<u>SUPPLEMENTARY MATERIAL:</u> Impact of drought hazards on flow regimes in anthropogenically impacted streams: an isotopic perspective on climate stress

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- Table S1 summarizing catchment characteristics and land use information for the rural and urban catchment.
- Figure S1 and S2 showing hydrologic and isotope responses per water year for the rural agricultural stream and urban stream respectively
- Table S2 summarizing the **c**haracteristics of storm events observed in both the rural and urban stream.
- Figure S3 showing lc-excess summarized in a boxplot for the rural and urban stream.
- Table S3 summarizing the applied transit time distribution models.
- Table S4 summarizing the results of the TPLR and gamma model for Mean Transit Time estimations.

Table S1: *Catchment characteristics and land use for the entire rural and urban catchment (Marx et al., 2021; Smith et al., 2020).*

	Rural (DMC)	**Urban (Panke)**
Catchment Area (km^2)	66	220
<u>Land Use</u>		
Non-irrigated arable	50.4	34.6
Urbanized	2.5	34.1*
Pasture	6.9	<1%
Broadleaf Forest	6.0	6.5
Coniferous Forest	29.2	38.2
Mixed Forest	1.0	4.1
Wetlands	4.0	1.2
Heather and Shrub	-	5.2

* Incl. Housing, industry, roads, squares and railroads

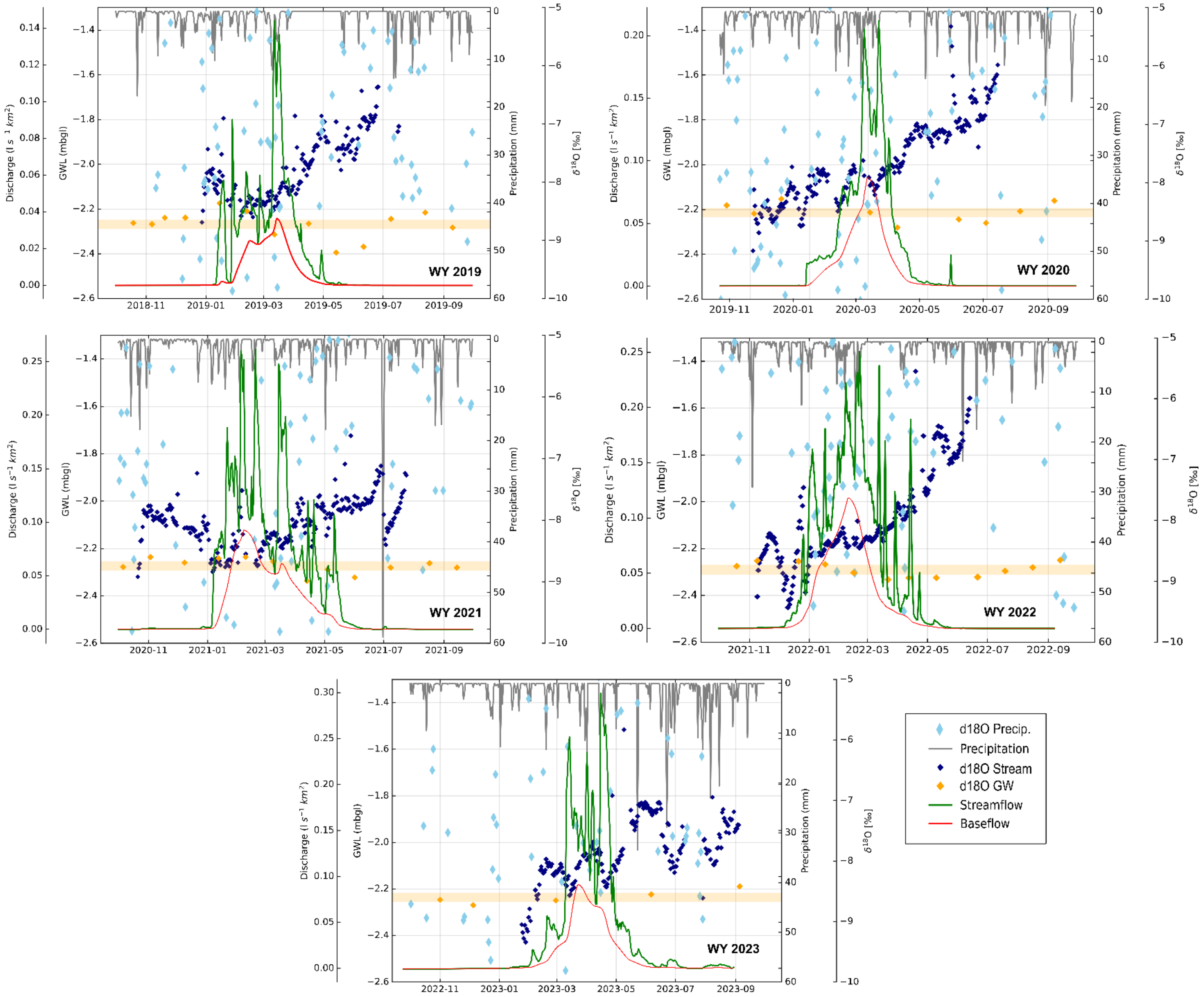

Figure S1: Hydrologic and isotope responses per water year for the rural stream

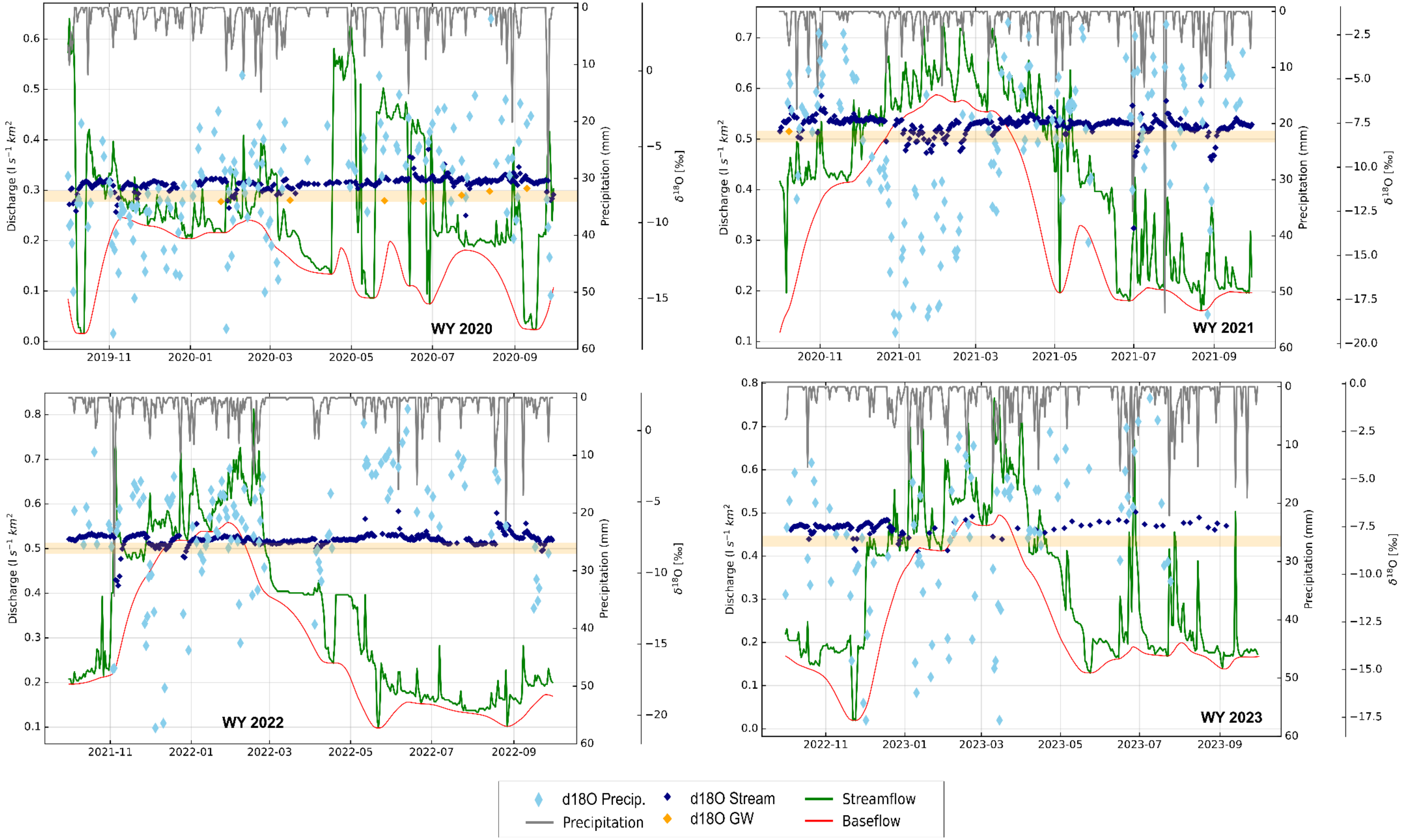

Figure S2: *Hydrologic and isotope responses per water year for the urban stream.*

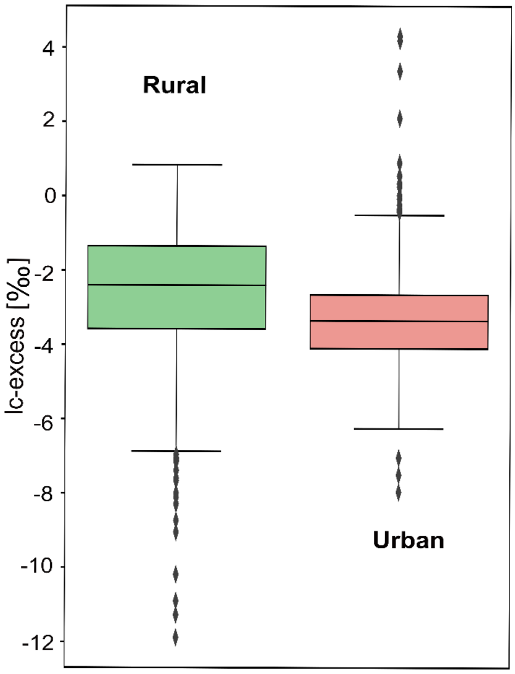

Figure S3*: Boxplot of lc-excess for the rural (left) and urban (right) stream. Horizontal bars denote means, whiskers show the upper and lower percentiles. Outliers are indicated as points with more negative values indicating greater evaporative enrichment.*

Table 1: *Summarized annual discharge statistics for the rural and urban stream per water year; total annual precipitation (mm), catchment normalized mean (Q_{mean}), maximum (Q_{max}) and minimum discharge (Q_{min}) (all in $ls^{-1}km^{2}$) and 95th and 5th percentiles (Q_{95}, Q_{5}), as well as annual runoff coefficient (Q/P), annual baseflow index (BFI) and total annual runoff (mm).*

Water Year	Annual P (mm/wy)	Q_{max} ($ls^{-1}km^{-2}$)	Q_{min} ($ls^{-1}km^{-2}$)	Q_{mean} ($ls^{-1}km^{-2}$)	Q_{5} ($ls^{-1}km^{-2}$)	Q_{95} ($ls^{-1}km^{-2}$)	Q_{Ro} (mm/wy)	*BFI* *(-)*	*Q/P* (-)
Rural									
2019	388.6	0.16	0	0.01	0.06	<0.01	44.6	0.54	0.11
2020	494.4	0.23	0	0.02	0.13	<0.01	52.5	0.72	0.11
2021	534.8	0.39	0	0.04	0.18	<0.01	133.7	0.58	0.25
2022	434.1	0.50	0	0.04	0.18	<0.01	113.1	0.64	0.26
2023	535.2	0.33	0	0.05	0.22	<0.01	115.3	0.56	0.22
Urban									
2019	546.4	1.1	0.14	0.45	0.70	0.2	819.4	0.76	1.49
2020	527	1.2	0.01	0.27	0.54	0.07	670.5	0.72	1.27
2021	600.5	2.3	0.04	0.45	0.67	0.19	872.8	0.78	1.45
2022	461.4	2.1	0.06	0.35	0.65	0.14	447.4	0.86	0.96
2023	624.0	3.4	0.01	0.33	0.62	0.165	523.0	0.82	0.84

Table S2: *Characteristics of storm events observed in both the rural and urban stream (highlighted in Fig. 1 of the main manuscript) during the summer (June-September) and winter (October-May) period: total discharge (Q), total precipitation (P_{total}), mean intensity (P_{int}), maximum precipitation over 1 hour (P_{max}), duration of event (T) and runoff coefficient (Q/P).*

Event	**Q ($lskm^2$)**		**P_{total} (mm)**		**P_{int} (mm hr^{-1})**		**P_{max} (mm hr^{-1})**		**T (hrs)**		**Q/P (-)**	
	Rur	Urb	Rur	Urb	Rur	Urb	Rur	Urb	Rur	Urb	Rur	Urb
	SUMMER											
11.06.2019	-	5.3	0	54.9	-	13.7	-	46.2	-	4	-	0.1
26.09.2020	<0.001		27.8	32.2	1.85	3.22	2.2	7.6	15	10	<0.01	0.5
30.06.2021	0.002	14.5	57.6	35.5	5.76	1.9	19.6	6.7	10	18	<0.01	0.4
06.06.2022	<0.001	3.3	24	15.9	5.0	2.7	12.8	9.6	5	6	<0.01	0.2
26.08.2022	<0.001	6.1	8.2	23.5	2.1	3.4	4	10		7	<0.01	0.3
22.6.2023+	0.02	17.1	31.3	30.3	7.8	1.7	19.01	18.1	4	18	<0.01	0.5
24.07.2023	<0.001	2.0	10.9	21.2	5.6	7.1	6.7	17.4	2	3	<0.01	0.2
	WINTER											
04.10.2019	<0.001	17.9	17	12.6	8.5	0.8	1.4	2.4	2	15	<0.01	0.7
30.10.2020	0.003	59.2	11	18.1	0.45	9.1	2.2	2.1	24	2	<0.01	0.2
04.11.2021	0.001	49.3	31.6	40.6	1.4	1.8	5.0	4.4	24	22	<0.01	0.2
18.10.2022	<0.001	13.8	9.5	13.8	1.1	1.7	3.4	3.4	9	8	<0.01	0.1
14.04.2023*	6.54	13.8	28	23.9	0.6	0.5	1.4	1.5	49	47	0.2	0.1
23.05.2023	0.06	0.8	30.3	0.5	10.1	0.5	17.4	0.5	3	1	0.1	0.1

*Summarized multiple rain event spans between 14.04-17.04, with <5hr between events
+ Event extends into 23.6

Table S3: *Description of applied transit time distributions – gamma and two parallel linear reservoir model (TPLR).*

Model	**Parameters**	**TTD**	**MTT**
Gamma	α = shape parameter β = scale parameter	$\frac{\tau^{\alpha-1}}{\beta^{\alpha}\Gamma(\alpha)}\exp(-\frac{\tau}{\beta})$	αβ
Two parallel linear reservoir (TPLR)	τ_f = transit time of fast reservoir τ_s= transit time of slow reservoir φ =ratio of fast/slow reservoir	$\frac{\varphi}{\tau_f}\exp\left(-\frac{\tau}{\tau_f}\right)+\frac{1-\varphi}{\tau_s}\exp(-\frac{\tau}{\tau_s})$	$\varphi\tau_f+(1-\varphi)\tau_s$

Table S4: *Mean transit times estimated with TPLR and Gamma Models. TPLR TTD Parameters (τ_f and τ_s) and Gamma Model fitting parameters (α and β), fitting efficiency (NSE), minimized root-mean-square error (RMSE), mean square error (R^2) and estimated mean transit time (MTT). Below: TPLR Model results for a wet and a dry year in the rural and urban stream.*

TPLR	τ_f *(1-50)*	τ_s *(1-1825)*	**φ**	**NSE**	**RMSE**	R^2	**MTT (d)**
Rural	21.7	1262	0.6	0.54	0.63	0.54	1014
Urban	5.3	1311	0.4	0.57	0.64	0.59	1180
Gamma	**α** *(0.1-2.5)*	**β** *(1-1825)*	**-**	**NSE**	**RMSE**	R^2	**MTT (d)**
Rural	0.44	1704	-	0.49	0.67	0.48	759
Urban	0.42	1698	-	0.46	0.65	0.46	707