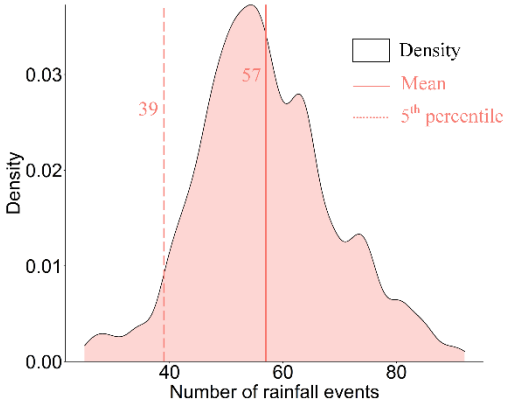
Supplementary Information

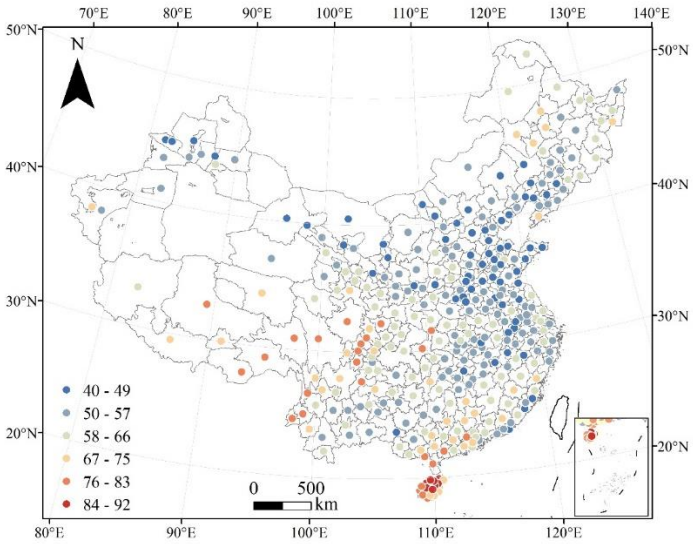
For

Quantifying unequal urban resilience to rains across China from location-aware big data

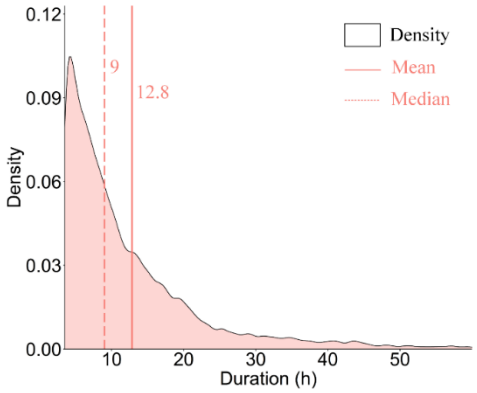
Supplementary Figure



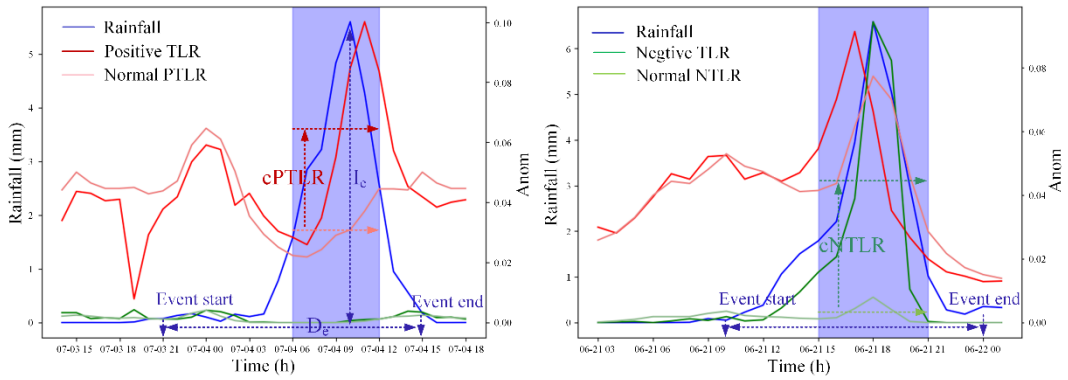
Supplementary Figure 1. The probability density function of the number of rainfall events for all cities.



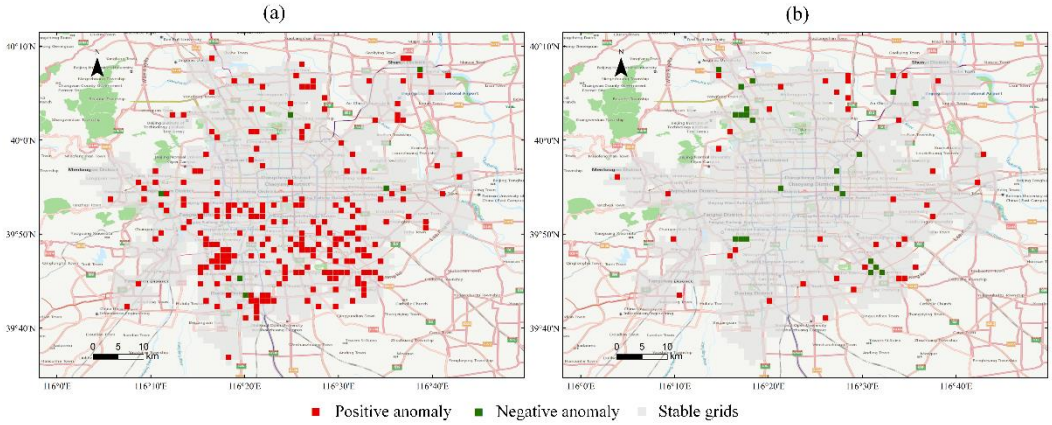
Supplementary Figure 2. The number of rainfall events by city.



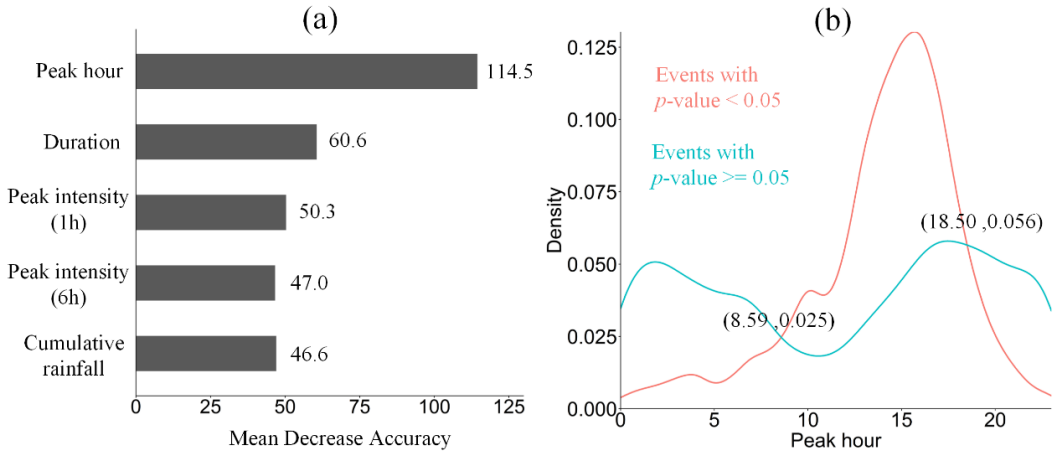
Supplementary Figure 3. The rainfall duration probability density function for all rainfall events.



Supplementary Figure 4. Definitions of the variables of rainfall and human activity anomalies used in this study, as exemplified by Beijing and Zhuhai city.

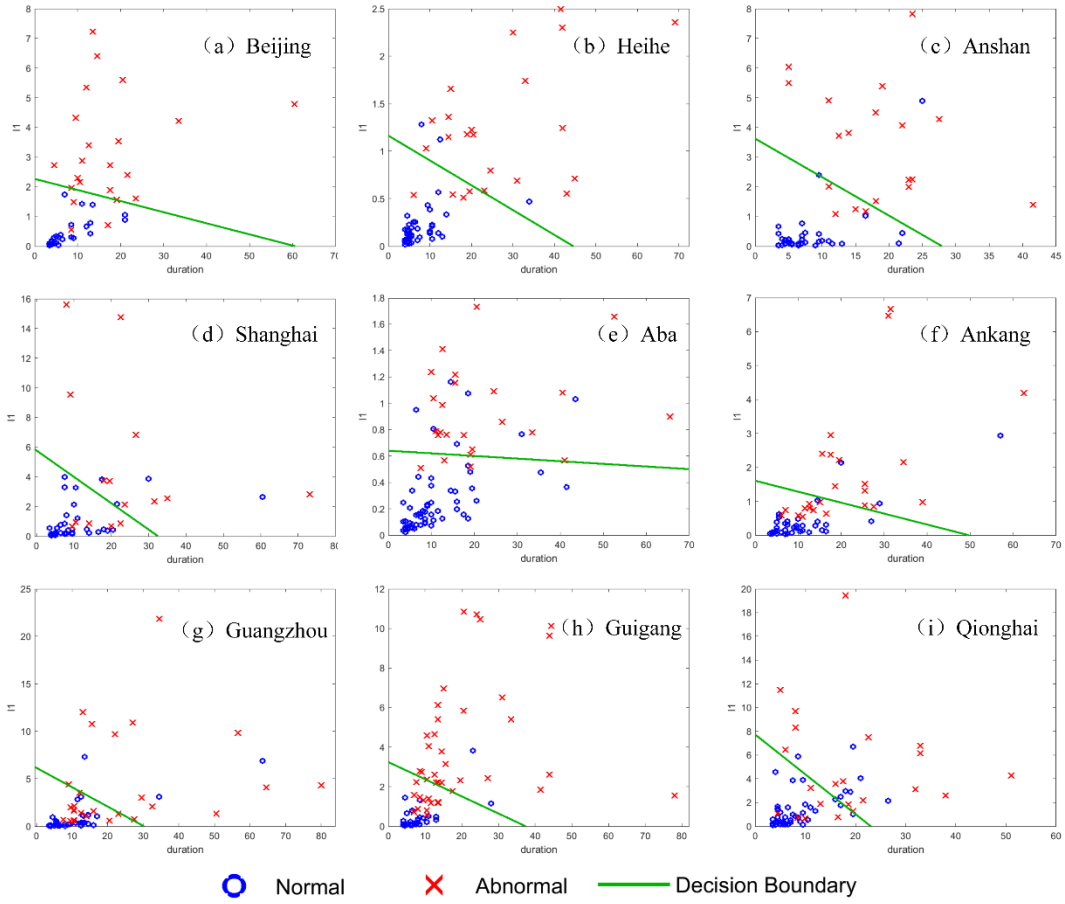


Supplementary Figure 5. The stable grids with positive, negative, and no anomalies in Beijing when it is raining at 10:00 am on July 04, 2017 (a) and not raining at 10:00 am on June 18, 2017 (b).

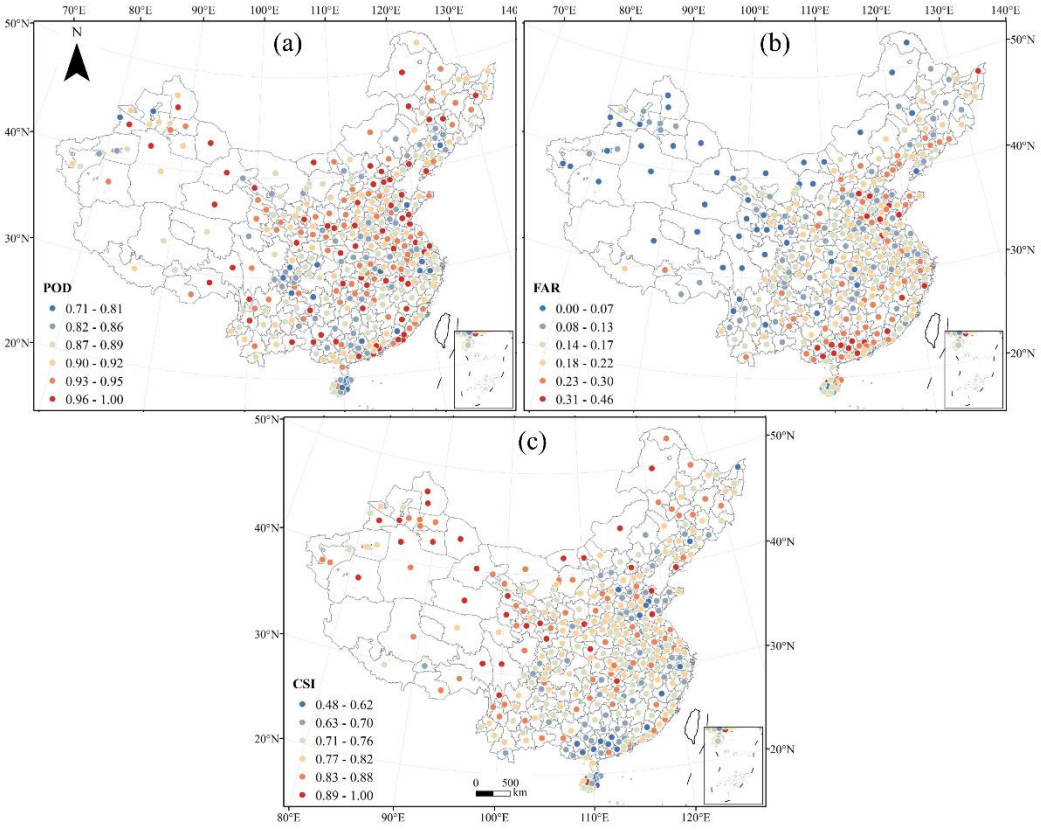


Supplementary Figure 6. (a) The importance of the five rainfall indicators obtained by the random forest model. The peak hour is the most important covariate that triggers human activity anomalies and has the highest decrease accuracy value of 114.5. (b) The peak hour thresholds identified from the differences of the peak hour PDF values between the rainfall events with and without significant collective human activity anomalies. When the peak hours

are between 8:59 am and 6:50 pm, the PDF values of the events with human activity anomalies are higher than those without. In other words, daytime rains are more likely to trigger human activity anomalies. There are 11,491 daytime rains (i.e., from 8.59 am to 6.50 pm) out of the total 20,860 rainfall events (ratio: 55.11%).



Supplementary Figure 7. The binary classification results of the cities in Northern(a-c), Midwestern(d-f), and Southern(g-i) China.



Supplementary Figure 8. The POD, FAR, and CSI of rainfall threshold detection based on the binary classifiers.

Supplementary Table

Supplementary Table 1. Rainfall indices uses in this study

Rainfall indices	Description
Peak intensity (1h)	Hourly peak rainfall intensity
Peak intensity (6h)	Six-hour-window peak rainfall intensity
Cumulative rainfall	Cumulative rainfall during a rainfall event
Duration	The time period a rainfall event lasts
Peak hour	The time of peak intensity(1h)

Supplementary Table 2. Correlations between the 3-hour rainfall threshold and explanatory variables

Urban indices	Coefficients	Kendall	Pearson	Spearman
Annual rainfall	0.40***	0.22***	0.40***	0.31***
Population density	0.21**	0.27***	0.40***	0.40***
Gross domestic product	0.20*	0.25***	0.40***	0.37***
Area of paved roads	-0.16*	-0.05	-0.17*	-0.07
Green coverage rate	0.17	0.21**	0.27**	0.31**
Drainage network density	0.09	0.17*	0.20*	0.24*

***p<0.001;**p<0.01;*p<0.05. R^2=0.40.

Supplementary Table 3. Correlations between the 6-hour rainfall threshold and the explanatory variables

Urban indices	Coefficients	Kendall	Pearson	Spearman
Annual rainfall	0.43***	0.24***	0.42***	0.33***
Population density	0.21**	0.26***	0.39***	0.38***
Gross domestic product	0.20*	0.24***	0.39***	0.36***
Area of paved roads	-0.17*	-0.06	-0.19*	-0.09
Green coverage rate	0.16	0.20**	0.26**	0.30**
Drainage network density	0.10	0.17*	0.20*	0.24*

***p<0.001;**p<0.01;*p<0.05. R^2=0.42

Supplementary Table 4. Correlations between the 12-hour rainfall threshold and the explanatory variables

Urban indices	Coefficients	Kendall	Pearson	Spearman
Annual rainfall	0.50***	0.35***	0.49***	0.50***
Population density	0.19*	0.19***	0.31**	0.27**
Gross domestic product	0.13	0.15*	0.29**	0.22*
Area of paved roads	-0.17*	-0.12	-0.23*	-0.17
Green coverage rate	0.07	0.12	0.17	0.19
Drainage network density	0.10	0.14*	0.18	0.20*

***p<0.001;**p<0.01;*p<0.05. R^2=0.38.

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Supplementary Table 5. Correlations between the response sensitivity and the explanatory variables

Urban indice	Coefficients	Kendall	Pearson	Spearman
Annual rainfall	-0.37***	-0.22***	-0.35***	-0.33***
Population density	-0.19*	-0.23***	-0.34***	-0.33***
Gross domestic product	-0.17	-0.23***	-0.34***	-0.38***
Area of paved roads	0.05	0.03	0.05	0.06
Green coverage rate	-0.05	-0.18**	-0.20*	-0.26**
Drainage network density	-0.20*	-0.18**	-0.29**	-0.27**

***p<0.001;**p<0.01;*p<0.05. R^2=0.31

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