

SUPPLEMENTARY MATERIAL

Summary

Page 2: Summary table of all rainfall and discharge events and their related statistics

Page 3: Vallon de Nant hydrogram from January 1st 2017 to December 31st 2018

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Page 56: RMSE values (P_{ALL} , I_{ASYM} and RC) obtained with the different optimized network

Page 56: Correlation coefficient obtained between all the variables used in the paper

Note about the Figure S2 to Figure S49

Each figure presents:

- On top, the general hydrogram over the whole observation period (July 1st to September 23th). The red dashed lines mark out the period the other plots are focusing on. The shaded red areas correspond to periods the river stage data are not available.
- In the middle, the zoomed hydrogram show a detailed view of the river discharge. In case a river reaction is associated, the discharge event is marked out by red dashed lines. Between these vertical lines is drawn a line joining the initial and final baseflow, separating the discharge amount fed by the baseflow (under the line) to the fast runoff (over the line). The red square shows the center of mass of the fast runoff part.
- On the bottom are shown the rainfall recorded by each of the 12 rain gauges (the y-axis scale between 2 stations is about 20 mm/h). The rainfall event is marked out by green dashed lines. For rainfall events causing a river reaction, an additional green dotted line marks the time taken as rainfall event beginning.
- On the left, a map with the 12 rain gauge locations show the total amount of rainfall recorded by each station during the event (with a red cross in case of missing data).

Table S1. Summary table of the 48 rainfall events (*P event*) and 15 corresponding discharge event (*Q event*), and statistics: the minimal number of working weather stations (*Working WS*) during the event, the rainfall over the lower area (*P lower*), the upper area (*P upper*) and on the full catchment (*P total*), the asymmetry index (*I asym*), the cumulated rainfall over the X previous days (*wet. X day*), the initial baseflow (*initial Q*), the fast discharge (*fast Q*) and runoff coefficient (*RC*), the lag time between the significant beginning of rainfall and the river reaction (*P start/Q start*), the center of mass of rainfall over the hillslopes (*Centroid hillslope*) and within the river network (*Centroid river*). The shaded red areas correspond to periods the river stage data are not available.

Prevent No.	Prevent starting date	Prevent end date	Prevent duration	Quarent No.	Quarent starting date	Quarent end date	Quarent duration	Working WS	P lower [mm]	P upper [mm]	P total [mm]	I asym [°]	wet. 1 day [mm]	wet. 2 day [mm]	wet. 3 day [mm]	wet. 4 day [mm]	Initial Q [mm]	Fast Q [mm]	RC [-]	P start / Q start [min]	Centroid hillslope [m]	Centroid river [m]	
1	Jul 02 04:56 PM	Jul 02 06:36 PM	02:14	1	Jul 02 10:43 PM	Jul 02 11:27 PM	00:44	8	2	1.2	3.2	-0.25	0.0	0.0	0.0	0.0	7.9	1.0	0.1	-	241	1402	
2	Jul 02 04:50 PM	Jul 03 04:44 AM	00:54		8	4	4	8.0	0.00	3.2	3.2	3.2	11.3	11.3	11.3	11.3	12.7	8.6	0.6	33	348	1852	
3	Jul 03 04:50 AM	Jul 03 05:44 AM	00:54		8	0.5	0.8	1.3	0.23	11.3	11.3	11.3	11.3	11.3	11.3	11.3	12.7	8.6	0.6	33	382	1901	
4	Jul 03 05:09 PM	Jul 03 05:49 PM	00:40		8	8.1	5.2	13.4	-0.22	12.5	12.7	12.7	12.7	12.7	12.7	12.7	12.7	7.5	8.6	0.6	12	354	1784
5	Jul 05 04:28 AM	Jul 05 05:28 AM	01:00		9	0.5	0.7	1.2	0.17	0.8	15.5	26.7	26.7	26.7	26.7	26.7	26.7	26.7	8.6	0.6	12	496	2067
6	Jul 05 05:28 AM	Jul 05 12:08 PM	02:30	3	Jul 05 04:38 PM	Jul 05 09:42 PM	05:09	9	0.7	1.1	1.7	0.24	2.1	15.4	28.0	28.0	6	6.4	0.8	59	417	2023	
7	Jul 05 05:28 AM	Jul 05 12:08 PM	02:30		9	4	4.1	8.1	0.01	3.9	17.2	29.8	29.8	29.8	29.8	29.8	29.8	6	6.4	0.8	59	367	1718
8	Jul 06 01:14 AM	Jul 06 03:36 AM	02:22		9	0.3	1.1	1.5	0.53	11.9	12.7	27.4	38.6	40.3	40.3	40.3	40.3	23.9	1.2	77	609	2403	
9	Jul 06 03:36 AM	Jul 06 03:36 PM	07:58		9	8.9	11.9	20.8	0.14	12.3	14.4	27.8	40.3	40.3	40.3	40.3	40.3	5.8	23.9	1.2	77	469	2003
10	Jul 14 03:00 PM	Jul 14 04:58 PM	05:58		5	Jul 14 04:51 PM	Jul 14 09:53 PM	05:02	11	11.1	8.1	19.2	-0.16	0.0	0.0	0.0	0.0	4.5	11.7	0.6	64	362	1825
11	Jul 15 04:52 PM	Jul 15 07:42 PM	02:16	6	Jul 15 05:42 PM	Jul 15 11:01 PM	04:41	11	6.4	5.1	11.5	-0.11	2.8	18.9	18.9	18.9	5.5	9.6	0.8	38	342	1733	
12	Jul 19 01:26 AM	Jul 19 03:10 AM	01:44		11	1.9	1.3	3.2	-0.19	0.0	0.1	11.6	4.8	14.4	14.4	14.4	14.4	4.8	14.4	0.8	68	341	1732
13	Jul 20 05:40 PM	Jul 20 10:28 PM	04:48		8	8.1	10.4	18.5	0.12	0.0	3.3	3.3	3.4	4.8	14.4	14.4	14.4	4.8	14.4	0.8	68	438	1891
14	Jul 21 10:46 AM	Jul 21 12:00 PM	01:14		11	0.6	0.6	1.3	0.00	18.8	18.8	22.1	22.1	22.1	22.1	22.1	22.1	4.0	14.4	0.8	68	410	1893
15	Jul 21 04:06 PM	Jul 21 05:42 PM	01:36		11	0.7	1	1.7	0.18	20.3	20.3	23.6	23.6	23.6	23.6	23.6	23.6	3.1	31.3	3.0	32	428	1899
16	Jul 24 06:32 PM	Jul 24 10:12 PM	03:40	8	Jul 24 06:07 PM	Jul 24 11:56 PM	03:49	12	9.6	1	10.6	-0.81	0.1	0.1	1.0	12.2	284	1417	3.0	32	284	1417	
17	Jul 28 05:18 AM	Jul 28 06:16 AM	00:58		12	2	2	4.0	0.00	0.2	0.2	0.6	10.7	10.7	10.7	10.7	10.7	388	1796	3.0	32	388	1796
18	Jul 28 10:02 AM	Jul 28 02:06 PM	04:04		12	3.7	3.2	6.9	-0.07	4.2	4.2	4.6	14.7	14.7	14.7	14.7	14.7	401	1800	4.7	32	401	1800
19	Aug 01 03:34 PM	Aug 01 07:50 PM	04:16		10	2.6	2.5	5.1	-0.02	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	427	1911	5.8	32	427	1911
20	Aug 03 03:18 PM	Aug 03 04:26 PM	01:08		12	0.9	0.4	1.3	-0.38	0.5	5.8	5.8	5.8	5.8	5.8	5.8	5.8	286	1411	5.8	32	286	1411
21	Aug 05 02:56 PM	Aug 05 03:28 PM	00:32	12	Aug 05 02:56 PM	Aug 05 03:28 PM	00:32	12	0.9	0.2	1.2	-0.58	0.0	1.4	1.9	7.2	251	1433	5.8	32	251	1433	
22	Aug 06 04:36 PM	Aug 06 07:44 PM	03:08		9	20.5	21.9	42.4	0.03	0.0	1.2	1.3	2.6	2.6	2.6	2.6	2.6	357	1755	5.8	32	357	1755
23	Aug 08 02:32 PM	Aug 08 03:04 PM	00:32		12	2.3	0.1	2.4	-0.92	0.5	42.8	44.0	44.0	44.0	44.0	44.0	44.0	79	359	4.8	32	79	359
24	Aug 09 11:40 AM	Aug 09 01:54 PM	02:14		12	1.3	1.1	2.4	-0.08	2.1	2.6	44.9	46.0	46.0	46.0	46.0	46.0	418	1874	4.8	32	418	1874
25	Aug 09 10:12 PM	Aug 09 11:24 PM	01:12		12	0.7	0.8	1.5	0.07	2.6	4.7	5.1	47.4	47.4	47.4	47.4	47.4	379	1786	4.7	32	379	1786
26	Aug 10 02:30 AM	Aug 10 06:36 AM	04:06	12	Aug 10 06:36 AM	Aug 10 06:36 AM	04:06	12	1.9	1.8	3.7	-0.03	4.3	6.4	6.9	49.1	370	1846	4.8	32	370	1846	
27	Aug 13 07:52 AM	Aug 13 09:38 AM	01:46		11	1.8	1.1	2.9	-0.24	0.0	0.0	0.1	8.1	8.1	8.1	8.1	8.1	343	1613	4.8	32	343	1613
28	Aug 13 02:08 PM	Aug 13 03:06 PM	00:58		12	0.9	1.8	2.7	0.33	2.9	2.9	2.9	8.5	8.5	8.5	8.5	8.5	500	2272	4.8	32	500	2272
29	Aug 14 02:16 AM	Aug 14 05:40 AM	03:24		9	4	7.3	11.2	0.29	6.4	6.4	6.4	10.2	10.2	10.2	10.2	10.2	40	7.6	0.7	90	339	1835
30	Aug 14 12:54 PM	Aug 14 02:28 PM	01:34		12	0.9	0.7	1.6	-0.13	15.4	18.2	18.3	18.3	18.3	18.3	18.3	18.3	4.0	7.6	0.7	90	339	1835
31	Aug 17 12:54 PM	Aug 17 02:36 PM	02:32	10	Aug 17 01:53 PM	Aug 17 03:42 PM	01:49	12	6.2	5.3	11.5	-0.08	0.3	0.3	2.2	17.5	3.2	5.0	0.4	87	417	1718	
32	Aug 19 03:22 PM	Aug 19 04:00 PM	00:38		12	0.7	1.7	2.3	0.43	0.1	0.2	11.9	11.9	11.9	11.9	11.9	11.9	679	2380	4.8	32	679	2380
33	Aug 22 07:10 PM	Aug 22 08:42 PM	01:32		12	1.5	1.7	3.2	0.06	1.0	1.9	1.9	4.5	4.5	4.5	4.5	4.5	386	1864	4.8	32	386	1864
34	Aug 23 04:36 PM	Aug 23 10:29 PM	06:28		11	Aug 23 06:32 PM	Aug 23 10:29 PM	03:57	12	9.6	14	23.6	0.19	3.5	5.0	5.3	5.4	2.4	14.7	0.6	84	503	2149
35	Aug 24 02:36 PM	Aug 24 05:34 AM	02:38		12	Aug 24 04:10 AM	Aug 24 05:57 PM	01:47	12	4.7	3.8	8.5	-0.11	24.2	28.5	29.4	29.5	4.1	7.4	0.9	83	582	1803
36	Aug 25 10:24 AM	Aug 25 11:24 AM	01:02	12	Aug 24 04:10 AM	Aug 24 05:57 PM	01:47	12	0.4	0.7	1.2	0.25	0.1	32.7	37.0	38.0	382	1803	4.8	32	382	1803	
37	Aug 25 01:36 PM	Aug 25 04:30 PM	02:54		12	1.4	1.7	3.1	0.10	1.3	34.0	38.3	39.3	39.3	39.3	39.3	39.3	487	2246	4.8	32	487	2246
38	Aug 25 09:38 PM	Aug 25 09:38 PM	02:18		12	1.5	1.1	2.6	-0.15	4.6	29.8	40.6	41.6	41.6	41.6	41.6	41.6	393	1897	4.8	32	393	1897
39	Aug 26 08:02 AM	Aug 26 10:06 AM	02:04		12	0	1	1.0	1.00	7.4	7.4	40.0	44.4	44.4	44.4	44.4	44.4	1088	9471	4.8	32	1088	9471
40	Aug 29 11:52 AM	Aug 29 01:06 PM	01:14		12	4.5	3.9	8.4	-0.07	0.0	0.0	0.0	7.3	7.3	7.3	7.3	7.3	387	1776	4.8	32	387	1776
41	Aug 29 05:24 PM	Aug 29 06:44 PM	01:12	13	Aug 29 06:38 PM	Aug 29 08:34 PM	01:56	12	2.8	3	5.8	0.03	8.4	8.4	8.4	12.4	3.0	2.0	0.3	66	485	2039	
42	Aug 31 03:46 PM	Aug 31 07:16 PM	03:30		11	1.4	2	3.4	0.18	1.1	7.2	15.5	15.5	15.5	15.5	15.5	15.5	454	2059	4.8	32	454	2059
43	Sep 01 05:36 AM	Sep 01 04:04 PM	10:28		11	4	6.7	10.7	0.25	5.6	6.0	20.4	20.4	20.4	20.4	20.4	20.4	3.4	16.6	1.6	49	456	2251
44	Sep 06 10:38 PM	Sep 07 02:34 AM	08:56		11	2.1	2.2	4.4	0.02	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.6	4.1	0.3	81	392	1899
45	Sep 13 02:34 PM	Sep 13 09:04 PM	06:10		15	Sep 13 08:39 PM	Sep 13 09:38 PM	00:59	11	8.1	4.2	12.3	-0.32	0.0	0.0	0.0	0.0	2.6	4.1	0.3	81	366	1897
46	Sep 14 12:42 AM	Sep 14 12:42 AM	01:18	11	Sep 14 12:42 AM	Sep 14 12:42 AM	01:18	11	1.2	0.7	1.8	-0.28	12.2	12.2	12.2	12.2	2.6	4.1	0.3	-	355	1897	
47	Sep 18 06:04 PM	Sep 18 08:18 PM	02:14		11	1.2	1.3	2.5	0.04	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	375	1706	
48	Sep 21 02:24 PM	Sep 21 11:20 PM	08:56		7	4.7	3.5	8.2	-0.15	0.0	0.0	0.0	2.6	2.6	2.6	2.6	2.6	347	1650	4.8	32	347	1650

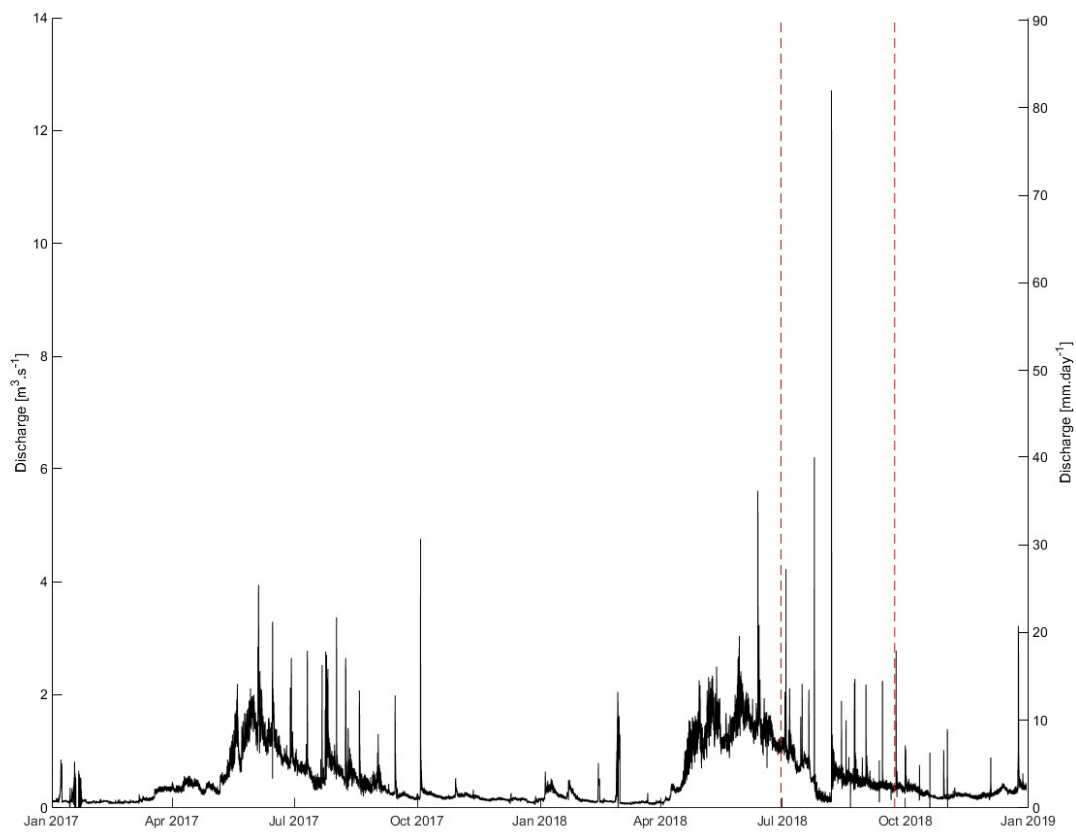


Figure S1. River discharge measured at the Vallon de Nant outlet (in $\text{m}^3.\text{s}^{-1}$ and $\text{mm}.\text{day}^{-1}$) over 2017 and 2018. The study period (from July 1st 2018 to September 23th 2018) is marked out by the two red dashed lines.

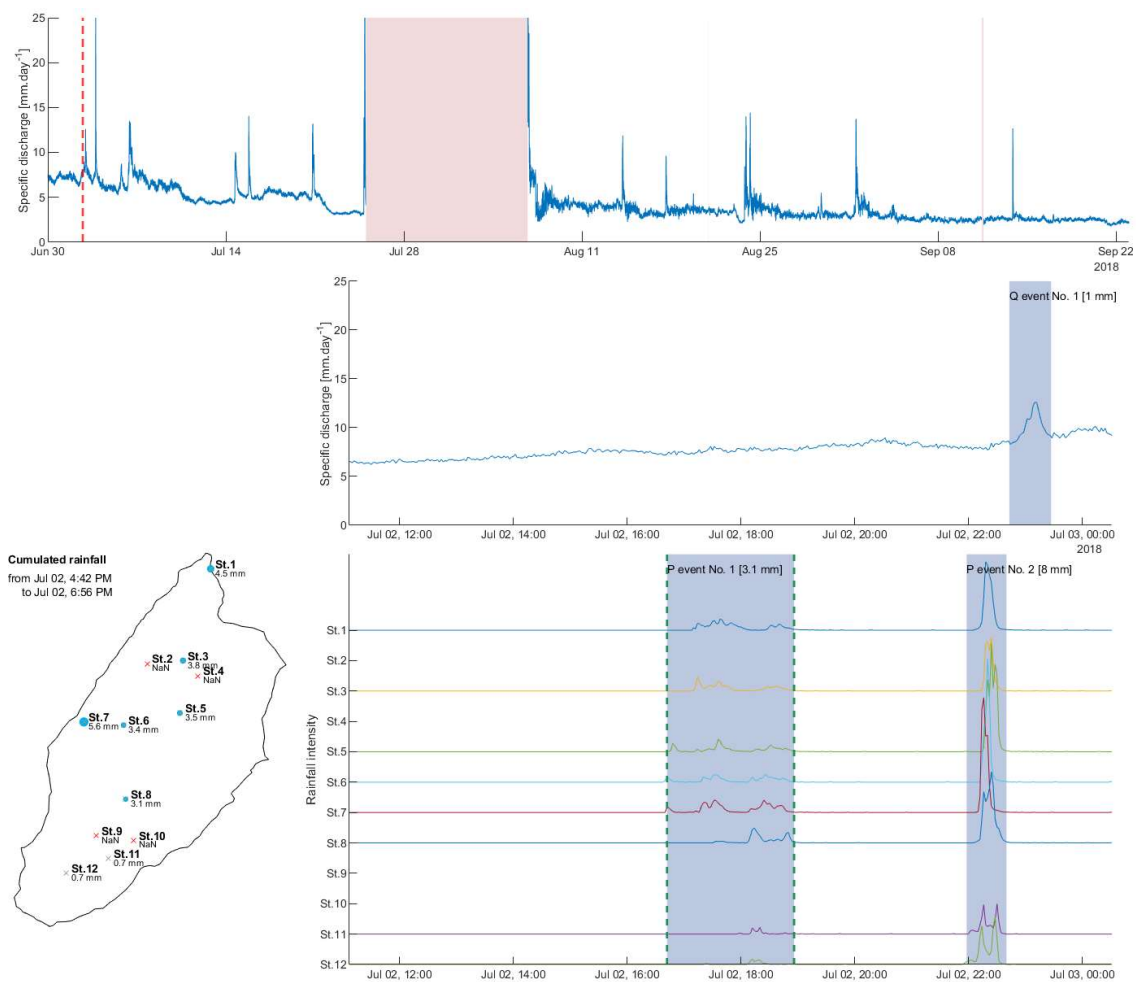


Figure S2. Precipitation event No. 1 from July 2nd 04:42 PM to July 2nd 06:56 PM

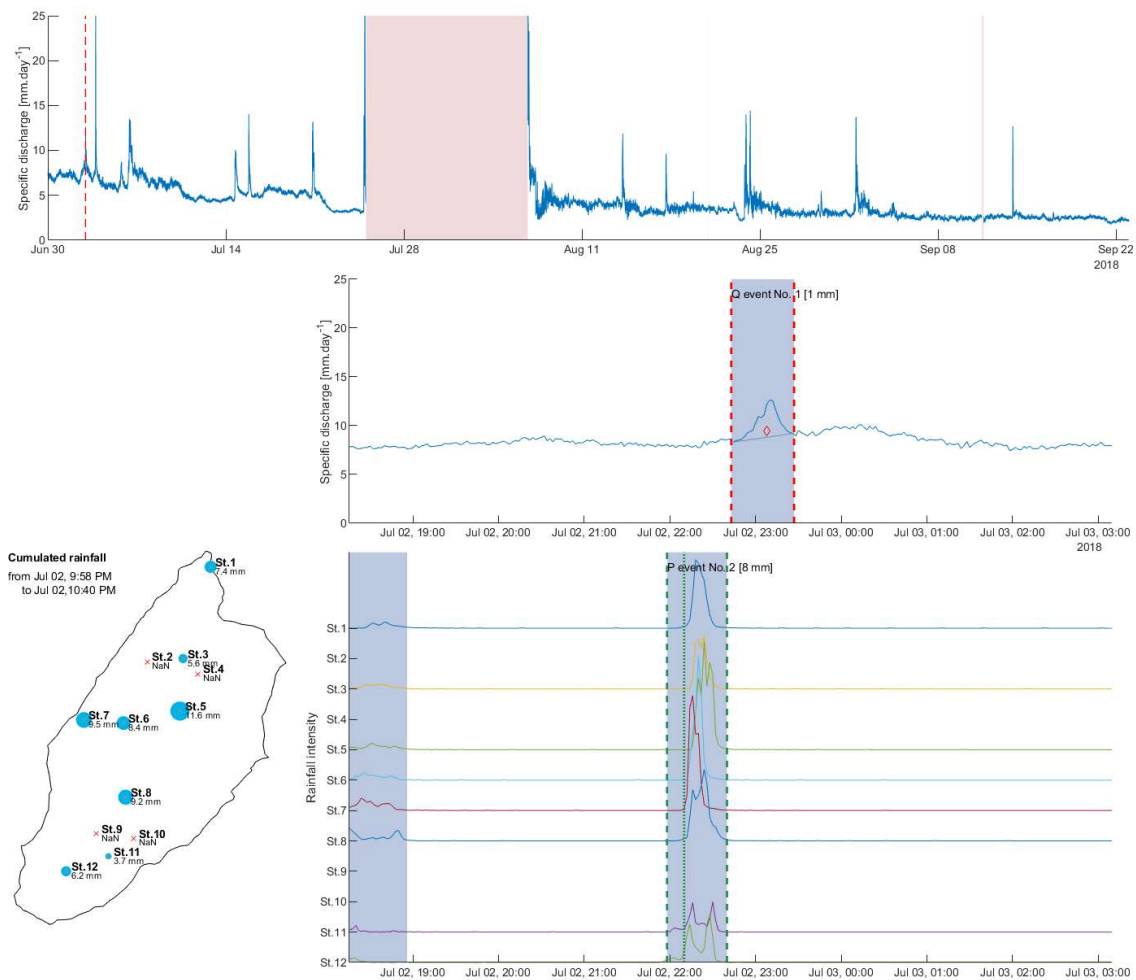


Figure S3. Precipitation event No. 2 from July 2nd 09:58 PM to July 2nd 10:40 PM and discharge event No. 1 from July 2nd 10:43 PM to July 2nd 11:27 PM

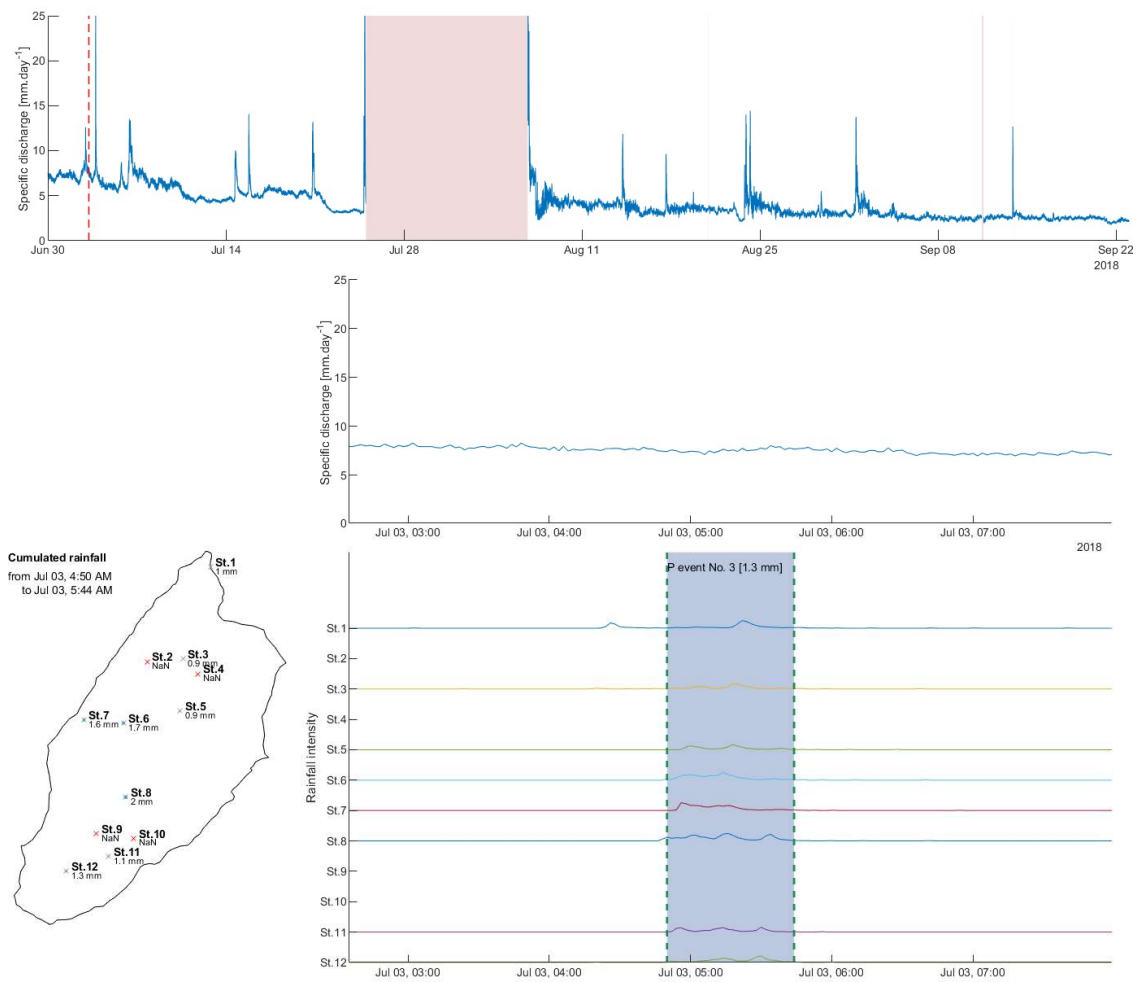


Figure S4. Precipitation event No. 3 from July 3rd 04:50 AM to July 3rd 05:44 AM

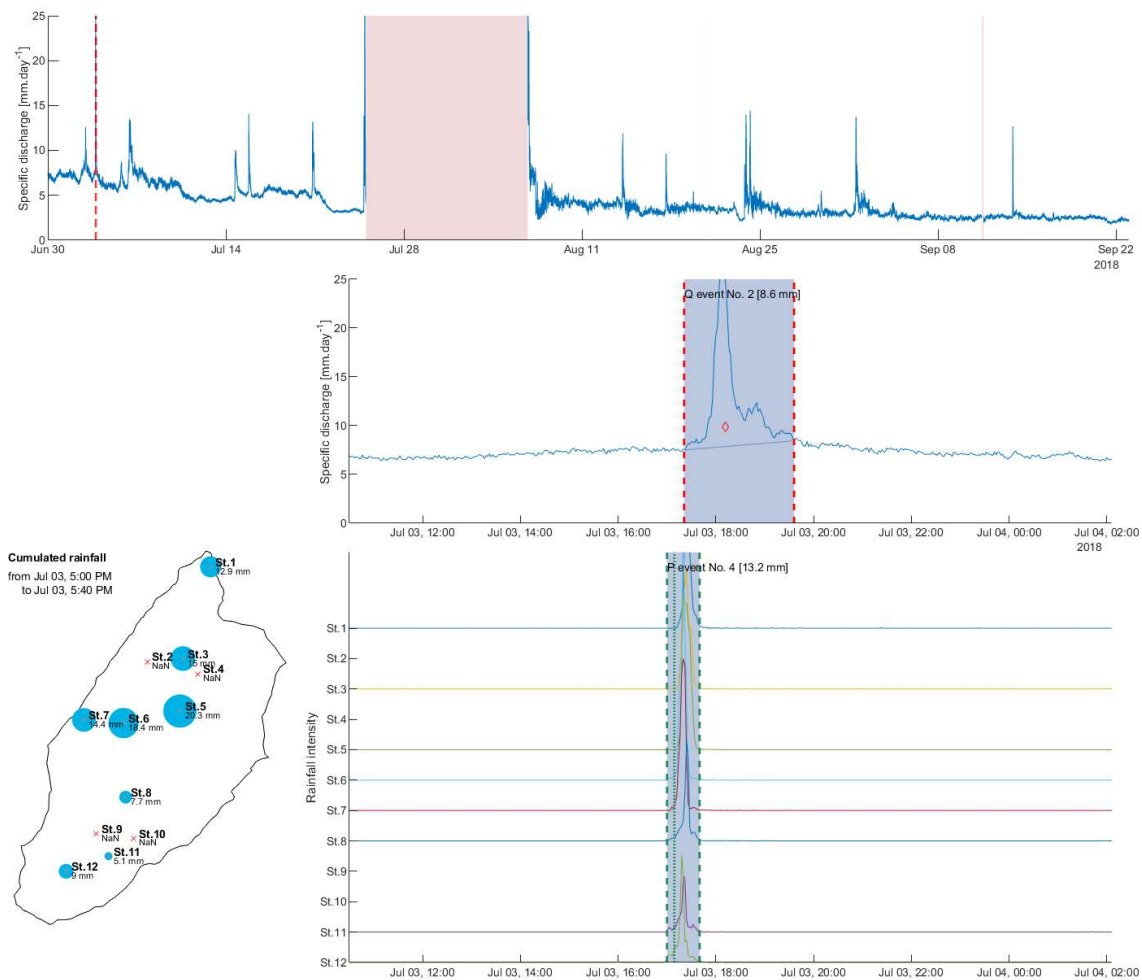


Figure S5. Precipitation event No. 4 from July 3rd 05:00 PM to July 3rd 05:40 PM and discharge event No. 2 from July 3rd 05:21 PM to July 3rd 07:36 PM

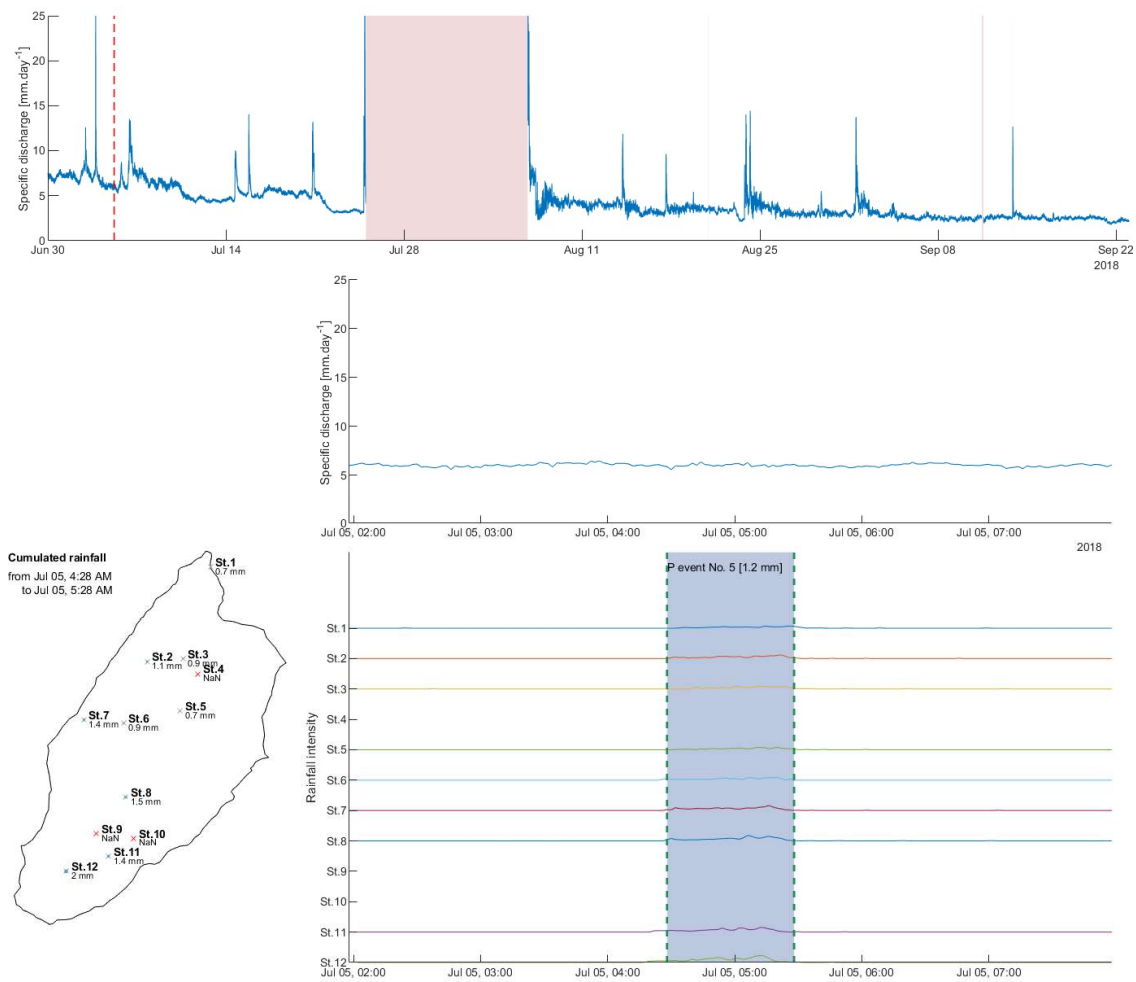


Figure S6. Precipitation event No. 5 from July 5th 04:28 AM to July 5th 05:28 AM

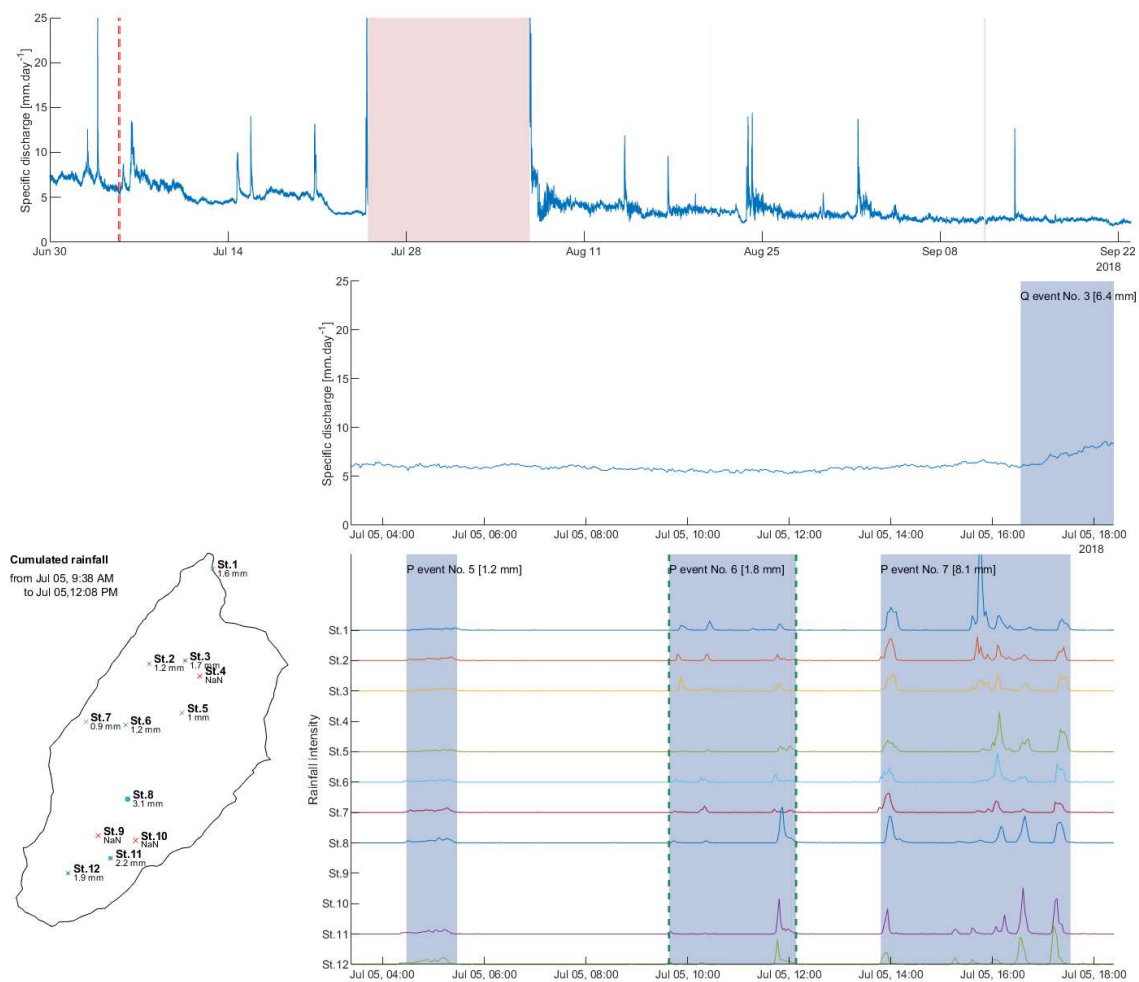


Figure S7. Precipitation event No. 6 from July 5th 09:38 AM to July 5th 12:08 PM

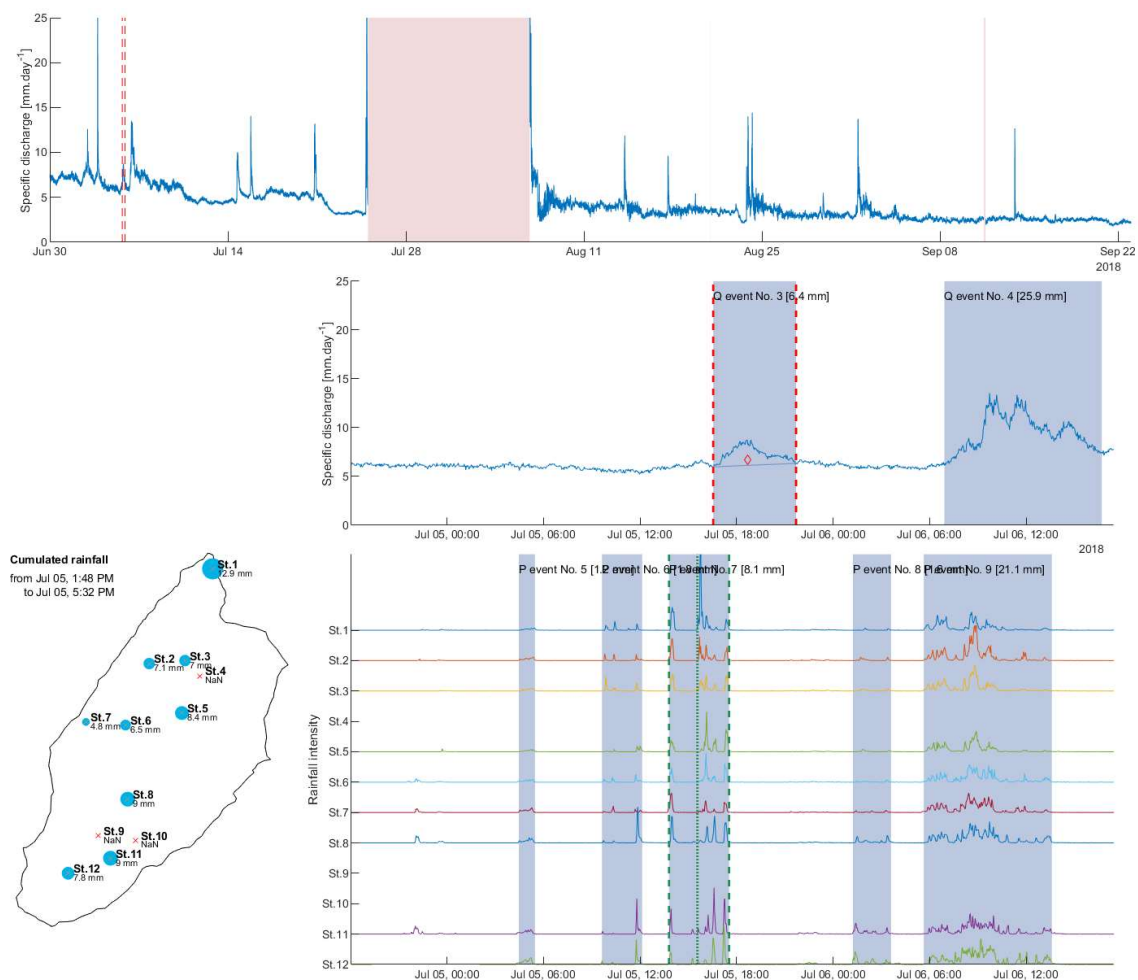


Figure S8. Precipitation event No. 7 from July 5th 01:48 PM to July 5th 05:32 PM and discharge event No. 3 from July 5th 04:33 PM to July 5th 09:42 PM

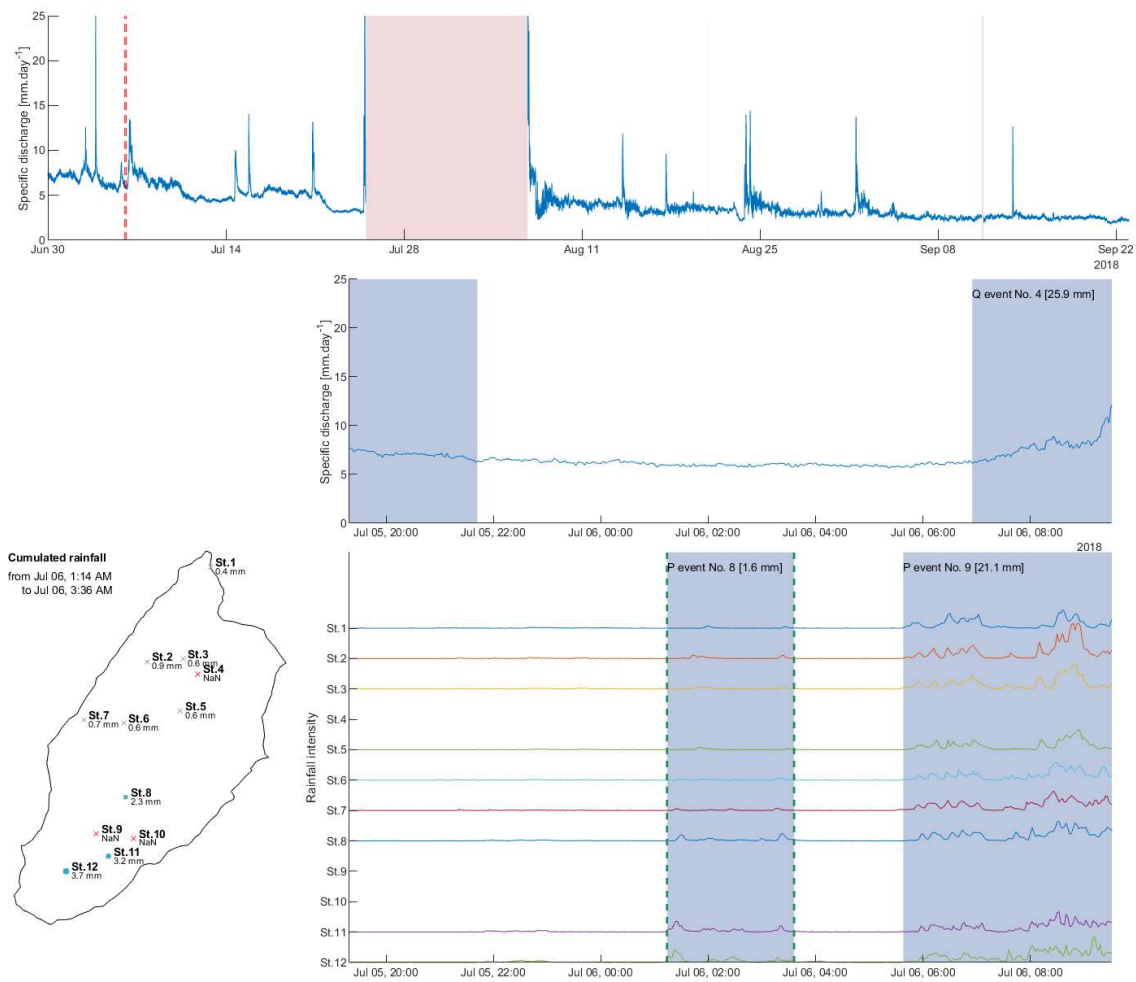


Figure S9. Precipitation event No. 8 from July 6th 01:14 AM to July 6th 03:36 AM

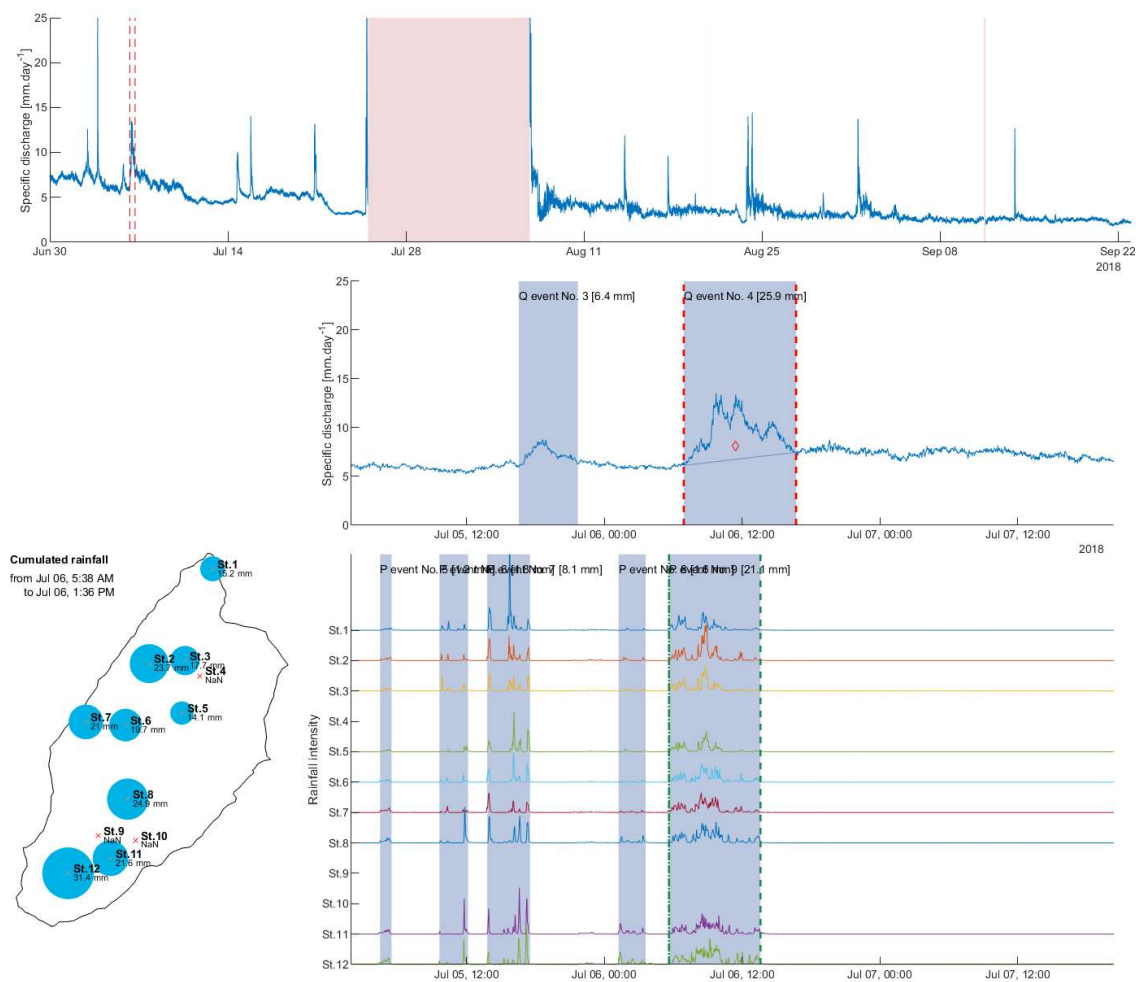


Figure S10. Precipitation event No. 9 from July 6th 05:38 AM to July 6th 01:36 PM and discharge event No. 4 from July 6th 06:55 AM to July 6th 04:42 PM

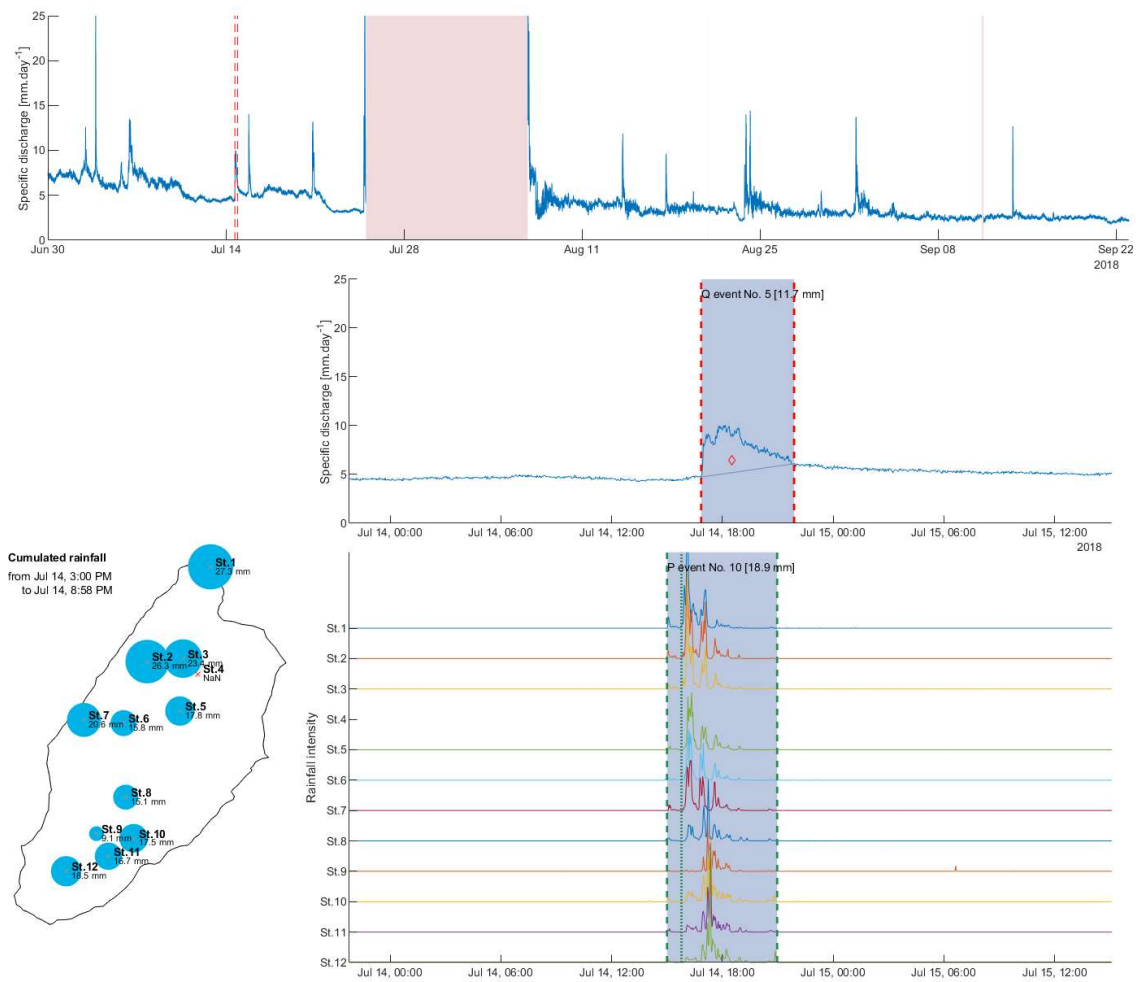


Figure S11. Precipitation event No. 10 from July 14th 03:00 PM to July 14th 08:58 PM and discharge event No. 5 from July 14th 04:51 PM to July 14th 09:53 PM

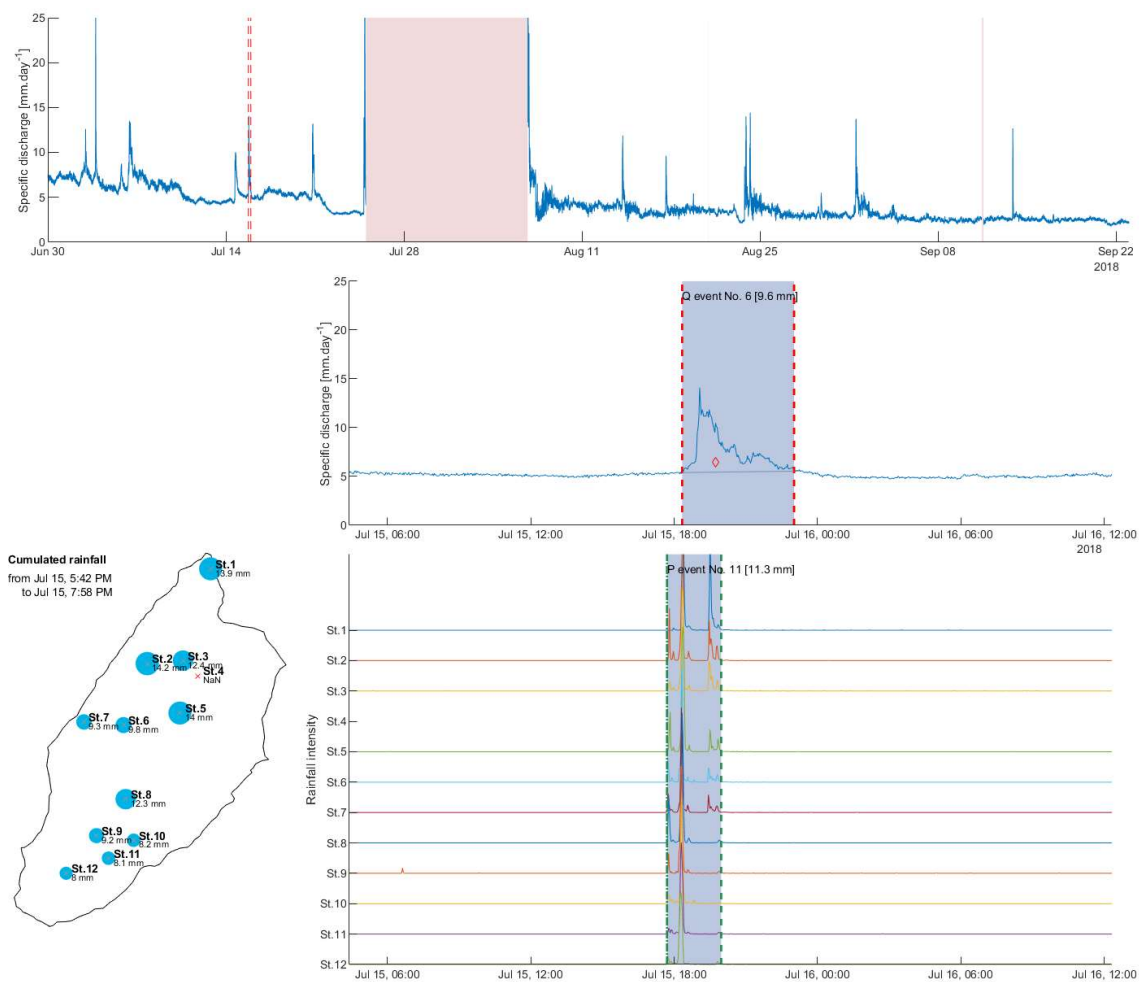


Figure S12. Precipitation event No. 11 from July 15th 05:42 PM to July 15th 07:58 PM and discharge event No. 6 from July 15th 06:20 PM to July 15th 11:01 PM

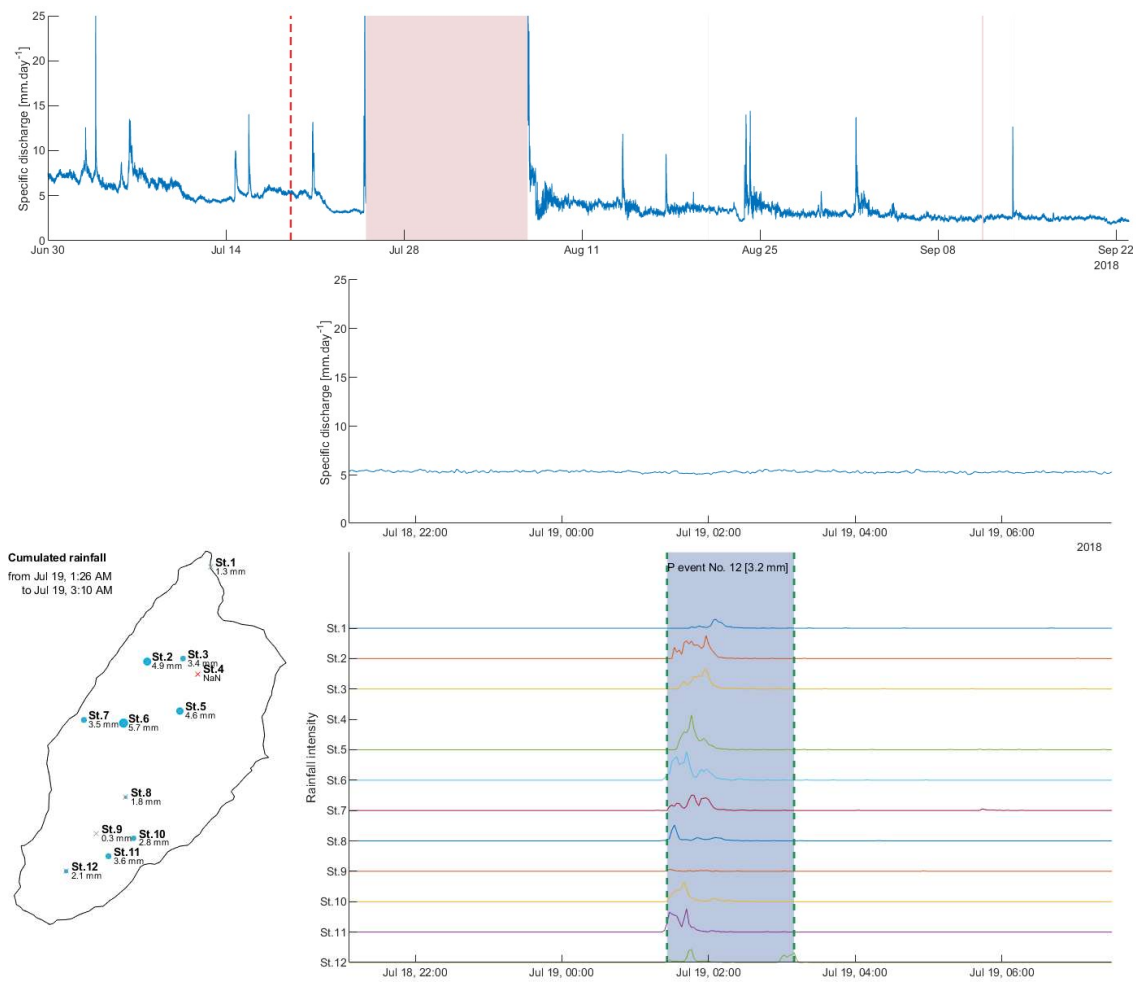


Figure S13. Precipitation event No. 12 from July 19th 01:26 AM to July 19th 03:10 AM

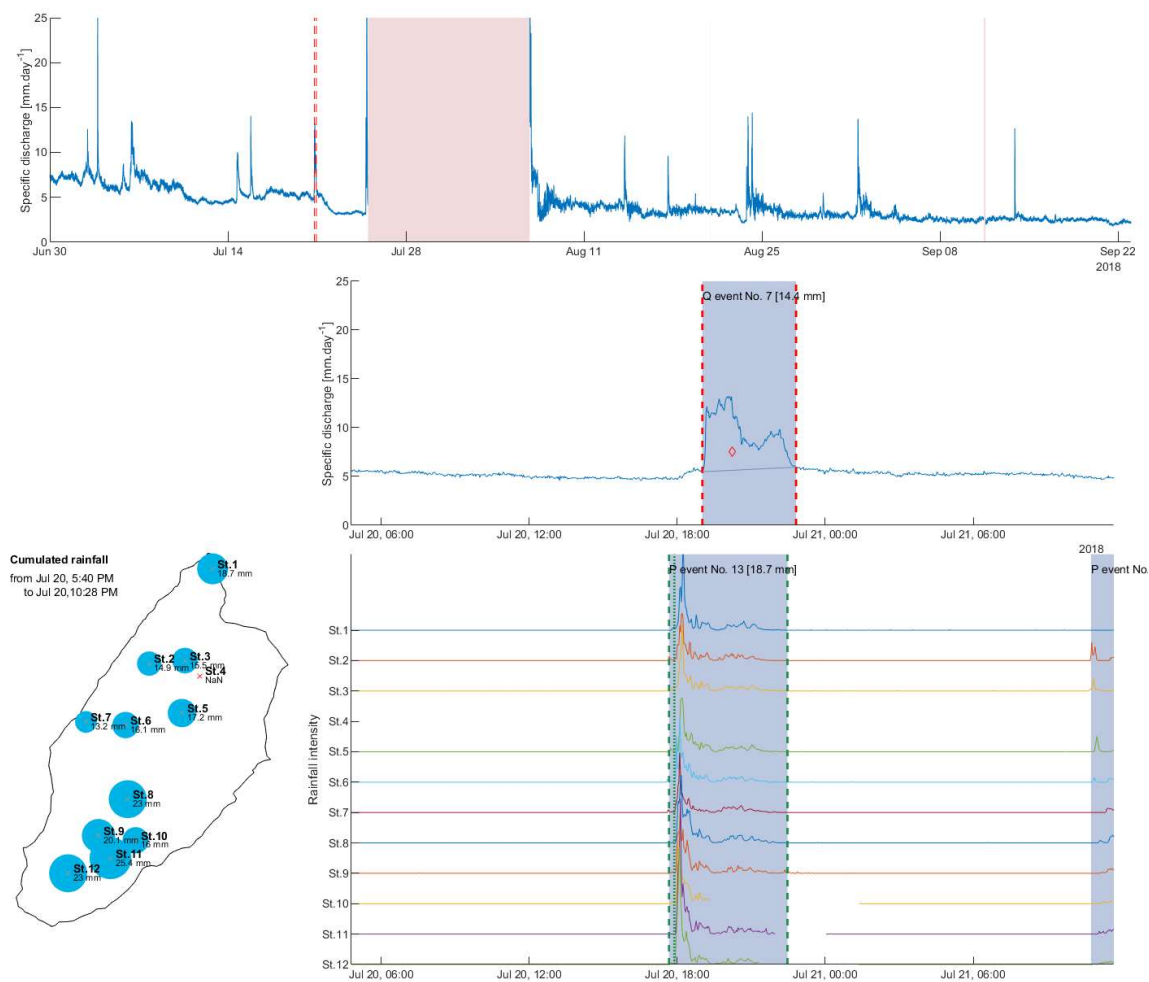


Figure S14. Precipitation event No. 13 from July 20th 05:40 PM to July 20th 10:28 PM and discharge event No. 7 from July 20th 07:01 PM to July 20th 10:49 PM

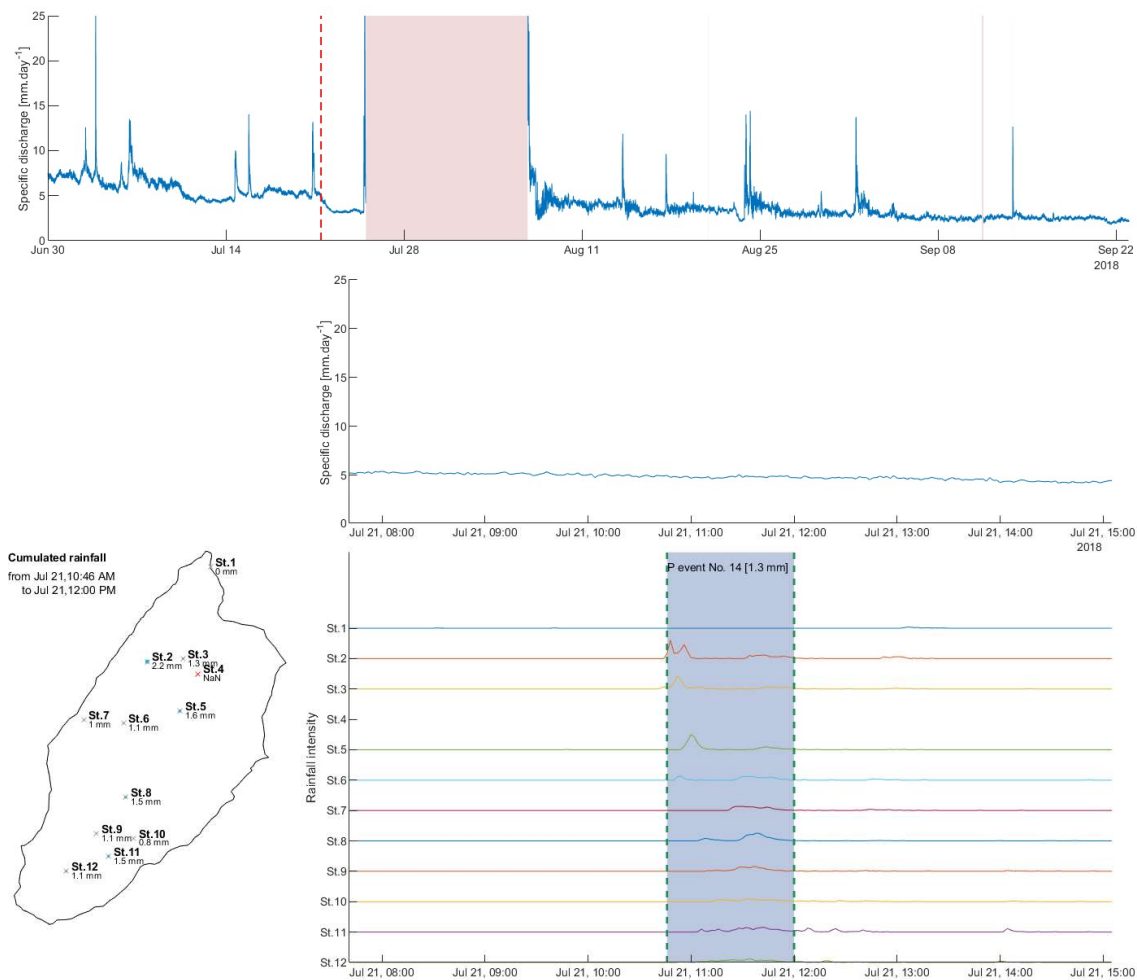


Figure S15. Precipitation event No. 14 from July 21st 10:46 AM to July 21st 12:00 PM

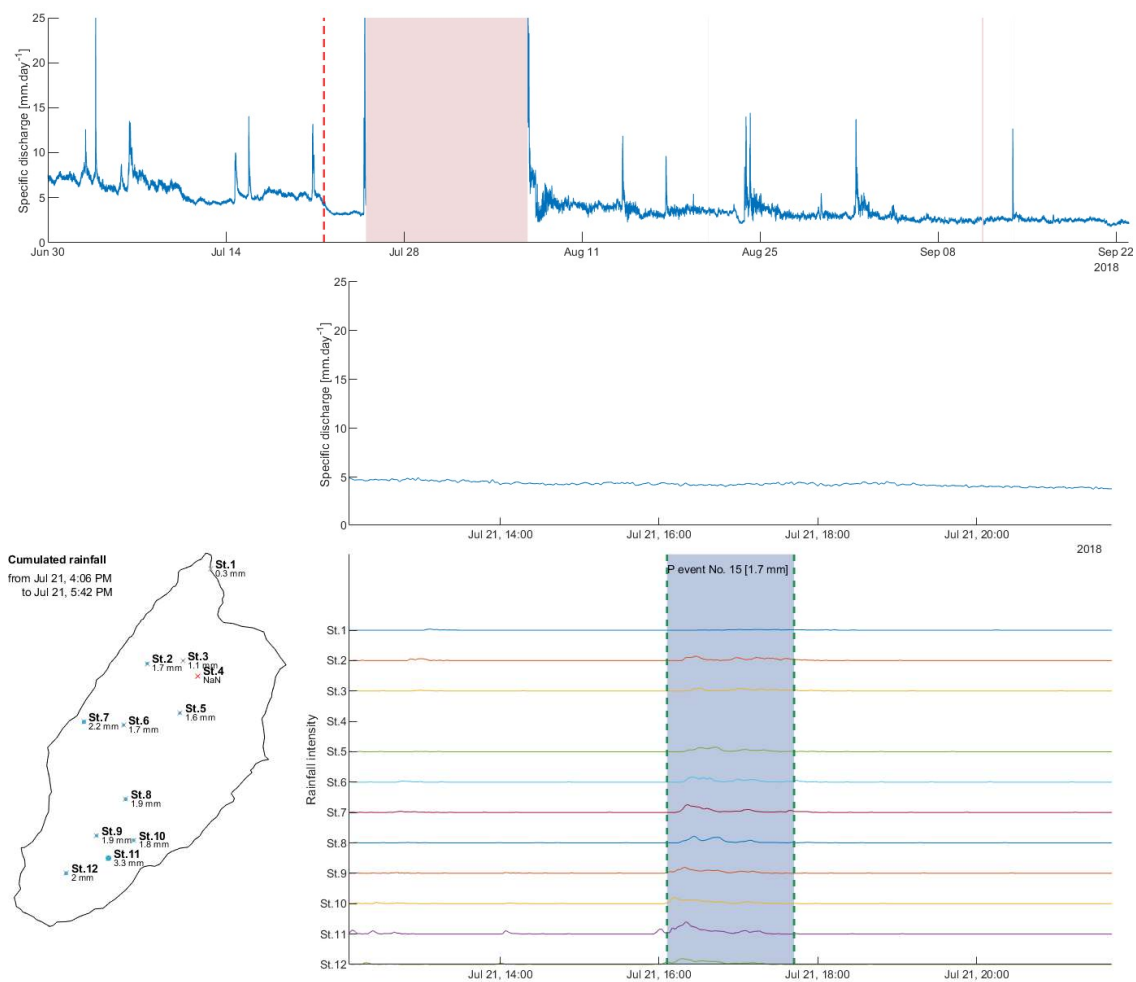


Figure S16. Precipitation event No. 15 from July 21st 04:06 PM to July 21st 05:42 PM

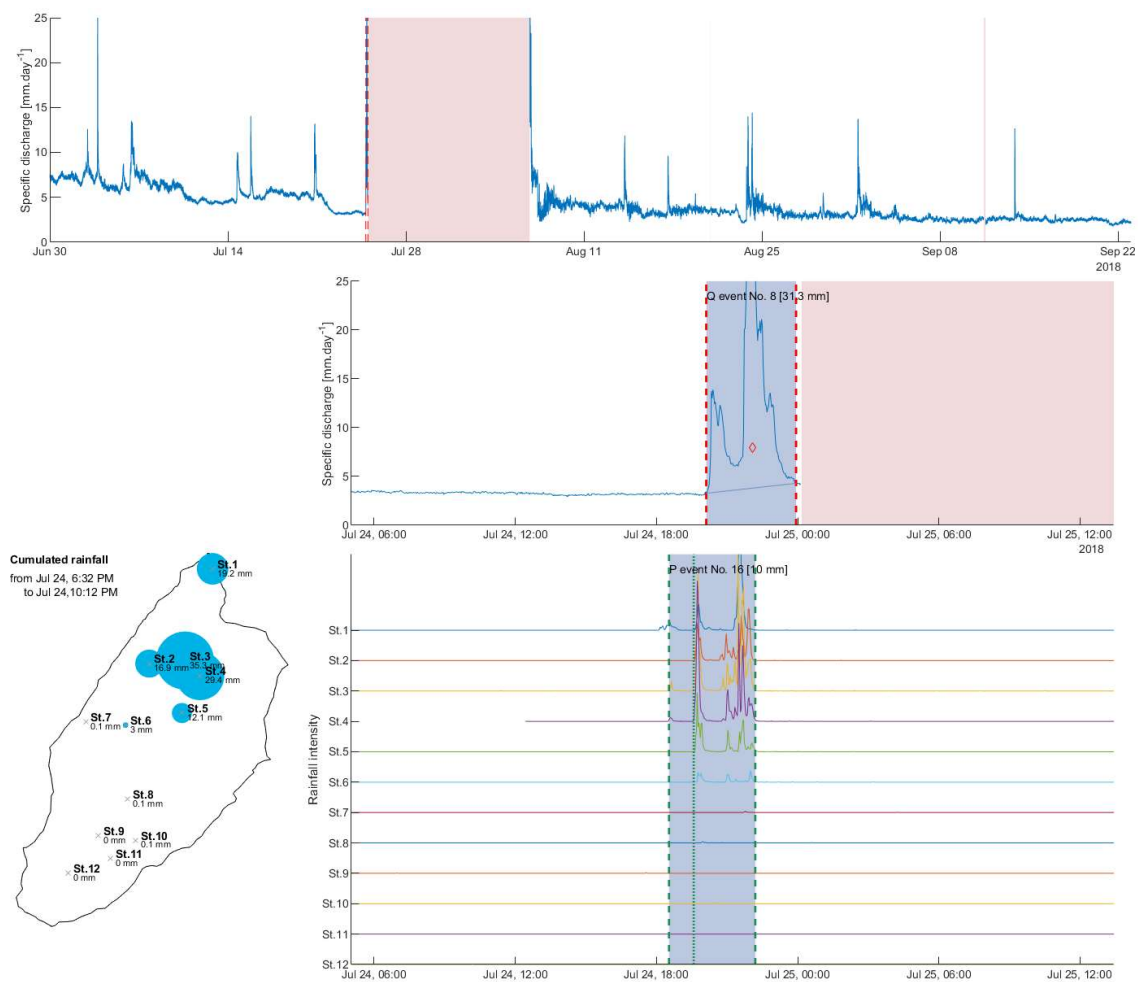


Figure S17. Precipitation event No. 16 from July 24th 06:32 PM to July 24th 10:12 PM and discharge event No. 8 from July 24th 08:07 PM to July 24th 11:56 PM

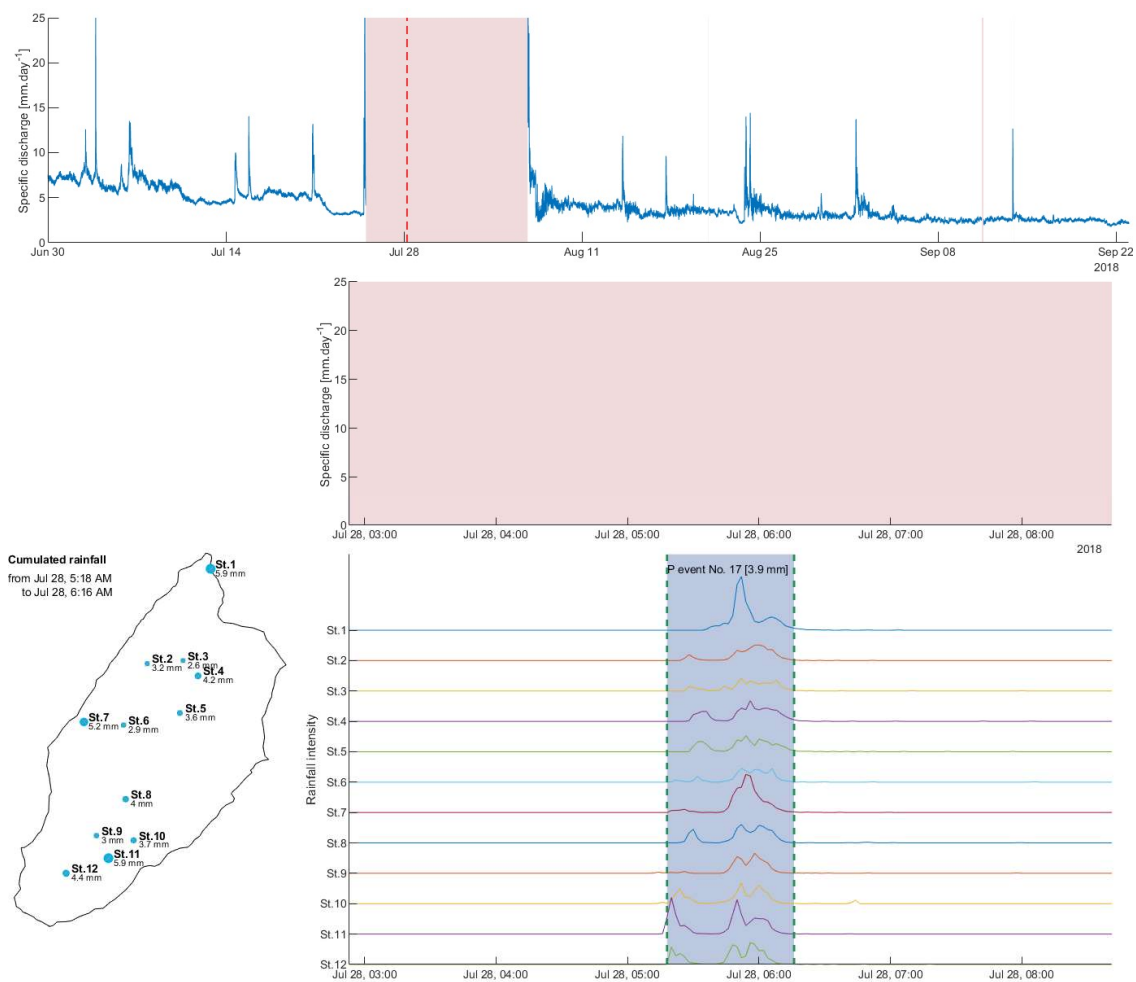


Figure S18. Precipitation event No. 17 from July 28th 05:18 AM to July 28th 06:16 AM

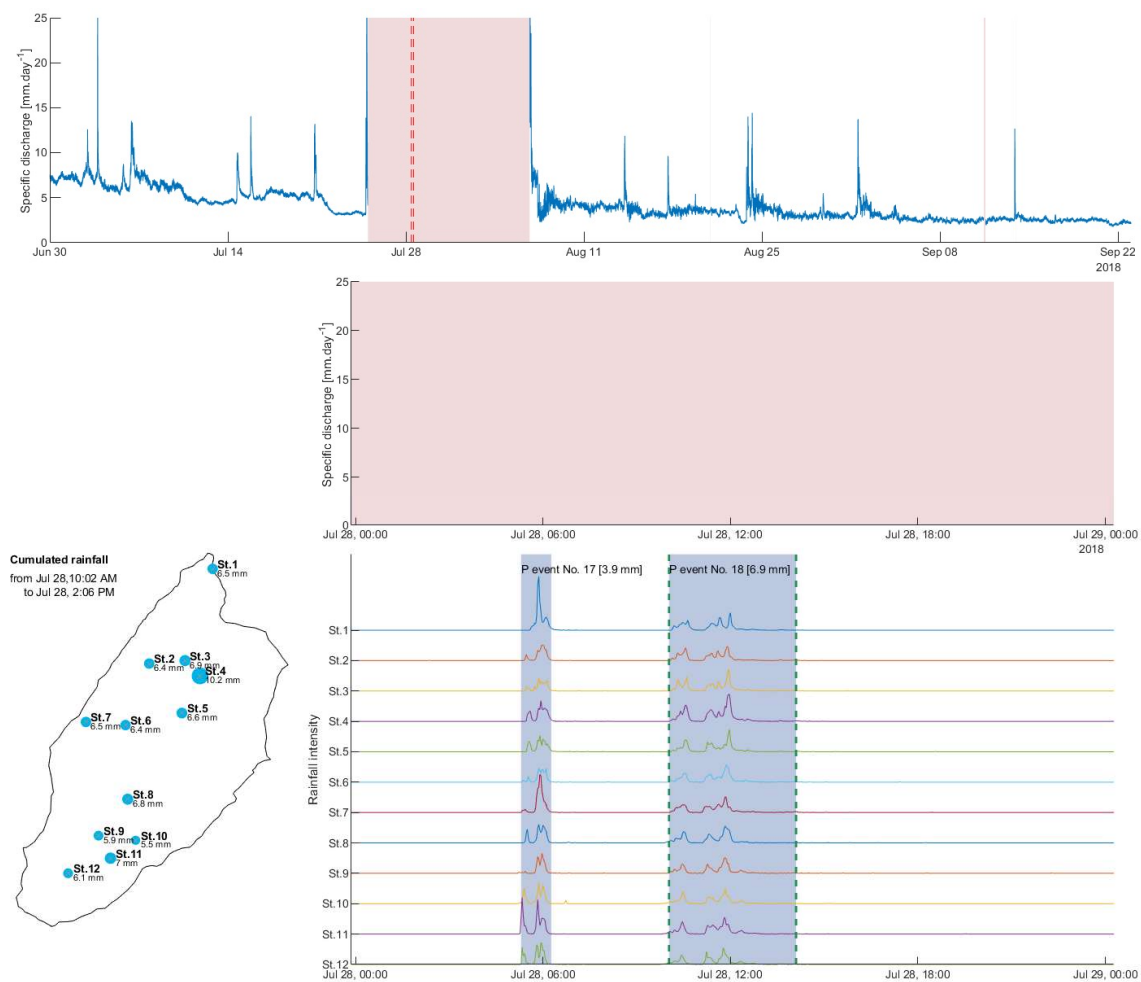


Figure S19. Precipitation event No. 18 from July 28th 10:02 AM to July 28th 02:06 PM

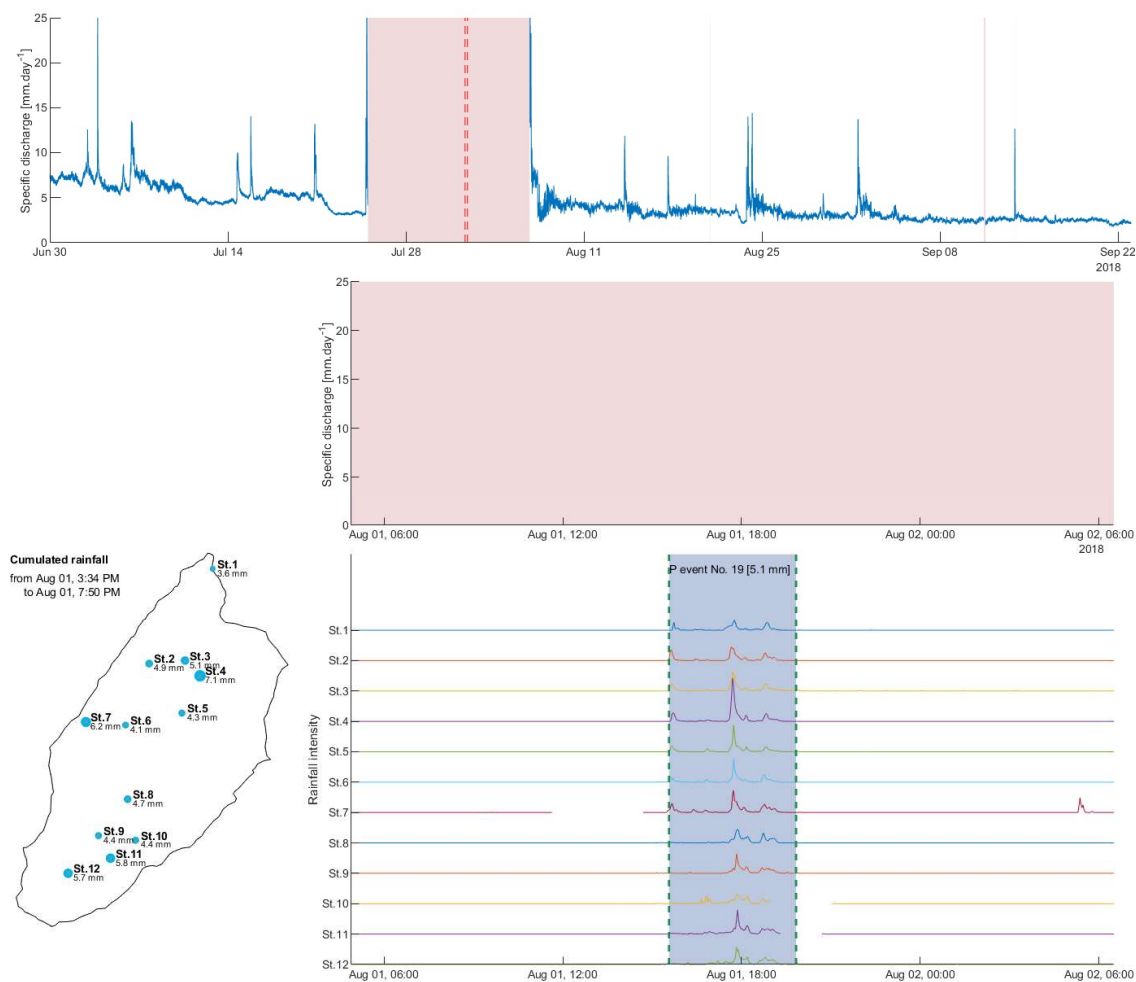


Figure S20. Precipitation event No. 19 from August 1st 03:34 PM to August 1st 07:50 PM

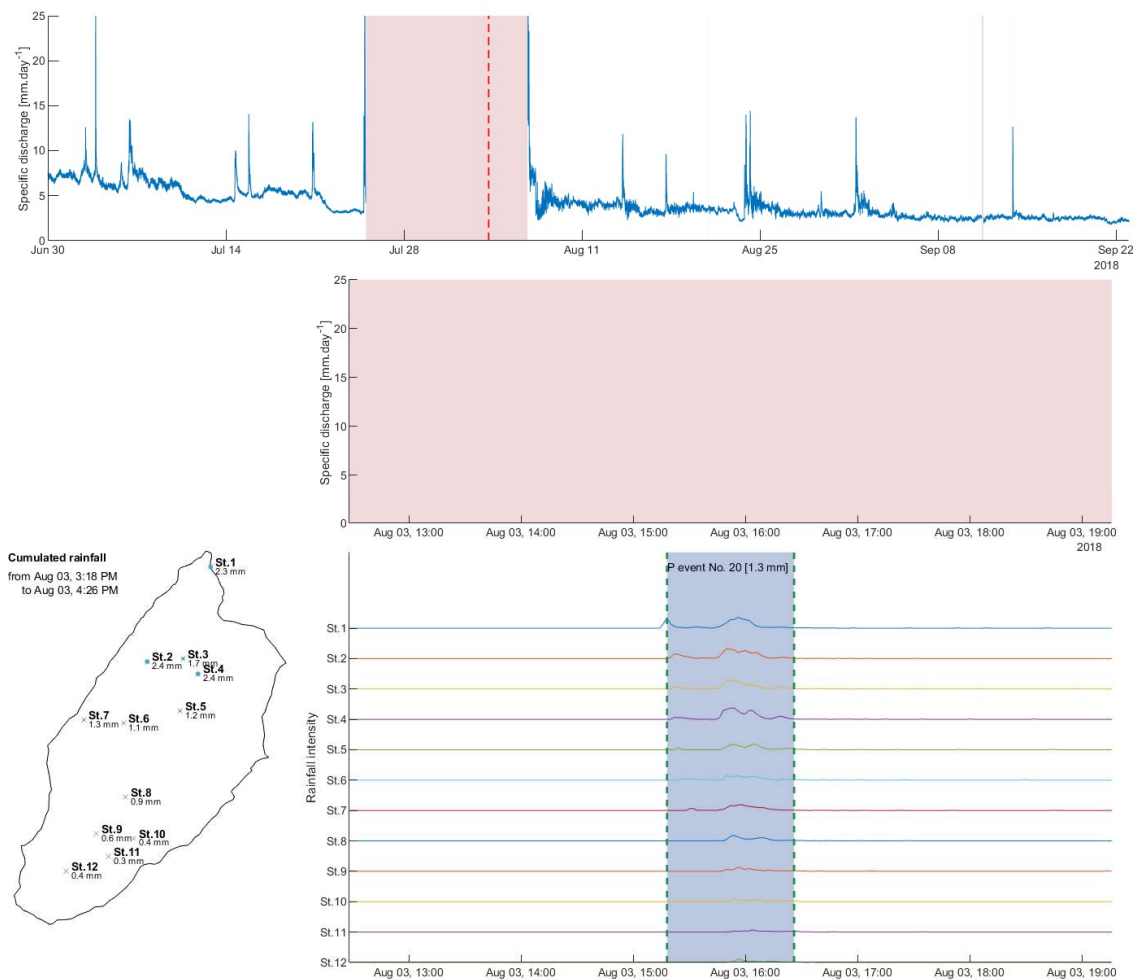


Figure S21. Precipitation event No. 20 from August 3rd 03:18 PM to August 3rd 04:26 PM

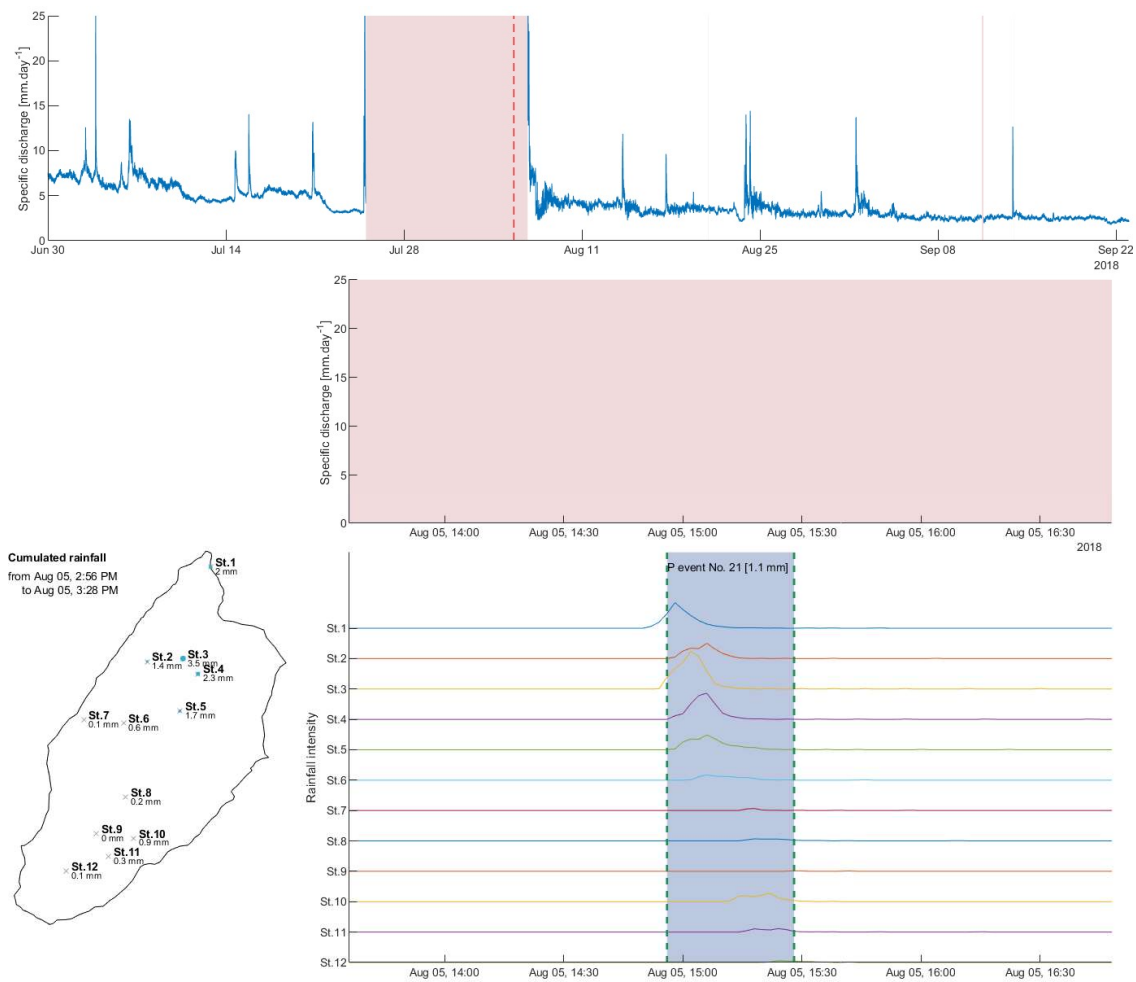


Figure S22. Precipitation event No. 21 from August 5th 02:56 PM to August 5th 03:28 PM

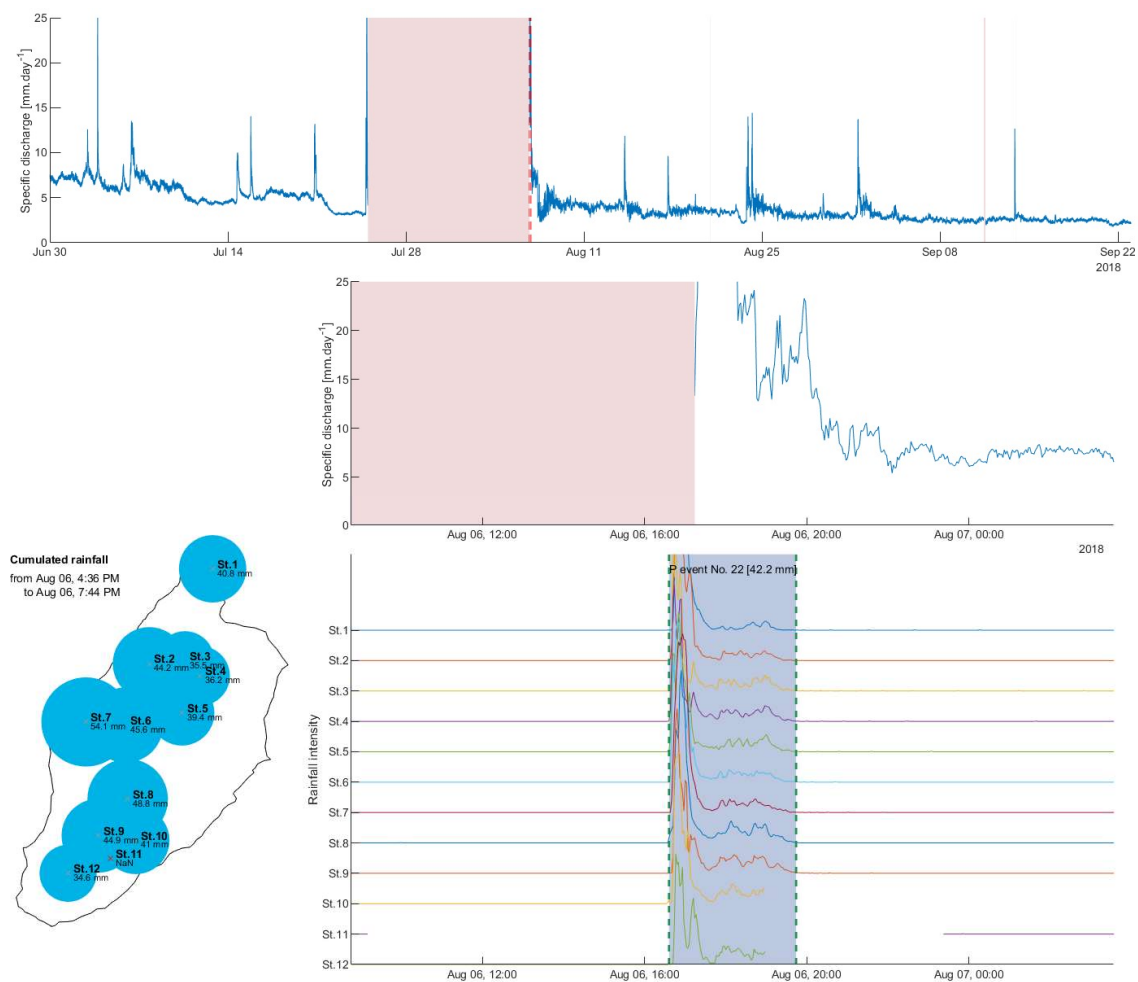


Figure S23. Precipitation event No. 22 from August 6th 04:36 PM to August 6th 07:44 PM

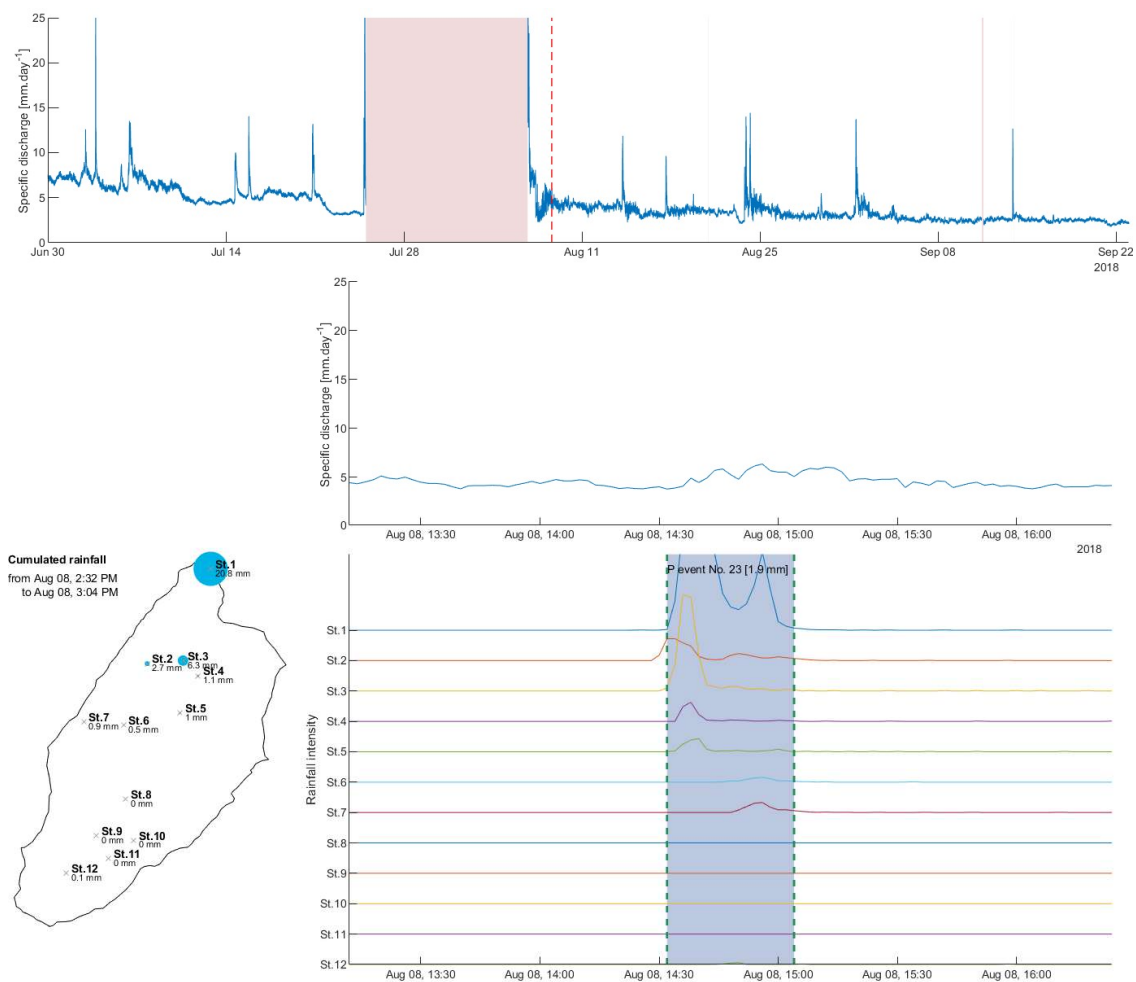


Figure S24. Precipitation event No. 23 from August 8th 02:32 PM to August 8th 03:04 PM

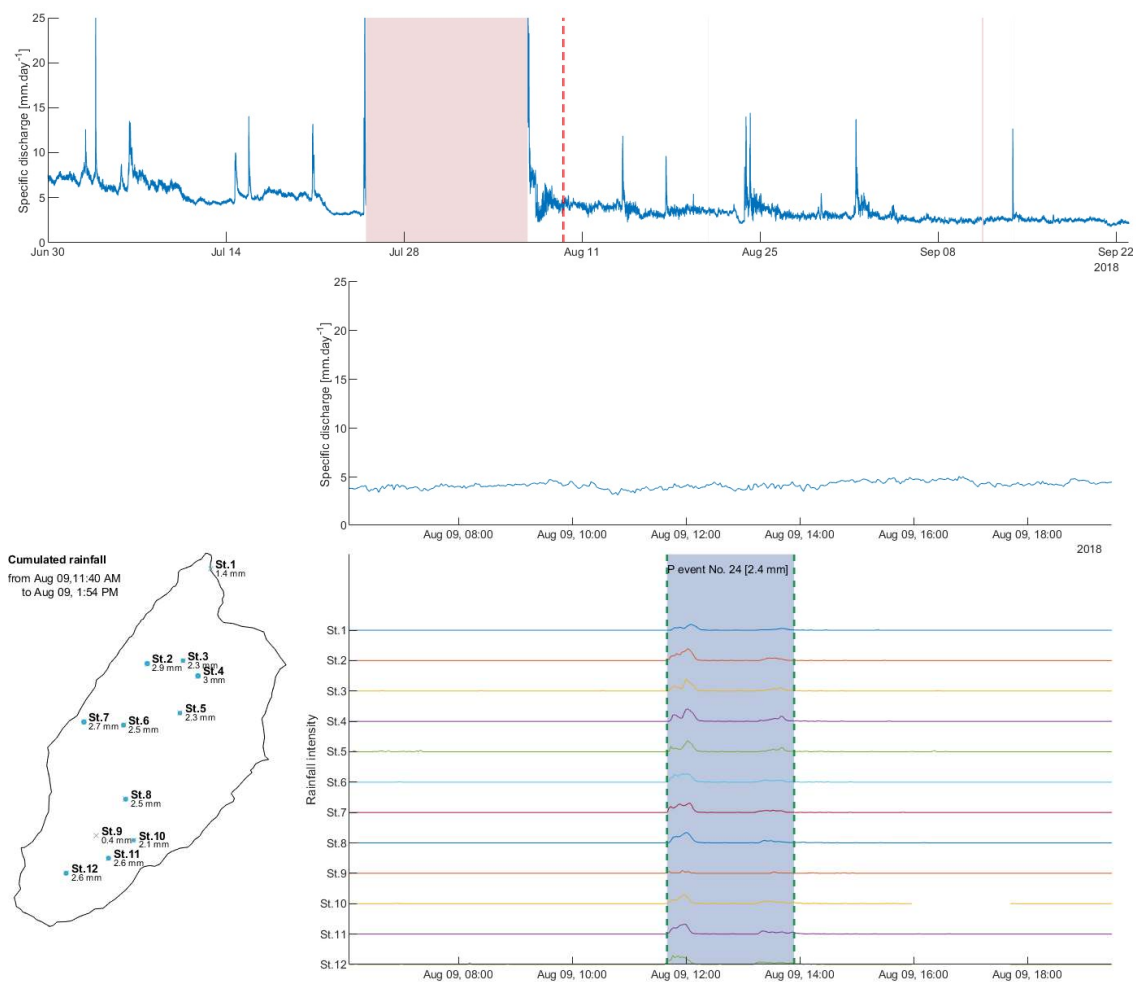


Figure S25. Precipitation event No. 24 from August 9th 11:40 AM to August 9th 01:54 PM

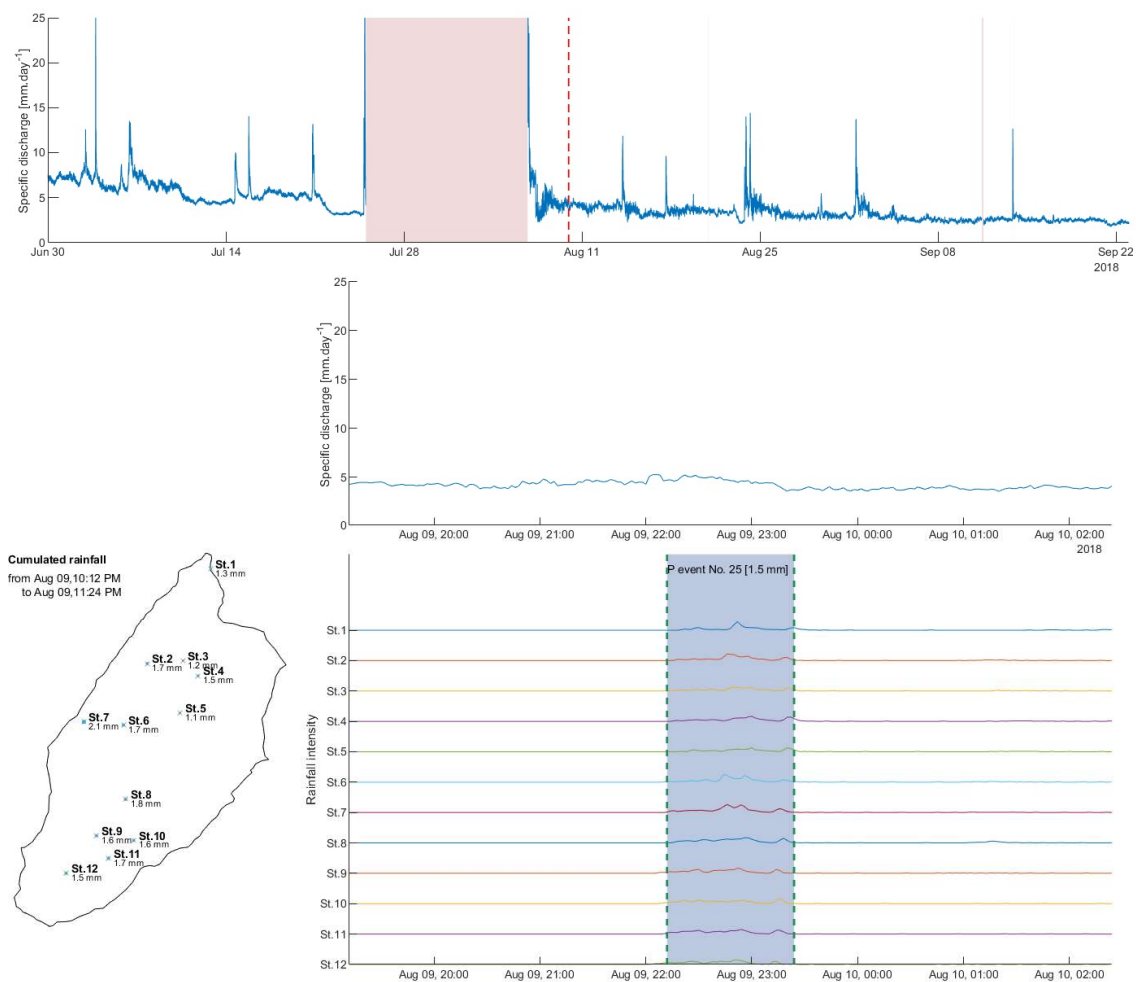


Figure S26. Precipitation event No. 25 from August 9th 10:12 PM to August 9th 11:24 PM

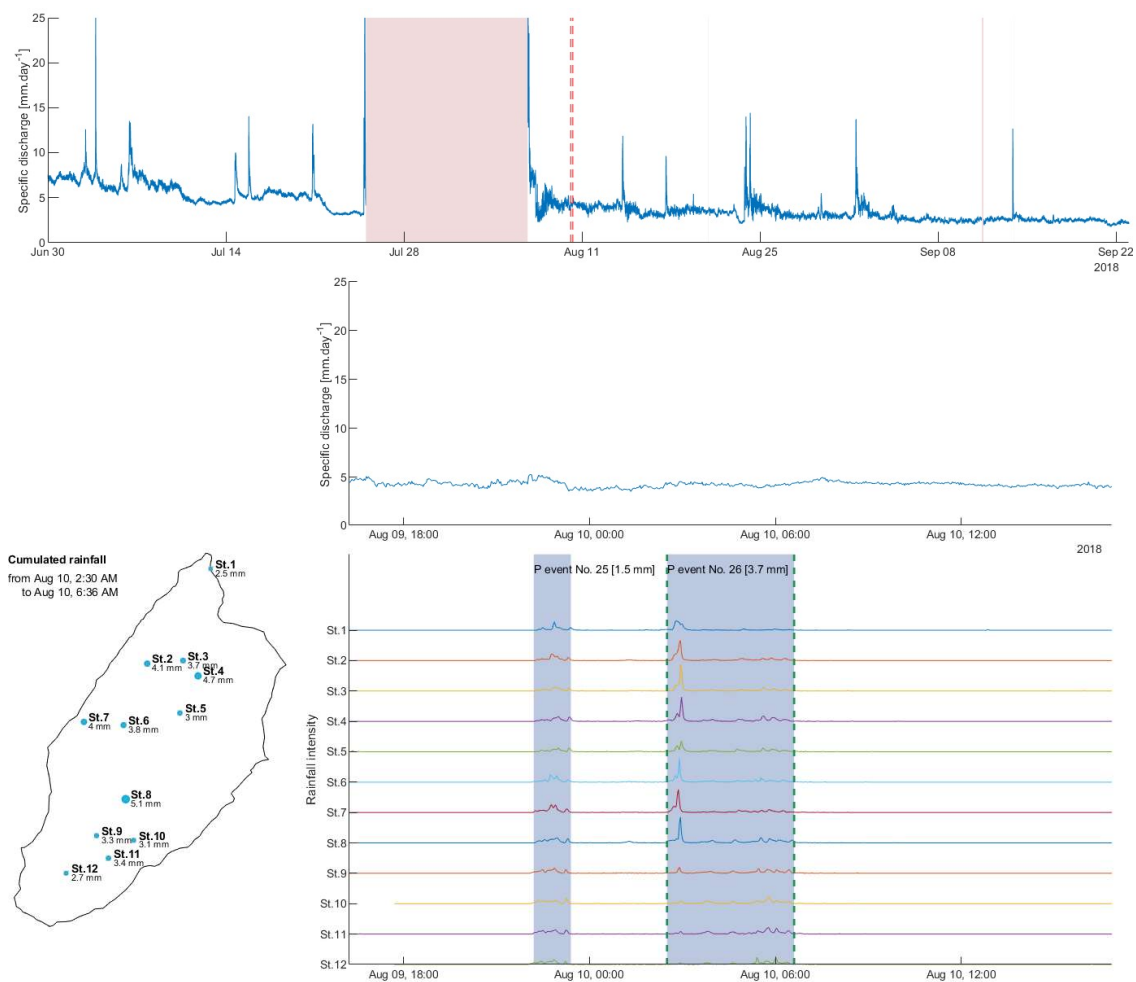


Figure S27. Precipitation event No. 26 from August 10th 02:30 AM to August 10th 06:36 AM

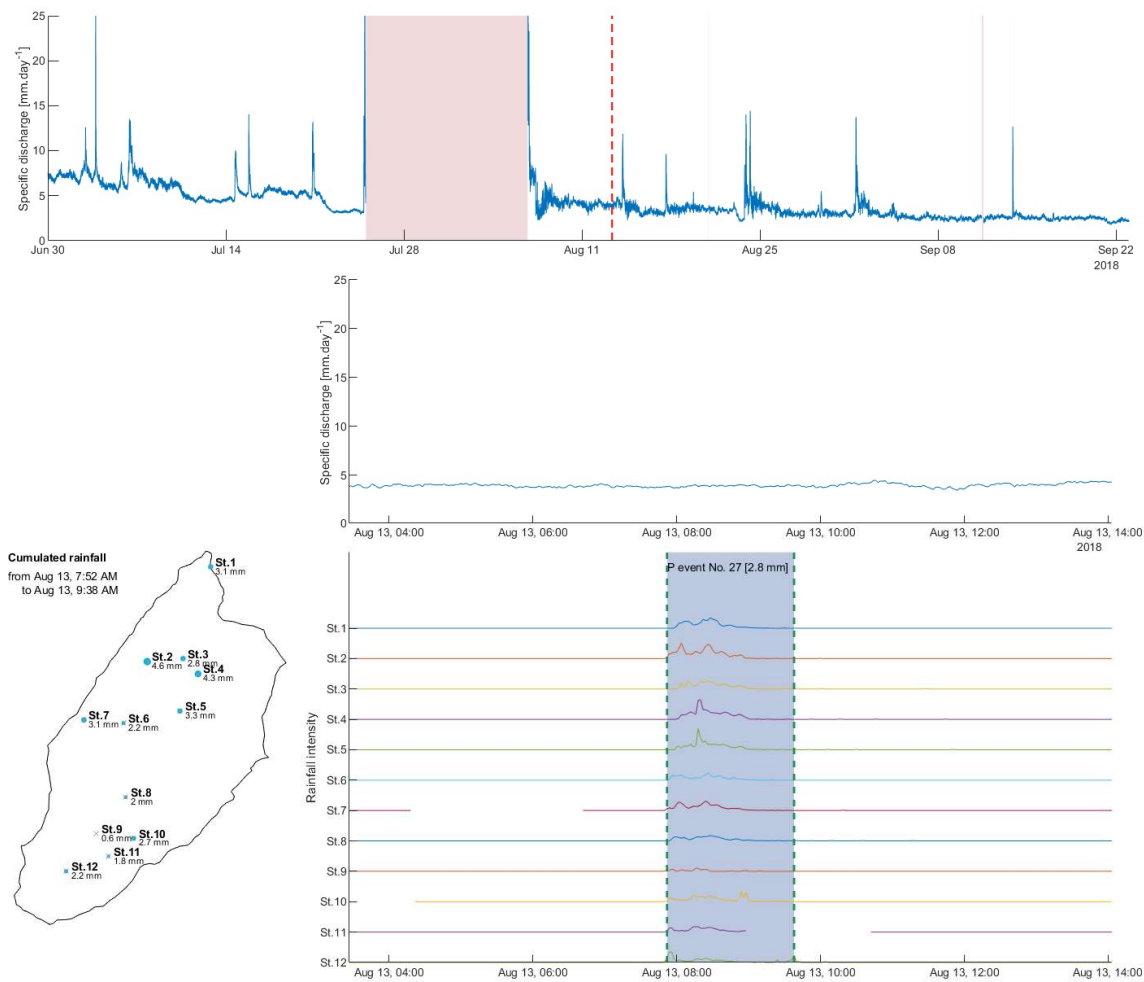


Figure S28. Precipitation event No. 27 from August 13th 07:52 AM to August 13th 09:38 AM

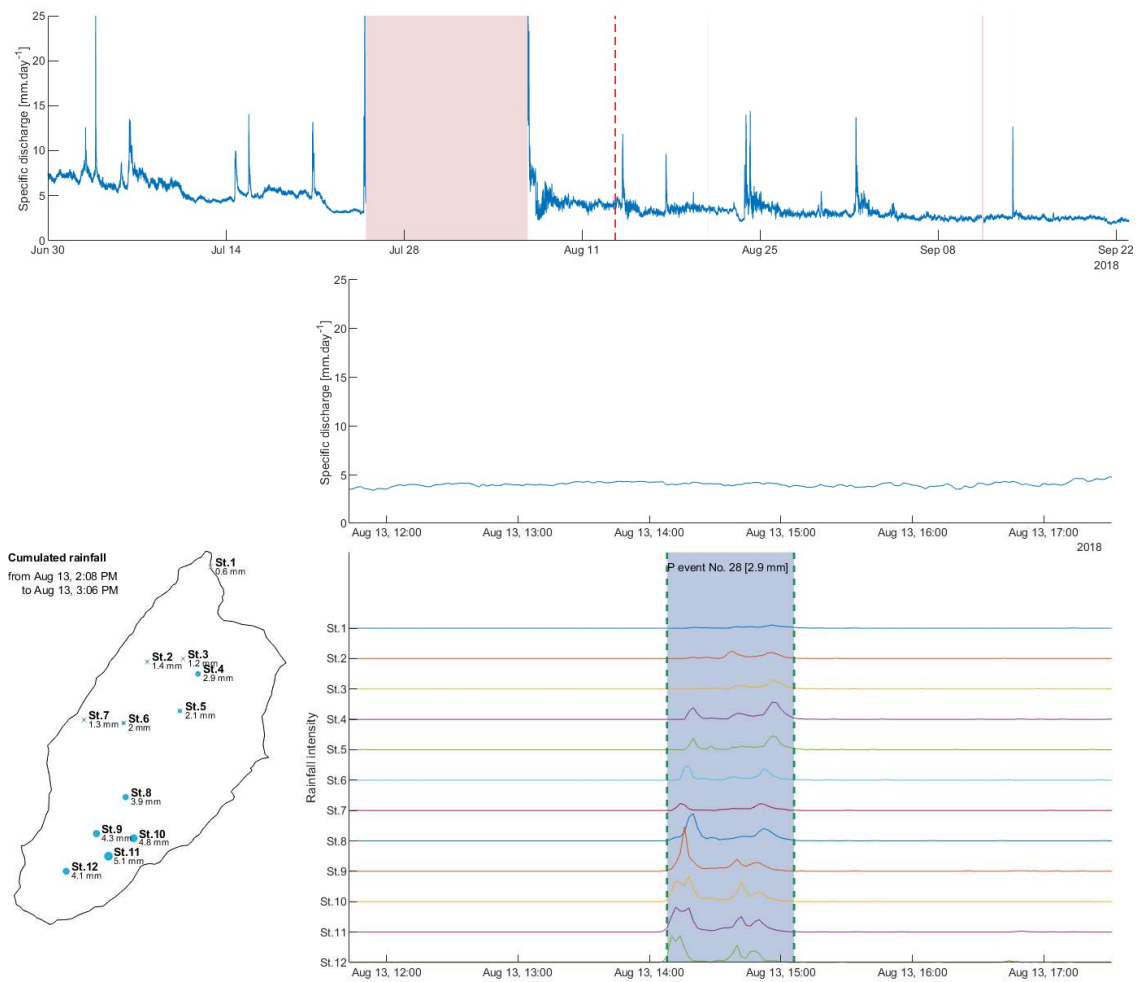


Figure S29. Precipitation event No. 28 from August 13th 02:08 PM to August 13th 03:06 PM

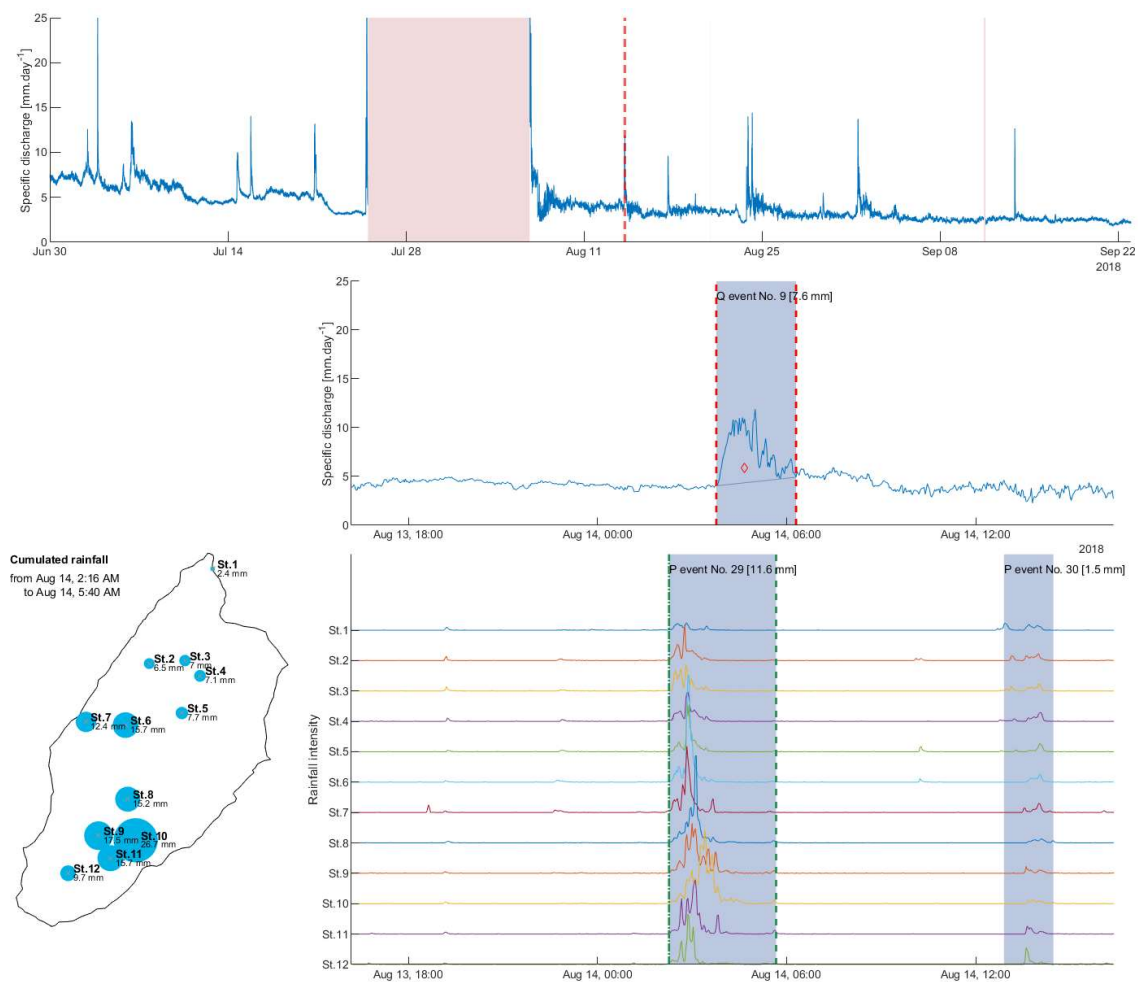


Figure S30. Precipitation event No. 29 from August 14th 02:16 AM to August 14th 05:40 AM and discharge event No. 9 from August 14th 03:46 AM to August 14th 06:18 AM

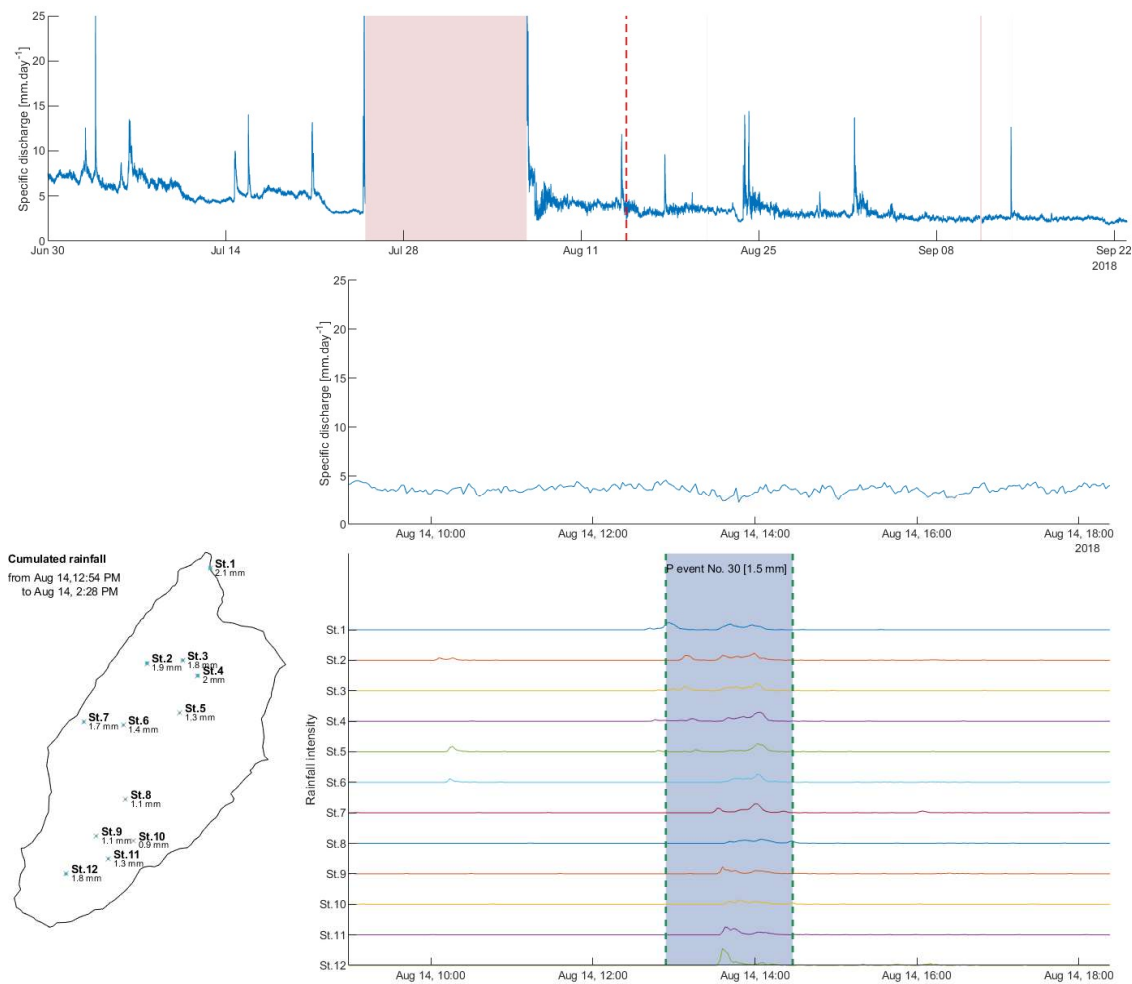


Figure S31. Precipitation event No. 30 from August 14th 12:54 PM to August 14th 02:28 PM

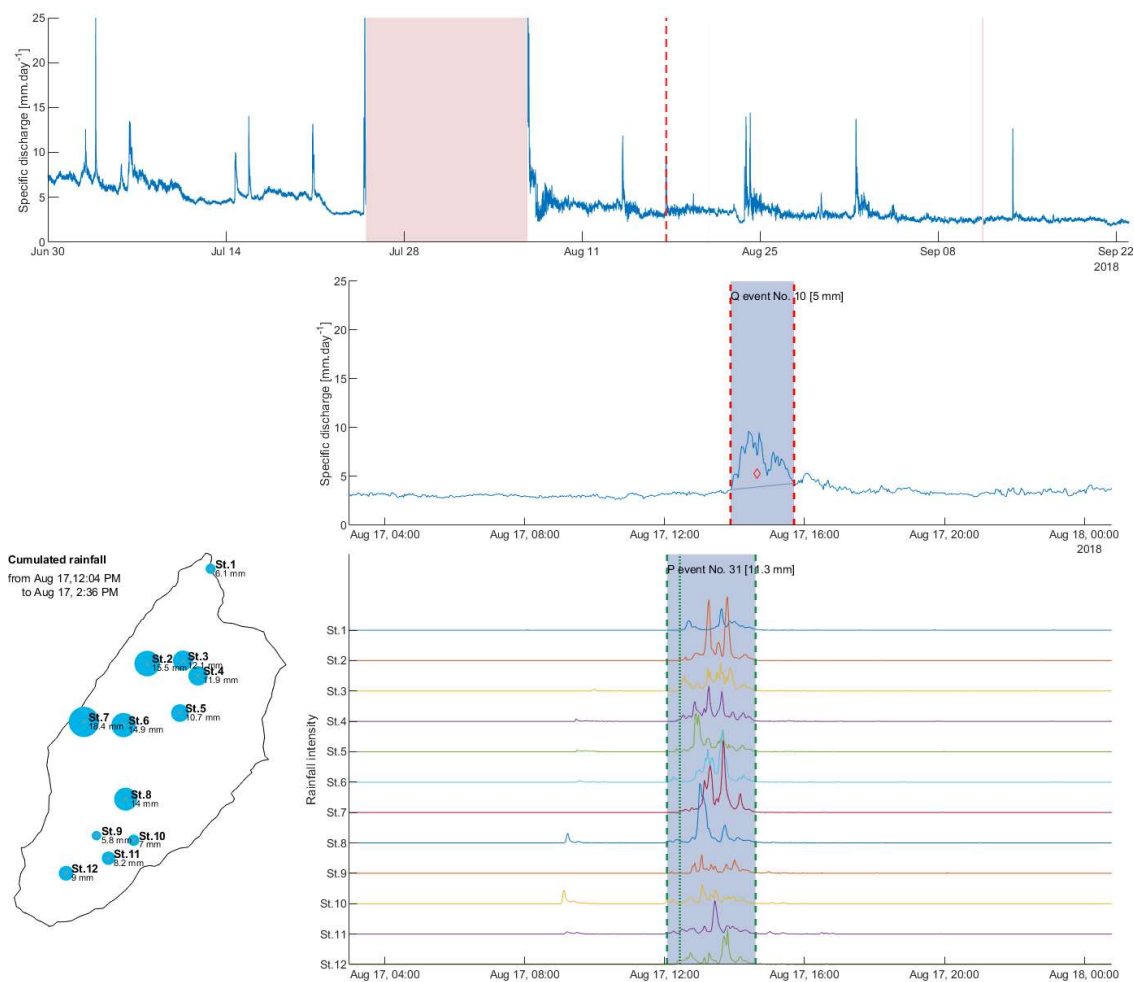


Figure S32. Precipitation event No. 31 from August 17th 12:04 PM to August 17th 02:36 PM and discharge event No. 10 from August 17th 01:53 PM to August 17th 03:42 PM

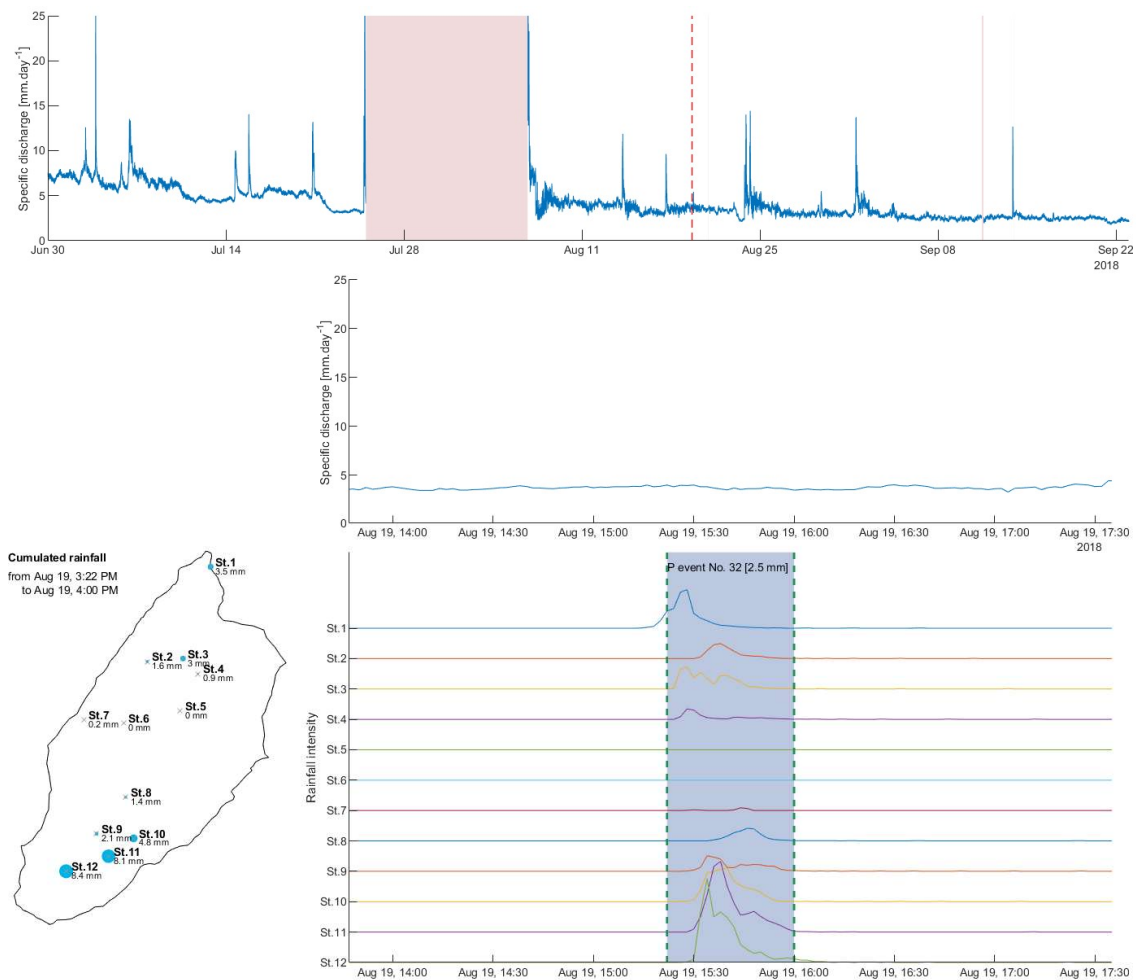


Figure S33. Precipitation event No. 32 from August 19th 03:22 PM to August 19th 04:00 PM

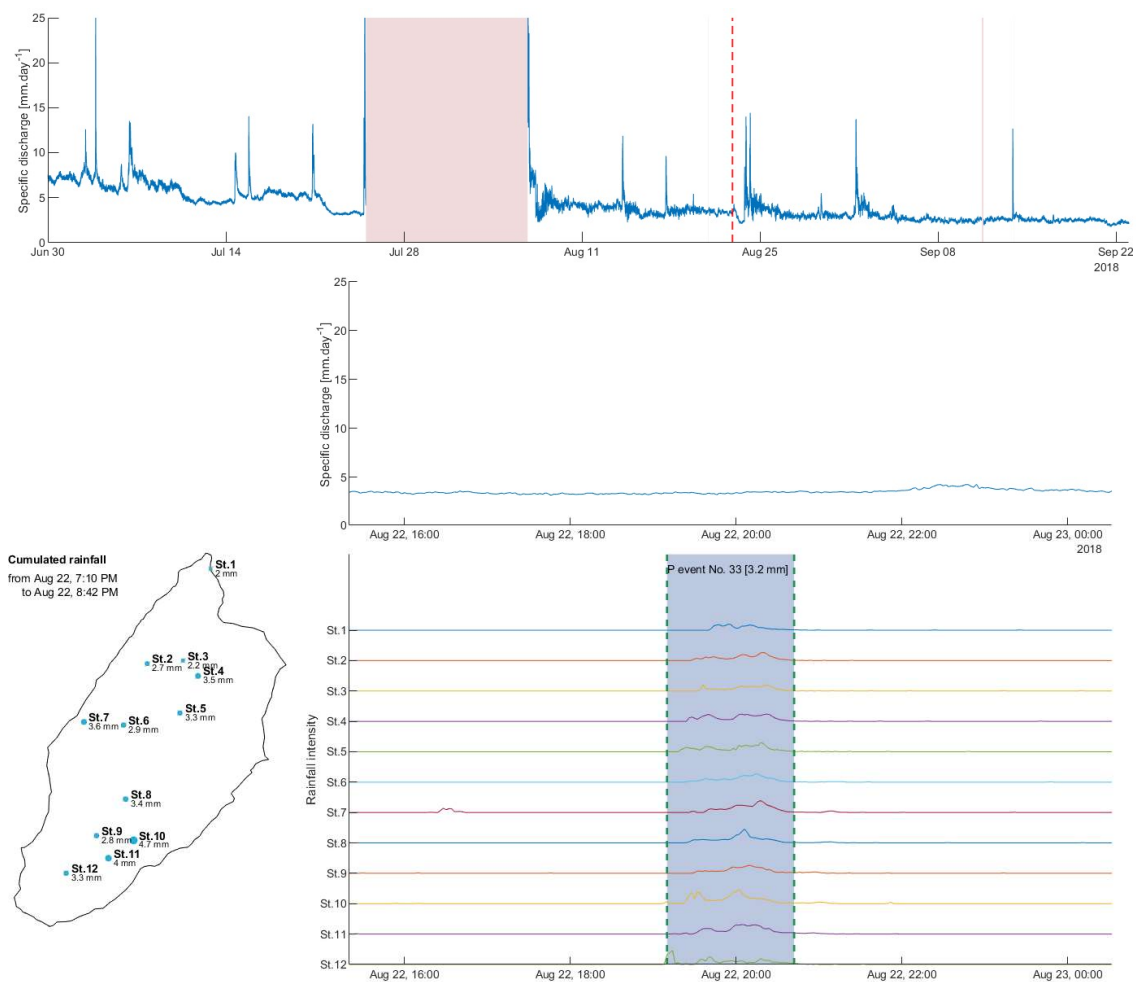


Figure S34. Precipitation event No. 33 from August 22nd 07:10 PM to August 22nd 08:42 PM

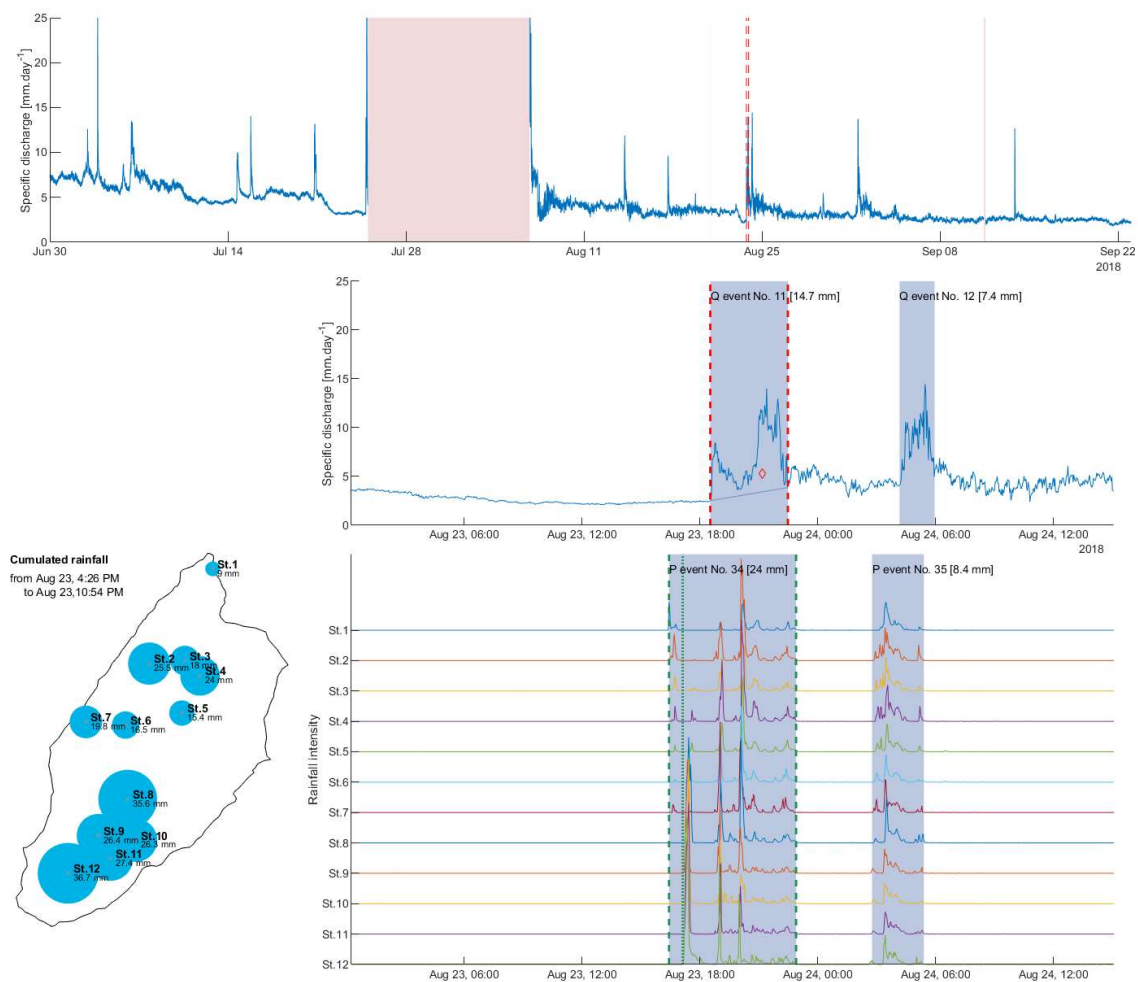


Figure S35. Precipitation event No. 34 from August 23rd 04:26 PM to August 23rd 10:54 PM and discharge event No. 11 from August 23rd 06:32 PM to August 23rd 10:29 PM

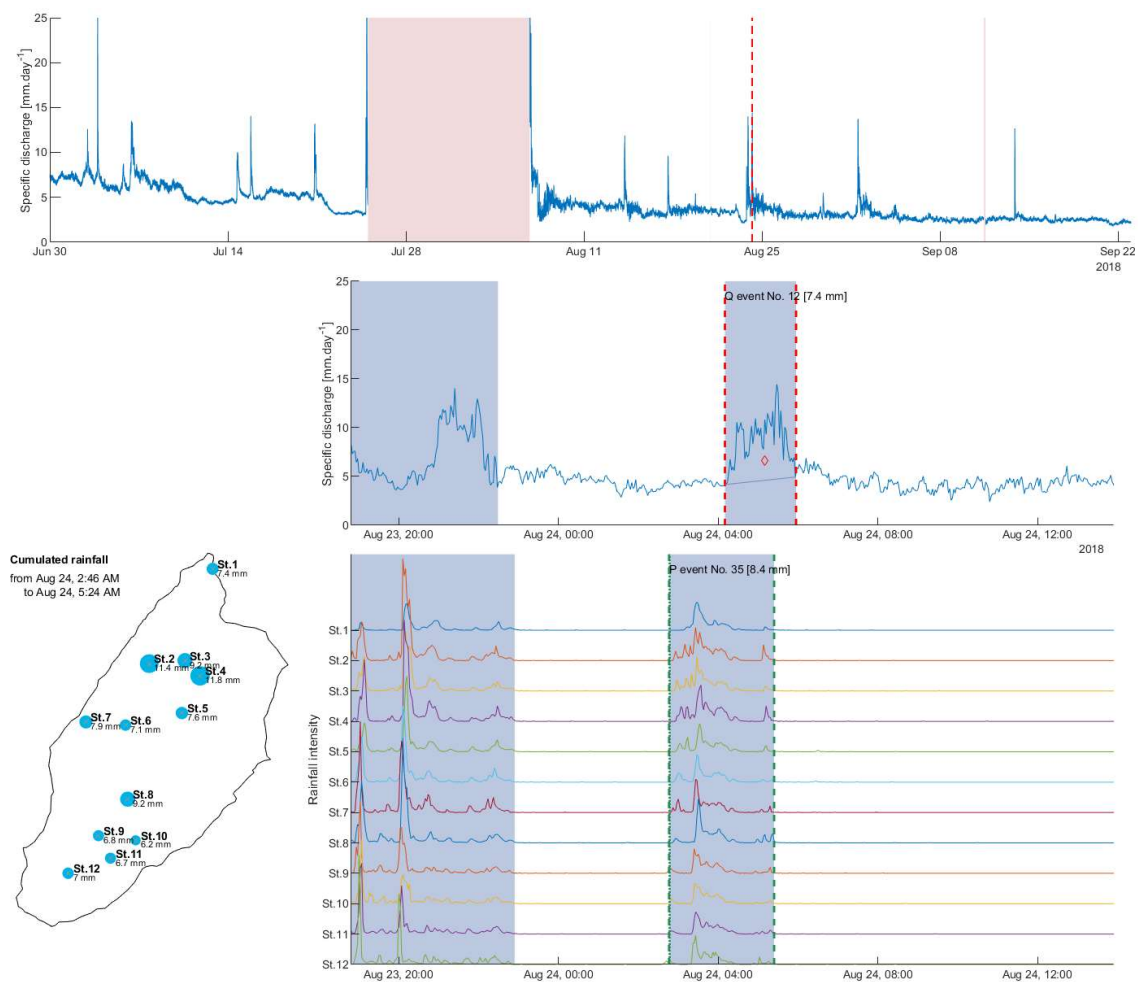


Figure S36. Precipitation event No. 35 from August 24th 02:46 AM to August 24th 05:24 AM and discharge event No. 12 from August 24th 04:10 AM to August 24th 05:57 AM

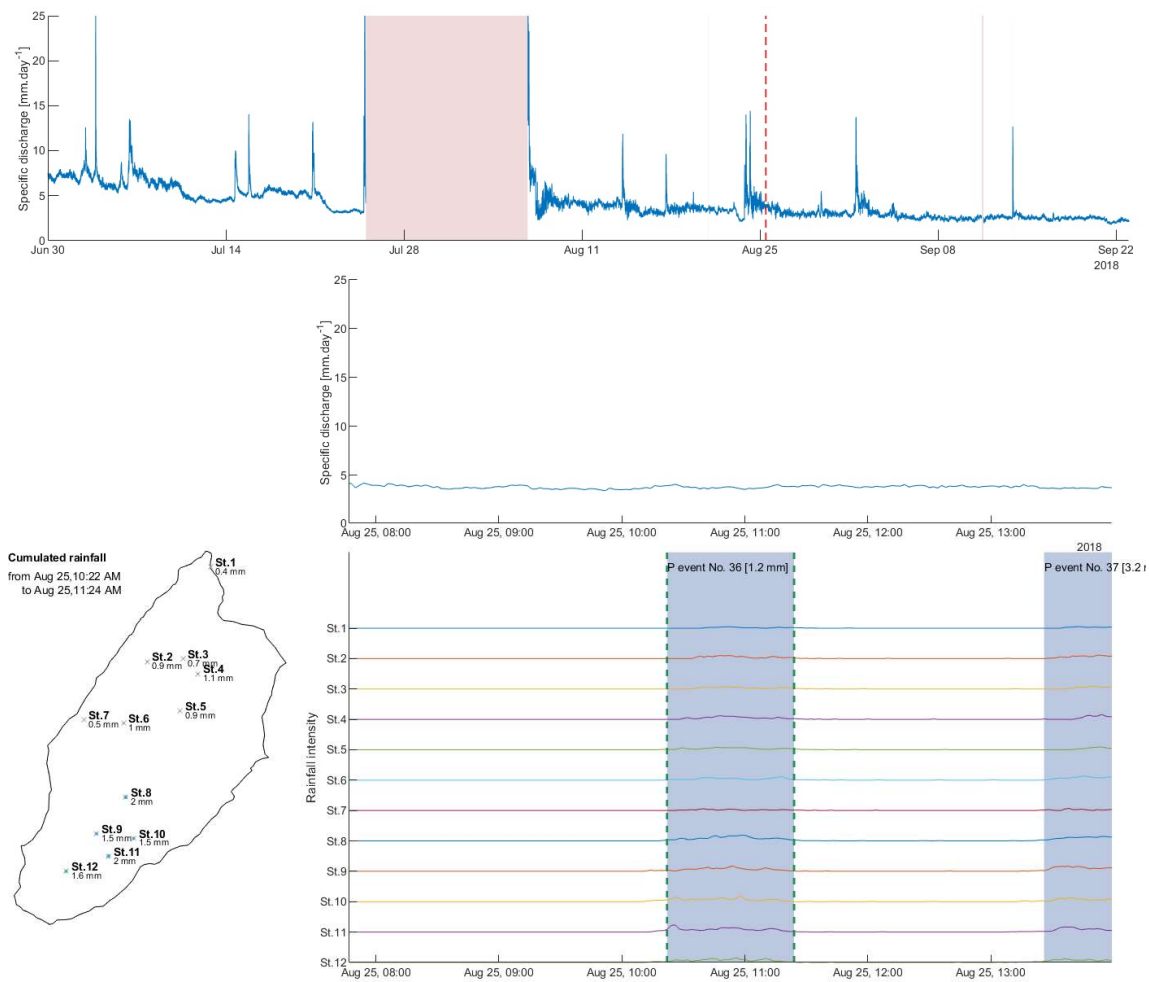


Figure S37. Precipitation event No. 36 from August 25th 10:22 AM to August 25th 11:24 AM

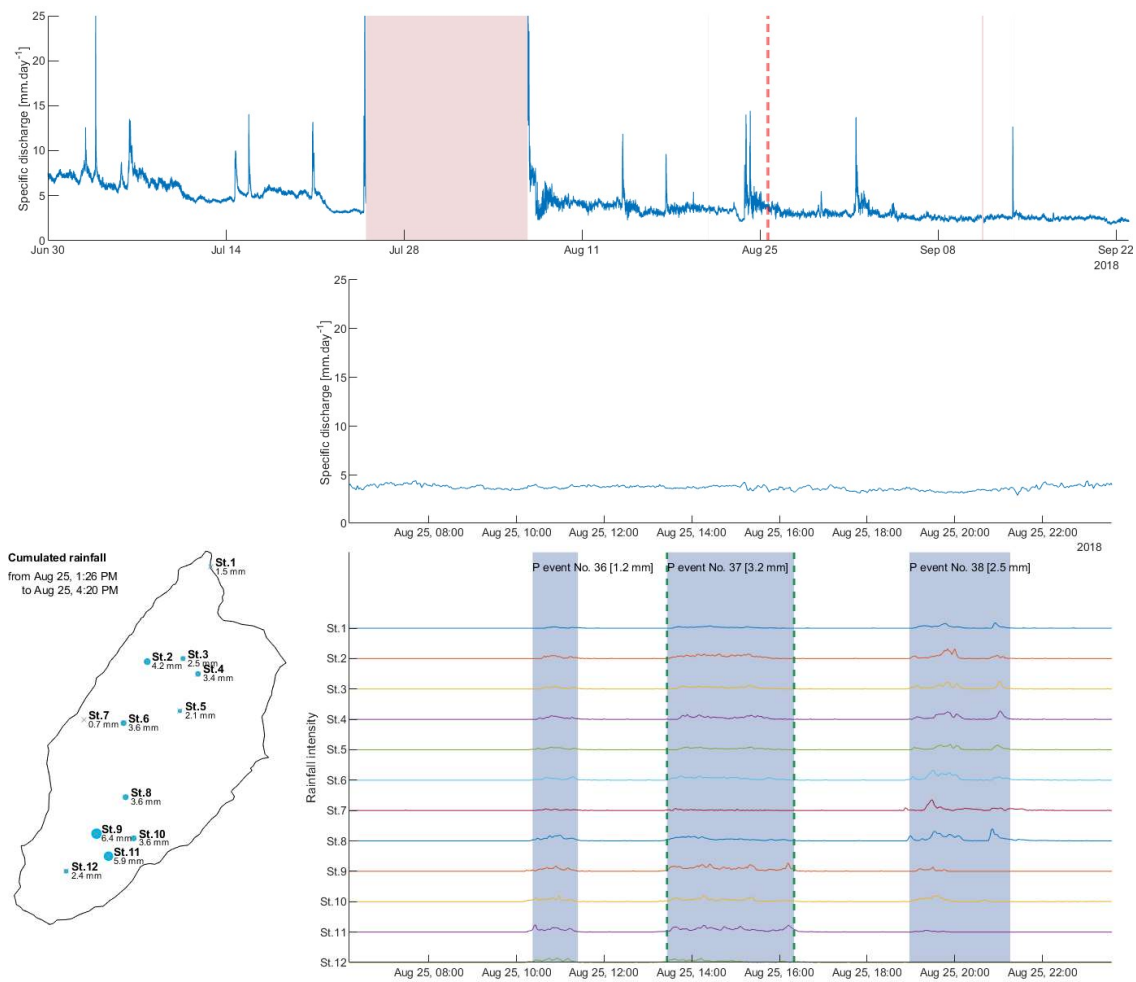


Figure S38. Precipitation event No. 37 from August 25th 01:26 PM to August 25th 04:20 PM

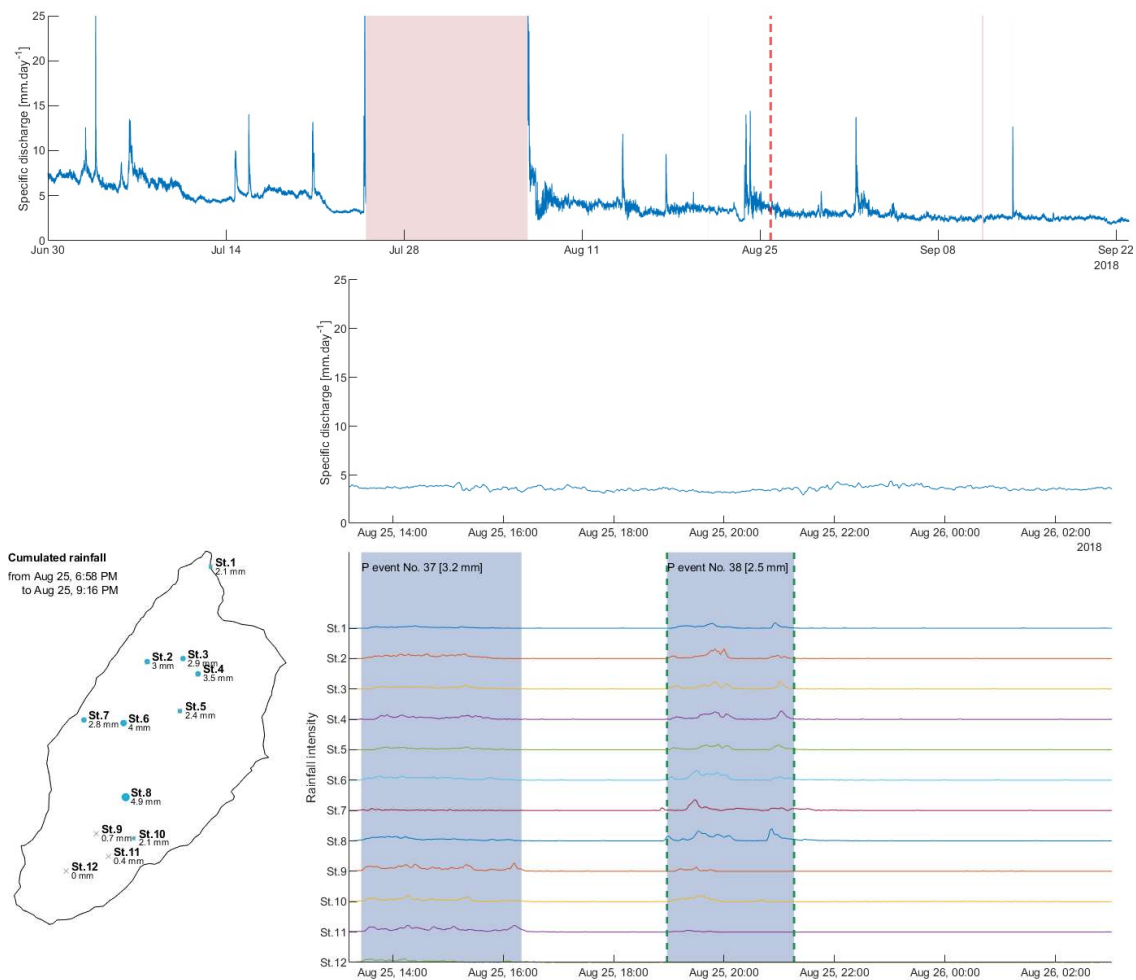


Figure S39. Precipitation event No. 38 from August 25th 06:58 PM to August 25th 09:16 PM

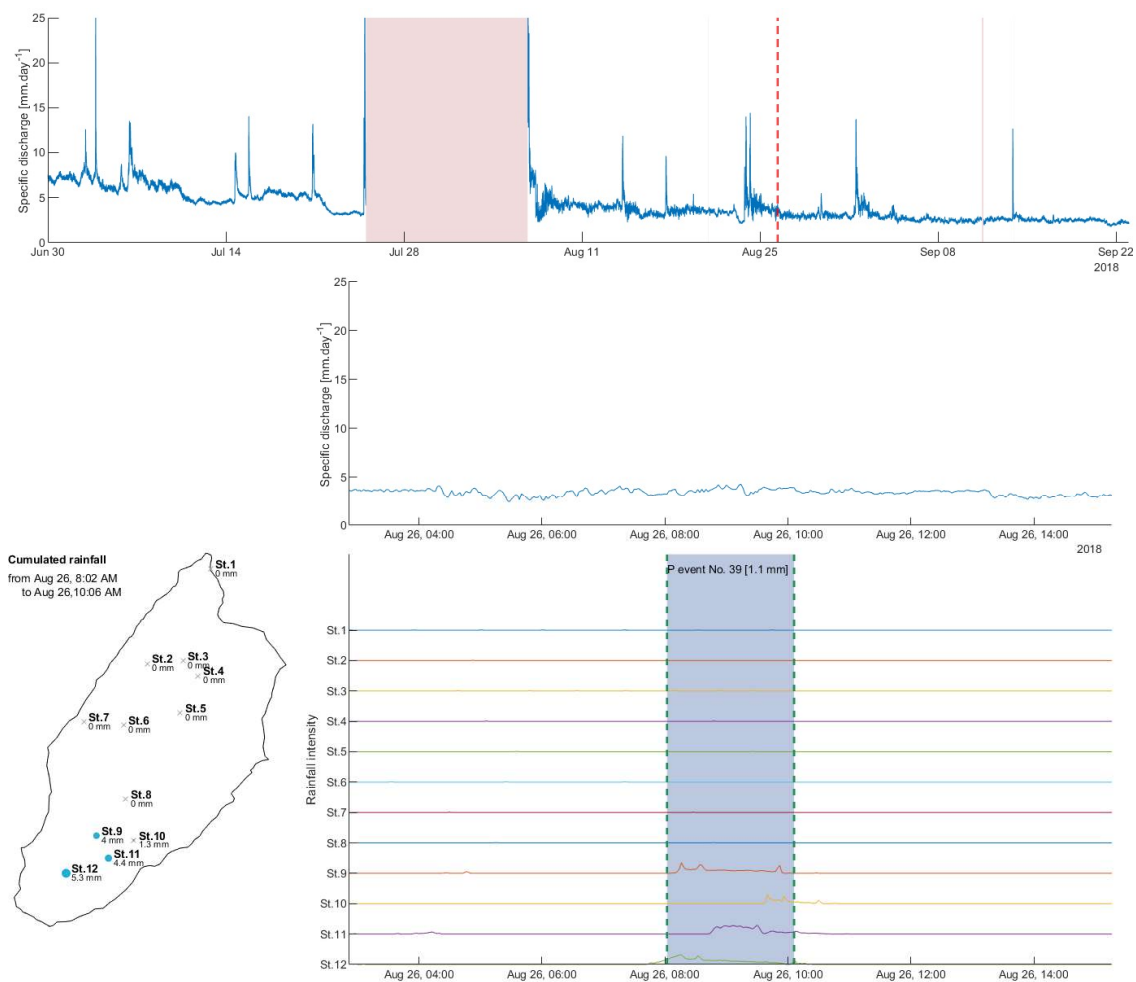


Figure S40. Precipitation event No. 39 from August 26th 08:02 AM to August 26th 10:06 AM

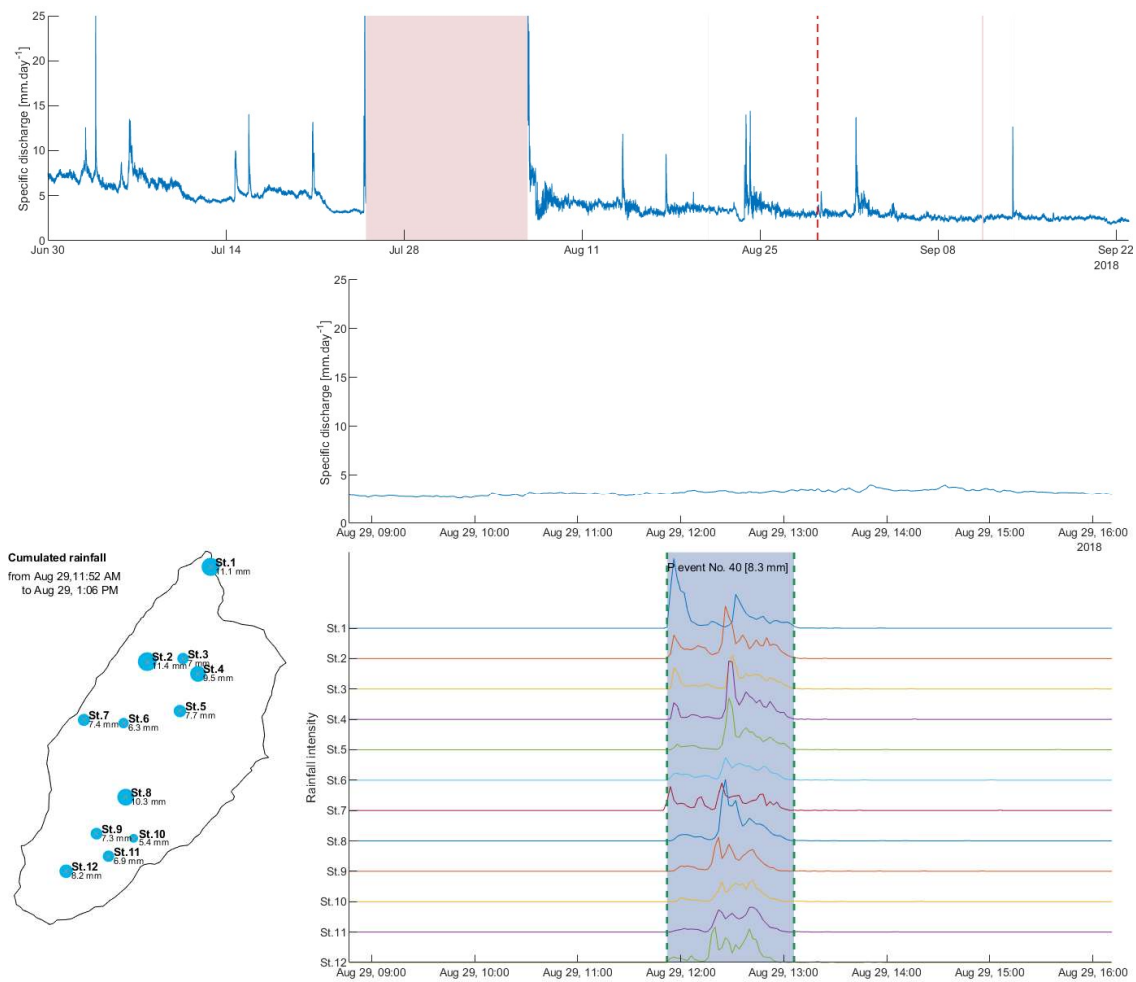


Figure S41. Precipitation event No. 40 from August 29th 11:52 AM to August 29th 01:06 PM

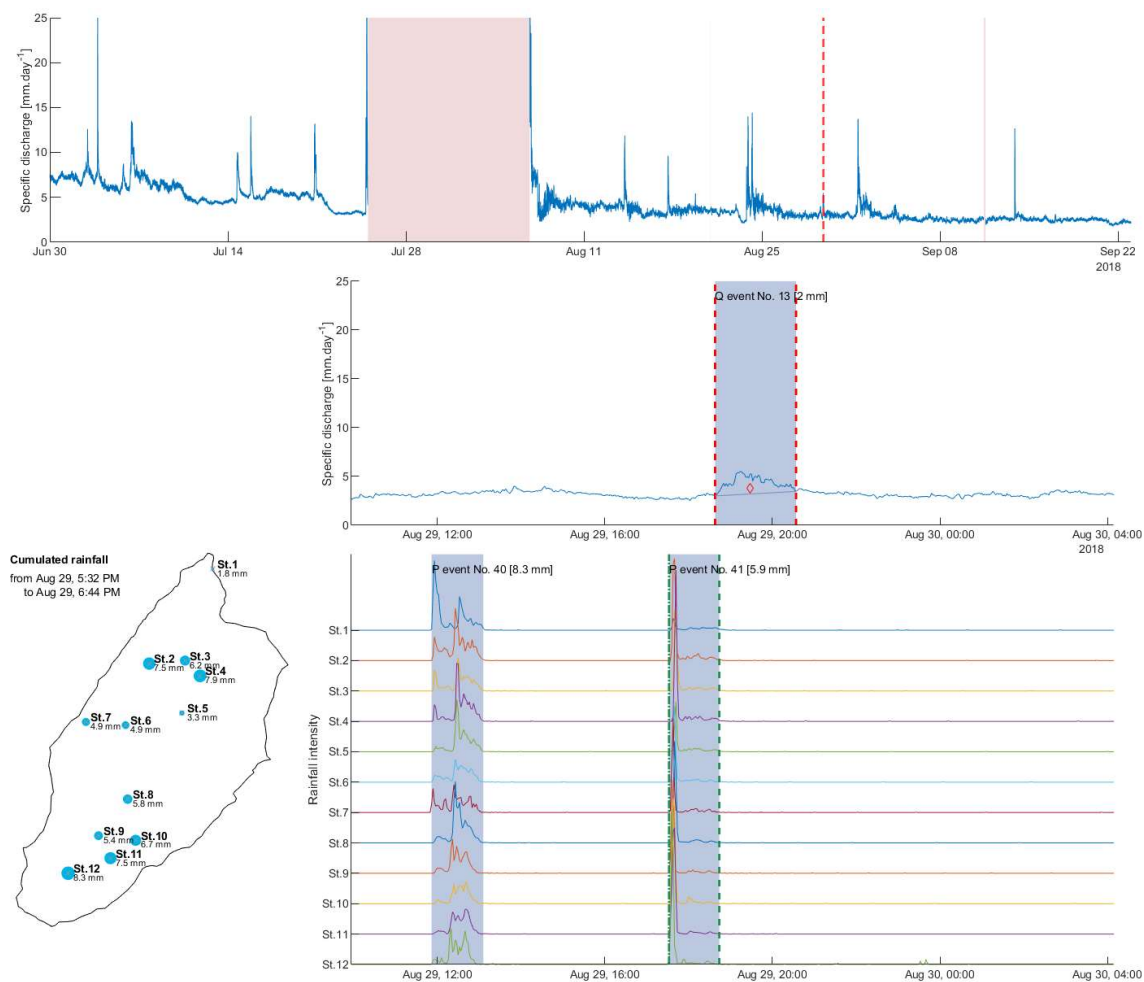


Figure S42. Precipitation event No. 41 from August 29th 05:32 PM to August 29th 06:44 PM and discharge event No. 13 from August 29th 06:38 PM to August 29th 08:34 PM

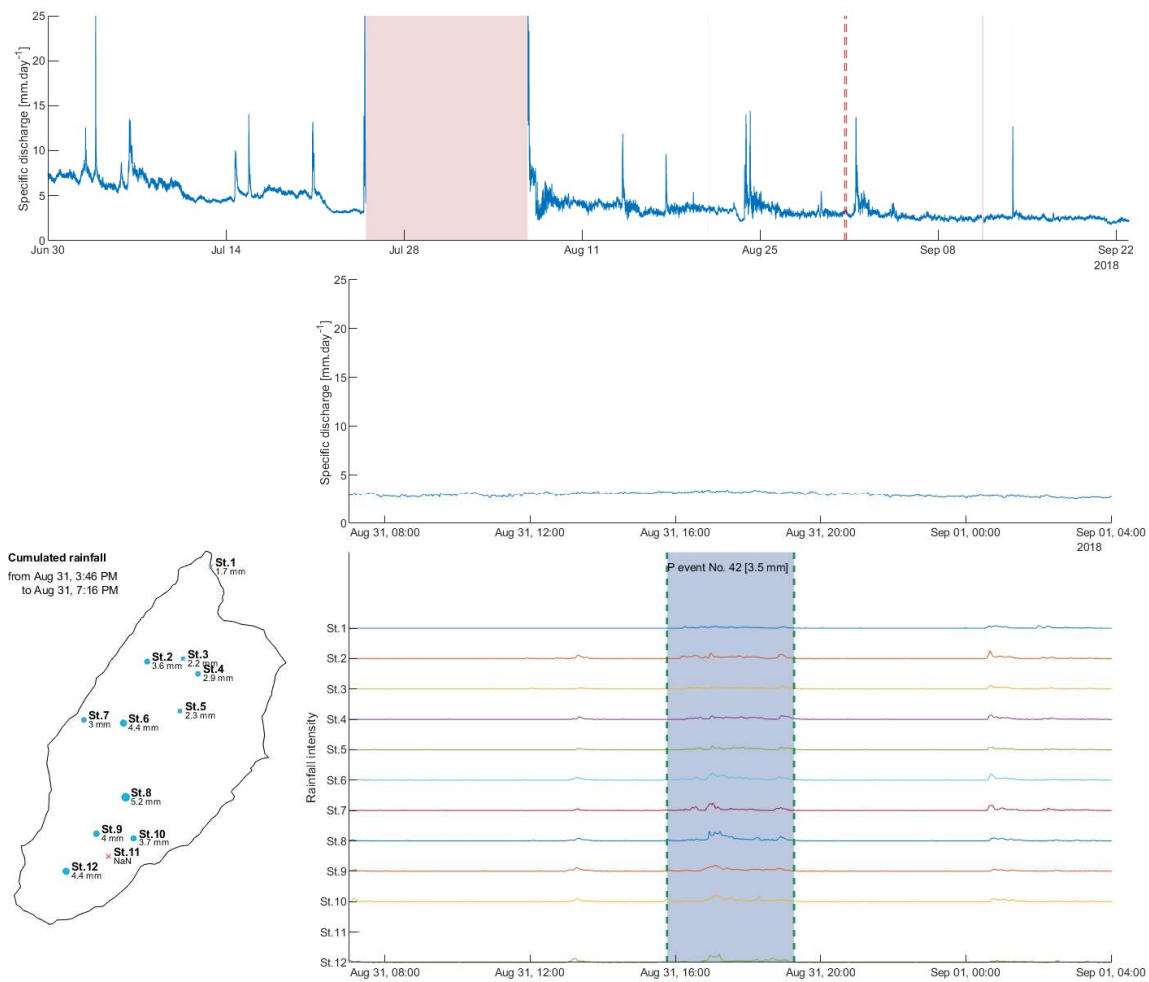


Figure S43. Precipitation event No. 42 from August 31th 03:46 PM to August 31st 07:16 PM

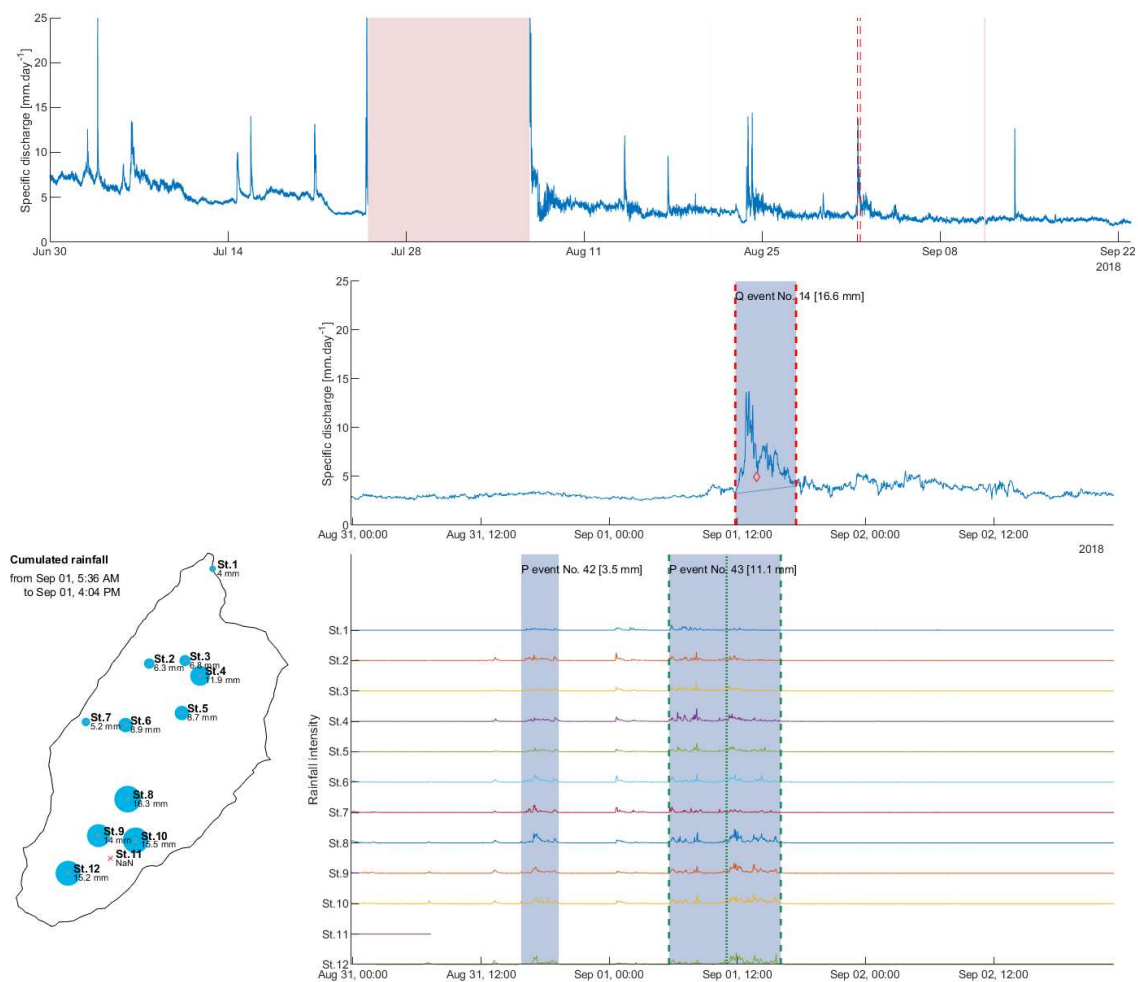


Figure S44. Precipitation event No. 43 from September 1st 05:36 AM to September 1st 04:04 PM and discharge event No. 14 from September 1st 11:49 AM to September 1st 05:30 PM

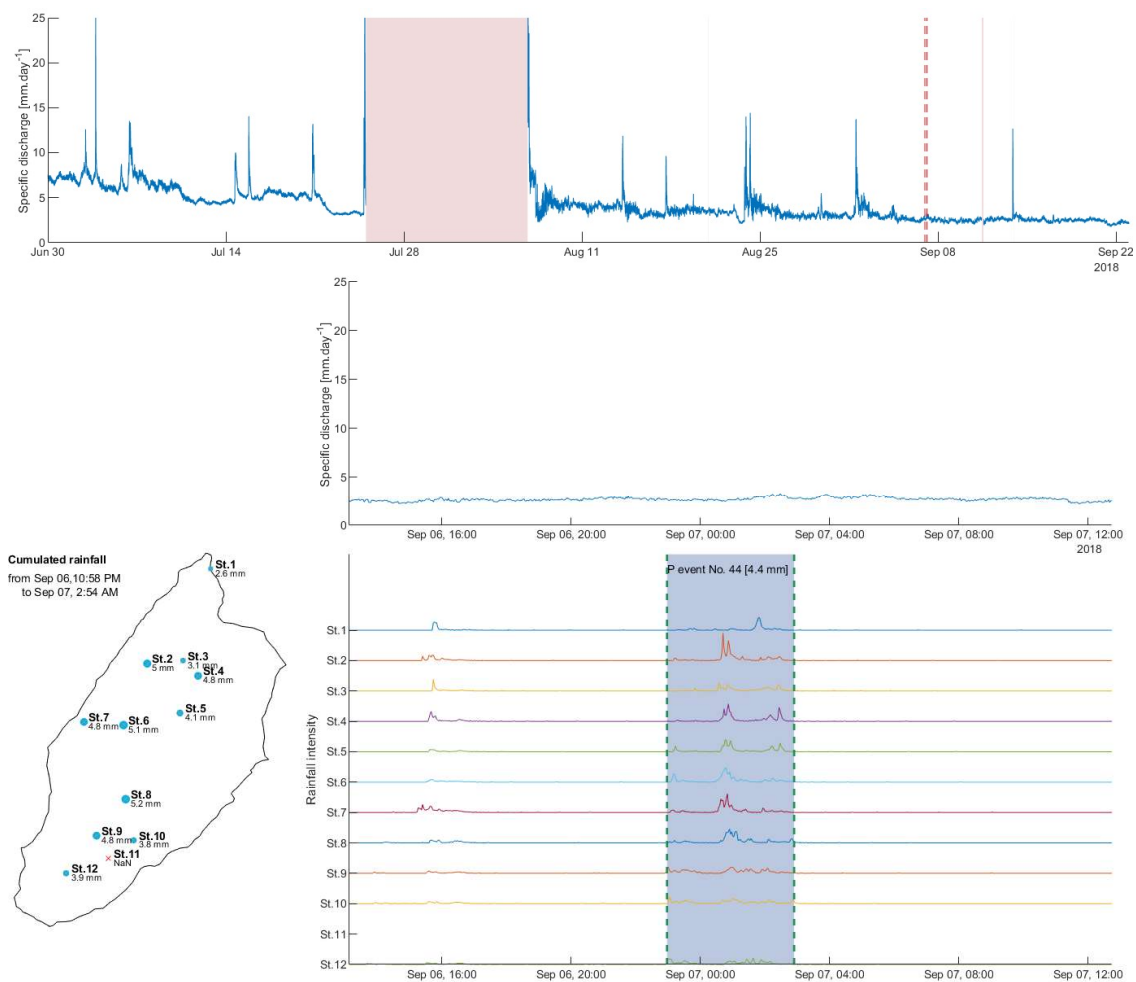


Figure S45. Precipitation event No. 44 from September 6th 10:58 PM to September 7th 02:54 AM

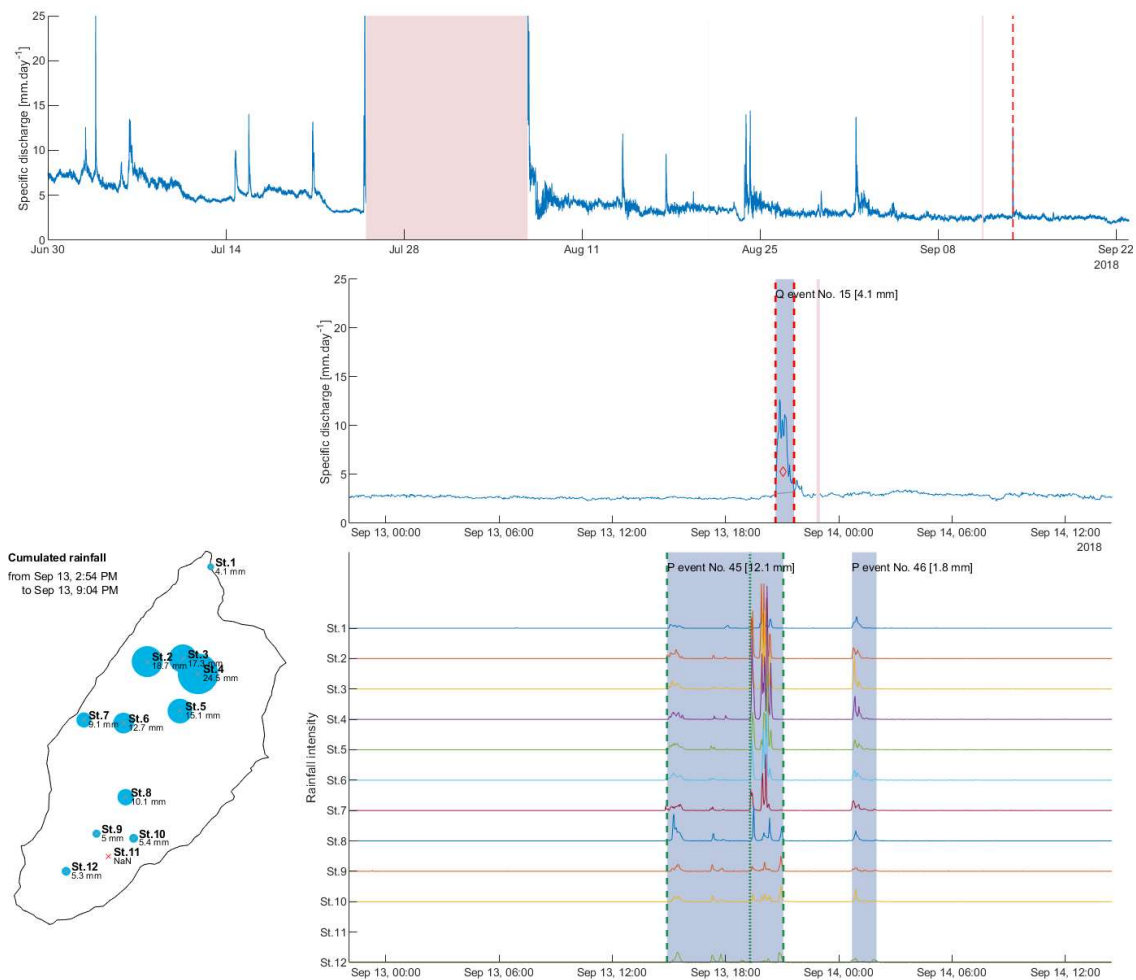


Figure S46. Precipitation event No. 45 from September 13th 02:54 PM to September 13th 09:04 PM and discharge event No. 15 from September 13th 08:39 PM to September 13th 09:38 PM

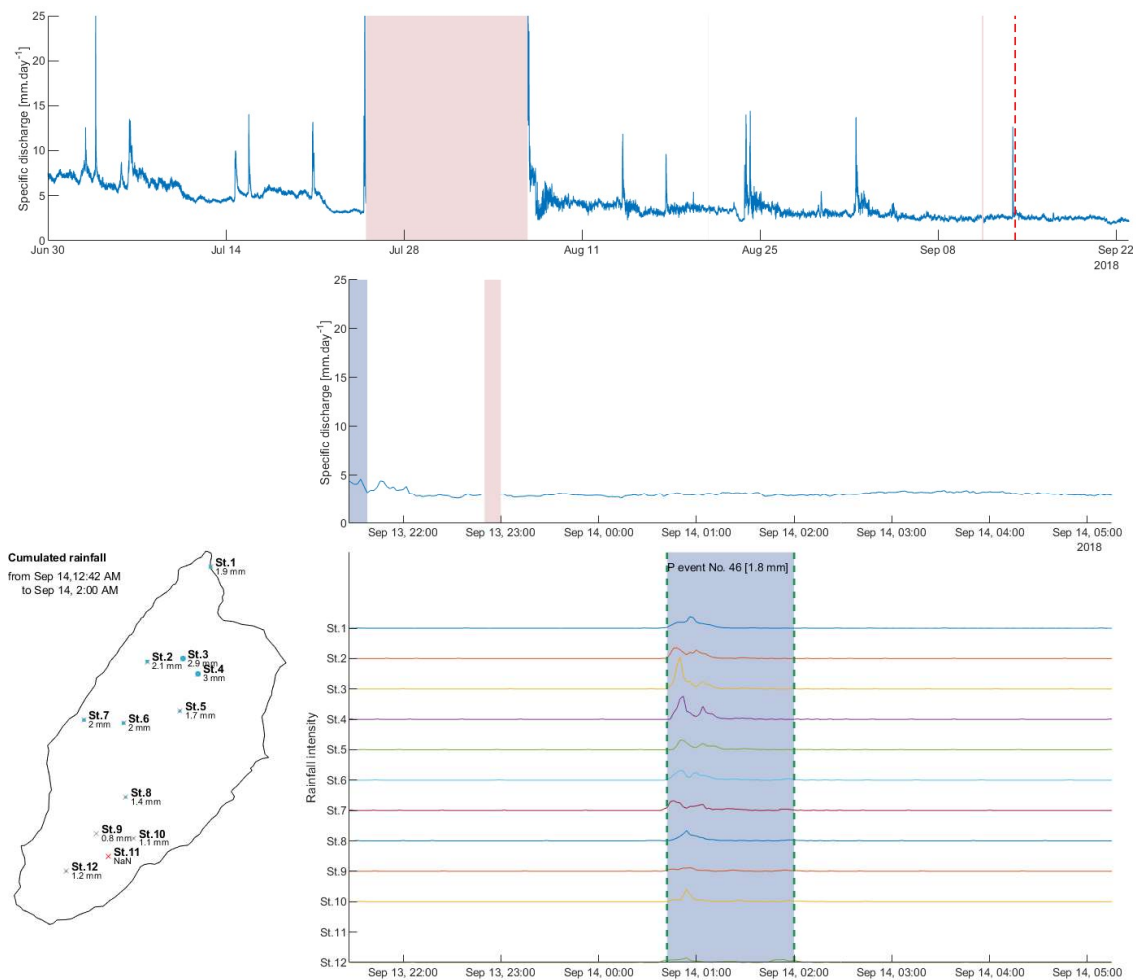


Figure S47. Precipitation event No. 46 from September 14th 12:42 AM to September 14th 02:00 AM

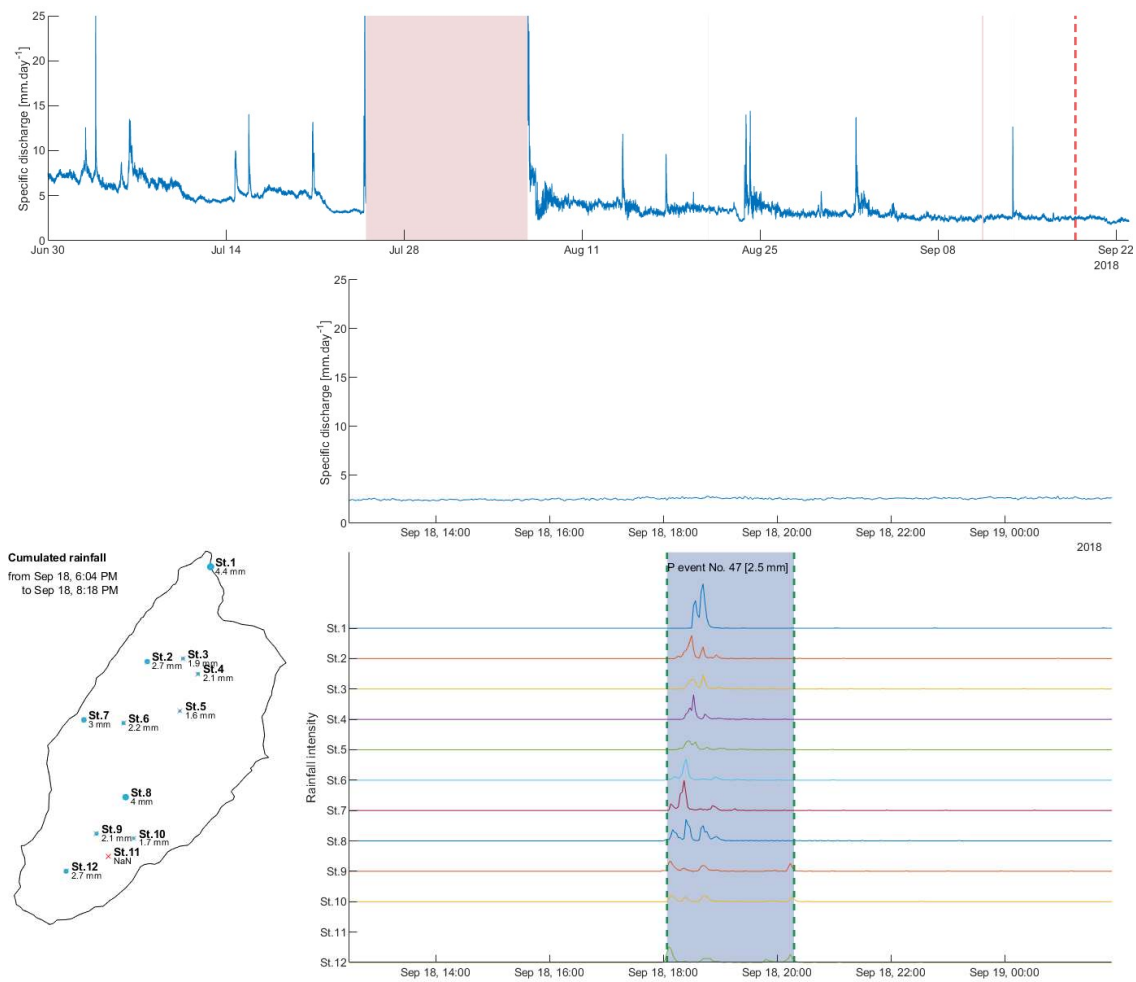


Figure S48. Precipitation event No. 47 from September 18th 06:04 PM to September 18th 08:18 PM

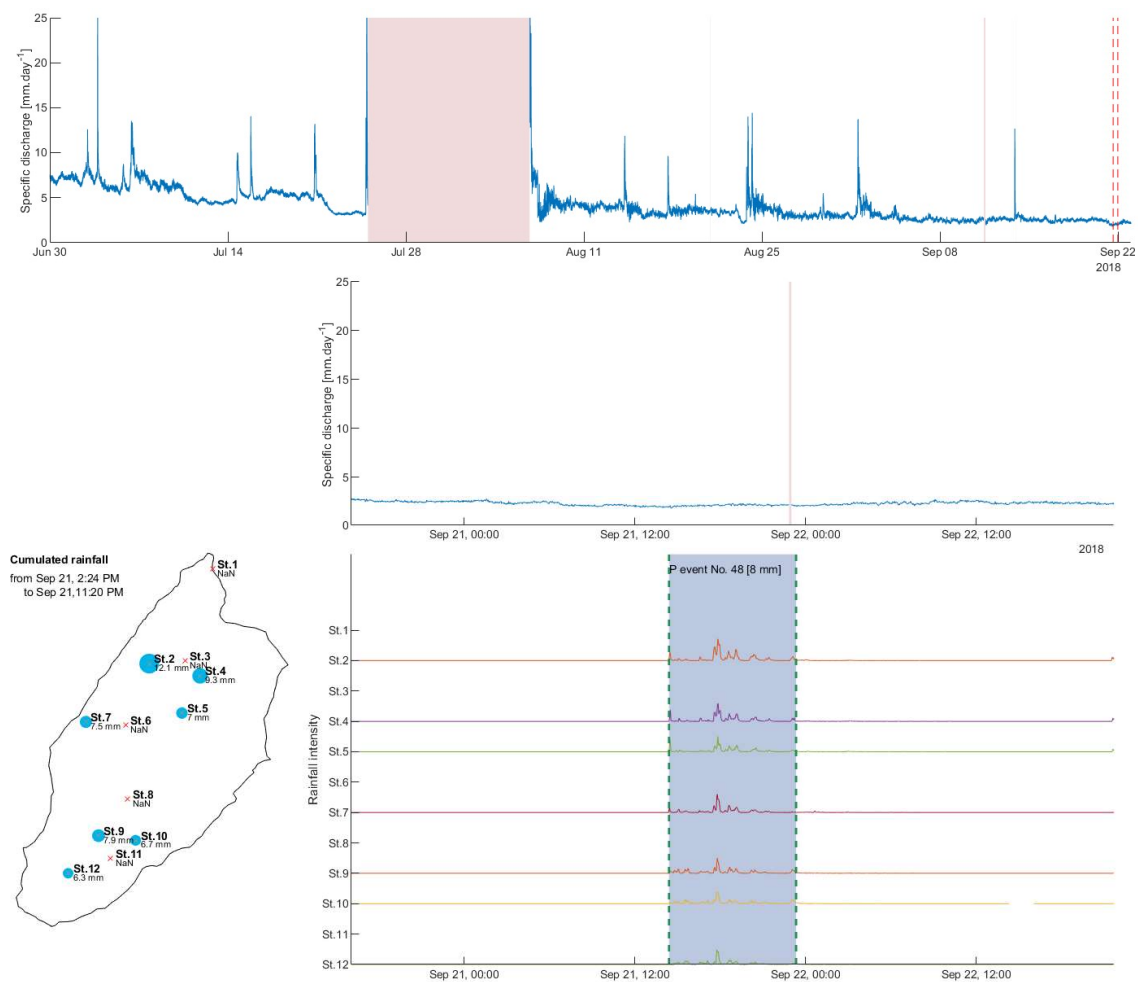


Figure S49. Precipitation event No. 48 from September 21st 02:24 PM to September 21st 11:20 PM



Figure S50. Automatic picture of the Avançon de Nant measurement station at the Vallon de Nant outlet on July 30th 2018. The river stage measure by the SONAR above the middle point of the river is disturbed by a rock.

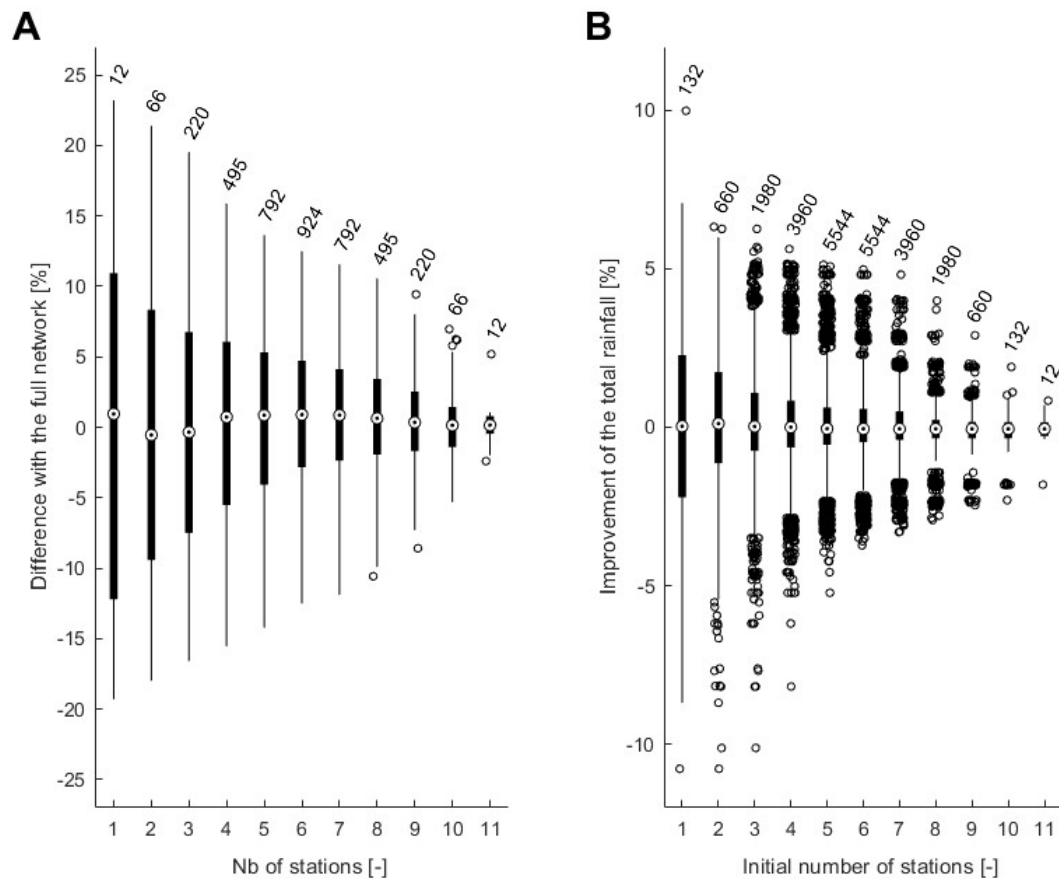


Figure S51. A) relative difference between networks composed of a partial number of stations and the full station network. **B)** Relative improvement of the estimation of total rainfall when adding one weather station to a partial station network. Based on the rainfall amount over 23 events recorded with the full network setup. The boxplots show the median and the quartile values; the whiskers extend to the most extreme data points not considered outliers, and outliers are individually marked as dots.

Table S2. List of the tested predictors for the $P_{\text{START_QSTART}}$ lag times pure quadratic regression, and their corresponding statistics: root mean square error (RMSE), coefficient of determination (R^2), variance of residuals (var. residuals), p-value, Akaike criterion (AIC), AIC ranking, corrected Akaike criterion (AICc) and AICc ranking.

Predictor 1	Predictor 2	RMSE	R^2	var. residuals	p-value	AIC	rank AIC	AICc	rank AICc
P_{LOWER}		25.14	0.01	534.79	0.94	92.9	15	95.3	10
P_{UPPER}		23.69	0.12	474.85	0.49	91.2	8	93.6	4
P_{ALL}		24.05	0.10	489.34	0.58	91.7	10	94.1	7
I_{ASYM}		23.92	0.11	484.19	0.54	91.5	9	93.9	6
D_{HILLS}		24.07	0.09	490.20	0.58	91.7	11	94.1	8
Wet. 1 day		23.51	0.14	467.60	0.45	91.0	7	93.4	3
Wet. 2 days		22.72	0.19	436.62	0.31	90.1	6	92.5	2
Wet. 3 days		21.75	0.26	400.23	0.19	88.9	3	91.3	1
Wet. 4 days		24.36	0.07	502.21	0.66	92.0	13	94.4	9
P_{LOWER}	I_{ASYM}	26.14	0.13	473.12	0.86	95.2	22	102.7	22
P_{UPPER}	I_{ASYM}	25.24	0.18	441.13	0.73	94.2	19	101.7	19
P_{ALL}	I_{ASYM}	25.18	0.19	439.09	0.72	94.1	17	101.6	17
D_{HILLS}	I_{ASYM}	24.22	0.25	406.01	0.58	93.1	16	100.6	16
Wet. 1 day	I_{ASYM}	21.12	0.43	308.95	0.24	89.2	4	96.7	12
Wet. 2 days	I_{ASYM}	20.36	0.47	287.00	0.18	88.2	2	95.7	11
Wet. 3 days	I_{ASYM}	19.08	0.53	252.08	0.11	86.4	1	93.9	5
Wet. 4 days	I_{ASYM}	25.23	0.19	440.71	0.73	94.2	18	101.7	18
P_{LOWER}	D_{HILLS}	26.56	0.10	488.24	0.91	95.6	24	103.1	24
P_{UPPER}	D_{HILLS}	25.27	0.18	442.15	0.73	94.2	20	101.7	20
P_{ALL}	D_{HILLS}	25.78	0.15	459.97	0.81	94.8	21	102.3	21
Wet. 1 day	D_{HILLS}	24.09	0.26	401.68	0.57	92.9	14	100.4	15
Wet. 2 days	D_{HILLS}	23.17	0.31	371.79	0.45	91.8	12	99.3	14
Wet. 3 days	D_{HILLS}	21.29	0.42	313.83	0.25	89.4	5	96.9	13
Wet. 4 days	D_{HILLS}	26.24	0.12	476.61	0.87	95.3	23	102.8	23

Table S3. For the 23 events measured by the full network setup: number of stations wrong by a factor 2 compared to the average of all the stations.

P event No.	Number of stations wrong by a factor 2
16	9
17	0
18	0
20	4
21	7
23	11
24	1
25	0
26	0
28	4
29	2
30	0
31	0
32	7
33	0
34	1
35	0
36	2
37	2
38	4
39	11
40	0
41	1

Table S4. For the 23 events measured by the full network setup: number of events for which the station is wrong by a factor 2 compared to the average of all the stations.

Station No.	Number of events for which the station is wrong by a factor 2
1	8
2	2
3	5
4	5
5	3
6	4
7	8
8	6
9	7
10	4
11	7
12	7

Table S5. RMSE values of P_{ALL} , I_{ASYM} and RC obtained for each network optimized over P_{ALL} , I_{ASYM} and RC. Missing RMSE values are caused by the measure of null precipitations for one or more events given the selected network.

Variable the network is optimized on	Variable the RMSE is computed on	1 station	2 stations	3 stations	4 stations	5 stations
P_{ALL}	P_{ALL}	2,22	0,83	0,66	0,49	0,37
	I_{ASYM}	-	0,20	0,13	0,09	0,06
	RC	0,20	0,10	0,12	0,14	0,04
I_{ASYM}	P_{ALL}	5,99	2,10	1,39	1,25	0,84
	I_{ASYM}	0,41	0,12	0,07	0,05	0,05
	RC	0,84	0,35	0,20	0,13	0,28
RC	P_{ALL}	2,22	0,97	0,83	0,91	0,67
	I_{ASYM}	-	0,15	0,13	0,22	0,14
	RC	0,20	0,07	0,05	0,04	0,03

Table S6. R^2 between the variables listed in the Table 1 (based on 14 events with a river reaction, without the outlier discussed in 4.1).

	P_{LOWER}	P_{UPPER}	P_{ALL}	I_{ASYM}	D_{HILLS}	D_{STREAM}	Wet. 1 day	Wet. 2 days	Wet. 3 days	Wet. 4 days	Q_{FAST}	RC	$P_{START_Q_{START}}$
P_{LOWER}	1,00												
P_{UPPER}	0,42	1,00											
P_{ALL}	0,78	0,86	1,00										
I_{ASYM}	0,08	0,27	0,03	1,00									
D_{HILLS}	0,00	0,28	0,12	0,30	1,00								
D_{STREAM}	0,03	0,18	0,04	0,43	0,80	1,00							
Wet. 1 day	0,06	0,02	0,05	0,00	0,01	0,00	1,00						
Wet. 2 days	0,08	0,05	0,08	0,00	0,01	0,02	0,62	1,00					
Wet. 3 days	0,10	0,01	0,04	0,03	0,02	0,01	0,43	0,76	1,00				
Wet. 4 days	0,07	0,00	0,02	0,04	0,03	0,01	0,36	0,54	0,83	1,00			
Q_{FAST}	0,26	0,63	0,54	0,20	0,29	0,18	0,01	0,01	0,13	0,17	1,00		
RC	0,00	0,13	0,05	0,22	0,19	0,19	0,09	0,15	0,45	0,39	0,62	1,00	
$P_{START_Q_{START}}$	0,01	0,10	0,05	0,08	0,05	0,01	0,00	0,02	0,01	0,01	0,02	0,00	1,00