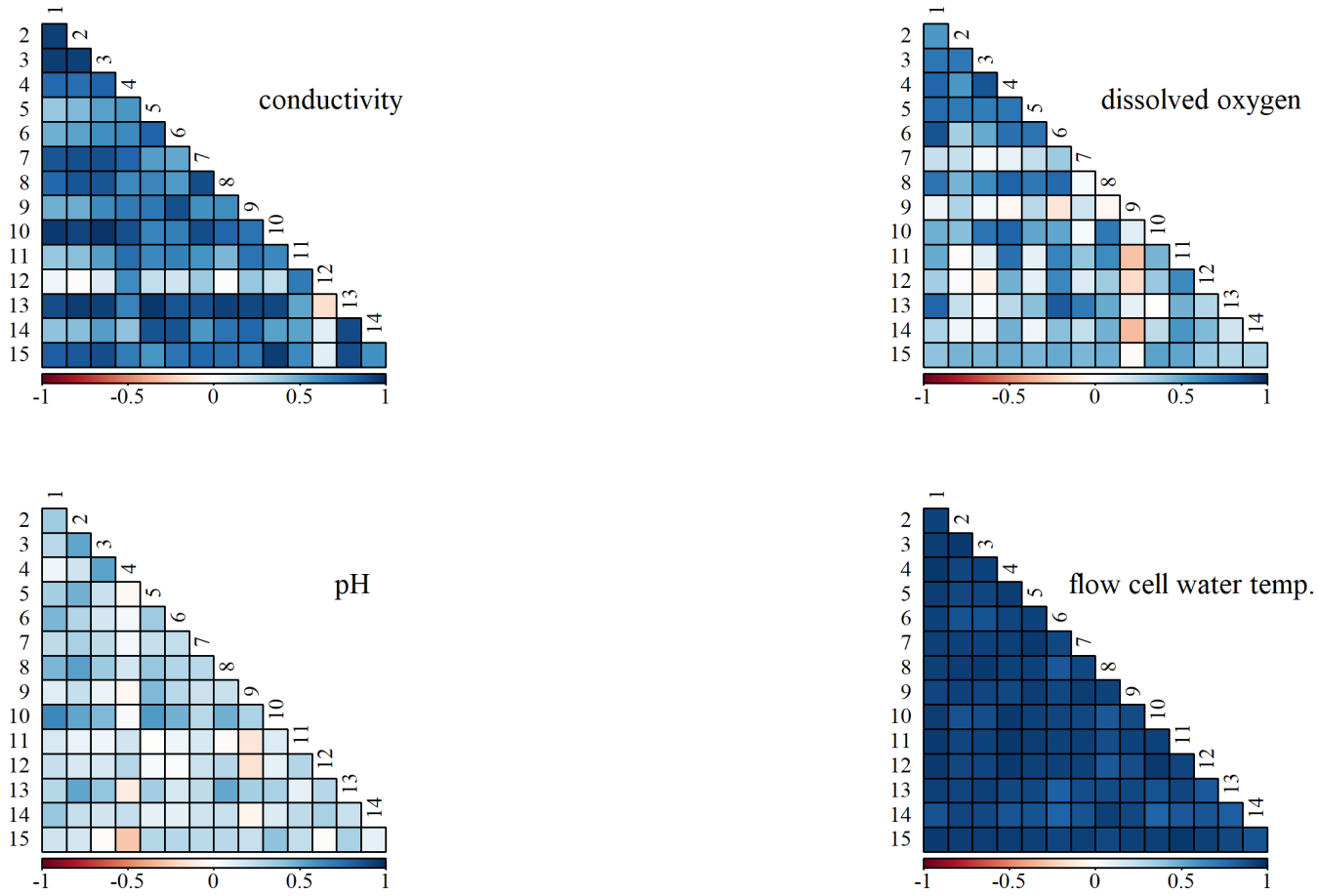
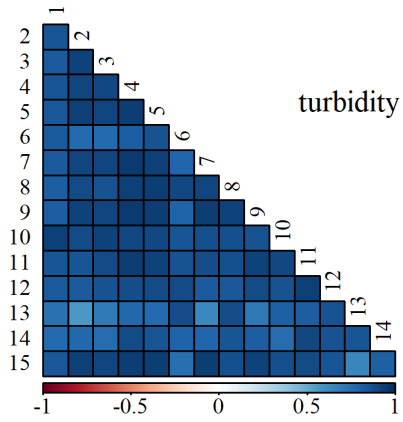
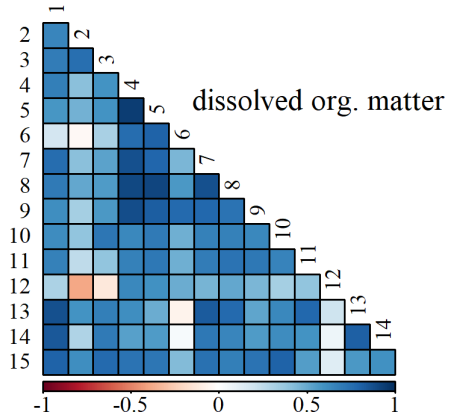


Figure 34: Correlations between catchments - conductivity, dissolved oxygen, pH, flow cell water temperature



total phosphorus

all missing/all zeros/insufficent data



ortho-phosphorus

all missing/all zeros/insufficent data

Figure 35: Correlations between catchments - turbidity, total phosphorus, dissolved organic matter, ortho-phosphorus

2 MONTHLY

2.1 Flow duration curves

Data are in triplet/catchment order with catchments arranged from largest to smallest across the page. NB. Data may include missing values.

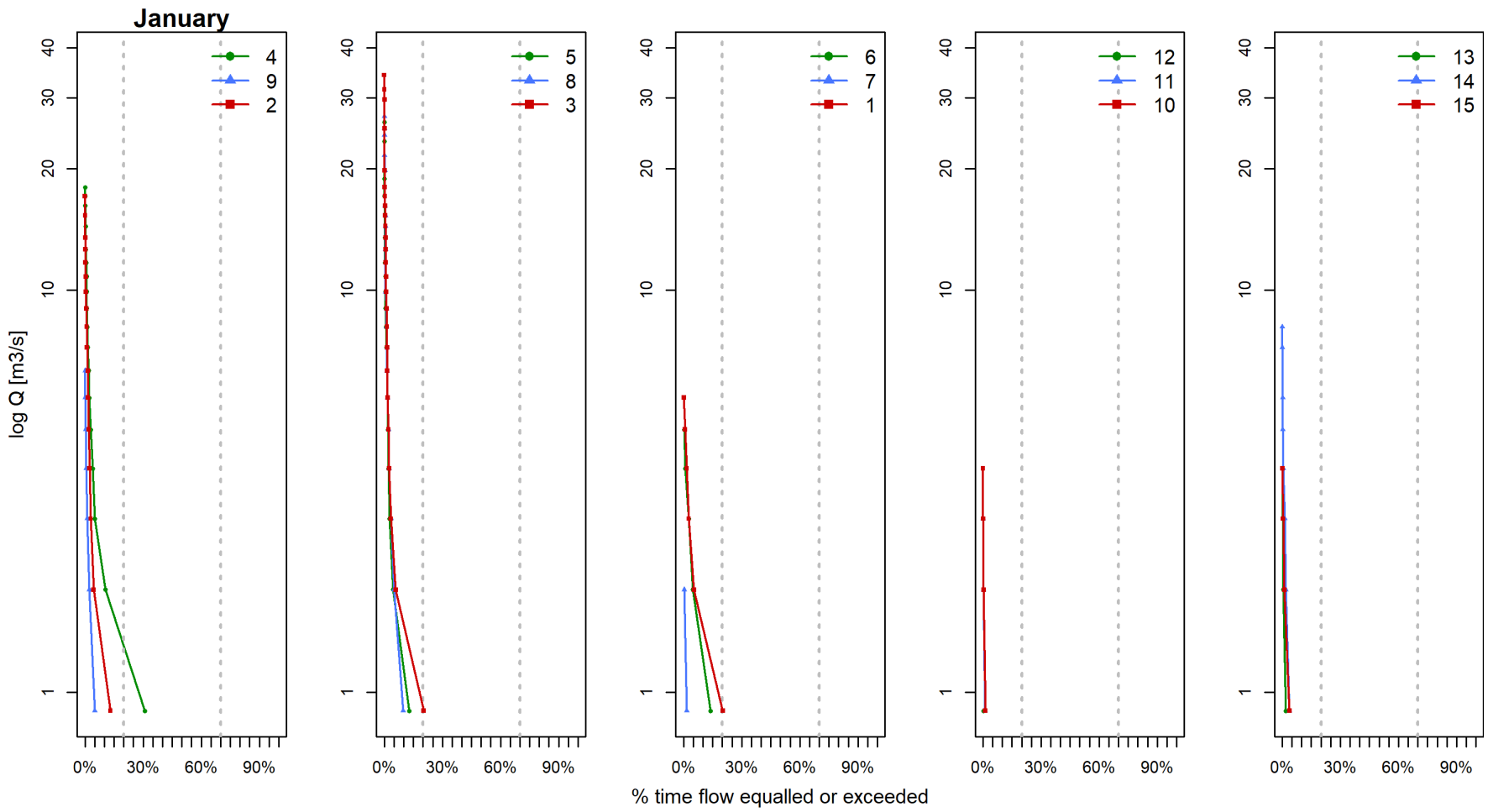


Figure 36: Flow duration curves for January

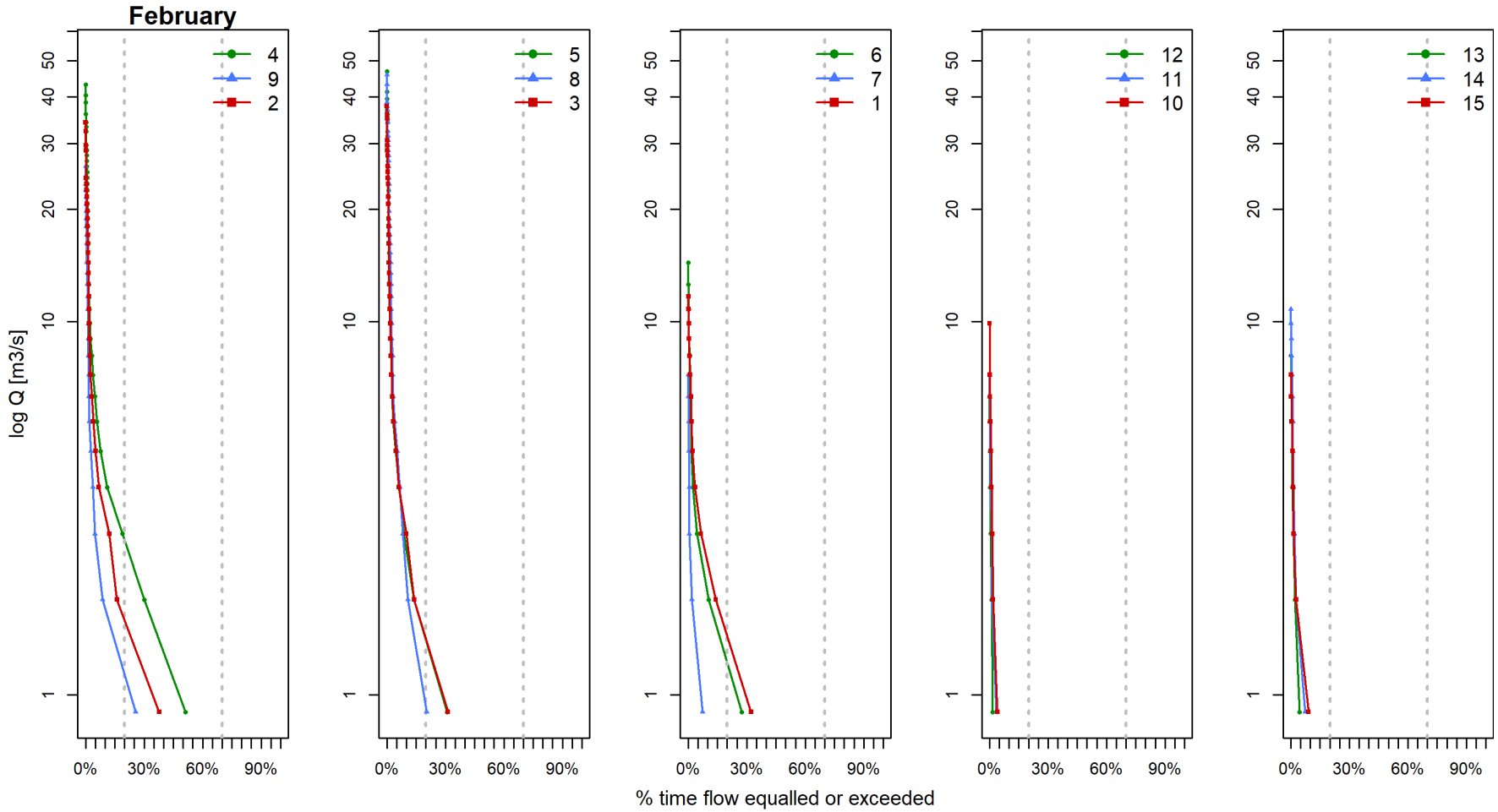


Figure 37: Flow duration curves for February

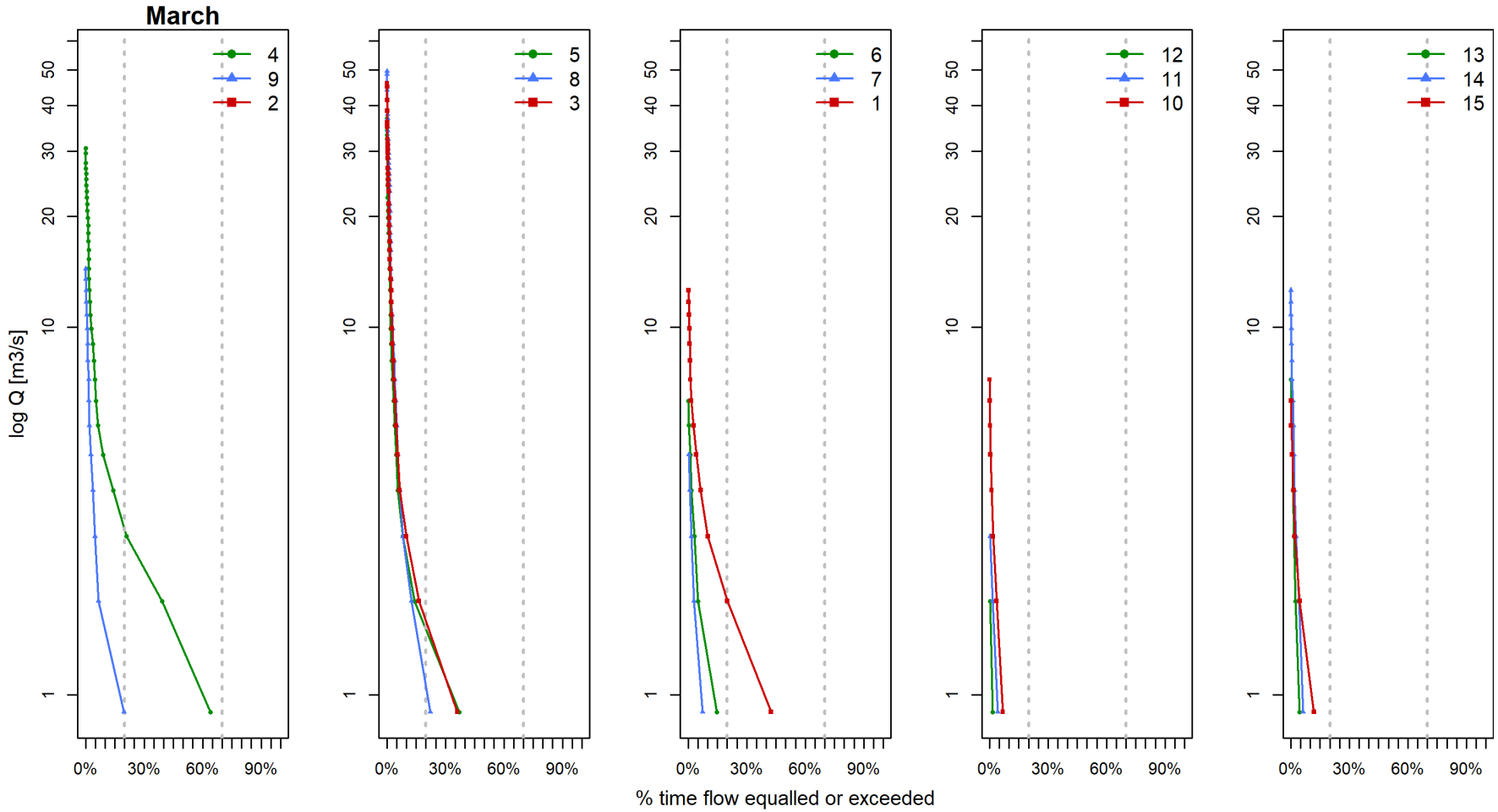


Figure 38: Flow duration curves for March

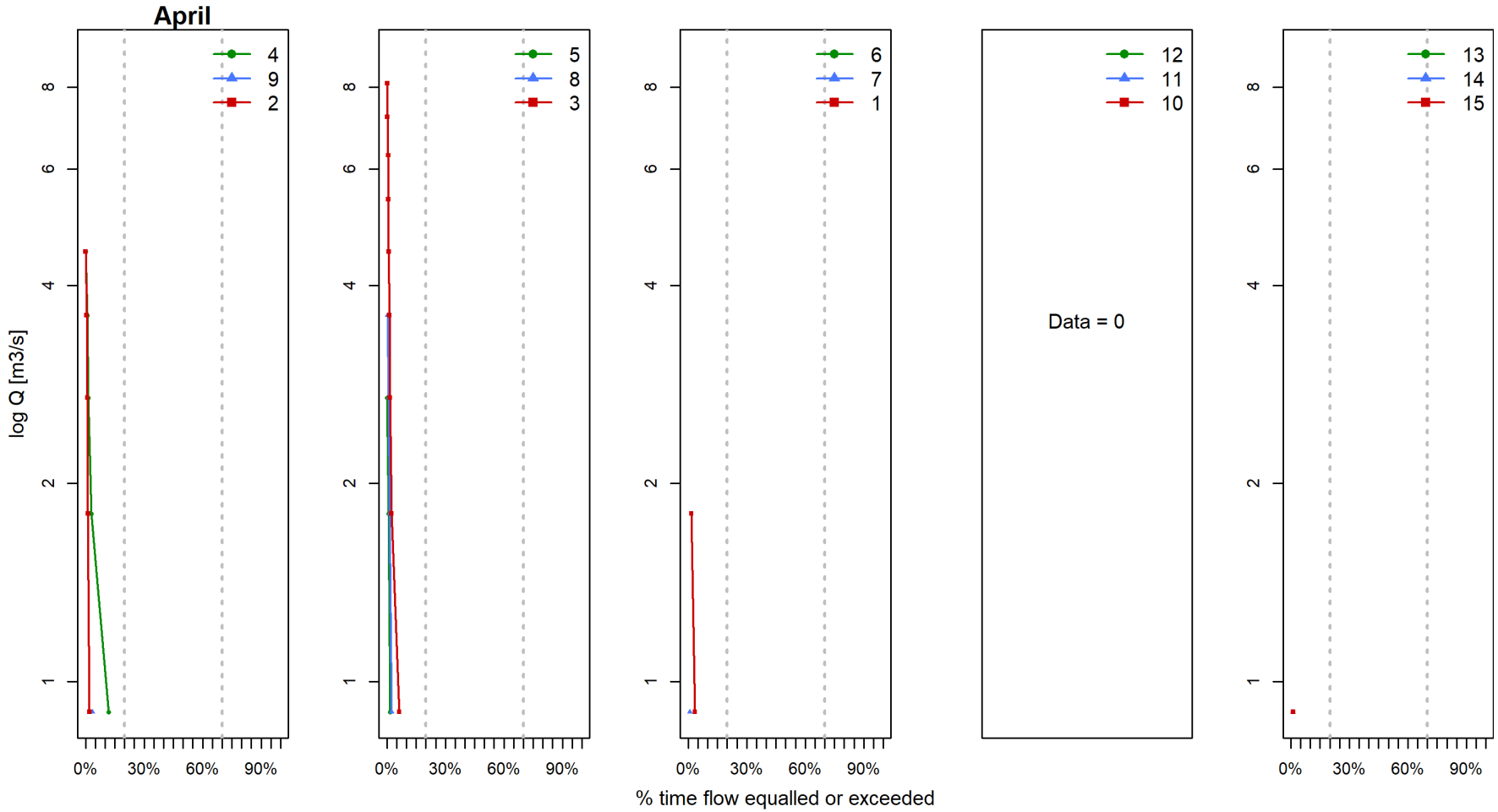


Figure 39: Flow duration curves for April

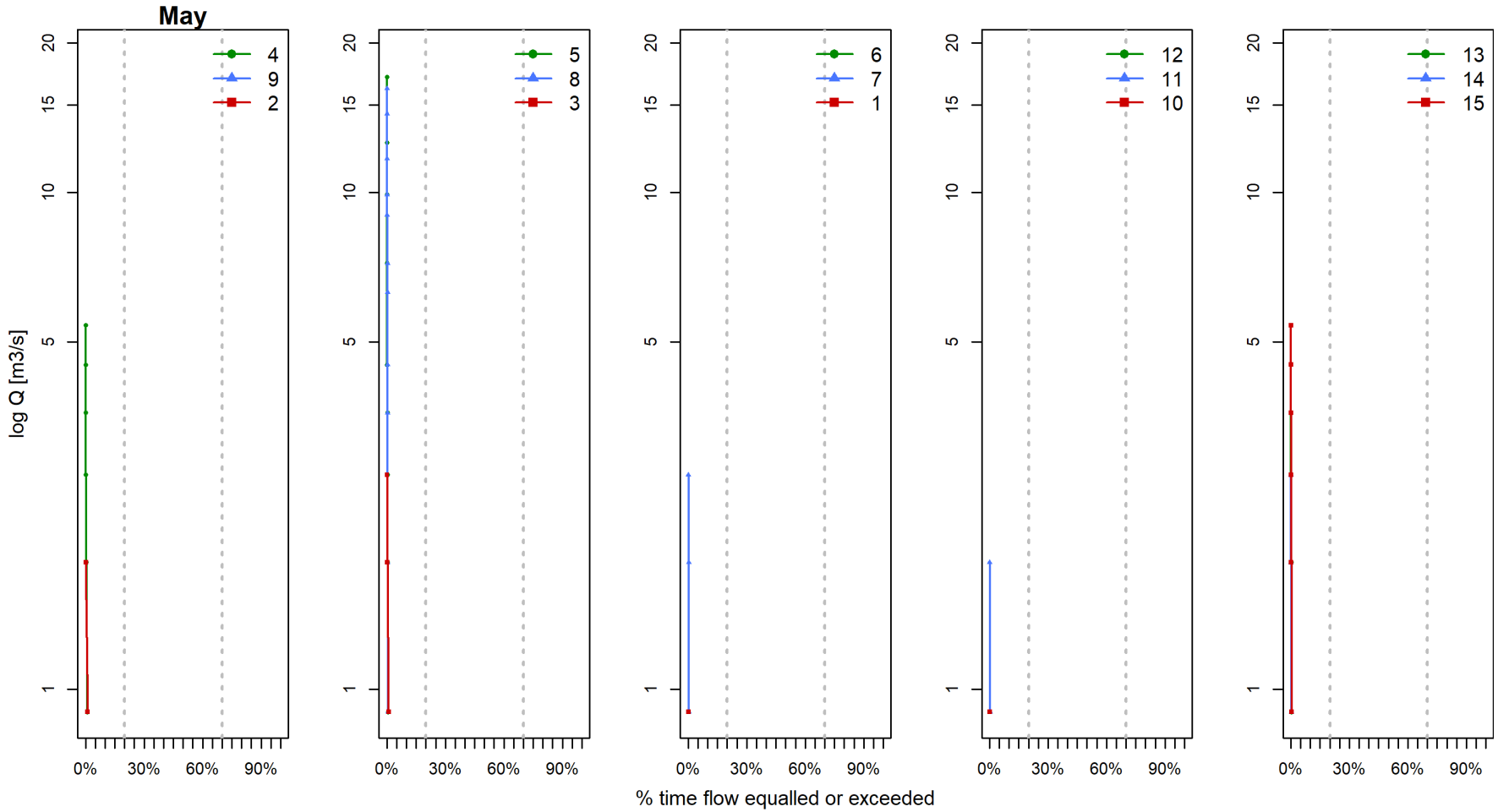


Figure 40: Flow duration curves for May

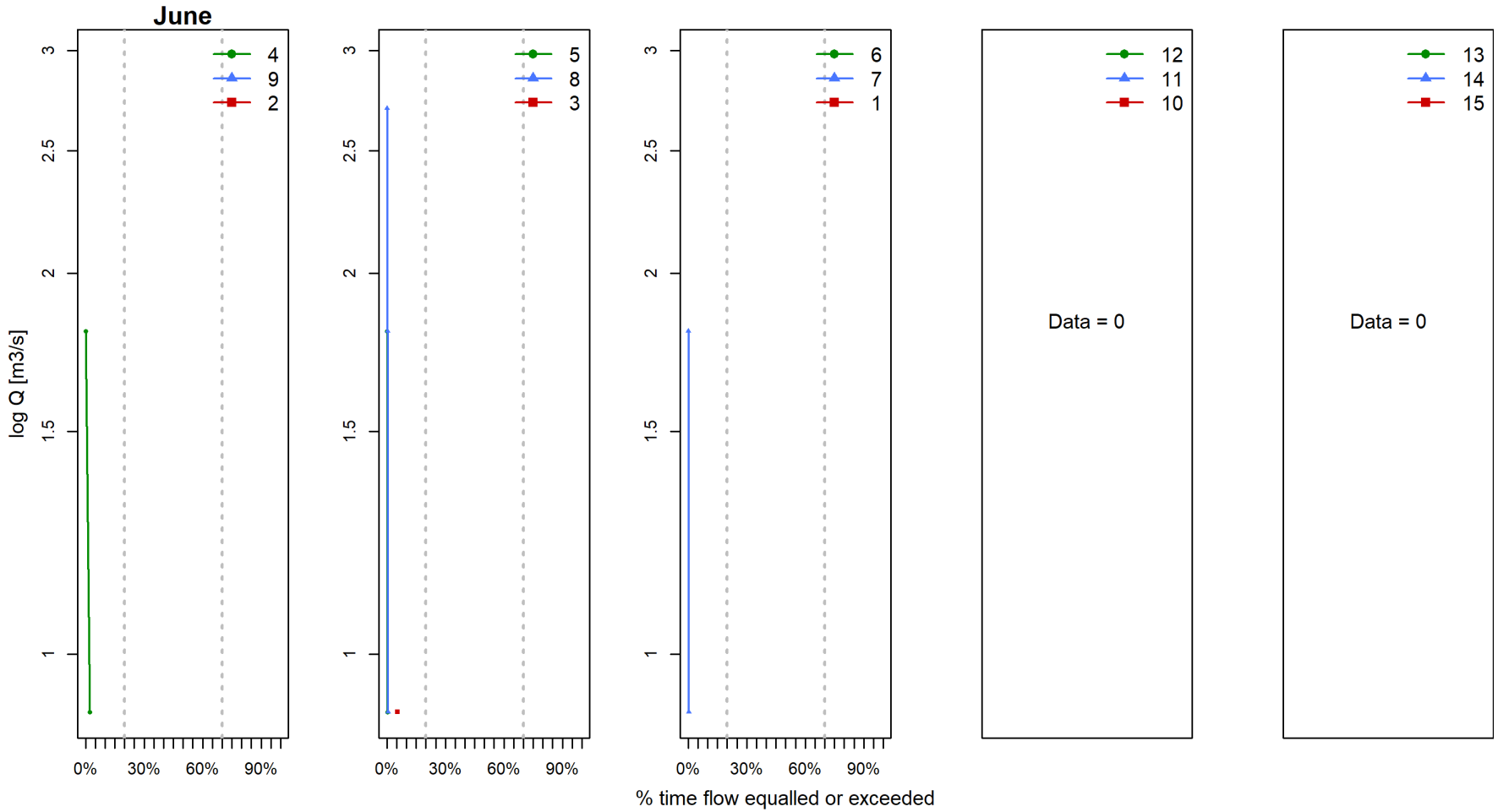


Figure 41: Flow duration curves for June

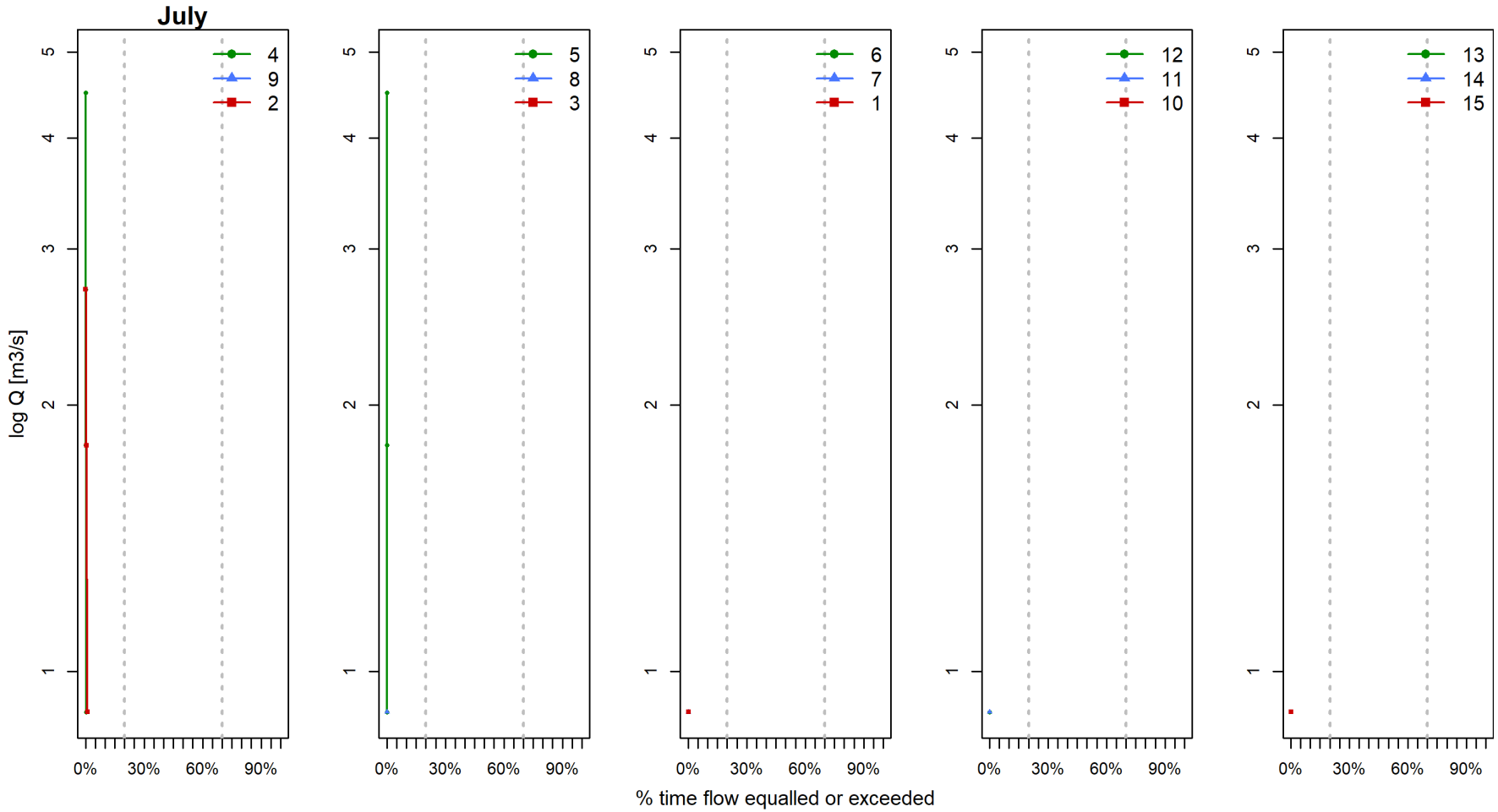


Figure 42: Flow duration curves for July

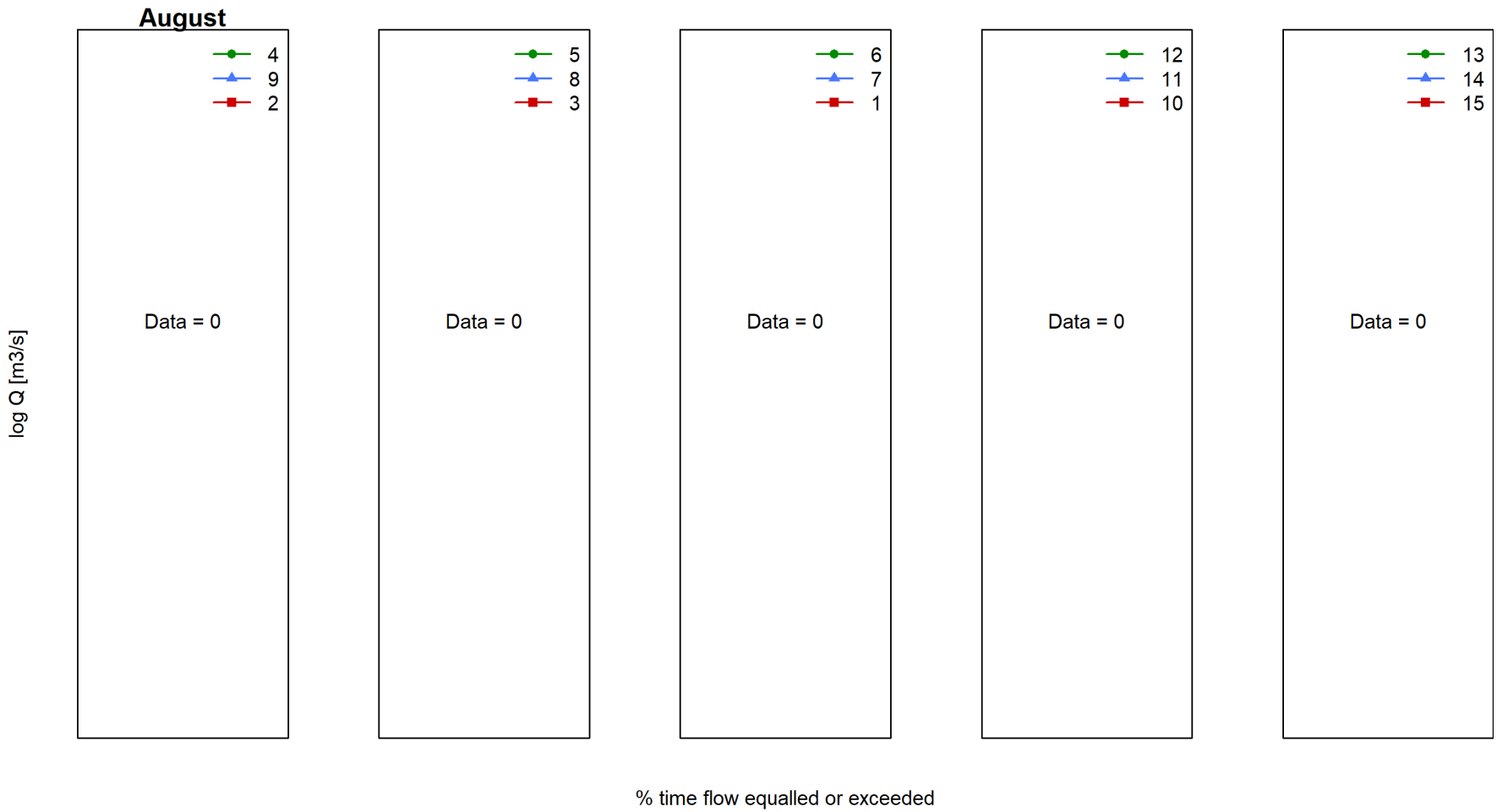


Figure 43: Flow duration curves for August

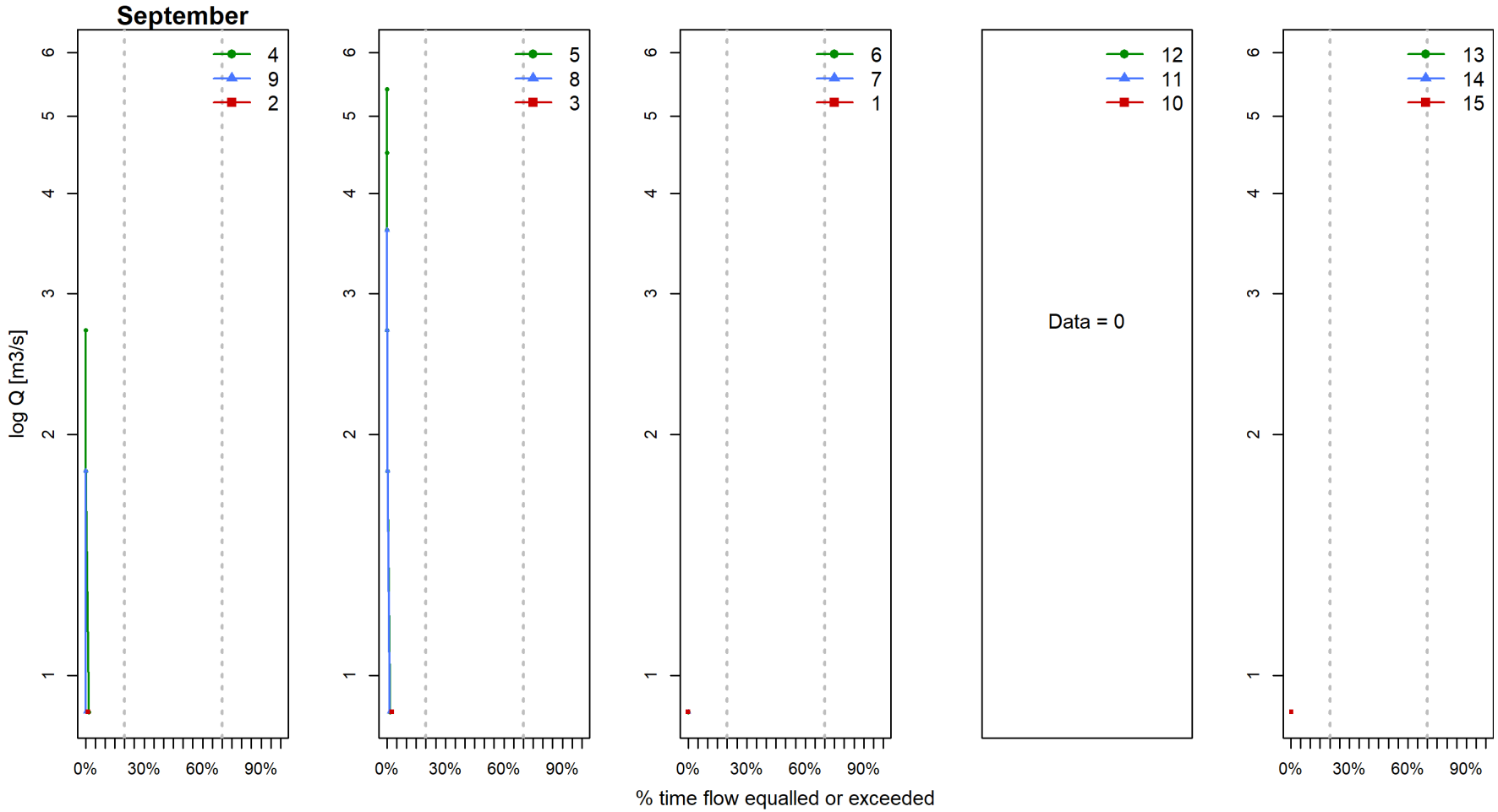


Figure 44: Flow duration curves for September

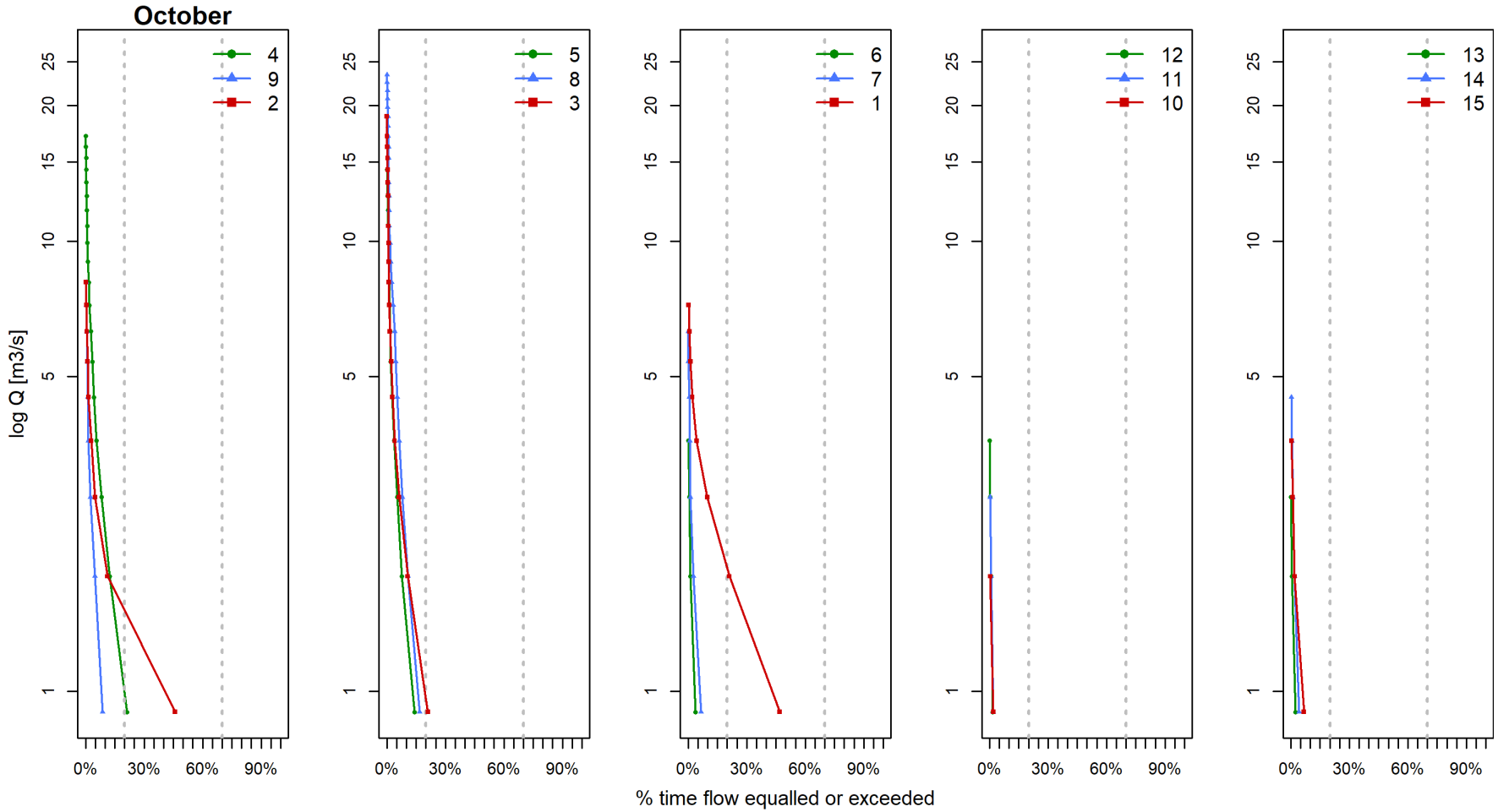


Figure 45: Flow duration curves for October

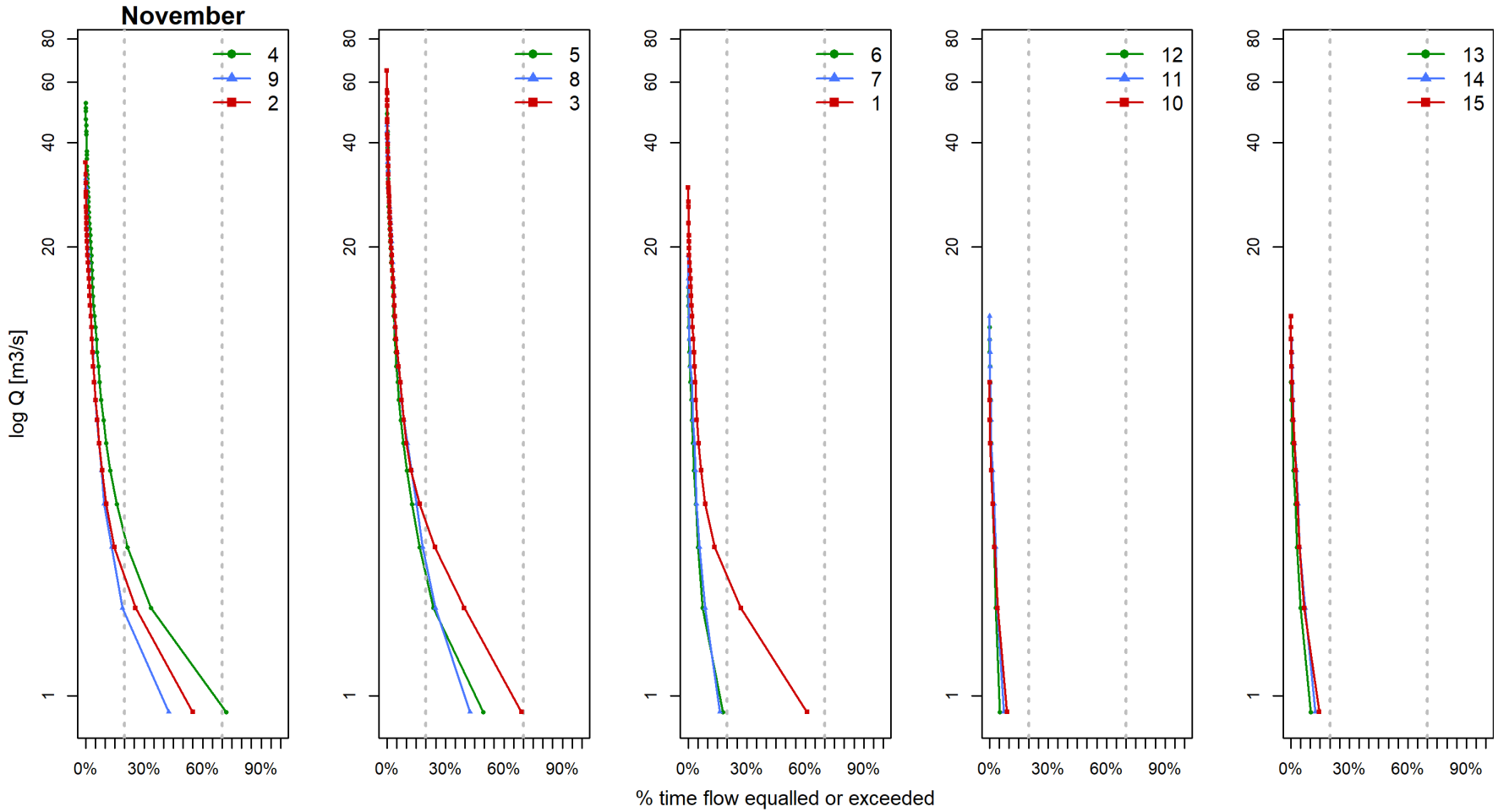


Figure 46: Flow duration curves for November

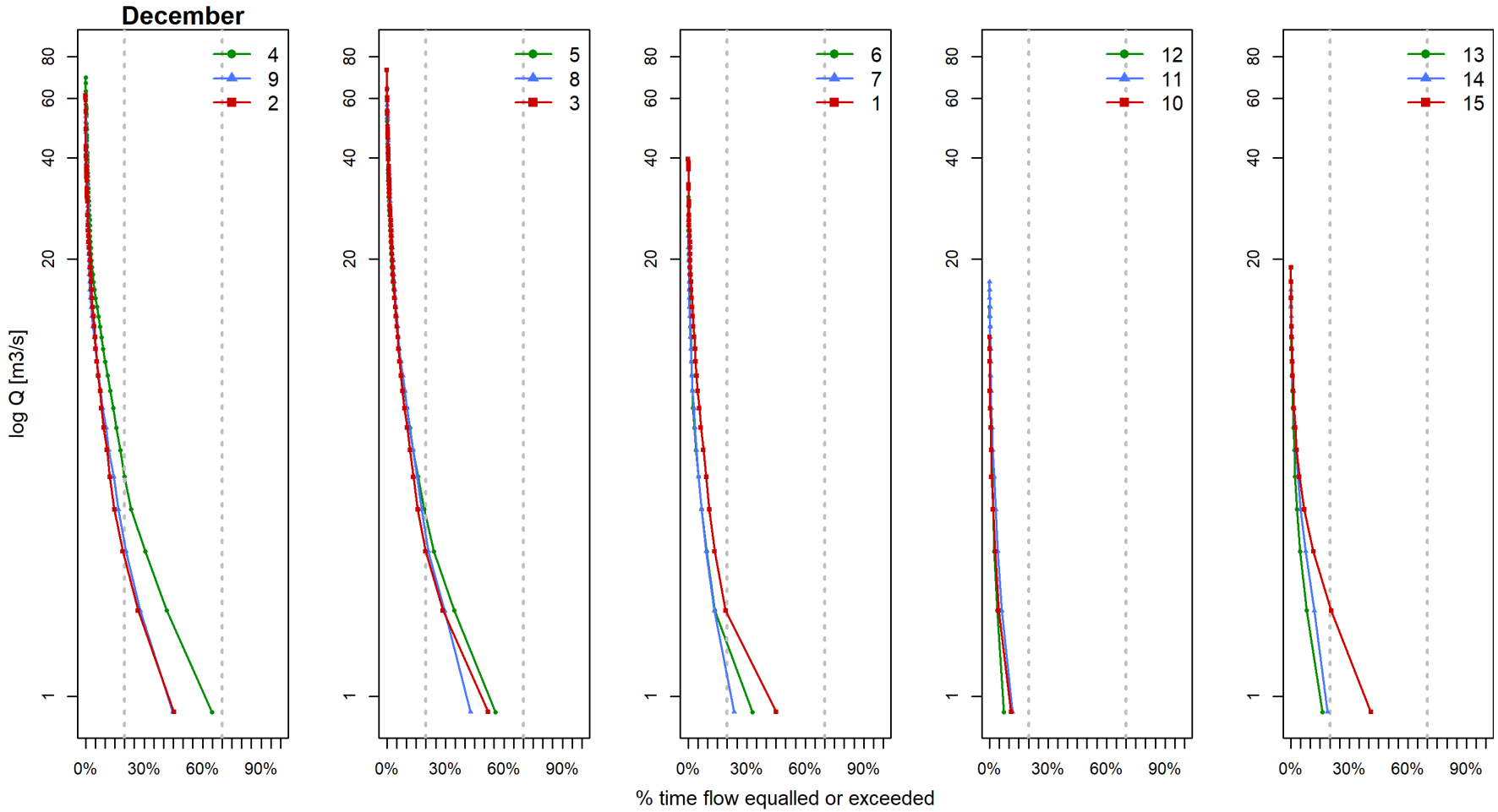


Figure 47: Flow duration curves for December

2.2 Means

Please be aware that the means are based on data that may contain missing values. Full data summaries are available on request.

Vertical lines = positive standard error of the mean. Values above bars = number of observations.

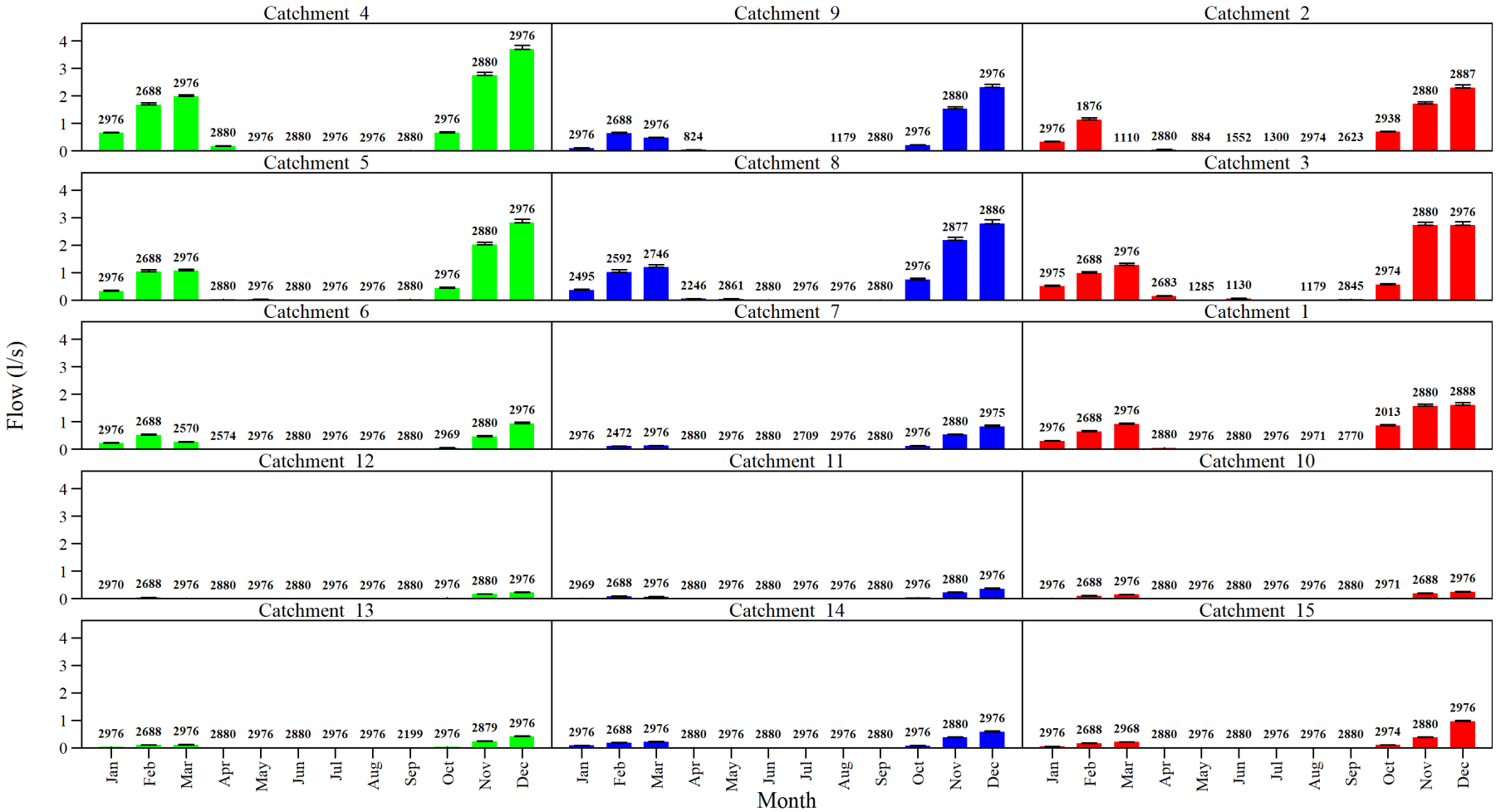


Figure 48: Monthly means for flow

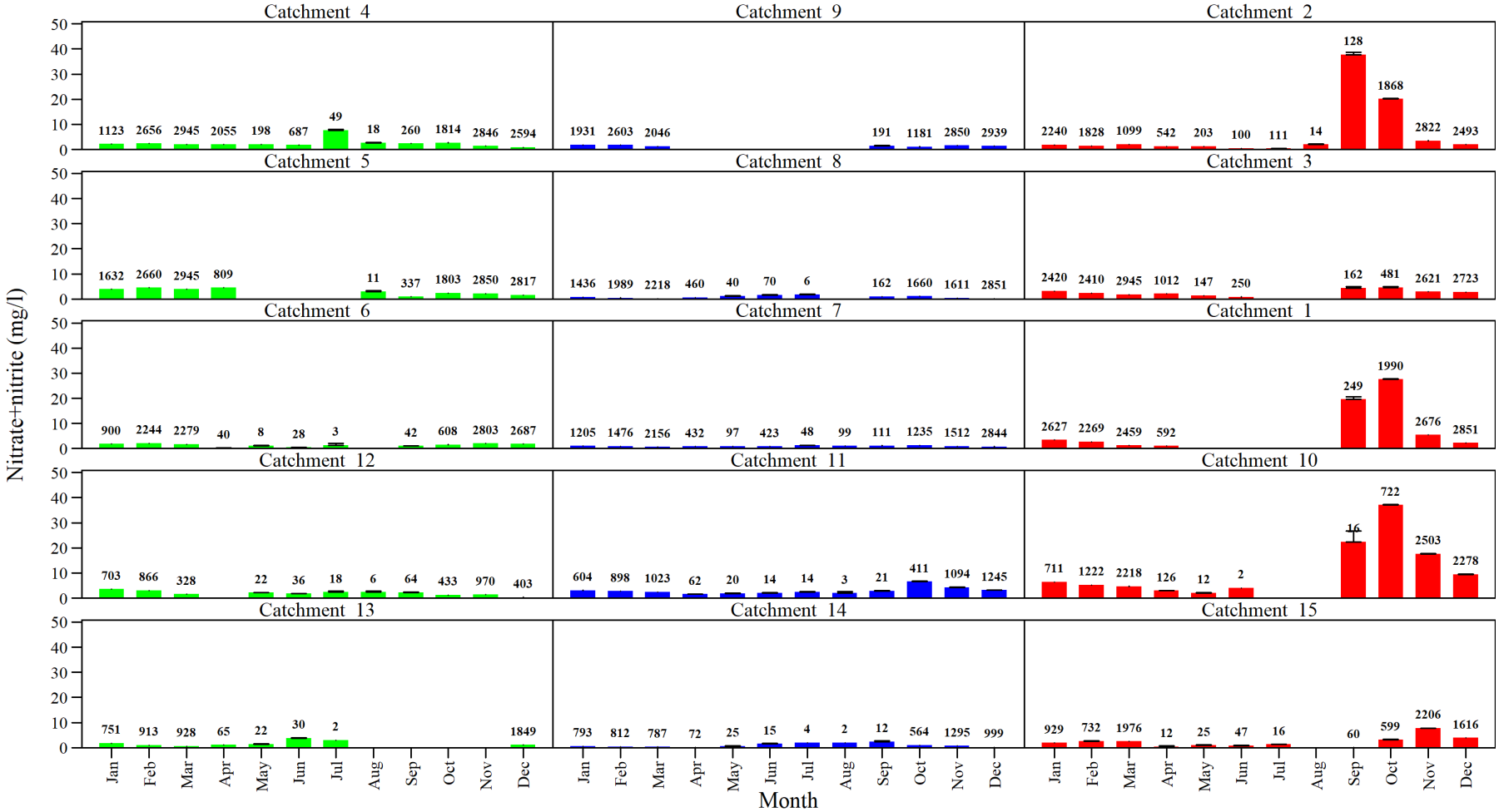


Figure 49: Monthly means for nitrate+nitrite

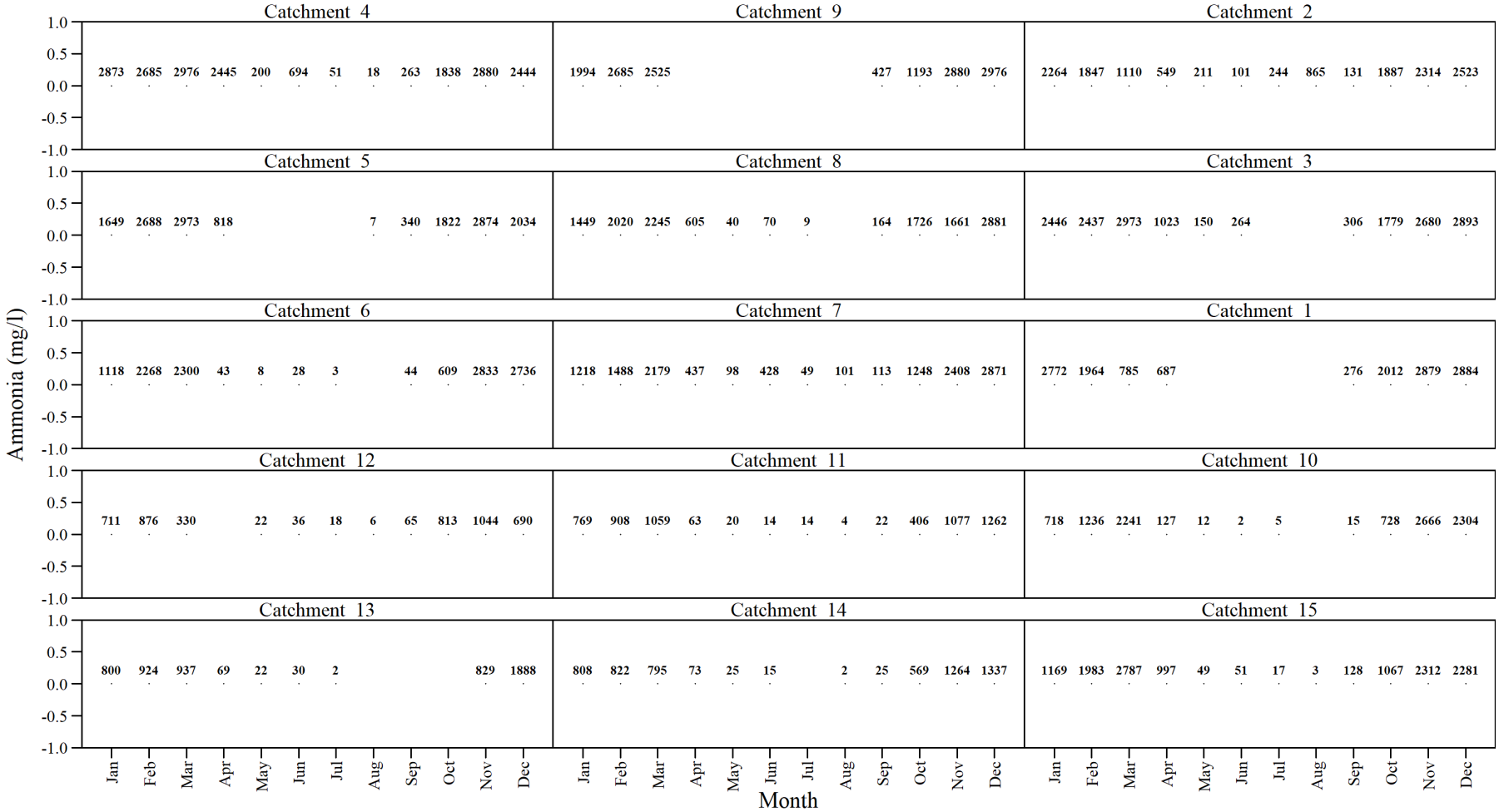


Figure 50: Monthly means for ammonia

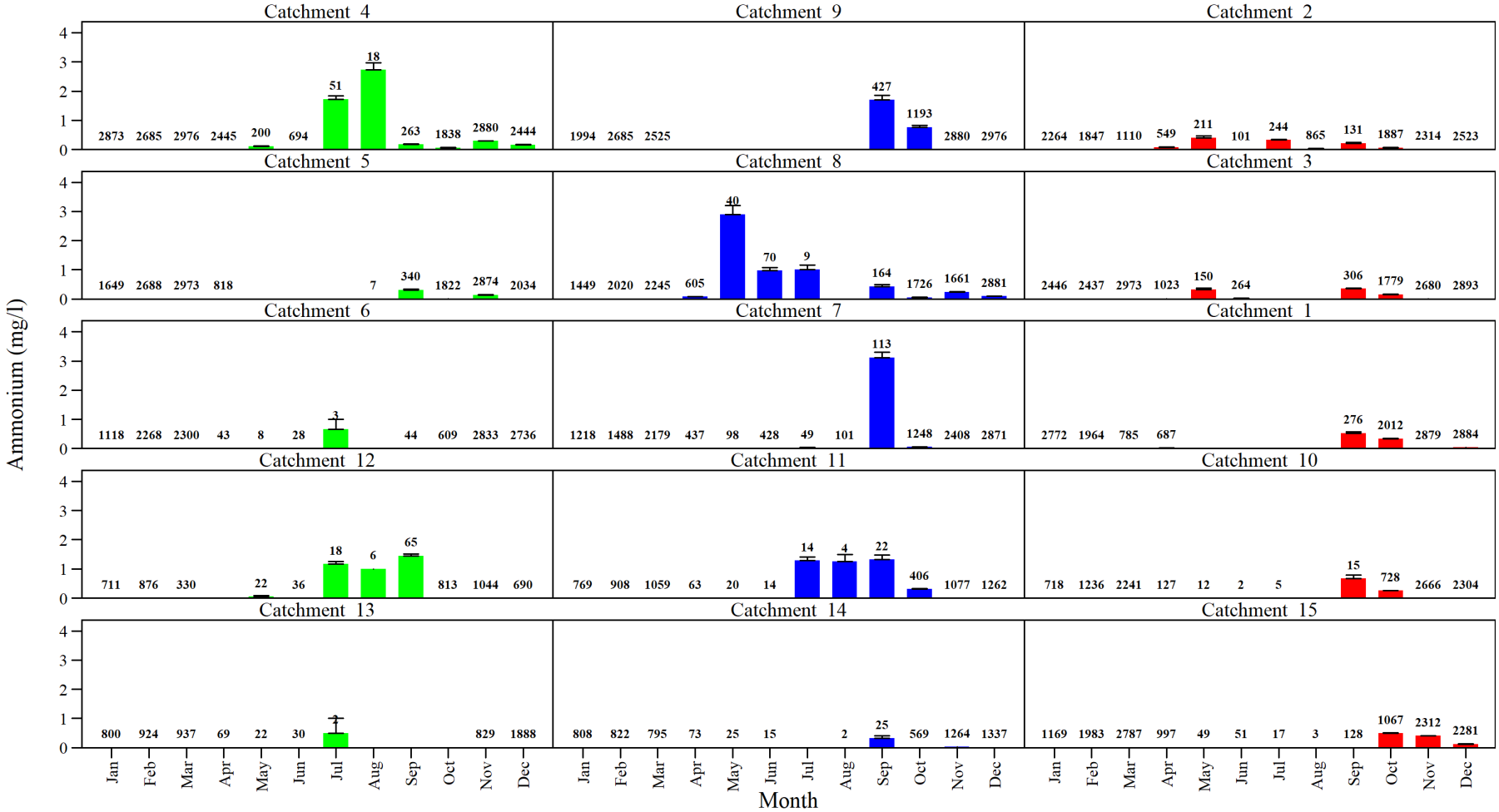


Figure 51: Monthly means for ammonium

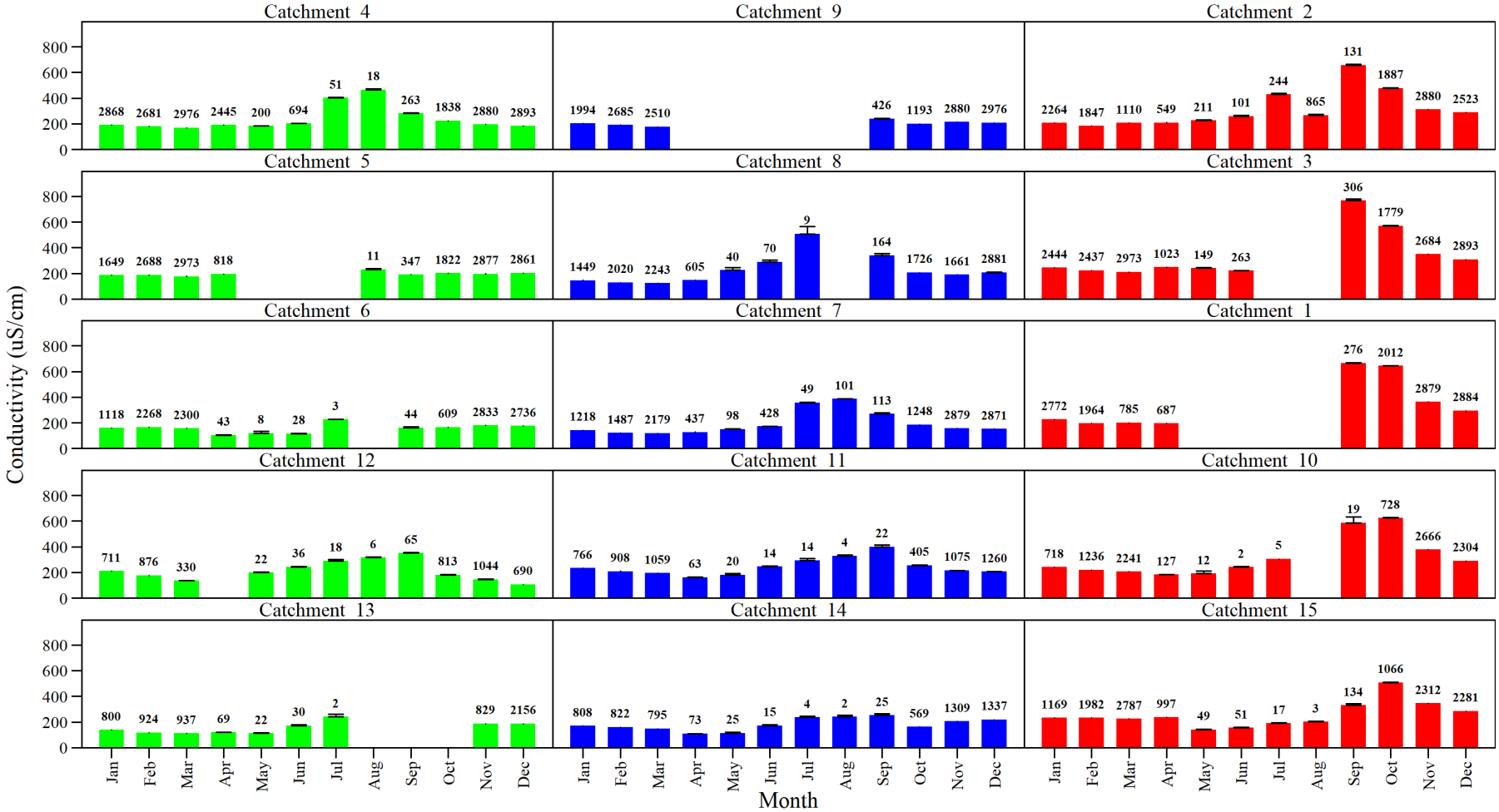


Figure 52: Monthly means for conductivity

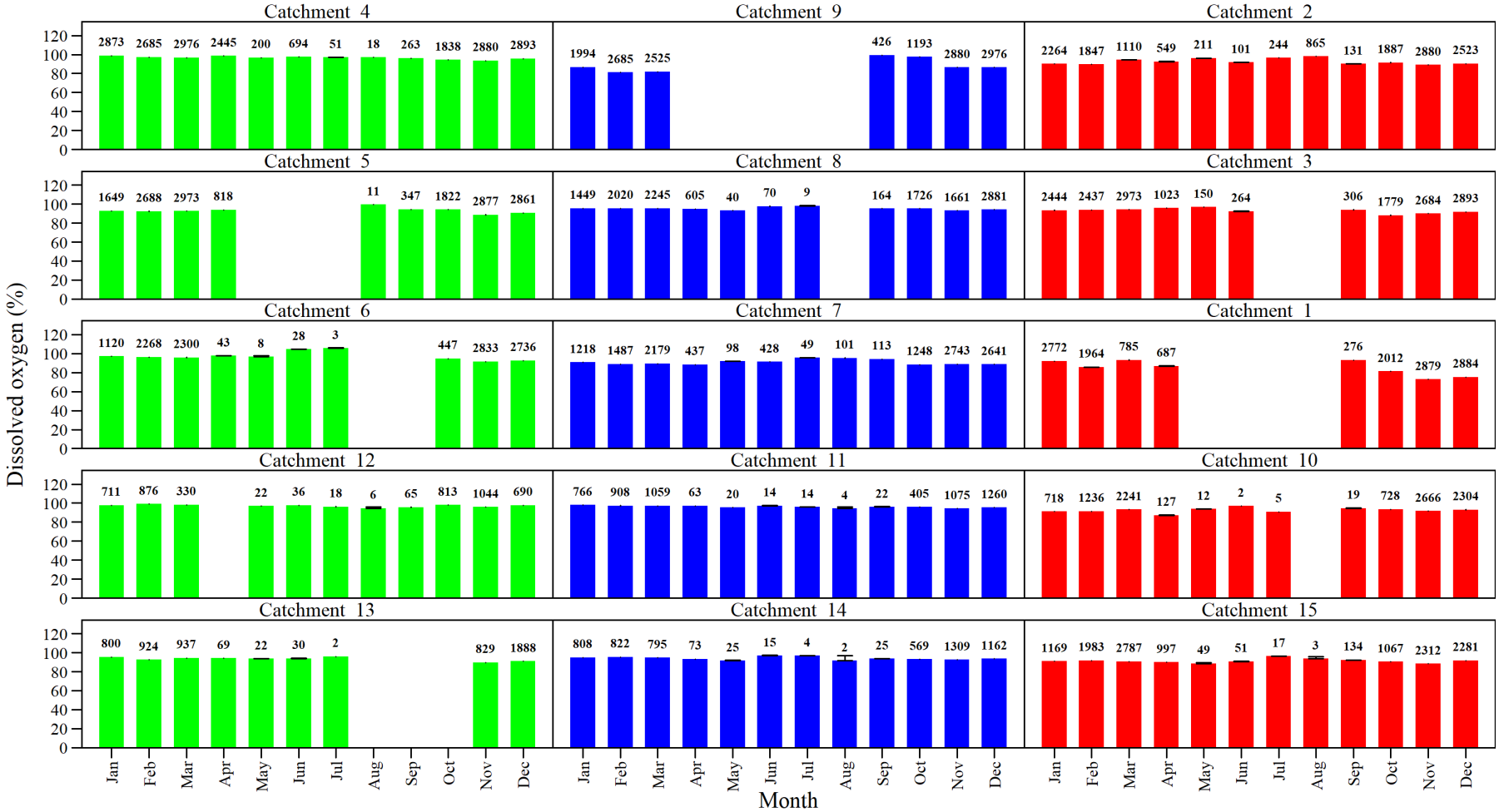


Figure 53: Monthly means for dissolved oxygen

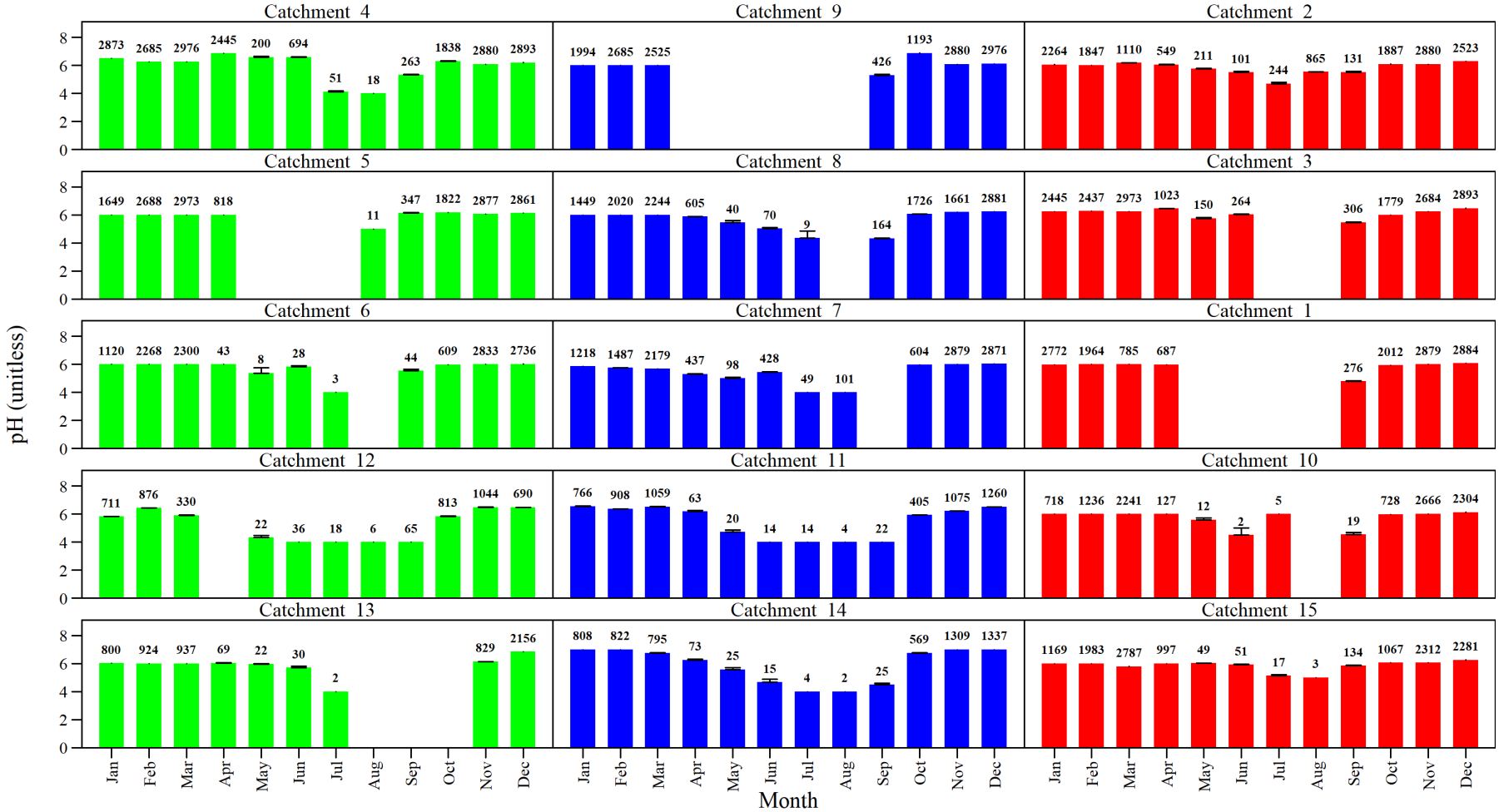


Figure 54: Monthly means for pH

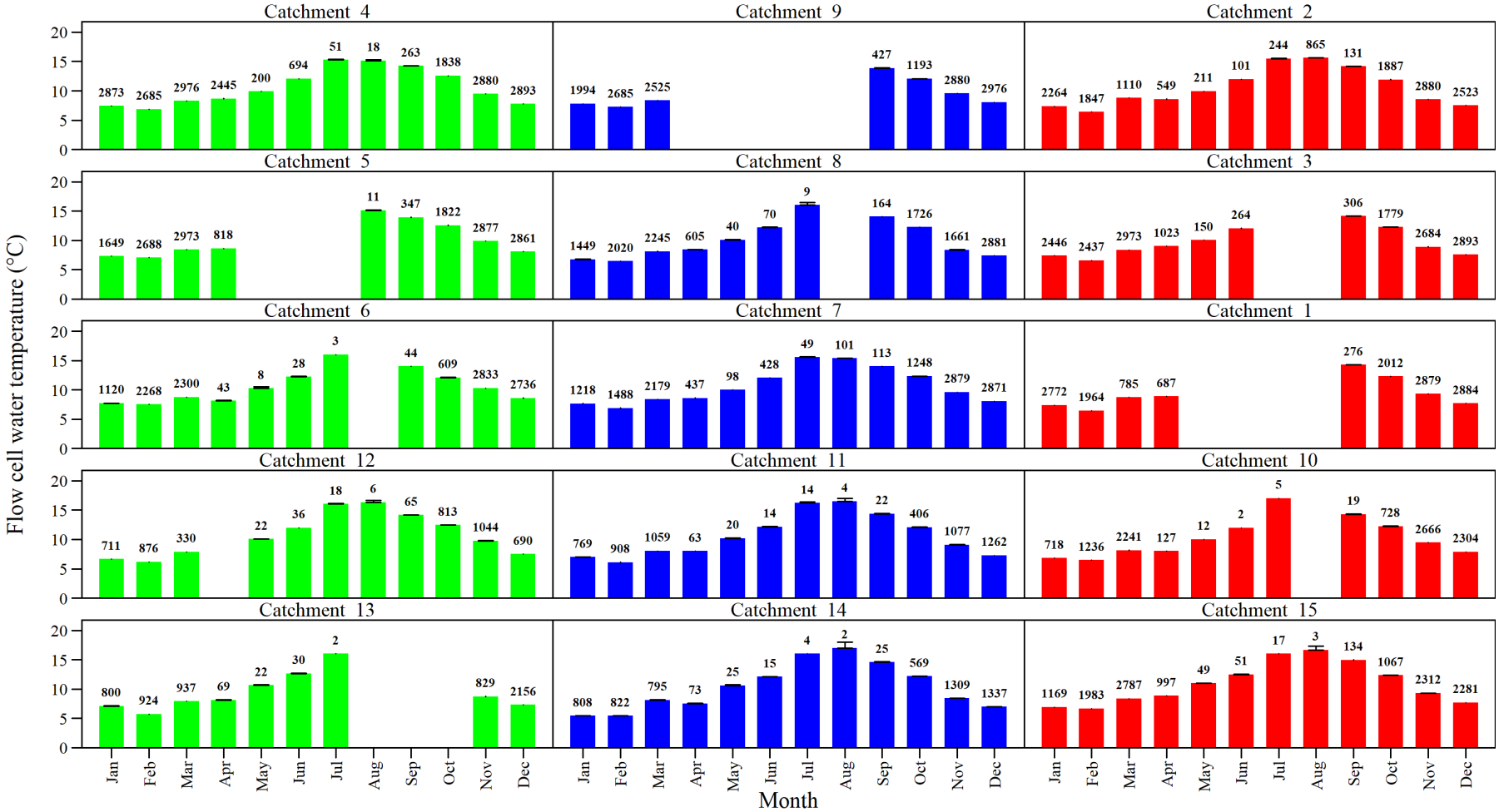


Figure 55: Monthly means for flow cell water temperature

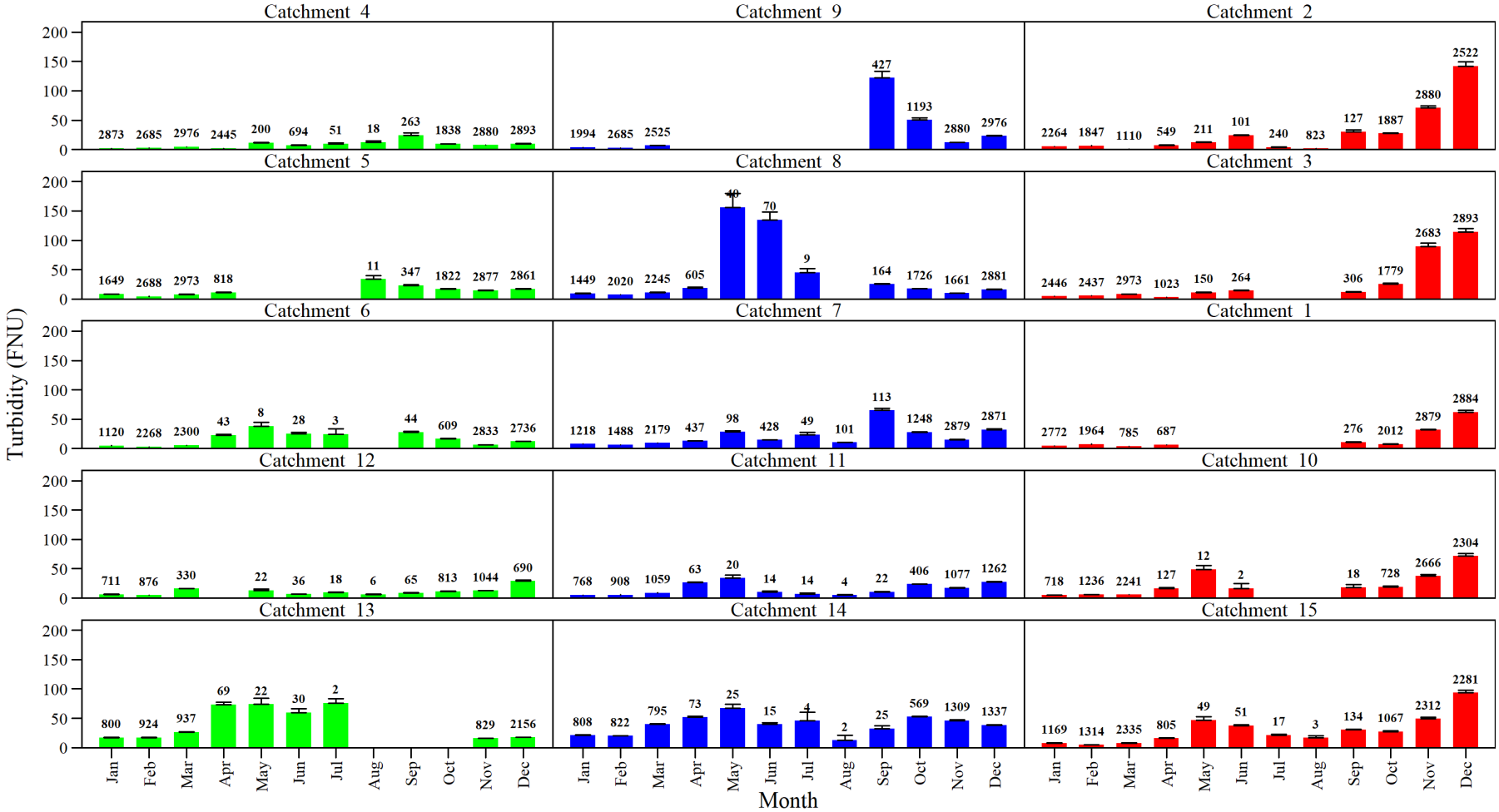


Figure 56: Monthly means for turbidity

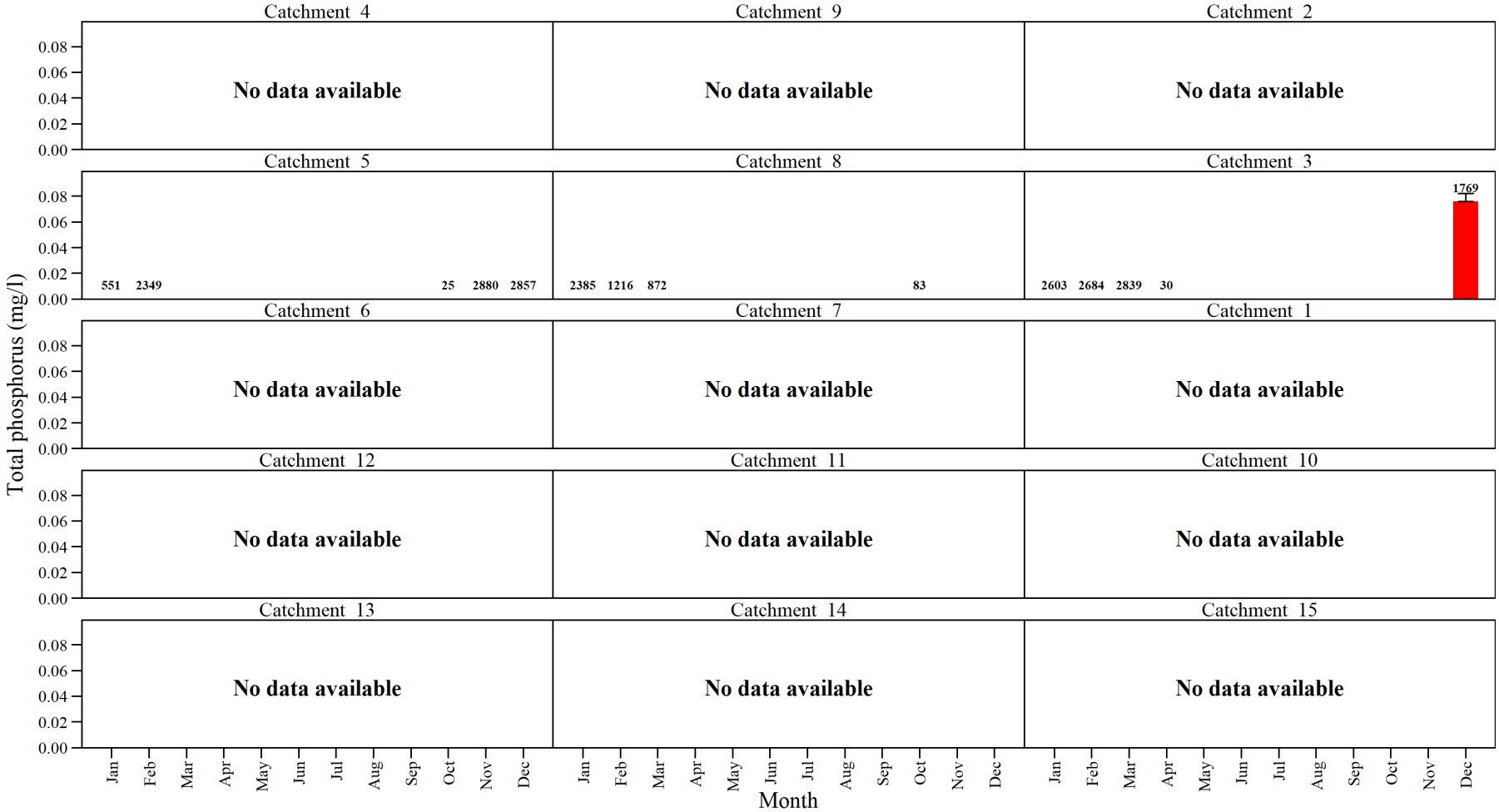


Figure 57: Monthly means for total phosphorus

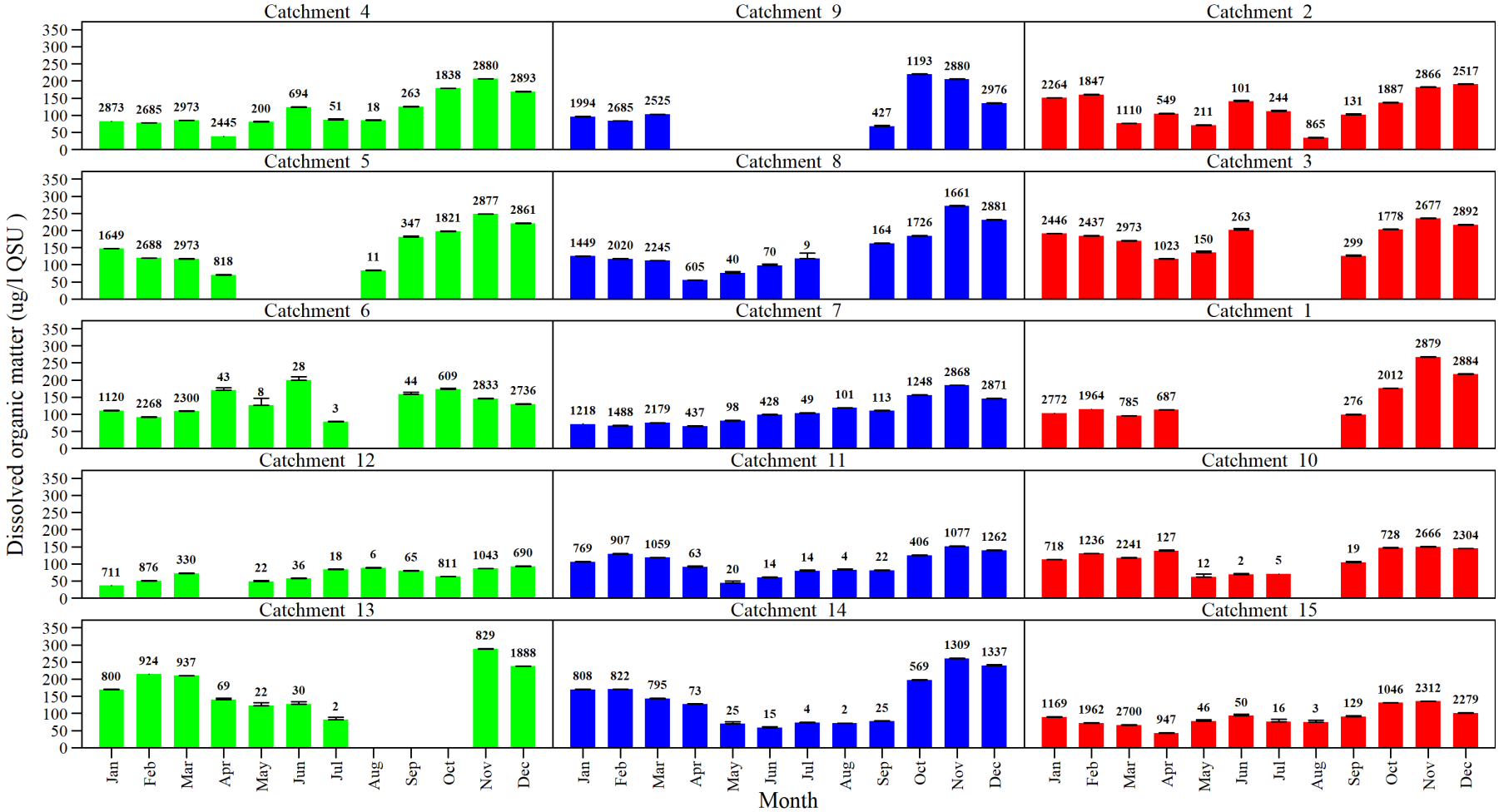


Figure 58: Monthly means for dissolved organic matter

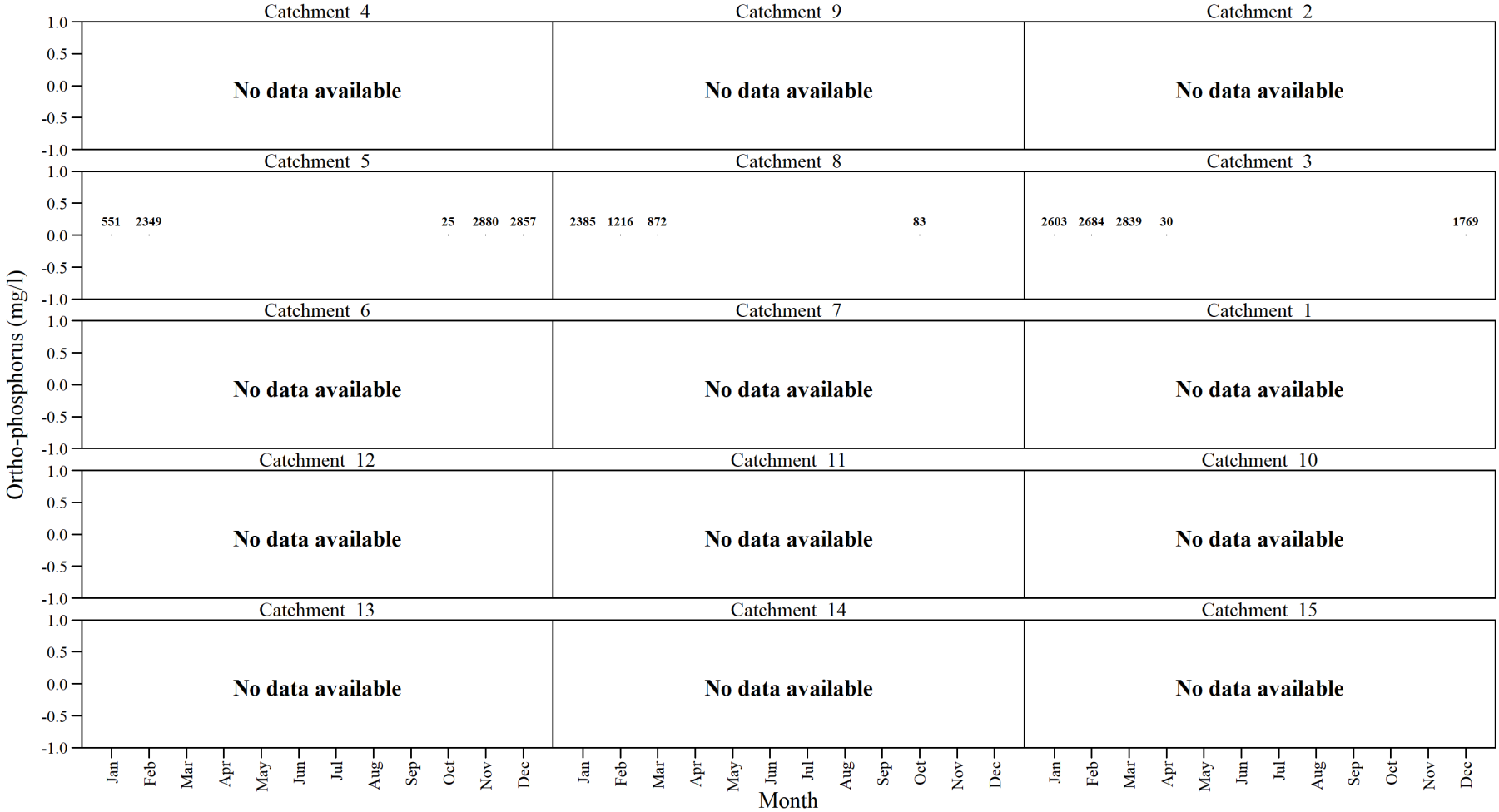


Figure 59: Monthly means for ortho-phosphorus

2.3 Chloropleth maps of means

Grey areas represent missing data

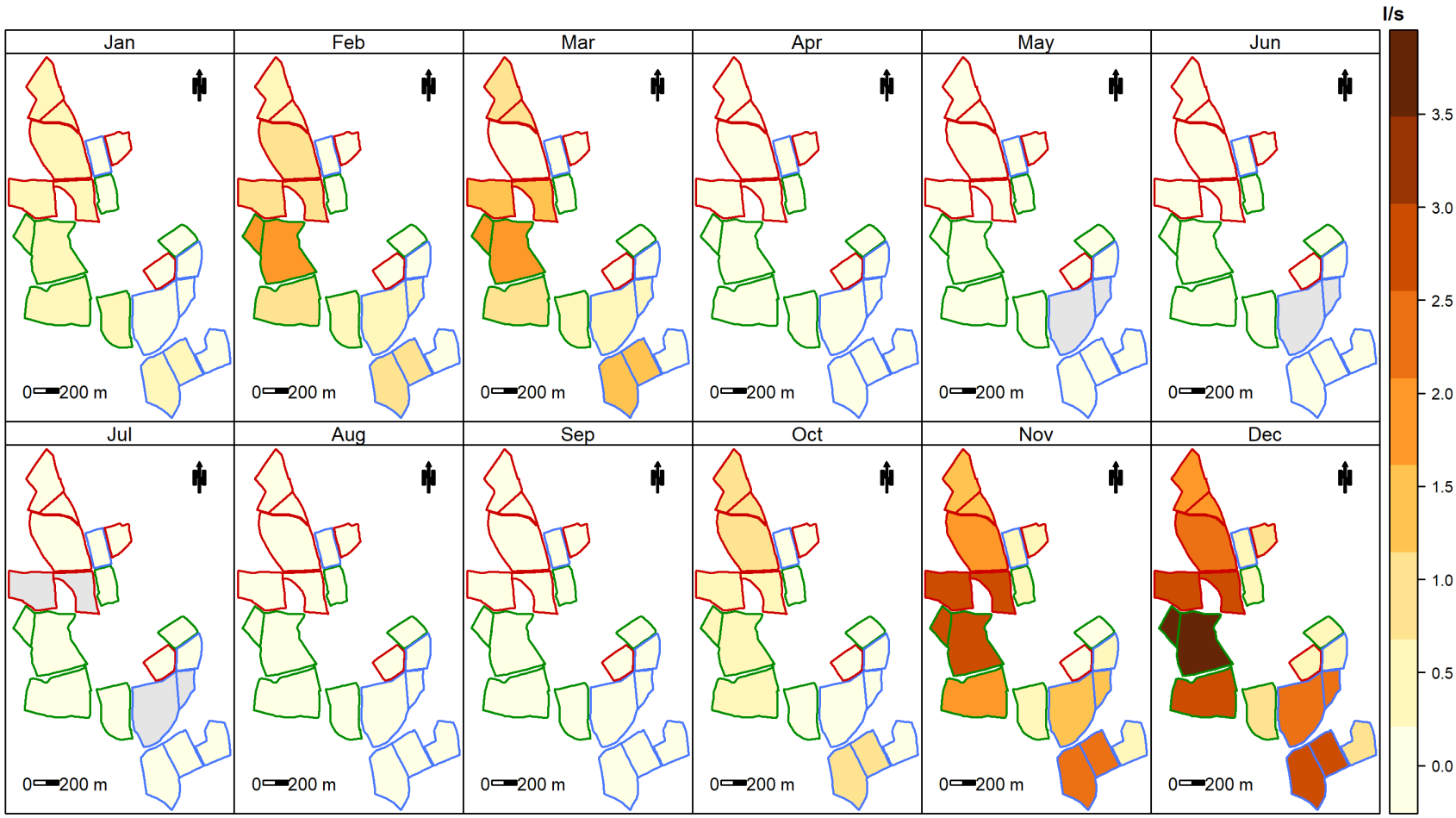


Figure 60: Mapped means for flow

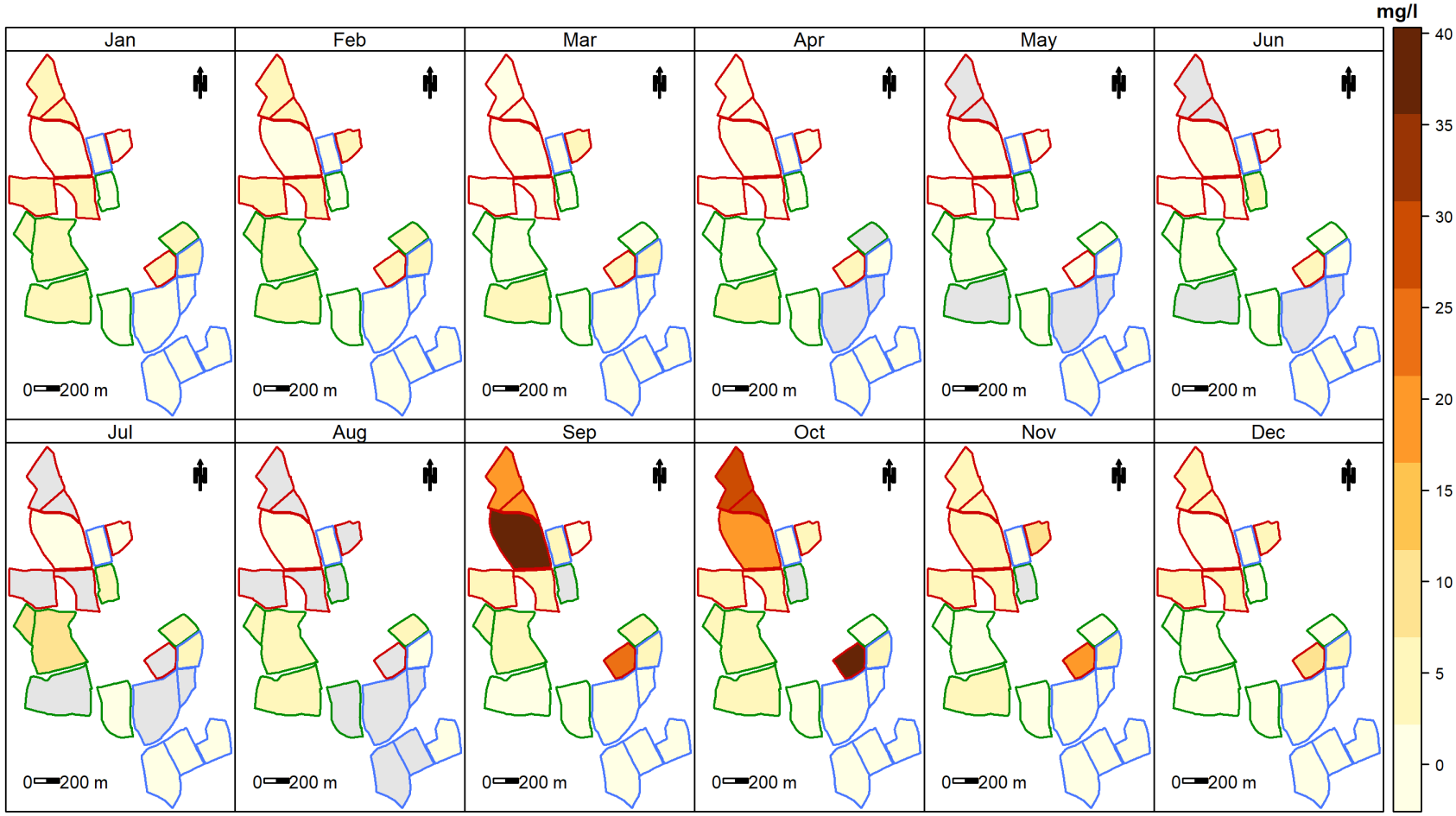


Figure 61: Mapped means for nitrate+nitrite

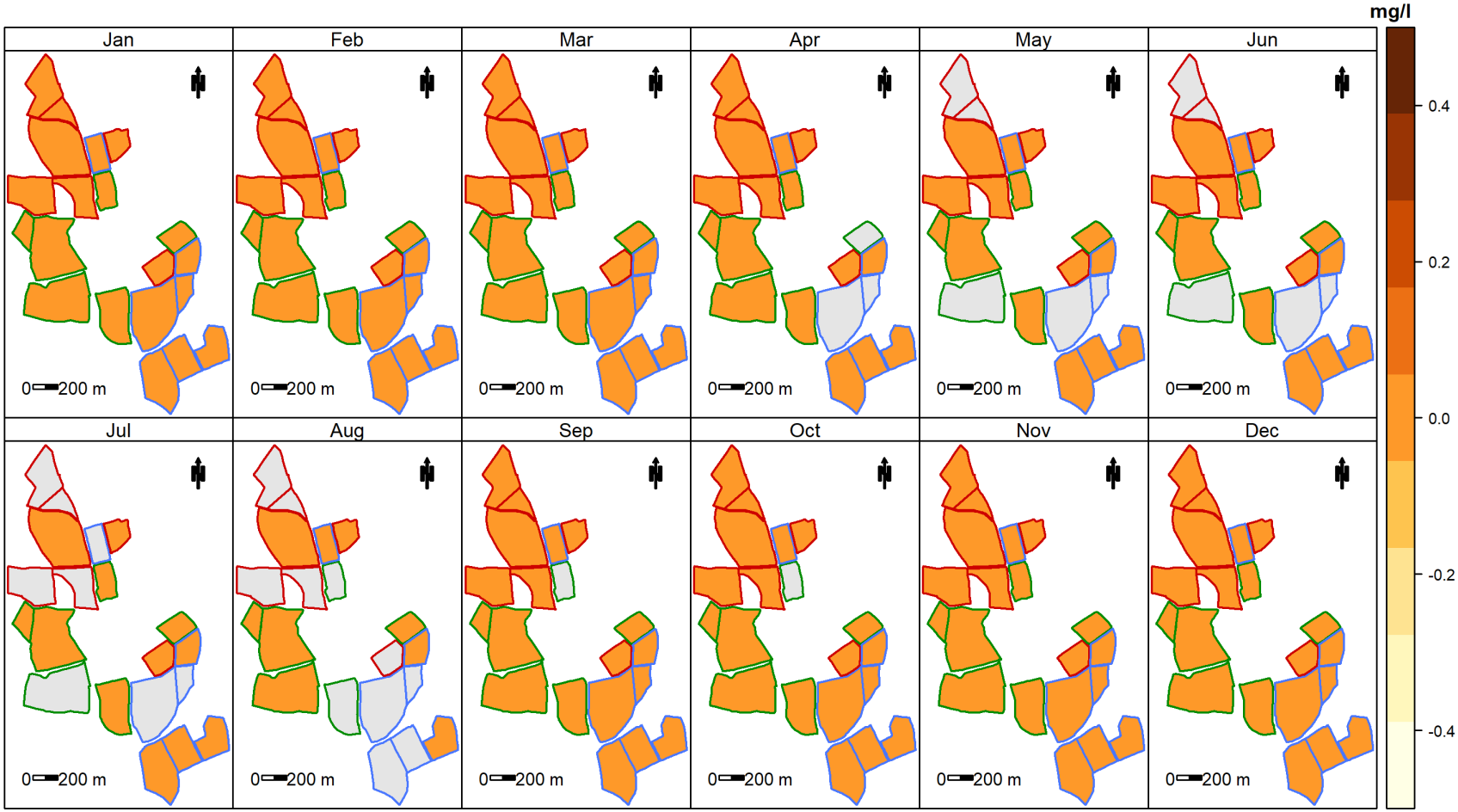


Figure 62: Mapped means for ammonia

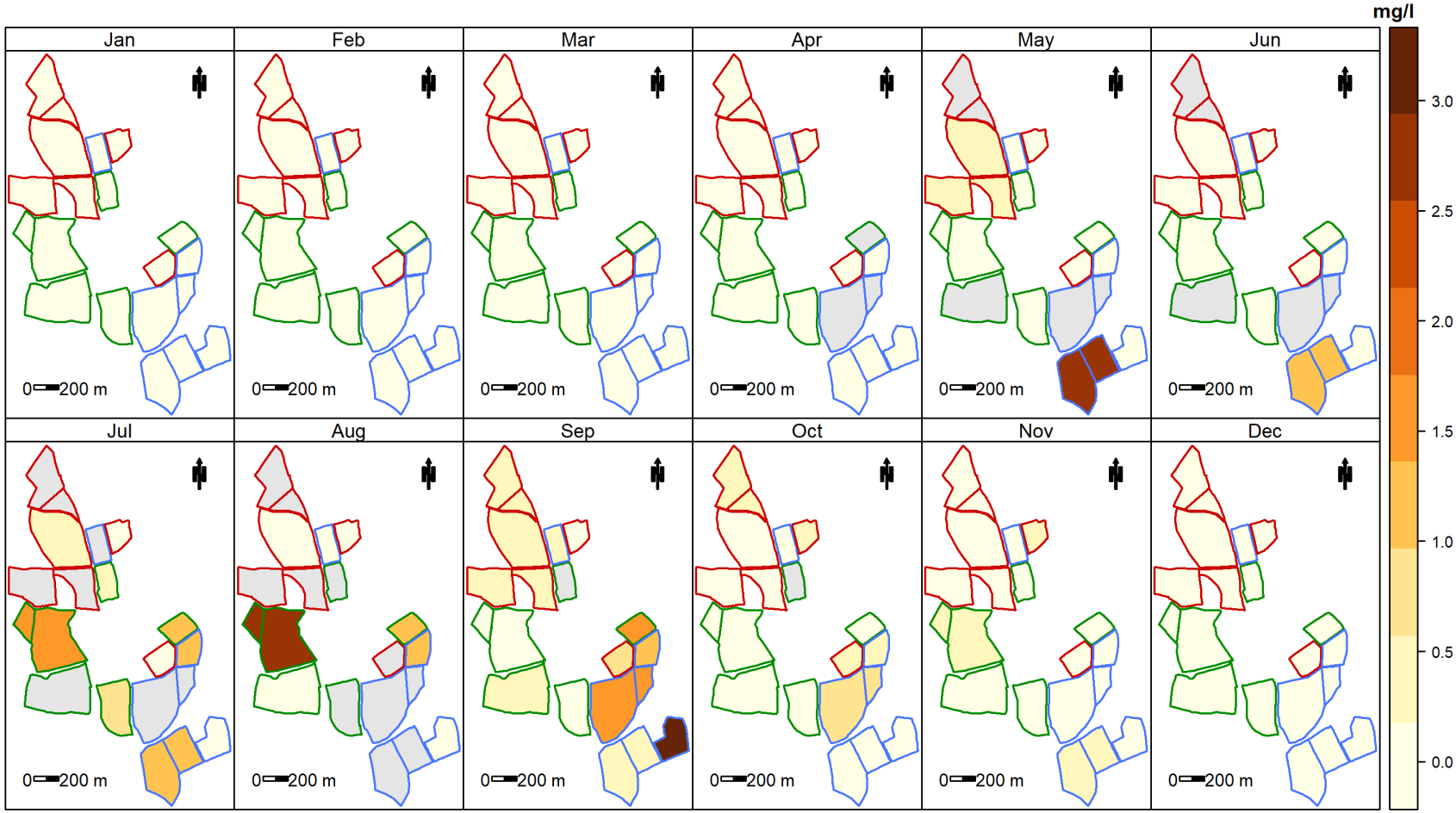


Figure 63: Mapped means for ammonium

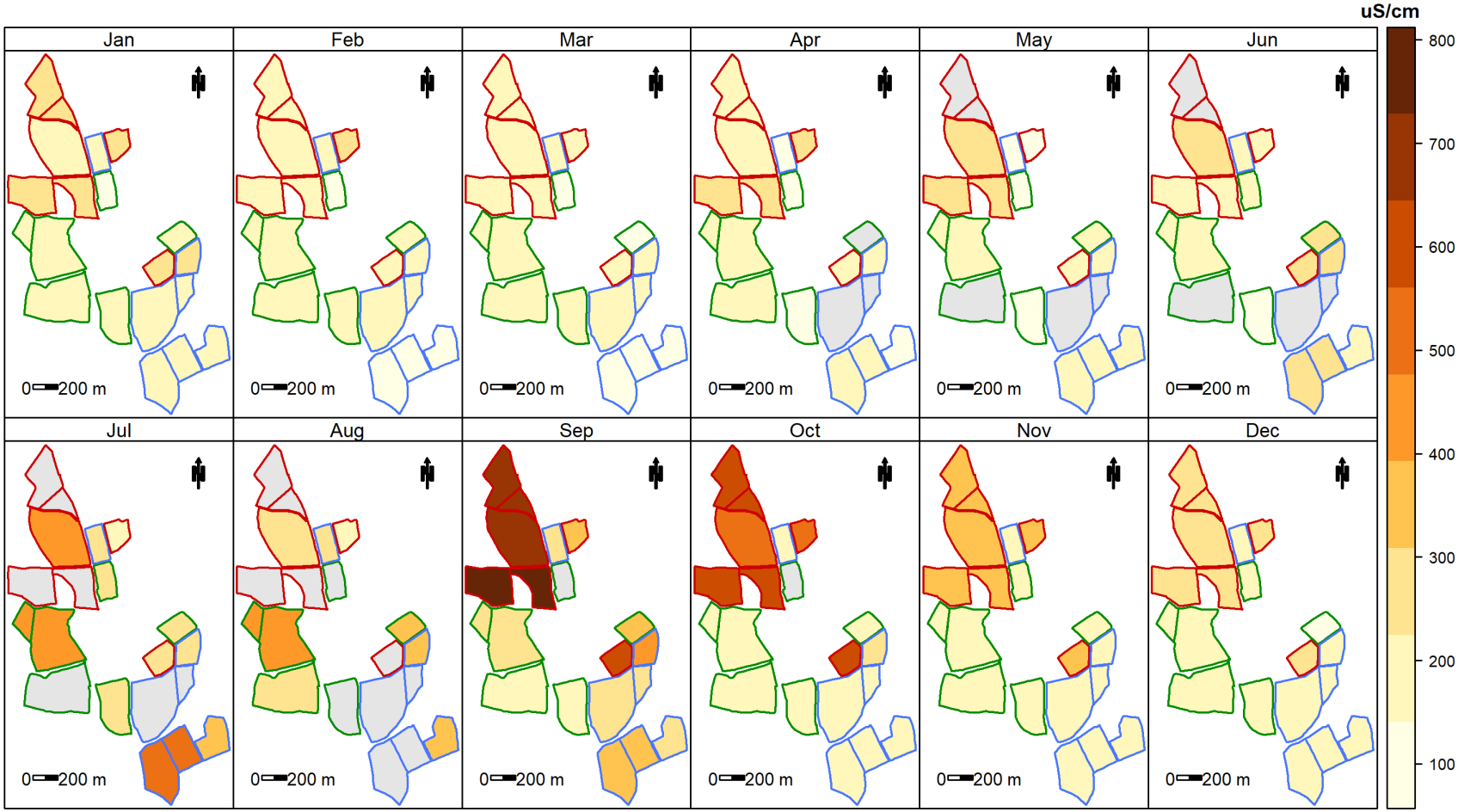


Figure 64: Mapped means for conductivity

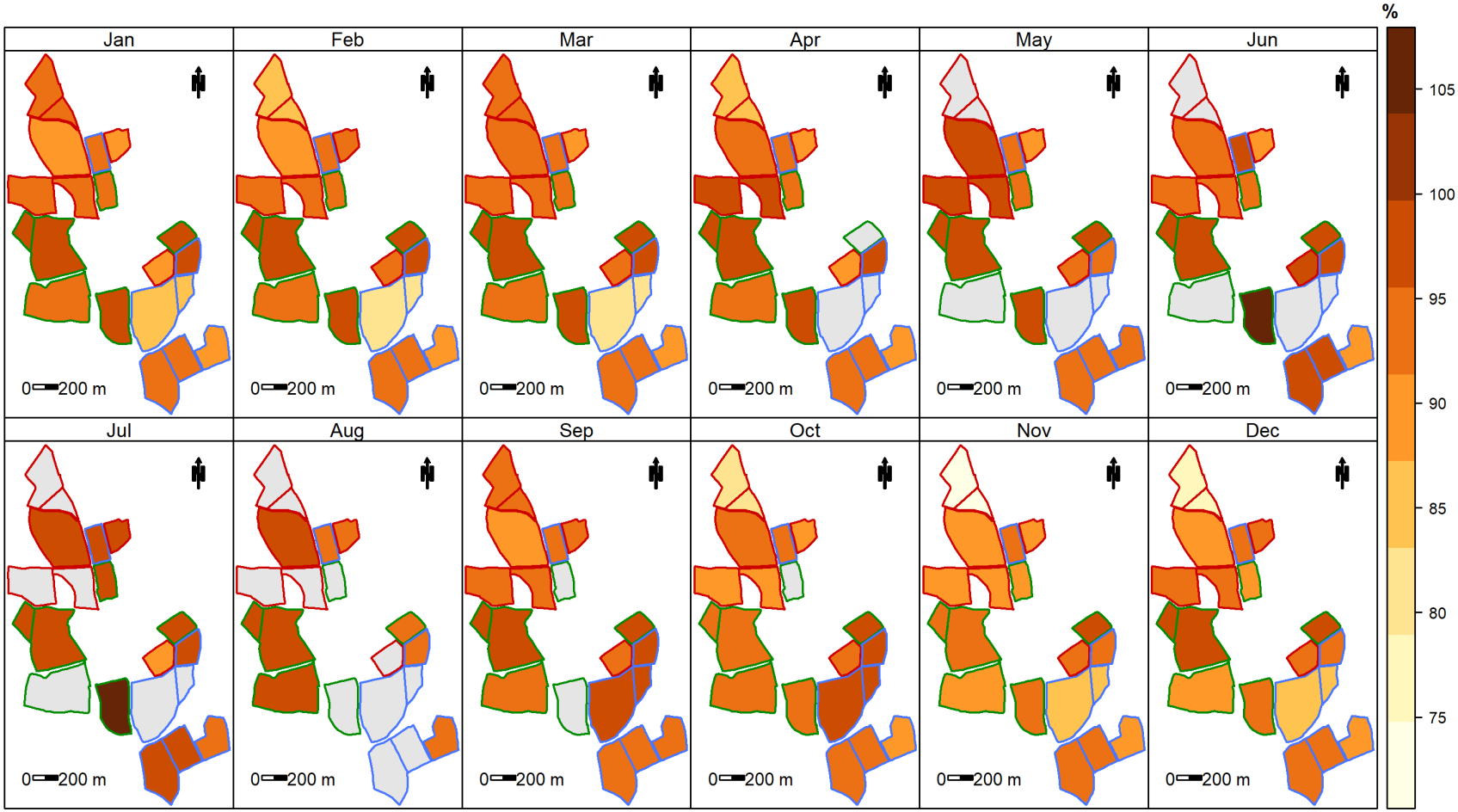


Figure 65: Mapped means for dissolved oxygen

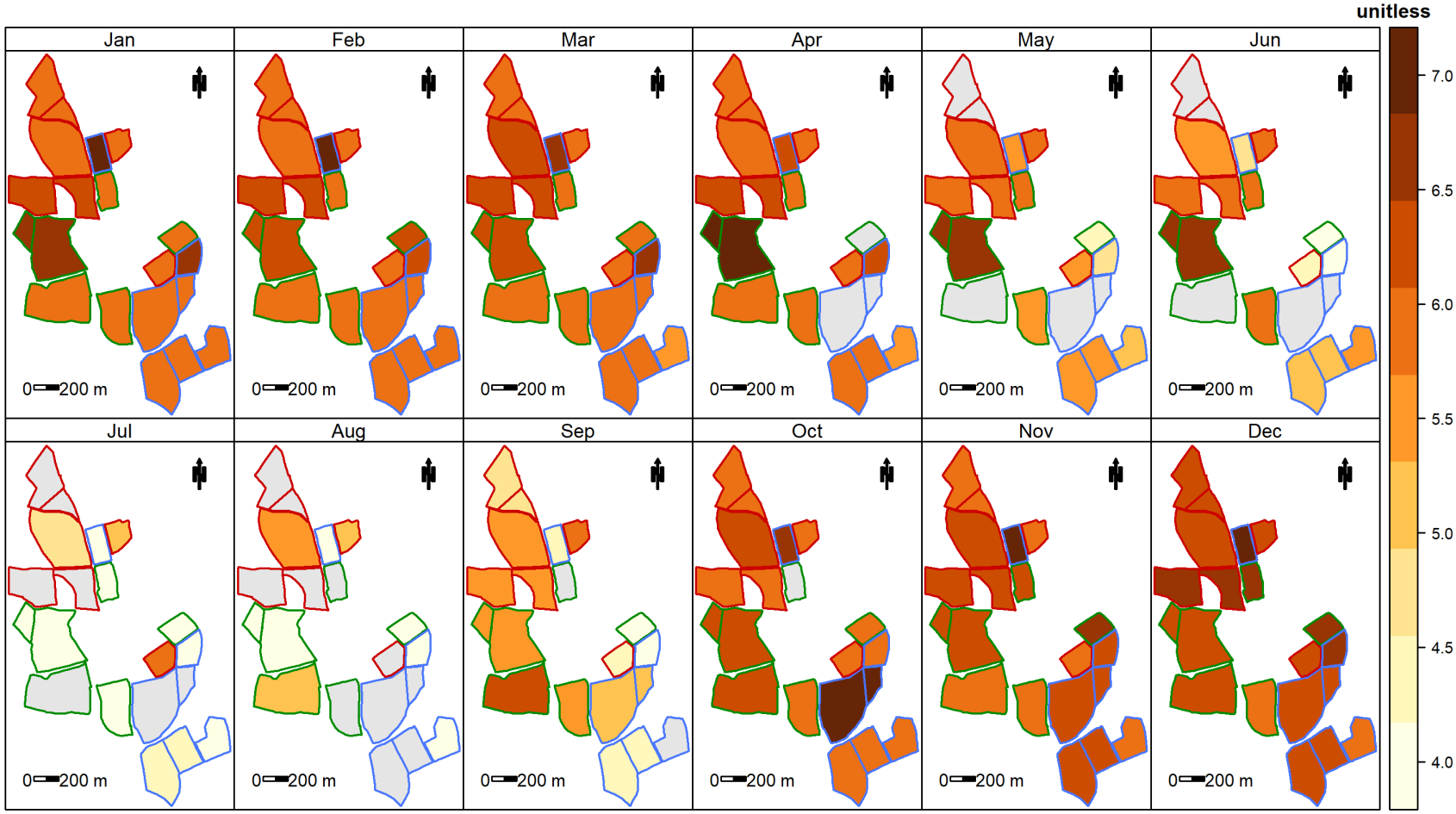


Figure 66: Mapped means for pH

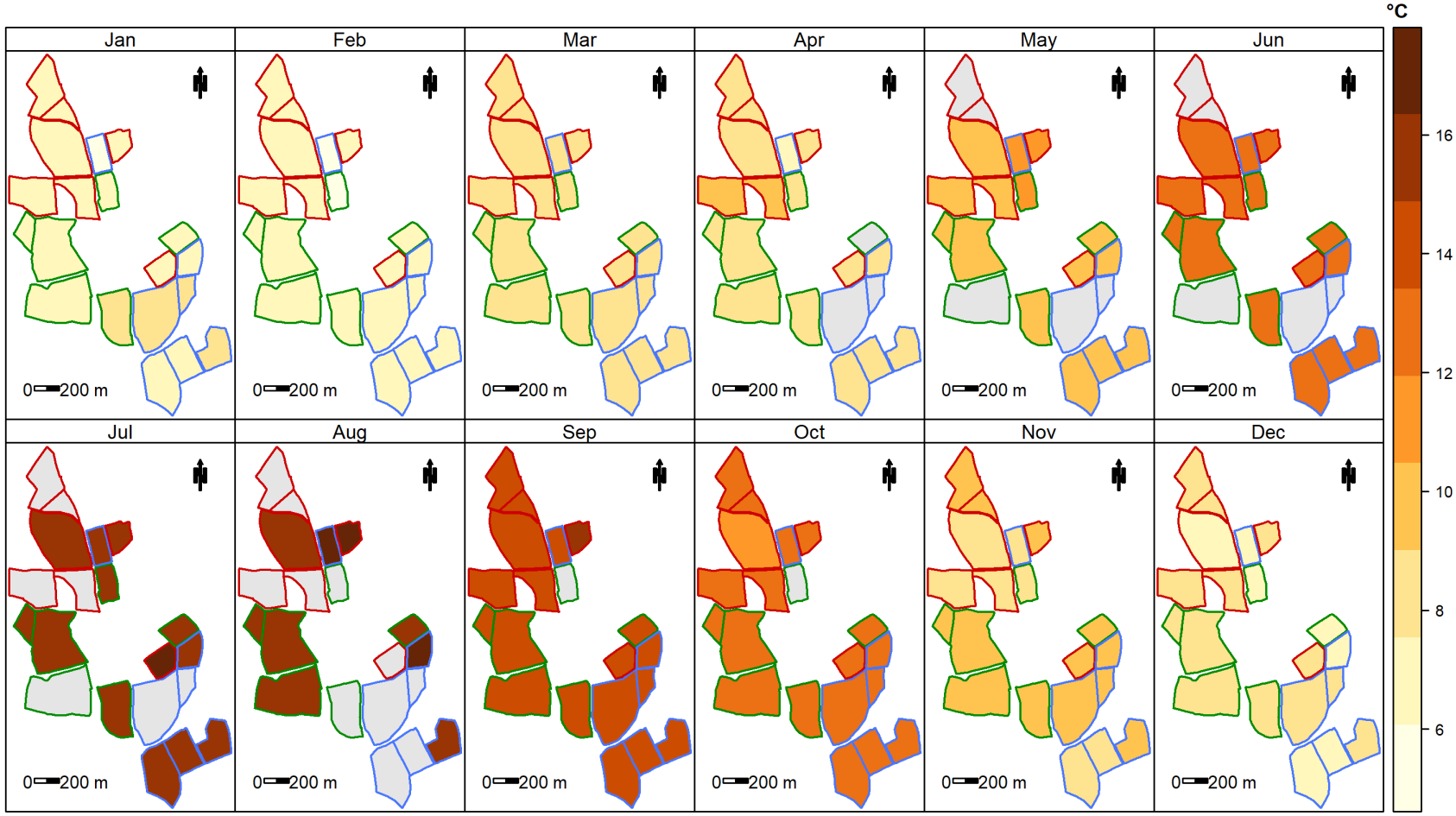


Figure 67: Mapped means for flow cell water temperature

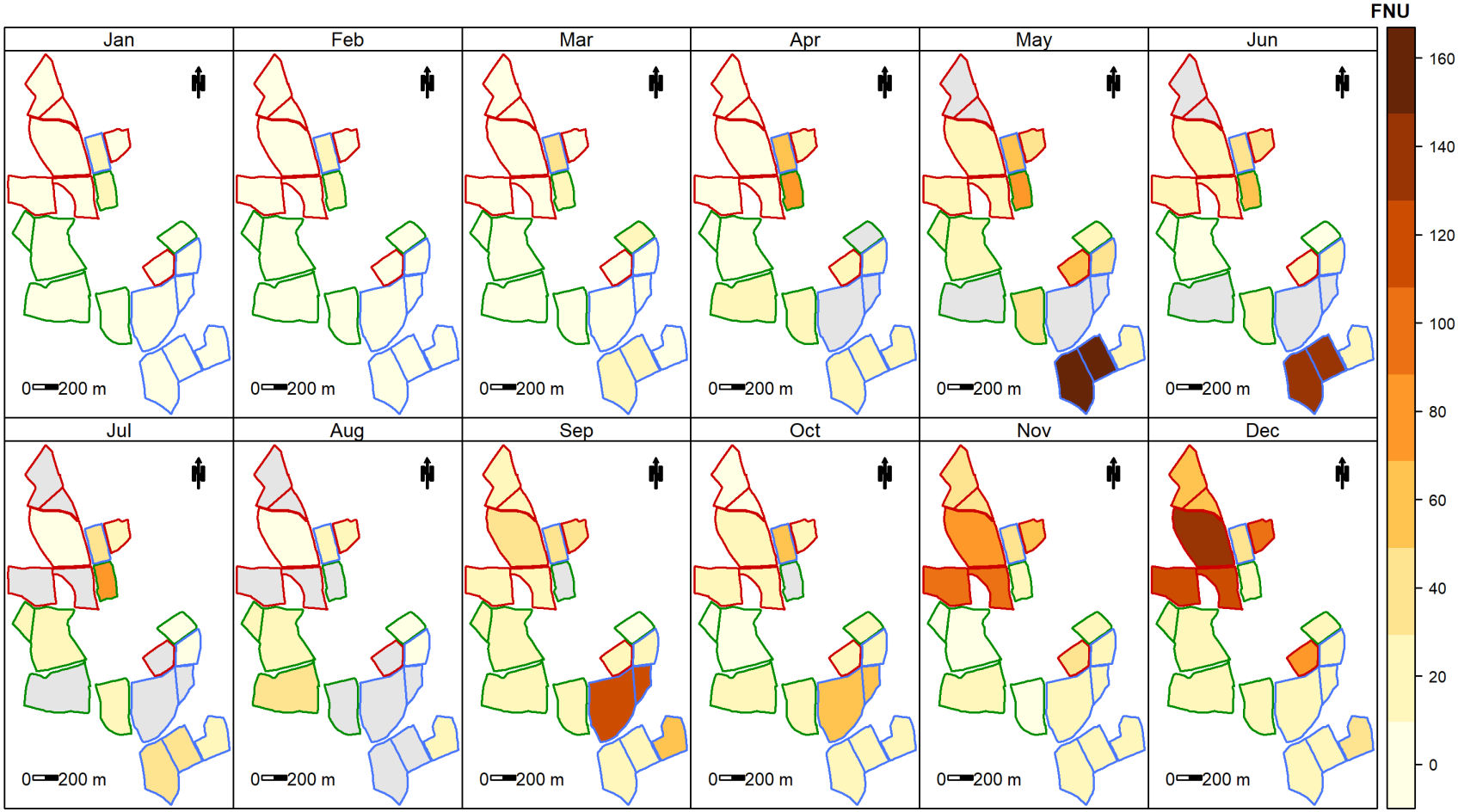


Figure 68: Mapped means for turbidity

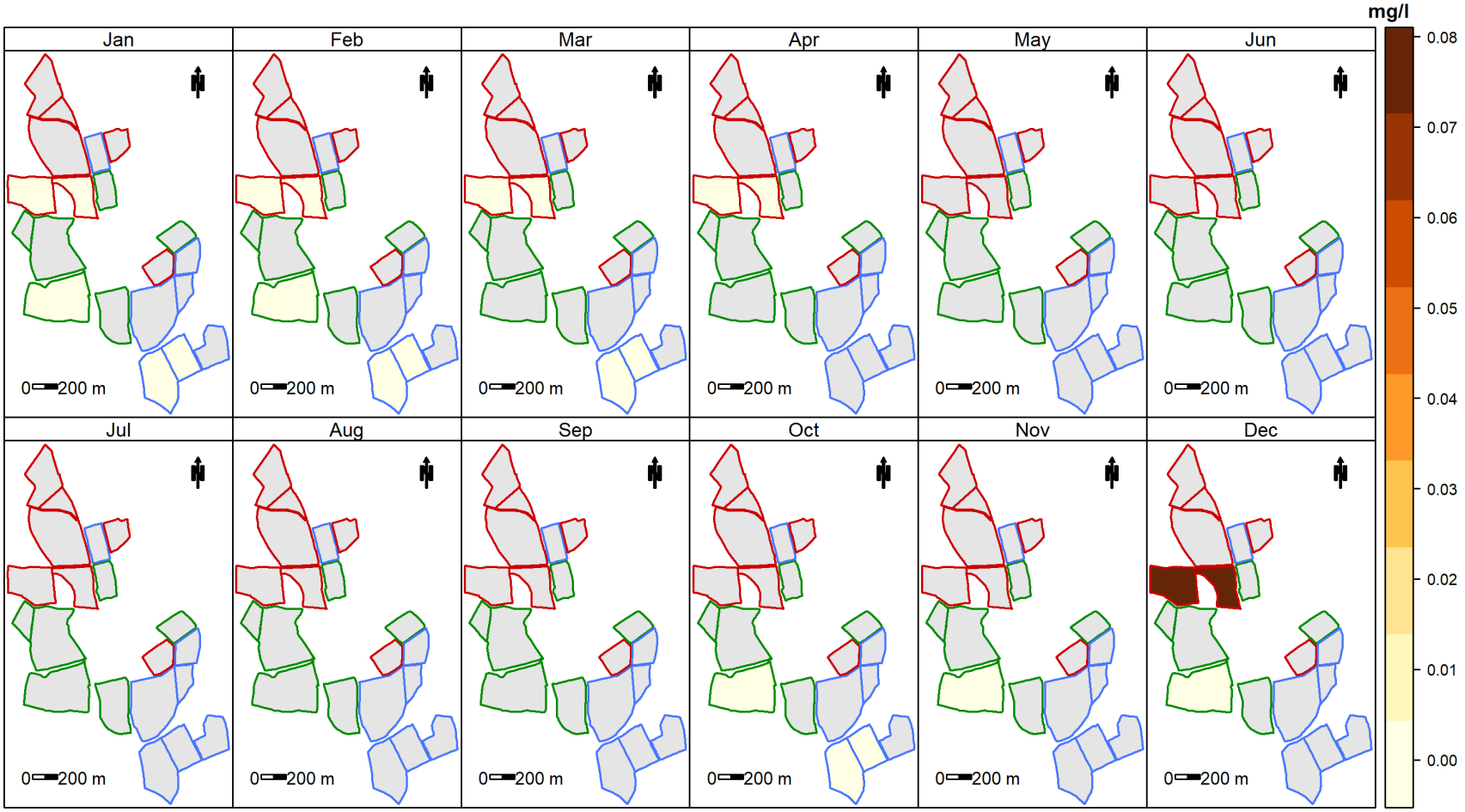


Figure 69: Mapped means for total phosphorus

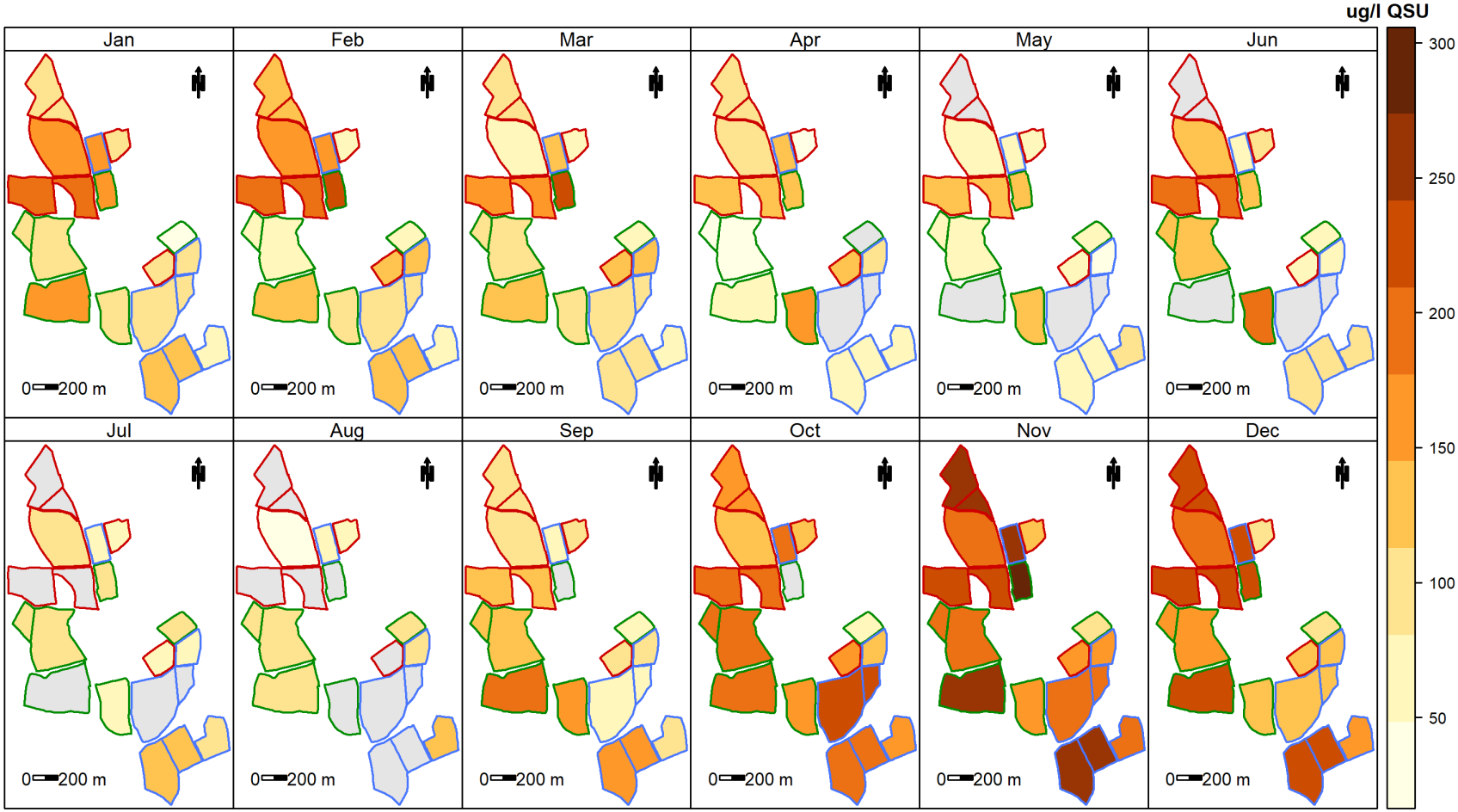


Figure 70: Mapped means for dissolved organic matter

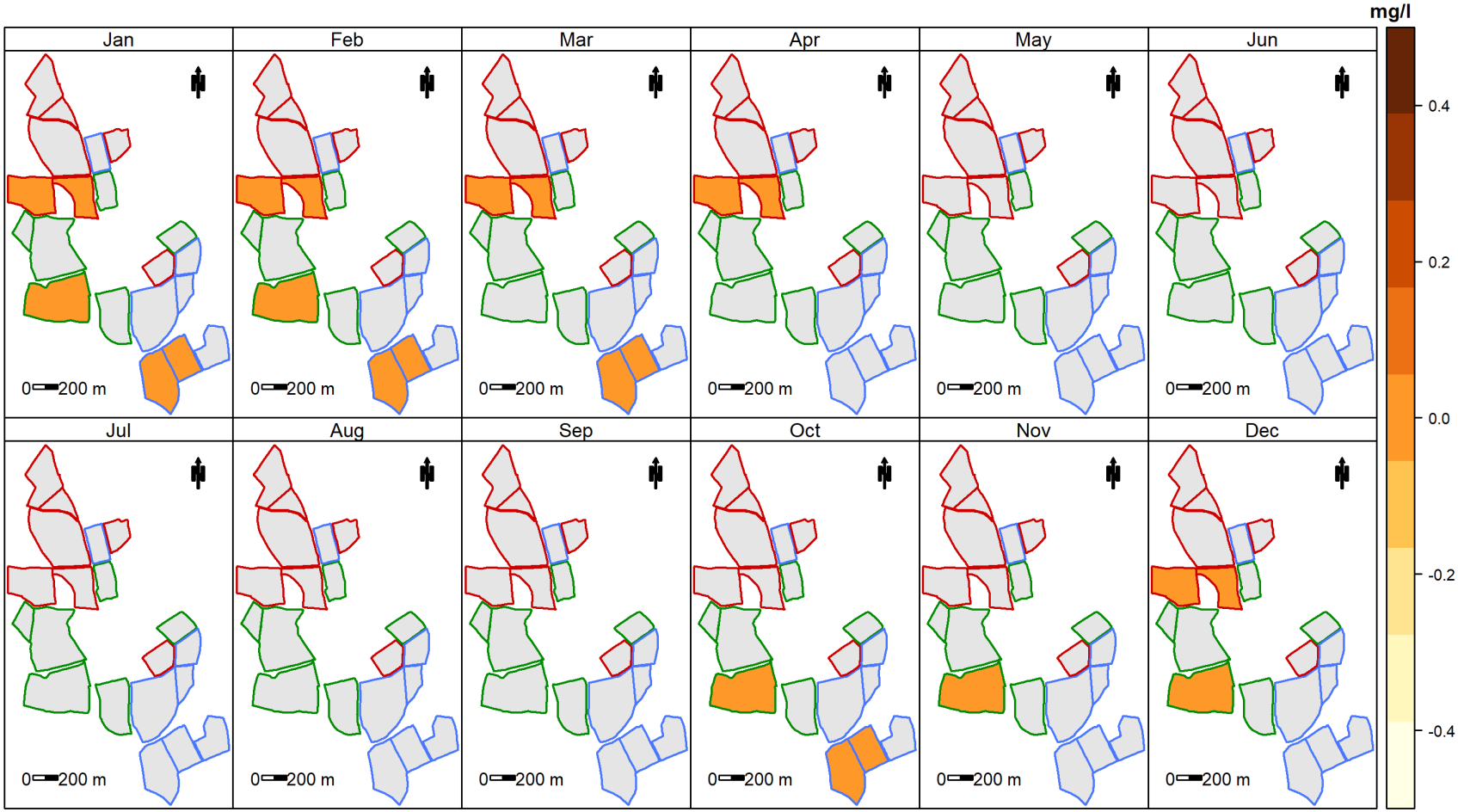


Figure 71: Mapped means for ortho-phosphorus

2.4 Chloropleth maps of standard deviations

Grey areas represent missing data

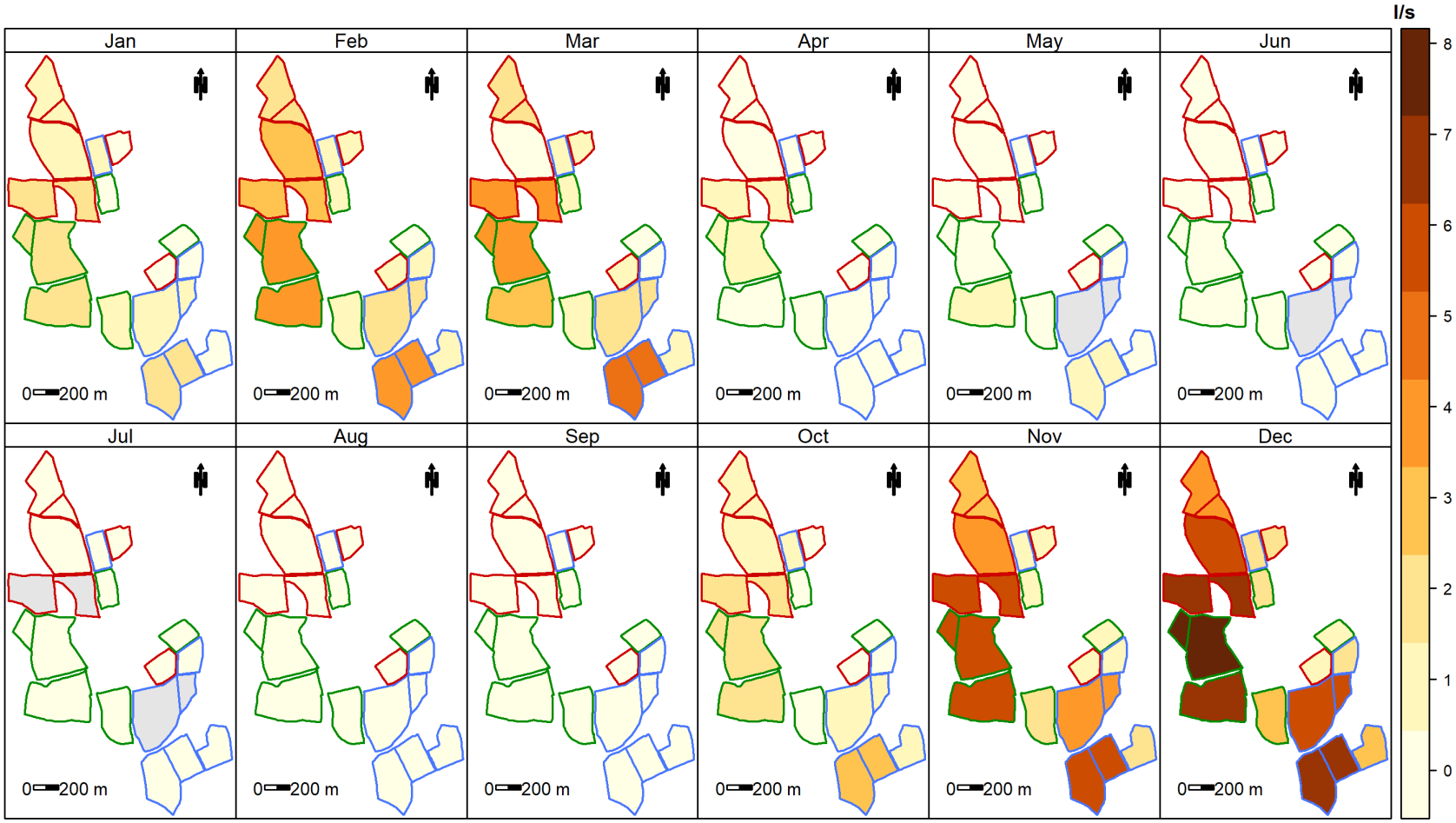


Figure 72: Mapped standard deviations for flow

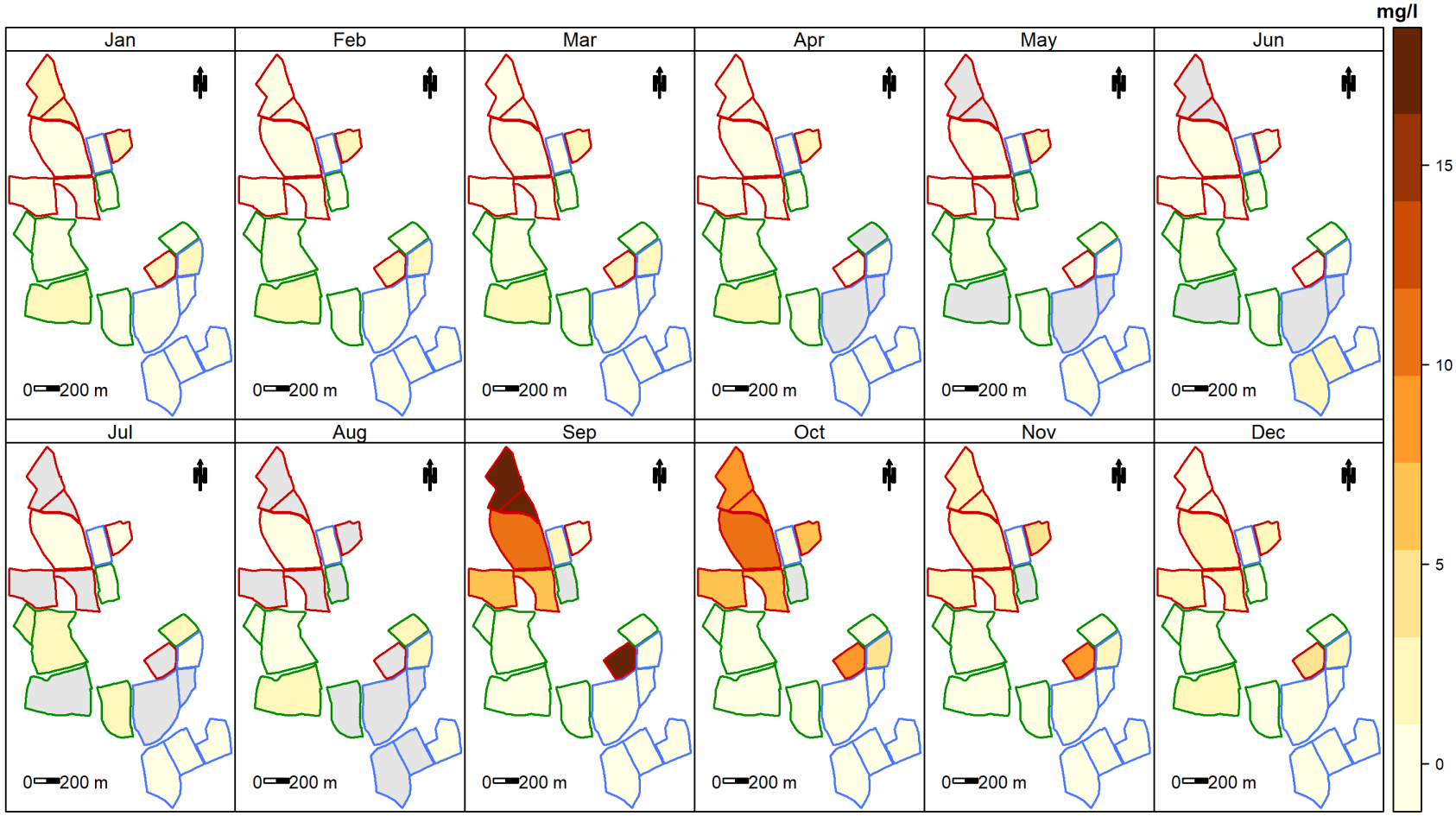


Figure 73: Mapped standard deviations for nitrate+nitrite

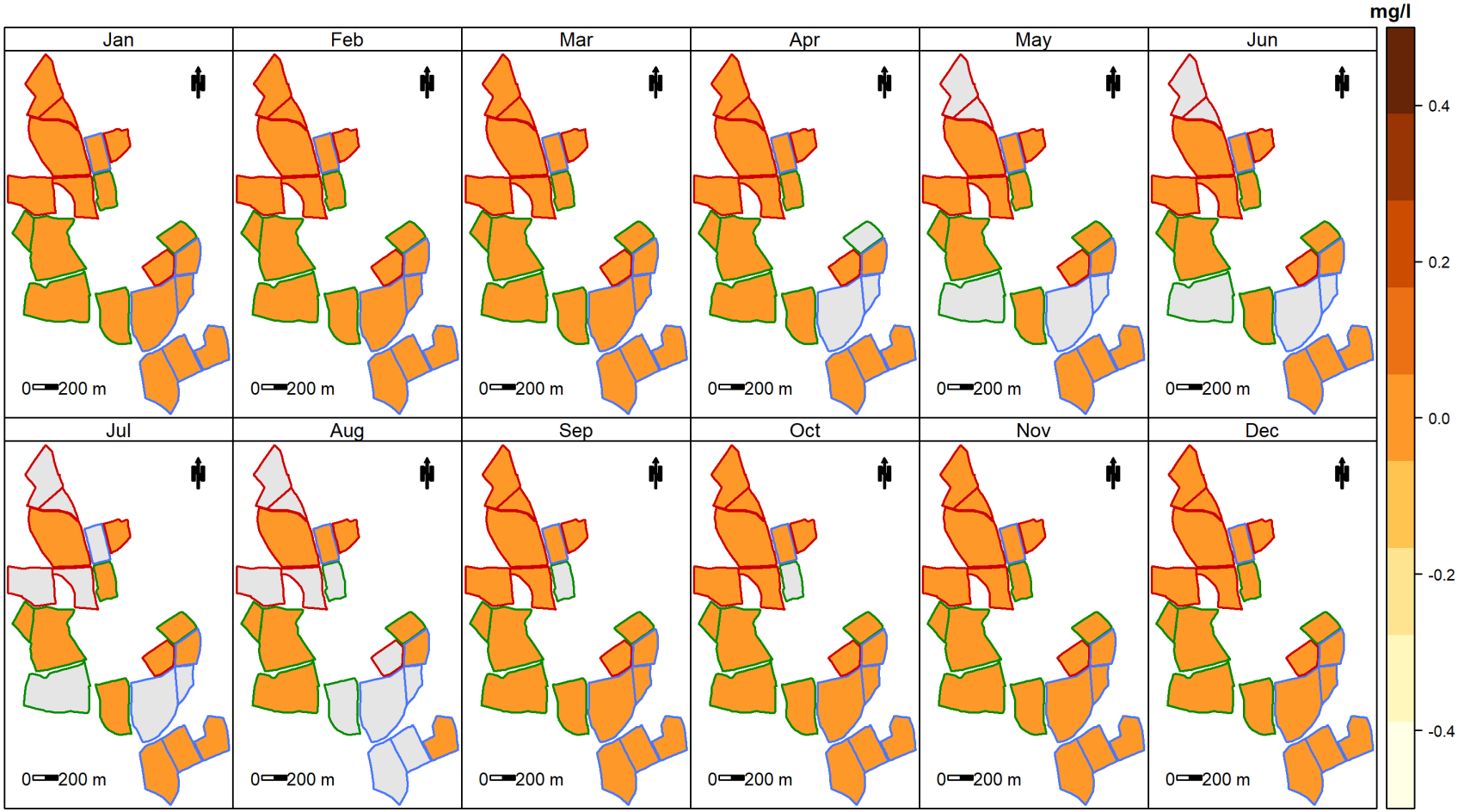


Figure 74: Mapped standard deviations for ammonia

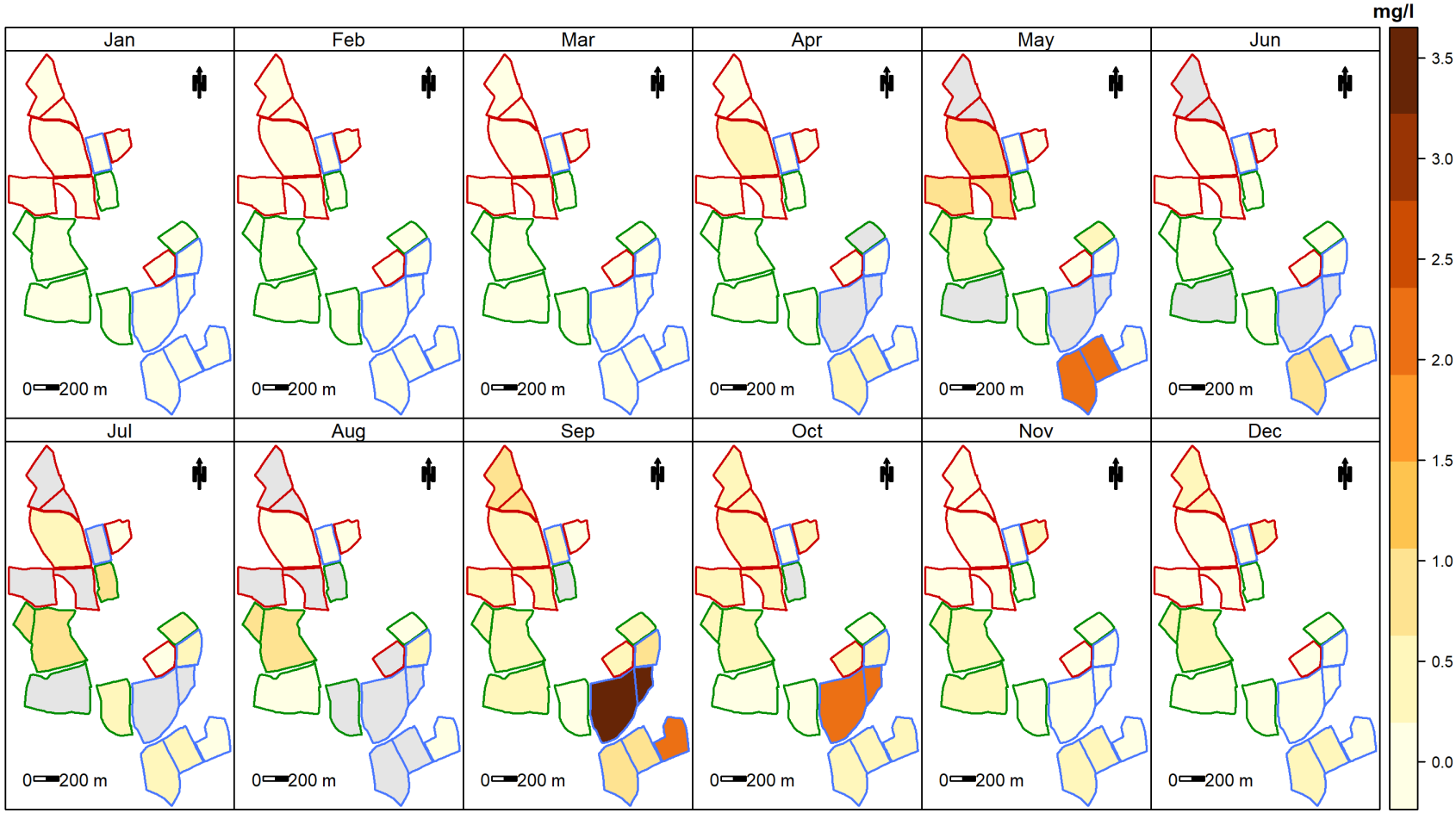


Figure 75: Mapped standard deviations for ammonium

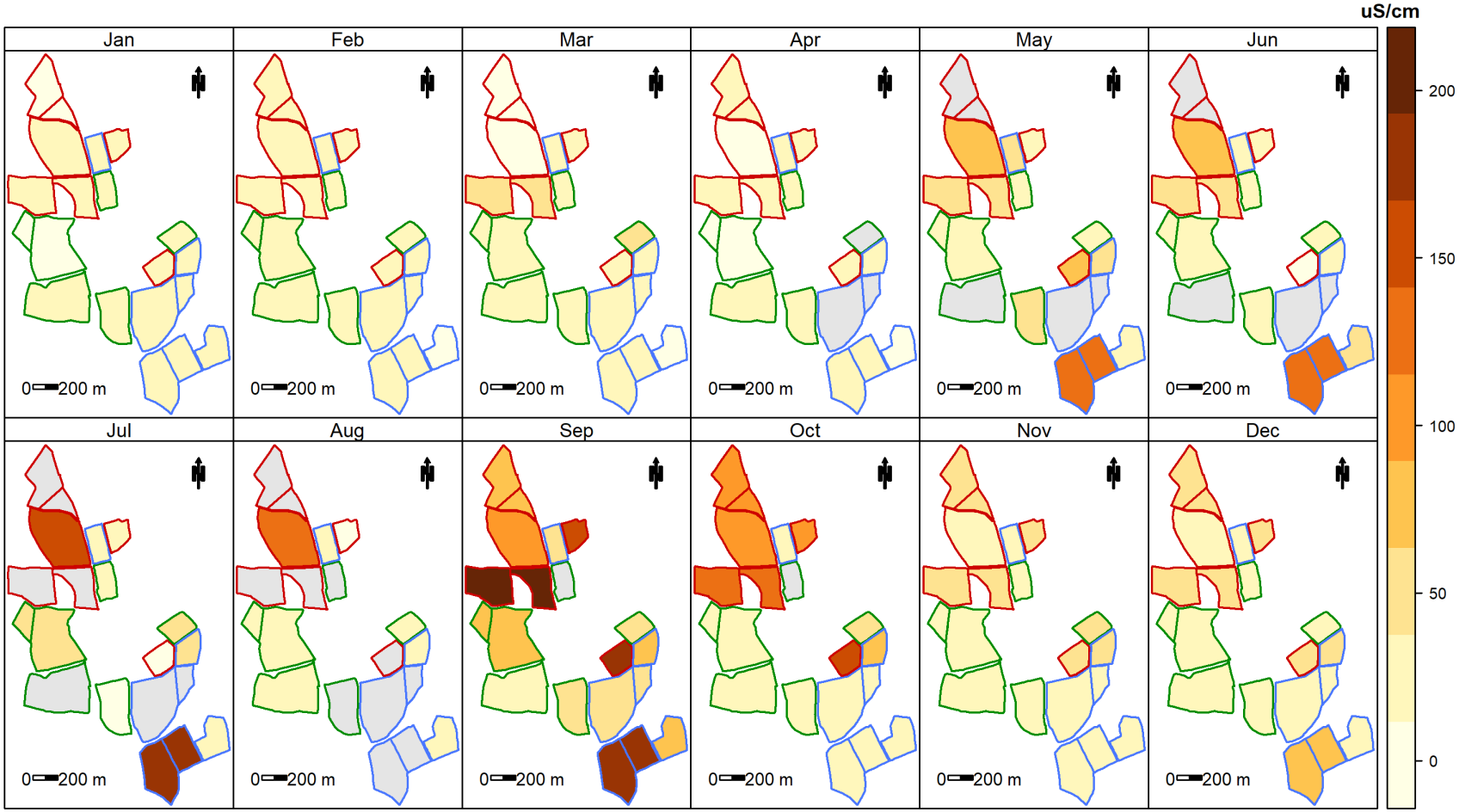


Figure 76: Mapped standard deviations for conductivity

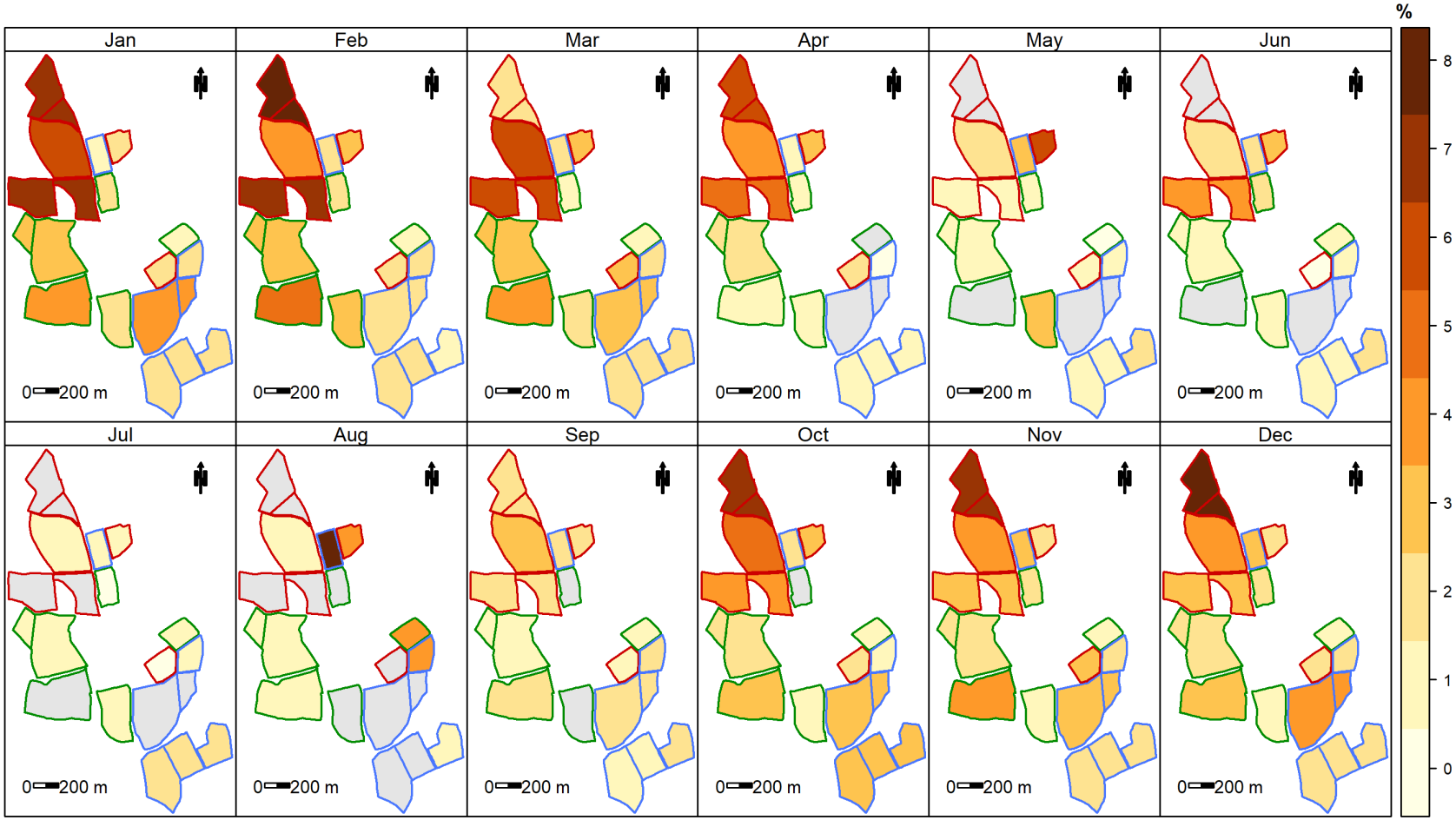


Figure 77: Mapped standard deviations for dissolved oxygen

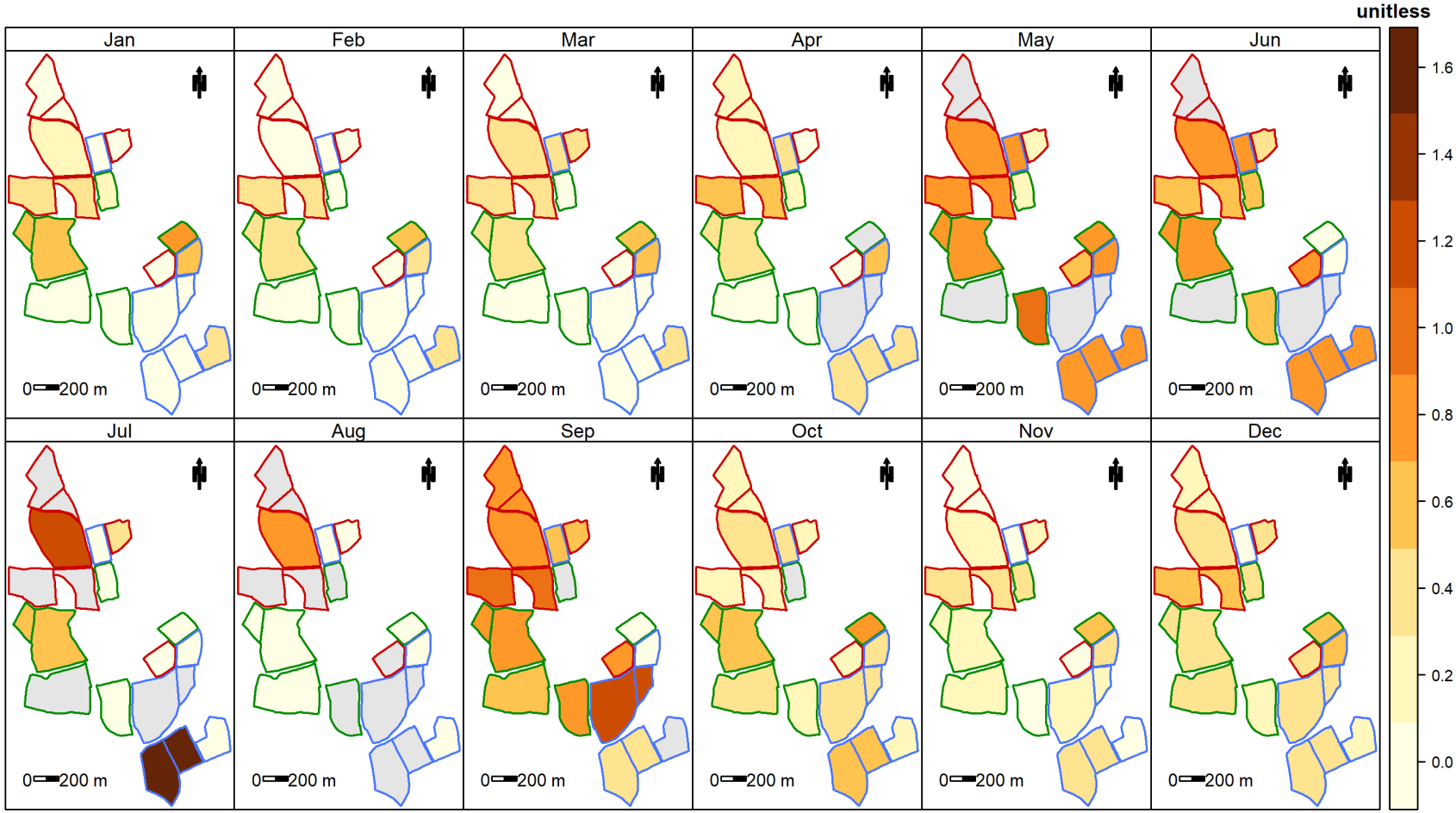


Figure 78: Mapped standard deviations for pH

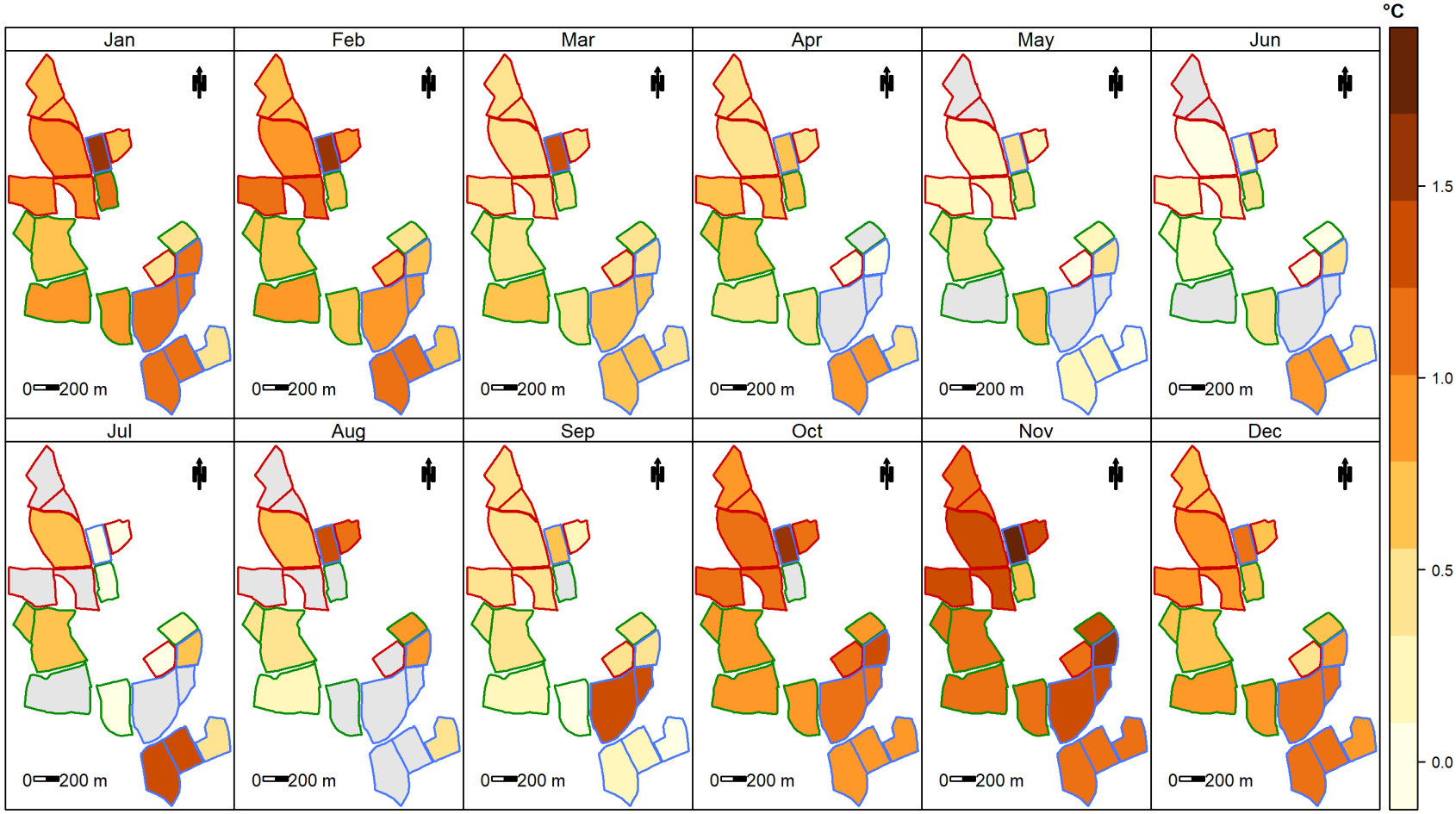


Figure 79: Mapped standard deviations for flow cell water temperature

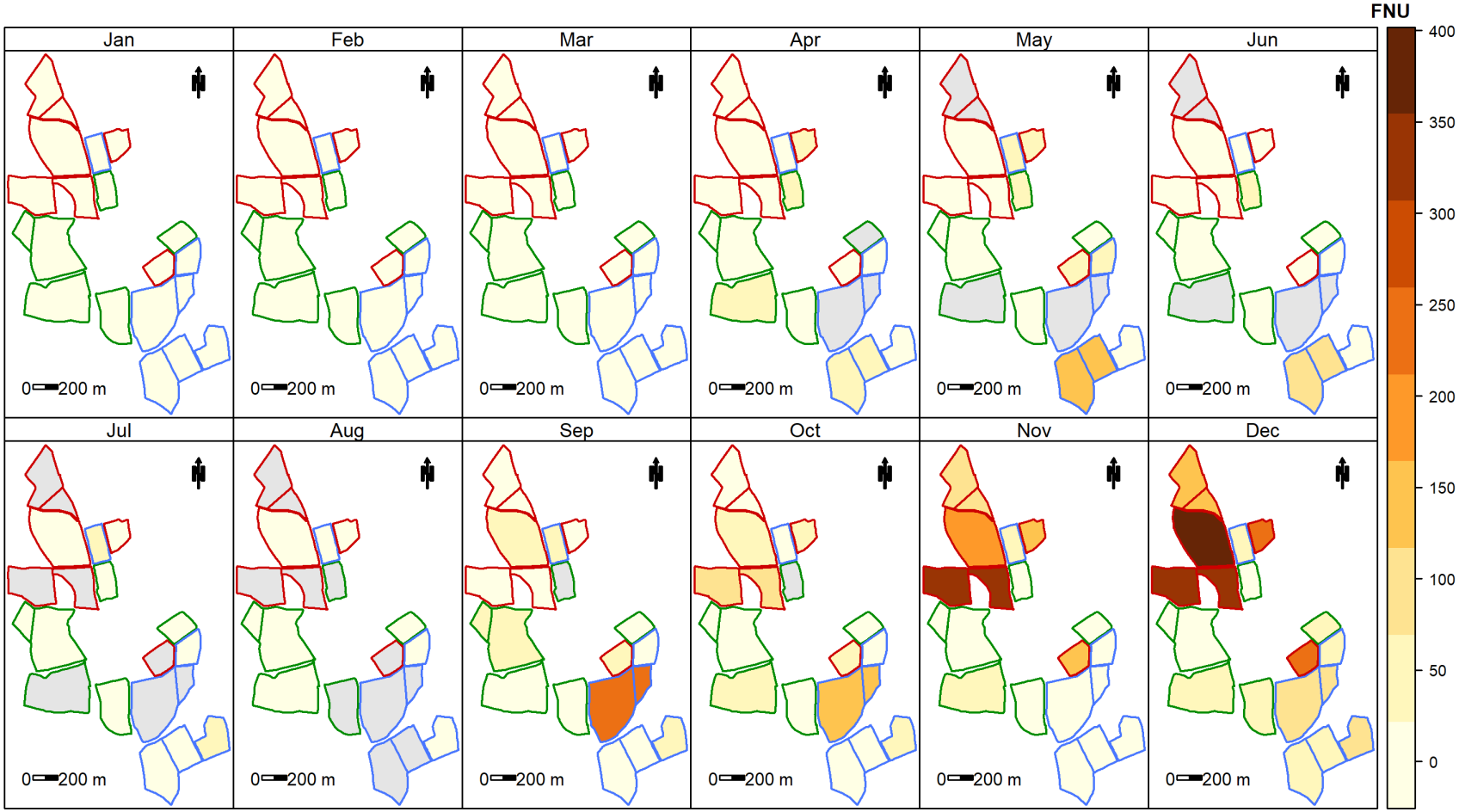


Figure 80: Mapped standard deviations for turbidity

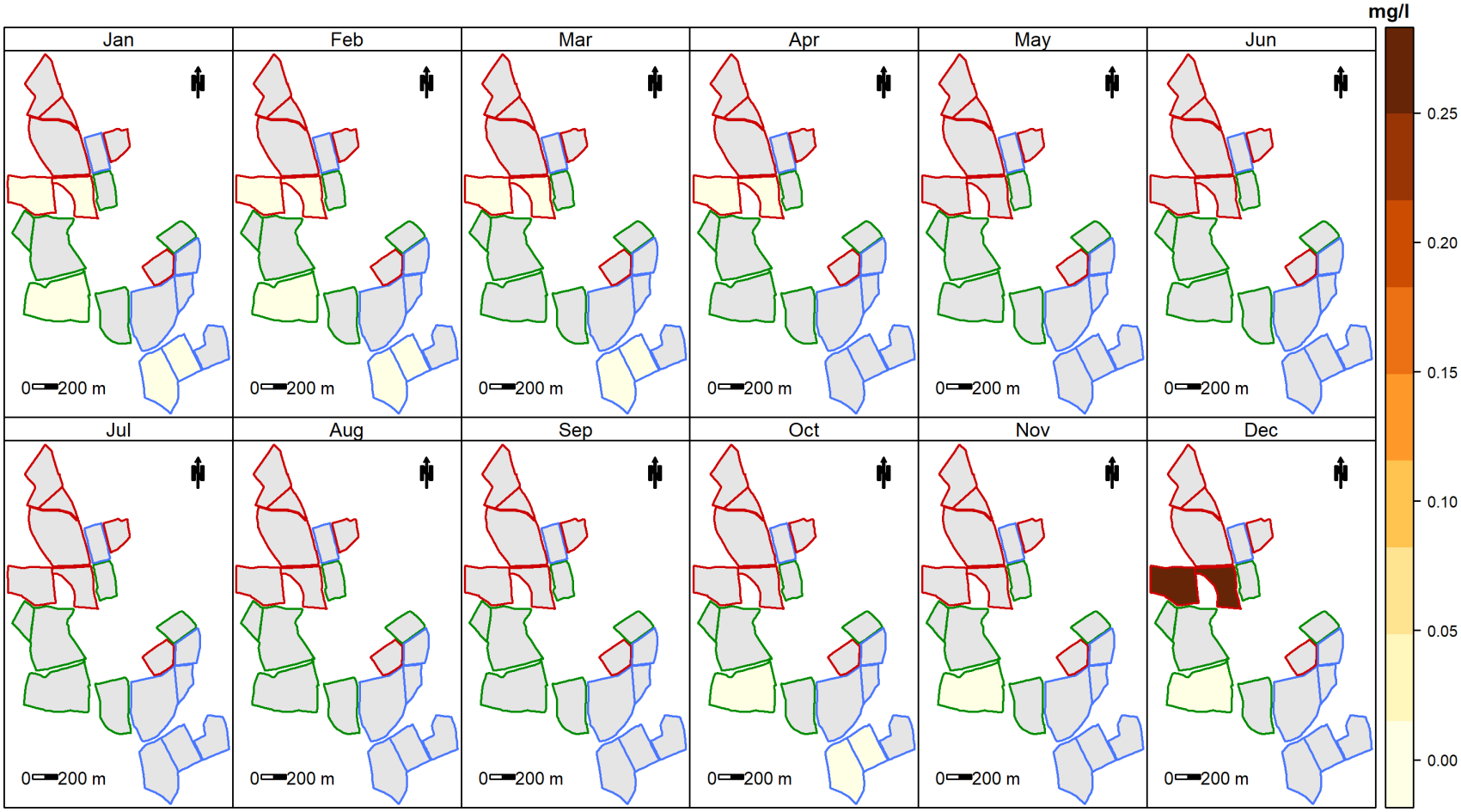


Figure 81: Mapped standard deviations for total phosphorus

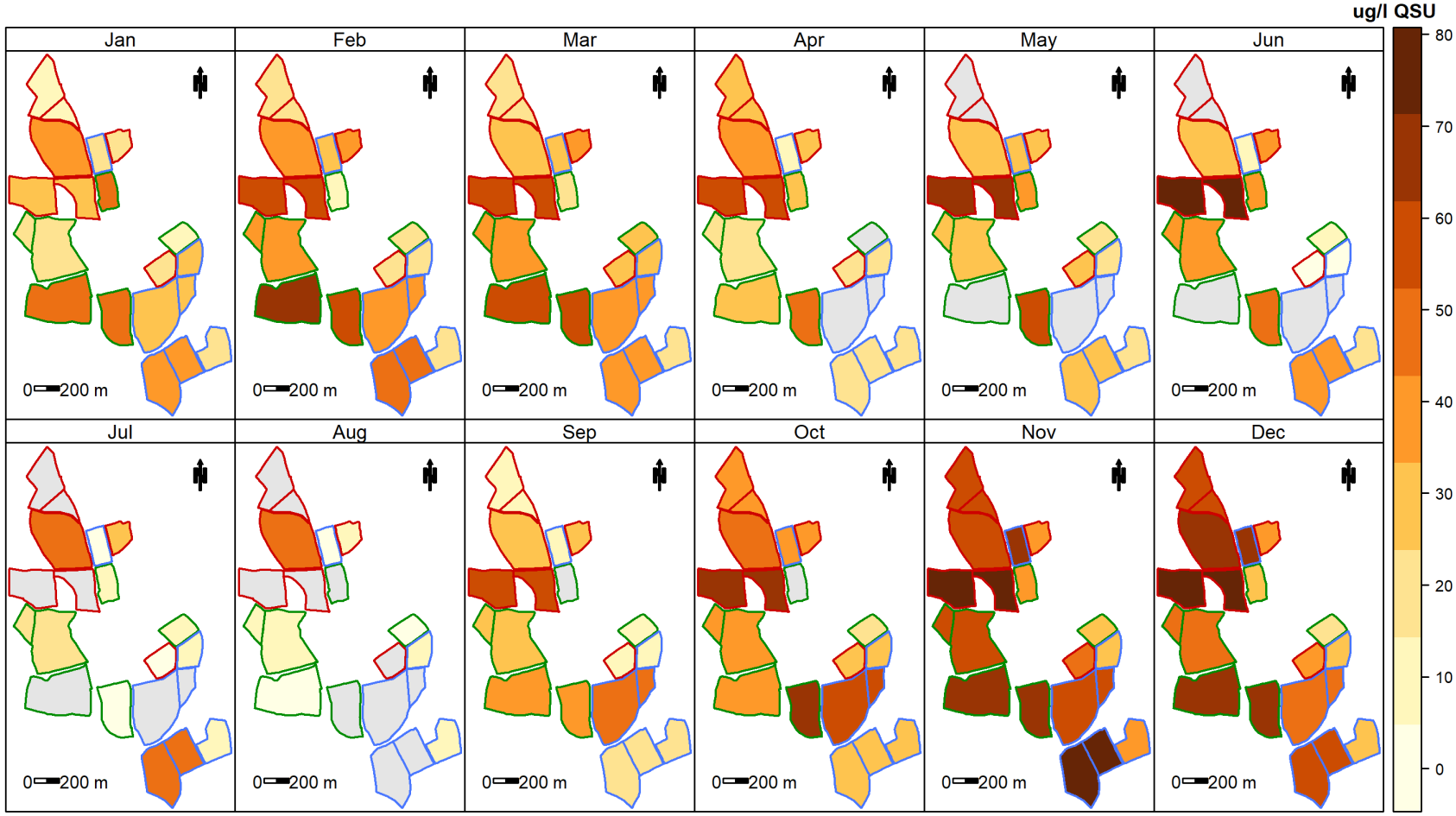


Figure 82: Mapped standard deviations for dissolved organic matter

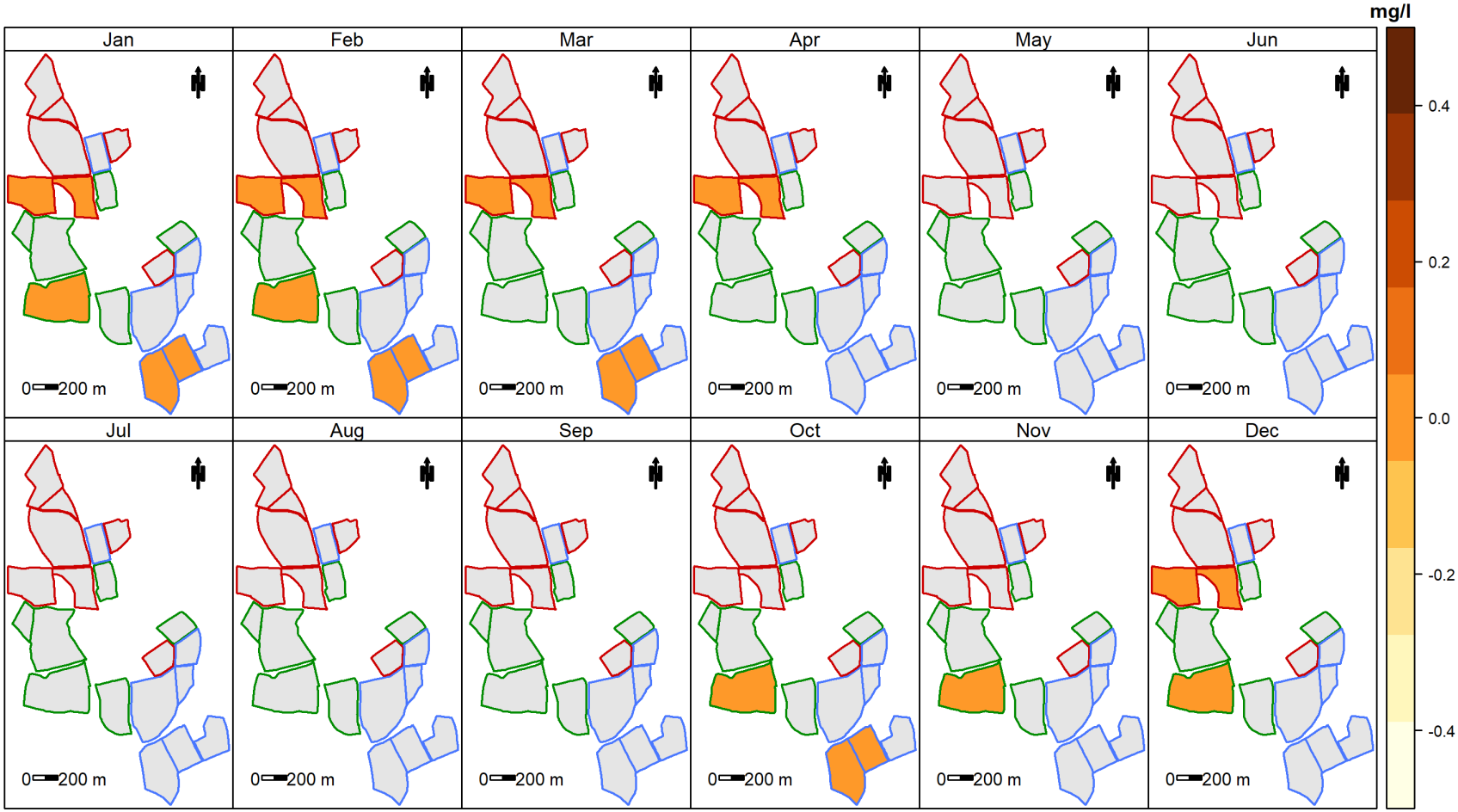


Figure 83: Mapped standard deviations for ortho-phosphorus

3 ANNUAL

3.1 Summary Statistics

Please be aware that statistics are based on data that may contain missing values. Full data summaries are available on request.

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	l/s	1.0	0.6	0.2	0.0	0.1	0.7	0.7	0.1	0.1	0.1	0.6	1.0	0.5	0.1	0.2
Median	l/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standard deviation	l/s	3.5	3.0	1.1	0.4	0.6	2.9	3.5	1.0	0.6	0.8	2.6	3.8	1.8	0.5	0.8
Inter-quartile range	l/s	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Coefficient of variation	l/s	3.6	4.6	5.2	11.6	7.4	4.2	4.9	6.7	9.0	6.4	4.2	3.9	3.7	7.8	5.0
Minimum	l/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	l/s	77.0	71.0	34.0	16.0	16.0	61.0	72.0	29.0	19.0	18.0	68.0	81.0	44.0	13.0	21.0
Missing values	count	0	0	719	6	682	12685	1649	484	7	0	8160	8449	1166	197	10
Missing values as a %	%	0	0	2	0	2	36	5	1	0	0	23	24	3	1	0

Table 7: Annual summary statistics for flow

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	1.9	3.1	1.9	2.1	1.1	1.5	0.5	0.9	3.4	0.5	5.0	2.6	6.3	11.7	4.1
Median	mg/l	2.0	3.0	2.0	2.0	1.0	2.0	0.0	1.0	3.0	1.0	2.0	2.0	3.0	7.0	3.0
Standard deviation	mg/l	0.8	1.7	0.8	1.4	0.7	0.7	0.6	0.5	2.3	0.5	8.3	2.2	9.3	10.3	3.8
Inter-quartile range	mg/l	1.0	2.0	1.0	2.0	0.0	1.0	1.0	0.0	2.0	1.0	2.0	1.0	3.0	11.0	5.0
Coefficient of variation	mg/l	0.4	0.6	0.4	0.7	0.6	0.5	1.2	0.5	0.7	1.0	1.7	0.8	1.5	0.9	0.9
Minimum	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	mg/l	11.0	6.0	11.0	7.0	6.0	8.0	11.0	2.0	17.0	4.0	45.0	35.0	43.0	47.0	22.0
Missing values	count	17795	19176	23398	31191	30480	21299	22537	23402	29631	29660	21592	19869	19327	25230	26822
Missing values as a %	%	51	55	67	89	87	61	64	67	85	85	62	57	55	72	77

Table 8: Annual summary statistics for nitrate+nitrite

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Median	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standard deviation	mg/l	0.3	0.2	0.0	0.2	0.0	0.9	0.3	0.4	0.2	0.1	0.2	0.2	0.3	0.1	0.3
Inter-quartile range	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coefficient of variation	mg/l	4.1	5.4	72.6	7.6	74.2	8.4	4.2	10.8	6.1	12.5	6.9	6.0	3.9	7.1	2.5
Minimum	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	mg/l	4.0	2.0	3.0	3.0	1.0	16.0	9.0	8.0	3.0	2.0	4.0	4.0	3.0	1.0	2.0
Missing values	count	15673	19835	23050	30429	29539	20360	22170	22402	29422	29305	20994	18089	20781	24986	22196
Missing values as a %	%	45	57	66	87	84	58	63	64	84	84	60	52	59	71	63

Table 9: Annual summary statistics for ammonium

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	uS/cm	190.4	191.4	169.2	166.0	155.4	200.3	170.5	150.1	213.9	183.0	285.0	305.9	328.0	305.4	283.2
Median	uS/cm	190.0	198.0	177.0	180.0	158.0	207.0	164.0	151.0	218.0	178.0	264.0	257.0	272.0	264.0	251.0
Standard deviation	uS/cm	29.8	26.7	22.6	52.9	38.0	29.4	61.4	37.7	48.0	40.7	115.5	135.5	160.4	126.2	95.9
Inter-quartile range	uS/cm	18.0	34.0	27.0	70.0	71.0	36.0	57.0	33.0	58.0	56.0	110.5	107.0	156.0	142.0	90.5
Coefficient of variation	uS/cm	0.2	0.1	0.1	0.3	0.2	0.1	0.4	0.3	0.2	0.2	0.4	0.4	0.5	0.4	0.3
Minimum	uS/cm	10.0	64.0	64.0	53.0	63.0	70.0	48.0	79.0	74.0	71.0	39.0	60.0	37.0	82.0	71.0
Maximum	uS/cm	662.0	269.0	348.0	426.0	261.0	429.0	932.0	499.0	500.0	331.0	1626.0	1024.0	928.0	949.0	683.0
Missing values	count	15233	18994	23050	30429	29271	20376	22172	21932	29430	29256	20428	18089	20781	24982	22192
Missing values as a %	%	43	54	66	87	84	58	63	63	84	83	58	52	59	71	63

Table 10: Annual summary statistics for conductivity

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	%	96.4	91.8	94.3	97.6	92.3	86.0	94.8	89.3	96.2	93.9	91.1	92.4	82.2	92.4	90.6
Median	%	97.0	93.0	94.0	98.0	92.0	85.0	95.0	89.0	96.0	94.0	91.0	92.0	83.0	92.0	91.0
Standard deviation	%	3.0	4.1	2.9	1.6	2.6	5.8	2.1	2.4	2.2	2.3	5.0	5.5	10.2	2.7	2.8
Inter-quartile range	%	4.0	6.0	4.0	1.0	4.0	7.0	3.0	3.0	3.0	2.0	8.0	8.0	17.0	4.0	4.0
Coefficient of variation	%	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Minimum	%	87.0	79.0	88.0	85.0	87.0	75.0	88.0	82.0	79.0	82.0	77.0	78.0	62.0	85.0	78.0
Maximum	%	105.0	100.0	106.0	101.0	100.0	104.0	104.0	98.0	103.0	103.0	101.0	103.0	100.0	102.0	102.0
Missing values	count	15224	18994	23254	30429	29539	20361	22170	22298	29430	29431	20428	18087	20781	24982	22190
Missing values as a %	%	43	54	66	87	84	58	63	64	84	84	58	52	59	71	63

Table 11: Annual summary statistics for dissolved oxygen

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	unitless	6.3	6.1	6.0	6.1	6.3	6.1	6.0	5.8	6.4	6.9	6.0	6.2	6.0	6.0	6.0
Median	unitless	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	7.0	6.0	6.0	6.0	6.0	6.0
Standard deviation	unitless	0.5	0.2	0.1	0.8	0.5	0.4	0.4	0.4	0.6	0.4	0.5	0.5	0.3	0.2	0.3
Inter-quartile range	unitless	1.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0
Coefficient of variation	unitless	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1
Minimum	unitless	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
Maximum	unitless	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Missing values	count	15224	18994	23048	30429	29271	20361	22171	22689	29430	29256	20428	18086	20781	24982	22190
Missing values as a %	%	43	54	66	87	84	58	63	65	84	83	58	52	59	71	63

Table 12: Annual summary statistics for pH

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	°C	8.8	8.9	9.0	8.7	7.4	8.7	8.3	9.0	8.0	7.6	9.0	8.5	8.7	8.5	8.5
Median	°C	8.0	8.0	9.0	8.0	7.0	8.0	8.0	9.0	8.0	7.0	8.0	8.0	8.0	8.0	8.0
Standard deviation	°C	2.0	2.0	1.6	2.5	1.2	1.9	2.2	1.9	1.9	2.5	2.7	2.0	2.1	1.6	1.9
Inter-quartile range	°C	2.0	2.0	2.0	4.0	1.0	1.0	2.0	2.0	2.0	3.0	3.0	2.0	2.0	1.0	2.0
Coefficient of variation	°C	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2
Minimum	°C	4.0	3.0	4.0	3.0	3.0	0.0	2.0	0.0	0.0	2.0	2.0	0.0	4.0	4.0	4.0
Maximum	°C	19.0	16.0	16.0	18.0	16.0	18.0	19.0	17.0	18.0	18.0	18.0	18.0	15.0	17.0	18.0
Missing values	count	15224	18994	23048	30429	29271	20360	22170	21931	29422	29256	20428	18085	20781	24982	22190
Missing values as a %	%	43	54	66	87	84	58	63	63	84	83	58	52	59	71	63

Table 13: Annual summary statistics for flow cell water temperature

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	FNU	5.6	11.7	7.5	12.5	19.6	16.8	13.8	17.9	15.0	37.0	44.8	39.9	22.7	30.4	35.6
Median	FNU	2.0	5.0	3.0	6.0	14.0	4.0	6.0	9.0	8.0	28.0	5.0	4.0	5.0	3.0	6.0
Standard deviation	FNU	12.3	23.4	19.5	24.2	18.5	66.9	27.3	36.7	24.7	30.5	184.0	193.3	82.7	133.3	119.1
Inter-quartile range	FNU	5.0	8.0	4.0	11.0	11.0	8.0	14.0	12.0	12.0	31.0	18.0	9.0	8.0	8.0	21.0
Coefficient of variation	FNU	2.2	2.0	2.6	1.9	0.9	4.0	2.0	2.1	1.6	0.8	4.1	4.8	3.6	4.4	3.3
Minimum	FNU	0.0	1.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	FNU	970.0	505.0	894.0	804.0	380.0	1443.0	551.0	822.0	455.0	458.0	4931.0	4375.0	1953.0	3504.0	3088.0
Missing values	count	15224	18994	23048	30429	29271	20360	22170	21931	29423	29256	20479	18086	20781	24988	23503
Missing values as a %	%	43	54	66	87	84	58	63	63	84	83	58	52	59	71	67

Table 14: Annual summary statistics for turbidity

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Median	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Standard deviation	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.1	NA	NA	NA
Inter-quartile range	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Coefficient of variation	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.5	NA	NA	NA
Minimum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Maximum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	1.0	NA	NA	NA
Missing values	count	35039	26378	35039	35039	35039	35039	30484	35039	35039	35039	35039	25115	35039	35039	35039
Missing values as a %	%	100	75	100	100	100	100	87	100	100	100	100	72	100	100	100

Table 15: Annual summary statistics for total phosphorus

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	ug/l QSU	118.0	170.5	123.1	66.9	224.0	133.0	169.1	122.3	128.8	203.7	146.1	192.7	170.9	135.6	92.0
Median	ug/l QSU	107.0	166.0	118.0	58.0	223.0	120.0	163.0	114.0	134.0	186.0	157.0	204.0	142.0	139.0	99.0
Standard deviation	ug/l QSU	68.9	80.1	65.5	29.9	47.3	67.6	80.8	54.3	30.6	67.6	65.6	68.7	76.6	38.0	45.7
Inter-quartile range	ug/l QSU	99.0	119.0	106.0	54.0	40.0	86.0	108.0	91.0	41.0	87.0	95.0	86.0	137.0	50.0	68.0
Coefficient of variation	ug/l QSU	0.6	0.5	0.5	0.4	0.2	0.5	0.5	0.4	0.2	0.3	0.4	0.4	0.4	0.3	0.5
Minimum	ug/l QSU	0.0	15.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0
Maximum	ug/l QSU	327.0	419.0	318.0	147.0	331.0	431.0	405.0	326.0	202.0	397.0	277.0	393.0	324.0	220.0	195.0
Missing values	count	15227	18995	23048	30432	29539	20360	22170	21942	29423	29256	20448	18102	20781	24982	22381
Missing values as a %	%	43	54	66	87	84	58	63	63	84	83	58	52	59	71	64

Table 16: Annual summary statistics for dissolved organic matter

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Median	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Standard deviation	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Inter-quartile range	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Coefficient of variation	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Maximum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA
Missing values	count	35039	26378	35039	35039	35039	35039	30484	35039	35039	35039	35039	25115	35039	35039	35039
Missing values as a %	%	100	75	100	100	100	100	87	100	100	100	100	72	100	100	100

Table 17: Annual summary statistics for ortho-phosphorus

4 APPENDIX

4.1 Hydrological areas - Catchments

	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
pre-13/08/2013	11.6	6.7	4.0	1.9	1.8	7.9	7.3	2.7	1.8	1.8	6.8	6.8	5.0	1.9	1.6
post-13/08/2013	8.1	6.7	4.0	1.9	1.8	7.9	7.3	2.7	1.8	1.8	6.8	6.8	5.0	1.9	1.6

Table 18: Catchment hydrological areas (ha) pre- and post- change to area of Catchment 4 on 13th August 2013

4.2 Hydrological areas - Farmlets

	Green	Blue	Red
pre-13/08/2013	25.9	21.6	22.2
post-13/08/2013	22.4	21.6	22.2

Table 19: Farmlet hydrological areas (ha) pre- and post- change to area of Catchment 4 on 13th August 2013