- Data sets:
  - "48-hour laboratory experiment CWS.csv" contains the isotope measurements of the 48-hour laboratory experiment.
  - "48-hour laboratory experiment IC.csv" contains the IC measurements of the 48-hour laboratory experiment.
  - "Field experiment corrected and calibrated data.csv" contains the drift-corrected and calibrated data of the field experiment (calcium data were not drift-corrected due to calcium-precipitation effects in the check standard solution).
  - "Field experiment raw data.csv" contains the raw data of the field experiment
  - "Precipitation CombiPrecip.csv" contains the precipitation data based on the CombiPrecip grid-data product of MeteoSwiss.
  - "Ancillary data.csv" contains the measurements of stream stage, streamwater electrical conductivity, and streamwater temperature.

Supplement

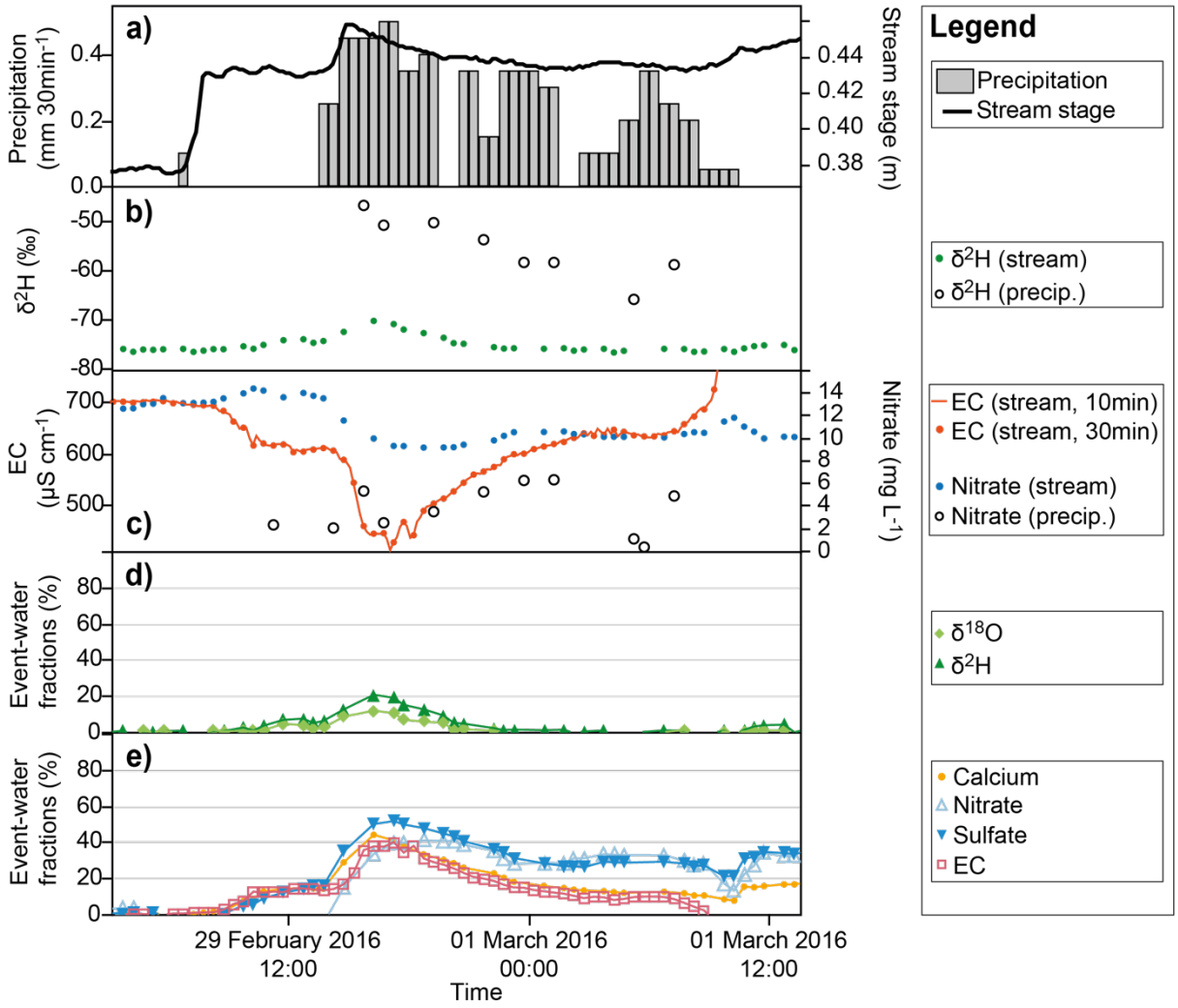

Figure S1: Precipitation Event #5 together with the hydrologic a), isotopic b) and chemical c) responses in streamwater. Panels d) and e) show the fractions of event-water based on isotopic hydrograph separation and chemical hydrograph separation, respectively, which are different for both types of tracers: While the isotope tracers yield event-water fractions smaller than 21%, chemical tracers estimated much larger event-water fractions of more than 40%.

Table S 1: End-members and event-water fractions during peak flow.

	$\delta^{18}O$ (‰)	$\delta^{2}H$ (‰)	Ca^{2+} (mg L^{-1})	NO_3^- (mg L^{-1})	SO_4^{2-} (mg L^{-1})	EC (µS cm^{-1})
Event	**Pre-event-water end member (C_P) ±SE_{CP}**					
#1	-11.16±0.08	-77.22±0.29	162.68±1.60	11.04±0.24	20.06±1.25	710.20±14.57
#2	-10.81±0.07	-75.50±0.29	166.58±1.59	13.62±0.15	23.98±1.48	718.00±14.38
#3	-10.85±0.03	-75.55±0.18	166.28±1.62	12.84±0.10	23.77±1.47	712.20±14.27
#4	-10.92±0.06	-75.78±0.34	158.00±1.52	11.53±0.21	21.95±1.36	669.80±13.92
#5	-10.93±0.03	-76.26±0.20	163.97±1.66	12.94±0.18	24.46±1.51	700.60±14.02
#6	-11.36±0.05	-79.13±0.26	142.07±1.56	8.50±0.15	15.20±0.99	586.00±12.15
#7	-11.09±0.03	-77.61±0.18	163.61±1.57	11.52±0.12	21.05±1.30	695.80±13.99
#8	-11.16±0.03	-77.96±0.19	167.56±1.59	12.14±0.16	22.34±1.38	708.60±14.23
Event	**Event-water end member (C_E) ±SE_{CE} at peak flow**					
#1	-13.21±0.36	-91.34±2.34	14.78±4.32	0.55±0.28	0.16±0.08	64.28±26.86
#2	-5.25±0.41	-55.01±3.16	14.55±2.74	1.41±0.64	1.07±0.60	14.05±20.65
#3	-8.37±0.74	-62.05±4.08	17.35±1.26	0.48±0.13	0.07±0.04	26.41±20.29
#4	-10.99±0.55	-98.84±4.37	9.26±1.87	1.94±0.30	0.05±0.04	4.94±20.04
#5	-5.78±0.10	-47.64±1.58	14.36±1.05	3.95±0.63	2.60±0.66	12.04±20.08
#6	-12.04±0.23	-88.96±1.54	6.03±2.04	0.27±0.09	0.05±0.04	8.90±20.29
#7	-14.36±1.19	-133.59±7.28	11.75±2.16	1.52±0.50	0.09±0.05	21.99±21.07
#8	-15.87±0.53	-125.34±3.00	10.48±2.39	2.46±0.39	0.18±0.14	17.35±20.79
Event	**Streamwater end member (C_S) ±SE_{CS} at peak flow**					
#1	-11.43±0.03	-79.39±0.17	114.90±1.11	8.60±0.04	15.72±0.98	414.00±8.28
#2	-10.39±0.03	-72.41±0.17	64.60±0.66	3.73±0.03	5.12±0.34	304.00±6.08
#3	-9.65±0.03	-68.88±0.17	96.38±0.94	7.36±0.04	13.63±0.85	363.00±7.26
#4	-12.65±0.03	-89.72±0.17	101.97±0.99	6.56±0.04	11.10±0.70	428.00±8.56
#5	-10.32±0.03	-70.36±0.17	98.23±0.96	9.94±0.04	13.56±0.85	442.00±8.84
#6	-11.77±0.03	-82.40±0.17	107.28±1.04	5.48±0.04	9.57±0.61	431.00±8.62
#7	-15.89±0.03	-113.99±0.17	88.22±0.87	4.62±0.04	7.98±0.52	380.00±7.60
#8	-13.20±0.03	-92.12±0.17	139.13±1.33	9.68±0.04	16.80±1.05	1369.00±27.38
	Event-water fraction F_E ±SE (%) at peak flow					
Event	**$\delta^{18}O$**	**$\delta^{2}H$**	**Ca^{2+}**	**NO_3^-**	**SO_4^{2-}**	**EC**
#1	13.36±4.28	15.40±3.33	32.31±1.41	23.30±1.89	21.84±6.95	45.86±2.60
#2	7.64±1.33	15.09±2.75	67.08±1.33	80.98±4.28	82.33±2.87	58.81±2.10
#3	48.66±14.64	49.36±14.99	46.94±0.95	44.30±0.72	42.77±5.05	50.92±2.11
#4	-[a]	60.45±11.50	37.67±1.04	51.86±1.99	49.53±4.48	36.37±2.15
#5	11.77±0.82	20.59±1.40	43.94±0.95	33.39±2.72	49.87±5.42	37.56±2.11
#6	60.14±21.00	33.30±5.78	25.58±1.21	36.73±1.33	37.19±5.75	26.86±2.34
#7	146.70±53.19	64.98±8.46	49.64±1.05	69.04±3.48	62.36±3.40	46.87±2.15
#8	43.49±4.97	29.89±1.95	18.10±1.21	25.40±1.64	24.98±6.64	-95.54±6.34[b]

[a] Unrealistic event-water fractions were obtained because the $\delta^{18}O$ signatures in precipitation and streamwater were too similar.

[b] Wash-off of road salt resulted in unrealistic event-water fractions based on EC.

Table S 2: End-members and event-water fractions during maximum event-water fraction.

	$\delta^{18}O$ (‰)	$\delta^{2}H$ (‰)	Ca^{2+} (mg L^{-1})	NO_3^- (mg L^{-1})	SO_4^{2-} (mg L^{-1})	EC (µS cm^{-1})
Event	**Pre-event-water end member (C_P) ±SE_{CP}**					
#1	-11.16±0.08	-77.22±0.29	162.68±1.60	11.04±0.24	20.06±1.25	710.20±14.57
#2	-10.81±0.07	-75.50±0.29	166.58±1.59	13.62±0.15	23.98±1.48	718.00±14.38
#3	-10.85±0.03	-75.55±0.18	166.28±1.62	12.84±0.10	23.77±1.47	712.20±14.27
#4	-10.92±0.06	-75.78±0.34	158.00±1.52	11.53±0.21	21.95±1.36	669.80±13.92
#5	-10.93±0.03	-76.26±0.20	163.97±1.66	12.94±0.18	24.46±1.51	700.60±14.02
#6	-11.36±0.05	-79.13±0.26	142.07±1.56	8.50±0.15	15.20±0.99	586.00±12.15
#7	-11.09±0.03	-77.61±0.18	163.61±1.57	11.52±0.12	21.05±1.30	695.80±13.99
#8	-11.16±0.03	-77.96±0.19	167.56±1.59	12.14±0.16	22.34±1.38	708.60±14.23
Event	**Event-water end member (C_E) ±SE_{CE} at maximum event-water fraction**					
#1	-13.17±0.27	-96.54±4.42	14.65±3.07	0.4±0.23	0.13±0.07	55.09±25.08
#2	-5.25±0.41	-55.01±3.16	14.55±2.74	1.41±0.64	1.07±0.60	15.57±20.81
#3	-8.37±0.74	-62.05±4.08	15.6±1.30	0.39±0.14	0.07±0.04	24.86±20.47
#4	-10.68±0.55	-95.95±4.56	9.36±1.65	1.84±0.29	0.05±0.04	4.15±20.03
#5	-5.78±0.10	-47.64±1.58	14.36±1.05	3.6±0.34	1.97±0.60	9.17±20.07
#6	-12.04±0.23	-88.96±1.54	6.03±2.04	0.27±0.09	0.05±0.04	9.01±20.29
#7	-14.36±1.19	-133.59±7.28	11.75±2.16	1.52±0.50	0.08±0.05	19.68±21.12
#8	-15.87±0.53	-125.34±3.00	10.35±9.73	2.5±0.68	0.15±1.19	16.53±20.79
Event	**Streamwater end member (C_S) ±SE_{CS} at maximum event-water fraction**					
#1	-12.77±0.03	-88.67±0.17	78.00±0.78	4.16±0.15	7.12±0.46	343.00±7.16
#2	-10.39±0.03	-72.41±0.17	64.60±0.66	3.73±0.03	5.12±0.34	264.00±5.28
#3	-9.65±0.03	-68.88±0.17	89.92±0.89	6.26±0.04	10.52±0.67	346.00±6.92
#4	-12.78±0.03	-90.53±0.17	90.82±0.90	5.39±0.04	8.00±0.52	347.00±6.94
#5	-10.32±0.03	-70.36±0.17	98.23±0.96	9.13±0.04	12.86±0.81	425.00±8.50
#6	-11.77±0.03	-82.40±0.17	107.28±1.04	5.48±0.04	9.57±0.61	336.00±6.72
#7	-15.89±0.03	-113.99±0.17	88.22±0.87	4.62±0.04	7.59±0.49	366.00±7.32
#8	-13.20±0.03	-92.12±0.17	130.86±1.25	9.06±0.04	14.83±0.93	1369.00±27.38
	Maximum event-water fraction $F_{E,max}$ ±SE_{FE} (%)					
Event	**$\delta^{18}O$**	**$\delta^{2}H$**	**Ca^{2+}**	**NO_3^-**	**SO_4^{2-}**	**EC**
#1	80.21±10.75	59.28±13.61	57.20±1.38	64.63±2.14	64.95±3.21	56.05±2.60
#2	7.64±1.33	15.09±2.75	67.08±1.33	80.98±4.28	82.33±2.87	64.63±2.18
#3	48.66±14.64	49.36±14.99	50.68±0.91	52.85±0.76	55.91±3.92	53.28±2.11
#4	-[a]	73.11±16.55	45.20±0.96	63.32±2.07	63.72±3.26	48.49±2.09
#5	11.77±0.82	20.59±1.4	43.94±0.95	40.74±1.91	51.58±5.03	39.86±2.08
#6	60.14±21.00	33.30±5.78	25.58±1.21	36.73±1.33	37.19±5.75	43.33±2.26
#7	146.70±53.19	64.98±8.46	49.64±1.05	69.04±3.48	64.18±3.24	48.78±2.15
#8	43.49±4.97	29.89±1.95	23.34±1.82	31.95±2.55	33.82±6.13	-95.42±6.33[b]

[a] Unrealistic event-water fractions were obtained because the $\delta^{18}O$ signatures in precipitation and streamwater were too similar.

[b] Wash-off of road salt resulted in unrealistic event-water fractions based on EC.