Supplement of

Quantification of Ecohydrological Sensitivities and Their Influencing Factors at the Seasonal Scale

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1 Description of the study watersheds and data

1.1 Study watersheds

In this study, 14 large watersheds across environmental zones in China were selected. The properties of four dominant soil types, the land cover of the selected watersheds in 2001 and detailed information of hydrological and climate data are listed in Tables S1-S3. The temporal variations of lead area index (LAI) are shown in Fig. S1.

The Pingjiang and Xiangshui watersheds are located in the upper reach of the Ganjiang River in the Poyang Lake basin. They lie in hill regions in the Jiangxi province (Liu et al., 2016), where the mean elevations are the lowest among 14 watersheds (314 m and 440 m above sea level, respectively). The Tangwang River and Xinancha River watersheds are nested and situated in the Xiaoxing'an Mountain that flow into the Songhua River. The Tangwang River watershed has a drainage area of 19198 km^2, the largest onein this study. The Xinancha River watershed with an area of 2585 km^2 is an upstream sub-watershed of the Tangwang River. They are characterized by gentle hills with the lowest mean slope of 8.7° and 11.3°, respectively. The Upper Zagunao, Zagunao, Upper Heishui River and Heishui River watersheds located in the transitional zone from the Southeast Tibet Canyon to Sichuan basin flow into the Minjiang River, the largest tributary of the Upper Yangtze River (Zhang et al., 2012). These watersheds are featured by steep slopes with the slope ranging from 0 to 72° and a mean slope of greater than 27°. The Gongbujiangda and Gengzhang are two nested watersheds located in the Niyang River basin, originating from a glacier lake in Mount Nyainqentanglha and eventually entering into the Yarlung Zangbo River (Zhang et al., 2011). Located in the transitional zones from Qinghai-Tibet Plateau to the Southeast Tibet Canyon, the Gongbujiangda and Gengzhang watersheds are featured by the highest mean elevation of 4946 and 4752 m asl., respectively. As sub-watersheds of Jing River basin, the Dongchuan, Heishuichuan, Jingchuan and Rui River watersheds lie in the Loess Plateau. The Dongchuan and Heishuichuan watersheds are neighboring rivers originating from the northeast parts of Jing River basin with lower elevation and steeper slope, while the Jingchuan and Rui River watersheds situated in southwest regions of Jing River basin are characterized by higher elevation and lower slope.

The Pingjiang and Xiangshui watersheds locate in subtropical monsoon climate zone with more than 70% of annual precipitation falling in the wet season from March to August. Their hydrological regime is rain-dominated regime. The Tangwang River and Xinancha River watershed are situated in a temperate continental monsoon climate zone with cold dry winter and humid wet summer, where wet season mean temperature is about 13 °C and mean temperature can reach -11 °C in dry season (Table 1). They also belong to rain-dominated watersheds. The climate of Upper Zagunao, Zagunao, Upper Heishui River, Heishui River, Gongbujiangda and Gengzhang watersheds can be classified as alpine climate, which are characterized by cold winter and cool summer. These watersheds are frequently disturbed by southwest monsoon in summer (Li et al., 2018b), leading to a wet season from May to October with mean precipitation greater than 600 mm. The hydrological regime of these watersheds is hybrid controlled by rainfall and snow. Located in the semi-arid region, the Dongchuan, Heishuichuan, Jingchuan and Rui River watersheds belong to temperate continental climate. Precipitation in the Loess Plateau decreases with latitude, leading to more precipitation in southern watersheds (Jingchuan and Rui River) than in the northern ones (Dongchuan and Heshuichuan). The hydrological year (November to October) of these four watersheds can be divided into dry season from November to April and wet season between May and October.

Dominant soil type in the Pingjiang and Xiangshui watersheds is LIXISOLS, accounting for 63.8% and 80.3% of total watershed area, respectively. LIXISOLS is frequently distributed in the forested areas, characterized by high permeability and moderate weathering degree of minerals (Jiang and Ji, 2011). Under a humid and warm condition, LIXISOLS is easy to be eroded (Baldwin, 1938; Bockheim et al., 2014). The Tangwang River and Xinancha River are dominated by LUVISOLS that is featured with distinct seasonal humidity and low permeability (Duan and Cai, 2018). There are more than 20 types of soil in the Upper Zagunao, Zagunao, Upper Heishui River and Heishui River watersheds, and over 80% of watersheds are occupied with LEPTOSOLS. Soils in these watersheds are characterized by distinct altitudinal pattern, and the distribution of soil is associated with temperature, water distribution and vegetation type. In addition, due to intensive harvesting activities in the early years, soils in the Upper Minjiang River basin were severely impaired, resulting in serious soil erosion and degradation. Similar to the former four watersheds, the Gongbujiangda and Gengzhang are mainly occupied by LEPTOSOLS. The Dongchuan, Heshuichuan, Jingchuan and Rui River watersheds in the Loess Plateau are dominated by CAMBISOLS, where topsoils are directly exposed in open air, and frequently washed up by heavy rainstorm in wet season, resulting severe soil erosion. The properties of four dominant soil types are listed in Table S1.

Table S1: The properties of four dominant soil types in the study watersheds

Dominant soil type	Topsoil organic carbon (%)	Topsoil salinity (dS/m)	Topsoil available water holding capacity (cm/cm)	Topsoil saturated hydraulic conductivity (mm/h)	Topsoil bulk density (g/cm3)	Subsoil organic carbon (%)	Subsoil salinity (dS/m)	Subsoil available water holding capacity (cm/cm)	Subsoil saturated hydraulic conductivity (mm/h)	Subsoil bulk density (g/cm3)
LUVISOLS	1.20	0.56	0.13	9.94	1.46	0.62	0.59	0.13	4.89	1.50
LIXISOLS	1.34	0.23	0.12	4.15	1.44	0.56	0.24	0.12	1.50	1.44
LEPTOSOLS	1.38	0.19	0.13	13.54	1.45	0.34	0.18	0.16	6.29	1.55
CAMBISOLS	0.79	0.37	0.13	12.46	1.52	0.44	0.33	0.12	6.91	1.55

The major vegetation types in the Pingjiang and Xiangshui watersheds include subtropical evergreen broadleaf forest and planted evergreen coniferous forest. The dominant natural tree species are *Castanopsis fabri*, *Castanopsis sclerophylla*, *Schima superba*, *Sassafras tzumu* and *Castanopsis fissa*, while planted tree species include *Pinus massoniana*, *Cunninghamia lanceolata*, *Camellia oleifera Abel* and *Phyllostachys heterocycle* (Liu et al., 2016). These two watersheds have experienced large-scale harvesting since 1960s, forest cover decreased by 10% during 1965-1984 (Liu et al., 2016). After that, a series of afforestation and forest restoration programs have been implemented to mitigate serious environment issues in the Poyang Lake basin, then forest coverage recovered to 18% in the Pingjiang watershed and 55% in the Xiangshui watershed in 2001 (Table S2), respectively. During the study period, seasonal LAI in the Pingjiang watershed (1.45 m^2/m^2 in dry season and 1.90

m^2/m^2 in wet season) was lower than in the Xiangshui watershed (dry season LAI of 2.54 m^2/m^2 and wet season LAI of 3.17 m^2/m^2 (Fig. S1)). Watersheds in the Xiaoxing'an Mountain are covered with a large area of temperate mixed forests, and dominated tree species are *Pinus koraiensis*, *Picea jezoen*, *Abies nephrolepis*, *Fraxinus mandschurica*, *Quercus mongolica* and *Tilia amurensis* (Cai and Tan, 2007; Duan and Cai, 2018; Liu et al., 2011; Yao et al., 2015). Due to a large proportion of deciduous forests, dry season LAI in the Tangwang River and Xinancha River watersheds was less than 1.00 m^2/m^2, while wet season LAI can rise to 3.50 m^2/m^2. Alpine meadow and subalpine coniferous forest are dominated vegetation types in the Upper Zagunao, Zagunao, Upper Heishui River and Heishui River watersheds. Vegetation distribution is featured with distinct altitudinal pattern. Forest coverages in the year 2001 were 46% in the Upper Zagunao, 52% in the Zagunao, 34% in the Upper Heishui River and 37% in the Heishui River, respectively (Table S2). The dominant tree species in these watersheds are *Abies faxoniana*, *Picea purpurea*, *Picea asperata Mast* and *Betula albo-sinensi* (Zhang et al., 2012; Cui et al., 2012). Forests in the Upper Zagunao and Zagunao watersheds were severely logged from 1950s to 1980s and strictly protected after 1998 (Hou et al., 2018b; Zhang et al., 2008). Thus, LAI showed no increase but a slight decrease at the beginning of recovery period (Fig. S1). On the contrary, seasonal LAI was on an increase in the Upper Heishui River and Heishui River due to limited forest disturbances. Similar to the watersheds in the Minjiang River basin, the Gongbujiangda and Gengzhang watersheds are dominated by alpine meadows and subalpine coniferous forests. *Picea likiangensis* var. *Linzhiensis* and *Abies georgei* var. *Smithii* are two major species (Zhang et al., 2011). From 1983 to 2003, there was a slight decrease in LAI from 1983 to 1993, while a sharp increase can be seen after 1998 (Fig. S1). Long-term average dry season LAI were 0.11 m^2/m^2 in the Gongbujiangda and 0.22 m^2/m^2 in the Gengzhang, and wet season LAI were 0.45 m^2/m^2 and 0.59 m^2/m^2, respectively. Vegetation coverage are extremely low in watersheds in the Loess Plateau, and shrubland and grassland cover large areas of the Dongchuan, Heshuichuan, Jingchuan and Rui River watersheds (Table S2), where *Quercus wutaishanica*, *Larix principis-rupprechtii* and *Pinus tabuliformis* are dominant tree species (Wang et al., 2010; Xu et al., 2015). Dry season LAI in the Dongchuan, Heshuichuan, Jingchuan and Rui River were 0.19 m^2/m^2, 0.34 m^2/m^2, 0.26 m^2/m^2 and 0.28 m^2/m^2, respectively, while the corresponding wet season LAI were 0.59 m^2/m^2, 1.51 m^2/m^2, 0.98 m^2/m^2 and 1.23 m^2/m^2.

Table S2: Land cover of the selected watersheds in the year of 2001

Watersheds	Forest (%)	Shrubland (%)	Grassland (%)	Farmland (%)	Snow (%)	Other lands (%)
Pingjiang	17.9	2.8	49.5	21.7	0.0	8.2
Xiangshui	55.0	1.3	34.1	8.7	0.0	0.9
Tangwang River	91.3	0.1	2.2	5.7	0.0	0.7
Xinancha River	93.8	0.2	1.0	4.5	0.0	0.5
Upper Zagunao	45.9	1.0	50.1	1.2	0.3	1.6
Zagunao	52.1	2.1	42.6	1.7	0.2	1.3
Upper Heishui River	34.2	0.4	63.3	1.3	0.7	0.1
Heishui River	37.3	1.2	58.7	2.5	0.2	0.2
Gongbujiangda	3.9	0.8	83.5	0.2	4.0	7.7
Gengzhang	14.5	1.3	67.3	0.2	9.2	7.5
Dongchuan	1.7	2.1	35.8	60.4	0.0	0.0
Heshuichuan	25.4	17.1	31.5	26.0	0.0	0.0
Jingchuan	18.8	2.2	36.5	42.3	0.0	0.2
Rui River	20.1	5.7	30.2	44.0	0.0	0.0

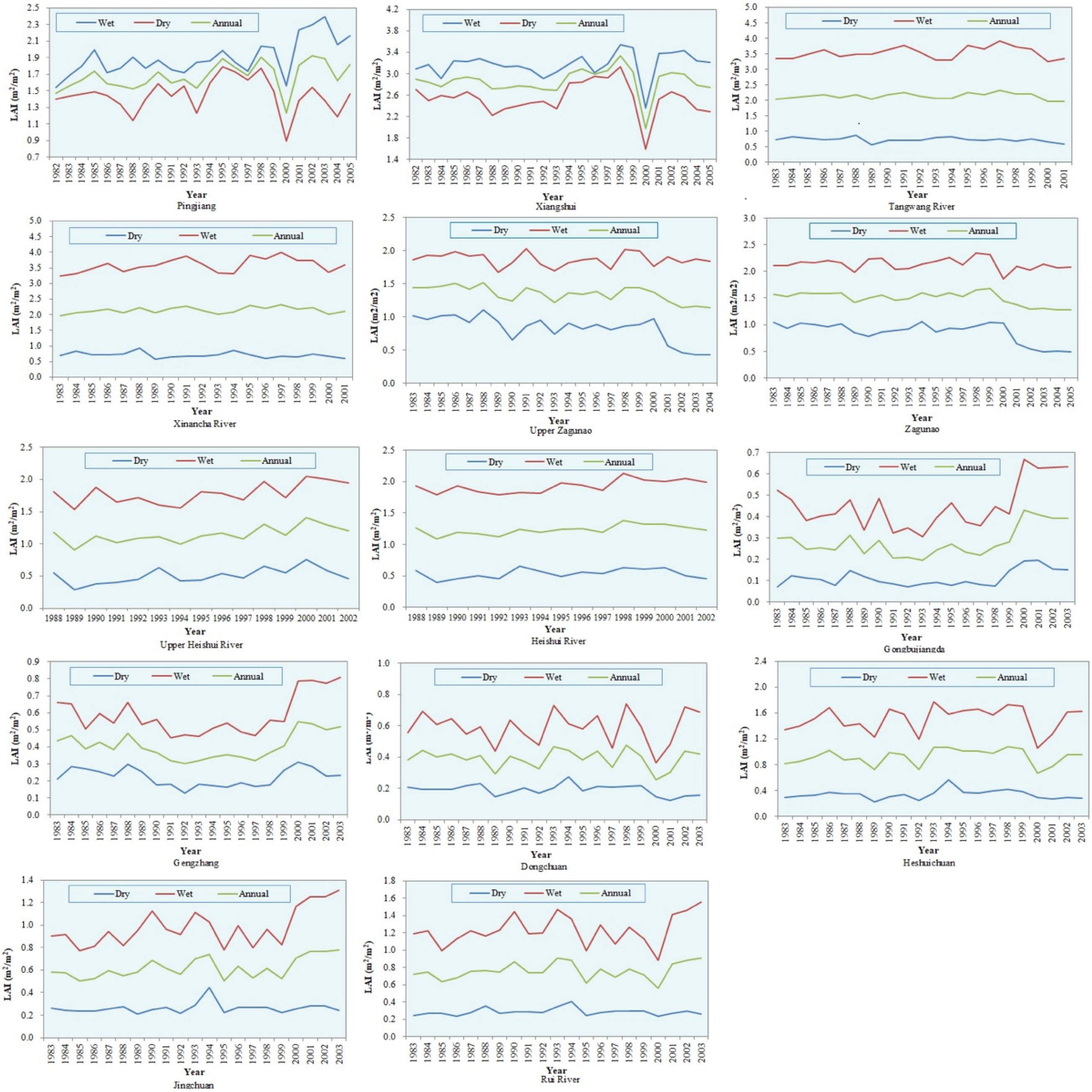

Figure S1: The temporal variations of dry season, wet season and annual leaf area index (LAI) in 14 study watersheds.

1.2 Climate data

CMA dataset contains daily climatic observations from 752 active stations in China and the earliest climate data can date back to 1950s. There are active climate stations within or around the Tangwang River, Xinancha River, Zagunao River, Upper Heishui River and Heishui River watersheds, and daily records collected from CMA climate stations (http://data.cma.cn) were used in these watersheds for analysis (Table S3). Due to a lack of long-term climate data from CMA stations within the Pingjiang, Xiangshui, Dongchuan, Heshuichuan, Jingchuan and Rui River watersheds, we generated spatial-interpolated gridded climate dataset by ANUSPLIN model based on CMA data. Monthly mean temperature, maximum temperature, minimum temperature and precipitation from all CMA climate stations in the Poyang Lake basin were collected as inputs, and ANUSPLIN model was then applied to interpolate point climate records into spatial gridded climate dataset based on digital elevation model (DEM) (Hartkamp et al., 1999; Price et al., 2000; Wang et al., 2006), and from which climate data for Pingjiang and Xiangshui watersheds were eventually derived. Similarly, climate data for the Dongchuan, Heshuichuan, Jingchuan and Rui River watersheds were derived from spatial-interpolated dataset by use of all CMA climate stations in the Yellow River basin. Climate data for the Upper Zagunao, Gongbujiangda and Gengzhang watersheds were obtained from active hydrological stations or rain gauges due to the lack of active CMA stations within these watersheds.

Table S3: Detailed information of hydrological station, sources of climate data and study period

Watersheds	Hydrological station	Longitude	Latitude	Climate data source	Study period
Pingjiang	Hanlinqiao	115° 04’	26° 02’	ANUSPLIN[2]	1982-2006
Xiangshui	Mazhou	115° 50’	25° 23’	ANUSPLIN[2]	1982-2006
Tangwang River	Chenming	129° 29’	46° 48’	Yichun, Hegang[1]	1983-2001
Xinancha River	Nancha	129° 15’	47° 08’	Yichun[1]	1983-2001
Upper Zagunao	Zagunao	103° 10’	31° 26’	Miyaluo, Li County[3]	1983-2004
Zagunao	Sangping	103° 35’	31° 28’	Songpan, Dujiangyan[1]	1983-2005
Upper Heishui River	Heishui	103°	31° 02’	Songpan, Hongyuan[1]	1988-2002
Heishui River	Shaba	103° 40’	31° 50’	Songpan, Hongyuan[1]	1988-2002
Gongbujiangda	Gongbujiangda	93° 15’	29° 53’	Gongbujiangda[3]	1983-2003
Gengzhang	Gengzhang	94° 09’	29° 44’	Gengzhang[3]	1983-2003
Dongchuan	Jiaqiao	107° 32’	36° 03’	ANUSPLIN[2]	1983-2003
Heshuichuan	Banqiao	107° 35’	35° 33’	ANUSPLIN[2]	1983-2003
Jingchuan	Jingchuan	107° 12’	35° 12’	ANUSPLIN[2]	1983-2003
Rui River	Yuanjiaan	107° 12’	35° 12’	ANUSPLIN[2]	1983-2003

Note: Climate data source: [1] CMA station; [2]ANUSPLIN model; and [3]hydrological stations or rain gauges.

2 Seasonal hydrological responses to vegetation change

2.1 Improved single watershed approach

An improved single watershed approach combined modified double mass curve (MDMC) and time series Multivariate Autoregressive Integrate Moving Average model (ARIMAX) was employed to quantify seasonal streamflow variations attributed to vegetation change, climate variability and other factors. Firstly, MDMC with accumulated seasonal effective precipitation plotted versus accumulated seasonal streamflow was performed to exclude the effects of climate variability on seasonal streamflow (Fig. S2a). There is a consistent relationship between seasonal streamflow and seasonal effective precipitation in a watershed during a period with limited hydrological impact of non-climate factors, resulting in a straight line in the MDMC (Zhang et al., 2012). In other words, seasonal streamflow variation is only determined by climate variability during an undisturbed period or a period of limited watershed disturbances. Once non-climate factors produce a detectable impact on seasonal streamflow, a breakpoint in the MDMC can be found. A linear regression model based on the accumulated seasonal effective precipitation and accumulated seasonal flows before the breakpoint can be built, and the differences between observed line and predicted line built by linear regression model after the breakpoint can represent the accumulated seasonal streamflow variation attributed to non-climate factors (ΔQ_{anc}) (Li et al., 2018a; Wei and Zhang, 2010; Zhang and Wei, 2012). Then, multivariate ARIMA (ARIMAX) model, a typical ARIMA model with one or multiple external variables was introduced to quantify seasonal streamflow variation attributed to vegetation change and other factors (Engle and Watson, 1981). Here, an ARIMAX model was fitted by time series of accumulated seasonal streamflow variation attributed to non-climate factors from MDMC (ΔQ_{anc}) with accumulated LAI variation (ΔLAI_a) added as an external variable. After that, the predicted accumulated seasonal streamflow variation attributed to non-climate factors (ΔQ_{anc0}) can be generated from a significant ARIMAX model (p<0.10). The differences between the predicted and observed seasonal streamflow variation attributed to non-climatic factors (ΔQ_d) can be expressed as statistical errors (ΔQ_{se}) and the accumulated seasonal streamflow variation attributed to other factors (ΔQ_o) (Fig. 2b). Finally, the 95% confidence interval (95%CI) was further used to differentiate statistical errors and seasonal streamflow variation attributed to other factors. Data points located within 95%CI were viewed as statistical errors only, while points fall beyond 95%CI were attributed to both seasonal streamflow variation to other factors and statistical errors (Fig. 2c). Once seasonal streamflow variation attributed to other factor was estimated, seasonal streamflow variation attributed to vegetation change (ΔQ_v) can be computed eventually (Hou et al., 2018a; Hou et al., 2018b). Equations (S1) to (S5) showed the calculations of the improved single watershed approach.

$$\Delta Q_{anc} = Q_a - Q_{a0} \quad \text{(S1)}$$

$$\Delta Q_{ac} = \Delta Q_a - \Delta Q_{anc} \quad \text{(S2)}$$

$$\Delta Q_{ad} = \Delta Q_{anc} - \Delta Q_{ana0} \quad \text{(S3)}$$

$$\Delta Q_o = \Delta Q_d - \Delta Q_{se} \quad \text{(S4)}$$

$$\Delta Q_v = \Delta Q_{nc} - \Delta Q_o \quad \text{(S5)}$$

where Q_a and Q_{a0} are the observed accumulated seasonal streamflow, and predicted accumulated seasonal streamflow by the linear regression model in MDMC, respectively; ΔQ_{anc} stands for accumulated seasonal streamflow variation attributed to non-climate factors; ΔQ_{ac} and ΔQ_a represent accumulated seasonal streamflow variation attributed to climate variability and seasonal streamflow variation, respectively; ΔQ_{anc0} stands for the predicted accumulated seasonal streamflow variation attributed to non-climatic factors from ARIMAX model, ΔQ_{ad} is accumulated seasonal streamflow variation from others. ΔQ_d, ΔQ_v and ΔQ_o represent seasonal streamflow variations attributed to others, vegetation change and other factors; ΔQ_{se} is statistical errors.

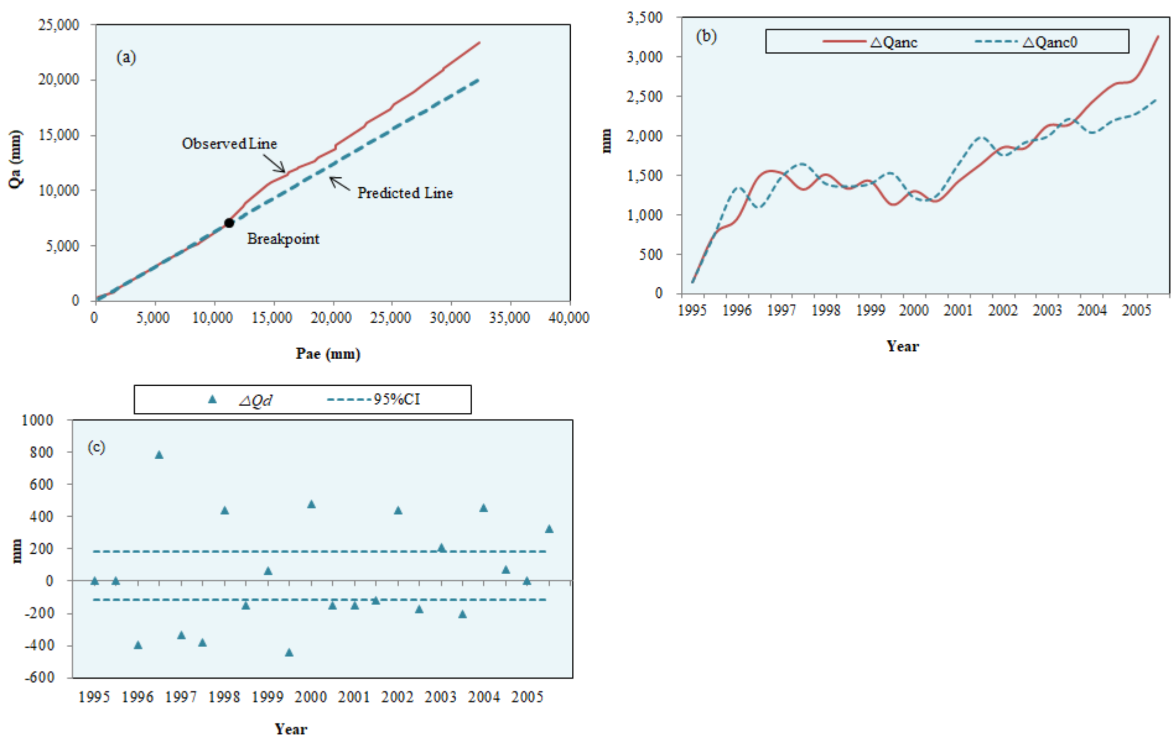

Figure S2: An example of the improved single watershed approach.

2.2 Effects of vegetation change on seasonal streamflow

According to the improved single watershed approach (Figs. S3 to S5), hydrological responses to climate variability, vegetation change and other factors can be quantified (Figs. S6 to S7). In dry season, vegetation loss can increase streamflow by 20.7 mm (8.8%), 135.7 mm (82.7%), 66.2 mm (46.0%), 49.5 mm (51.6%), 3.8 mm (58.5%) and 4.0 mm (24.2%) in the Pingjiang, Upper Zagunao, Zagunao, Gengzhang, Dongchuan and Jingchuan watersheds, respectively, while it can decrease streamflow by 30.9 mm (102.6%) and 23.4 mm (62.0%) in the Tangwang River and Xinancha River watersheds, respectively (Table S3). As a result of vegetation gain, dry season streamflow declined by 29.1% (5.8 mm) in the Rui River watershed and increased by 26.5% (64.2 mm), 4.6% (6.3 mm), 30.0% (35.4 mm), 44.1% (26.7 mm) and 2.4% (0.1 mm) in the Xiangshui, Upper Heishui River, Heishui River, Gongbujiangda and Heshuichuan watersheds, respectively. In wet season, vegetation loss can increase streamflow by 28.5 mm (4.6%) in the Xiangshui, 20.6 mm (3.3%) in the Upper Zagunao, 1.9 mm (0.5%) in the Zagunao, 44.7 mm (5.1%) in the Gengzhang, respectively and reduced streamflow by 1.4 mm (6.3%) in the Dongchuan watersheds. Wet season streamflow reduction due to vegetation gain in the Pingjiang, Tangwang River, Upper Heishui River, Heishui River, Gongbujingda, Jingchuan and Rui River watersheds varied from 8.4 mm to 104.7 mm (1.3%-94.2%). However, vegetation gain increased wet season streamflow by 31.9 mm (10.9%) and 0.6 mm (3.9%) in the Xinancha River and Heshuichuan watersheds, respectively.

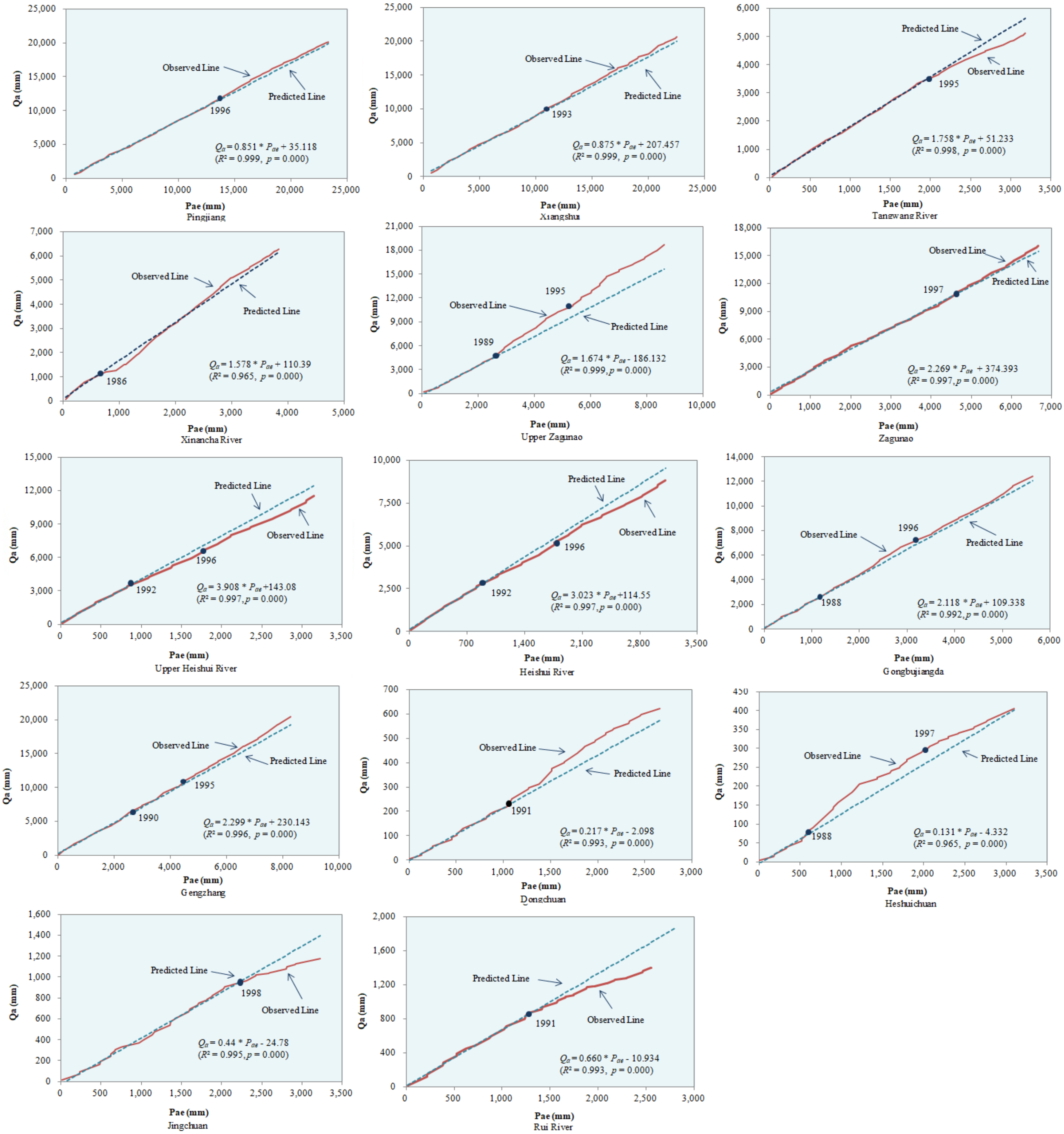

Figure S3: Modified double mass curves (MDMCs) for the study watersheds.

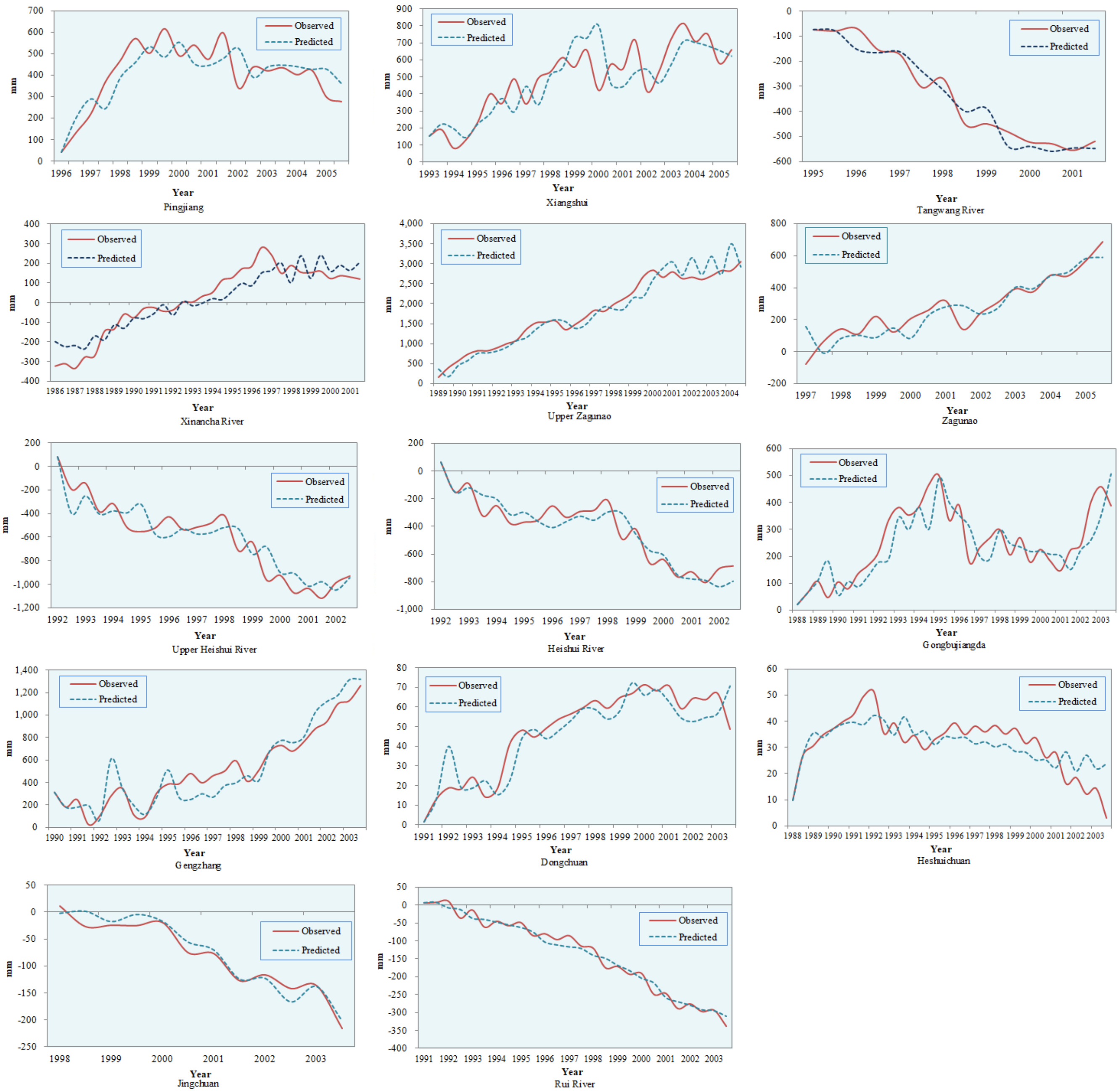

Figure S4: Observed accumulated seasonal streamflow variation attributed to non-climatic factors by MDMC and predicted accumulated seasonal streamflow variation attributed to non-climatic factors by ARIMAX.

Figure S5: 95% confidence intervals (95% CIs) of seasonal streamflow variation attributed to others.

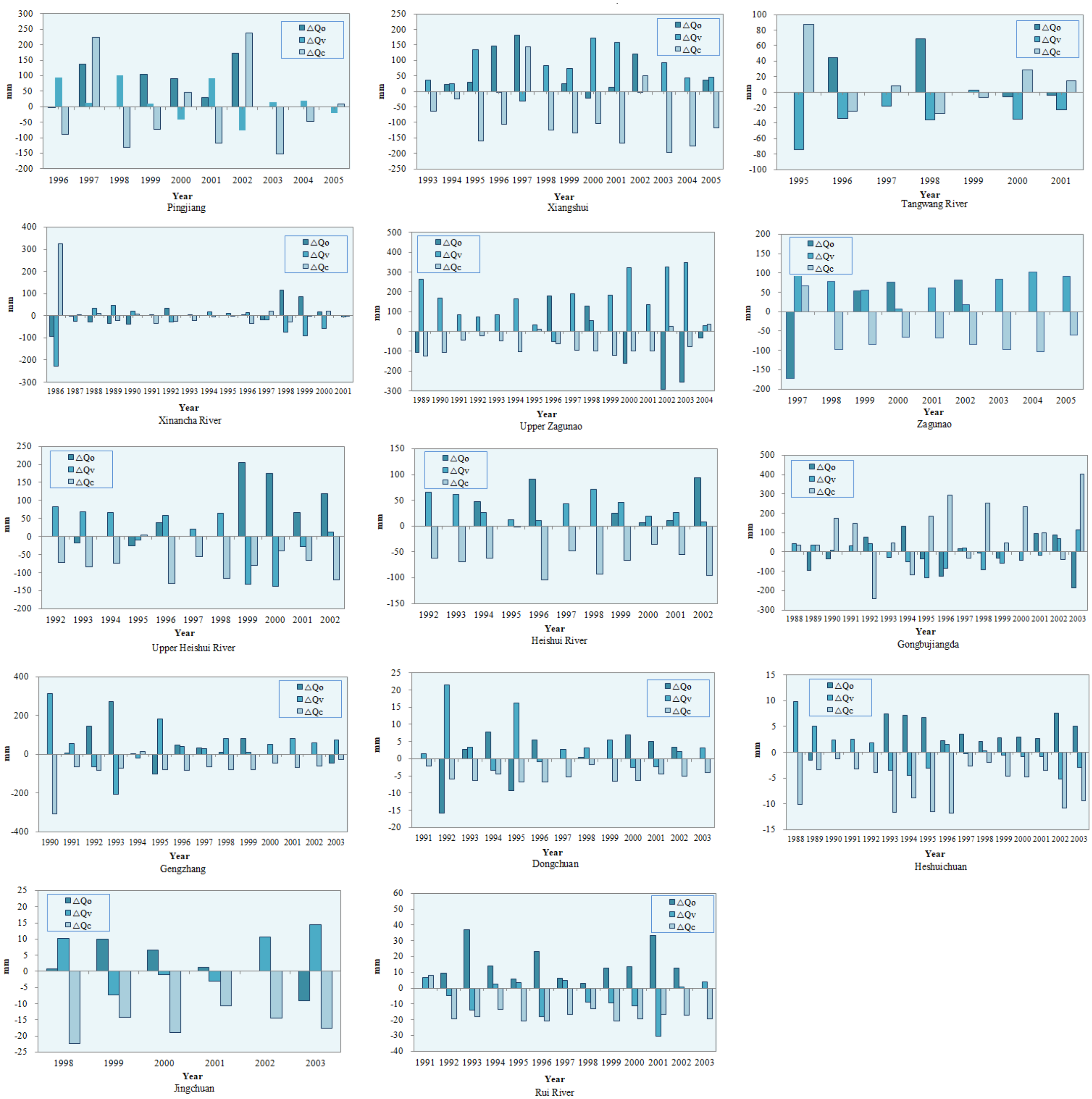

Figure S6: Dry season streamflow variations and their components.

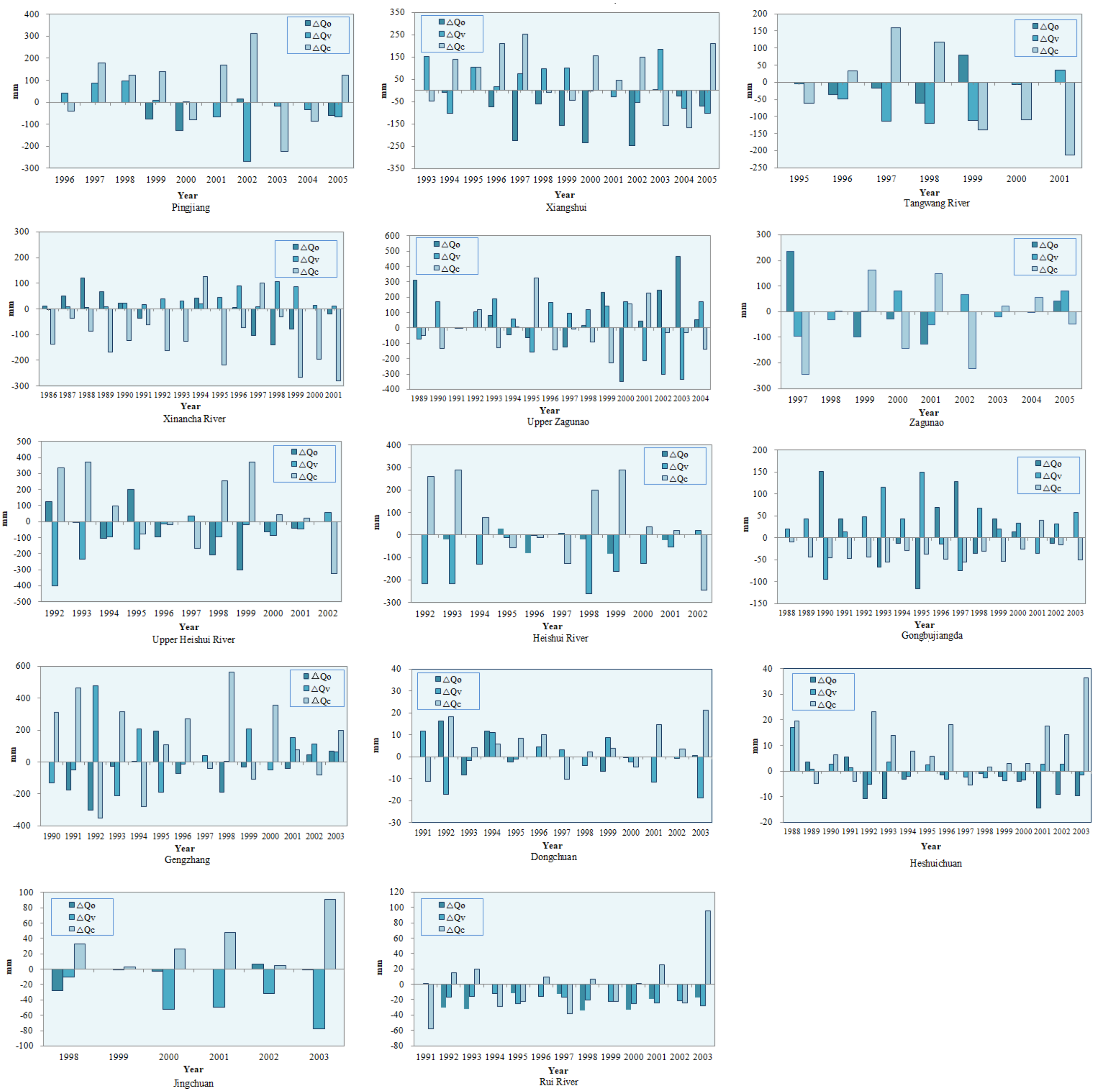

Figure S7: Wet season streamflow variations and their components.

Table S4: Seasonal streamflow response to climate variability, vegetation change and other factors, and seasonal ecohydrological sensitivity in the study watersheds

Watersheds	Disturbed period	Phase	ΔQ (mm)	ΔQ_c (mm)	ΔQ_v (mm)	ΔQ_o (mm)	ΔQ_c (%)	ΔQ_v (%)	ΔQ_o (%)	ΔQ (%)	ΔLAI (%)	S_f
PJ	1996-2005	Dry season	64.4	-9.7	20.7	53.4	-4.1	8.8	22.6	27.2	-0.2	3.03
		Wet season	15.0	61.4	-21.3	-25.0	10.2	-3.5	-4.1	2.5	13.1	0.83
XS	1993-2005	Dry season	16.3	-90.5	64.2	42.6	-37.3	26.5	17.6	6.7	28.6	1.27
		Wet season	8.8	65.0	28.5	-84.7	10.5	4.6	-13.7	1.4	-17.4	0.40
TR	1995-2001	Dry season	-4.6	11.4	-30.9	14.9	37.9	-102.6	49.4	-15.3	-6.7	27.75
		Wet season	-88.8	-30.4	-52.9	-5.4	-12.7	-22.0	-2.2	-37.0	3.6	4.36
XR	1986-2001	Dry season	-7.7	13.3	-23.4	2.4	35.2	-62.0	6.4	-20.5	-6.8	5.07
		Wet season	-80.2	-108.8	31.9	-3.3	-37.0	10.9	-1.1	-27.3	8.8	1.10
UZGN	1989-2004	Dry season	49.3	-59.3	135.7	-27.1	-36.1	82.7	-16.5	30.1	-24.7	3.74
		Wet season	57.8	-7.4	20.6	44.6	-1.2	3.3	7.2	9.4	-4.4	4.11
ZGN	1997-2005	Dry season	4.4	-66.3	66.2	4.4	-46.0	46.0	3.1	3.0	-21.1	1.37
		Wet season	-24.1	-29.8	1.9	2.7	-5.1	0.5	0.5	-4.1	-1.4	2.24
UHR	1992-2002	Dry season	-18.5	-75.9	6.3	51.1	-55.5	4.6	37.3	-13.5	35.4	1.01
		Wet season	-58.9	83.0	-97.0	-44.9	13.2	-15.4	-7.1	-9.4	5.0	2.02
HR	1992-2002	Dry season	-2.6	-63.1	35.4	25.1	-53.6	30.0	21.3	-2.2	15.2	2.08
		Wet season	-55.8	67.0	-104.7	-18.1	14.2	-22.2	-3.8	-11.8	3.7	3.49
GBJD	1988-2003	Dry season	5.1	-34.4	26.7	12.7	-56.7	44.1	21	8.4	17.1	4.45
		Wet season	79.7	94.9	-8.4	-6.9	17.9	-1.6	-1.3	15	3.5	0.51
GZ	1990-2003	Dry season	4.0	-78.3	49.5	32.8	-81.7	51.6	34.3	4.2	-21.2	4.90
		Wet season	136.6	128.8	44.7	-37.0	14.6	5.1	-4.2	15.5	-0.4	1.17
DC	1991-2003	Dry season	-0.7	-5.0	3.8	0.5	-76.9	58.5	7.8	-10.5	-4.8	6.54
		Wet season	4.4	5.1	-1.4	0.8	21.9	-6.3	3.6	19.3	-0.2	2.16
HSC	1988-2003	Dry season	-3.3	-6.4	0.1	3.1	-138.4	2.4	65.6	-70.4	3.8	3.45
		Wet season	6.8	9.8	0.6	-3.6	67.0	3.9	-39.2	21.8	3.4	1.40
JC	1998-2003	Dry season	-10.8	-16.4	4.0	1.6	-98.9	24.2	9.4	-65.3	-0.5	8.27
		Wet season	-7.2	34.2	-37.2	-4.2	86.6	-94.2	-10.7	-18.3	22.4	3.57
RR	1991-2003	Dry season	-8.7	-16.1	-5.8	13.1	-80.4	-29.1	65.7	-43.8	3.8	6.03
		Wet season	-35.0	-1.6	-18.8	-14.6	-2.5	-29.0	-22.5	-54.0	4.4	2.22

Note: (1) PJ, XS, TR, XR, UZGN, ZGN, UHR, HR, GBJD, GZ, DC, HSC, JC and RR refer to the Pingjiang, Xiangshui, Tangwang River, Xinancha River, Upper Zagunao, Zagunao, Upper Heishui River, Heishui River, Gongbujiangda, Gengzhang, Dongchuan, Heishuichuan, Jingchuan and Rui River watersheds, respectively.

(2) ΔQ, ΔQc, ΔQv and ΔQo stand for seasonal streamflow variations, seasonal streamflow variation to climate variability, vegetation change and other factors, respectively.

(3) ΔLAI means LAI deviation compared to average LAI before the first breakpoint.

3 Comparisons of dry season and wet season ecohydrological sensitivity in the study watersheds dominated by different climate condition, climate zone, dominant soil type and hydrological regime

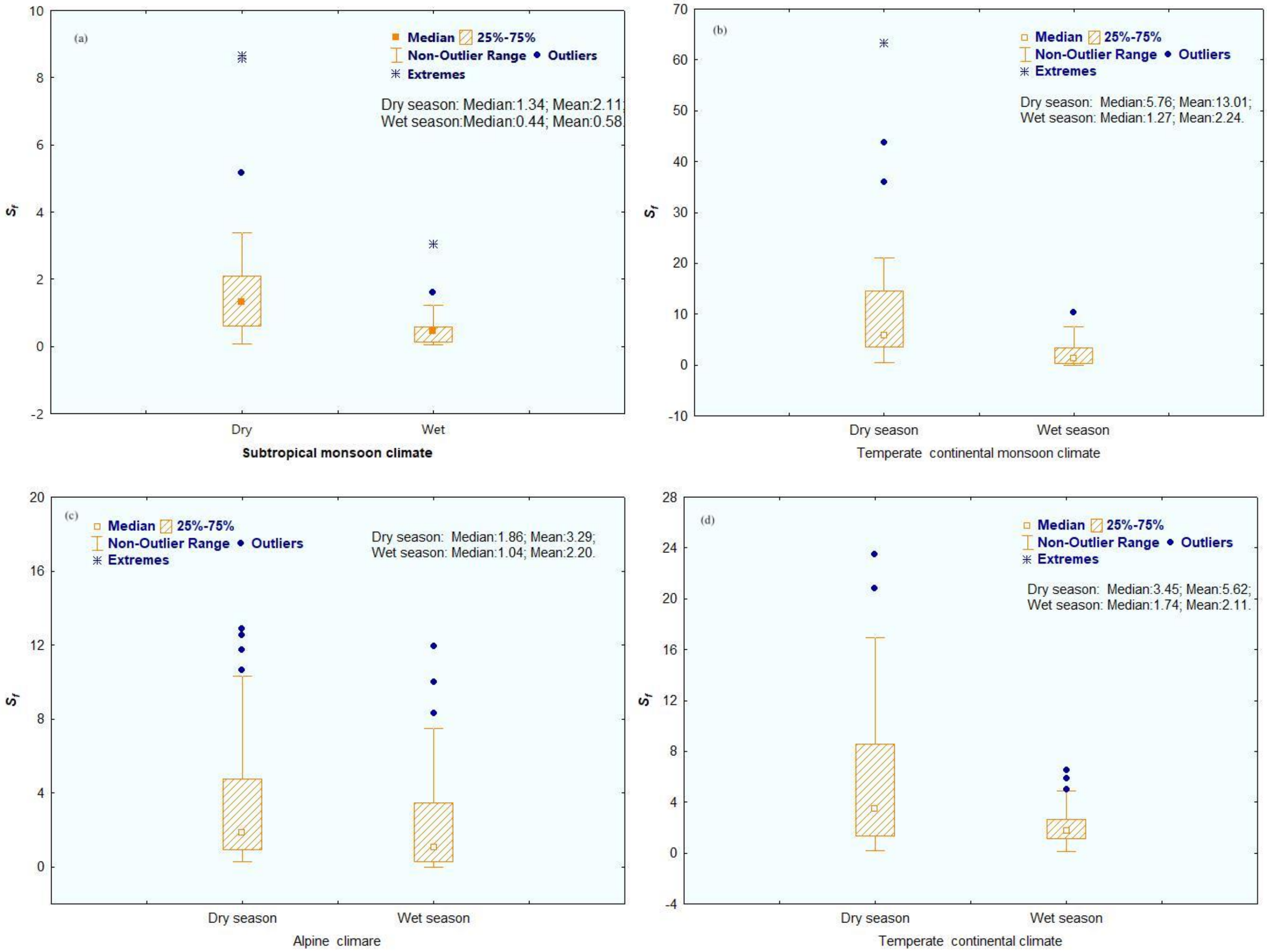

Figure S8: Comparisons of dry season and wet season ecohydrological sensitivity in different climate zones. (The Pingjiang and Xiangshui watersheds belong to subtropical monsoon climate, the Tangwang River and Xinancha River lie in temperate continental climate zone, the Upper Zagunao, Zagunao, Upper Heishui River, Heishui River, Gongbujiangda and Gengzhang experience alpine climate, and the Dongchuan, Heishuichuan, Jingchuan and Rui River are characterized by temperate continental climate.)

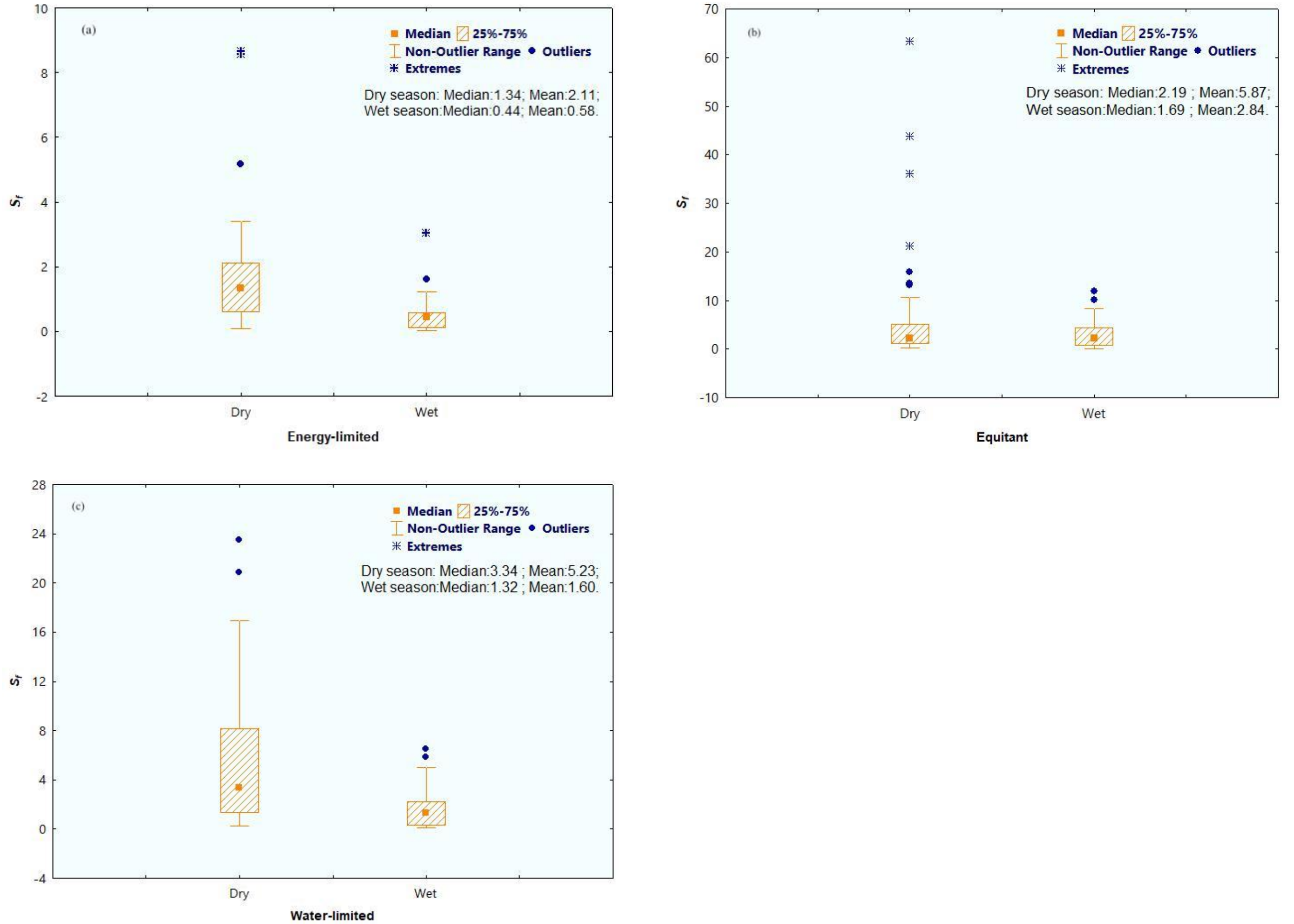

Figure S9: Comparisons of dry season and wet season ecohydrological sensitivity in different climate conditions. (Watershed classifications can be found in Table 3.)

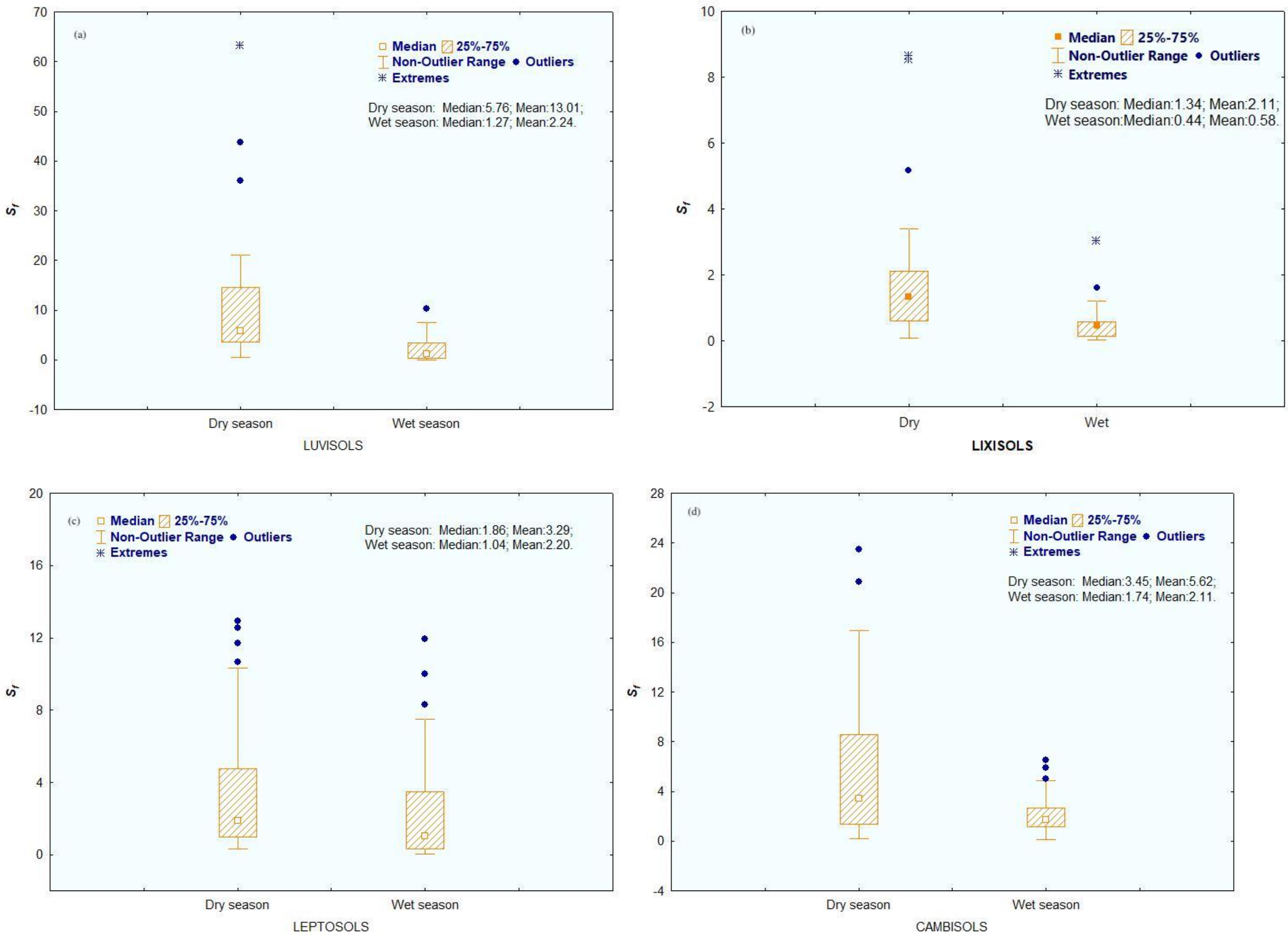

Figure S10: Comparisons of dry season and wet season ecohydrological sensitivity in different dominant soil types. (Watershed classifications can be found in Table 3.)

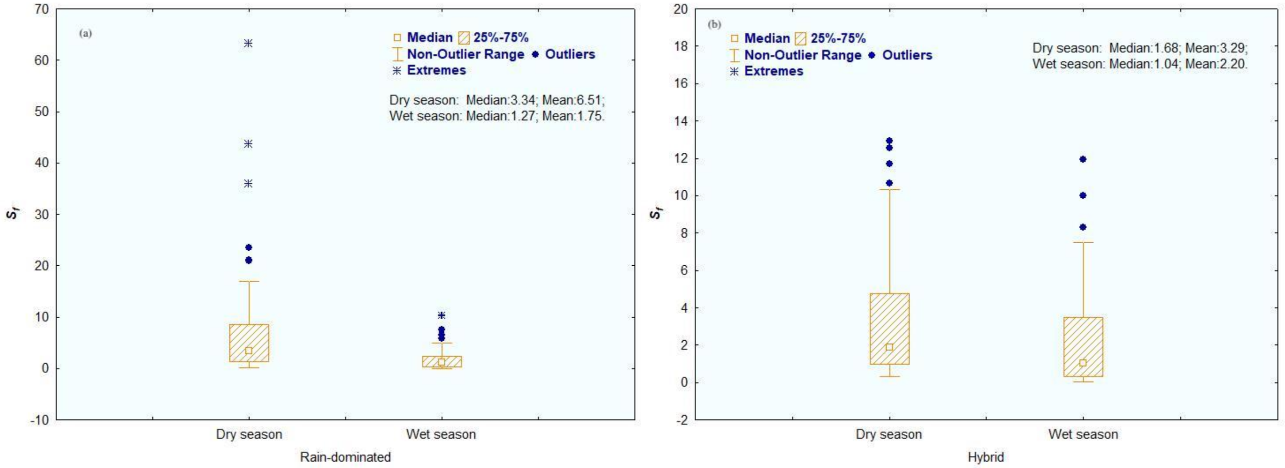

Figure S11: Comparisons of dry season and wet season ecohydrological sensitivity in different hydrological regimes. (Watershed classifications can be found in Table 3.)

Table S5: Statistical test for the differences of dry season and wet season ecohydrological sensitivity in climate zone, climate condition, dominant soil types and hydrological regime

Classification	S_{fd} vs. S_{fw}	Mann-Whitney U test	
		Z	*p*
Climate zone	Subtropical monsoon climate	**3.36**	**<0.001**
	Temperate continental monsoon climate	**3.65**	**<0.001**
	Alpine climate	**2.90**	**0.004**
	Temperate continental climate	**2.93**	**0.003**
Climate condition	Energy-limited	**3.36**	**<0.001**
	Equitant	1.59	0.11
	Water-limited	**5.28**	**0.00**
Dominant soil type	LIXISOLS	**3.36**	**<0.001**
	LUVISOLS	**3.65**	**<0.001**
	LEPTOSOLS	**2.90**	**0.004**
	CAMBISOLS	**2.93**	**0.003**
Hydrological regime	Rain-dominated	**4.98**	**<0.001**
	Hybrid	**2.90**	**0.004**

Note: S_{fd} and S_{fw} refer to dry season and wet season ecohydrological sensitivity.

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