Supplementary Material for Downpour Dynamics: Outsized impacts of storm events on unprocessed atmospheric nitrate export

Supplementary tables

Table S1. Rainfall depth and chemistry for sampled events.

Date	Rainfall (cm)		NO_3^- (mg N L^{-1})		NO_3^- (g N ha^{-1})		$\delta^{15}N$ (‰)		$\delta^{18}O$ (‰)		$\Delta^{17}O$ (‰)		$\delta^{18}O_{H2O}$ (‰)	
	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN
9/9/18	4.90	3.60	0.08	0.07	38	26	n/a	n/a	56.5 ± 0.2	58.8 ± 0.9	19.8 ± 0.4	21.3 ± 0.5	-7.6 ± 0.2	-7.2 ± 0.2
10/27/18	1.90	2.30	0.09	0.10	18	22	-3.2 ± 0.3	-4.3 ± 0.4	56.5 ± 0.5	55.1 ± 0.7	19.8 ± 0.5	19.3 ± 0.4	-14.9 ± 0.2	-15.0 ± 0.2
12/28/18	3.30	3.00	0.12	0.17	38	52	-1.4 ± 0.3	-1.9 ± 0.5	56.6 ± 0.8	66.7 ± 0.9	21.4 ± 0.2	24.9 ± 0.4	-6.0 ± 0.2	-5.7 ± 0.2
3/21/19	8.10	6.80	0.05	0.07	44	49		-1.6 ± 1.4	48.0 ± 0.6	53.7 ± 0.9	20.5 ±0.4	20.4 ± 0.6	-11.8 ± 0.2	-11.6 ± 0.2
5/4/19	3.90	3.80	0.13	0.20	52	77	-5.8 ± 0.2	-2.2 ± 0.6	63.7 ± 0.5	69.6 ± 0.5	23.1 ± 0.4	23.0 ± 0.7	-5.5 ± 0.2	-4.8 ± 0.2
7/12/19	3.00	3.80	0.26	0.17	79	63	-5.5 ± 0.3	-8.7 ± 0.4	66.9 ± 0.7	53.4 ± 0.1	22.9 ± 0.2	16.4 ± 0.6	-4.8 ± 0.2	-5.0 ± 0.2
7/22/19	5.30	2.00	0.17	0.16	88	31	-4.4 ± 0.2	-4.8 ± 0.8	58.3 ± 0.2	48.9 ± 0.5	18.4 ± 0.4	13.6 ± 0.5	-6.8 ± 0.2	-6.3 ± 0.2
10/16/19	3.60	3.90	0.06	0.05	20	21	-8.0 ± 0.5	-6.9 ± 0.7	56.8 ± 0.3	51.2 ± 0.6	18.8 ± 0.4	19.0 ± 0.7	-10.7 ± 0.2	-11.4 ± 0.2

Rainfall depth is the spatially averaged mean for the entire watershed.

Table S2. Hydrologic characteristics of sampled storm events and antecedent conditions.

Date	Q_{mean} (mm hr^{-1})		Q_{median} (mm hr^{-1})		Q_{min} (mm hr^{-1})		Q_{max} (mm hr^{-1})		$Q_{EventSampled}$ (cm)		$Q_{EventTotal}$ (cm)		7-day antecedent Q (cm)		$\delta^{18}O$-H_2O Baseflow		$\delta^{18}O$-H_2O Peak		$f_{Event\ Water}$ Peak	
	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN
9/9/18	0.33	1.37	0.36	1.59	0.11	0.40	0.41	1.77	0.95	2.22	1.50	2.90	1.31	2.07	n/a	n/a	-7.1	-6.9	n/a	n/a
10/27/18	0.08	0.24	0.08	0.23	0.06	0.04	0.11	0.42	0.25	0.41	0.23	0.54	0.80	0.60	-7.2	-7.7	-7.8	-11.3	0.08 ± 0.09	0.49 ± 0.12
12/28/18	0.22	0.48	0.23	0.39	0.12	0.06	0.38	1.14	0.82	1.26	0.89	1.33	2.90	2.01	-7.3	-7.8	-7.3	-6.8	0.00 ± 0.61	0.48 ± 0.27
3/21/19	0.25	0.66	0.21	0.54	0.09	0.05	0.76	2.00	2.16	2.60	2.35	2.92	1.67	1.02	-7.7	-7.7	-9.1	-10.8	0.34 ± 0.17	0.79 ± 0.25
5/4/19	0.14	0.38	0.12	0.32	0.08	0.05	0.22	0.94	0.53	1.23	0.56	1.27	1.29	0.79	-7.6	-6.1	-7.4	-5	0.10 ± 0.36	0.85 ± 0.40
7/12/19	0.17	0.75	0.14	0.45	0.07	0.04	0.33	1.99	0.26	1.25	0.29	1.38	0.92	2.52	-8	-7.1	-7.4	-5.0	0.19 ± 0.22	1.00 ± 0.29
7/22/19	0.14	0.16	0.12	0.11	0.05	0.03	0.24	0.51	0.32	0.44	0.33	0.43	1.11	1.02	-7.3	-7.3	-6.7	-6.3	1.06 ± 1.39	0.96 ± 0.64
10/16/19	0.05	0.25	0.04	0.13	0.02	0.01	0.09	0.81	0.12	0.57	0.09	0.57	0.33	0.20	-7.9	-7.6	-8.4	-10.4	0.18 ± 0.26	0.72 ± 0.24

$Q_{EventSampled}$ equals the discharge representing the duration of sampling. $Q_{EventTotal}$ equals the total event discharge as quantified using the constant slope method (Dingman, 1994). $f_{Event\ Water}$ = fraction of event water at peak discharge.

Table S3. Water chemistry of sampled storm events. Concentrations and isotope ratios are discharge-weighted means (i.e., EMC, EMV).

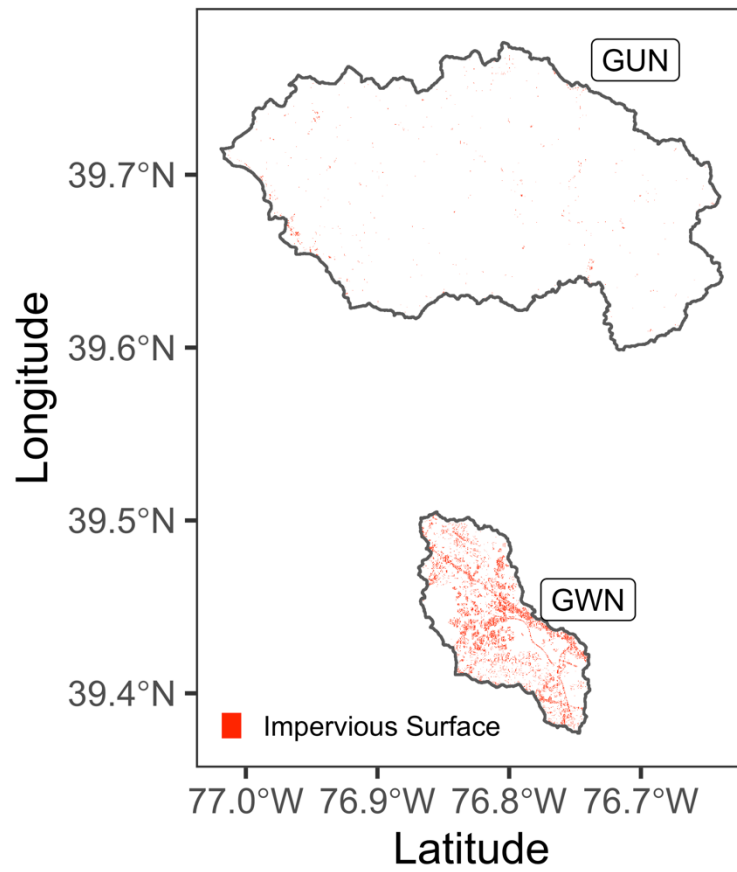| Date	NO_3^- (mg N L^{-1})		$NO_{3\ Atm}^-$ (mg N L^{-1})		NO_3^- (g N ha^{-1})		$NO_{3\ Atm}^-$ (g N ha^{-1})		$\delta^{15}N$ (‰)		$\delta^{15}N_{Terr}$ (‰)		$\delta^{18}O$ (‰)		$\delta^{18}O_{Terr}$ (‰)		$\Delta^{17}O$ (‰)	
	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN	GUN	GWN
9/9/18	1.68	0.39	0.03	0.02	163	83	3	5	5.9	5.5	6.0	6.0	1.7	6.0	0.5	2.1	0.5	1.2
10/27/18	2.96	1.11	0.06	0.06	77	48	2	2	6.3	6.6	6.3	6.7	2.3	5.9	1.1	2.7	0.4	1.2
12/28/18	2.52	0.68	0.03	0.05	213	87	2	7	6.2	5.0	6.4	5.2	2.3	7.6	1.6	1.9	0.3	2.0
3/21/19	2.75	0.59	0.07	0.05	737	160	18	13	5.1	3.6	5.5	3.7	2.4	5.3	2.8	-1.1	0.5	2.0
5/4/19	2.88	0.63	0.03	0.07	161	80	2	9	5.8	4.5	5.7	4.7	3.5	9.3	3.6	0.9	0.2	2.5
7/12/19	2.17	0.48	0.08	0.10	58	61	2	13	6.2	2.8	6.4	6.1	4.9	14.4	2.3	-1.8	0.9	3.8
7/22/19	1.94	1.07	0.05	0.10	66	36	2	4	5.8	6.6	5.9	7.1	4.7	7.2	2.9	1.8	0.5	1.4
10/16/19	2.58	0.89	0.07	0.09	31	52	1	5	6.4	5.0	6.7	5.8	4.3	7.9	2.6	2.1	0.5	2.0

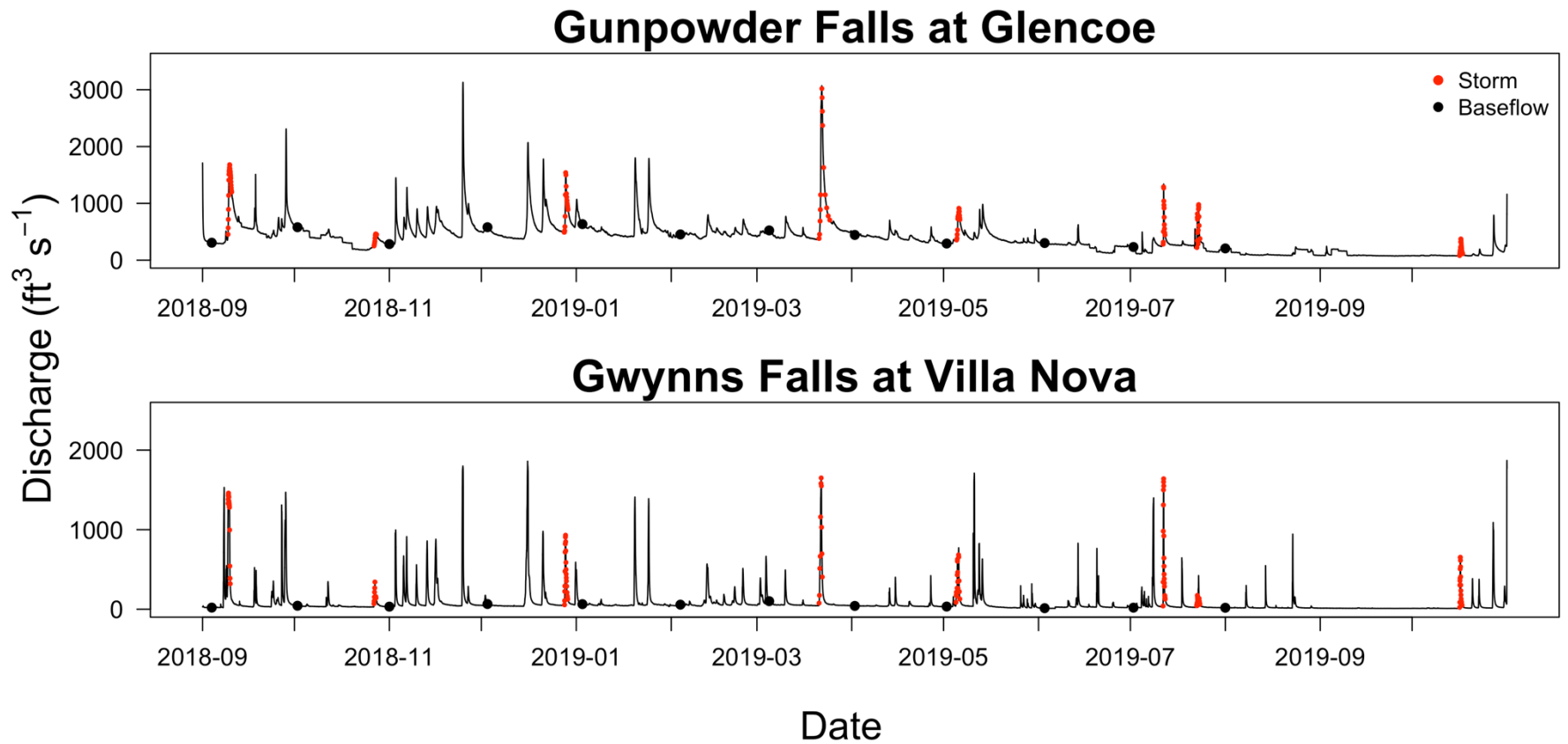Figure S1. Watershed map showing impervious surfaces in Gunpowder Falls

Figure S2. Hydrographs from September 2018 – October 2019 showing baseflow samples (black dots) and storm samples (red dots) for both watersheds.
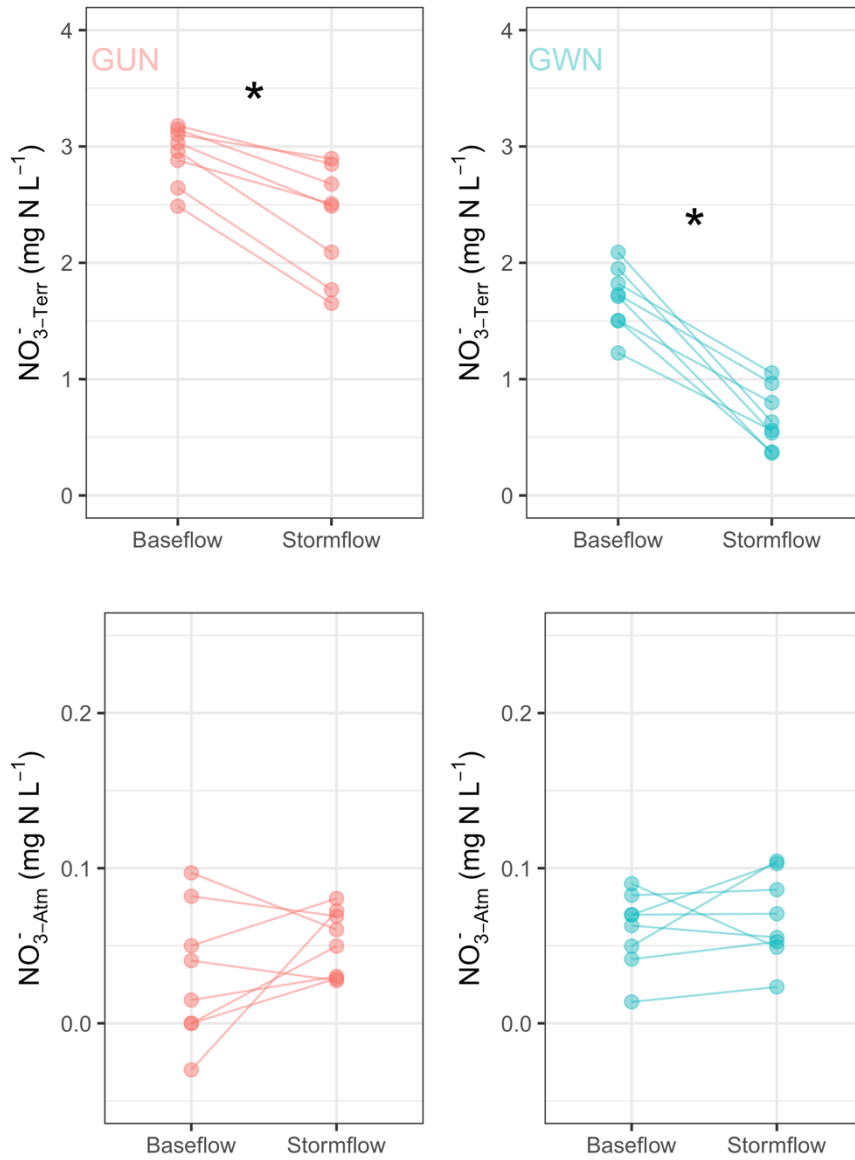
Figure S3. Baseflow and event mean concentrations ("Stormflow") for $NO_3^-{}_{Terr}$ and $NO_3^-{}_{Atm.}$ The asterisk (*) indicates a significant difference at $p < 0.05$.
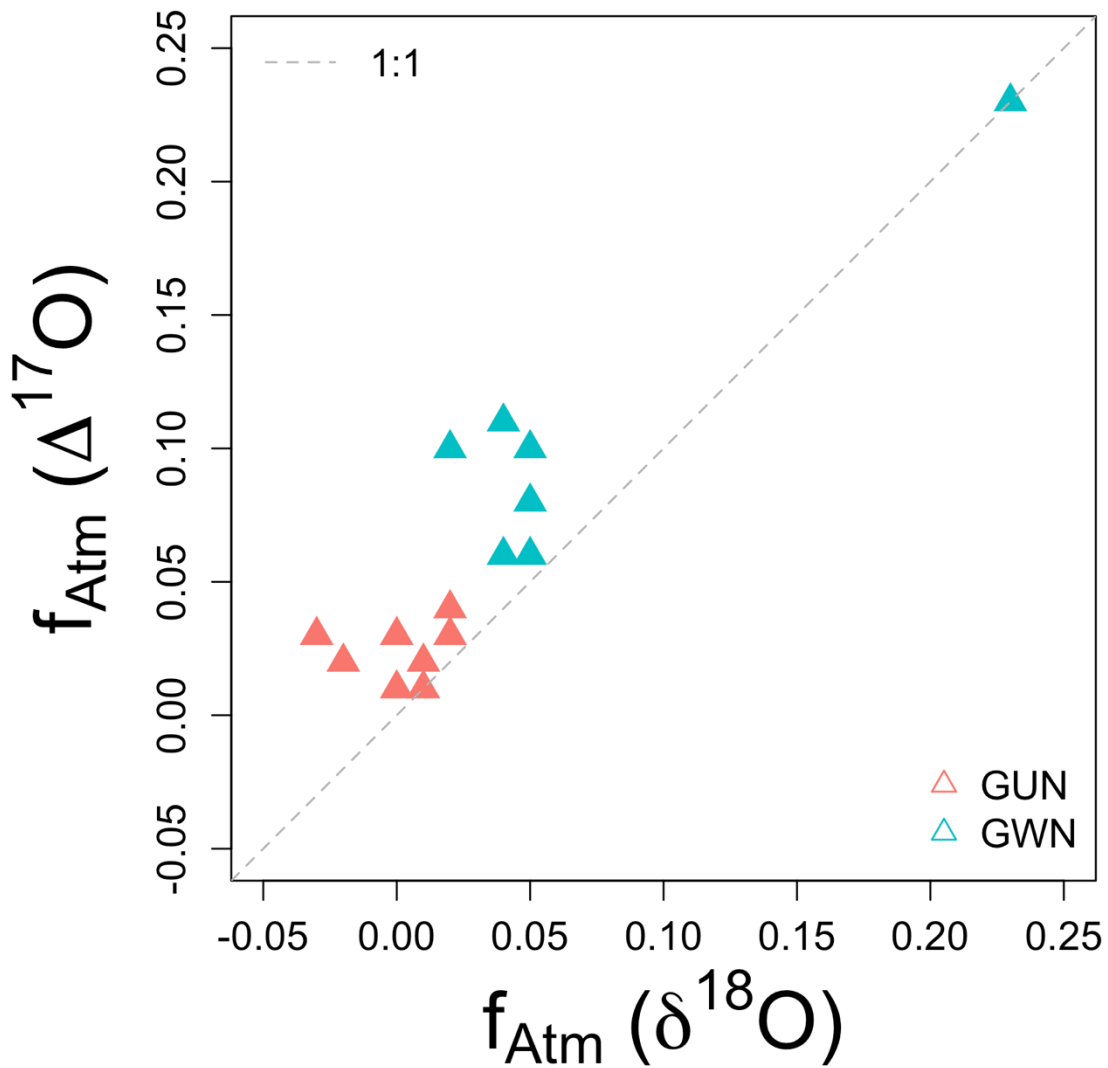
Figure S4. Average event fraction of unprocessed atmospheric NO_3^- (f_{Atm}) as calculated using $\Delta^{17}O$ and $\delta^{18}O$. Triangles above the dashed grey 1:1 line indicate f_{Atm} is underestimated by $\delta^{18}O$.