Supplemental information

Shifts in stream hydrochemistry in responses to typhoon and non-typhoon precipitation

Chung-Te Chang[1], Jr-Chuan Huang[1], Lixin Wang[2], Yu-Ting Shih[1], and Teng-Chiu Lin[3]

[1]Department of Geography, National Taiwan University, No 1 Section.4, Roosevelt Road, Taipei 10617, Taiwan
[2]Department of Earth Sciences, Indiana University-Purdue University Indianapolis, Indianapolis, IN 46202, USA
[3]Department of Life Science, National Taiwan Normal University, No 88 Section 4, Ting-Chow Road, Taipei 11677, Taiwan

Correspondence to: Teng-Chiu Lin (tclin@ntnu.edu.tw)

Table S1. The basic information of the typhoon affected weeks.

Name of typhoons	Date	Precipitation between the first and last typhoon warnings (mm, A)	Total precipitation of the typhoon week (mm, B)	C = A/B (%)	Discharge between the first and last typhoon warnings (mm, D)	Total discharge of the typhoon week (mm, E)	F = D/E (%)
Jelawat	26-29 Sep. 2012	181	184	98	106	132	80
Soulik	12-14 Jul. 2013	334	345	97	212	256	83
Trami	20-22 Aug. 2013	296	321	92	230	252	91
Kong-Rey	28-30 Aug. 2013	258	286	90	187	205	91
Usagi	20-22 Sep. 2013	265	304	87	159	195	82
Fitow	5-7 Oct. 2013	305	324	94	191	229	83
Matmo	22-23 Jul. 2014	170	184	92	145	167	87
Fung-Wong	20-23 Sep. 2014	180	187	96	112	120	93
Chan-Hom	9-11 Jul. 2015	243	252	96	157	185	85
Soudelor	7-9 Aug. 2015	470	507	93	380	446	85
Goni	21-24 Aug. 2015	160	168	95	112	122	92
Average		260	278	93	181	210	86

1. The accumulated precipitation of typhoons were summed from first and last typhoon warnings issued and the total precipitation (mm) of typhoon week is the average value of two rain gauges (COA530 and COA540) during the week of typhoon influenced, and same as the discharge (the average value of four watersheds, A1, A2, F1, and F2). Precipitation was recorded at a 5-min interval at the two rain gauge stations and aggregated to weekly and typhoon precipitation.

Table S2. The significant regression models between stream discharge (x) and ion budgets (y) for non-typhoon, typhoon and all data, respectively (referring to plots in Figs. 5 and 6).

Ions		A1	A2	F1	F2
Na^+	Non-typhoon	$y = 0.034x + 0.022$, $R^2 = 0.26^{**}$	$y = 0.035x - 0.31$, $R^2 = 0.32^{**}$	$y = 0.038x - 0.54$, $R^2 = 0.43^{**}$	$y = 0.035x + 0.13$, $R^2 = 0.46^{**}$
	Typhoon		$y = -0.101x + 21.59$, $R^2 = 0.37^{**}$	$y = -0.78x + 13.29$, $R^2 = 0.50^{*}$	$y = -0.10x + 25.24$, $R^2 = 0.74^{**}$
	All data				$y = -0.019x + 2.91$, $R^2 = 0.15^{**}$
K^+	Non-typhoon	$y = 0.009x - 0.07$, $R^2 = 0.65^{**}$	$y = 0.006x - 0.10$, $R^2 = 0.53^{**}$	$y = 0.004x - 0.15$, $R^2 = 0.37^{**}$	$y = 0.003x - 0.07$, $R^2 = 0.30^{**}$
	Typhoon				$y = -0.014x + 3.21$, $R^2 = 0.71^{**}$
	All data	$y = 0.005x + 0.08$ $R^2 = 0.39^{**}$	$y = 0.002x + 0.08$, $R^2 = 0.17^{**}$		$y = -0.003x + 0.25$, $R^2 = 0.19^{**}$
Ca^{2+}	Non-typhoon	$y = 0.044x + 0.51$, $R^2 = 0.95^{**}$	$y = 0.025x + 0.28$, $R^2 = 0.90^{**}$	$y = 0.022x + 0.26$, $R^2 = 0.91^{**}$	$y = 0.039x + 0.45$, $R^2 = 0.85^{**}$
	Typhoon	$y = 0.030x + 3.19$, $R^2 = 0.42^{**}$	$y = 0.009x + 3.73$, $R^2 = 0.17^{**}$	$y = 0.022x +0.66$, $R^2 = 0.79^{**}$	
	All data	$y = 0.043x + 0.65$, $R^2 = 0.92^{**}$	$y = 0.023x + 0.41$, $R^2 = 0.85^{**}$	$y = 0.023x + 0.24$, $R^2 = 0.89^{**}$	$y = 0.026x + 1.14$, $R^2 = 0.76^{**}$
Mg^{2+}	Non-typhoon	$y = 0.023x + 0.20$, $R^2 = 0.91^{**}$	$y = 0.015x + 0.13$, $R^2 = 0.82^{**}$	$y = 0.012x + 0.07$, $R^2 = 0.75^{**}$	$y = 0.018x + 0.18$, $R^2 = 0.83^{**}$
	All data	$y = 0.020x + 0.36$, $R^2 = 0.83^{**}$	$y = 0.012x + 0.26$, $R^2 = 0.72^{**}$	$y = 0.009x + 0.28$, $R^2 = 0.59^{**}$	$y = 0.011x + 0.53$, $R^2 = 0.72^{**}$
NH_4^+	Typhoon	$y = -0.006x + 0.86$, $R^2 = 0.57^{*}$	$y = -0.004x + 0.50$, $R^2 = 0.48^{*}$	$y = -0.005x + 0.53$, $R^2 = 0.66^{*}$	$y = -0.009x + 1.56$, $R^2 = 0.88^{**}$
	All data				$y = -0.003x + 0.05$, $R^2 = 0.35^{*}$
Cl^-	Non-typhoon	$y = 0.032x - 0.57$, $R^2 = 0.07^{**}$	$y = 0.042x - 1.08$, $R^2 = 0.10^{*}$	$y = 0.045x - 1.50$, $R^2 = 0.25^{**}$	$y = 0.030x - 0.23$, $R^2 = 0.19^{**}$
NO_3^-	Non-typhoon	$y = 0.127x - 0.97$, $R^2 = 0.93^{**}$	$y = 0.094x - 0.92$, $R^2 = 0.91^{**}$	$y = 0.014x - 0.98$, $R^2 = 0.23^{**}$	
	All data	$y = 0.112x - 0.005$, $R^2 = 0.75^{**}$	$y = 0.087x + 0.45$, $R^2 = 0.82^{**}$	$y = 0.014x - 0.91$, $R^2 = 0.31^{**}$	$y = 0.005x - 0.35$, $R^2 = 0.15^{**}$
SO_4^{2-}	Non-typhoon	$y = 0.049x + 0.63$, $R^2 = 0.58^{**}$	$y = 0.022x - 0.26$, $R^2 = 0.19^{**}$	$y = 0.026x - 0.36$, $R^2 = 0.31^{**}$	$y = 0.052x + 0.41$, $R^2 = 0.55^{**}$
	All data	$y = 0.046x + 0.93$, $R^2 = 0.46^{**}$	$y = 0.011x - 0.16$, $R^2 = 0.25^{**}$	$y = 0.023x + 0.06$, $R^2 = 0.32^{**}$	$y = 0.032x + 1.43$, $R^2 = 0.28^{**}$
PO_4^{3-}	Non-typhoon			$y = 0.0001x - 0.008$, $R^2 = 0.09^{**}$	
	Typhoon	$y = -0.0001x + 0.06$, $R^2 = 0.62^{**}$	$y = -0.005x + 0.08$, $R^2 = 0.41^{**}$	$y = -0.0005x + 0.07$, $R^2 = 0.68^{**}$	
	All data	$y = -0.0001x + 0.005$, $R^2 = 0.05^{*}$	$y = -0.0001x + 0.004$, $R^2 = 0.07^{*}$	$y = -0.0001x + 0.006$, $R^2 = 0.13^{*}$	

P-value: $^{*} < 0.05 < ^{**} < 0.01$.

Table S3. The mean (one standard deviation) concentrations of ions (mg/l) in precipitation during non-typhoon and typhoon periods.

	H	Na^+	K^+	Ca^{2+}	Mg^{2+}	NH_4^+	Cl^-	NO_3^-	SO_4^{2-}	PO_4^{3-}
A1										
Non-typhoon	0.06 (0.06)	4.15 (8.35)	0.64 (1.36)	0.84 (1.36)	0.59 (1.04)	0.85 (1.35)	9.43 (22.9)	3.97 (6.27)	5.18 (7.26)	0.04 (0.15)
Typhoon	0.02 (0.02)	3.78 (3.51)	0.43 (0.45)	0.48 (0.36)	0.51 (0.41)	0.12 (0.14)	6.05 (5.21)	0.40 (0.70)	1.54 (1.57)	0.01 (0.02)
F2										
Non-typhoon	0.04 (0.06)	3.37 (8.17)	0.61 (1.66)	0.84 (1.91)	0.55 (1.08)	0.55 (1.18)	7.96 (23.9)	2.56 (9.10)	4.84 (10.2)	0.01 (0.05)
Typhoon	0.01 (0.02)	3.36 (2.75)	0.37 (0.39)	0.32 (0.23)	0.46 (0.36)	0.14 (0.17)	5.03 (3.96)	0.39 (0.53)	2.11 (2.80)	0.002 (0.003)