DATA QUALITY AND SUMMARY STATISTICS

FLUME DATA

Annual Report 2016

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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Compiled by: Jane Hawkins using R version 3.6.1 (2019-07-05)

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)	24534	24153	24093	24133	24042	24117	24094	24046	24119	24090	24069	24152	24470	24011	24129
PLC Switch = 0 (no flow)	5696	6089	7238	10010	9606	6872	7737	6320	9688	9368	7299	5176	4300	8326	7612
PLC Switch = 1 (flow)	4905	4893	3804	992	1487	4146	3304	4769	1328	1677	3767	5807	6365	2798	3394

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	7814	8752	9682	10471	10580	9345	9375	9912	10235	10236	8994	9006	7732	10439	10075
Nitrate+nitrite	mg/l	1636	672	1006	827	452	527	2147	526	47	1497	1940	665	982	77	918
Ammonia	mg/l	4902	3637	3802	838	1412	4027	3301	4768	1079	1677	3573	5805	6363	2797	3392
Ammonium	mg/l	4858	3625	3801	838	1367	4018	2879	4735	1079	1676	3489	5707	6344	2789	3344
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	0	0	0	0	0	0	0	0	0	0
Turbidity	FNU	298	0	212	0	0	30	21	0	0	0	30	50	1	0	26
Total phosphorus	mg/l	NA	3396	NA	NA	NA	NA	4070	NA	NA	NA	1213	NA	NA	NA	NA
Dissolved organic matter	ug/l QSU	5	0	0	0	0	0	0	3	0	0	0	6	0	0	0
Ortho-phosphorus	mg/l	NA	187	NA	NA	NA	NA	190	NA	NA	NA	205	NA	NA	NA	NA

Table 2: Number of zero values (out of 35135)

1.3 Missing values

1.3.1 Total number of missing values

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	24173	24205	24106	24265	24109	24286	24068	24100	24410	24210	24404	24176	24327	24082	24189
Nitrate+nitrite	30281	30293	31637	34174	33663	31033	31936	30416	33823	33550	31847	31952	31092	32368	31848
Ammonia	30233	31498	31333	34297	33723	31108	31834	30367	34056	33458	31562	29330	28772	32338	31743
Ammonium	30233	31492	31333	34297	33723	31109	31834	30368	34056	33458	31562	29330	28773	32338	31743
Conductivity	30233	30244	31333	34146	33648	31108	31834	30367	33821	33458	31562	29330	28772	32338	31743
Dissolved oxygen	30233	30244	31627	34146	33648	31108	31834	30367	33821	33597	31562	29330	28772	32338	31743
pH	30233	31499	31333	34146	33648	31108	31834	30367	33821	33458	31562	29330	28772	32338	31743
Flow cell water temperature	30233	30244	31333	34146	33648	31108	31834	30367	33821	33458	31562	29330	28772	32338	31743
Turbidity	30275	30244	31337	34149	33648	31113	31875	30446	33923	33458	31562	29342	28777	32345	31744
Total phosphorus	35135	31739	35135	35135	35135	35135	31061	35135	35135	35135	33922	35135	35135	35135	35135
Dissolved organic matter	34211	34473	34841	34984	34887	34860	34533	33887	34900	34960	34440	33626	32745	34954	34816
Ortho-phosphorus	35135	34948	35135	35135	35135	35135	34945	35135	35135	35135	34930	35135	35135	35135	35135

Table 3: Total number of missing values (out of 35135)

1.3.2 Total number of missing values as a percentage

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69
PLC Switch	70	69	69	69	68	69	69	68	69	69	69	69	70	68	69
Nitrate+nitrite	86	86	90	97	96	88	91	87	96	95	91	91	88	92	91
Ammonia	86	90	89	98	96	89	91	86	97	95	90	83	82	92	90
Ammonium	86	90	89	98	96	89	91	86	97	95	90	83	82	92	90
Conductivity	86	86	89	97	96	89	91	86	96	95	90	83	82	92	90
Dissolved oxygen	86	86	90	97	96	89	91	86	96	96	90	83	82	92	90
pH	86	90	89	97	96	89	91	86	96	95	90	83	82	92	90
Flow cell water temperature	86	86	89	97	96	89	91	86	96	95	90	83	82	92	90
Turbidity	86	86	89	97	96	89	91	87	97	95	90	84	82	92	90
Total phosphorus	100	90	100	100	100	100	88	100	100	100	97	100	100	100	100
Dissolved organic matter	97	98	99	100	99	99	98	96	99	100	98	96	93	99	99
Ortho-phosphorus	100	99	100	100	100	100	99	100	100	100	99	100	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	2	2	2	1	0	118	1	1	14	0	193	3	200	1	1
Nitrate+nitrite	51	51	306	31	15	44	105	50	16	92	479	2624	2322	31	107
Ammonia	3	1256	2	154	75	119	3	1	249	0	194	2	2	1	2
Ammonium	3	1250	2	154	75	120	3	2	249	0	194	2	3	1	2
Conductivity	3	2	2	3	0	119	3	1	14	0	194	2	2	1	2
Dissolved oxygen	3	2	296	3	0	119	3	1	14	139	194	2	2	1	2
pH	3	1257	2	3	0	119	3	1	14	0	194	2	2	1	2
Flow cell water temperature	3	2	2	3	0	119	3	1	14	0	194	2	2	1	2
Turbidity	45	2	6	6	0	124	44	80	116	0	194	14	7	8	3
Dissolved organic matter	3981	4231	3510	841	1239	3871	2702	3521	1093	1502	3072	4298	3975	2617	3075
Ortho-phosphorus	4905	4799	3804	992	1487	4146	3299	4769	1328	1677	3606	5807	6365	2798	3394

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	223	223	290	1096	741	262	335	231	808	651	285	189	170	395	323
Nitrate+nitrite	99	99	92	97	99	99	97	99	99	95	87	55	64	99	97
Ammonia	100	74	100	84	95	97	100	100	81	100	95	100	100	100	100
Ammonium	100	74	100	84	95	97	100	100	81	100	95	100	100	100	100
Conductivity	100	100	100	100	100	97	100	100	99	100	95	100	100	100	100
Dissolved oxygen	100	100	92	100	100	97	100	100	99	92	95	100	100	100	100
pH	100	74	100	100	100	97	100	100	99	100	95	100	100	100	100
Flow cell water temperature	100	100	100	100	100	97	100	100	99	100	95	100	100	100	100
Turbidity	99	100	100	99	100	97	99	98	91	100	95	100	100	100	100
Dissolved organic matter	19	14	8	15	17	7	18	26	18	10	18	26	38	6	9
Ortho-phosphorus	0	4	0	0	0	0	6	0	0	0	5	0	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.

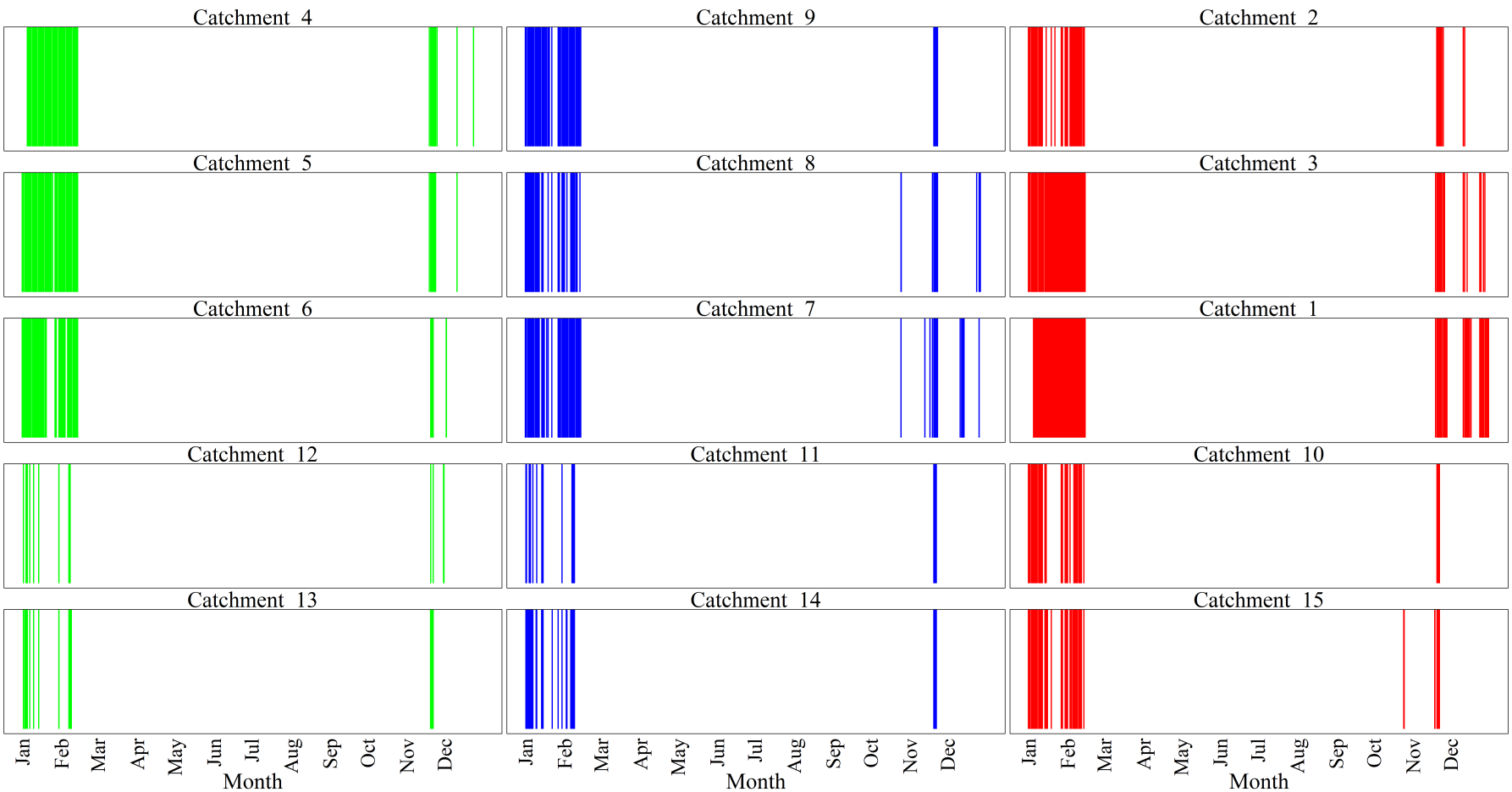


Figure 1: Timesteps of missing nitrate+nitrite data

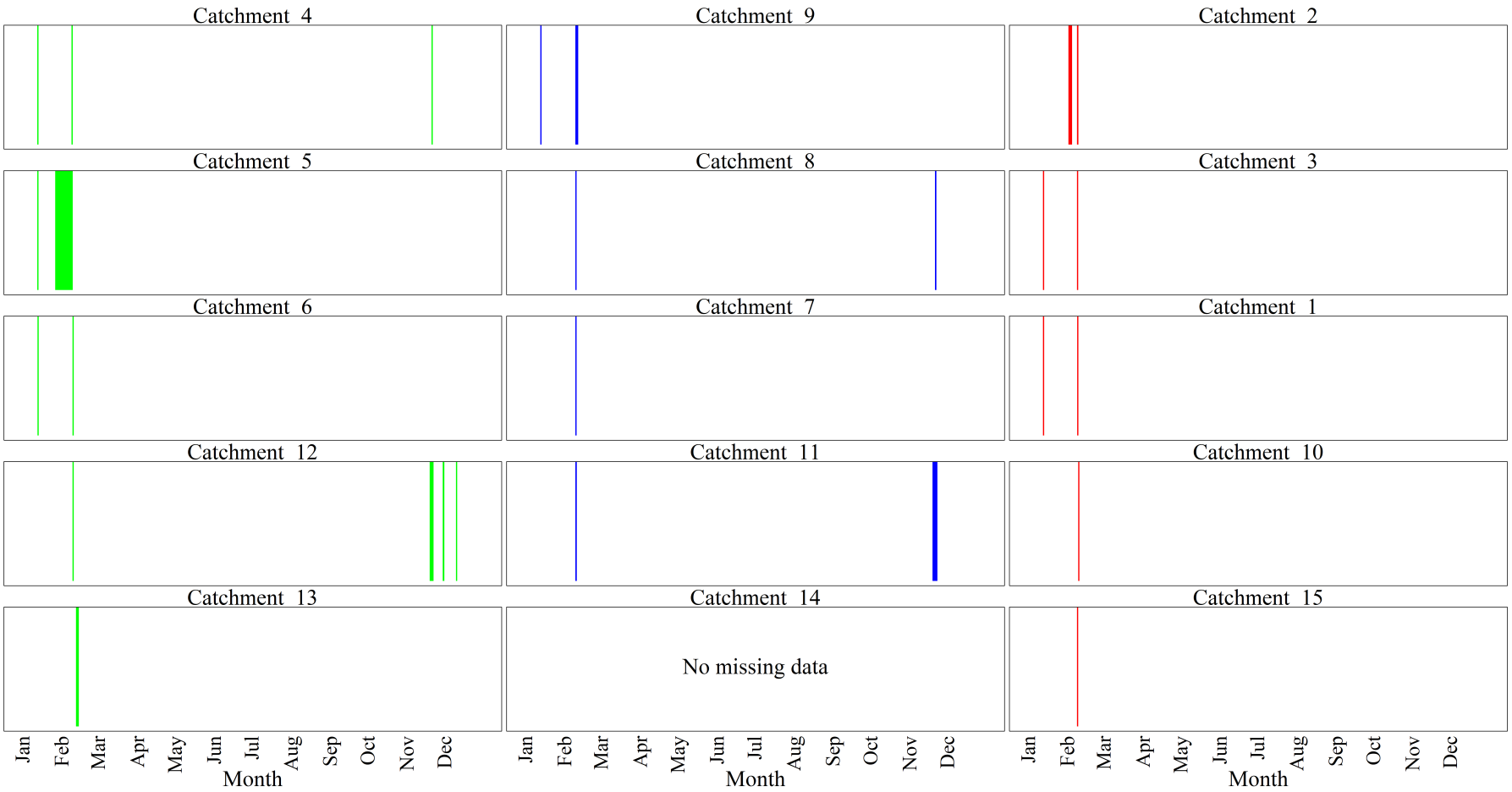


Figure 2: Timesteps of missing ammonia data

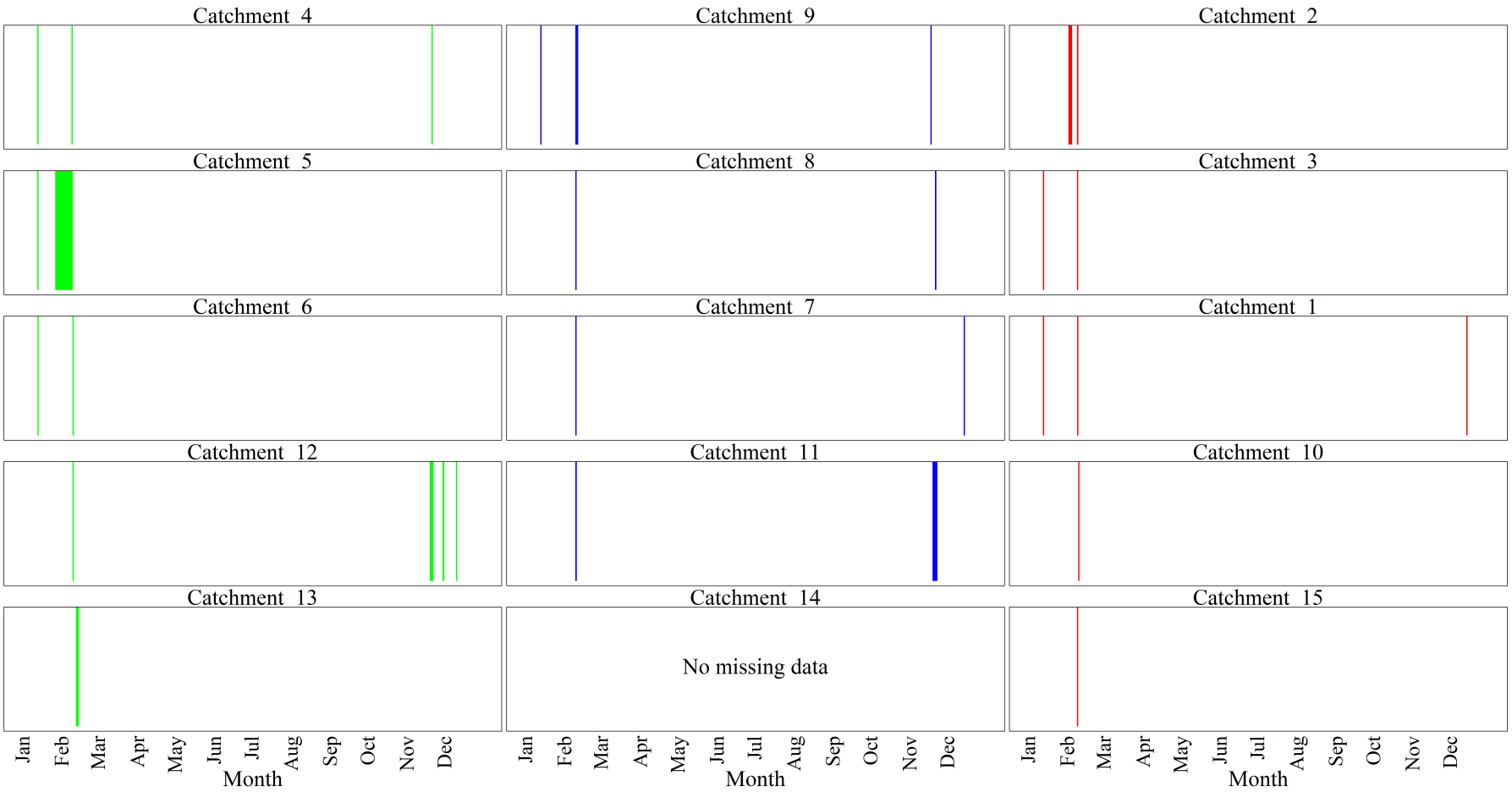


Figure 3: Timesteps of missing ammonium data

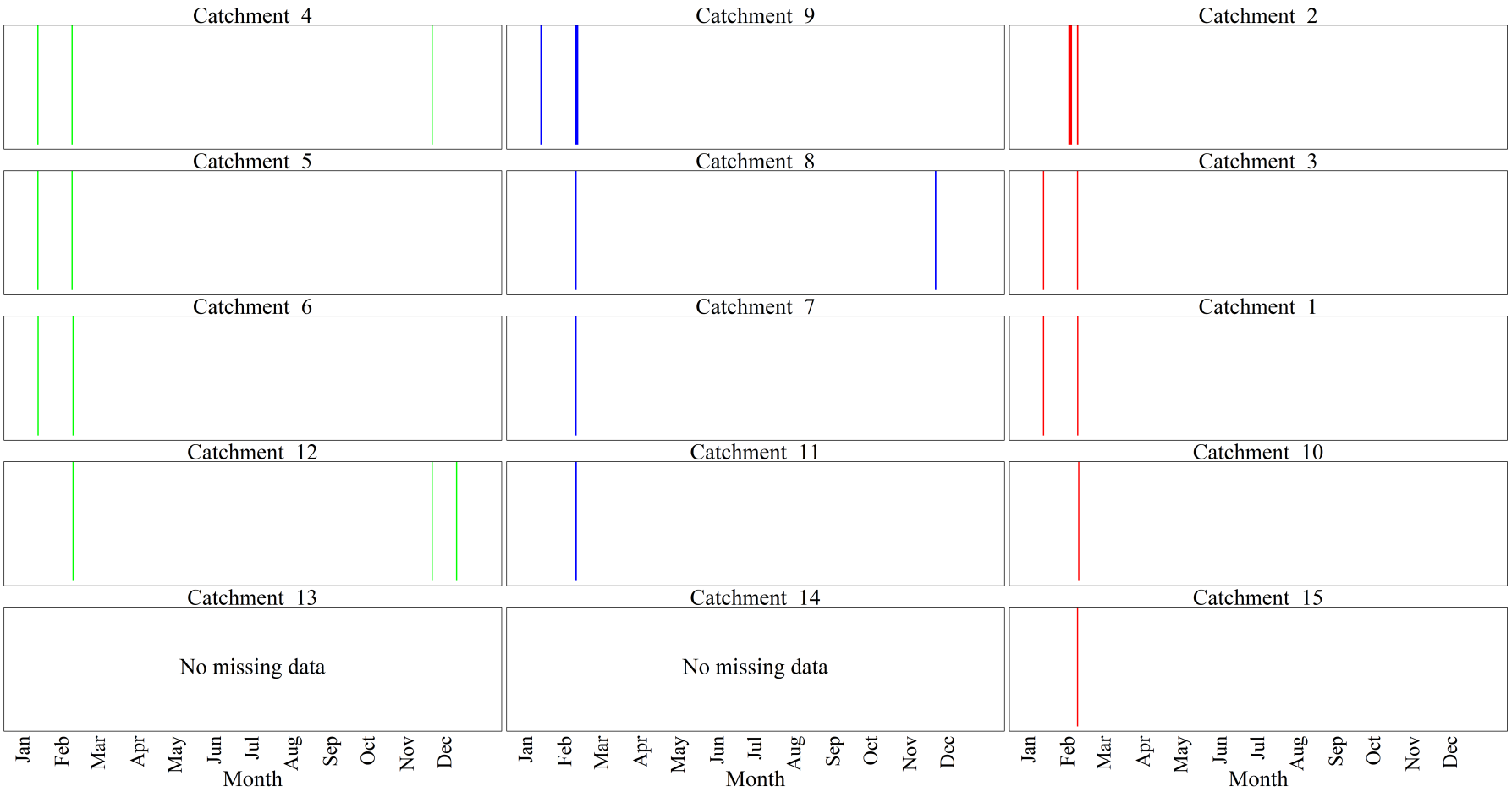


Figure 4: Timesteps of missing conductivity data

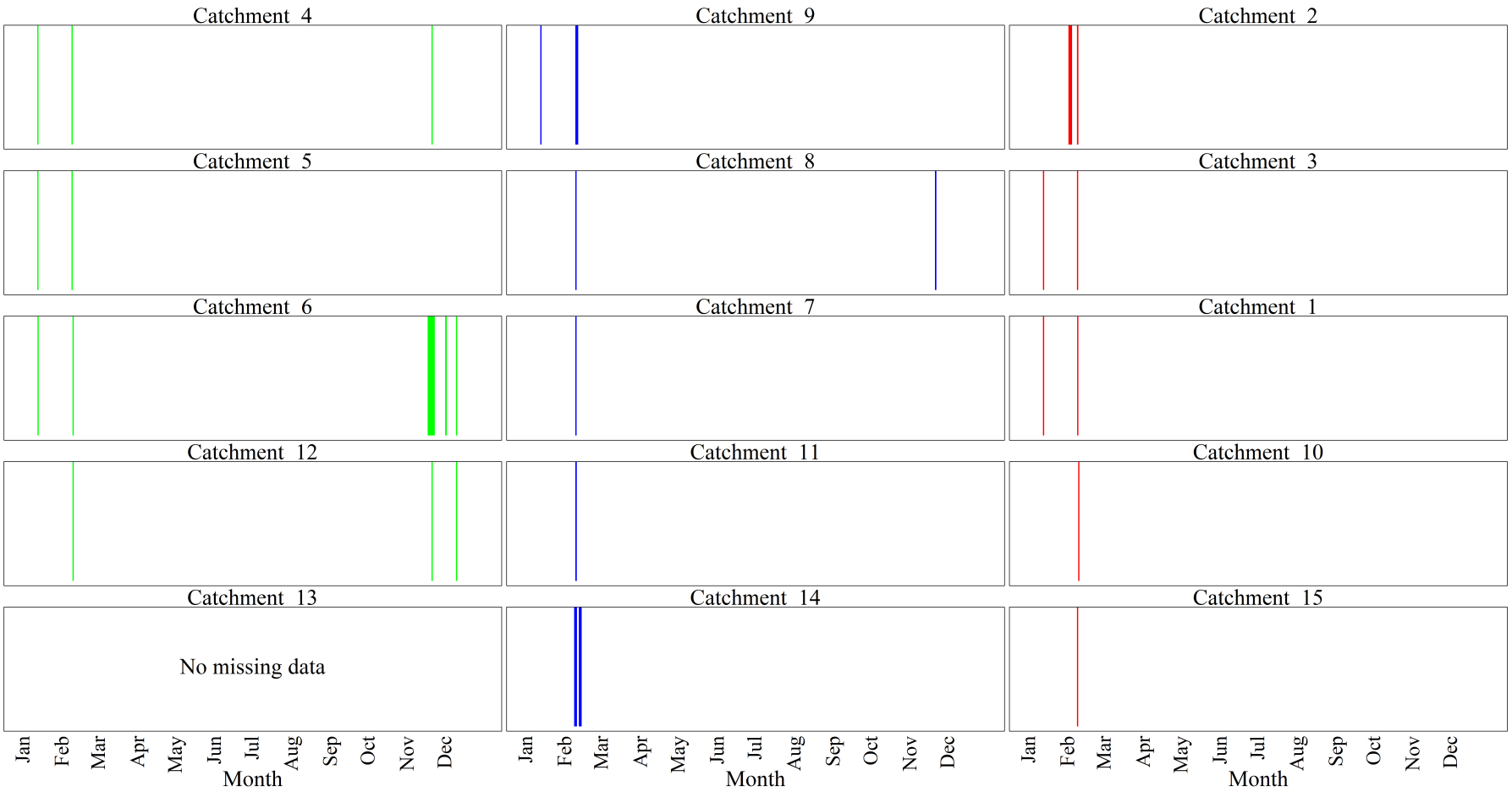


Figure 5: Timesteps of missing dissolved oxygen data

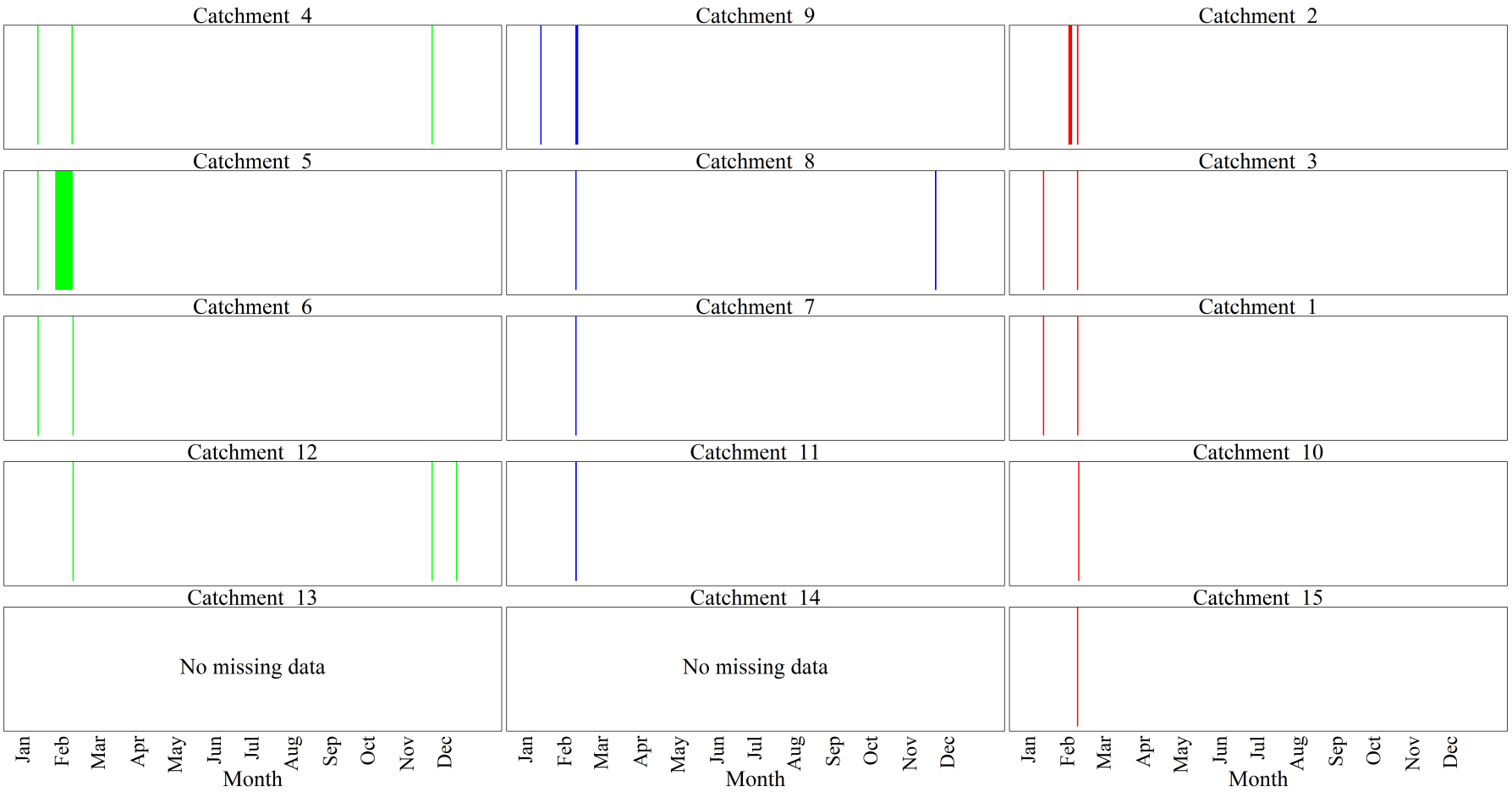


Figure 6: Timesteps of missing pH data

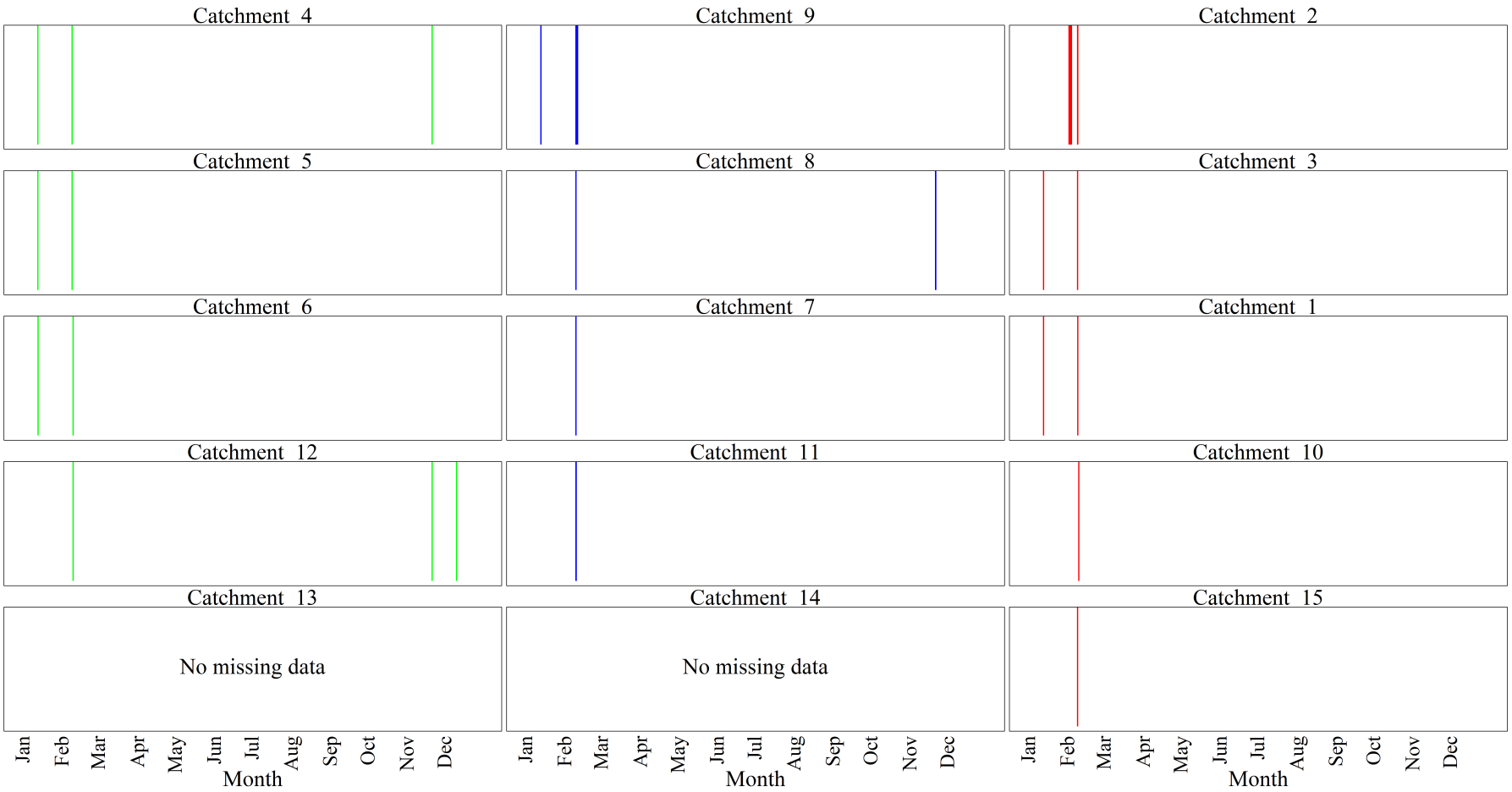


Figure 7: Timesteps of missing flow cell water temperature data

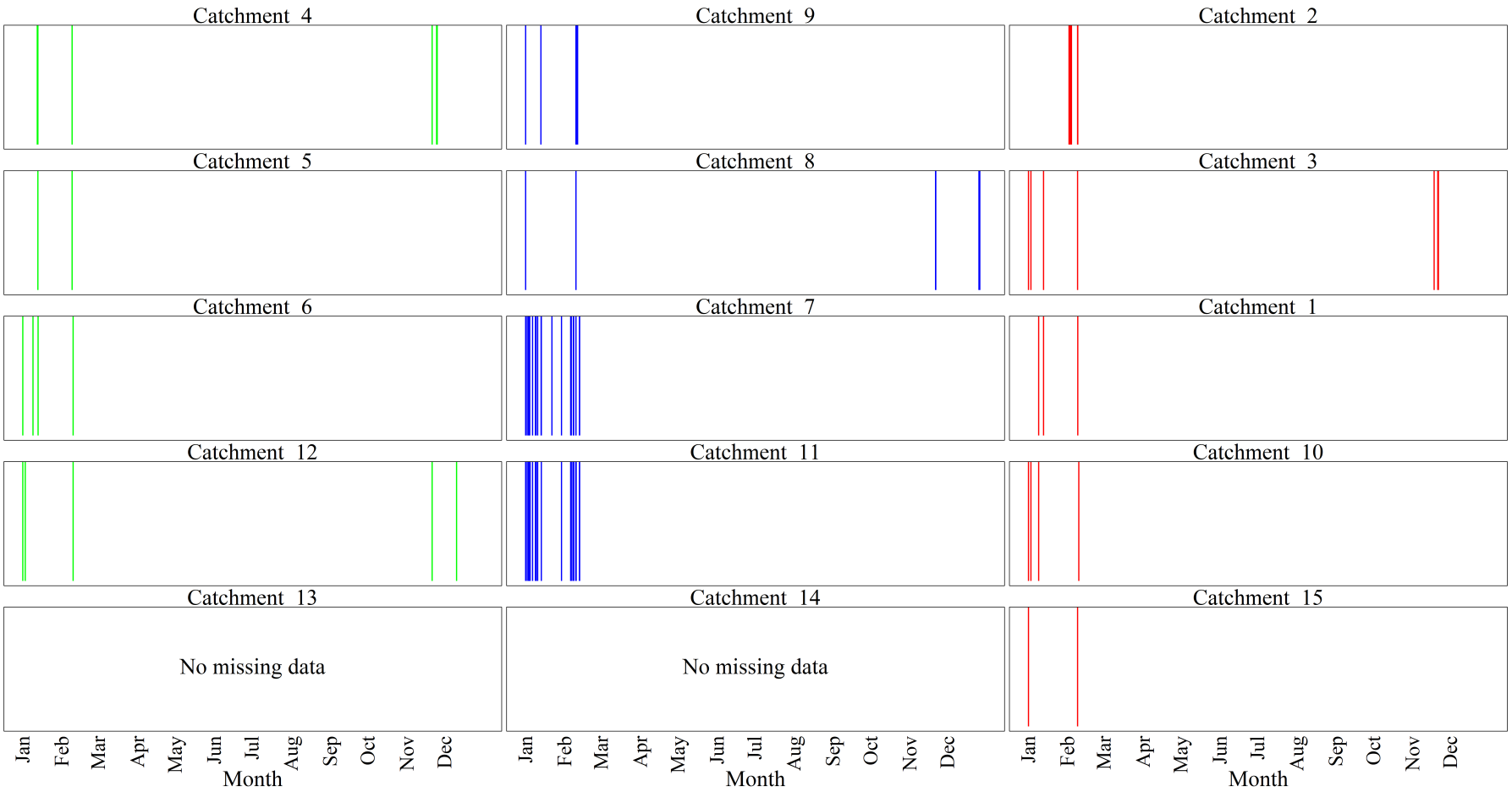


Figure 8: Timesteps of missing turbidity data

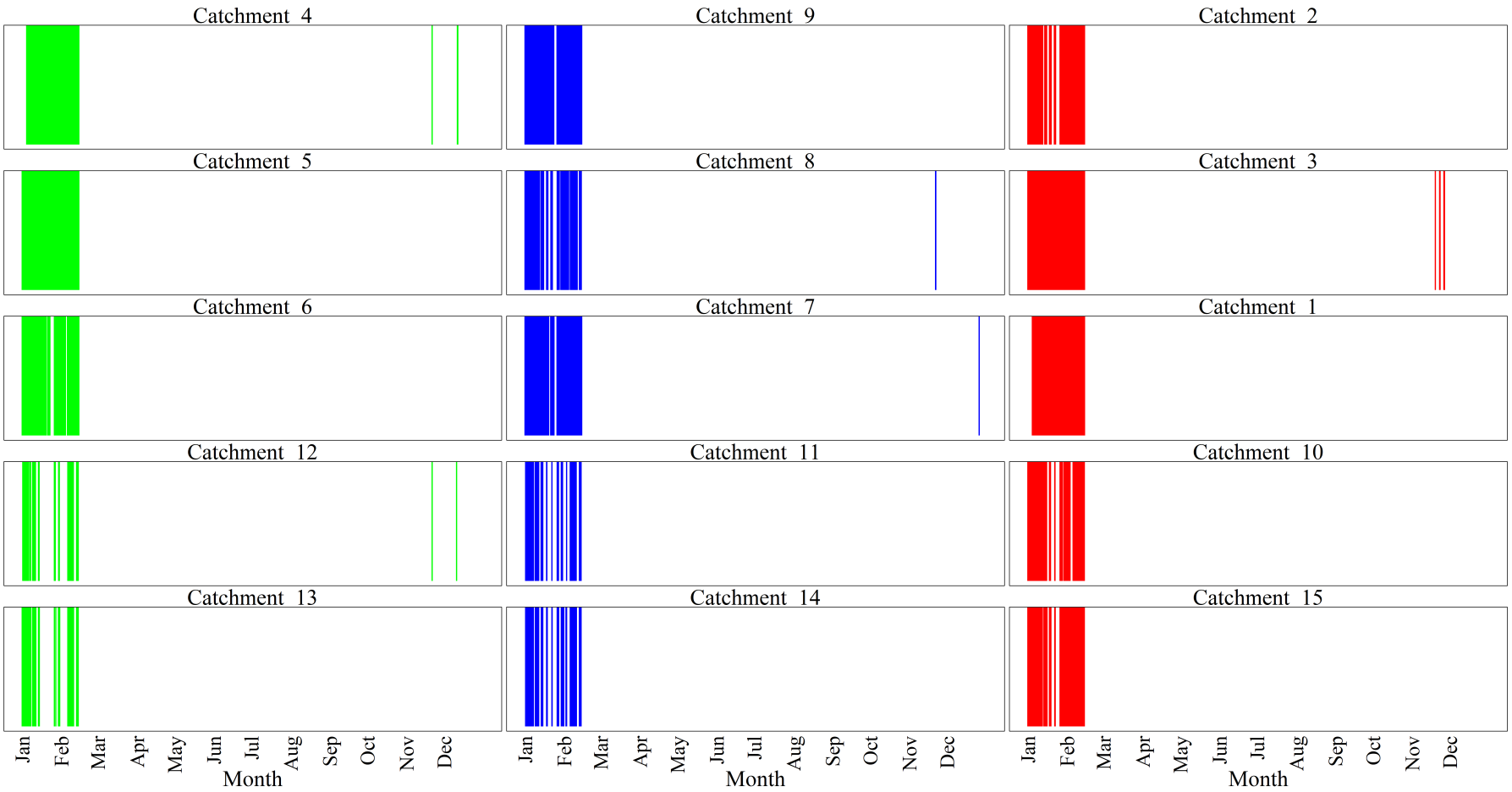


Figure 9: Timesteps of missing dissolved organic matter data

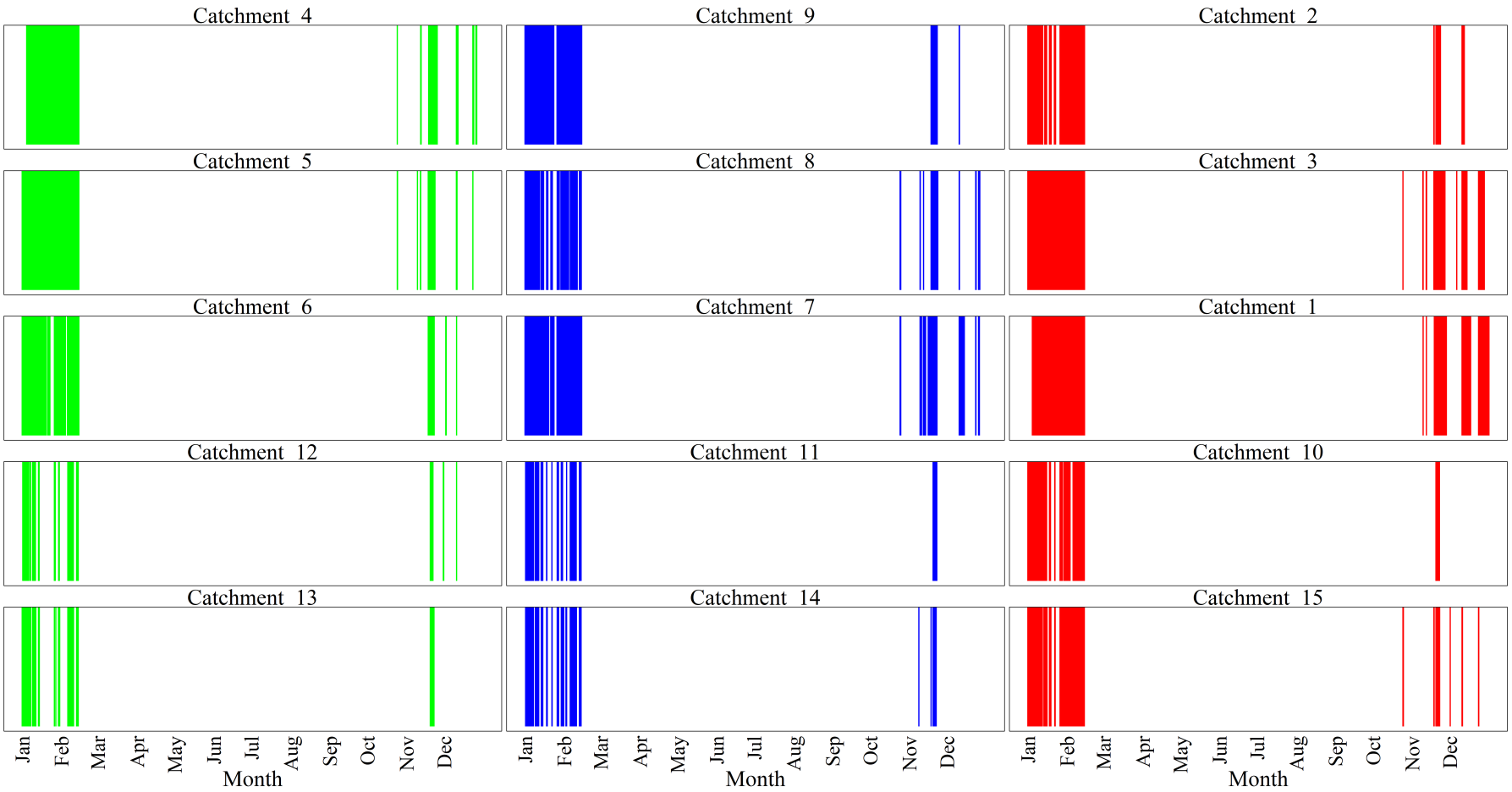


Figure 10: Timesteps of missing ortho-phosphorus data

1.4 Histograms of 15 minute data distribution

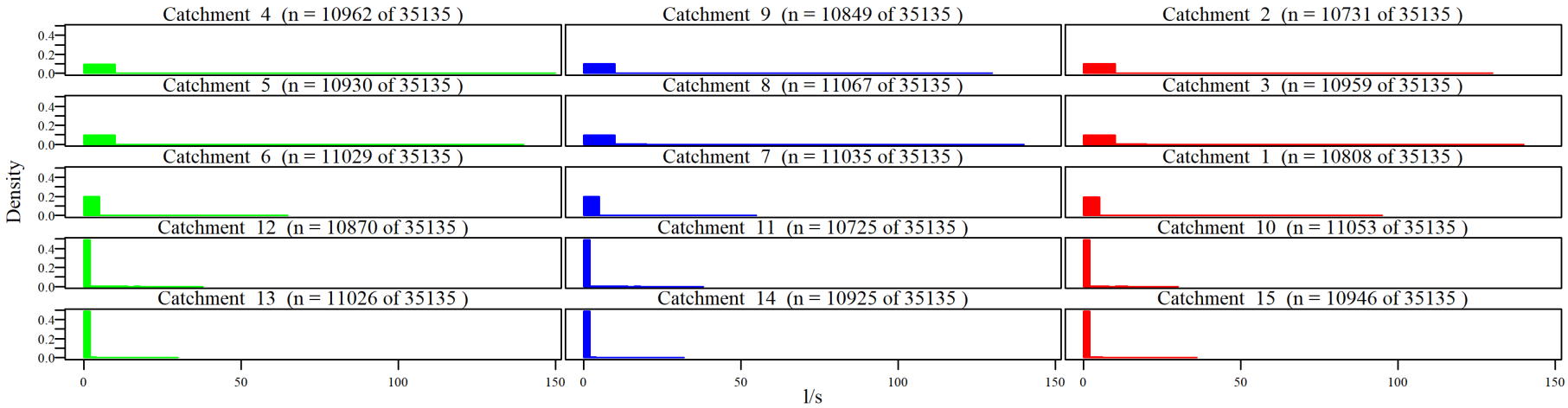


Figure 11: Distribution of data - flow

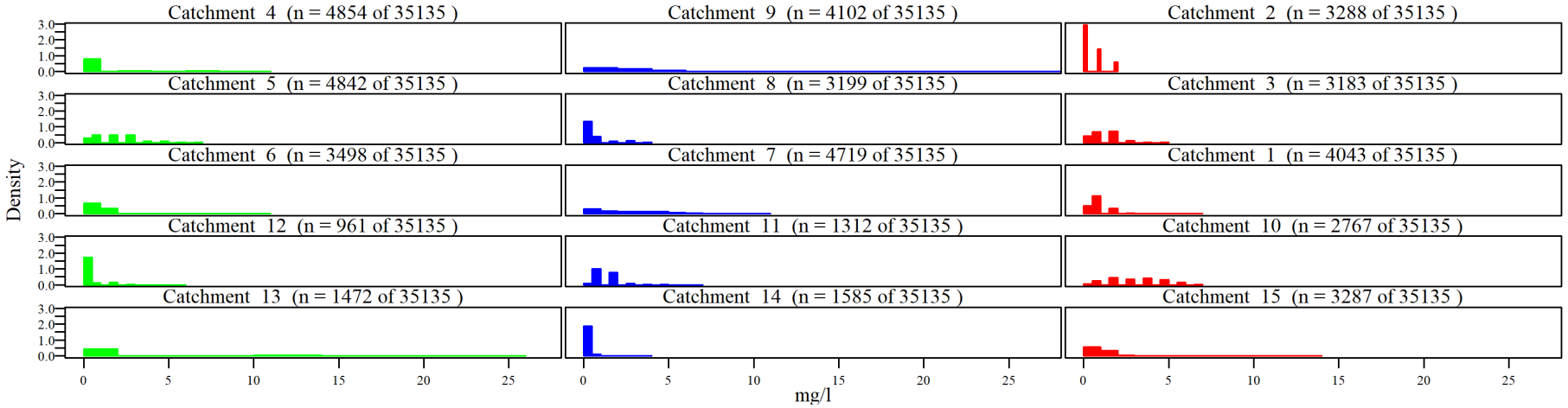


Figure 12: Distribution of data - nitrate+nitrite

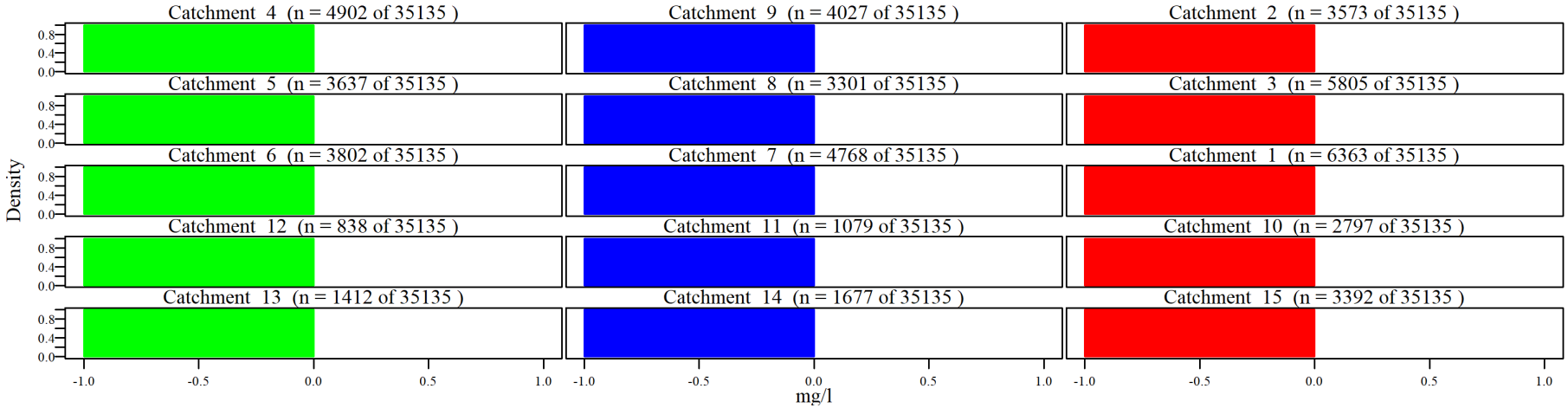


Figure 13: Distribution of data - ammonia

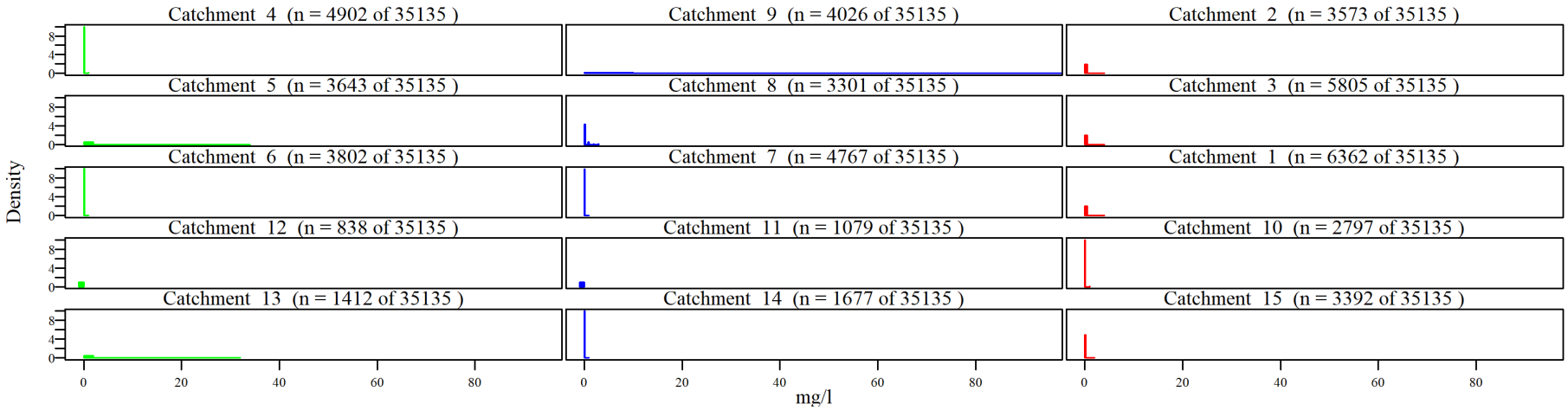


Figure 14: Distribution of data - ammonium

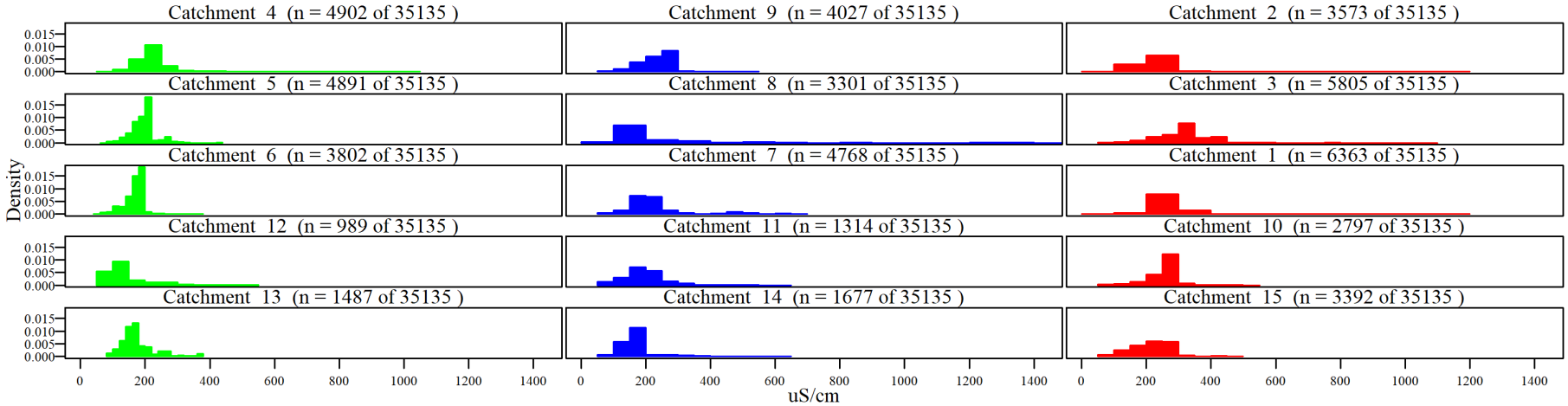


Figure 15: Distribution of data - conductivity

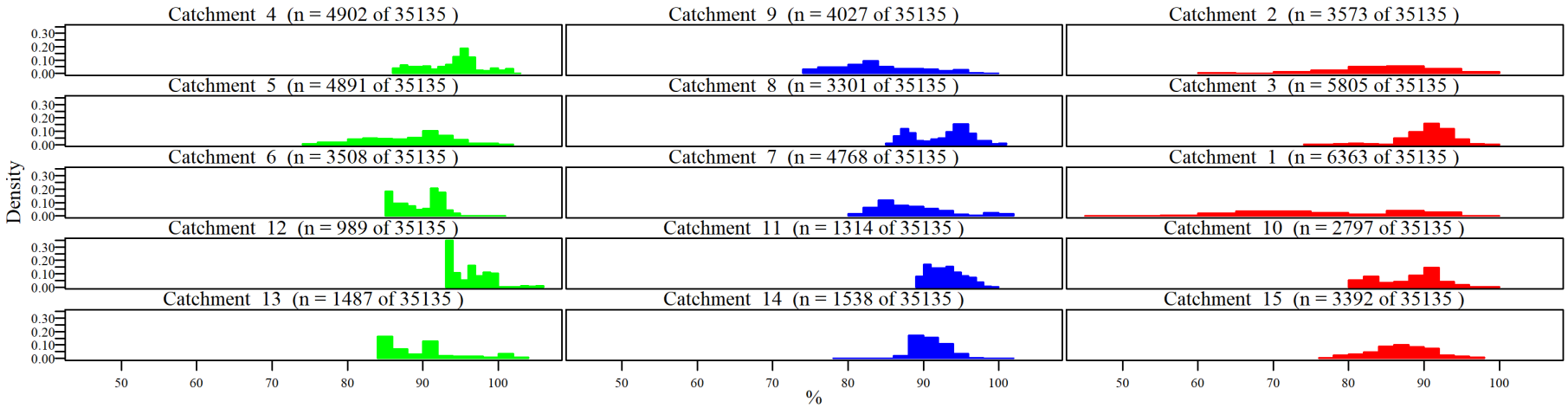


Figure 16: Distribution of data - dissolved oxygen

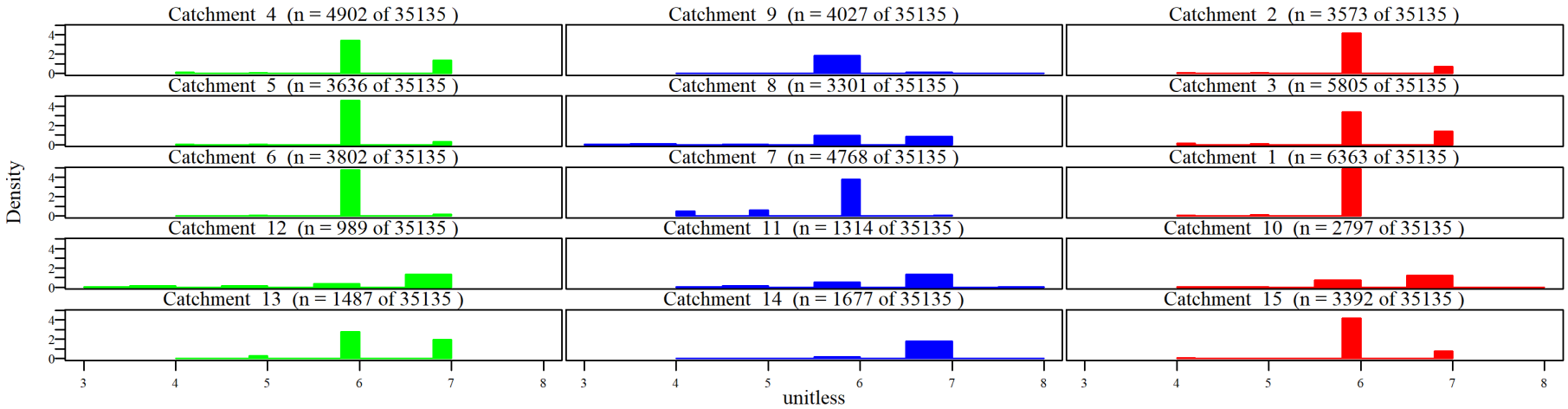


Figure 17: Distribution of data - pH

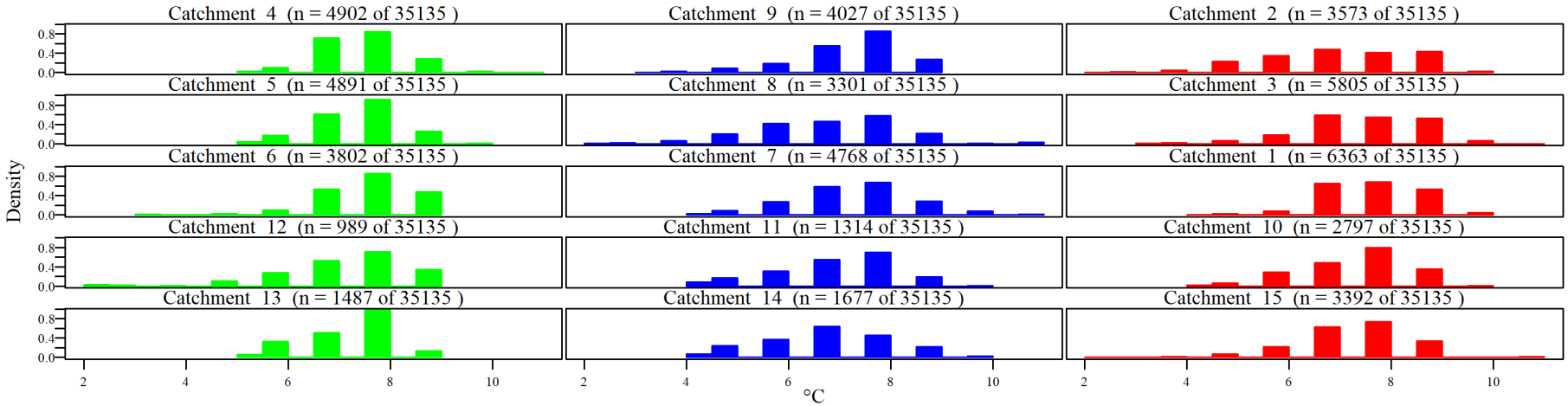


Figure 18: Distribution of data - flow cell water temperature

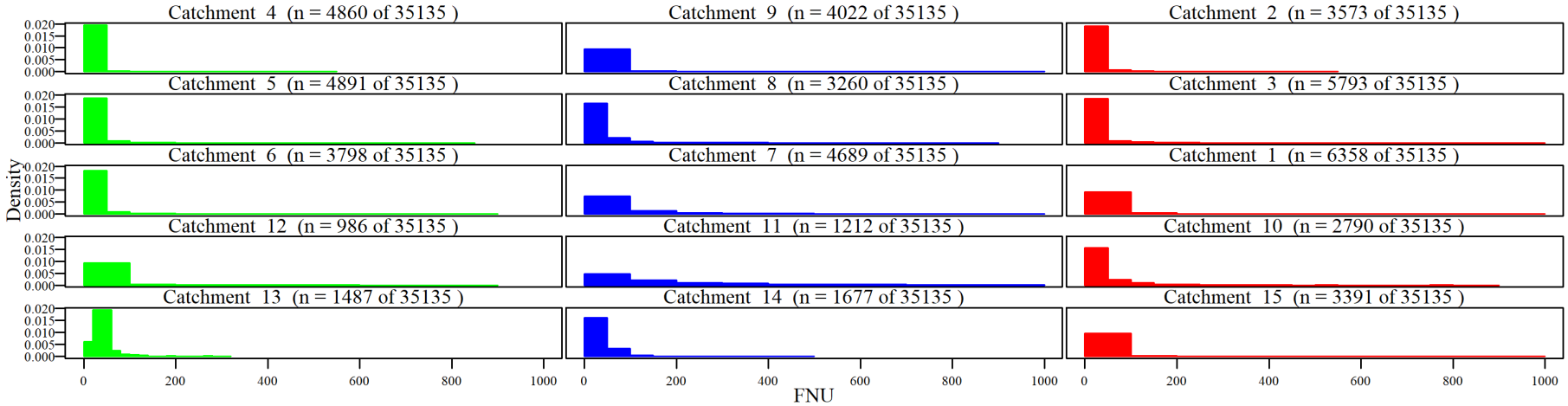


Figure 19: Distribution of data - turbidity

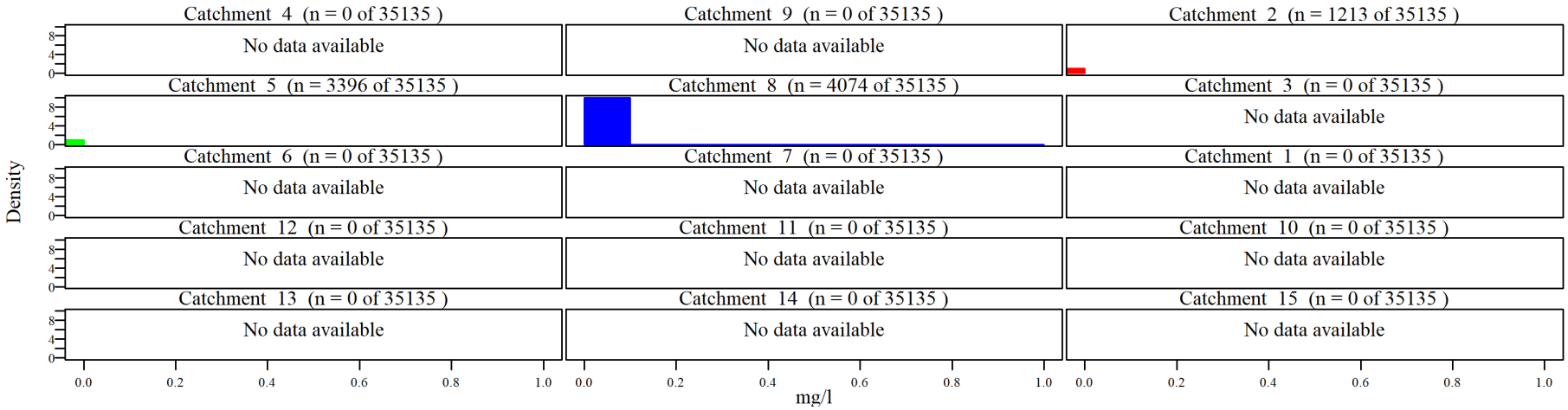


Figure 20: Distribution of data - total phosphorus

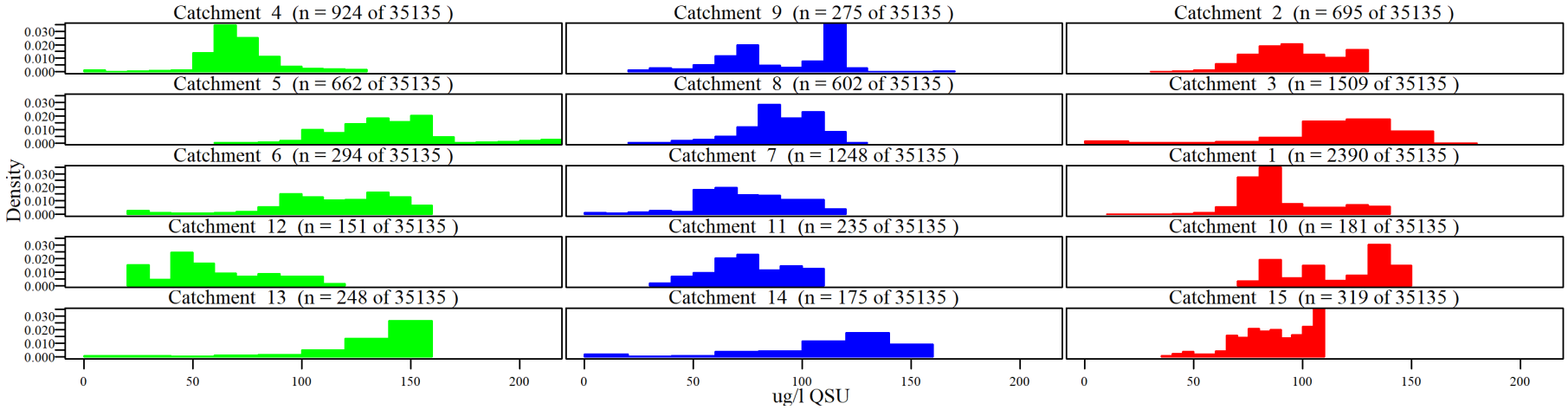


Figure 21: Distribution of data - dissolved organic matter

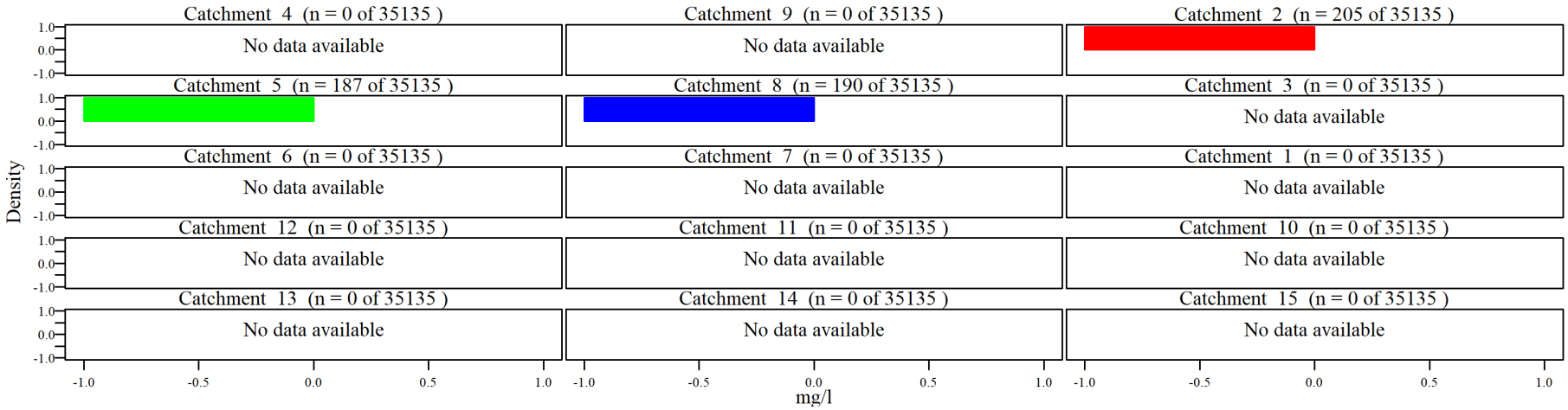


Figure 22: Distribution of data - ortho-phosphorus

1.5 Time series

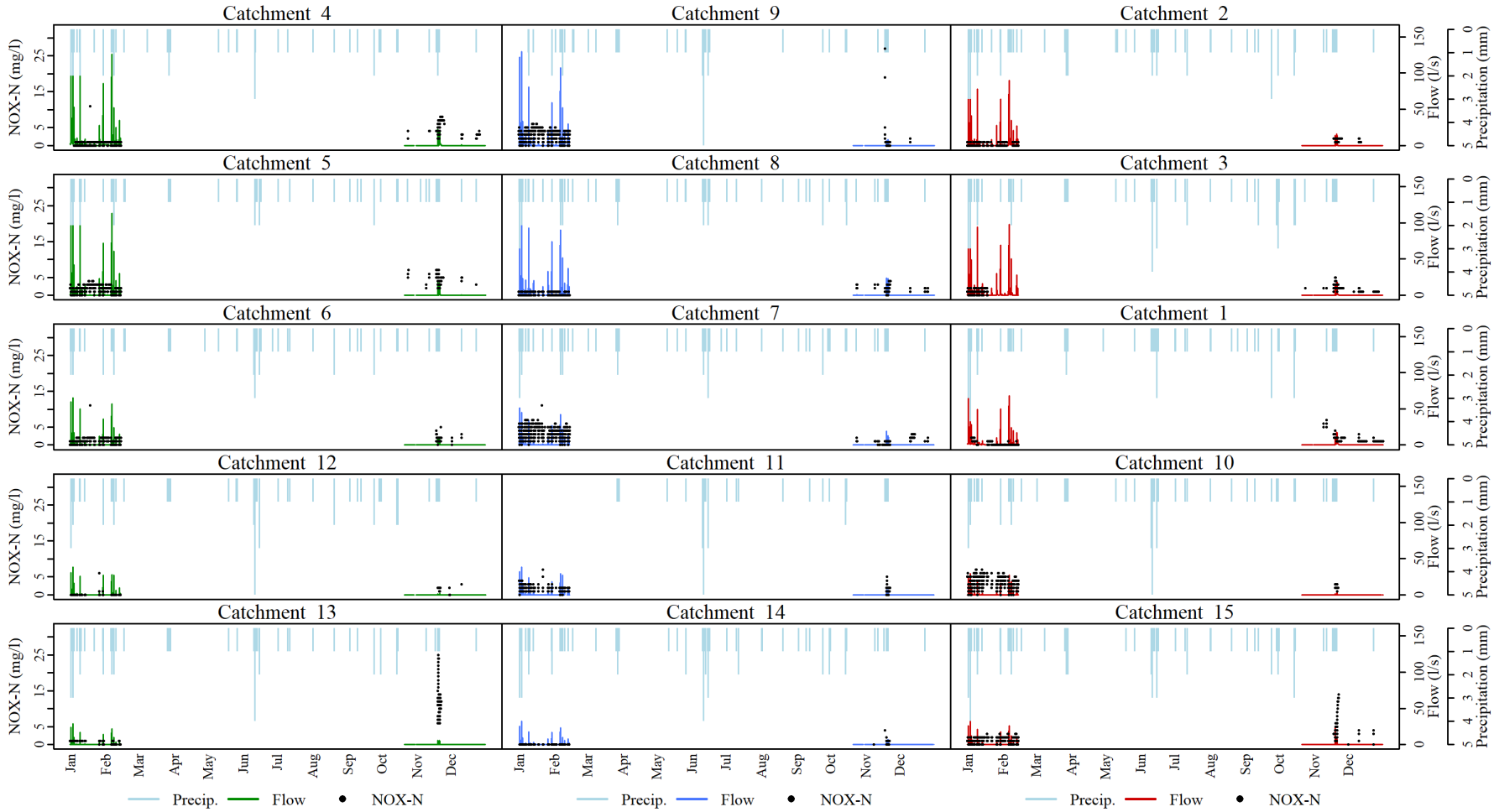


Figure 23: Time series of precipitation, flow and nitrate+nitrite (NOX-N)

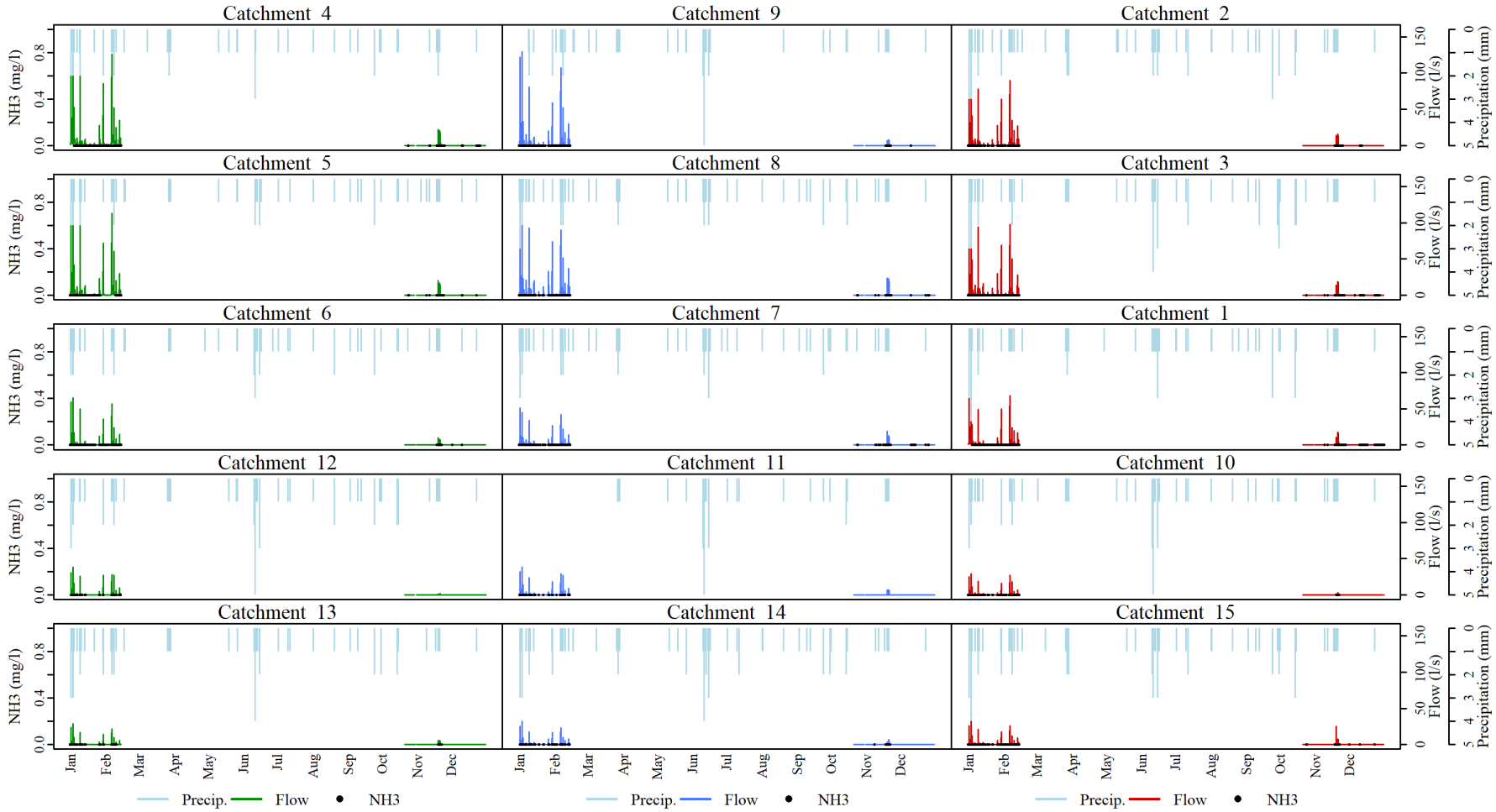


Figure 24: Time series of precipitation, flow and ammonia (NH3)

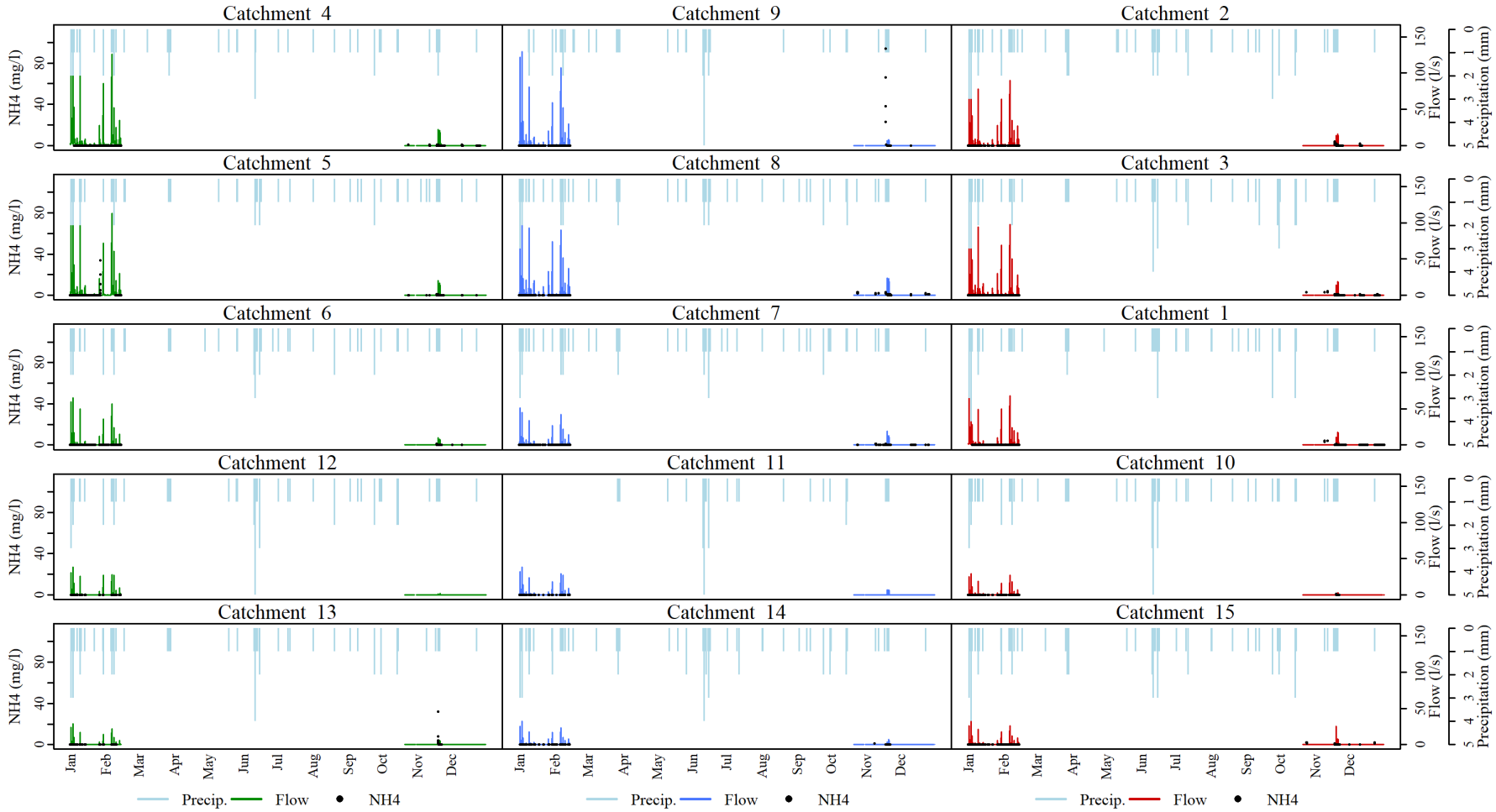


Figure 25: Time series of precipitation, flow and ammonium (NH4)

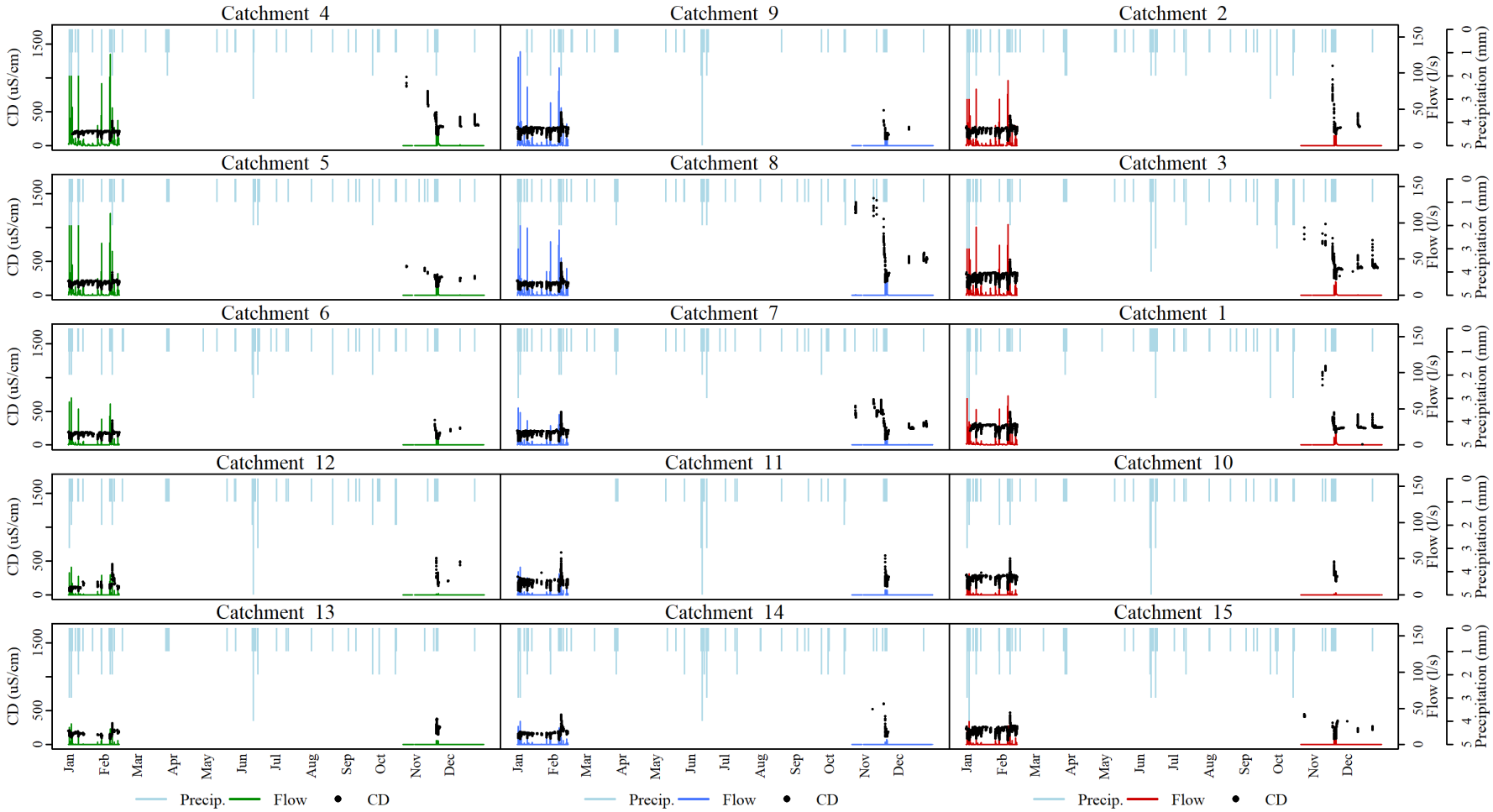


Figure 26: Time series of precipitation, flow and conductivity (CD)

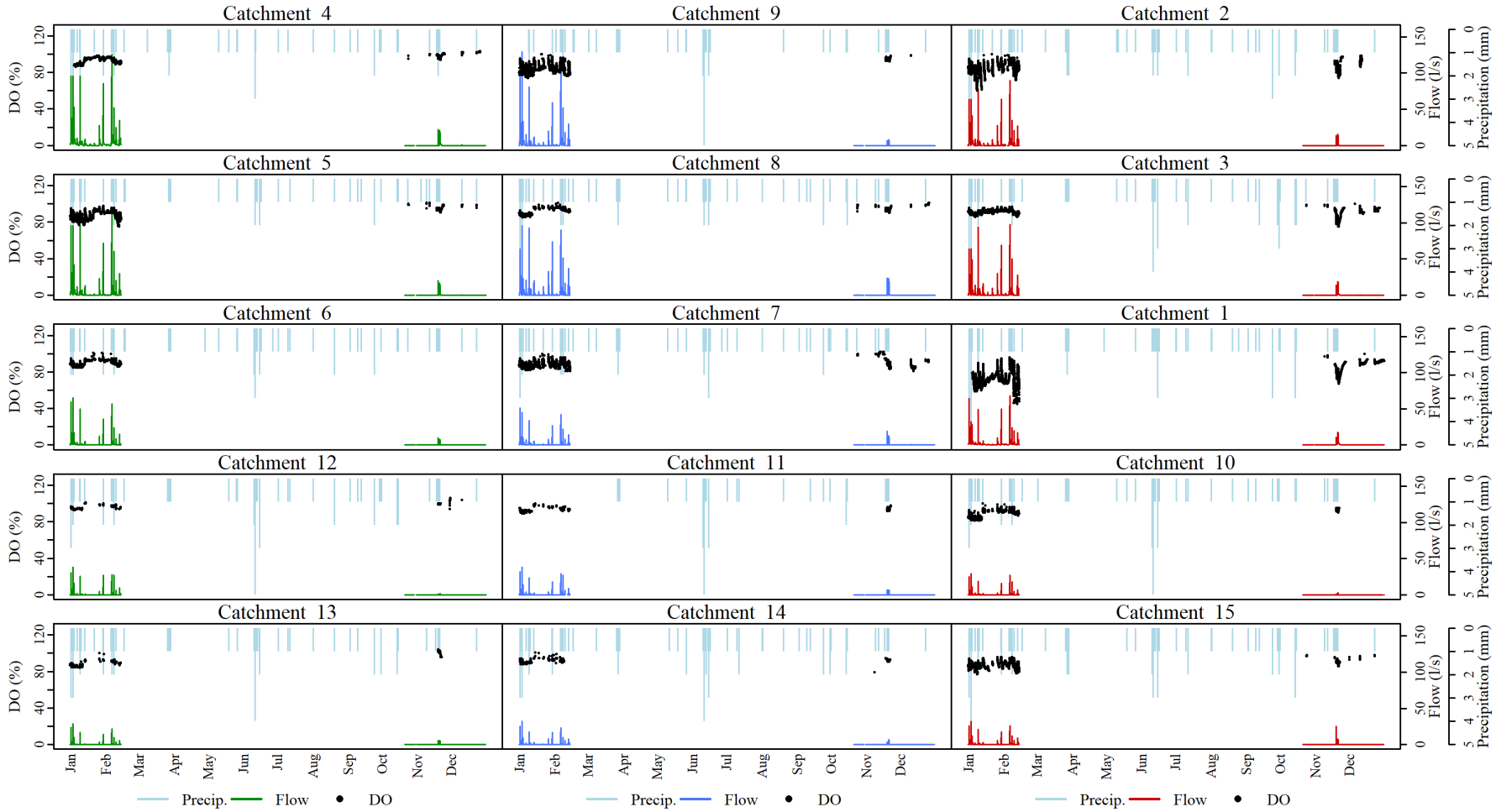


Figure 27: Time series of precipitation, flow and dissolved oxygen (DO)

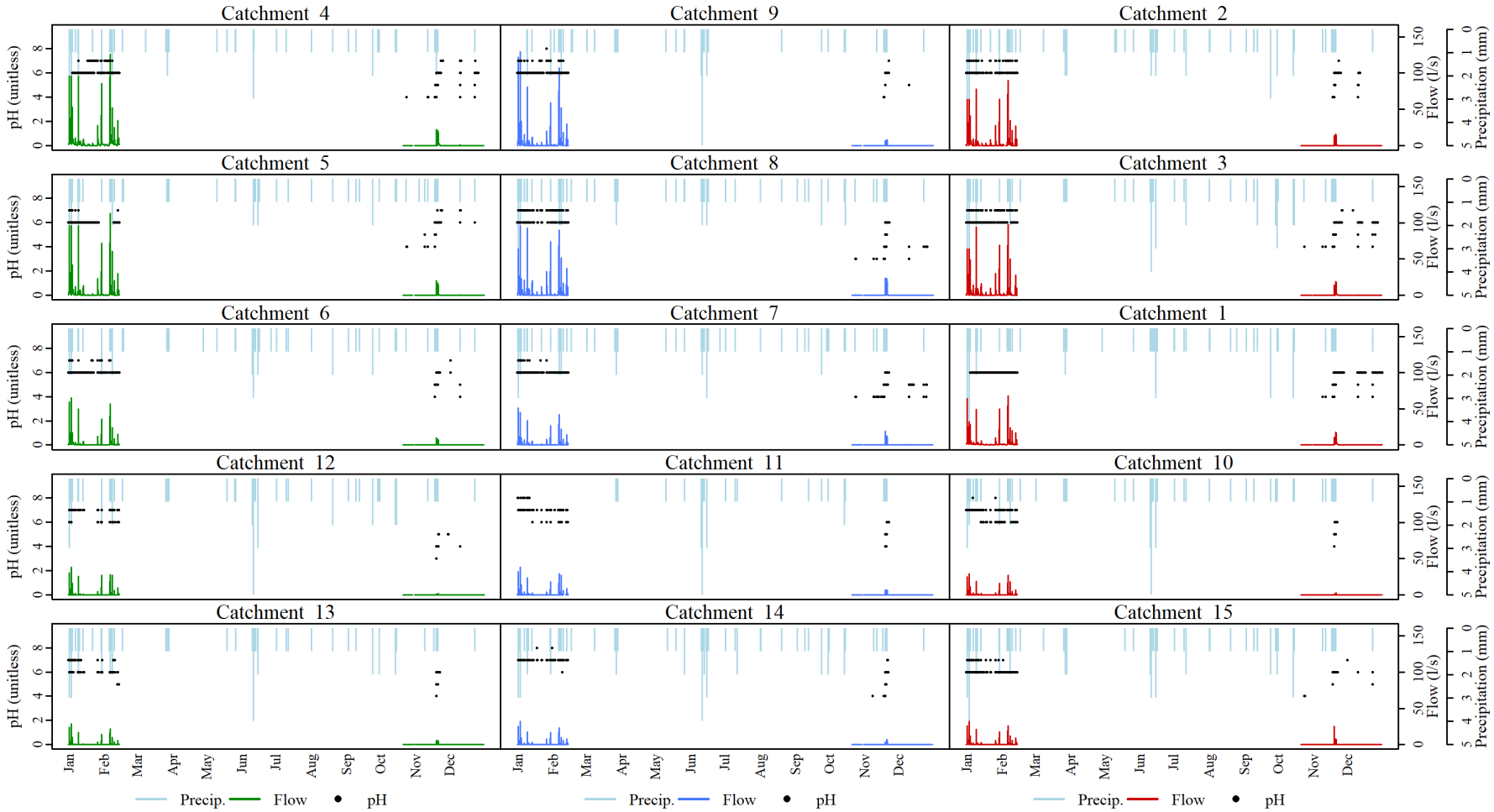


Figure 28: Time series of precipitation, flow and pH (pH)

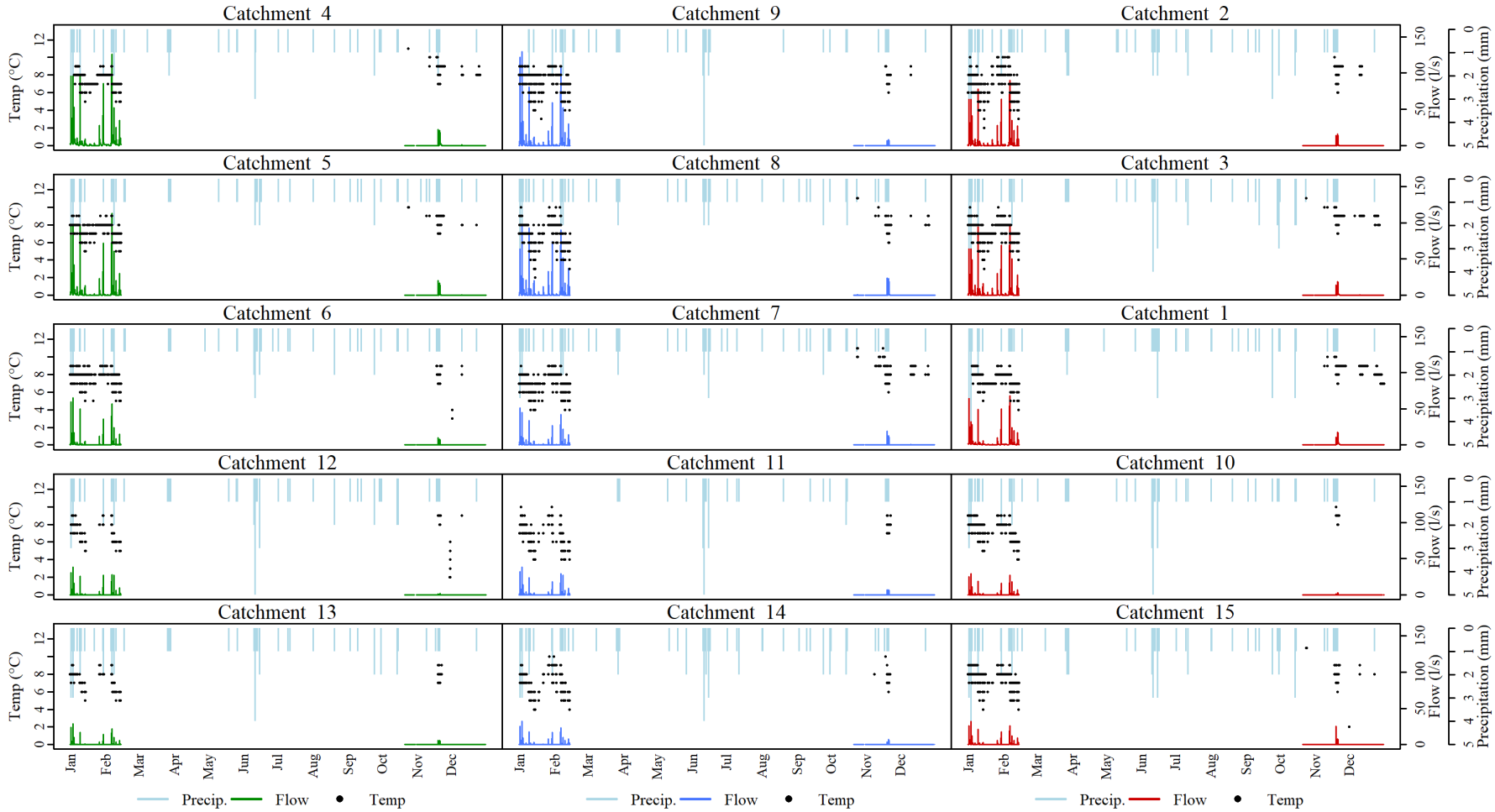


Figure 29: Time series of precipitation, flow and flow cell water temperature (Temp)

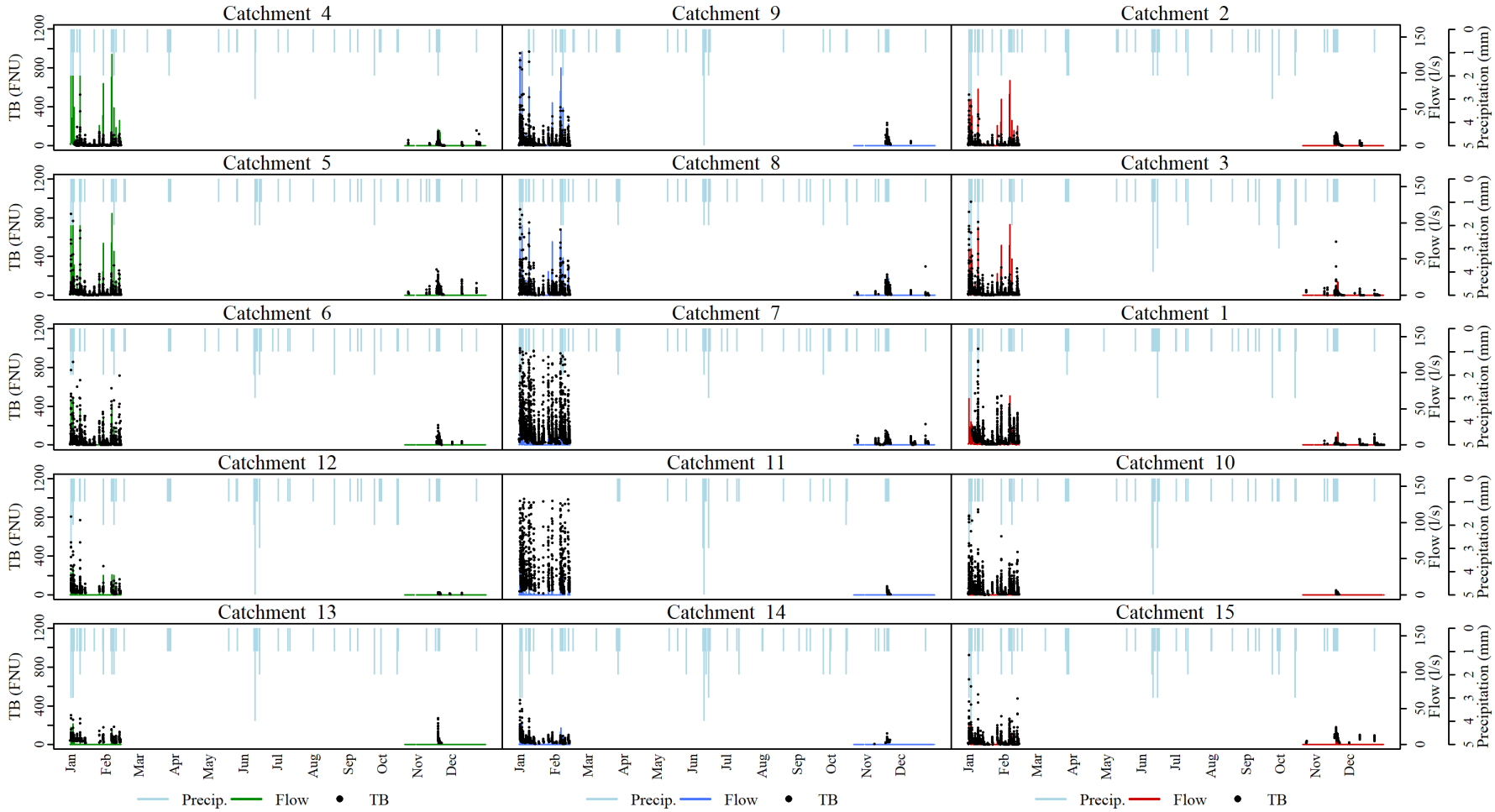


Figure 30: Time series of precipitation, flow and turbidity (TB)

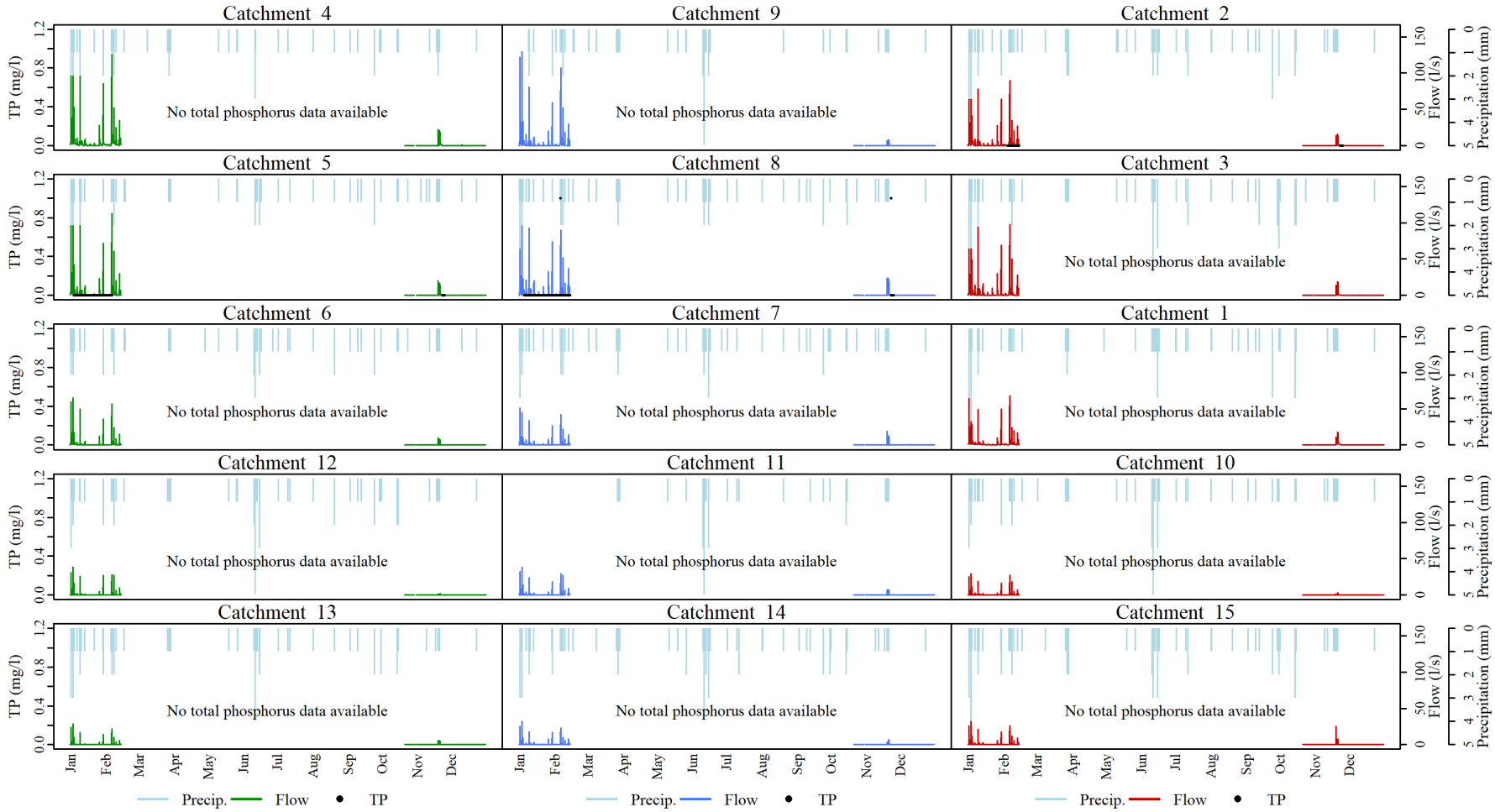


Figure 31: Time series of precipitation, flow and total phosphorus (TP)

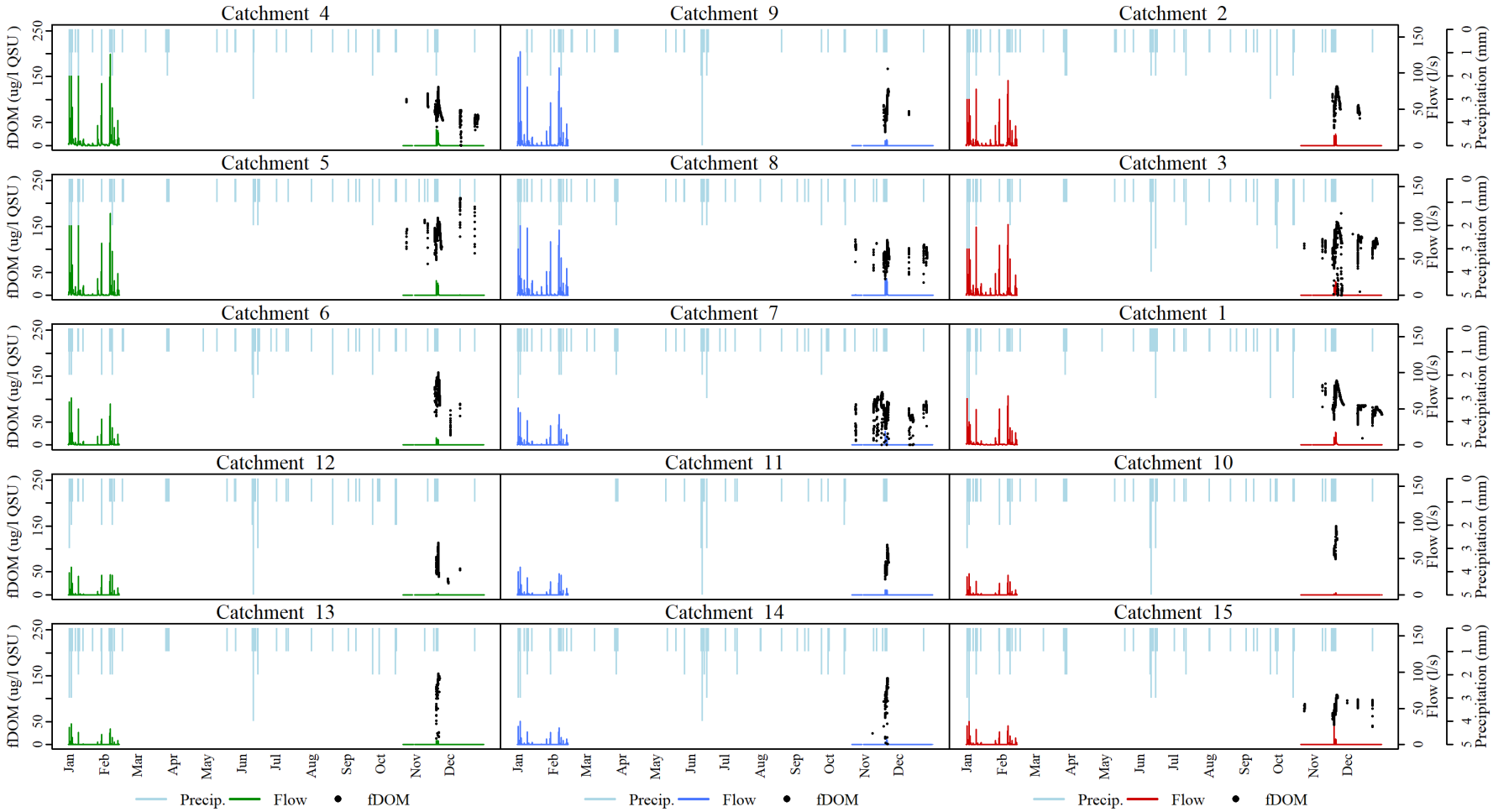


Figure 32: Time series of precipitation, flow and dissolved organic matter (fDOM)

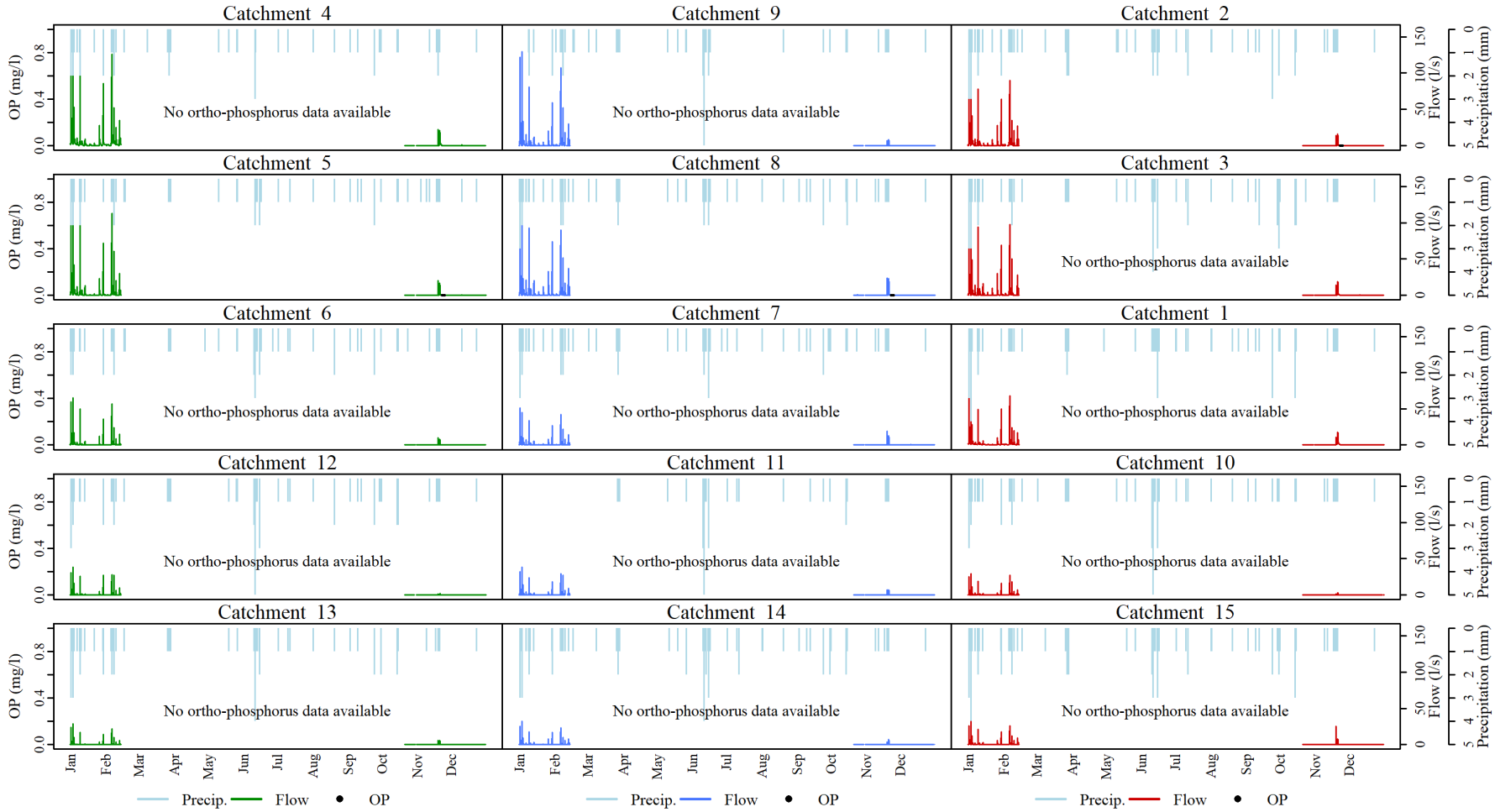


Figure 33: Time series of precipitation, flow and ortho-phosphorus (OP)

1.6 Correlations

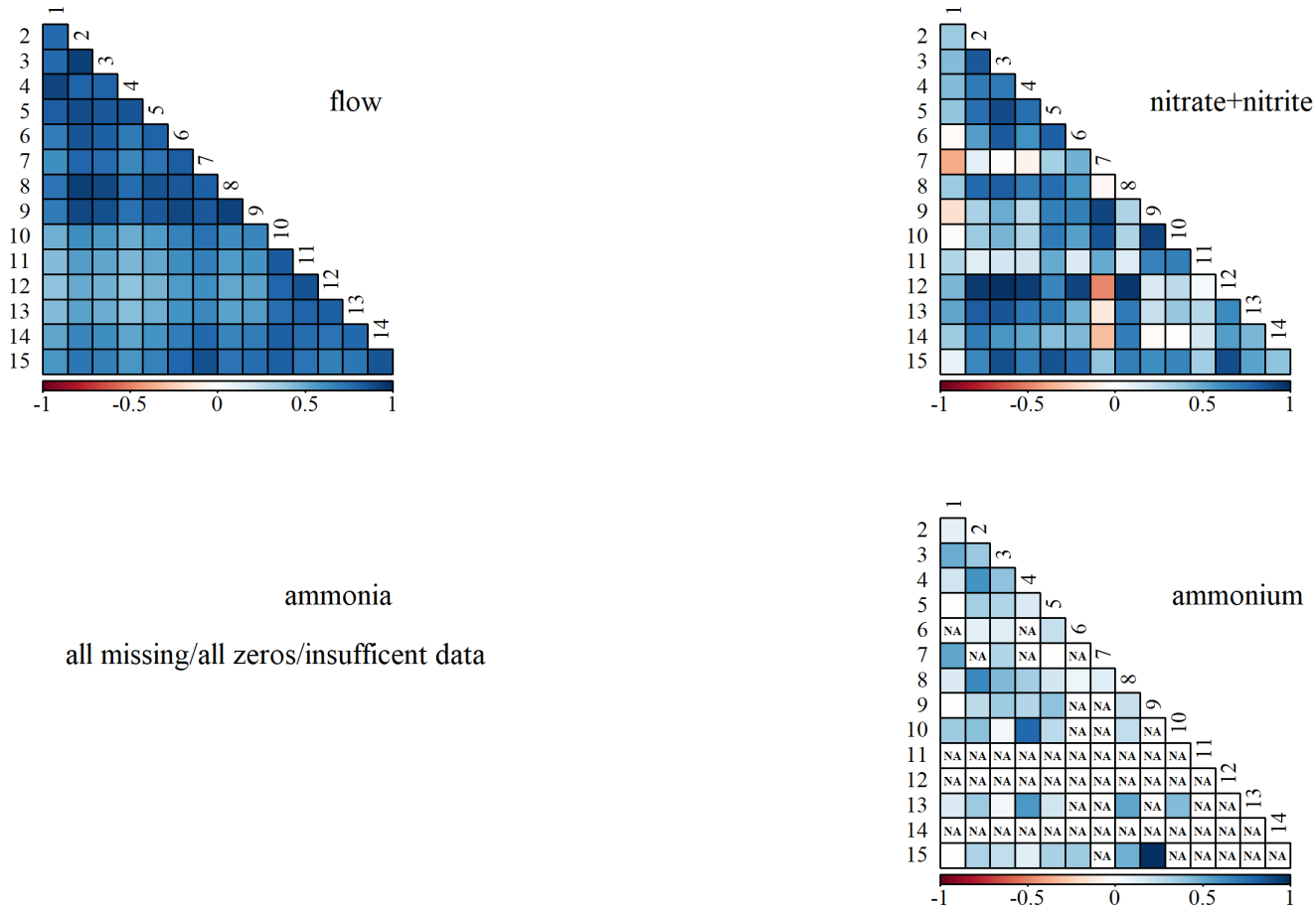


Figure 34: Correlations between catchments - flow, nitrate+nitrite, ammonia, ammonium

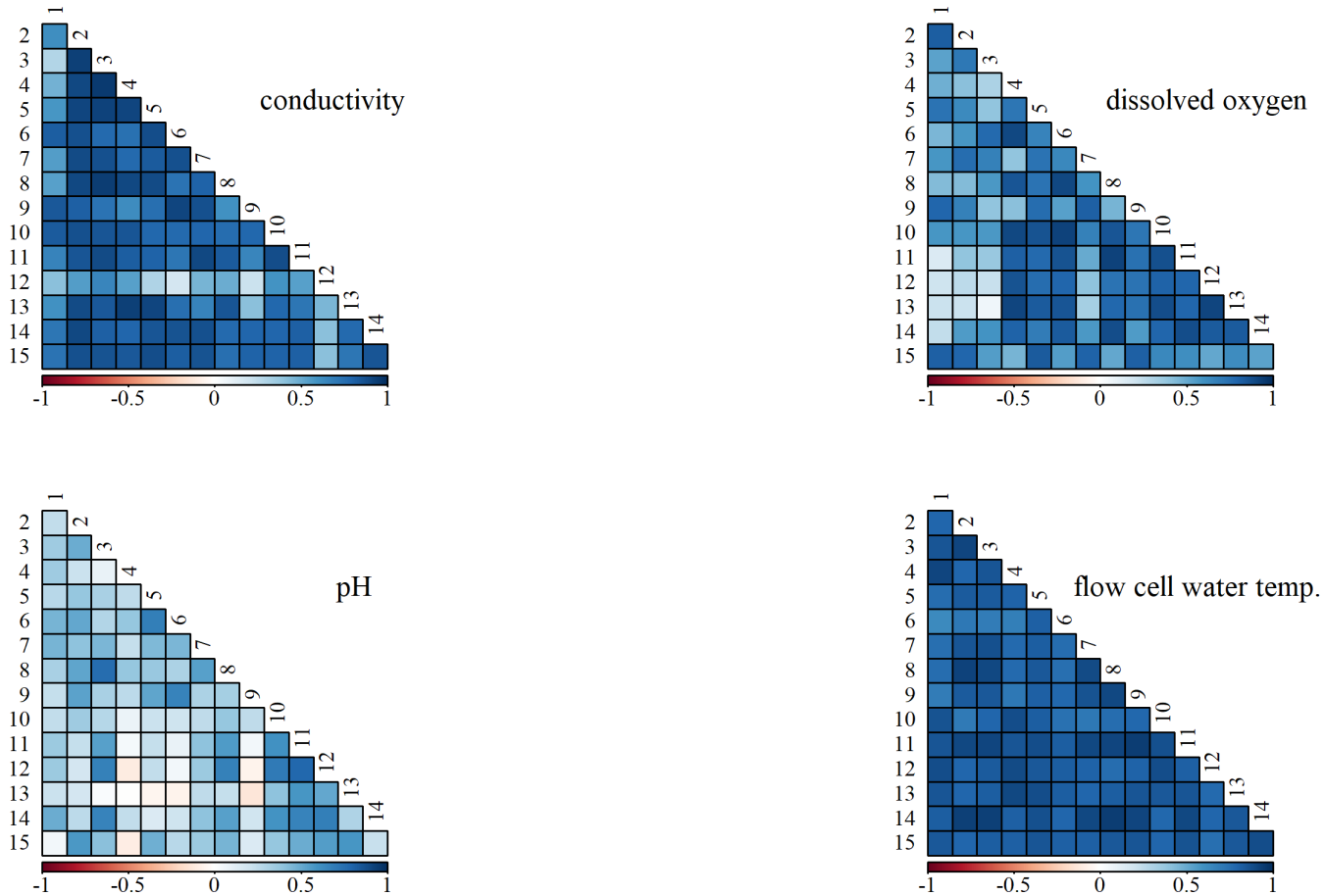
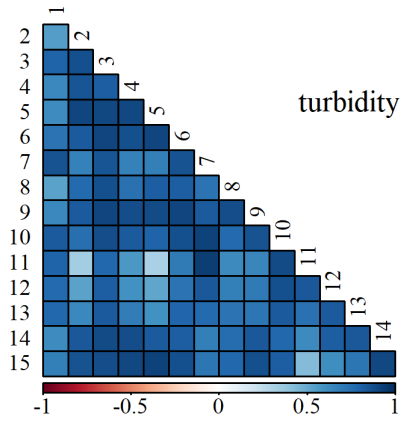
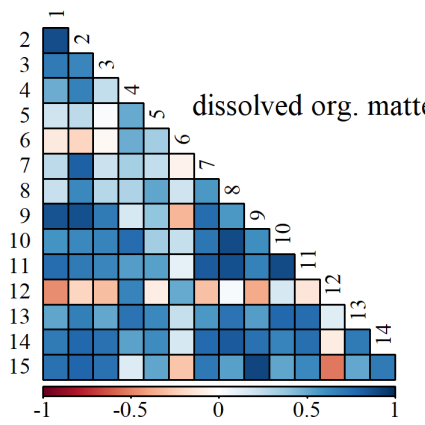


Figure 35: Correlations between catchments - conductivity, dissolved oxygen, pH, flow cell water temperature



total phosphorus

all missing/all zeros/insufficent data



ortho-phosphorus

all missing/all zeros/insufficent data

Figure 36: 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.

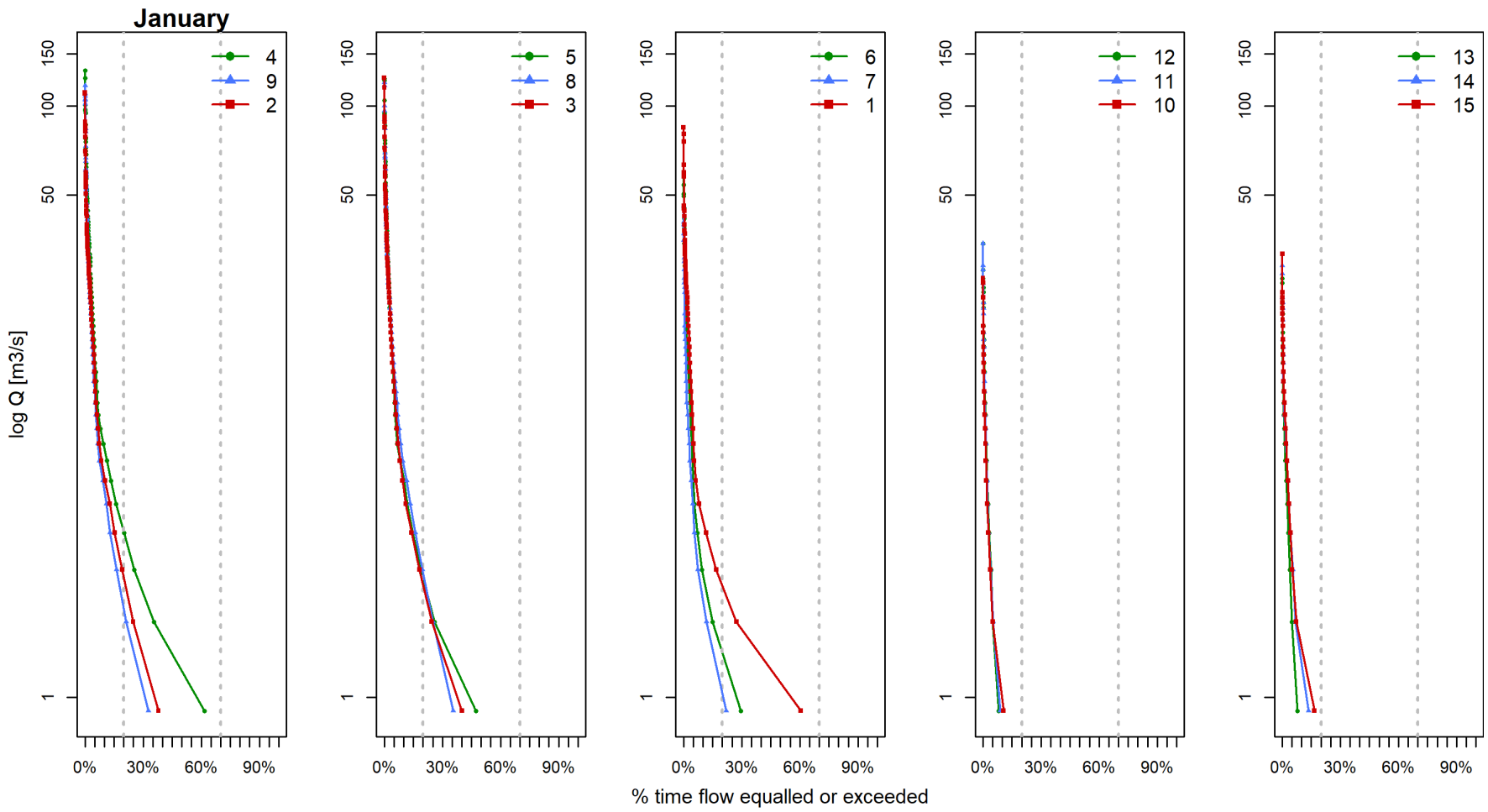


Figure 37: Flow duration curves for January

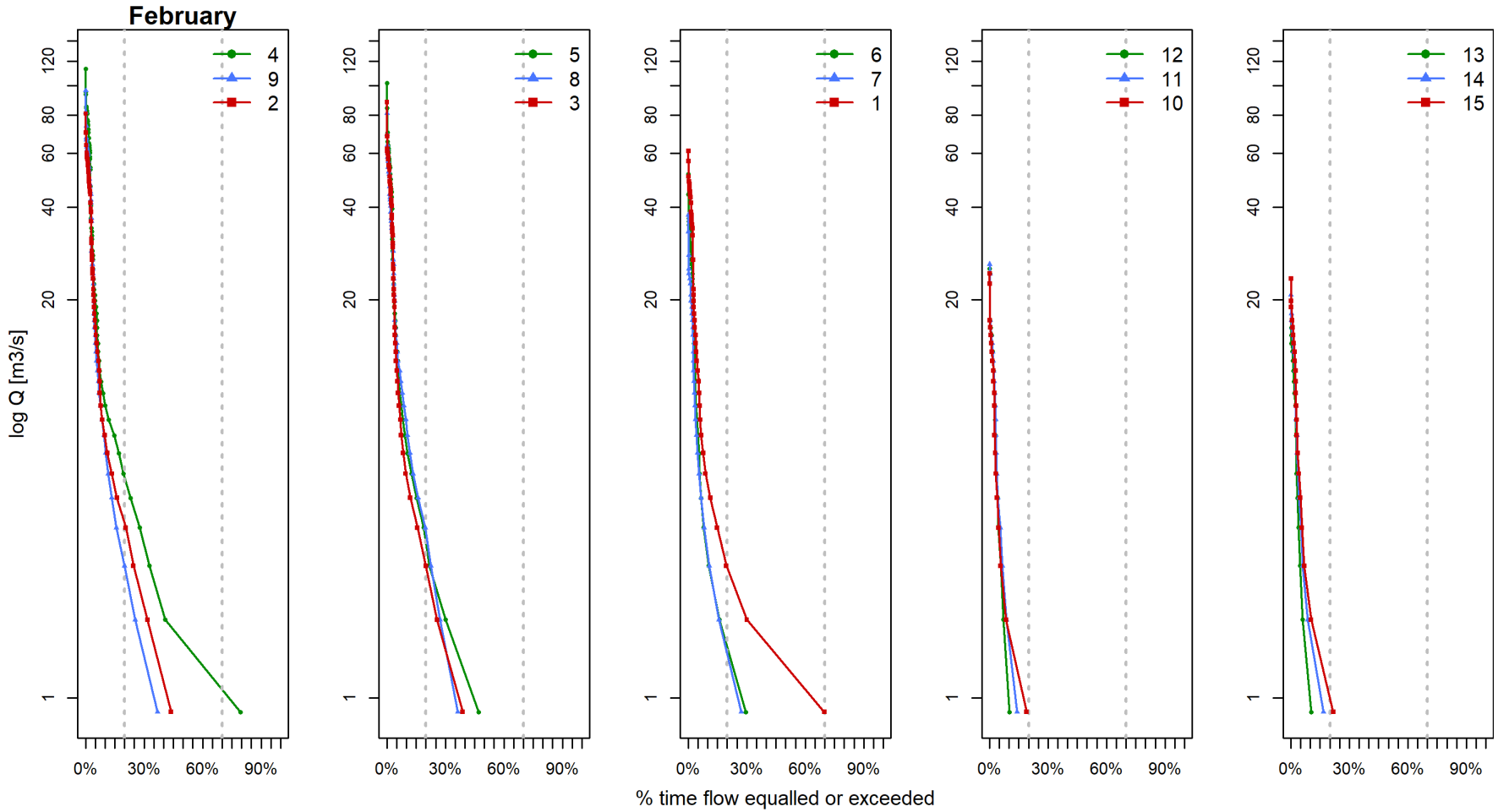


Figure 38: Flow duration curves for February

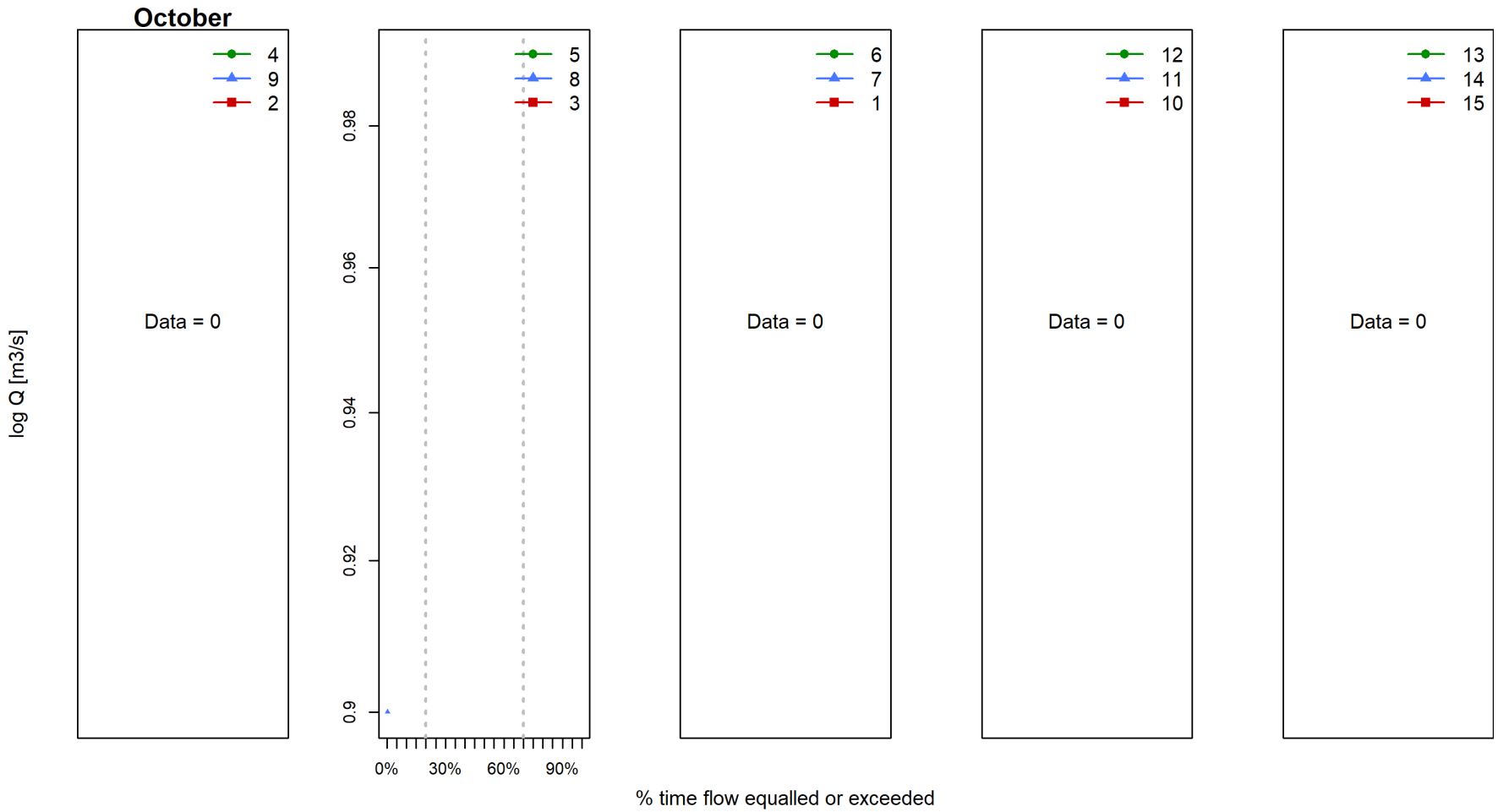


Figure 39: Flow duration curves for March

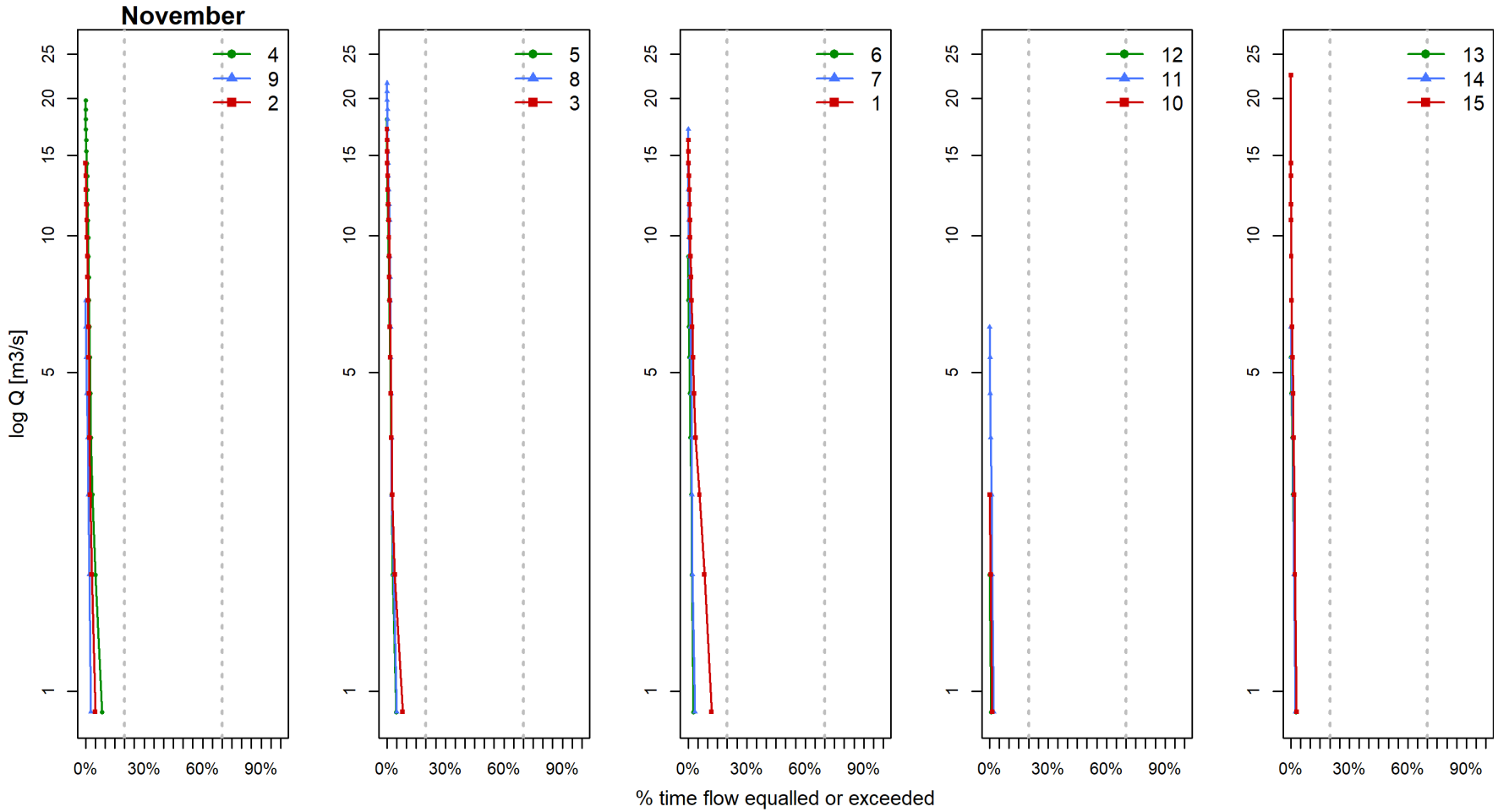


Figure 40: Flow duration curves for April

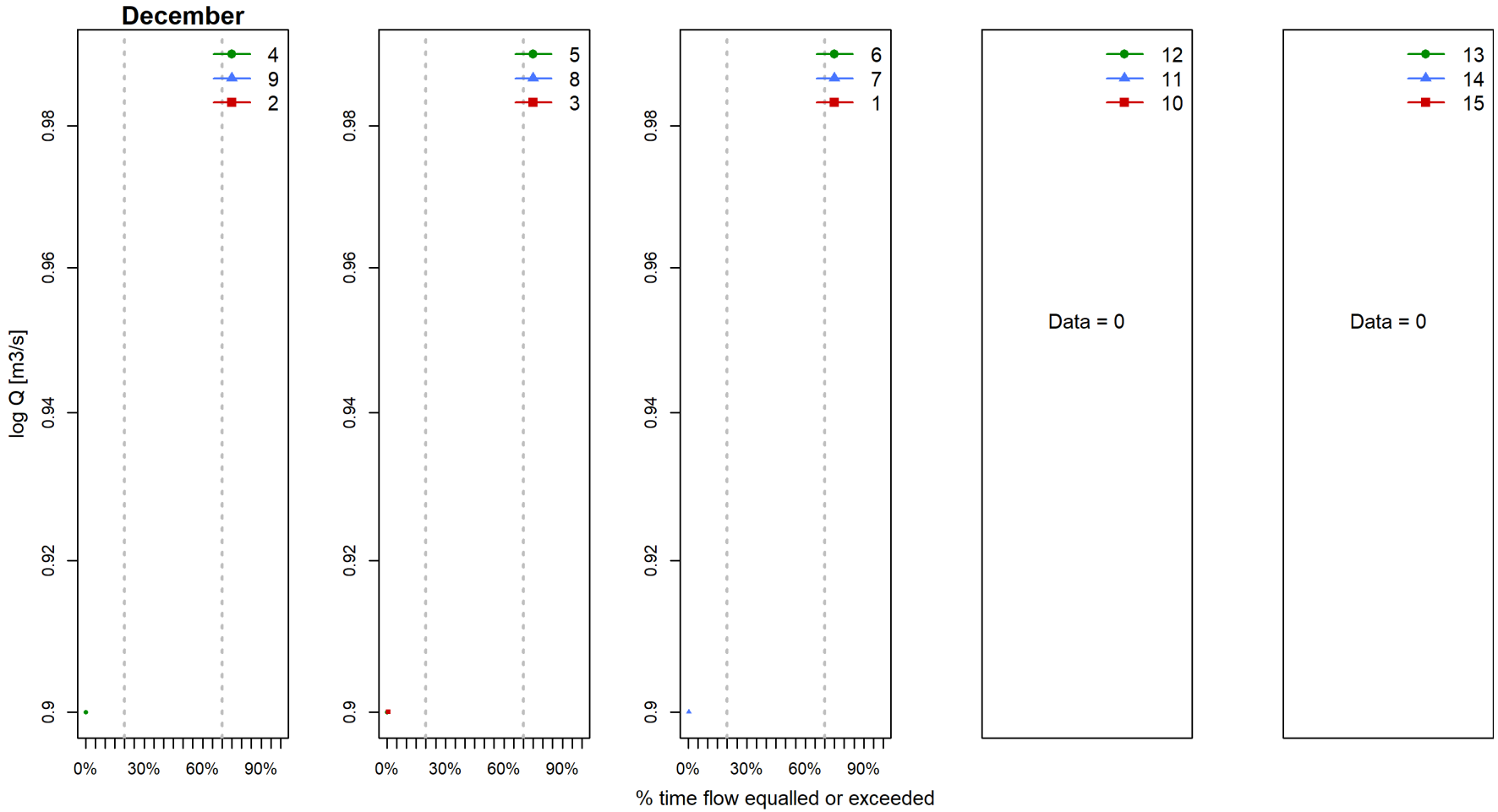


Figure 41: Flow duration curves for May

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.

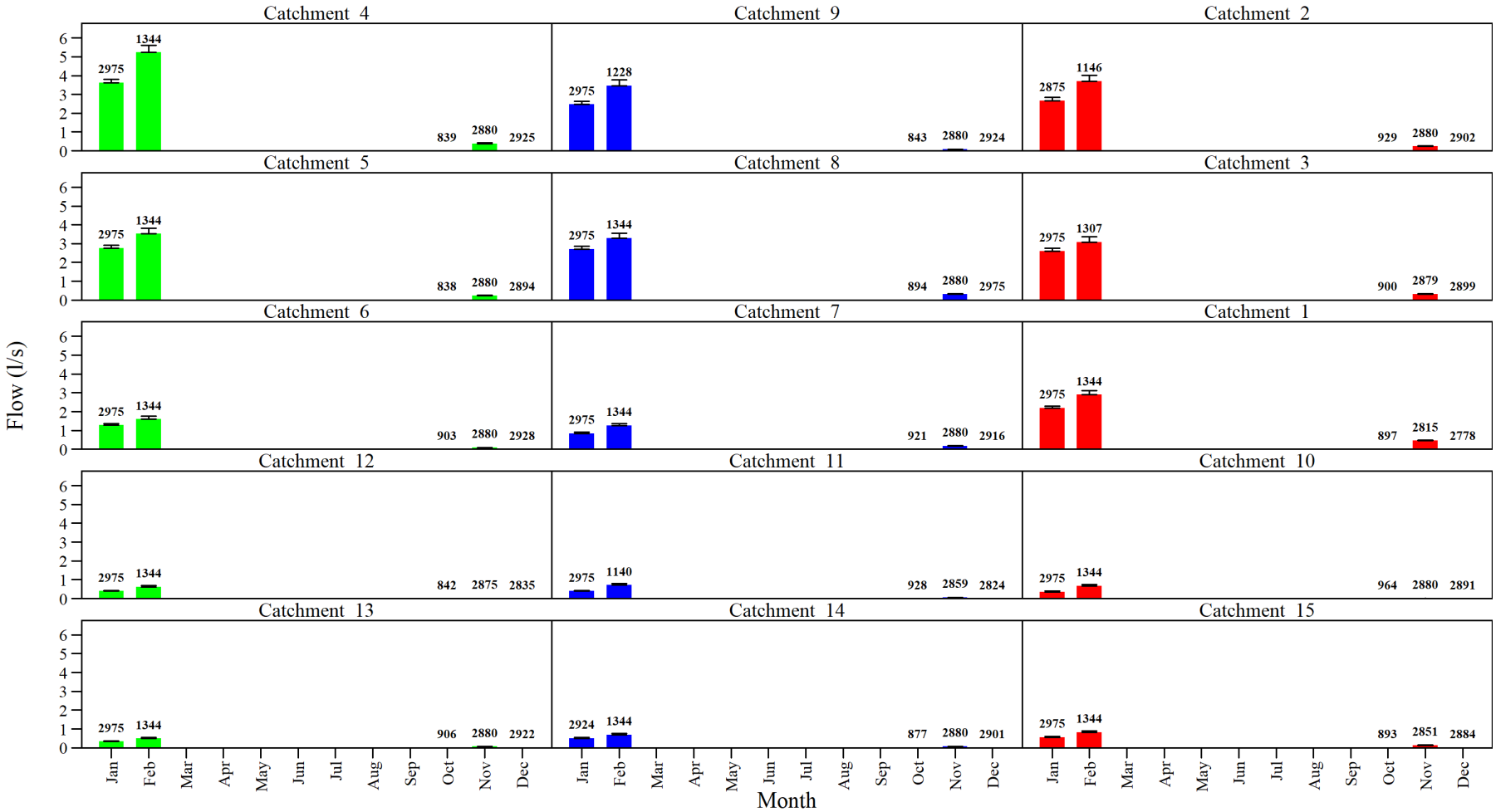


Figure 42: Monthly means for flow

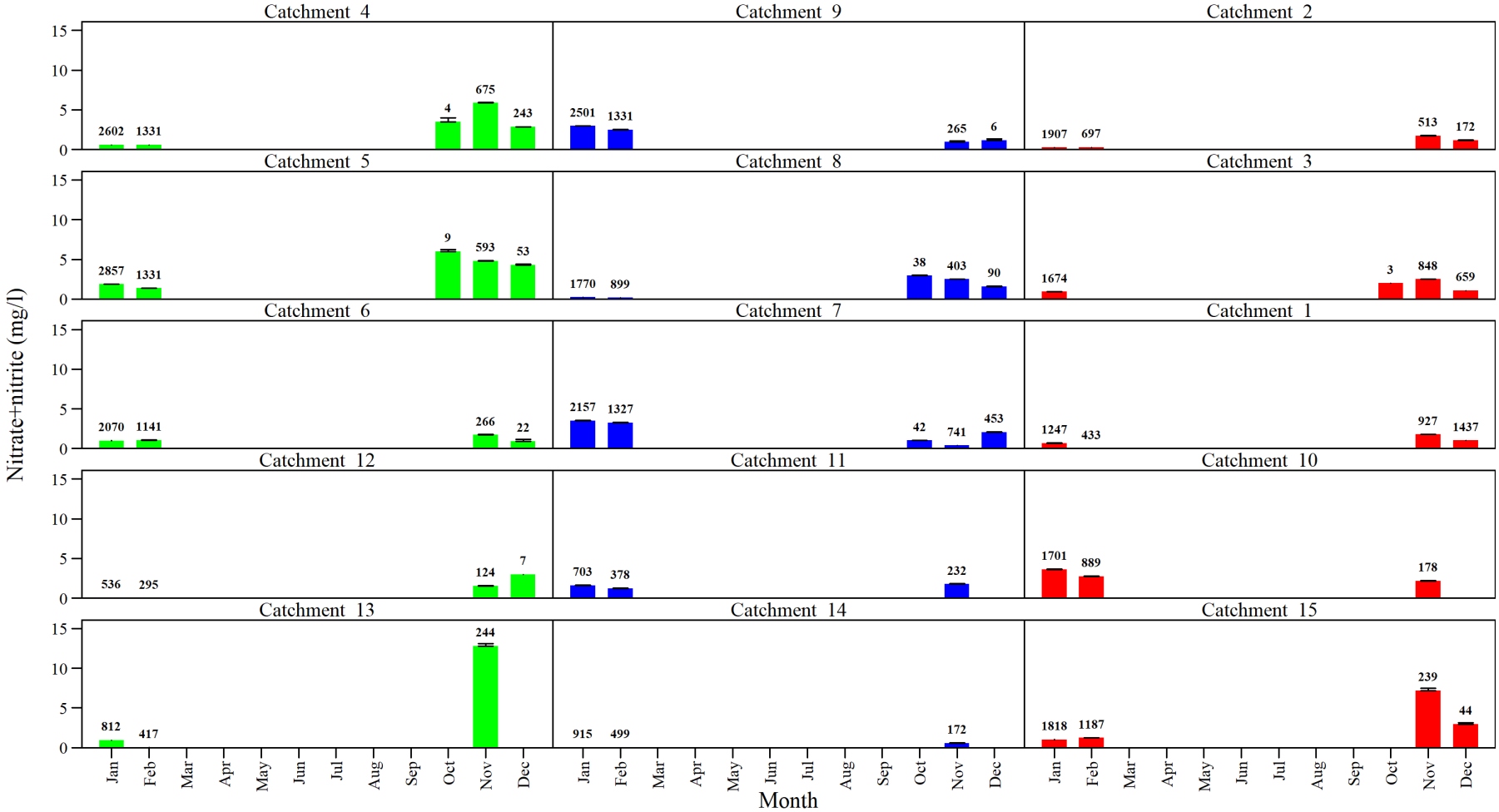


Figure 43: Monthly means for nitrate+nitrite

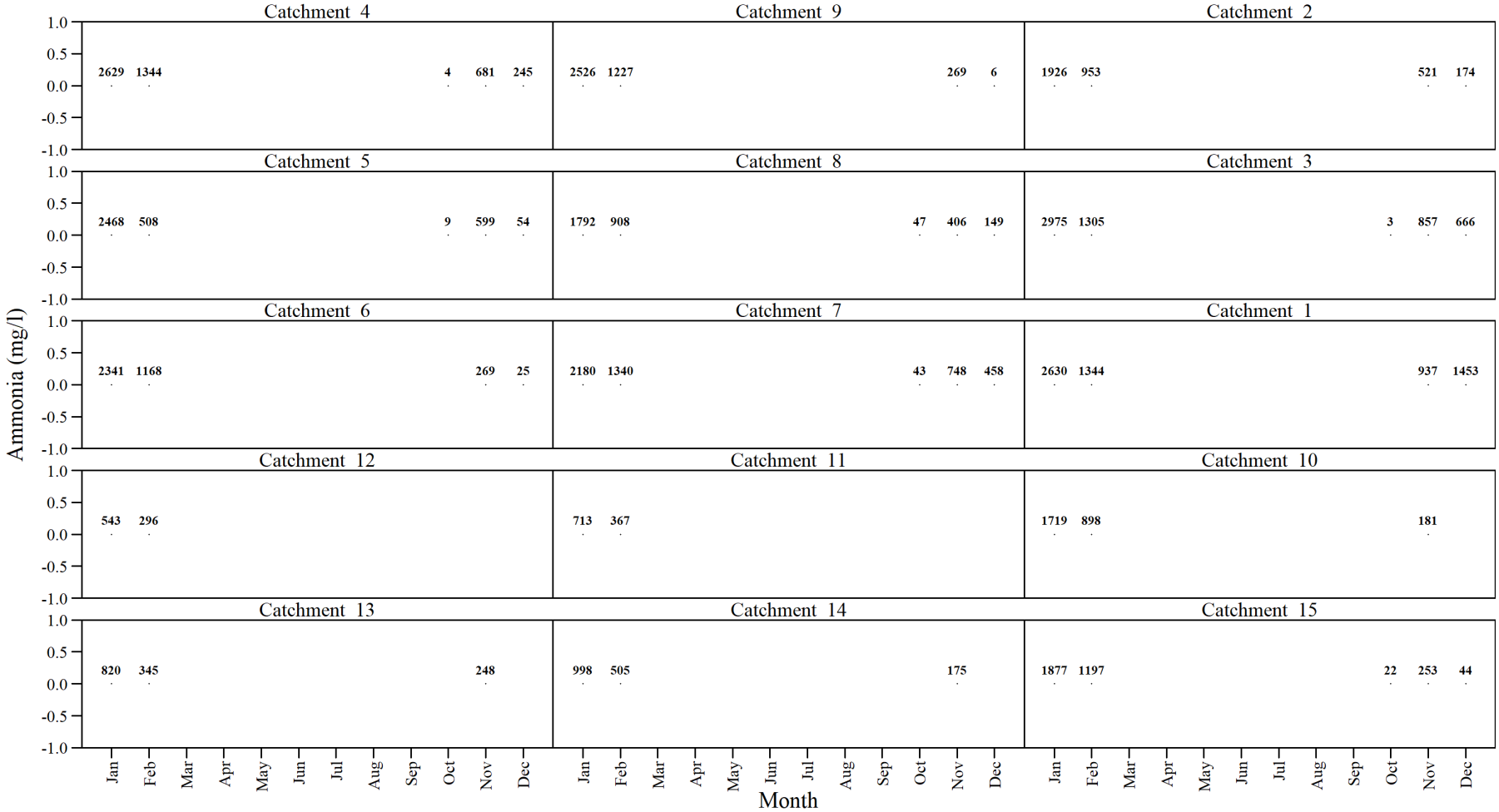


Figure 44: Monthly means for ammonia

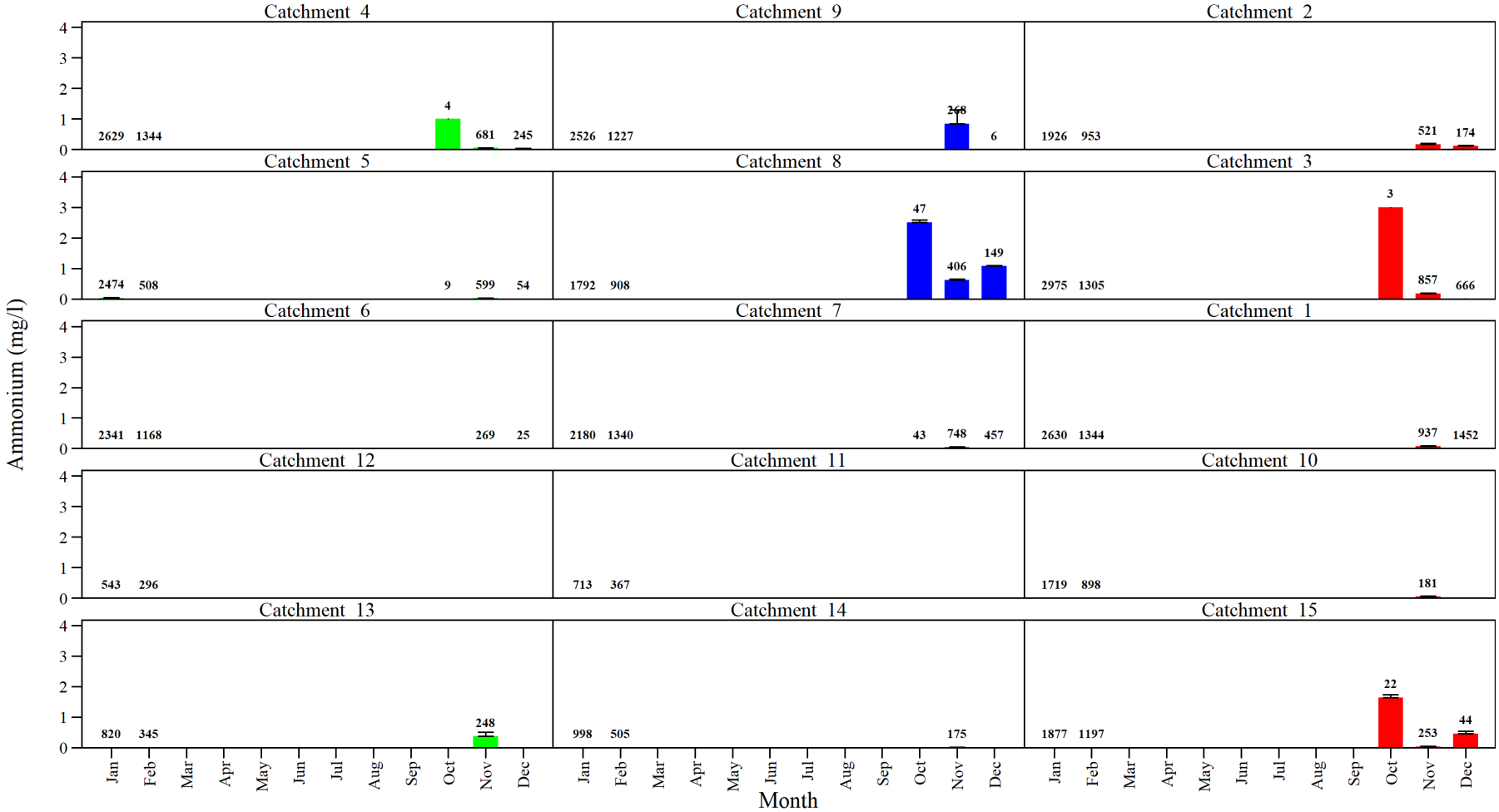


Figure 45: Monthly means for ammonium

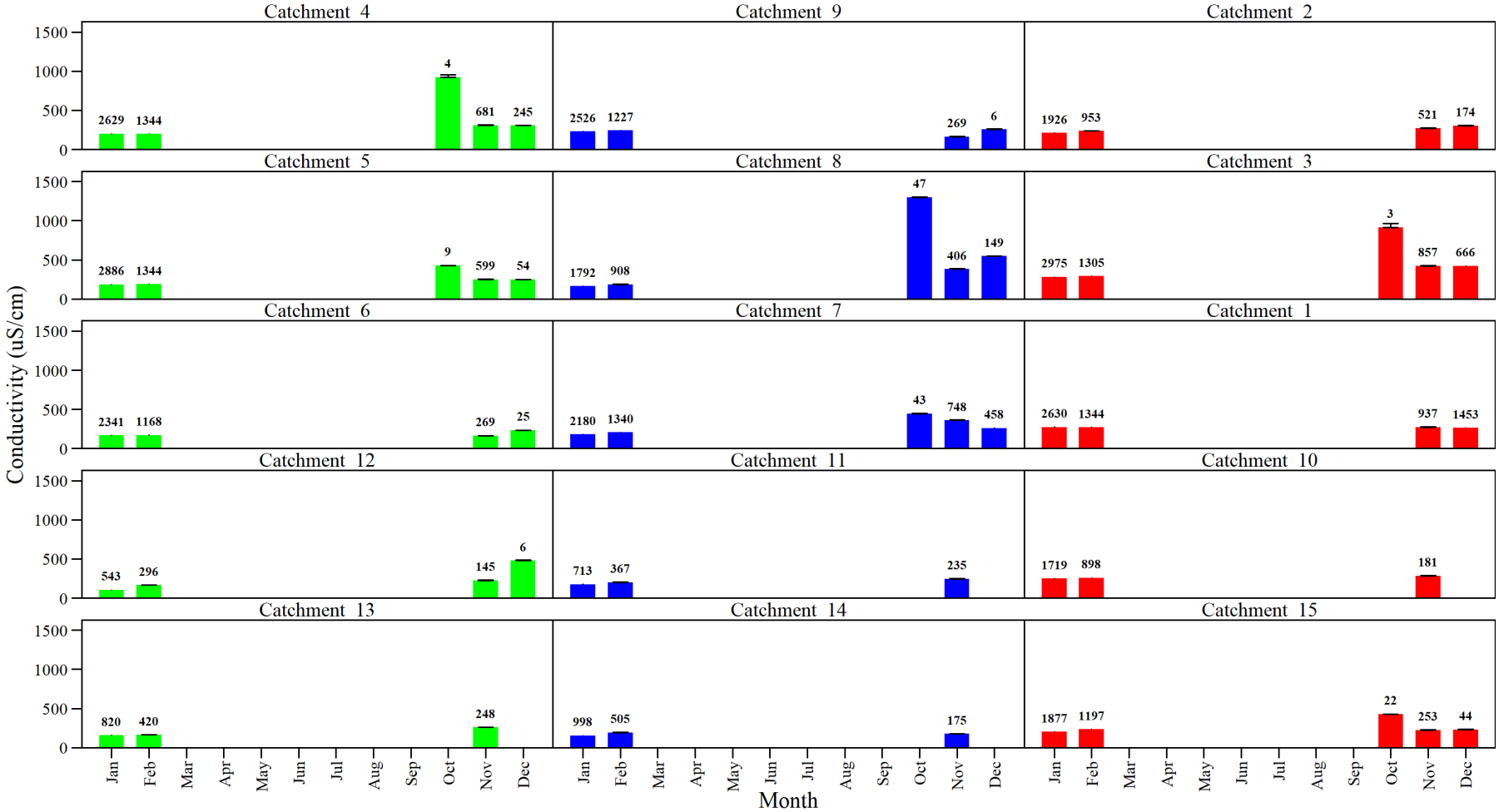


Figure 46: Monthly means for conductivity

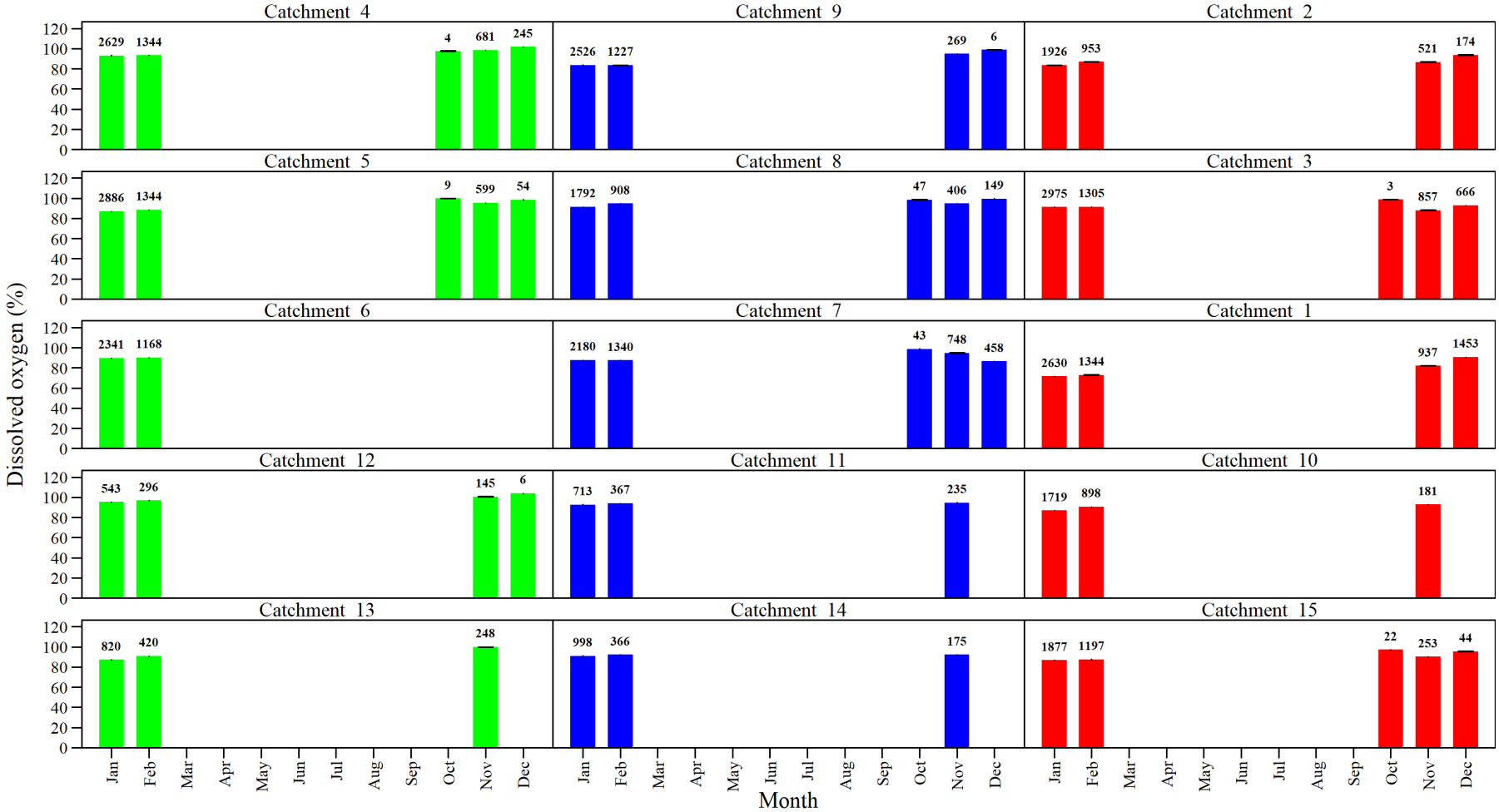


Figure 47: Monthly means for dissolved oxygen

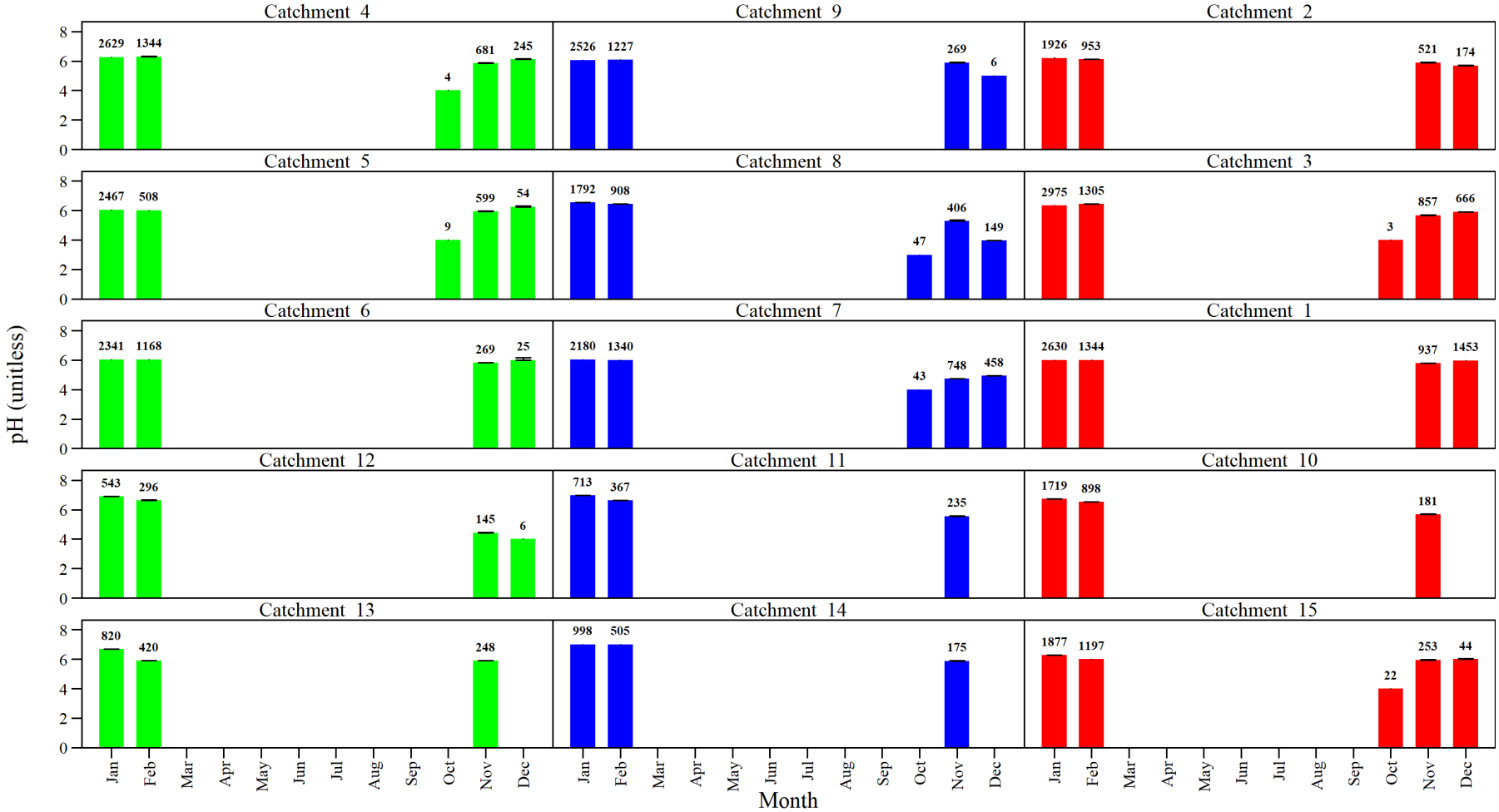


Figure 48: Monthly means for pH

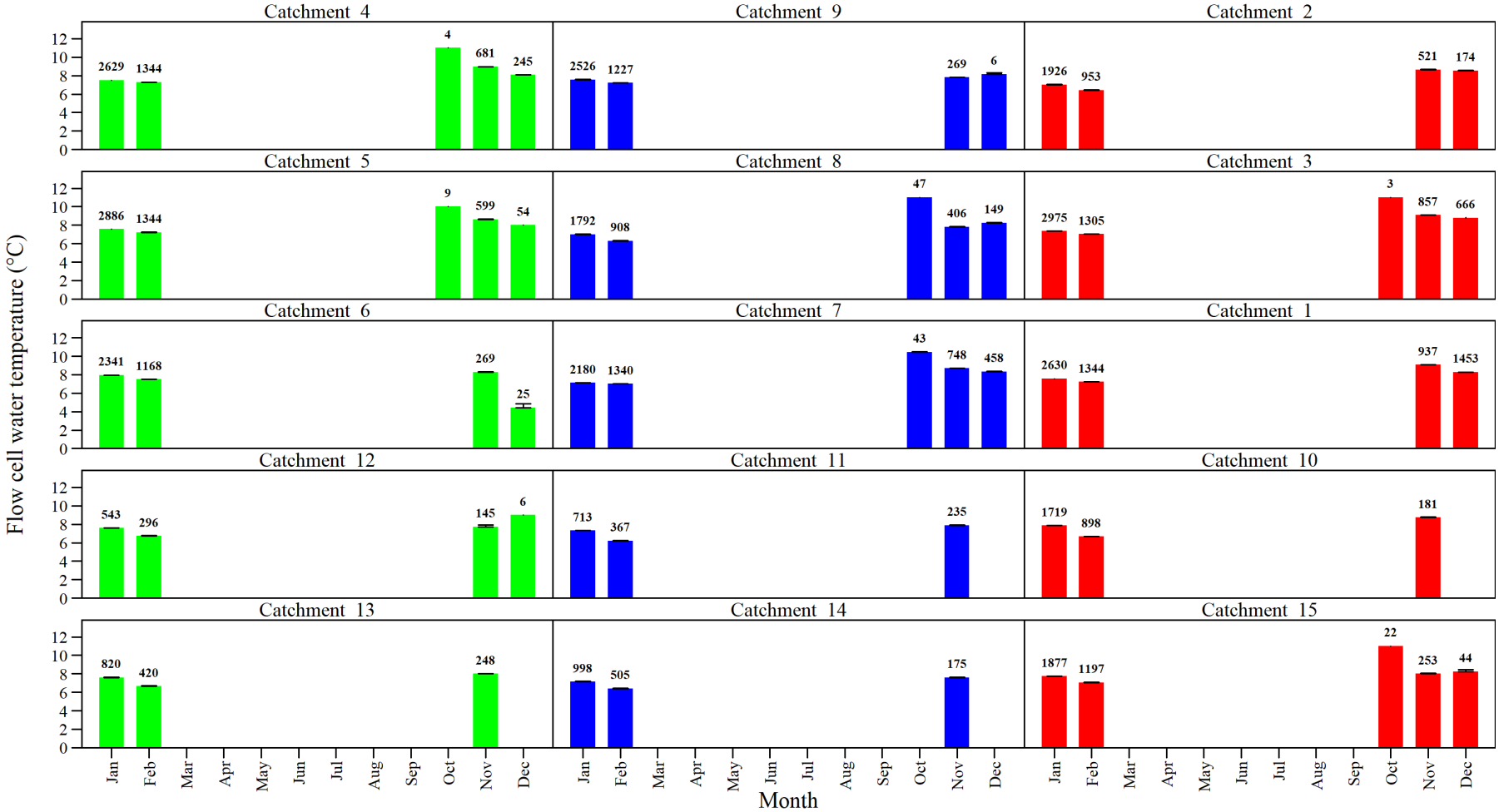


Figure 49: Monthly means for flow cell water temperature

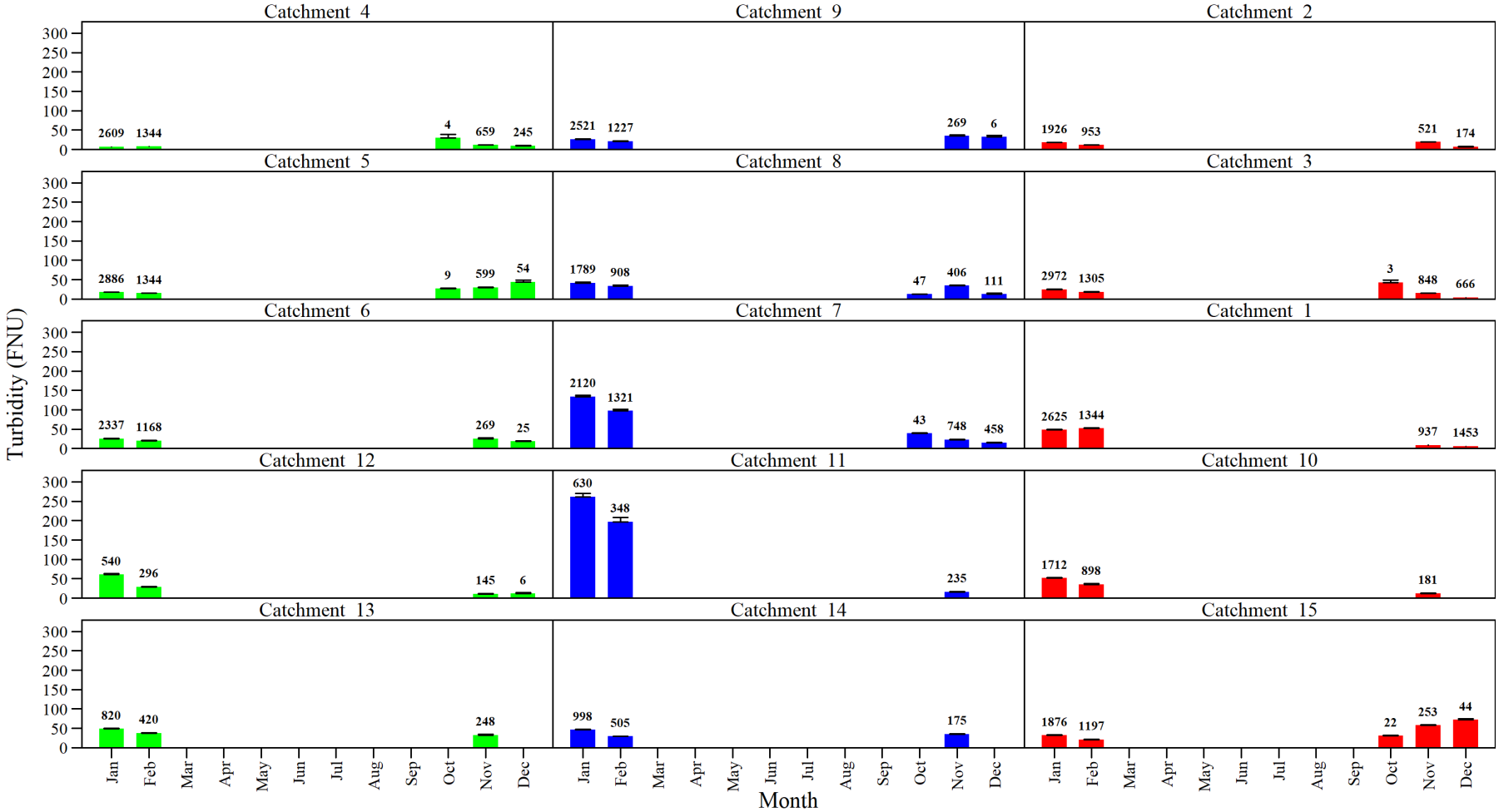


Figure 50: Monthly means for turbidity

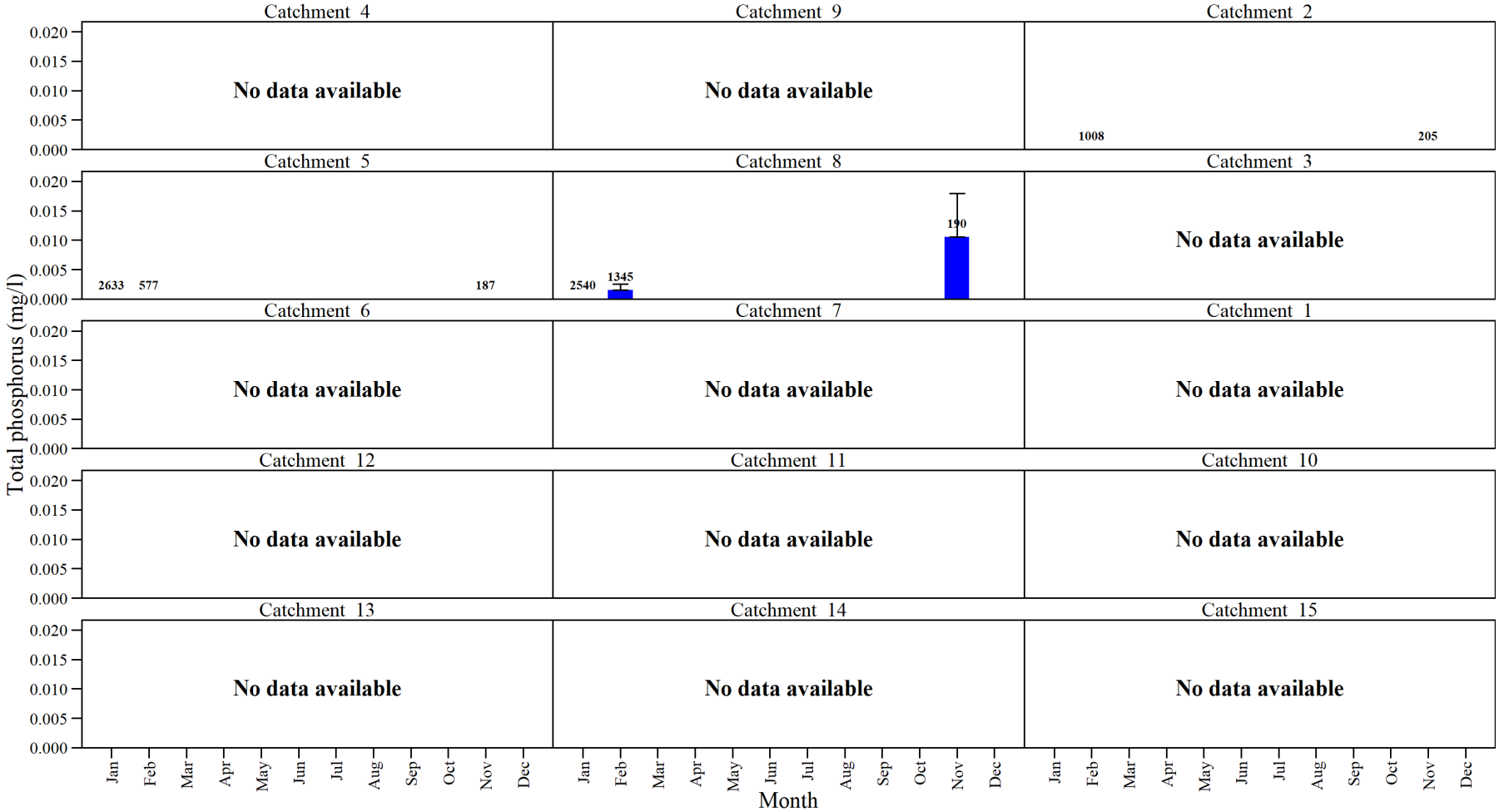


Figure 51: Monthly means for total phosphorus

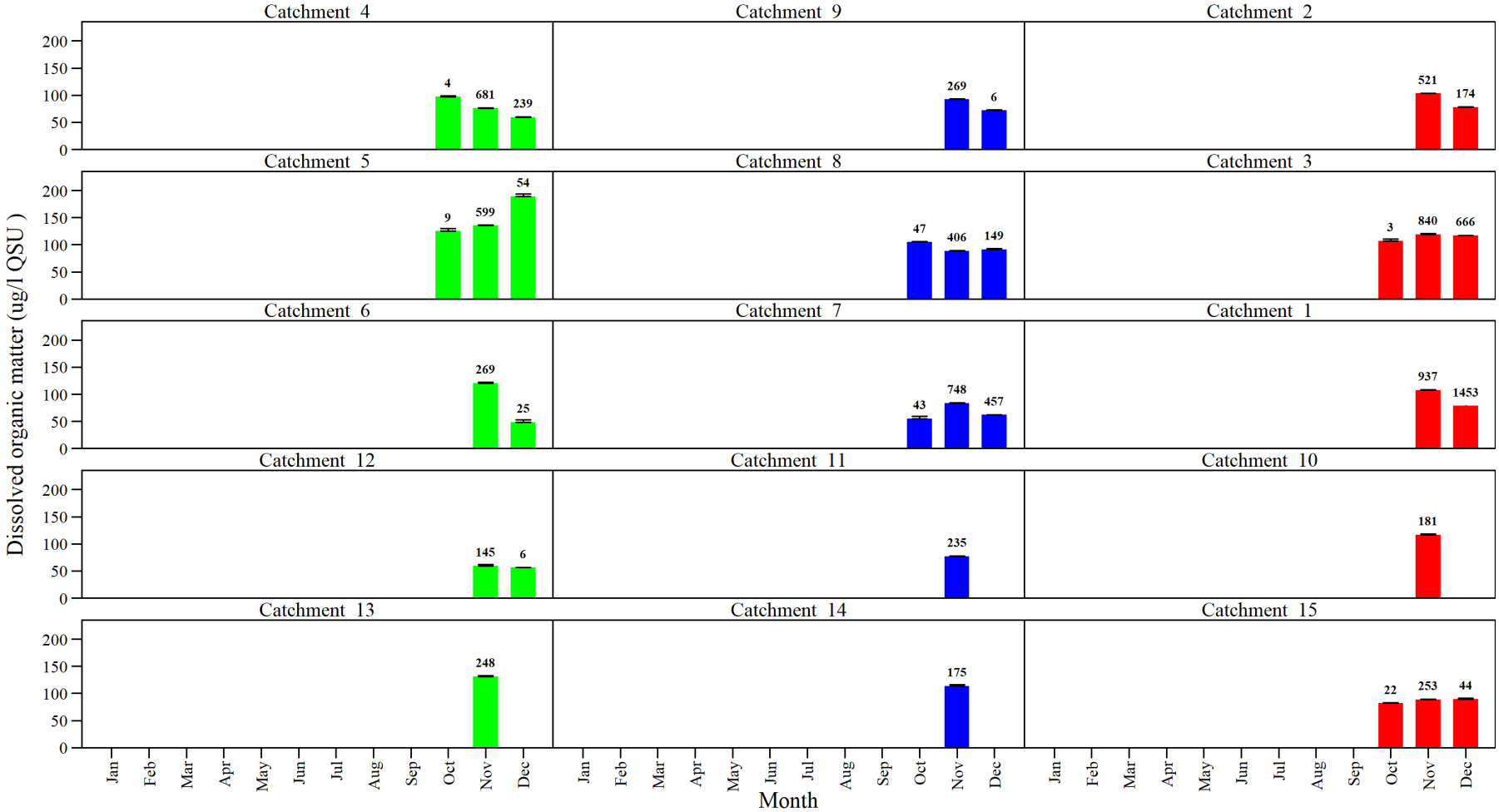


Figure 52: Monthly means for dissolved organic matter

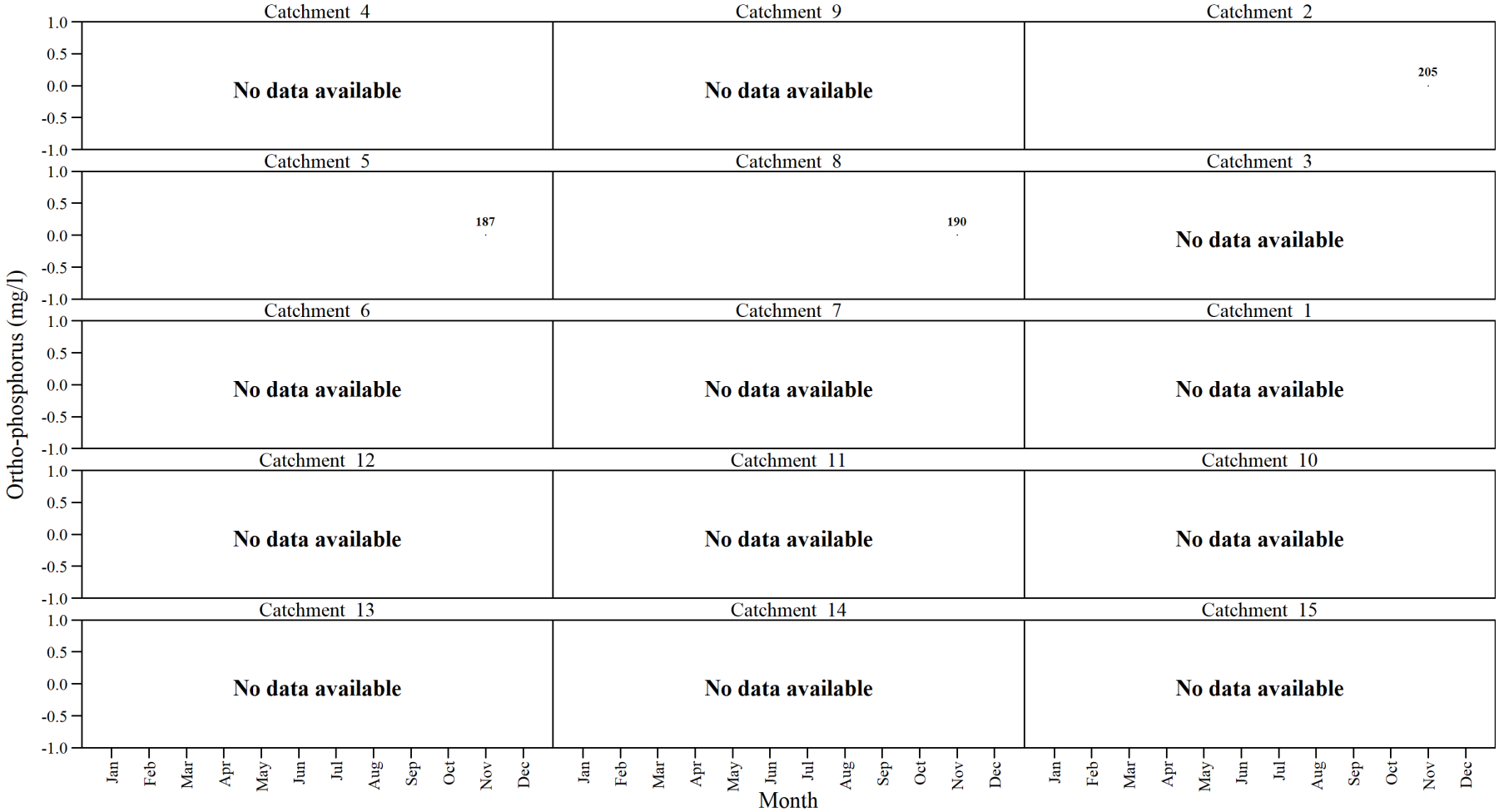


Figure 53: Monthly means for ortho-phosphorus

2.3 Chloropleth maps of means

Grey areas represent missing data

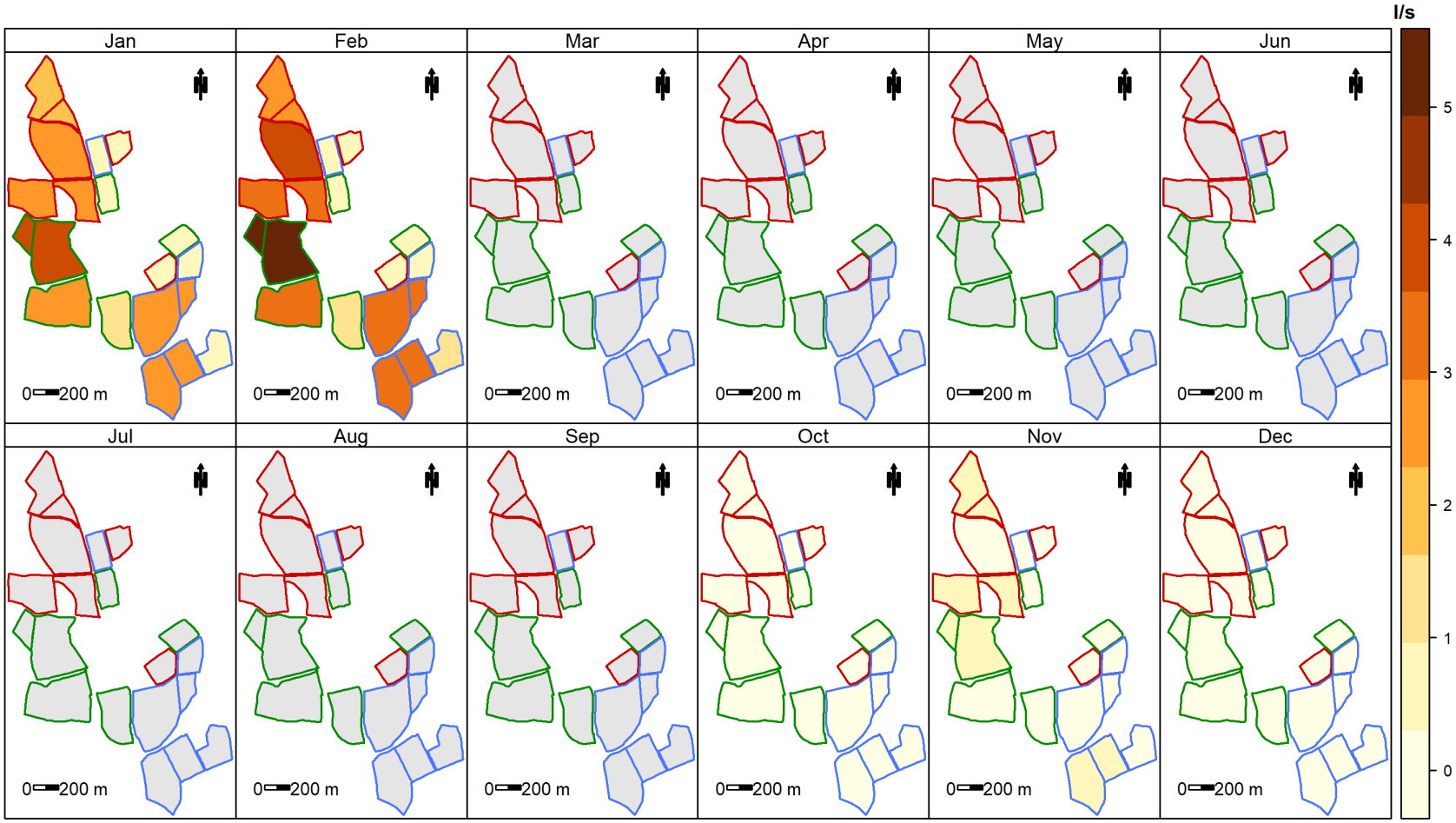


Figure 54: Mapped means for flow

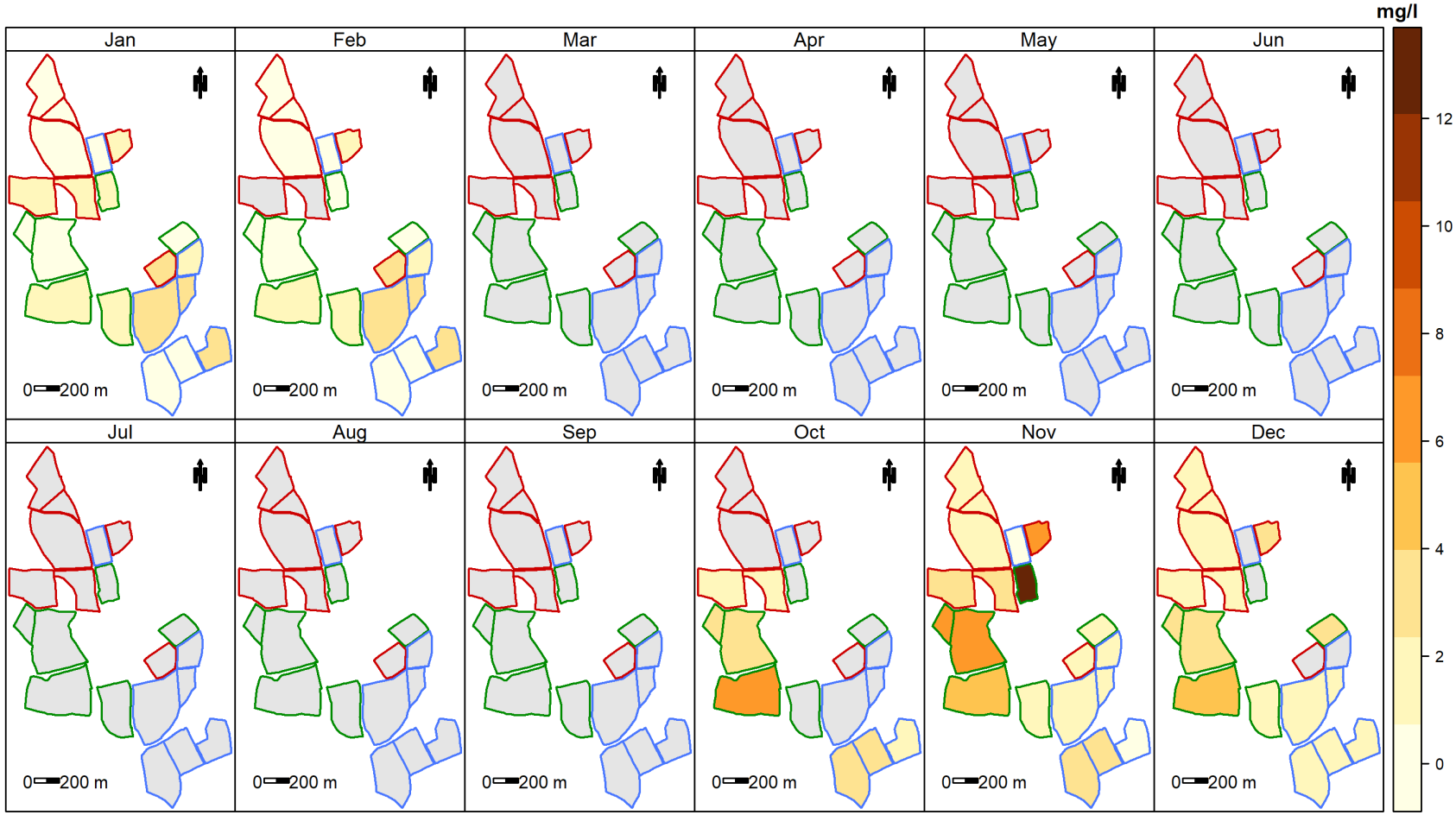


Figure 55: Mapped means for nitrate+nitrite

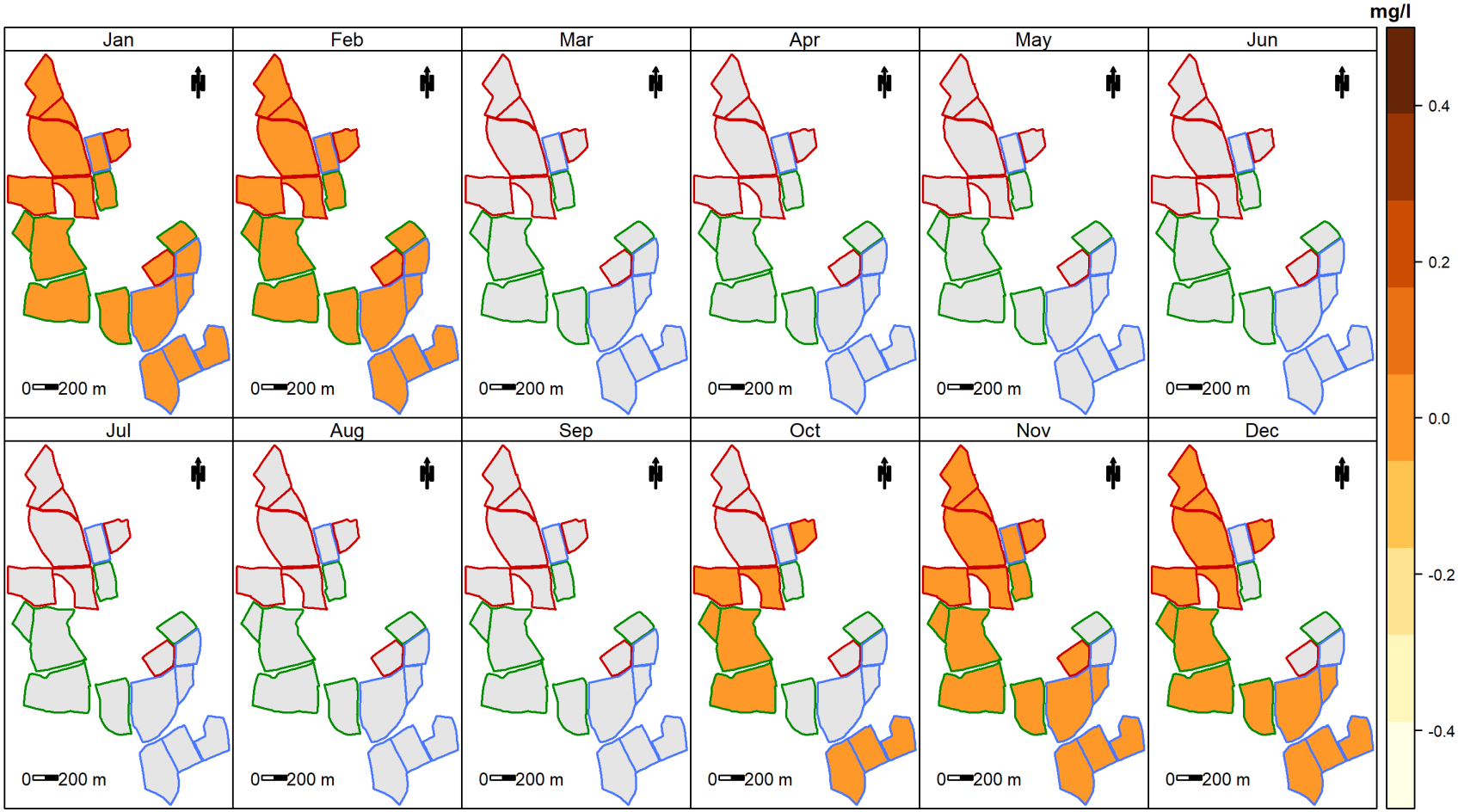


Figure 56: Mapped means for ammonia

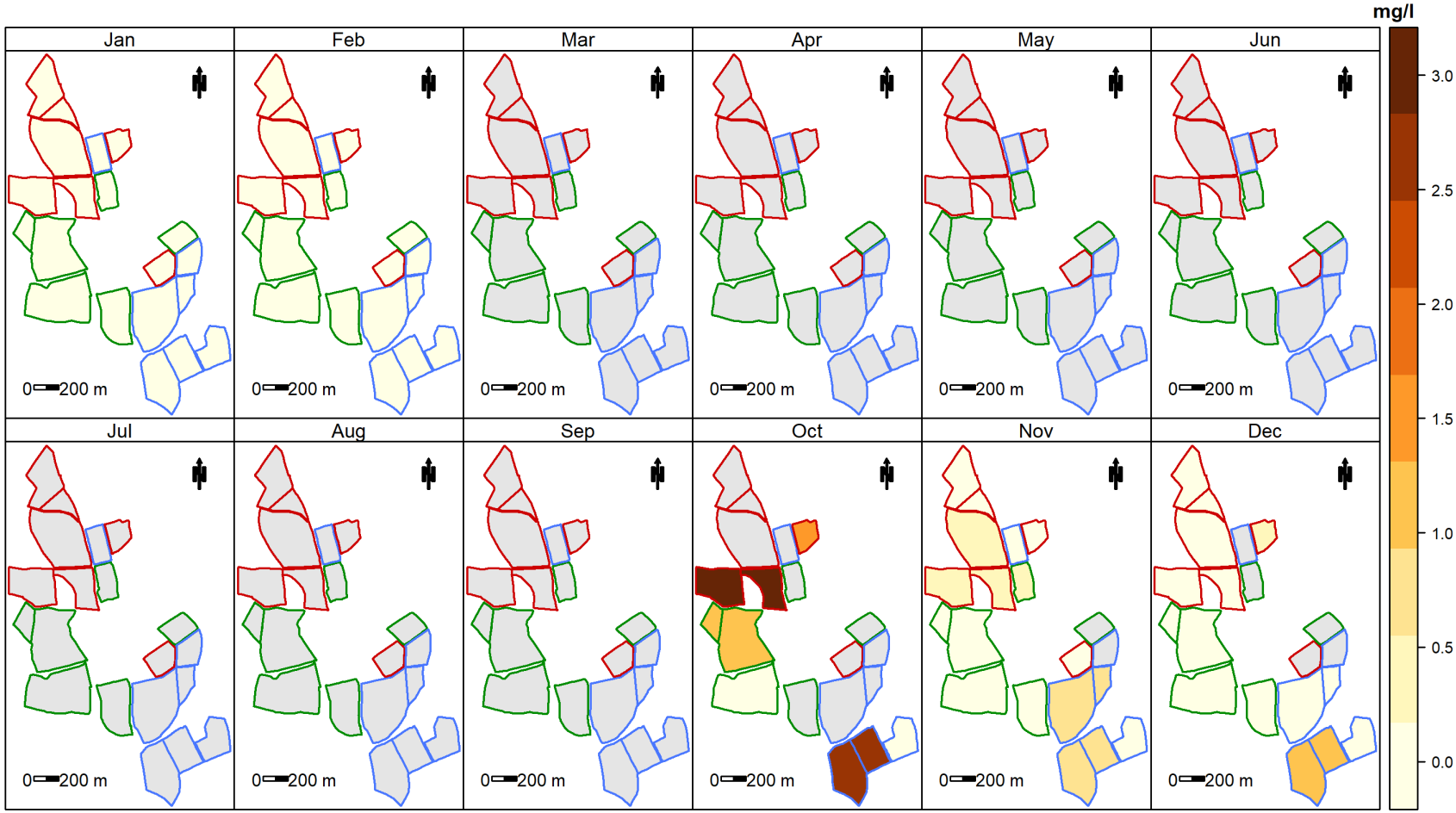


Figure 57: Mapped means for ammonium

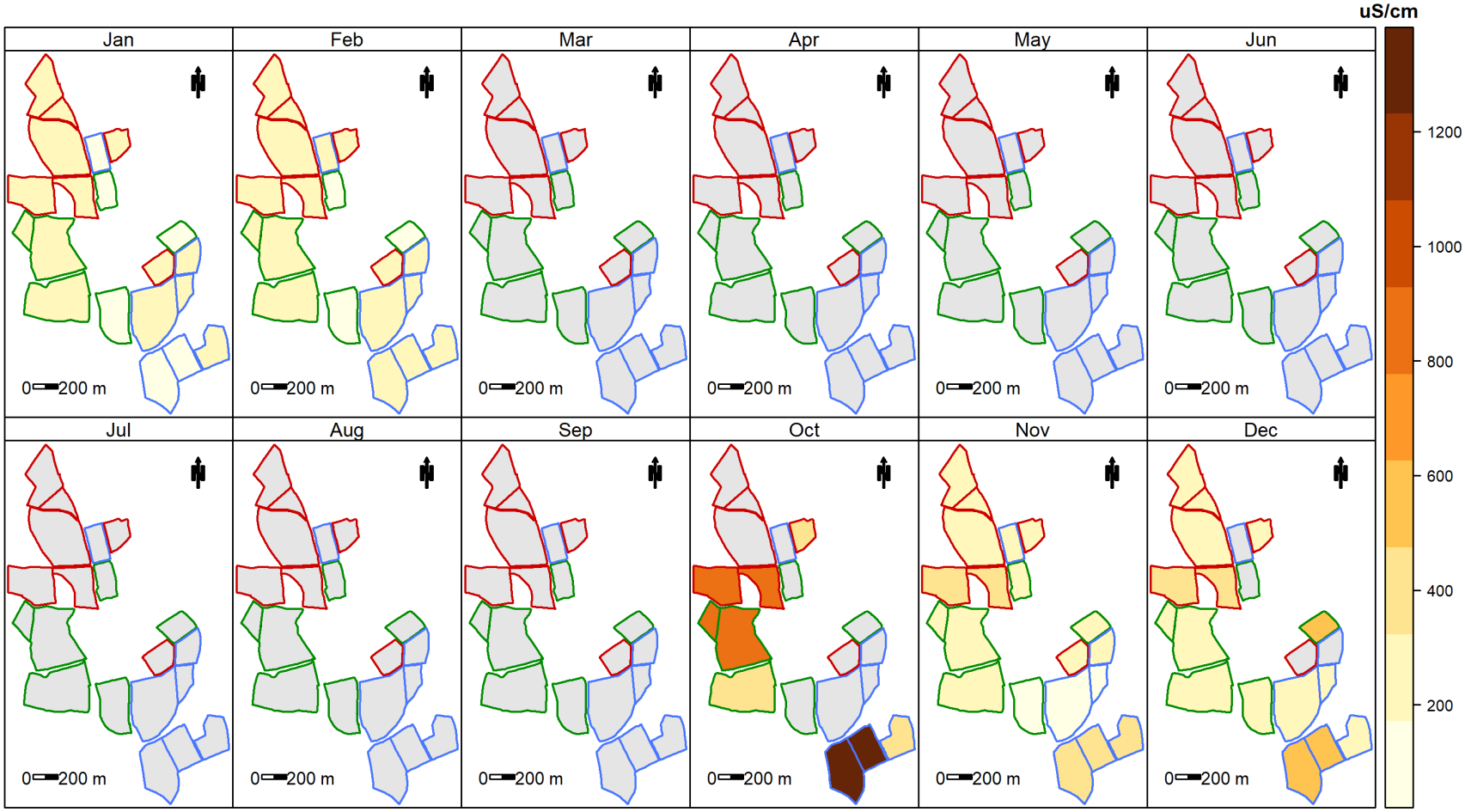


Figure 58: Mapped means for conductivity

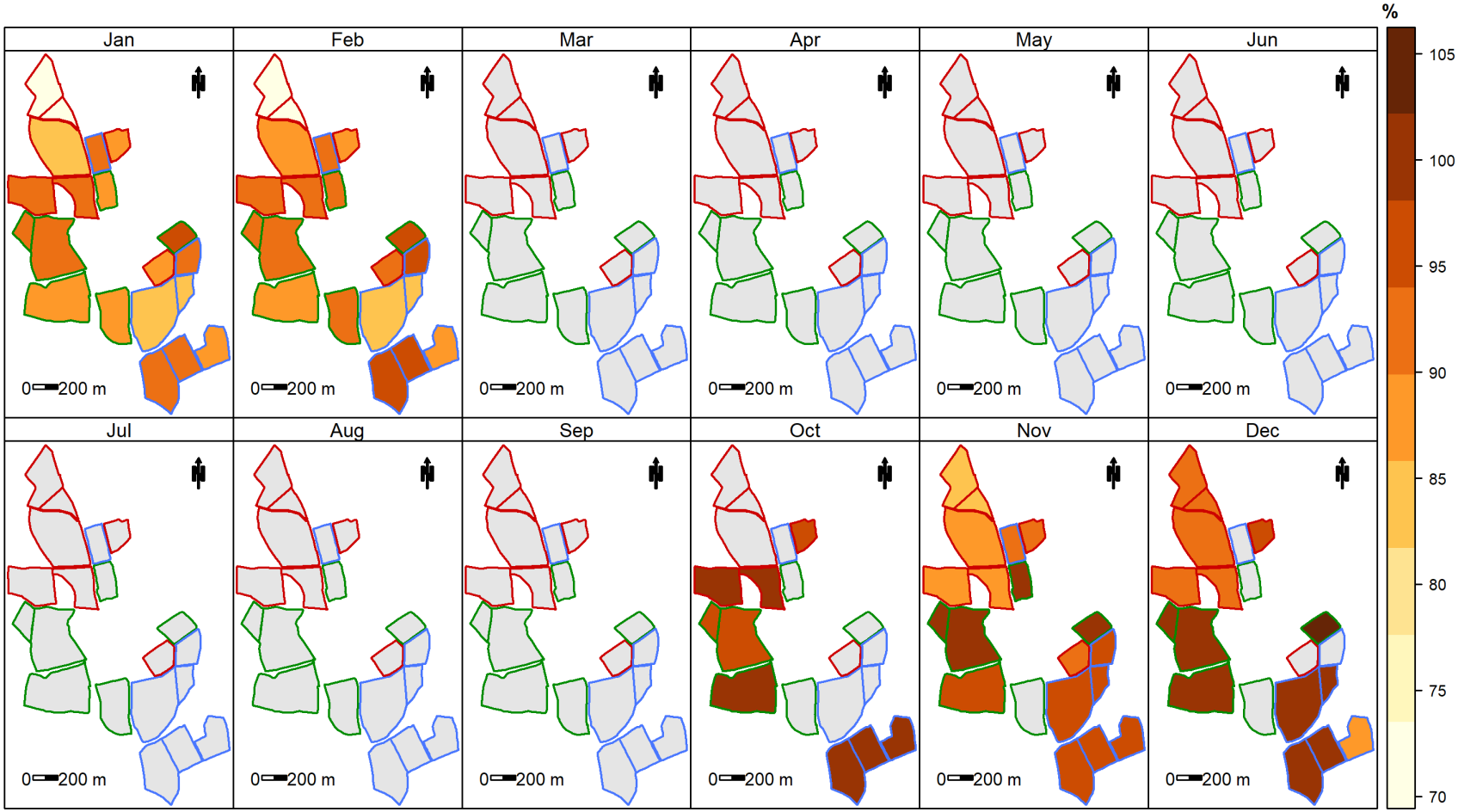


Figure 59: Mapped means for dissolved oxygen

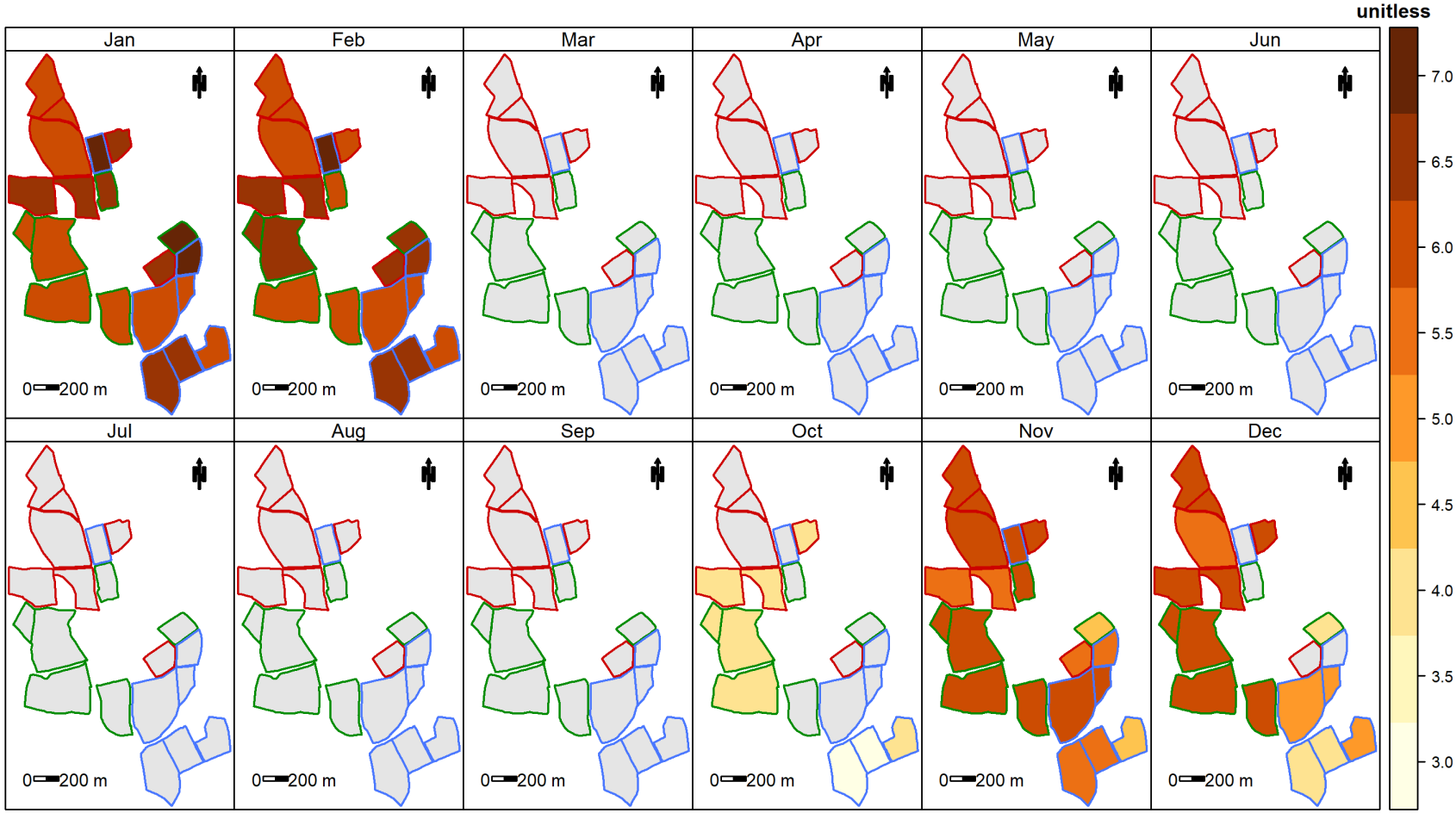


Figure 60: Mapped means for pH

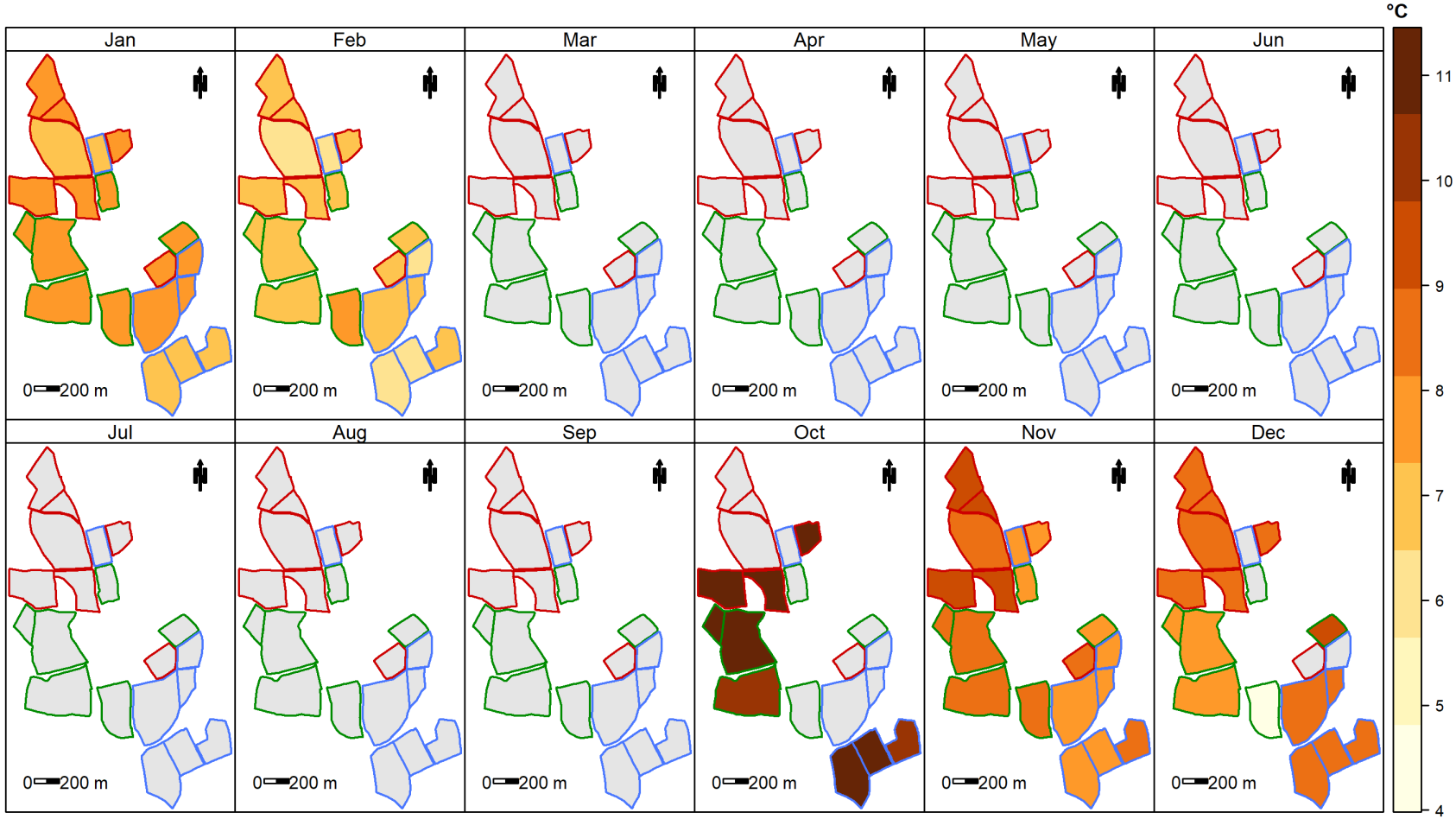


Figure 61: Mapped means for flow cell water temperature

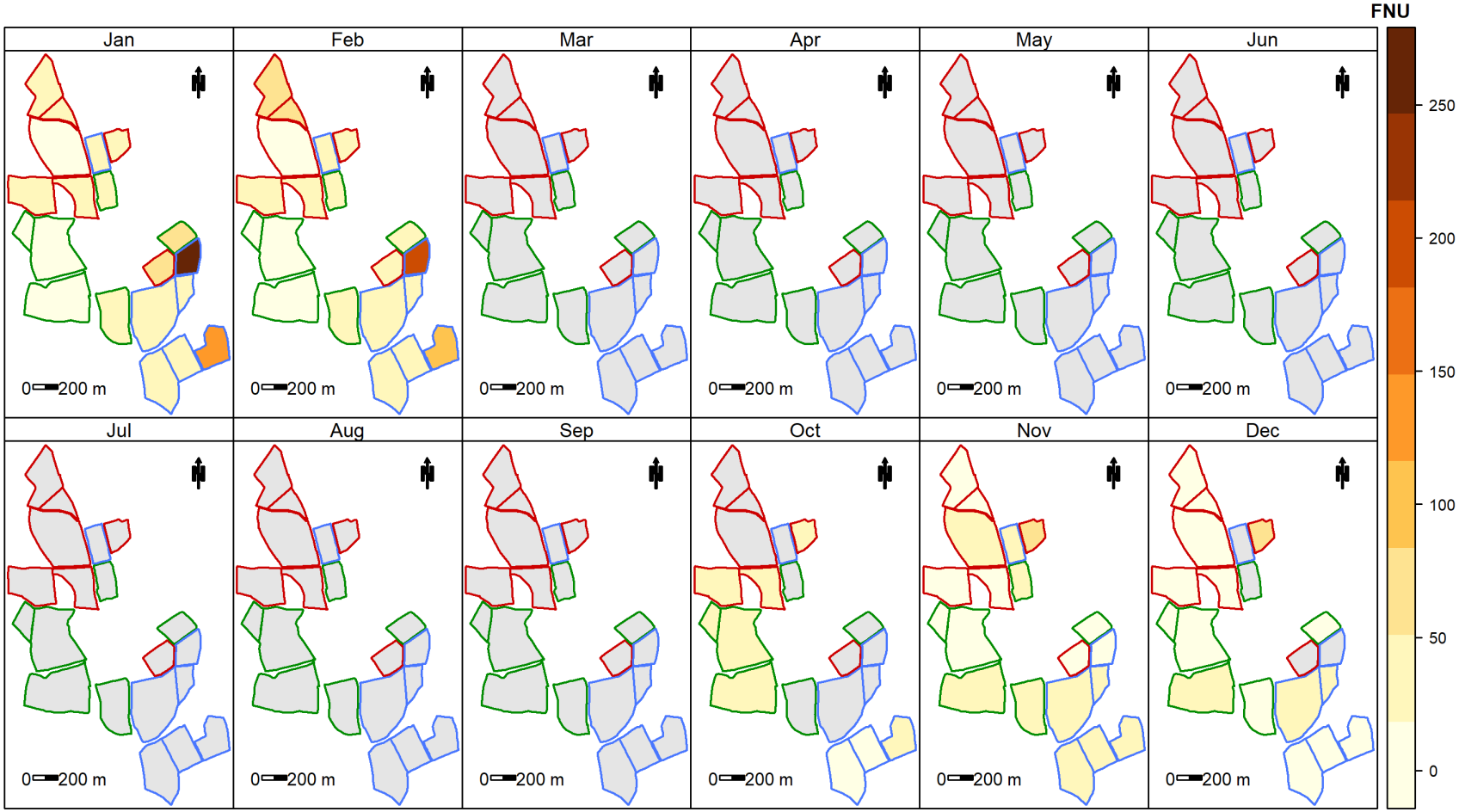


Figure 62: Mapped means for turbidity

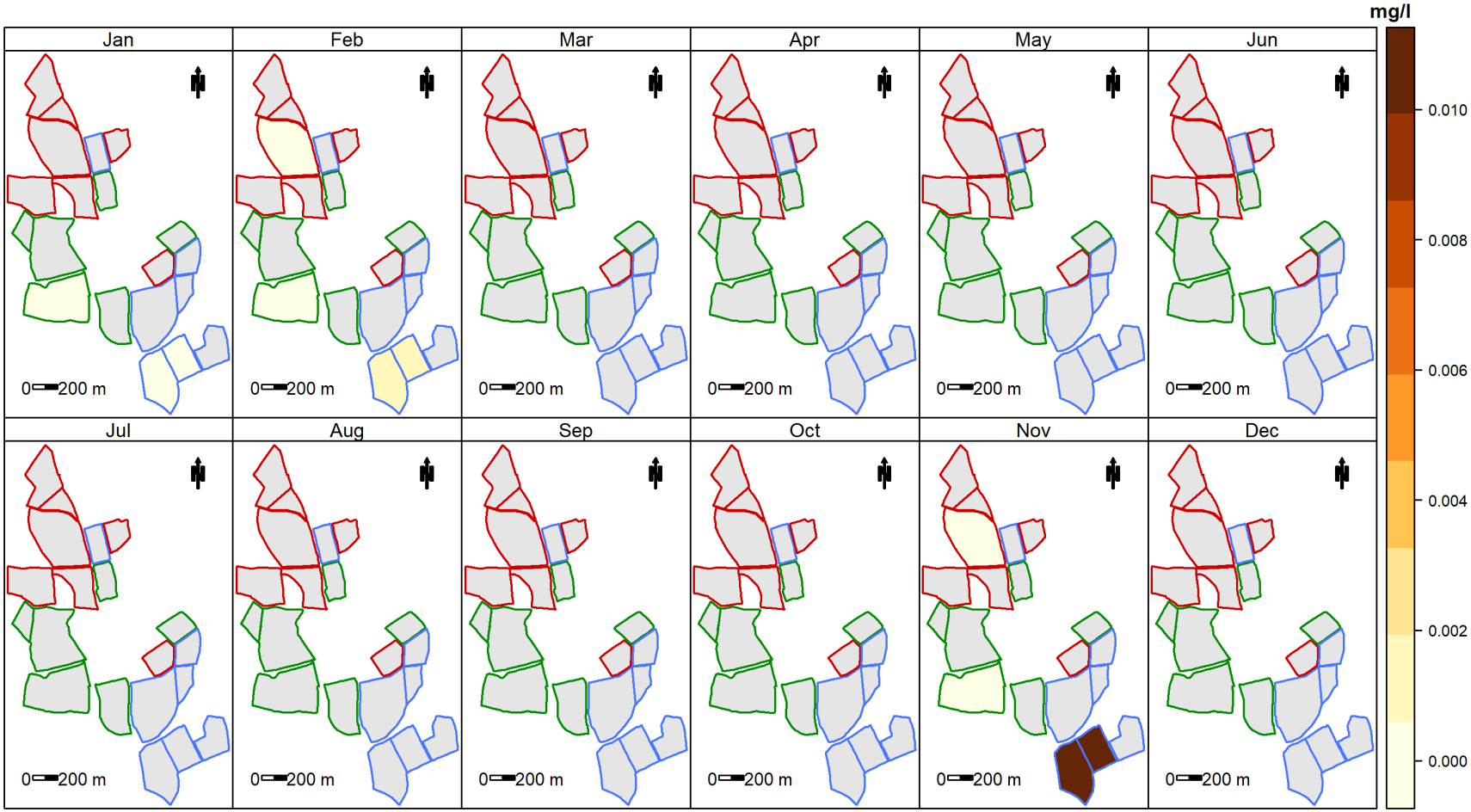


Figure 63: Mapped means for total phosphorus

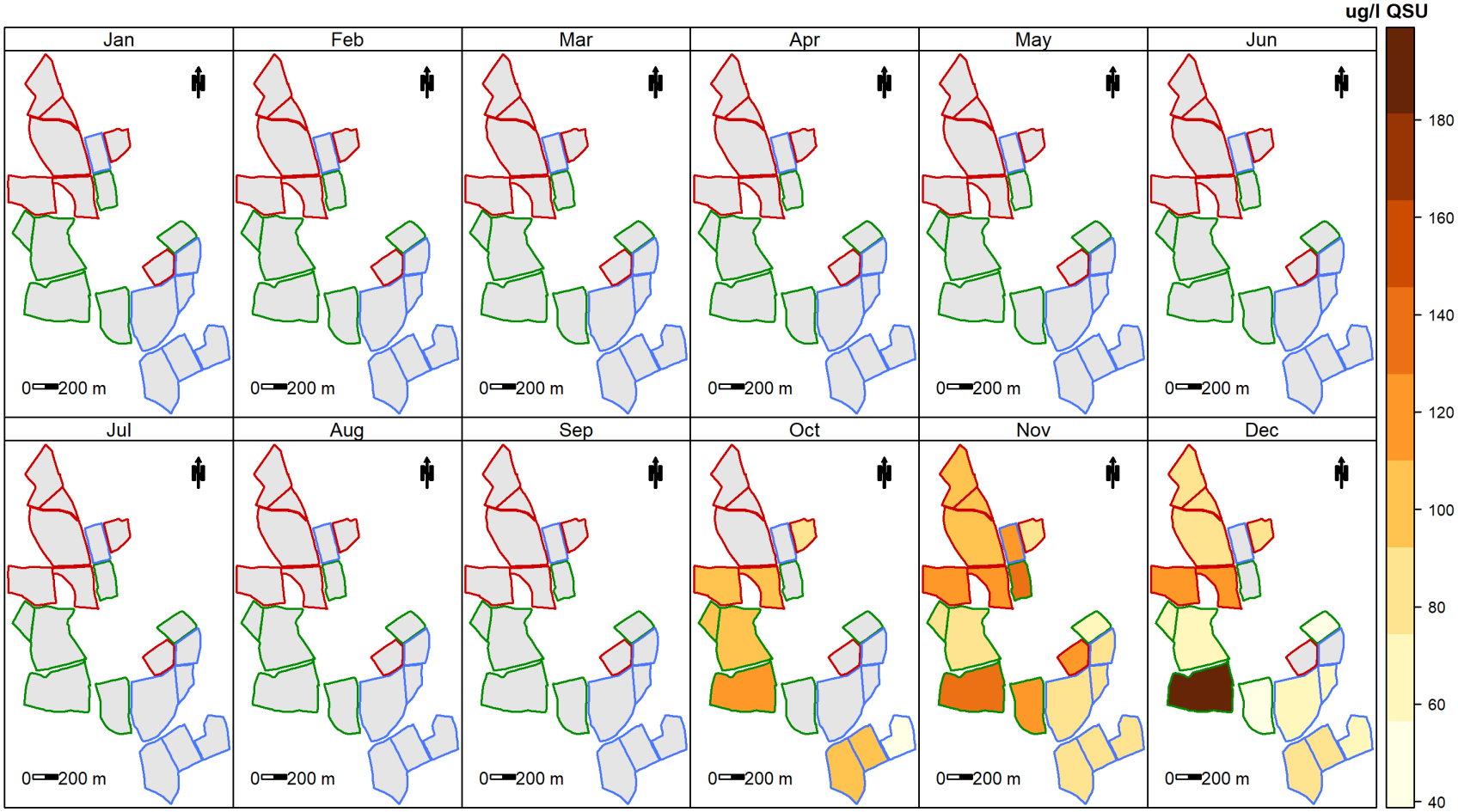


Figure 64: Mapped means for dissolved organic matter

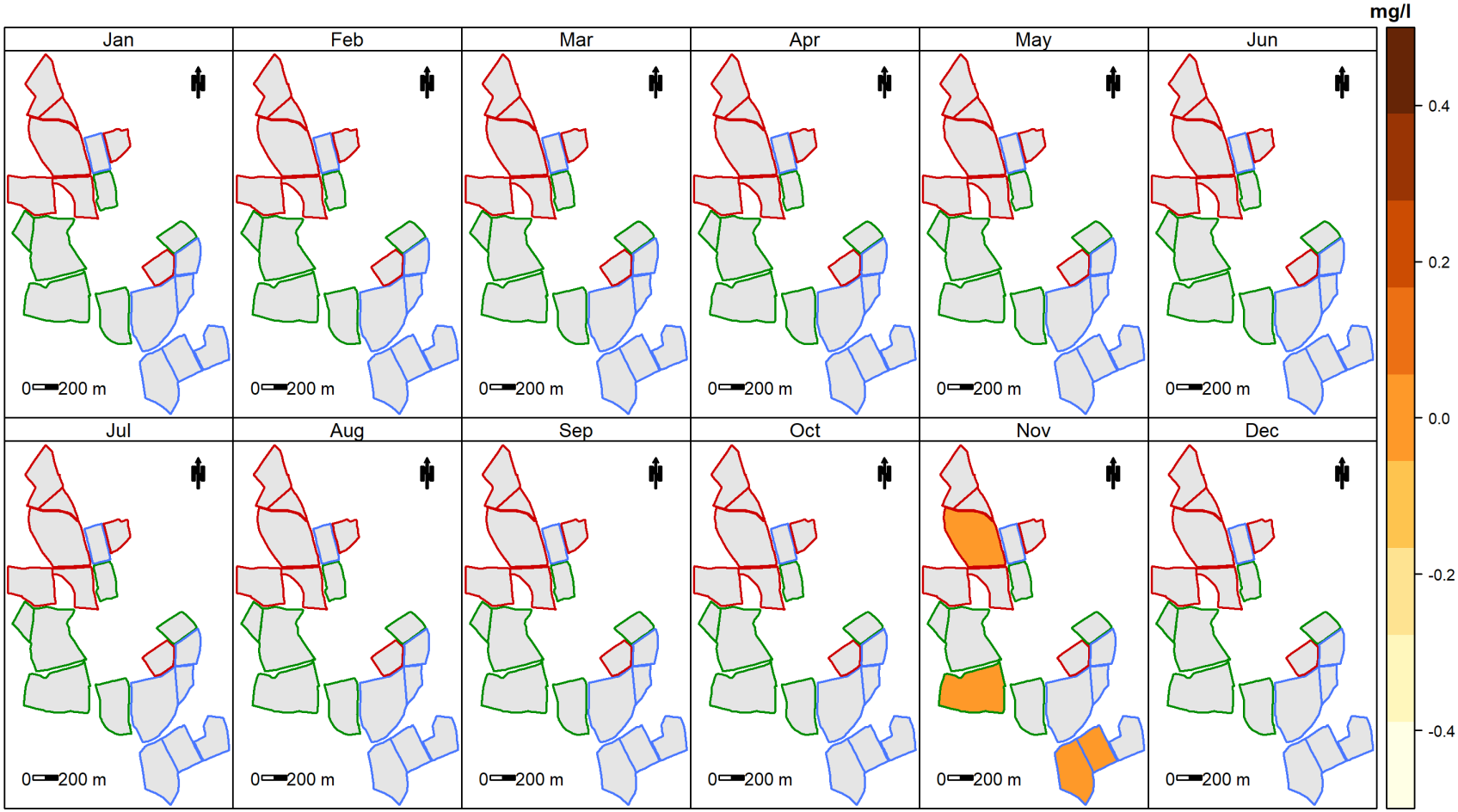


Figure 65: Mapped means for ortho-phosphorus

2.4 Chloropleth maps of standard deviations

Grey areas represent missing data

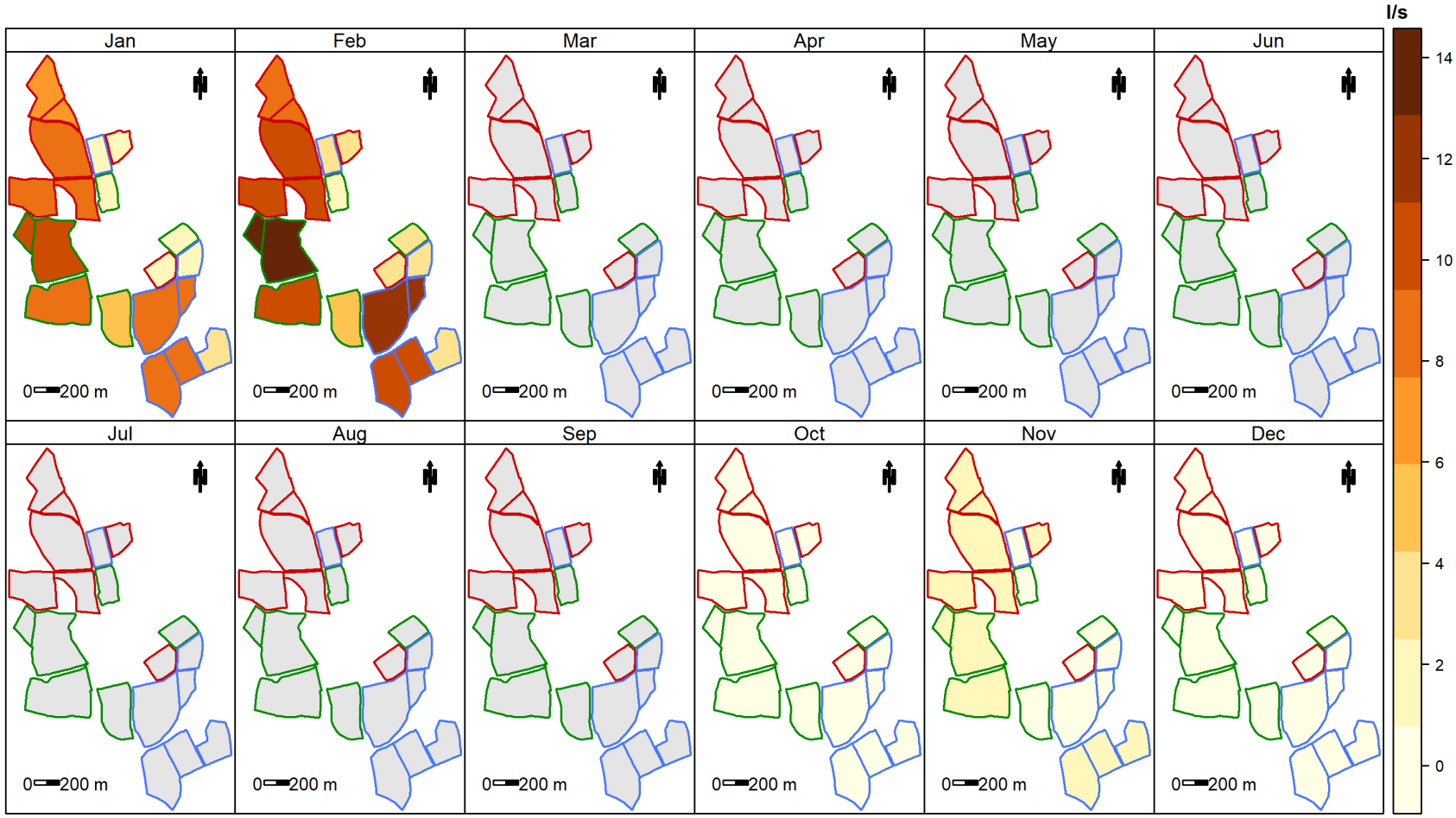


Figure 66: Mapped standard deviations for flow

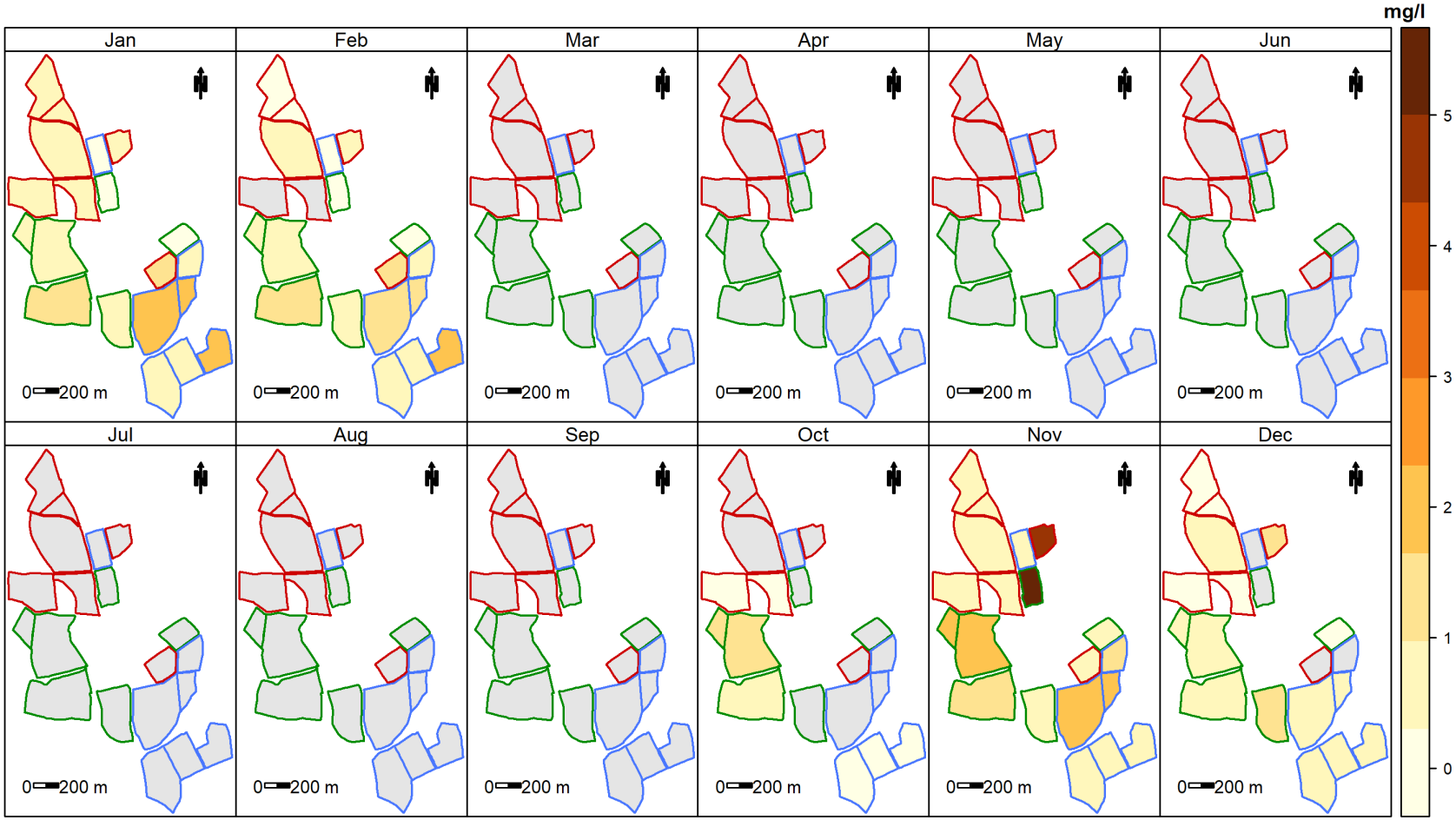


Figure 67: Mapped standard deviations for nitrate+nitrite

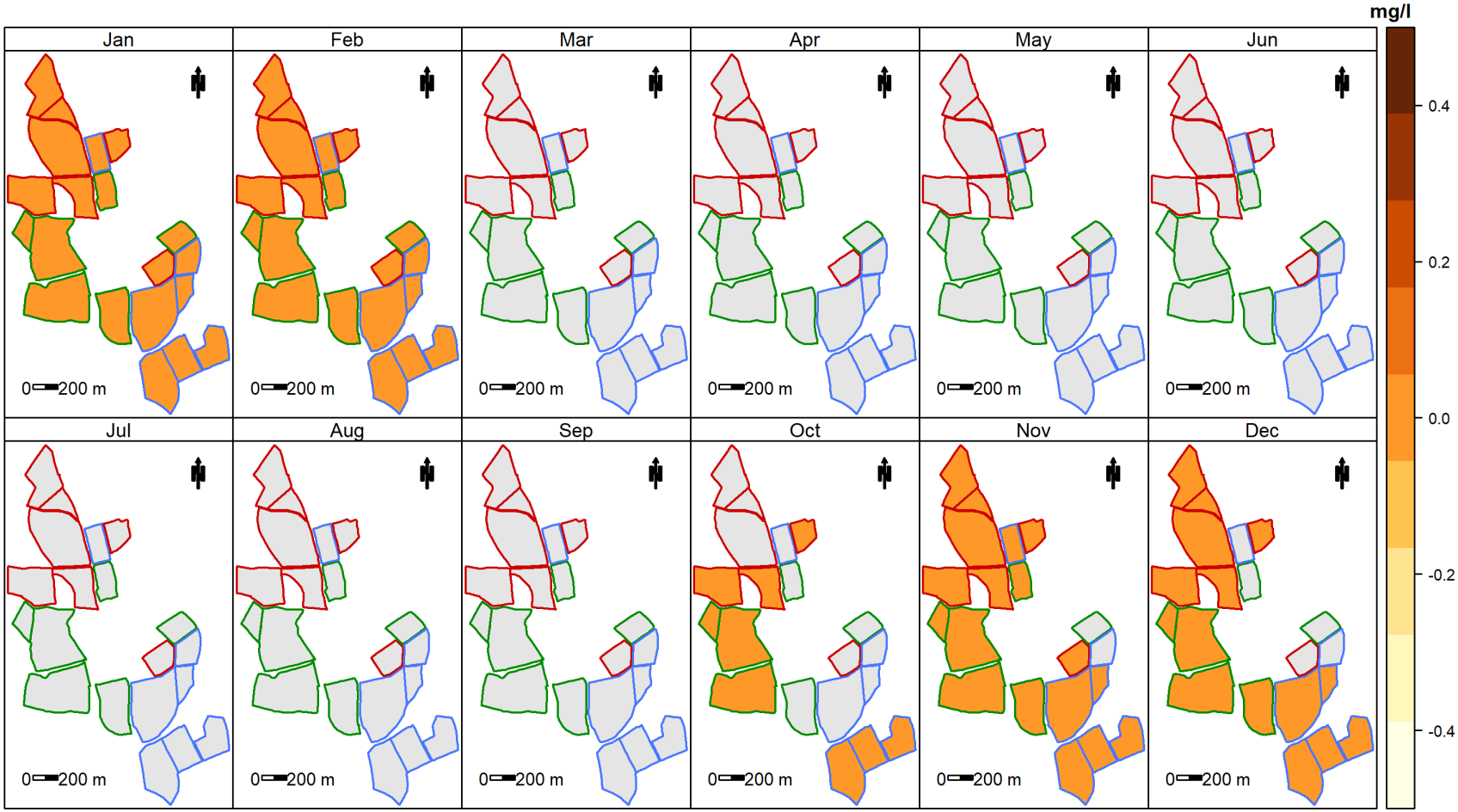


Figure 68: Mapped standard deviations for ammonia

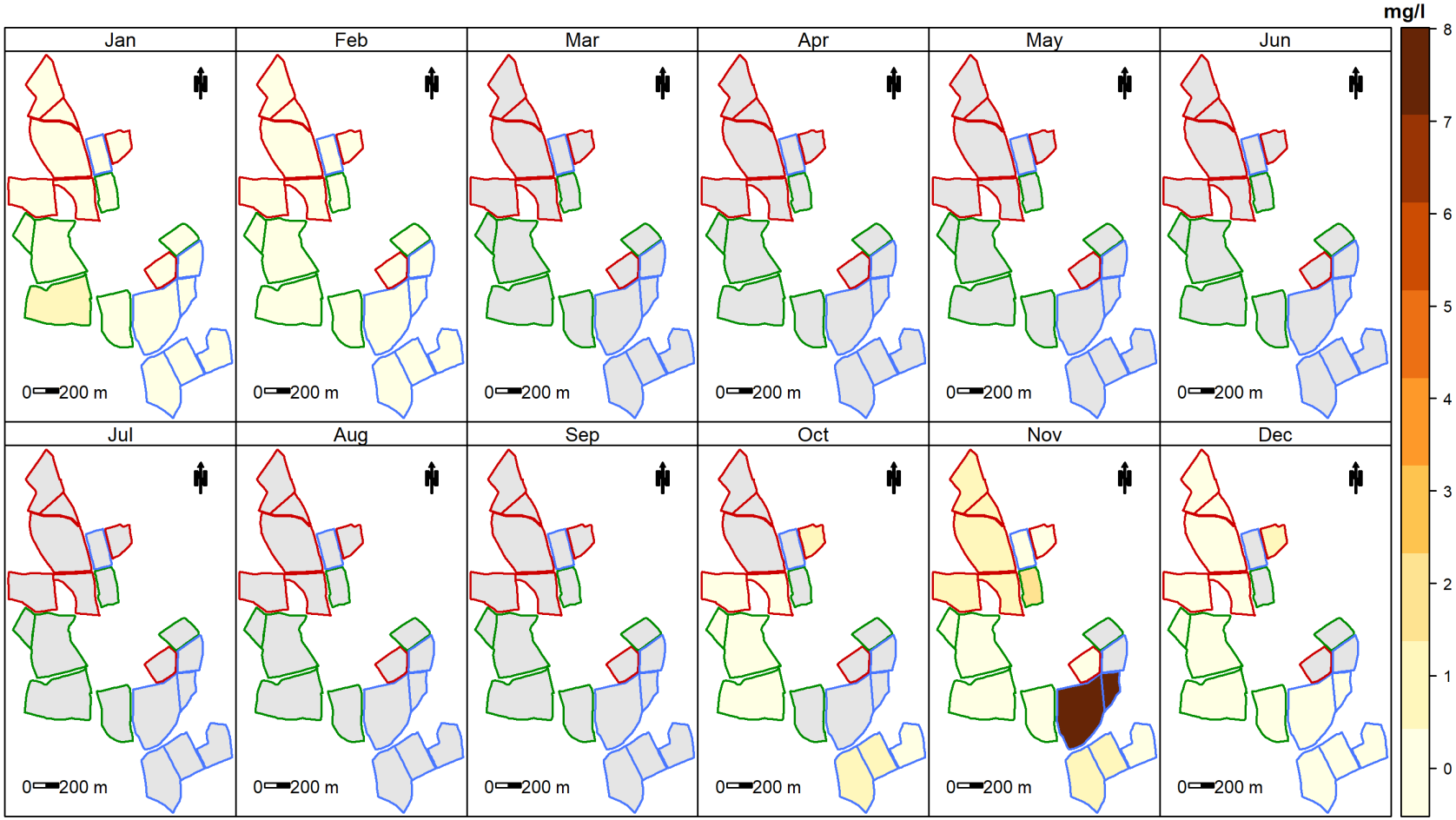


Figure 69: Mapped standard deviations for ammonium

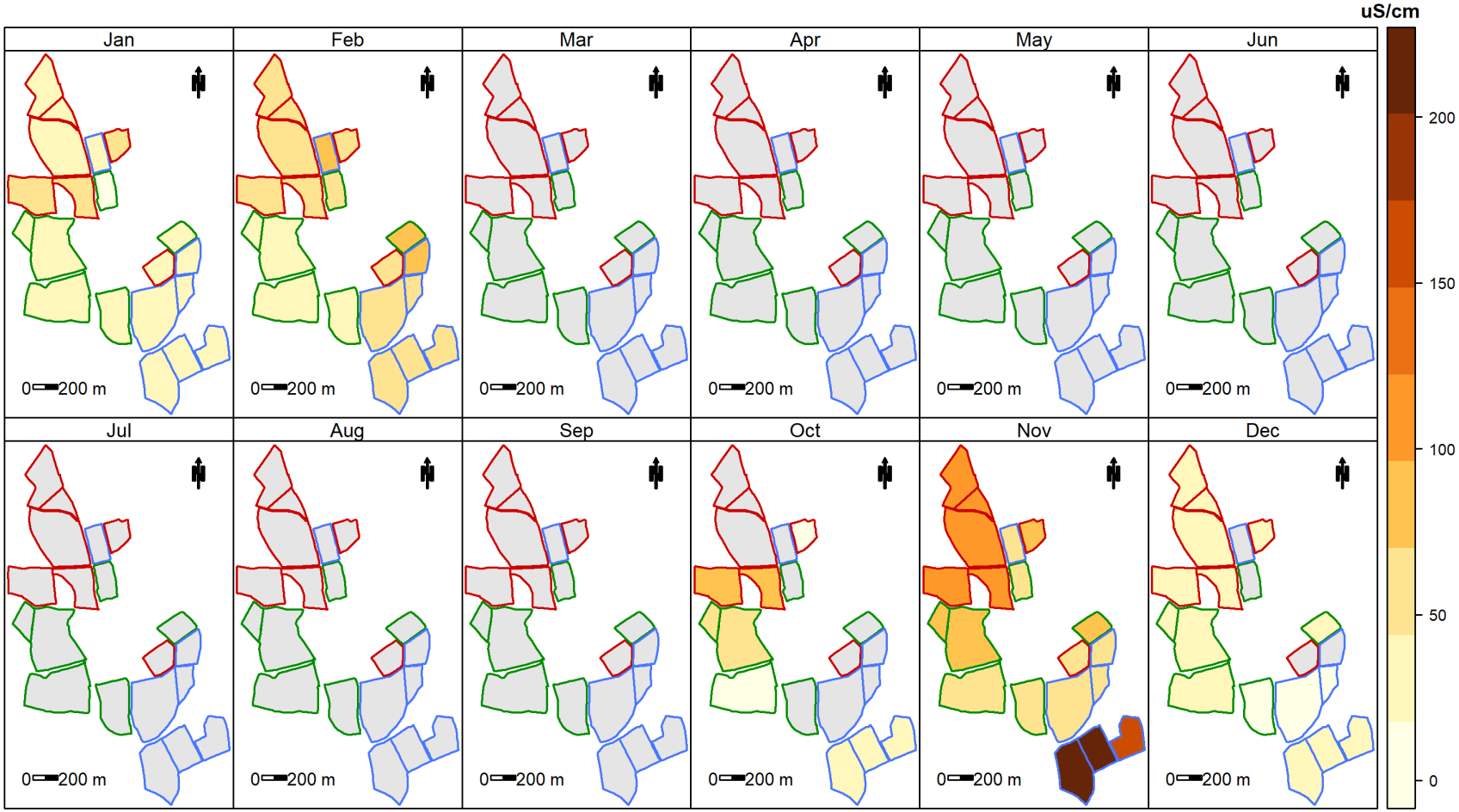


Figure 70: Mapped standard deviations for conductivity

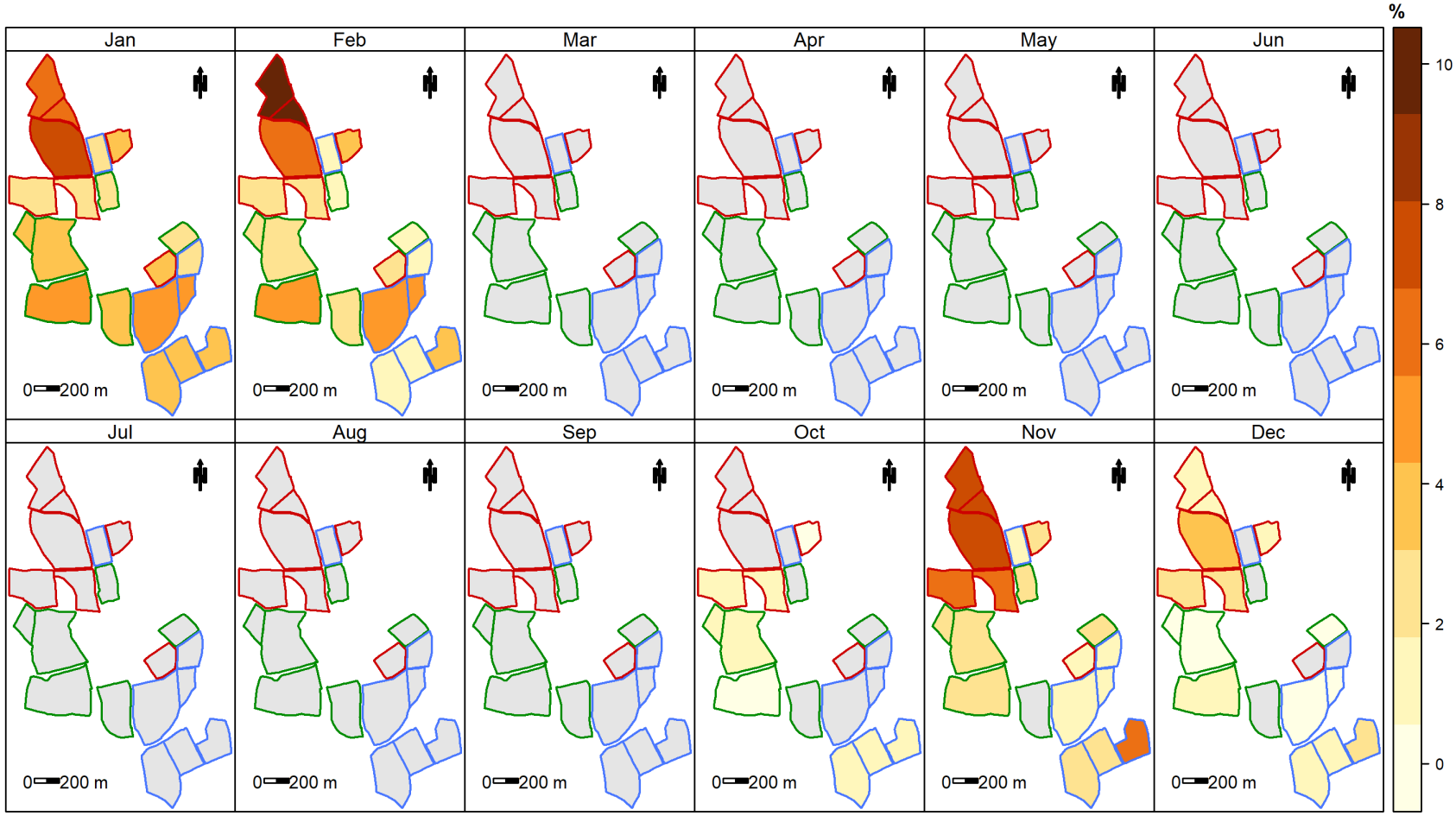


Figure 71: Mapped standard deviations for dissolved oxygen

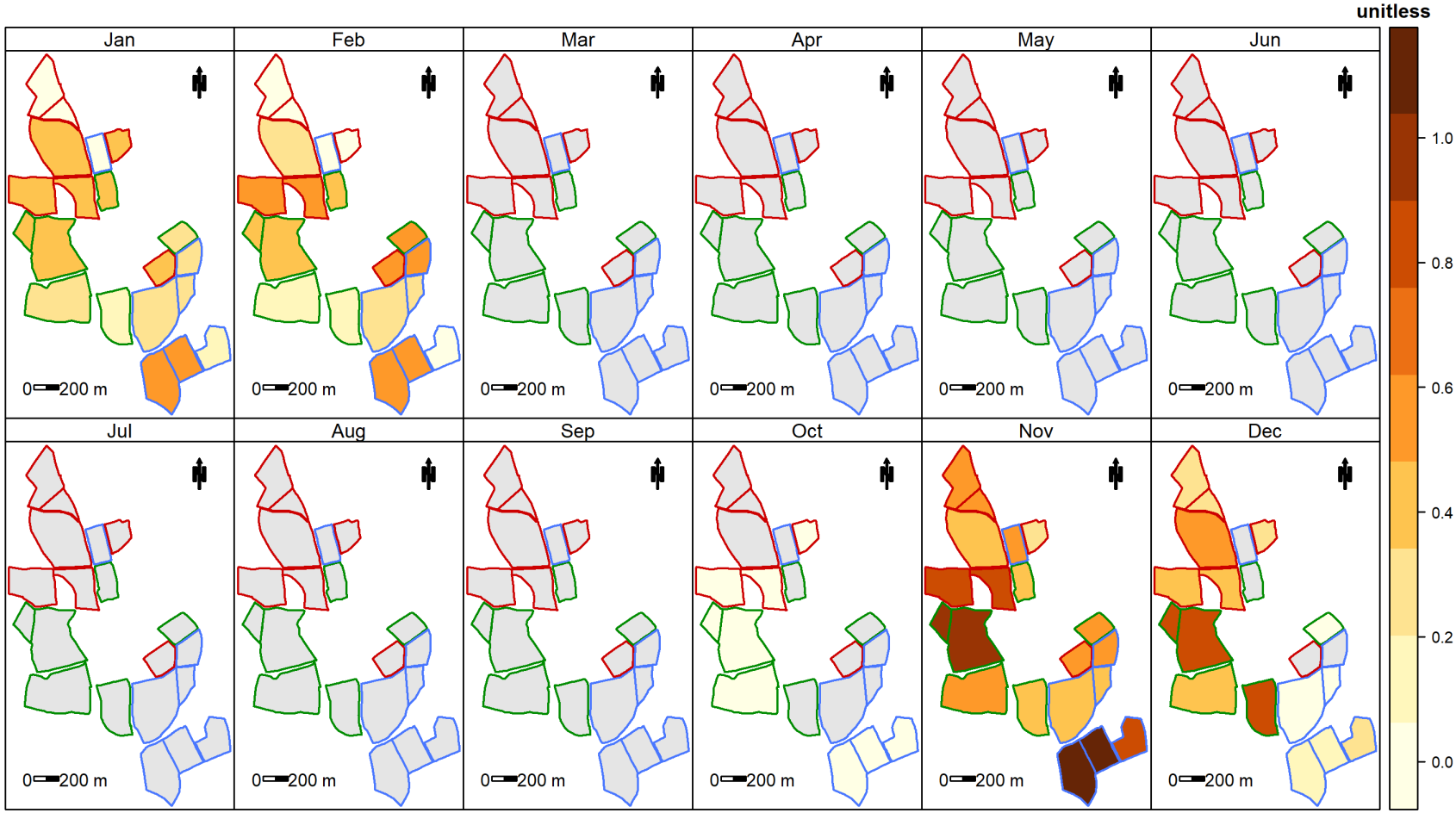


Figure 72: Mapped standard deviations for pH

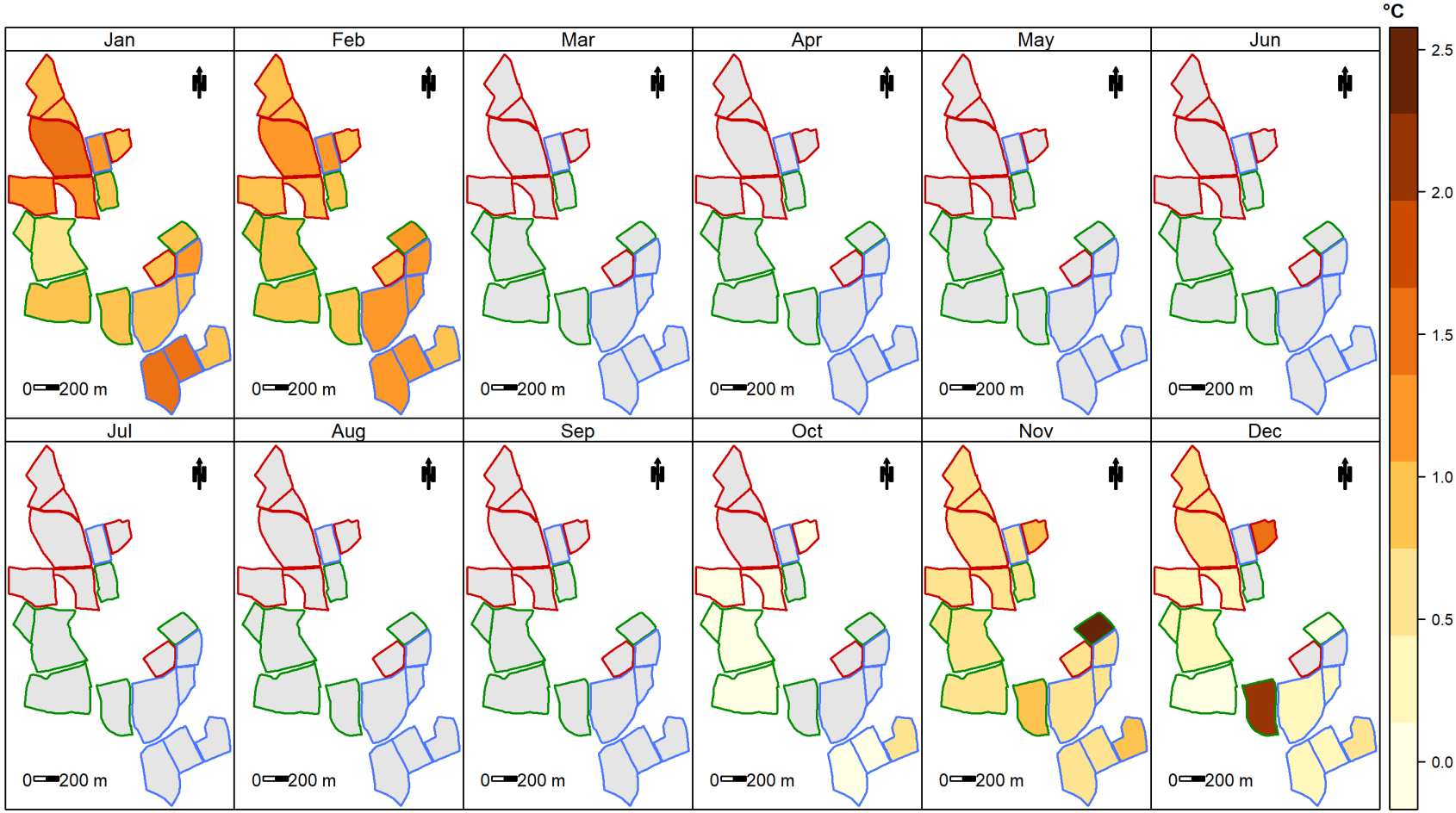


Figure 73: Mapped standard deviations for flow cell water temperature

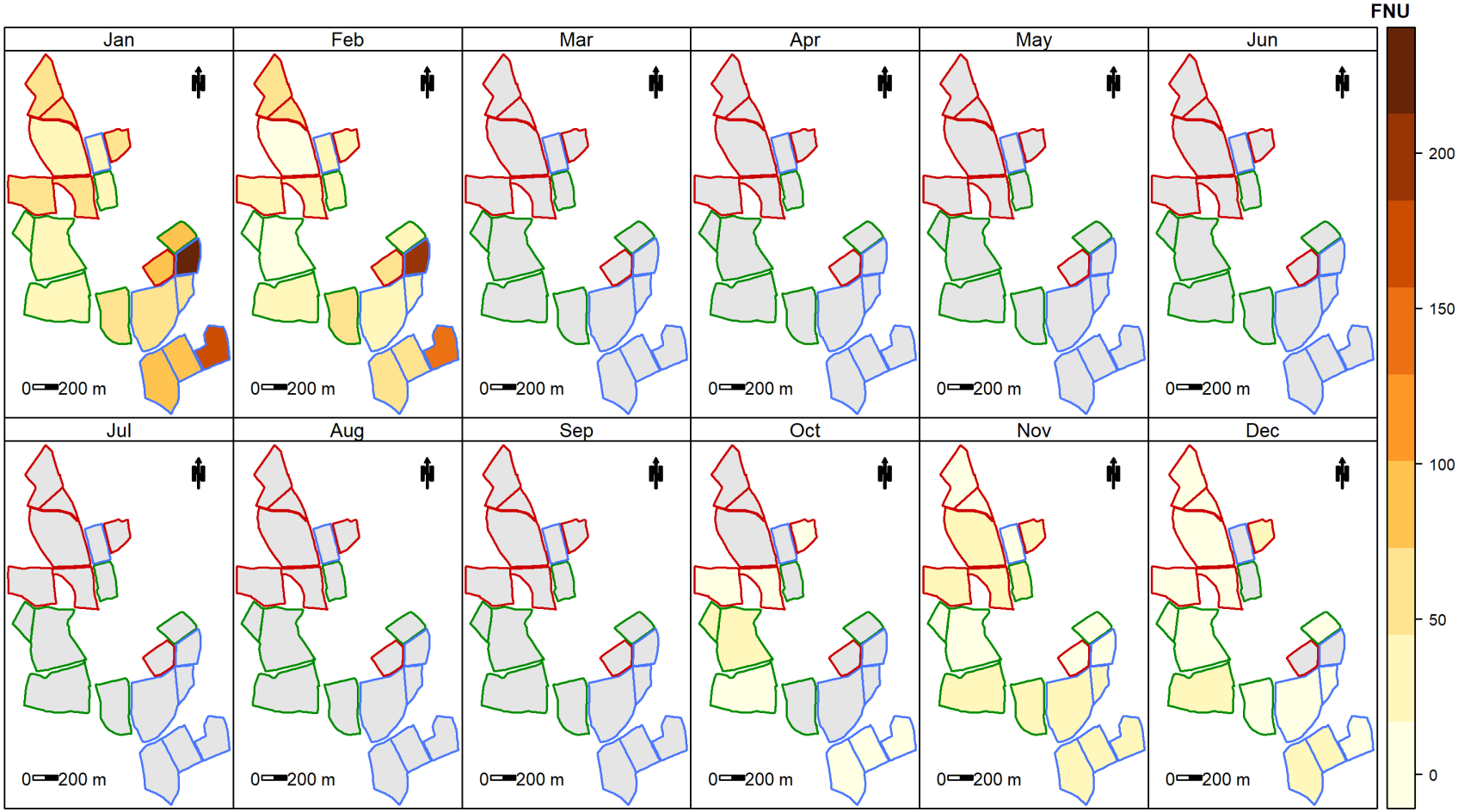


Figure 74: Mapped standard deviations for turbidity

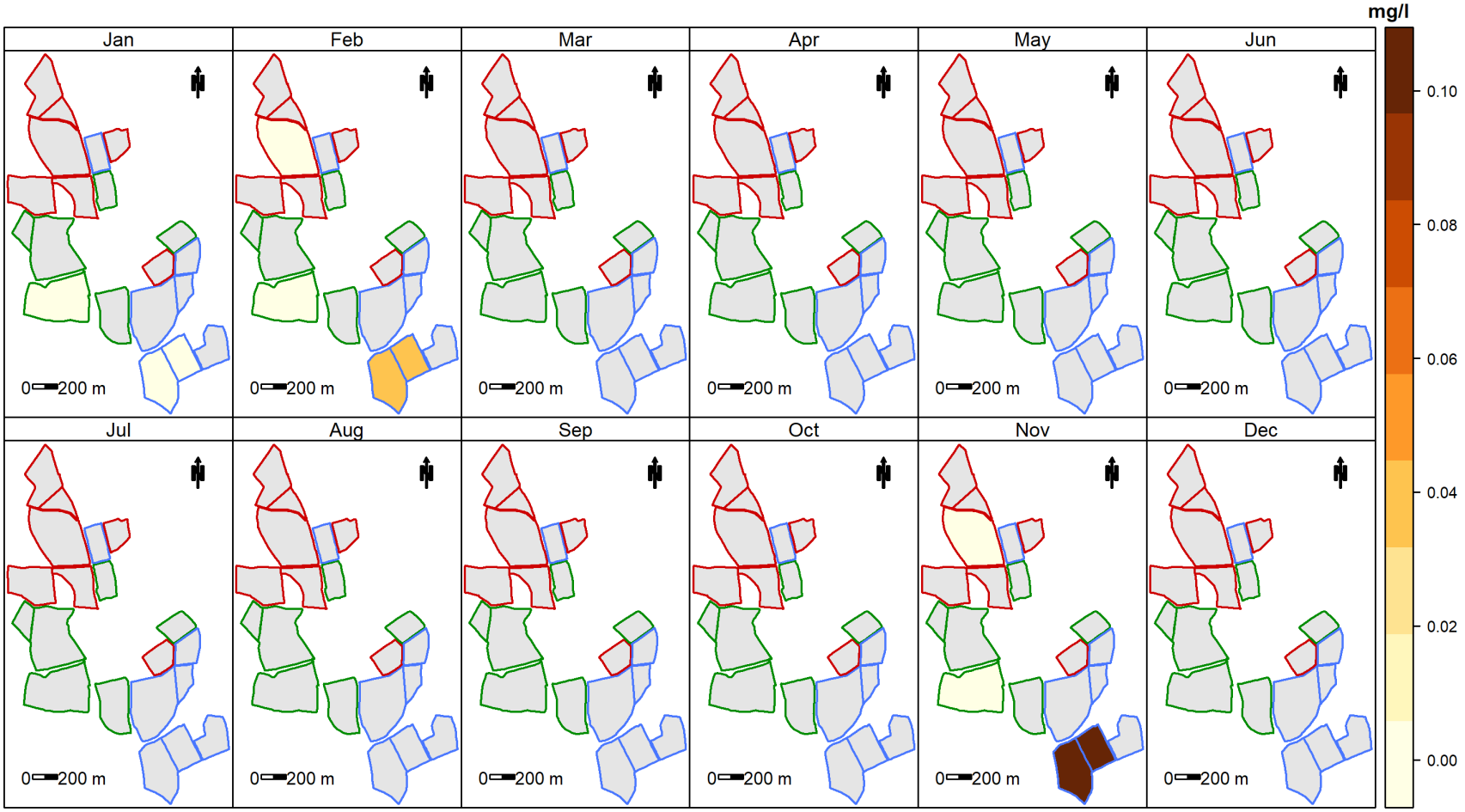


Figure 75: Mapped standard deviations for total phosphorus

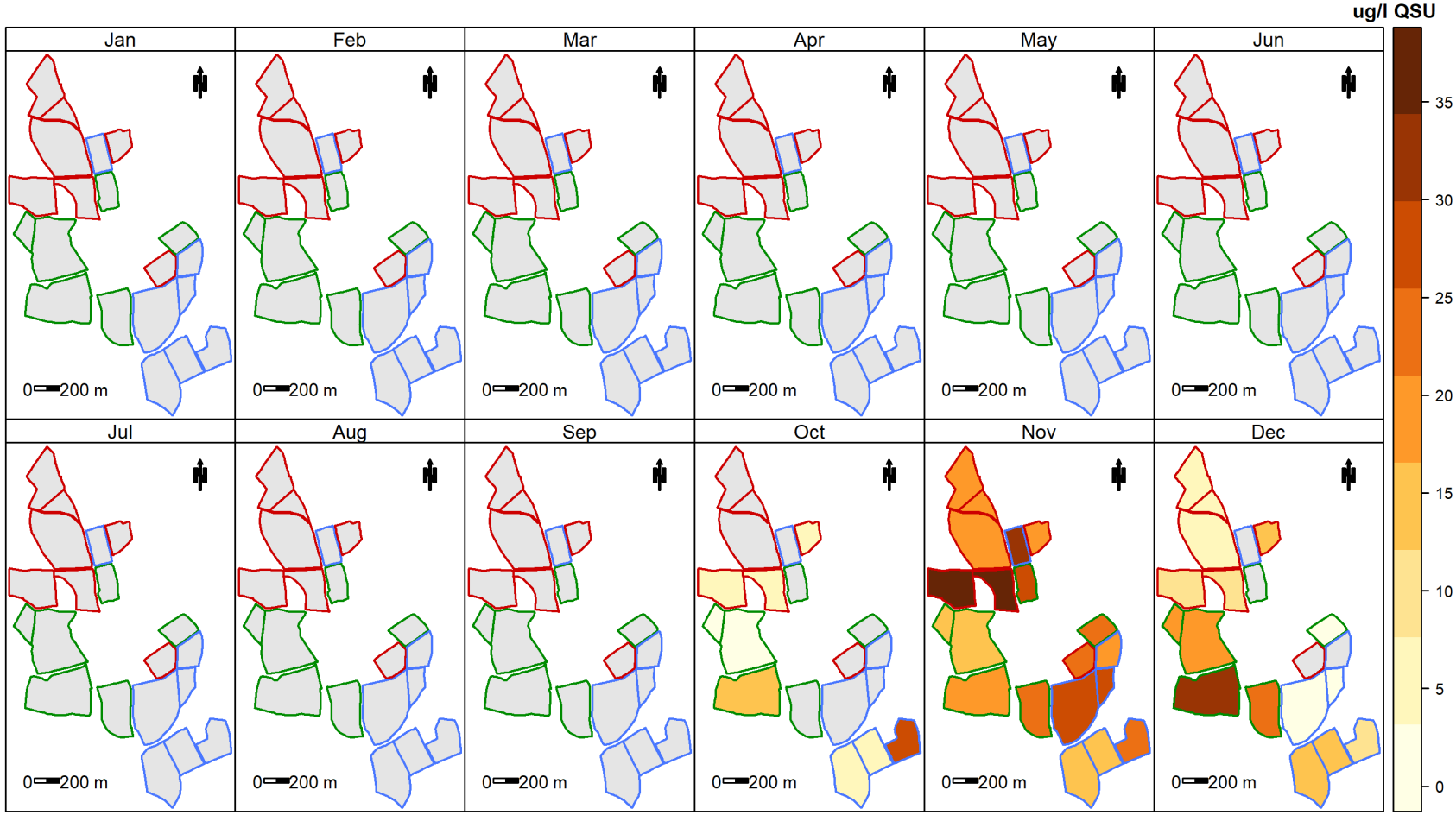


Figure 76: Mapped standard deviations for dissolved organic matter

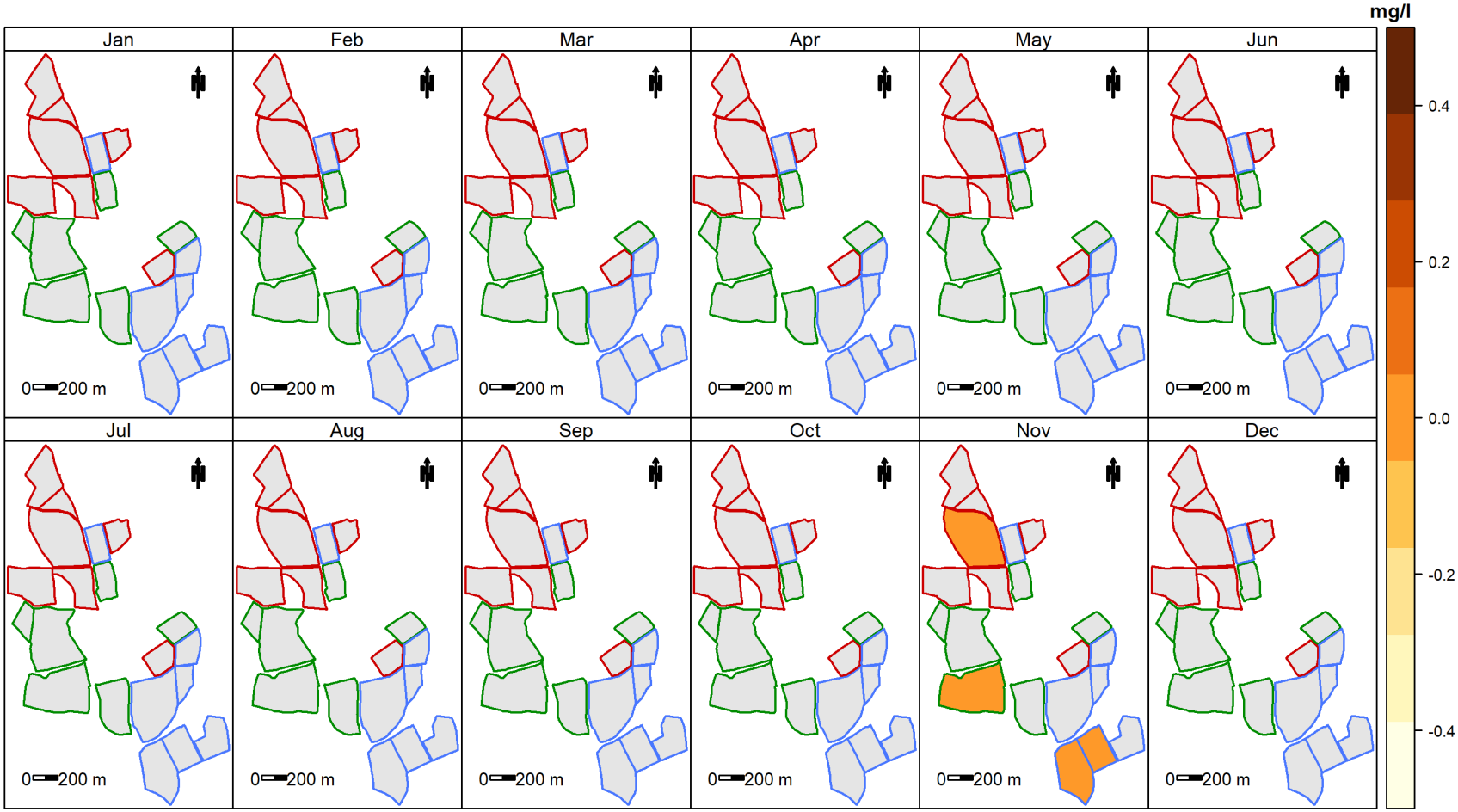


Figure 77: Mapped standard deviations for ortho-phosphorus

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	1.7	1.2	0.6	0.2	0.2	1.1	1.2	0.4	0.2	0.2	1.2	1.2	1.1	0.2	0.3
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	7.5	6.3	3.2	1.5	1.2	6.3	5.9	2.3	1.5	1.5	5.9	6.0	4.5	1.3	1.6
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	0.0	1.0	0.0	0.0
Coefficient of variation	l/s	4.4	5.1	5.7	8.1	7.4	5.7	4.9	5.5	7.4	6.2	5.0	5.2	4.1	7.0	5.8
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	146.0	137.0	65.0	38.0	29.0	130.0	133.0	51.0	38.0	32.0	123.0	138.0	94.0	29.0	35.0
Missing values	count	24173	24205	24106	24265	24109	24286	24068	24100	24410	24210	24404	24176	24327	24082	24189
Missing values as a %	%	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69

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	1.4	2.1	1.1	0.2	2.6	2.7	0.6	2.8	1.5	0.1	0.5	1.4	1.0	3.2	1.6
Median	mg/l	1.0	2.0	1.0	0.0	1.0	3.0	0.0	3.0	1.0	0.0	0.0	1.0	1.0	3.0	1.0
Standard deviation	mg/l	2.0	1.5	0.8	0.6	5.0	1.8	1.0	1.9	0.8	0.3	0.7	1.0	0.8	1.6	2.2
Inter-quartile range	mg/l	1.0	2.0	2.0	0.0	1.0	3.0	1.0	3.0	1.0	0.0	1.0	1.0	0.0	2.0	2.0
Coefficient of variation	mg/l	1.4	0.7	0.8	2.7	1.9	0.7	1.7	0.7	0.5	4.5	1.3	0.7	0.8	0.5	1.4
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	7.0	11.0	6.0	25.0	27.0	4.0	11.0	7.0	4.0	2.0	5.0	7.0	7.0	14.0
Missing values	count	30281	30293	31637	34174	33663	31033	31936	30416	33823	33550	31847	31952	31092	32368	31848
Missing values as a %	%	86	86	90	97	96	88	91	87	96	95	91	91	88	92	91

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	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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	0.1	0.7	0.0	0.0	0.9	1.9	0.5	0.1	0.0	0.0	0.2	0.3	0.2	0.1	0.2
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	10.5	29.4	61.7	NA	14.1	34.7	2.9	12.2	NA	41.0	7.1	8.8	19.1	18.7	8.9
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	1.0	34.0	1.0	0.0	32.0	94.0	3.0	1.0	0.0	1.0	4.0	4.0	4.0	1.0	2.0
Missing values	count	30233	31492	31333	34297	33723	31109	31834	30368	34056	33458	31562	29330	28773	32338	31743
Missing values as a %	%	86	90	89	98	96	89	91	86	97	95	90	83	82	92	90

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	219.8	196.0	168.2	142.6	175.4	228.6	229.6	225.5	194.9	166.9	230.0	320.2	271.0	253.7	215.2
Median	uS/cm	210.0	199.0	175.0	112.0	165.0	243.0	177.0	203.0	191.0	160.0	229.0	323.0	267.0	266.0	226.0
Standard deviation	uS/cm	63.3	38.7	30.9	76.7	52.3	50.9	183.4	96.3	68.4	50.6	65.8	88.4	59.4	47.2	58.4
Inter-quartile range	uS/cm	20.0	38.0	32.0	55.0	43.0	64.0	58.0	47.0	71.0	30.0	68.0	94.0	44.0	46.0	87.0
Coefficient of variation	uS/cm	0.3	0.2	0.2	0.5	0.3	0.2	0.8	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.3
Minimum	uS/cm	76.0	73.0	54.0	55.0	81.0	61.0	56.0	57.0	53.0	71.0	69.0	84.0	10.0	74.0	63.0
Maximum	uS/cm	1012.0	437.0	366.0	544.0	380.0	523.0	1431.0	676.0	623.0	605.0	1175.0	1056.0	1171.0	537.0	471.0
Missing values	count	30233	30244	31333	34146	33648	31108	31834	30367	33821	33458	31562	29330	28772	32338	31743
Missing values as a %	%	86	86	89	97	96	89	91	86	96	95	90	83	82	92	90

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	%	94.4	88.5	89.9	96.5	90.3	84.5	93.1	88.8	93.4	91.4	85.4	91.0	77.8	88.4	87.5
Median	%	95.0	90.0	91.0	96.0	89.0	83.0	94.0	88.0	93.0	91.0	86.0	92.0	76.0	90.0	88.0
Standard deviation	%	3.9	5.5	2.9	2.6	5.1	5.7	3.8	4.9	2.3	2.1	7.2	3.4	10.4	4.0	4.0
Inter-quartile range	%	6.0	9.0	5.0	4.0	6.0	8.0	7.0	6.0	4.0	3.0	9.0	3.0	20.0	7.0	5.0
Coefficient of variation	%	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
Minimum	%	86.0	75.0	85.0	93.0	84.0	74.0	85.0	81.0	89.0	79.0	60.0	75.0	45.0	81.0	77.0
Maximum	%	103.0	101.0	101.0	106.0	104.0	100.0	101.0	102.0	100.0	101.0	100.0	100.0	100.0	100.0	98.0
Missing values	count	30233	30244	31627	34146	33648	31108	31834	30367	33821	33597	31562	29330	28772	32338	31743
Missing values as a %	%	86	86	90	97	96	89	91	86	96	96	90	83	82	92	90

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	6.2	6.0	6.0	6.4	6.3	6.1	6.2	5.7	6.6	6.9	6.1	6.2	6.0	6.6	6.1
Median	unitless	6.0	6.0	6.0	7.0	6.0	6.0	6.0	6.0	7.0	7.0	6.0	6.0	6.0	7.0	6.0
Standard deviation	unitless	0.6	0.3	0.2	1.0	0.6	0.3	1.0	0.7	0.7	0.4	0.4	0.6	0.2	0.5	0.4
Inter-quartile range	unitless	1.0	0.0	0.0	1.0	1.0	0.0	1.0	0.0	1.0	0.0	0.0	1.0	0.0	1.0	0.0
Coefficient of variation	unitless	0.1	0.1	0.0	0.2	0.1	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Minimum	unitless	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Maximum	unitless	7.0	7.0	7.0	7.0	7.0	8.0	7.0	7.0	8.0	8.0	7.0	7.0	6.0	8.0	7.0
Missing values	count	30233	31499	31333	34146	33648	31108	31834	30367	33821	33458	31562	29330	28772	32338	31743
Missing values as a %	%	86	90	89	97	96	89	91	86	96	95	90	83	82	92	90

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	7.7	7.6	7.8	7.4	7.4	7.5	7.0	7.5	7.1	7.0	7.2	7.7	7.9	7.5	7.5
Median	°C	8.0	8.0	8.0	8.0	8.0	8.0	7.0	8.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0
Standard deviation	°C	0.9	0.9	0.9	1.3	0.9	1.1	1.4	1.2	1.3	1.3	1.5	1.2	1.0	1.1	1.1
Inter-quartile range	°C	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0
Coefficient of variation	°C	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Minimum	°C	5.0	5.0	3.0	2.0	5.0	3.0	2.0	4.0	4.0	4.0	2.0	3.0	4.0	4.0	2.0
Maximum	°C	11.0	10.0	9.0	9.0	9.0	9.0	11.0	11.0	10.0	10.0	10.0	11.0	10.0	10.0	11.0
Missing values	count	30233	30244	31333	34146	33648	31108	31834	30367	33821	33458	31562	29330	28772	32338	31743
Missing values as a %	%	86	86	89	97	96	89	91	86	96	95	90	83	82	92	90

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	7.9	18.6	23.8	43.5	42.6	25.3	36.9	93.4	195.0	39.7	16.0	19.5	33.5	43.6	30.3
Median	FNU	3.0	10.0	10.0	30.0	40.0	9.0	19.0	40.0	106.0	32.0	9.0	8.0	15.0	17.0	17.0
Standard deviation	FNU	16.7	35.9	54.6	63.1	26.6	56.5	65.4	141.8	218.2	34.2	27.5	44.2	58.2	76.4	44.1
Inter-quartile range	FNU	7.2	13.0	18.0	22.0	19.0	20.0	26.0	84.0	222.8	21.0	11.0	16.0	29.0	35.0	33.0
Coefficient of variation	FNU	2.1	1.9	2.3	1.5	0.6	2.2	1.8	1.5	1.1	0.9	1.7	2.3	1.7	1.8	1.5
Minimum	FNU	0.0	2.0	0.0	3.0	15.0	0.0	0.0	4.0	4.0	5.0	0.0	0.0	0.0	2.0	0.0
Maximum	FNU	523.0	841.0	856.0	807.0	302.0	968.0	884.0	999.0	991.0	458.0	527.0	964.0	991.0	878.0	922.0
Missing values	count	30275	30244	31337	34149	33648	31113	31875	30446	33923	33458	31562	29342	28777	32345	31744
Missing values as a %	%	86	86	89	97	96	89	91	87	97	95	90	84	82	92	90

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	0.0	NA	NA	NA	NA
Median	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Standard deviation	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Inter-quartile range	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Coefficient of variation	mg/l	NA	NA	NA	NA	NA	NA	31.9	NA	NA	NA	NA	NA	NA	NA	NA
Minimum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Maximum	mg/l	NA	0.0	NA	NA	NA	NA	1.0	NA	NA	NA	0.0	NA	NA	NA	NA
Missing values	count	35135	31739	35135	35135	35135	35135	31061	35135	35135	35135	33922	35135	35135	35135	35135
Missing values as a %	%	100	90	100	100	100	100	88	100	100	100	97	100	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	71.8	139.6	114.4	59.4	131.1	91.7	90.7	74.6	76.7	113.7	96.9	118.2	90.0	116.8	88.2
Median	ug/l QSU	70.0	138.0	116.5	54.0	143.0	97.0	90.0	74.5	71.0	123.0	94.0	122.0	84.0	121.0	88.0
Standard deviation	ug/l QSU	17.6	24.8	29.8	24.5	27.0	27.0	15.9	22.1	18.3	32.5	18.9	28.2	19.4	23.1	16.5
Inter-quartile range	ug/l QSU	14.2	28.0	40.0	35.0	23.0	47.0	21.0	31.0	27.0	34.0	31.0	21.0	21.0	44.0	28.0
Coefficient of variation	ug/l QSU	0.2	0.2	0.3	0.4	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2
Minimum	ug/l QSU	0.0	68.0	21.0	25.0	14.0	29.0	28.0	0.0	34.0	1.0	38.0	0.0	15.0	78.0	39.0
Maximum	ug/l QSU	127.0	211.0	158.0	113.0	154.0	167.0	121.0	115.0	109.0	145.0	129.0	179.0	140.0	150.0	108.0
Missing values	count	34211	34473	34841	34984	34887	34860	34533	33887	34900	34960	34440	33626	32745	34954	34816
Missing values as a %	%	97	98	99	100	99	99	98	96	99	100	98	96	93	99	99

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	0.0	NA	NA	NA	NA
Median	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Standard deviation	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Inter-quartile range	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	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	0.0	NA	NA	NA	NA
Maximum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Missing values	count	35135	34948	35135	35135	35135	35135	34945	35135	35135	35135	34930	35135	35135	35135	35135
Missing values as a %	%	100	99	100	100	100	100	99	100	100	100	99	100	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