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Accurate and precise quantification of atmospheric nitrate in streams draining land of various uses by using triple oxygen isotopes as tracers

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Table S1 Geographical characteristics of inflows and a outflow sampled in this study.

No.*	Name	Location*	Basin Area* (km^2)	Population Density* (km^{-2})	Agricultural Land* (%)	Forest* (%)	Residential* (%)
Inflow							
31	Tenjin	West	9.8	539	28.4	54.7	7.3
30	Mano	West	23.2	1048	28.8	42.8	15.6
29	Wani	West	17.2	186	16.1	65.9	5.4
28	U	West	7.0	66	6.0	89.1	0.8
1	Kamo	West	46.5	89	18.6	74.8	1.2
2	Ado	West	306.1	27	3.7	91.5	0.7
3	Ishida	North	59.9	84	10.5	81.1	2.0
4	Momose	North	13.1	65	4.4	87.7	0.6
5	Chinai	North	51.3	44	11.3	80.1	1.8
6	Ohura	North	39.2	98	12.9	78.5	2.7
7	Oh	North	20.2	55	7.0	86.9	1.6
8	Yogo	North	6.5	141	13.6	77.6	3.4
9	Chonoki	North	10.2	412	79.9	0.1	13.5
10	Ta	North	36.0	301	48.8	37.1	9.6
11	Ane	North	372.3	61	7.0	88.2	1.7
12	Yone	North	15.2	2047	56.1	0.8	34.5
13	Amano	North	110.9	226	21.0	66.3	5.8
14	Seri	East	73.9	462	7.9	75.2	8.1
15	Inukami	East	101.6	109	7.6	82.2	2.8
16	Ajiki	East	14.9	1002	70.9	1.1	20.1
17	Uso	East	83.7	411	52.7	28.6	11.0
18	Bunroku	East	14.0	595	68.0	15.7	11.7
19	Nomazu	East	7.2	758	66.7	3.6	20.2
20	Echi	East	211.1	110	11.1	78.0	2.5
27	Hino	South	225.9	338	33.4	44.3	8.4
26	Yanomune	South	41.8	859	53.7	19.5	15.7
25	Yasu	South	391.2	324	22.5	57.7	6.5
24	Yamaga	South	5.7	2540	54.7	1.2	33.7
23	Sakai	South	2.3	979	69.3	0.0	27.7
22	Hayama	South	33.7	2048	44.3	7.5	29.7
34	Kusatsu	South	48.3	370	32.6	14.1	30.6
21	Nagaso	South	3.7	3174	20.8	20.6	31.4
32	Fujinoki	South	3.9	1805	16.7	49.1	20.8
Outflow							
33	Seta	South	3848	323	17	59	14

*Data source: Ohte et al. (2010) and the references cited in the paper.

Table S2 Concentrations and stable isotopic compositions of nitrate in the wet deposition samples, together with the stable oxygen isotopic compositions ($\delta^{18}O$) of H_2O and the daily precipitaion when each of the samples was taken.

Date	Precipitation mm	$\delta^{18}O(H_2O)$ ‰	NO_3^- μmol L^{-1}	$\delta^{15}N$ ‰	$\delta^{18}O$ ‰	$\Delta^{17}O$ ‰
2009.4.14	8.0	-6.9	28.4	-6.0	+84.0	+28.7
2009.4.15	1.5	–	54.2	-6.6	+80.5	+25.5
2009.4.21	7.5	-4.8	17.1	-6.7	+79.7	+27.2
2009.4.25	9.0	-9.1	23.3	-5.6	+84.6	+28.0
2009.6.10	22.0	-7.0	20.9	-6.1	+77.3	+25.2
2009.6.11	1.5	-6.2	46.4	-4.1	+77.6	+23.6
2009.6.20	25.5	-8.8	10.5	-7.7	+80.1	+21.4
2009.6.22	26.5	-10.2	6.8	-1.8	+64.1	+22.8
2009.6.29	5.5	-10.3	10.7	-6.5	+73.0	+23.6
2009.6.30	9.5	-8.6	16.1	-7.1	+73.6	+25.9
2009.7.1	8.0	-6.8	11.5	-7.5	+71.8	+23.4
2009.7.6	0.5	-6.7	32.8	-8.0	+72.6	+23.0
2009.7.7	11.0	-5.4	11.5	-3.4	+73.3	+24.4
2009.7.8	21.5	–	5.2	-9.3	+69.4	+25.3
2009.7.9	24.5	-9.9	9.6	-6.1	+65.3	+21.7
2009.7.12	18.5	-5.7	18.6	-6.7	+69.5	+23.3
2009.7.17	7.0	-8.6	24.9	-4.8	+70.0	+22.0
2009.7.18	17.5	-7.9	18.9	-4.8	+63.0	+20.8
2009.7.19	15.5	-7.9	7.3	-5.8	+62.2	+20.2
2009.7.24	2.5	-6.3	46.9	-8.1	+68.8	+21.4
2009.7.26	9.5	-8.1	11.6	-7.3	+65.5	+22.2
2009.7.27	9.0	-10.4	11.0	-5.7	+69.4	+23.5
2009.7.28	1.5	-7.3	51.9	-5.6	+74.2	+23.7
2009.7.29	49.0	-9.1	7.5	-6.8	+67.3	+19.2
2009.7.31	1.0	-4.5	82.8	-4.0	+66.8	+21.8
2009.8.1	2.0	-6.0	53.7	-5.7	+69.0	+21.6
2009.8.2	8.0	-6.7	21.4	-7.2	+68.4	+22.9
2009.8.6	3.5	-7.5	33.3	-7.8	+66.4	+21.1
2009.8.7	6.5	-8.5	8.2	-9.6	+66.6	+20.4
2009.8.9	10.0	-10.8	8.1	-7.6	+66.9	+20.3
2009.8.12	5.0	-5.5	13.3	-5.4	+65.2	+18.7
2009.8.13	1.0	-2.4	57.3	-3.1	+63.3	+20.1
2009.8.20	1.5	-2.4	54.9	-3.2	+72.7	+21.8
2009.8.21	2.5	-2.5	52.1	-2.7	+68.4	+20.9
2009.8.28	15.5	-5.4	13.5	-5.8	+70.6	+21.7
2009.8.31	6.0	-7.5	7.4	-5.6	+73.8	+25.6
2009.9.11	1.0	-2.2	39.0	-5.8	+73.8	+24.9
2009.9.21	3.0	-2.2	30.5	-2.7	+73.4	+24.0
2009.9.23	4.0	-2.3	19.7	-6.5	+72.4	+24.3
2009.9.28	5.5	-2.0	32.1	-6.6	+71.9	+23.8
2009.10.4	5.0	-3.3	60.6	-3.3	+79.2	+27.3
2009.10.7	24.0	-11.3	1.6	-4.4	+69.9	+22.7
2009.10.9	7.5	-6.4	3.5	-5.5	+68.8	+23.9
2009.10.13	4.0	-6.4	9.0	-5.3	+79.9	+25.3
2009.10.19	6.5	-5.3	49.0	-3.1	+81.6	+25.8
2009.10.26	4.5	-14.8	14.4	-3.5	+80.5	+27.7
2009.10.31	1.0	-3.9	41.6	-4.7	+79.5	+24.7
2009.11.1	21.5	-8.0	9.5	-7.2	+78.8	+25.1
2009.11.2	9.0	-7.3	6.0	-6.1	+75.2	+26.6
2009.11.9	4.5	-3.9	46.4	-4.6	+81.9	+26.4
2009.11.10	10.5	-6.2	10.5	-6.8	+78.0	+25.3
2009.11.25	11.0	-6.3	20.5	-2.6	+76.1	+26.6
2009.11.28	4.0	-4.7	31.5	-1.9	+85.9	+29.2
2009.12.3	5.5	-6.8	21.3	-7.2	+82.4	+28.1
2009.12.5	9.0	-4.9	54.3	+1.1	+95.8	+29.5
2009.12.11	3.0	-14.7	15.9	-6.6	+85.9	+28.8
2009.12.14	6.0	-6.2	5.5	-7.9	+76.0	+27.9
2009.12.15	5.5	-6.4	7.1	-1.5	+82.1	+29.2
2009.12.16	5.0	-6.4	11.3	+1.5	+77.9	+26.5
2009.12.17	20.5	-12.9	3.4	-4.0	+78.8	+27.1
2009.12.20	1.5	-7.8	16.1	+2.0	+79.4	+25.8
2009.12.23	5.0	-6.6	75.9	+0.6	+93.3	+30.2
2009.12.25	6.0	-5.1	58.0	-3.4	+94.8	+29.7
2009.12.27	3.5	-6.6	22.6	-3.5	+85.0	+28.0
2010.1.2	0.5	-7.2	167.2	+0.3	+92.7	+30.0
2010.1.4	5.5	-6.1	39.0	-2.1	+93.3	+31.0
2010.1.20	35.5	-4.1	18.1	-4.7	+86.2	+29.1
2010.1.22	3.5	-8.9	7.7	-3.0	+79.4	+28.3
2010.1.27	6.0	-8.8	42.2	+0.2	+86.8	+27.0
2010.2.4	10.0	-9.2	6.9	-1.8	+79.9	+29.1
2010.2.5	1.0	-5.5	18.8	-0.3	+80.2	+27.6
2010.2.9	6.5	-5.0	29.9	-3.2	+85.4	+28.2
2010.2.11	3.5	-11.3	25.0	-2.1	+88.1	+28.5
2010.2.19	4.0	-7.8	51.2	+1.3	+91.3	+27.8
2010.2.26	18.5	-6.4	7.6	-4.6	+79.6	+27.0
2010.3.1	3.0	-8.7	30.0	-3.5	+86.5	+28.3
2010.3.2	2.5	-5.9	25.4	-4.2	+75.4	+26.9

Table S2 (continued)

Date	Precipitation mm	$\delta^{18}O(H_2O)$ ‰	NO_3^- μmol L^{-1}	$\delta^{15}N$ ‰	$\delta^{18}O$ ‰	$\Delta^{17}O$ ‰
2010.3.5	0.0	-7.8	29.7	-5.3	+84.2	+27.1
2010.3.9	3.0	-8.9	7.4	+0.5	+74.6	+25.9
2010.3.10	4.0	-10.5	9.1	-3.1	+66.5	+23.4
2010.3.15	15.5	-5.8	9.5	-7.5	+81.7	+26.3
2010.4.10	1.5	+0.9	68.9	-6.1	+73.2	+24.4
2010.4.11	6.5	-7.1	7.6	-7.2	+77.4	+25.7
2010.4.13	9.0	-3.4	49.8	-5.2	+75.9	+24.8
2010.5.11	10.5	-7.2	18.4	-6.3	+72.8	+25.8
2010.5.19	16.0	-4.7	6.2	-5.4	+74.9	+25.8
2010.5.25	13.5	-10.0	40.9	-2.4	+81.2	+26.5
2010.6.4	3.5	-4.8	61.2	-13.3	+72.7	+26.1
2010.6.15	21.6	-9.1	7.0	-11.7	+73.4	+23.0
2010.6.19	6.5	-11.6	35.7	-3.9	+77.1	+25.0
2010.6.20	11.5	-10.9	24.9	-3.2	+76.2	+25.7
2010.6.26	14.0	-10.4	7.6	-6.5	+76.3	+25.5
2010.6.27	35.5	-13.7	2.9	-8.7	+60.5	+19.3
2010.7.9	14.0	-8.1	30.0	-5.3	+76.8	+23.1
2010.7.15	18.0	-10.7	11.7	-5.8	+64.7	+21.3
2010.7.14	12.0	-11.7	12.0	-8.5	+67.2	+22.3
2010.7.24	4.0	-8.5	39.6	-6.0	+72.0	+24.4
2010.7.30	16.0	-9.3	51.8	-5.4	+68.5	+22.9
2010.8.11	0.5	-7.0	22.9	-2.9	+64.5	+21.3
2010.8.13	12.5	-8.3	14.7	-5.4	+73.4	+24.0
2010.8.14	13.5	-4.2	27.8	-2.8	+71.0	+22.0
2010.8.15	9.5	-5.1	45.6	-2.2	+63.9	+19.3
2010.8.24	0.5	-3.4	49.8	-7.1	+64.0	+20.7
2010.9.2	1.5	-4.1	21.1	-4.8	+63.8	+20.8
2010.9.6	16.0	-12.4	3.6	-2.1	+65.6	+20.7
2010.9.12	33.2	-12.0	2.9	-5.6	+62.7	+18.9
2010.9.13	34.3	-12.5	5.3	-7.7	+65.2	+21.4
2010.9.19	5.0	-4.9	30.9	-9.1	+79.7	+26.6
2010.9.20	3.5	-4.2	52.9	-8.4	+74.4	+24.6
2010.9.21	12.0	-3.6	34.0	-5.3	+71.0	+22.6
2010.9.22	6.5	-4.6	27.3	-6.2	+73.9	+25.7
2010.10.5	22.0	-8.1	17.4	-7.0	+75.7	+25.3
2010.10.14	8.0	-5.5	21.9	-4.0	+78.1	+26.0
2010.10.15	6.5	-5.3	22.9	-6.3	+83.1	+27.6
2010.10.28	7.5	-6.9	7.3	-5.2	+78.6	+26.3
2010.11.8	16.5	-4.8	52.5	-5.2	+84.0	+27.7
2010.11.22	11.5	-6.6	21.6	-4.8	+86.2	+28.5
2010.11.27	7.0	-5.6	50.1	-3.8	+90.8	+30.9
2010.11.30	8.0	-9.0	61.1	-3.0	+87.4	+29.6
2010.12.6	18.5	-5.8	31.9	-4.0	+87.1	+29.3
2010.12.9	12.0	-13.2	13.6	-5.3	+88.7	+29.9
2010.12.13	30.0	-14.9	19.4	+1.2	+91.9	+29.3
2010.12.17	12.5	-7.9	18.4	-5.4	+90.4	+31.4
2010.12.19	11.5	-7.0	22.7	+1.3	+89.2	+30.1
2010.12.28	10.0	-8.5	48.1	-4.9	+88.4	+30.1
2010.12.30	14.5	-16.5	20.3	-8.0	+89.2	+31.2
2011.1.8	11.0	-6.8	18.3	-2.9	+85.5	+29.5
2011.1.15	3.0	-9.3	80.7	-0.6	+91.4	+30.2
2011.1.23	3.5	-9.6	99.5	+6.1	+93.9	+31.2
2011.1.25	0.5	-7.5	238.3	+3.4	+94.3	+31.3
2011.1.28	1.5	-8.3	84.3	+3.2	+81.6	+28.9
2011.2.3	3.5	-7.2	90.0	-1.8	+85.6	+29.0
2011.2.4	3.0	-4.2	265.9	+1.2	+88.7	+30.6
2011.2.9	0.5	-7.5	54.3	+1.8	+79.6	+26.6
2011.2.17	23.0	-14.9	6.8	-12.0	+79.9	+28.0
2011.2.24	6.5	-5.0	64.3	-2.2	+88.0	+28.4
2011.2.27	2.0	-7.8	32.0	-5.3	+83.2	+28.3
2011.2.28	3.5	-8.7	31.5	-6.4	+81.5	+28.0
2011.3.5	1.5	-5.1	94.2	-0.1	+86.2	+29.4
2011.3.9	5.0	-10.7	68.1	-1.8	+85.7	+30.1
2011.3.15	12.5	-10.2	30.0	-0.9	+92.8	+29.2
2011.3.20	5.5	-6.7	303.3	-4.5	+89.6	+30.5
2011.3.25	7.5	-11.1	29.8	-1.8	+84.2	+28.3
2011.4.8	20.5	-8.1	13.6	-8.1	+70.2	+23.4
2011.4.18	6.5	-8.1	33.4	-5.2	+82.2	+28.2
2011.4.19	23.0	-9.6	9.1	-7.3	+79.9	+26.5
2011.4.24	6.5	-9.8	34.6	-3.6	+76.2	+26.4
2011.4.26	43.5	-7.2	18.3	-6.0	+81.3	+27.2
2011.4.27	20.0	-7.5	22.3	-5.5	+75.9	+25.0
2011.4.30	8.0	-7.3	55.6	-4.8	+78.0	+26.1
2011.5.1	9.0	-5.5	22.4	-3.7	+76.0	+25.7

Table S2 (continued)

Date	Precipitation	$\delta^{18}O(H_2O)$	NO_3^-	$\delta^{15}N$	$\delta^{18}O$	$\Delta^{17}O$
	mm	‰	μmol L^{-1}	‰	‰	‰
2011.5.9	26.0	-7.3	21.5	-5.5	+77.7	+25.3
2011.5.16	1.0	-7.5	456.0	-4.0	+82.1	+28.2
2011.5.20	5.0	-7.1	49.2	-5.7	+76.5	+26.4
2011.5.21	24.5	-7.4	18.2	-7.3	+77.0	+25.6
2011.5.27	5.5	-7.4	22.9	-8.1	+80.1	+26.4
2011.5.28	19.0	-6.3	6.9	-6.4	+79.9	+26.8
2011.6.1	7.0	-9.7	13.9	-8.6	+75.0	+25.9
2011.6.2	4.0	-7.8	21.3	-5.3	+79.7	+26.6
2011.6.22	91.5	-7.0	3.8	-2.7	+68.2	+21.1
2011.6.23	9.0	-2.3	31.2	-2.9	+60.0	+19.7
2011.6.27	28.0	-3.8	8.9	-4.3	+63.8	+20.8
2011.7.3	3.5	-7.9	77.9	-3.8	+72.4	+23.7
2011.7.4	12.0	-11.8	17.8	-7.6	+73.7	+24.2
2011.7.12	6.5	-4.5	19.0	-0.1	+65.8	+19.9
2011.7.27	45.0	-9.1	7.7	-3.4	+70.9	+23.0
2011.7.28	11.0	-2.8	29.2	-4.4	+65.2	+21.3
2011.7.29	16.5	-2.6	49.9	-6.0	+67.2	+21.0
2011.8.16	8.5	-7.3	17.7	+1.4	+70.5	+21.7
2011.8.17	60.0	-5.9	25.7	-4.4	+69.3	+22.4
2011.8.18	9.0	-5.3	32.5	-5.5	+72.2	+23.2
2011.9.1	1.5	-8.4	3.0	-3.0	+58.3	+18.6
2011.9.9	3.5	-7.7	71.5	-5.2	+72.9	+23.9
2011.9.19	58.5	-9.8	2.9	-6.3	+71.9	+23.4
2011.9.29	6.5	-7.0	17.0	-7.0	+75.8	+25.6
2011.10.6	9.0	-7.0	62.1	-2.6	+88.0	+27.6
2011.10.15	13.0	-14.6	13.2	-7.1	+79.4	+25.9
2011.10.30	0.0	-6.8	13.5	-8.3	+79.0	+26.7
2011.11.6	0.0	-6.0	17.6	-7.0	+82.1	+27.7
2011.11.12	2.0	-7.3	27.7	-8.6	+79.3	+27.1
2011.11.14	1.5	-7.6	107.6	-0.3	+90.0	+30.0
2011.11.23	49.5	-7.5	20.3	-5.4	+92.3	+29.4
2011.11.29	2.5	-7.5	125.7	-3.8	+86.9	+29.7
2011.12.7	5.0	-7.6	42.3	-1.0	+94.7	+31.5
2011.12.14	10.5	-7.2	25.0	-5.7	+84.8	+27.9
2011.12.15	5.5	-7.9	50.5	+0.3	+90.2	+30.0
2011.12.22	5.5	-7.9	51.3	-3.0	+100.5	+32.4
2012.1.1	12.0	-8.0	42.0	-5.1	+93.2	+30.0
2012.1.10	6.5	-8.0	46.2	-0.8	+90.8	+30.8
2012.1.25	5.0	-9.0	14.6	+5.0	+78.4	+27.1
2012.1.31	6.5	-13.1	45.6	+2.1	+86.2	+28.0
2012.2.2	3.0	-8.5	21.3	+2.1	+82.3	+27.6
2012.2.3	6.0	-7.0	8.8	-3.9	+81.8	+27.9
2012.2.6	12.0	-10.3	12.4	-4.2	+87.0	+28.0
2012.2.22	4.5	-8.7	25.4	-1.3	+89.7	+28.3
2012.2.23	8.0	-9.4	8.8	-1.5	+83.4	+26.0

Table S3 Stable oxygen isotopic compositions ($\delta^{18}O$) of H_2O in the stream water samples.

No.	Name	15 Mar. ‰	17 Jun. ‰	5 Aug. ‰	21 Oct. ‰
Inflow					
31	Tenjin	-7.7	-6.0	-7.4	-6.8
30	Mano	-7.6	-6.1	-7.5	-7.1
29	Wani	-8.2	-7.6	-8.1	-8.0
28	U	-8.8	–	-8.6	-8.7
1	Kamo	-9.1	-7.6	-8.5	-8.5
2	Ado	-9.3	-8.4	-8.9	-9.1
3	Ishida	-9.4	–	-8.7	-9.0
4	Momose	-9.3	-8.6	-8.8	-9.0
5	Chinai	-9.2	-8.4	-8.7	-8.8
6	Ohura	-8.7	-7.5	-8.6	-8.3
7	Oh	-8.8	-8.3	-8.7	-8.9
8	Yogo	-8.9	-5.8	-8.3	-8.6
9	Chonoki	-9.4	-6.6	-8.9	-8.9
10	Ta	-9.1	-7.1	-8.7	-8.3
11	Ane	-9.5	-7.8	-9.0	-8.5
12	Yone	-8.9	-8.7	-8.8	-8.9
13	Amano	-8.7	-7.5	-8.3	-8.1
14	Seri	-9.0	-8.1	-8.8	-8.3
15	Inukami	-8.5	-8.3	-8.2	-8.2
16	Ajiki	-7.9	-8.1	-8.1	-8.0
17	Uso	-7.2	-6.6	-8.8	-8.1
18	Bunroku	-8.1	-6.3	-8.3	-7.7
19	Nomazu	-7.3	-6.1	-7.5	-6.9
20	Echi	-8.7	-7.5	-8.1	-8.4
27	Hino	-6.8	-5.3	-7.9	-7.2
26	Yanomune	-5.7	-5.2	-7.3	-6.4
25	Yasu	-7.3	-6.5	-8.2	-7.5
24	Yamaga	-6.8	-6.0	-7.1	-7.2
23	Sakai	-7.4	-6.7	-7.1	-8.0
22	Hayama	-6.8	-5.9	-7.2	-6.6
34	Kusatsu	-7.6	-6.1	-6.6	-7.0
21	Nagaso	-7.4	-6.6	-7.1	-7.2
32	Fujinoki	-8.7	-7.9	-8.4	-8.4
Outflow					
33	Seta	-6.7	-6.2	-6.8	-6.5

Table S4 Concentrations and stable isotopic compositions of nitrate in the stream water samples.

No. Name	15 March, 2013				17 June, 2013				5 August, 2013				21 October, 2013				Annual average			
	C_{total}	$\delta^{15}N$	$\delta^{18}O$	$\Delta^{17}O$	C_{total}	$\delta^{15}N$	$\delta^{18}O$	$\Delta^{17}O$	C_{total}	$\delta^{15}N$	$\delta^{18}O$	$\Delta^{17}O$	C_{total}	$\delta^{15}N$	$\delta^{18}O$	$\Delta^{17}O$	C_{total}	$\delta^{15}N$	$\delta^{18}O$	$\Delta^{17}O$
	μM*	‰	‰	‰	μM*	‰	‰	‰	μM*	‰	‰	‰	μM*	‰	‰	‰	μM*	‰	‰	‰
Inflow																				
31 Tenjin	38.2	+7.8	+1.9	+1.1	24.5	+8.9	-3.1	+0.1	18.2	+8.4	+3.8	+1.9	49.9	+7.9	-1.3	+0.5	46.5	+7.9	-0.9	+0.6
30 Mano	31.1	+8.6	+2.2	+0.7	29.5	+6.0	+3.6	+0.4	20.0	+7.5	+3.3	+1.9	44.7	+6.5	-3.6	+0.0	34.0	+7.1	-0.5	+0.5
29 Wani	29.5	+4.8	+1.5	+1.2	12.8	+17.9	+5.6	+0.7	17.8	+7.0	+3.5	+1.9	37.0	+6.0	-2.2	+0.3	32.2	+5.6	-0.4	+0.8
28 U	19.8	+2.9	+9.8	+4.0	–	–	–	–	16.6	+3.2	-0.6	+1.2	10.4	+5.4	+1.8	+1.9	12.7	+3.8	+4.4	+2.6
1 Kamo	33.8	+4.7	+5.1	+2.0	12.0	+5.1	-1.2	+0.9	26.3	+9.1	+2.1	+1.0	24.0	+8.6	+0.1	+1.2	25.4	+7.2	+2.2	+1.4
2 Ado	31.3	+1.1	+4.5	+2.1	1.1	+9.9	+8.6	+3.8	34.3	+4.1	+1.6	+1.4	22.4	+4.3	-0.5	+0.4	26.7	+2.7	+2.2	+1.3
3 Ishida	48.5	+0.1	+9.0	+3.7	–	–	–	–	51.0	+4.9	-0.3	+1.0	34.7	+3.6	+0.5	+1.4	44.9	+1.0	+6.8	+3.1
4 Momose	76.4	+2.7	+6.7	+2.7	20.1	+4.5	+3.5	+2.1	29.8	+2.9	+1.9	+1.5	31.4	+7.9	+2.7	+0.7	41.1	+4.4	+4.5	+1.9
5 Chinai	47.6	+2.7	+9.4	+3.6	26.4	+2.5	+3.5	+2.2	32.8	+3.5	+3.7	+1.5	27.5	+5.2	+2.2	+1.4	39.2	+3.3	+7.2	+2.9
6 Ohura	27.4	+1.9	+7.2	+3.0	17.3	+4.5	-1.4	+0.7	20.4	+4.9	+1.9	+1.2	27.6	+8.7	-0.1	+0.9	25.5	+3.4	+5.0	+2.3
7 Oh	44.4	+3.6	+7.1	+2.3	19.1	+4.4	-1.2	+1.2	40.2	+4.2	+2.7	+1.1	34.2	+7.7	+1.6	+1.2	36.1	+5.3	+3.4	+1.5
8 Yogo	43.5	+6.4	+6.4	+2.2	22.2	+2.1	-3.7	+0.6	42.4	+3.9	+0.7	+1.4	42.9	+5.9	-1.8	+0.8	40.6	+5.6	+2.5	+1.6
9 Chonoki	67.3	+4.3	+4.8	+2.3	31.6	+3.4	-2.7	+0.6	25.5	+5.3	+2.4	+1.4	51.7	+7.4	-0.9	+0.4	47.5	+5.7	+1.4	+1.2
10 Ta	38.4	+3.0	+3.0	+2.1	21.3	+5.4	-1.6	+0.4	37.4	+6.3	+0.4	+1.1	43.0	+7.5	-2.0	+0.7	38.4	+5.8	-0.0	+1.2
11 Ane	30.1	+1.7	+7.8	+3.1	5.7	+3.2	-3.3	+0.1	29.0	+0.5	+1.2	+1.8	34.8	+3.3	-2.0	+0.6	32.6	+2.6	+1.6	+1.5
12 Yone	38.9	+14.1	+5.3	+1.4	26.0	+6.9	-1.1	+0.3	28.5	+7.7	+0.1	+1.2	50.7	+8.2	-0.6	+0.8	39.1	+8.8	+0.3	+0.9
13 Amano	80.1	+7.0	+3.1	+1.4	29.6	+8.0	-1.2	+0.9	58.1	+8.3	+1.1	+1.1	79.5	+5.5	-1.2	+0.6	77.5	+6.1	+0.1	+0.8
14 Seri	134.2	+4.2	+1.8	+1.2	47.1	+11.2	-0.3	+0.4	82.7	+3.4	+0.6	+0.9	79.6	+2.8	-1.2	+0.7	94.5	+3.4	+0.0	+0.9
15 Inukami	44.0	+4.3	+4.3	+2.2	42.5	+6.0	-1.9	+1.0	31.4	+4.9	+2.3	+1.6	46.1	+7.9	-1.6	+0.8	45.0	+6.6	+0.5	+1.3
16 Ajiki	33.3	+9.3	+3.6	+1.2	82.2	+8.4	-3.7	+0.5	62.4	+7.8	+2.1	+1.6	108.1	+8.8	-2.2	+0.4	75.7	+8.6	-1.0	+0.7
17 Uso	70.8	+7.0	+6.9	+2.7	76.5	+7.5	-1.5	+0.6	64.2	+6.2	+4.2	+2.1	66.6	+6.3	-3.1	+0.3	67.8	+6.5	-0.9	+0.8
18 Bunroku	134.9	+8.8	-0.6	+0.5	53.3	+7.8	-1.9	+0.4	16.3	+5.2	+0.7	+1.6	115.6	+10.7	-1.9	+0.3	91.3	+9.5	-1.3	+0.5
19 Nomazu	7.0	+10.7	+7.7	+0.4	6.7	+3.5	-2.7	+1.3	16.4	+4.4	+1.4	+1.9	68.0	+10.2	-1.3	+0.4	33.2	+9.5	-0.6	+0.6
20 Echi	32.2	+5.2	+8.9	+2.9	1.1	+1.0	+3.9	+0.7	1.3	+1.0	+28.2	+6.8	35.5	+4.2	-1.7	+0.9	33.9	+4.5	+1.3	+1.5
27 Hino	51.0	+6.3	+6.8	+2.8	15.2	+10.3	+0.1	+0.8	41.1	+6.9	+8.6	+0.9	48.5	+8.0	-2.6	+0.6	46.6	+7.5	+0.9	+1.2
26 Yanomune	58.0	+2.9	+13.2	+4.6	24.1	+9.4	+3.3	+0.8	61.7	+10.5	+6.4	+1.4	68.7	+8.0	-4.0	+0.3	59.0	+7.8	+1.5	+1.3
25 Yasu	82.4	+5.3	+8.0	+2.8	1.5	-0.1	+11.0	+2.9	37.5	+6.7	+5.6	+2.9	57.5	+6.7	-0.7	+0.6	58.6	+6.3	+2.5	+1.5
24 Yamaga	47.5	+8.9	+8.1	+2.1	37.0	+6.0	+3.8	+1.2	25.9	+8.0	+3.4	+1.1	79.8	+7.7	-3.0	+0.8	39.0	+7.8	+1.4	+1.1
23 Sakai	7.4	+4.1	-0.3	+1.0	6.6	-1.2	-0.6	+0.8	27.7	+7.7	+4.3	+1.7	30.6	+10.8	-5.4	+0.0	20.8	+8.8	-2.0	+0.6
22 Hayama	40.6	+5.8	+9.1	+3.0	26.0	+8.1	+2.2	+1.7	19.3	+7.7	+5.6	+2.6	43.4	+9.3	-2.7	+0.8	35.1	+8.1	+1.7	+1.6
34 Kusatsu	38.4	+8.7	+4.8	+1.7	7.3	+10.7	+4.5	+0.9	4.4	+12.7	+10.3	+2.9	44.2	+8.3	-0.2	+0.7	29.4	+8.7	+2.0	+1.1
21 Nagaso	66.2	+10.1	+3.0	+1.4	54.0	+3.8	+5.9	+0.7	80.8	+10.1	+12.7	+3.8	32.6	+12.4	+1.3	+1.3	54.3	+9.8	+6.0	+2.0
32 Fujinoki	146.8	+9.9	+0.5	+0.8	68.3	+13.4	+1.9	+0.6	57.5	+11.3	+0.2	+0.6	118.4	+10.2	-0.7	+0.6	106.2	+10.5	+0.1	+0.7
Outflow																				
33 Seta	14.7	+7.3	+3.4	+1.6	13.3	+11.4	+4.8	+0.4	2.8	+10.4	+3.0	+1.4	25.4	+18.0	-0.7	+0.4	13.3	+13.1	+1.5	+0.9

*μM = μmol L^{-1}

Table S5 The concentrations of atmospheric nitrate (C_{atm}) and the stable isotopic compositions of remineralized portion of nitrate ($\delta^{15}N_{re}$, $\delta^{18}O_{re}$) in the stream water samples.

No.	Name	15 March			17 June			5 August		
		C_{atm} μmol L^{-1}	$\delta^{15}N_{re}$ ‰	$\delta^{18}O_{re}$ ‰	C_{atm} μmol L^{-1}	$\delta^{15}N_{re}$ ‰	$\delta^{18}O_{re}$ ‰	C_{atm} μmol L^{-1}	$\delta^{15}N_{re}$ ‰	$\delta^{18}O_{re}$ ‰
Inflow										
31	Tenjin	1.7 ±0.4	+8.3 ±0.5	-1.6 ±1.1	0.1 ±0.1	+9.0 ±0.3	-3.5 ±0.4	1.3 ±0.3	+9.4 ±1.2	-2.3 ±1.7
30	Mano	0.9 ±0.3	+9.0 ±0.4	+0.0 ±0.8	0.4 ±0.2	+6.2 ±0.4	+2.5 ±0.5	1.5 ±0.3	+8.4 ±1.2	-2.8 ±1.7
29	Wani	1.4 ±0.3	+5.2 ±0.5	-2.3 ±1.2	0.3 ±0.1	+18.5 ±0.6	+3.6 ±0.8	1.3 ±0.3	+7.9 ±1.2	-2.5 ±1.7
28	U	3.0 ±0.5	+4.2 ±1.4	-2.6 ±3.4	–	–	–	0.8 ±0.2	+3.6 ±0.8	-4.5 ±1.2
1	Kamo	2.5 ±0.5	+5.5 ±0.7	-1.0 ±1.7	0.4 ±0.1	+5.5 ±0.6	-4.1 ±0.9	1.0 ±0.3	+9.7 ±0.7	-0.9 ±1.0
2	Ado	2.4 ±0.5	+1.5 ±0.7	-2.0 ±1.8	0.2 ±0.0	+12.3 ±2.4	-3.5 ±3.3	1.8 ±0.5	+4.5 ±0.9	-2.9 ±1.3
3	Ishida	6.8 ±1.1	+0.8 ±1.2	-2.6 ±3.1	–	–	–	1.9 ±0.5	+5.2 ±0.7	-3.3 ±1.0
4	Momose	7.9 ±1.4	+3.5 ±1.0	-1.7 ±2.3	1.6 ±0.4	+5.2 ±1.3	-3.2 ±1.8	1.7 ±0.4	+3.3 ±0.9	-2.7 ±1.3
5	Chinai	6.6 ±1.1	+3.8 ±1.3	-1.9 ±3.1	2.2 ±0.5	+3.1 ±1.3	-3.5 ±1.9	1.9 ±0.4	+4.0 ±0.9	-0.9 ±1.3
6	Ohura	3.1 ±0.5	+2.7 ±1.0	-2.0 ±2.5	0.5 ±0.2	+4.7 ±0.5	-3.6 ±0.8	0.9 ±0.2	+5.4 ±0.8	-1.9 ±1.1
7	Oh	3.9 ±0.7	+4.3 ±0.8	+0.0 ±2.0	0.9 ±0.2	+4.8 ±0.8	-5.0 ±1.1	1.7 ±0.4	+4.5 ±0.7	-0.6 ±1.0
8	Yogo	3.6 ±0.7	+7.4 ±0.8	-0.3 ±1.9	0.5 ±0.2	+2.2 ±0.5	-5.6 ±0.7	2.2 ±0.5	+4.4 ±0.9	-3.7 ±1.3
9	Chonoki	5.8 ±1.1	+5.1 ±0.8	-2.2 ±1.9	0.7 ±0.3	+3.6 ±0.5	-4.6 ±0.7	1.3 ±0.3	+5.8 ±0.9	-1.8 ±1.2
10	Ta	3.0 ±0.6	+3.7 ±0.8	-3.5 ±1.8	0.3 ±0.1	+5.6 ±0.4	-2.9 ±0.6	1.6 ±0.4	+6.7 ±0.8	-3.2 ±1.1
11	Ane	3.5 ±0.6	+2.5 ±1.1	-1.7 ±2.6	0.0 ±0.0	+3.3 ±0.3	-3.7 ±0.4	1.9 ±0.4	+0.8 ±1.0	-4.5 ±1.6
12	Yone	2.1 ±0.5	+15.2 ±0.6	+1.2 ±1.3	0.3 ±0.2	+7.0 ±0.3	-2.1 ±0.5	1.2 ±0.3	+8.2 ±0.8	-3.6 ±1.1
13	Amano	4.2 ±0.9	+7.6 ±0.6	-1.2 ±1.3	1.0 ±0.3	+8.5 ±0.6	-3.9 ±0.9	2.4 ±0.6	+8.9 ±0.7	-2.2 ±1.0
14	Seri	6.3 ±1.4	+4.6 ±0.5	-2.0 ±1.2	0.8 ±0.3	+11.4 ±0.4	-1.6 ±0.6	2.9 ±0.8	+3.7 ±0.6	-2.2 ±0.9
15	Inukami	3.7 ±0.7	+5.0 ±0.8	-2.6 ±1.9	1.6 ±0.4	+6.4 ±0.7	-5.0 ±1.0	1.9 ±0.4	+5.5 ±1.0	-2.6 ±1.4
16	Ajiki	1.5 ±0.4	+9.9 ±0.5	-0.0 ±1.1	1.5 ±0.6	+8.7 ±0.4	-5.2 ±0.6	3.8 ±0.9	+8.6 ±1.0	-2.9 ±1.4
17	Uso	7.2 ±1.3	+8.3 ±1.0	-1.3 ±2.2	1.9 ±0.6	+7.8 ±0.5	-3.6 ±0.7	5.1 ±1.1	+7.1 ±1.3	-2.3 ±1.8
18	Bunroku	2.8 ±1.0	+9.0 ±0.3	-2.3 ±0.7	0.9 ±0.4	+8.0 ±0.4	-3.3 ±0.6	1.0 ±0.2	+5.8 ±1.0	-4.3 ±1.4
19	Nomazu	0.1 ±0.0	+10.9 ±0.3	+6.5 ±0.6	0.3 ±0.1	+3.9 ±0.8	-6.8 ±1.2	1.2 ±0.3	+5.1 ±1.2	-4.7 ±1.7
20	Echi	3.6 ±0.6	+6.4 ±1.1	-0.0 ±2.4	0.0 ±0.0	+1.1 ±0.5	+1.8 ±0.8	0.3 ±0.1	+2.9 ±4.5	+10.0 ±5.8
27	Hino	5.4 ±1.0	+7.5 ±1.0	-1.8 ±2.3	0.4 ±0.1	+10.8 ±0.6	-2.3 ±0.8	1.4 ±0.4	+7.3 ±0.6	+6.1 ±0.9
26	Yanomune	10.2 ±1.6	+4.4 ±1.6	-1.1 ±3.9	0.7 ±0.2	+9.8 ±0.6	+0.9 ±0.8	3.4 ±0.8	+11.4 ±0.9	+2.2 ±1.3
25	Yasu	8.7 ±1.5	+6.4 ±1.0	-0.5 ±2.3	0.2 ±0.0	+0.4 ±1.7	+2.4 ±2.4	4.1 ±0.8	+8.0 ±1.8	-3.6 ±2.5
24	Yamaga	3.9 ±0.7	+10.1 ±0.8	+1.8 ±1.8	1.7 ±0.4	+6.6 ±0.8	+0.0 ±1.1	1.1 ±0.3	+8.5 ±0.7	+0.1 ±1.0
23	Sakai	0.3 ±0.1	+4.4 ±0.5	-3.4 ±1.0	0.2 ±0.1	-1.1 ±0.5	-3.0 ±0.8	1.8 ±0.4	+8.5 ±1.1	-0.9 ±1.5
22	Hayama	4.6 ±0.8	+7.0 ±1.1	-0.0 ±2.5	1.7 ±0.4	+8.9 ±1.1	-3.1 ±1.5	1.9 ±0.4	+9.0 ±1.6	-2.5 ±2.2
34	Kusatsu	2.5 ±0.5	+9.6 ±0.7	-0.5 ±1.5	0.2 ±0.1	+11.2 ±0.6	+1.9 ±0.9	0.5 ±0.1	+14.7 ±1.8	+1.8 ±2.4
21	Nagaso	3.4 ±0.8	+10.8 ±0.6	-1.2 ±1.2	1.5 ±0.5	+4.0 ±0.5	+3.9 ±0.8	11.7 ±2.3	+12.5 ±2.4	+1.3 ±3.1
32	Fujinoki	4.5 ±1.3	+10.4 ±0.4	-2.0 ±0.9	1.6 ±0.6	+13.8 ±0.5	+0.0 ±0.7	1.4 ±0.5	+11.6 ±0.5	-1.7 ±0.7
Outflow										
33	Seta	0.9 ±0.2	+8.1 ±0.6	-1.5 ±1.4	0.2 ±0.1	+11.7 ±0.4	+3.6 ±0.6	0.1 ±0.0	+11.2 ±0.9	-1.2 ±1.2

Table S5 (continued)

No.	Name	21 October			Annual average		
		C_{atm}	$\delta^{15}N_{re}$	$\delta^{18}O_{re}$	C_{atm}	$\delta^{15}N_{re}$	$\delta^{18}O_{re}$
		μmol L^{-1}	‰	‰	μmol L^{-1}	‰	‰
Inflow							
31	Tenjin	1.0 ±0.4	+8.1 ±0.5	-2.9 ±0.7	1.1 ±0.4	+8.2 ±0.5	-2.8 ±0.7
30	Mano	0.0 ±0.2	+6.5 ±0.2	-3.7 ±0.3	0.6 ±0.2	+7.3 ±0.4	-2.0 ±0.6
29	Wani	0.5 ±0.2	+6.2 ±0.4	-3.2 ±0.5	0.9 ±0.3	+5.8 ±0.6	-2.8 ±0.8
28	U	0.8 ±0.2	+6.1 ±1.2	-4.5 ±1.7	1.2 ±0.3	+4.6 ±1.5	-3.8 ±2.2
1	Kamo	1.1 ±0.3	+9.2 ±0.8	-3.7 ±1.1	1.3 ±0.3	+7.8 ±0.9	-2.2 ±1.3
2	Ado	0.3 ±0.2	+4.4 ±0.4	-1.7 ±0.6	1.4 ±0.3	+3.1 ±0.8	-2.0 ±1.2
3	Ishida	1.8 ±0.5	+4.1 ±0.9	-4.0 ±1.3	5.3 ±1.1	+1.7 ±1.8	-3.0 ±2.6
4	Momose	0.8 ±0.3	+8.2 ±0.5	+0.7 ±0.7	2.9 ±0.7	+5.1 ±1.1	-1.2 ±1.6
5	Chinai	1.4 ±0.4	+5.7 ±0.9	-2.1 ±1.3	4.3 ±0.9	+4.2 ±1.7	-1.9 ±2.4
6	Ohura	0.9 ±0.3	+9.2 ±0.6	-3.0 ±0.9	2.3 ±0.5	+4.1 ±1.4	-2.2 ±2.0
7	Oh	1.6 ±0.4	+8.3 ±0.8	-2.2 ±1.1	2.1 ±0.5	+5.9 ±1.0	-1.3 ±1.4
8	Yogo	1.3 ±0.4	+6.2 ±0.6	-4.5 ±0.9	2.4 ±0.6	+6.2 ±1.0	-2.4 ±1.4
9	Chonoki	0.8 ±0.4	+7.6 ±0.4	-2.2 ±0.6	2.2 ±0.6	+6.2 ±0.8	-2.4 ±1.1
10	Ta	1.1 ±0.4	+7.8 ±0.5	-4.2 ±0.8	1.7 ±0.5	+6.2 ±0.8	-3.8 ±1.1
11	Ane	0.8 ±0.3	+3.4 ±0.5	-3.9 ±0.7	1.9 ±0.4	+3.0 ±0.9	-3.2 ±1.4
12	Yone	1.6 ±0.5	+8.6 ±0.6	-3.2 ±0.9	1.3 ±0.4	+9.3 ±0.7	-2.5 ±0.9
13	Amano	1.8 ±0.6	+5.7 ±0.5	-3.0 ±0.7	2.4 ±0.7	+6.4 ±0.6	-2.5 ±0.9
14	Seri	2.1 ±0.7	+2.9 ±0.5	-3.4 ±0.8	3.3 ±1.0	+3.7 ±0.6	-2.8 ±0.9
15	Inukami	1.4 ±0.4	+8.3 ±0.6	-4.0 ±0.8	2.2 ±0.6	+7.2 ±0.8	-3.5 ±1.2
16	Ajiki	1.7 ±0.8	+9.0 ±0.4	-3.5 ±0.6	2.1 ±0.7	+9.0 ±0.6	-3.3 ±0.8
17	Uso	0.8 ±0.4	+6.5 ±0.3	-4.1 ±0.5	2.2 ±0.7	+6.9 ±0.6	-3.5 ±0.9
18	Bunroku	1.5 ±0.8	+10.9 ±0.4	-3.0 ±0.5	1.6 ±0.7	+9.8 ±0.4	-2.8 ±0.6
19	Nomazu	1.1 ±0.5	+10.5 ±0.4	-2.6 ±0.6	0.8 ±0.3	+9.8 ±0.5	-2.4 ±0.7
20	Echi	1.2 ±0.4	+4.5 ±0.6	-4.7 ±0.9	1.9 ±0.5	+5.0 ±0.9	-3.4 ±1.4
27	Hino	1.1 ±0.4	+8.3 ±0.5	-4.5 ±0.7	2.1 ±0.6	+8.1 ±0.8	-2.9 ±1.1
26	Yanomune	0.9 ±0.4	+8.1 ±0.4	-5.0 ±0.5	2.9 ±0.7	+8.4 ±0.8	-2.6 ±1.2
25	Yasu	1.3 ±0.5	+7.0 ±0.5	-2.6 ±0.7	3.2 ±0.8	+6.9 ±0.9	-2.0 ±1.3
24	Yamaga	2.6 ±0.8	+8.1 ±0.6	-5.7 ±0.9	1.7 ±0.4	+8.4 ±0.8	-2.1 ±1.1
23	Sakai	0.0 ±0.1	+10.8 ±0.2	-5.5 ±0.3	0.5 ±0.2	+9.1 ±0.5	-3.9 ±0.7
22	Hayama	1.3 ±0.4	+9.7 ±0.6	-5.2 ±0.8	2.2 ±0.5	+8.9 ±1.0	-3.5 ±1.5
34	Kusatsu	1.2 ±0.4	+8.7 ±0.6	-2.4 ±0.8	1.3 ±0.3	+9.3 ±0.8	-1.5 ±1.1
21	Nagaso	1.6 ±0.4	+13.2 ±0.9	-2.8 ±1.2	4.2 ±0.9	+10.9 ±1.3	-0.1 ±1.7
32	Fujinoki	2.8 ±1.0	+10.6 ±0.5	-2.6 ±0.7	2.8 ±0.9	+10.9 ±0.5	-2.1 ±0.8
Outflow							
33	Seta	0.4 ±0.2	+18.3 ±0.4	-1.9 ±0.5	0.4 ±0.1	+13.7 ±0.6	-1.2 ±0.9

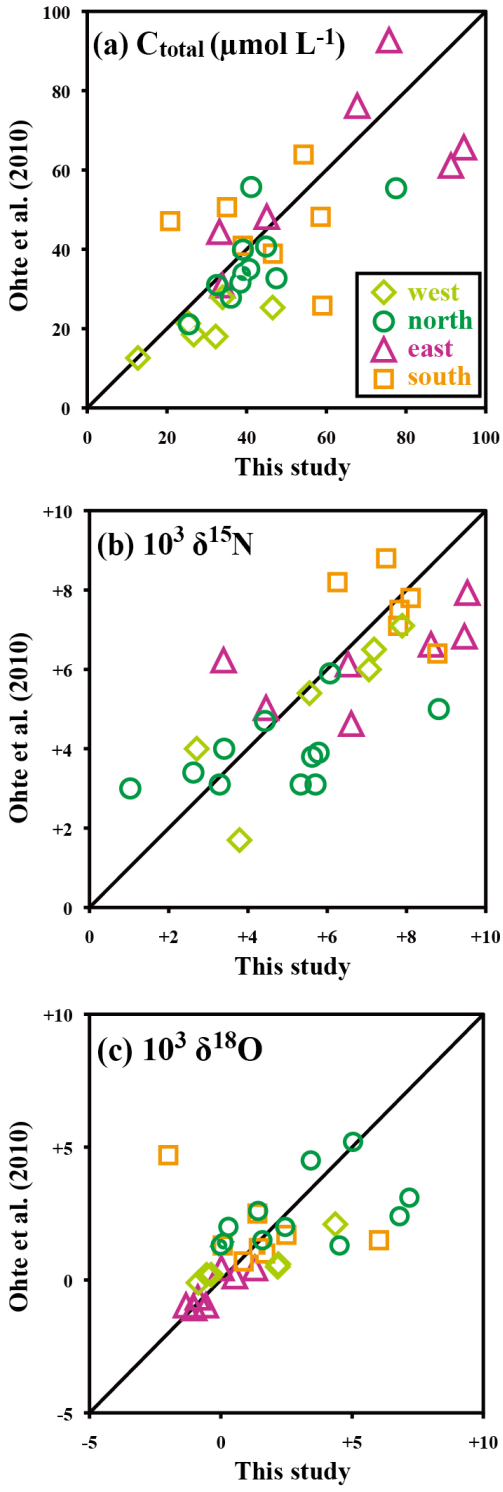

Figure S1. Comparison of the (a) annual average concentration, (b) $\delta^{15}N$, and (c) $\delta^{18}O$ for nitrate in each inflow stream with the values obtained in this study and those reported in Ohte et al. (2010). The symbols represent the location of each river (west: yellowish green diamonds; north: green circles; east: red triangles; south: orange squares).