

Supplementary Material

Combining fluorescent organic substances, ions, and oxygen-18 to trace diverse water sources of river flow in a hilly catchment

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Number of figures: 3

Number of tables: 2

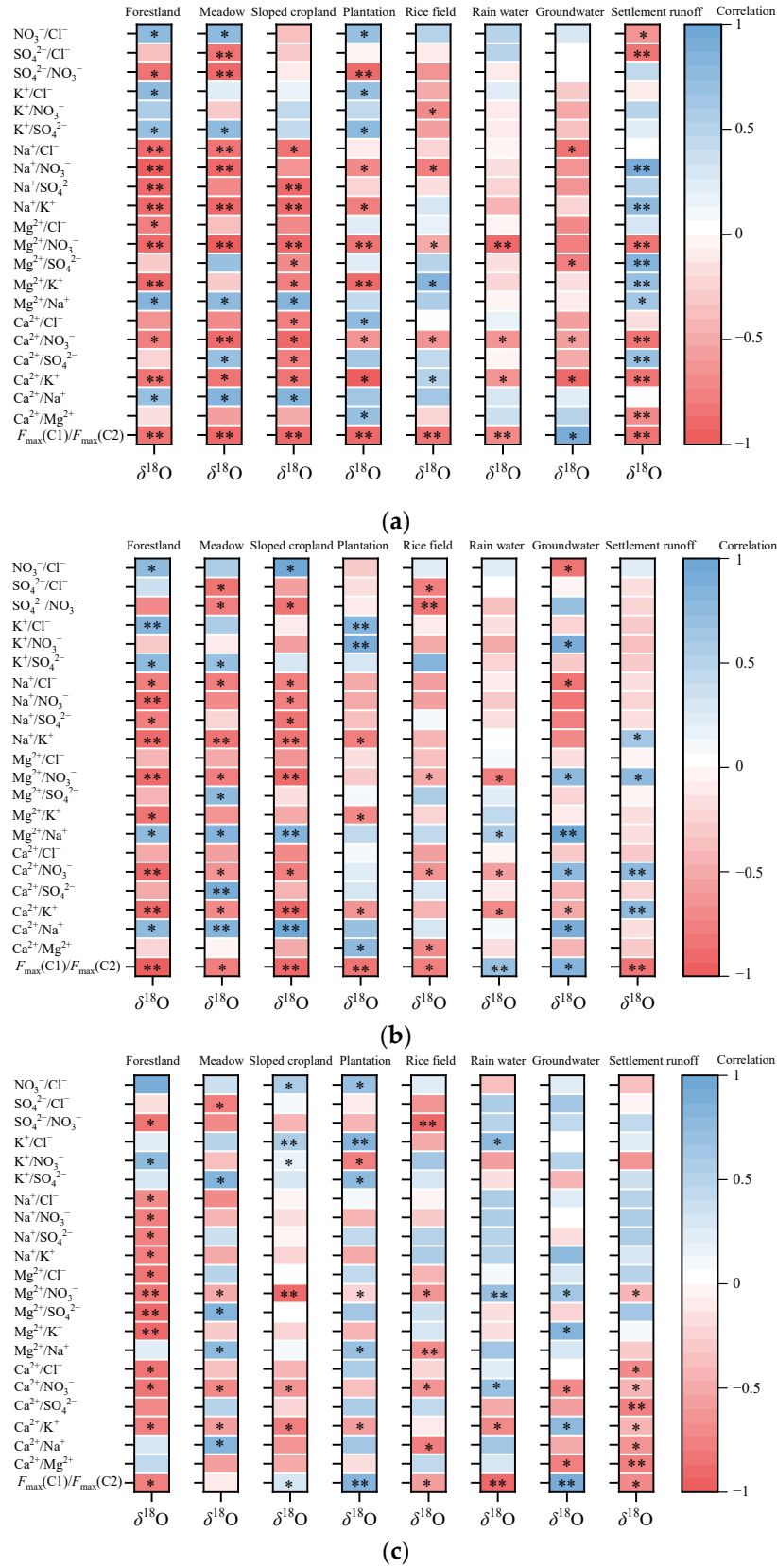
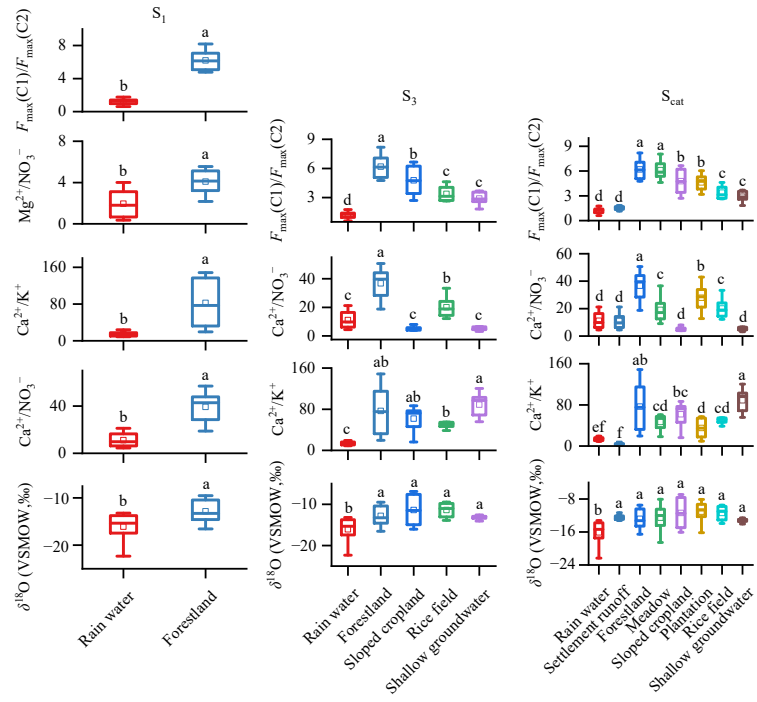
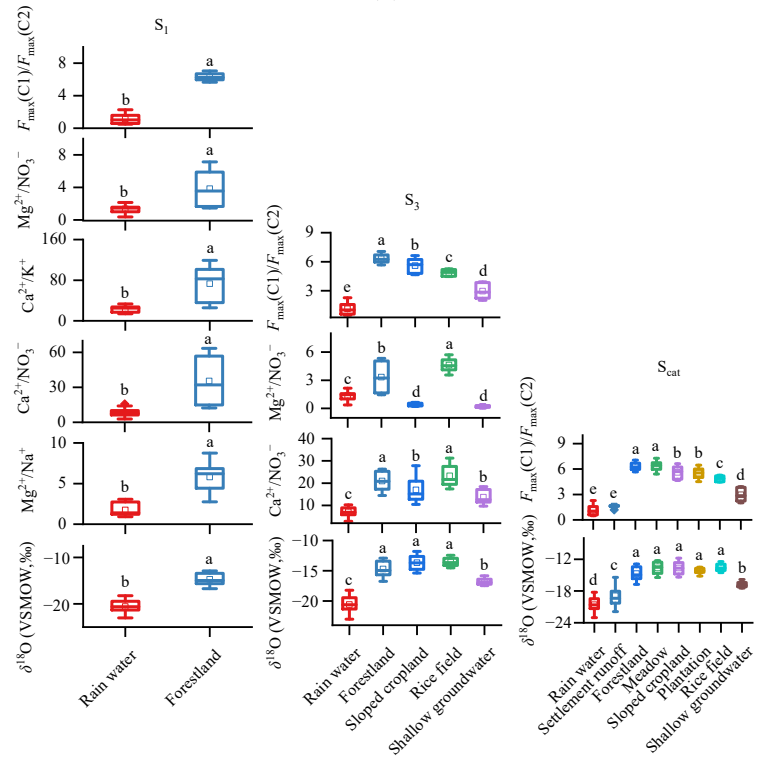


Figure S1. Correlations (r values) of hydrochemical parameters with $\delta^{18}\text{O}$ in rain water, soil waters of forestland, plantation, meadow, sloped cropland, rice field, shallow groundwater, and settlement runoff for rain events on June 28 (a), July 27 (b), and August 25 (c), 2023. * and ** represent significance at the 0.05 and 0.01 levels, respectively.



(a)



(b)

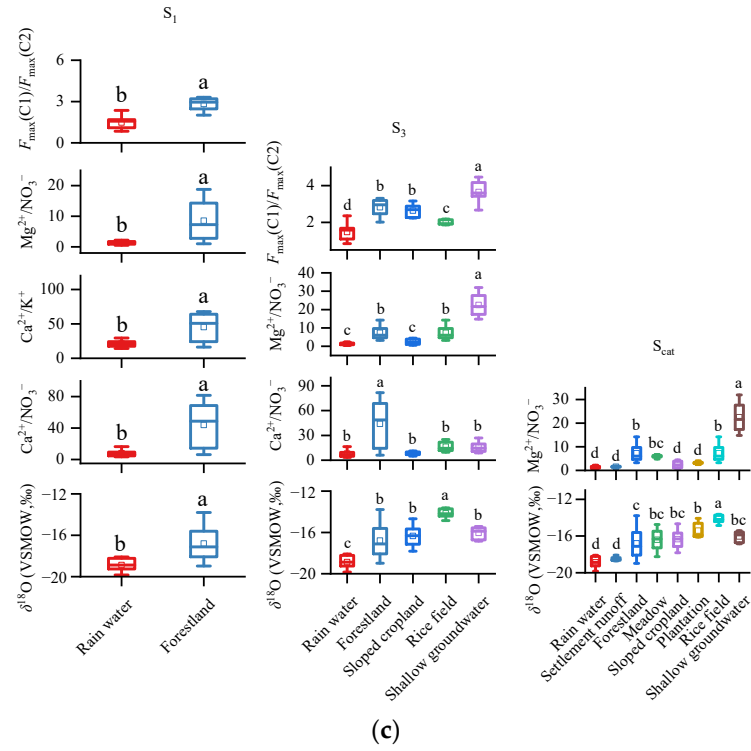


Figure S2. Differences in selected conservative parameters between water sources for river flow at three monitoring weirs in the study catchment for rain events on June 28 (a), July 27 (b), and August 25 (c), 2023. Different letters indicate significant differences between water sources at the 0.05 level.

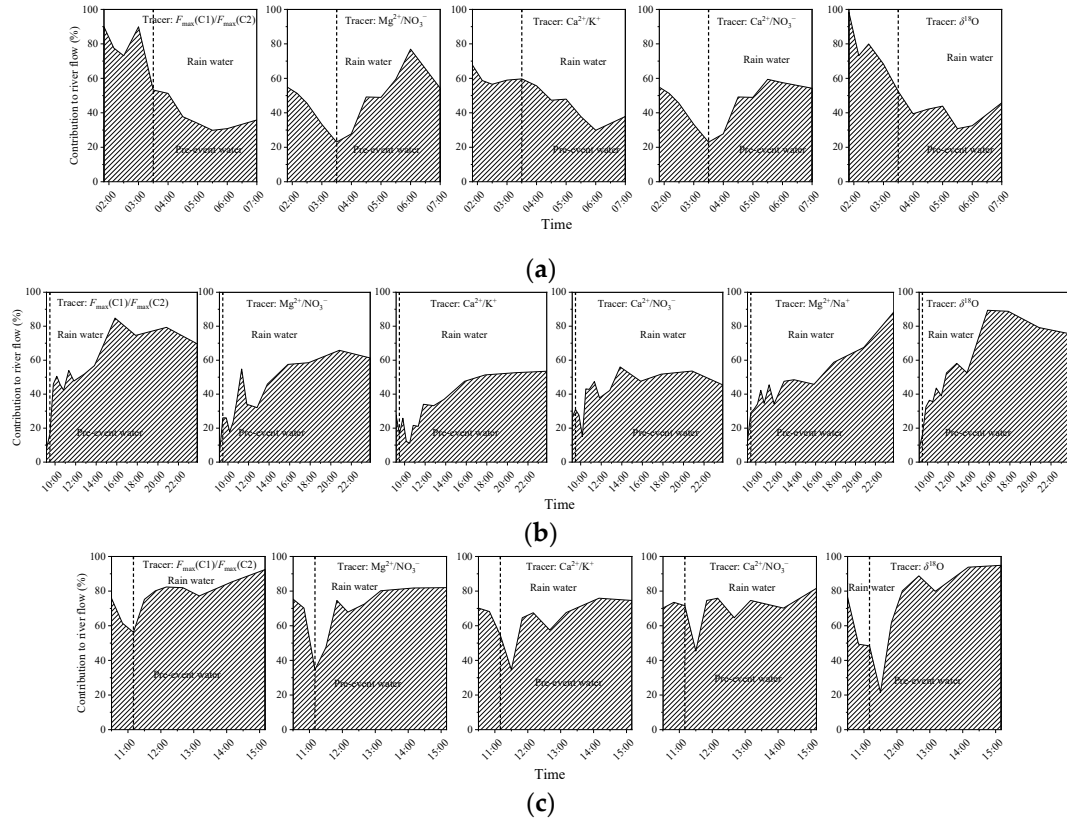


Figure S3. Dynamics of estimated contributions of rain water and pre-event soil water to river flow at the outlet of forestland drainage area (S_1) during rain events on June 28 (a), July 27 (b), and August 25 (c), 2023, based on the data of each hydrochemical tracer and $\delta^{18}\text{O}$ using MixSIAR. Dashed lines represent the occurring times of maximum river discharges. Water sampling and discharge monitoring were conducted at intervals of 30 min and 15 min, respectively.

Table S1. Conservative hydrochemical parameters in potential water sources of river flow at three monitoring weirs in the study catchment upon three rain events.

Rain Event No.	Conservative Hydrochemical Parameters *		
	S ₁	S ₃	S _{cat}
1	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$, $\text{Mg}^{2+}/\text{NO}_3^-$, $\text{Ca}^{2+}/\text{K}^+$, and $\text{Ca}^{2+}/\text{NO}_3^-$	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$, $\text{Ca}^{2+}/\text{NO}_3^-$, and $\text{Ca}^{2+}/\text{K}^+$	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$, $\text{Ca}^{2+}/\text{NO}_3^-$, and $\text{Ca}^{2+}/\text{K}^+$
2	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$, $\text{Mg}^{2+}/\text{NO}_3^-$, $\text{Ca}^{2+}/\text{K}^+$, $\text{Ca}^{2+}/\text{NO}_3^-$, and $\text{Mg}^{2+}/\text{Na}^+$	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$, $\text{Mg}^{2+}/\text{NO}_3^-$, and $\text{Ca}^{2+}/\text{NO}_3^-$	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$
3	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$, $\text{Mg}^{2+}/\text{NO}_3^-$, $\text{Ca}^{2+}/\text{K}^+$, and $\text{Ca}^{2+}/\text{NO}_3^-$	$F_{\max}(\text{C1})/F_{\max}(\text{C2})$, $\text{Mg}^{2+}/\text{NO}_3^-$, and $\text{Ca}^{2+}/\text{NO}_3^-$	$\text{Mg}^{2+}/\text{NO}_3^-$

Note: * River flow at outlets S₁, S₃, and S_{cat} had 2, 5, and 8 potential water sources, which are described in detail in “2.3 River water sources and tracers”.

Table S2. Statistical results of hydrochemical tracers' performance in estimating water source of river flow at the outlet of forestland drainage area (S₁) by comparing with $\delta^{18}\text{O}$.

Rain Event		Tracers				
No. (<i>n</i>) *		$F_{\max}(\text{C1})/F_{\max}(\text{C2})$	$\text{Ca}^{2+}/\text{K}^{+}$	$\text{Ca}^{2+}/\text{NO}_3^{-}$	$\text{Mg}^{2+}/\text{NO}_3^{-}$	$\text{Mg}^{2+}/\text{Na}^{+}$
1(11)	NSE	0.828	0.639	0.521	0.507	NA
	PBIAS (%)	-0.5	-9.5	-9.1	-20.6	NA
2(13)	NSE	0.889	0.695	0.461	0.727	0.601
	PBIAS (%)	3.0	-37.8	-20.1	-23.7	-12.6
3(10)	NSE	0.452	0.635	0.415	0.581	NA
	PBIAS (%)	24.0	-19.7	2.3	-2.7	NA

Note: * *n* represents the number of river flow samples.