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A comparison of catchment travel times and storage deduced from deuterium and tritium tracers using StorAge Selection functions

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Figure S1. Zoom on δ^2H simulations in October 2015. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

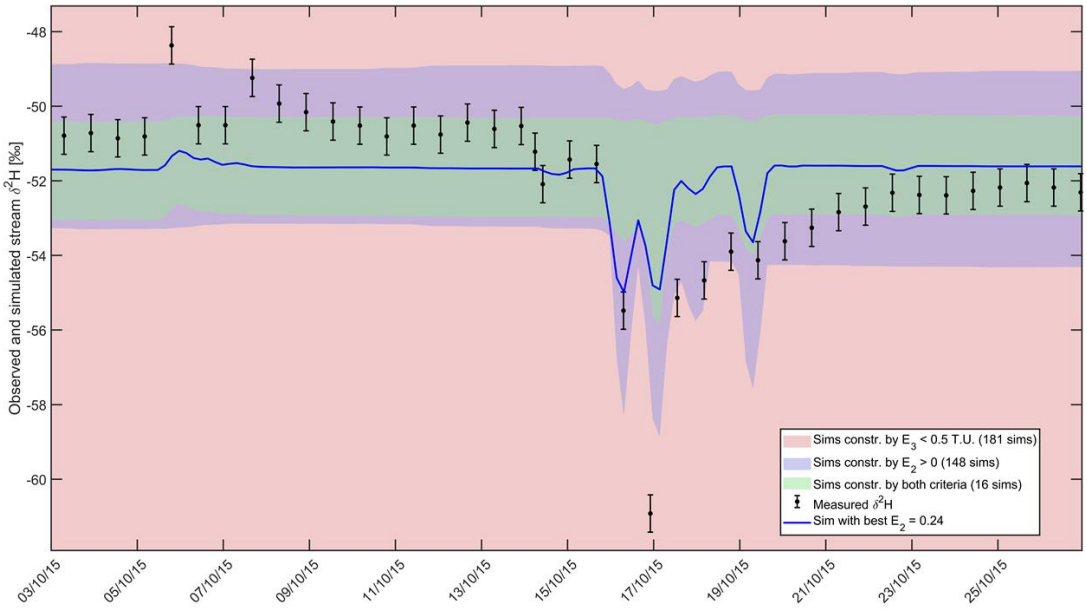

Figure S2. Zoom on δ^2H simulations in Nov.-Dec. 2015. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

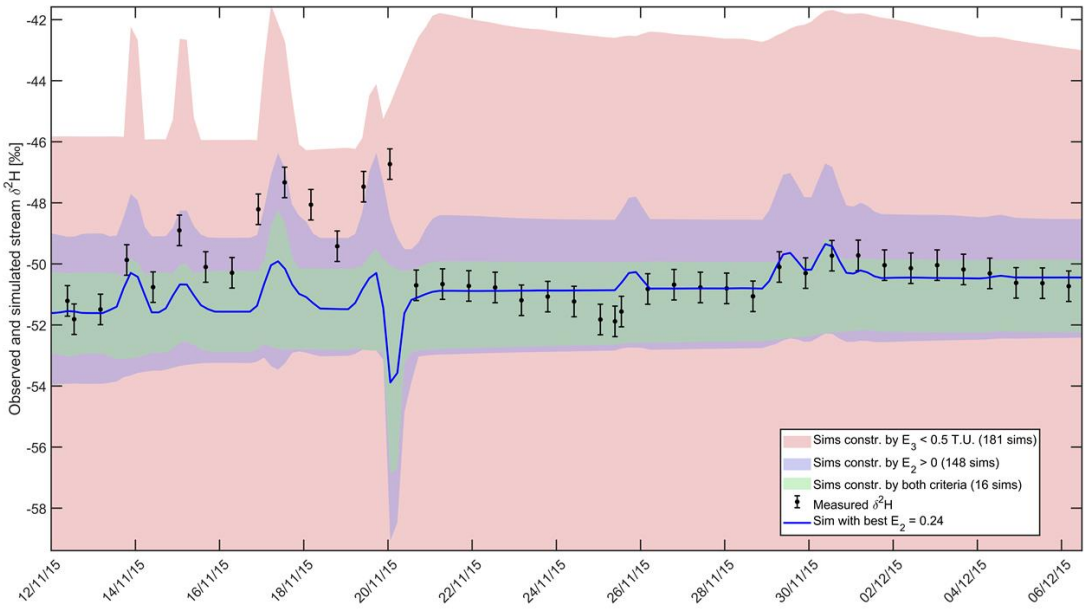

Figure S3. Zoom on δ^2H simulations in late 2015-early 2016. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

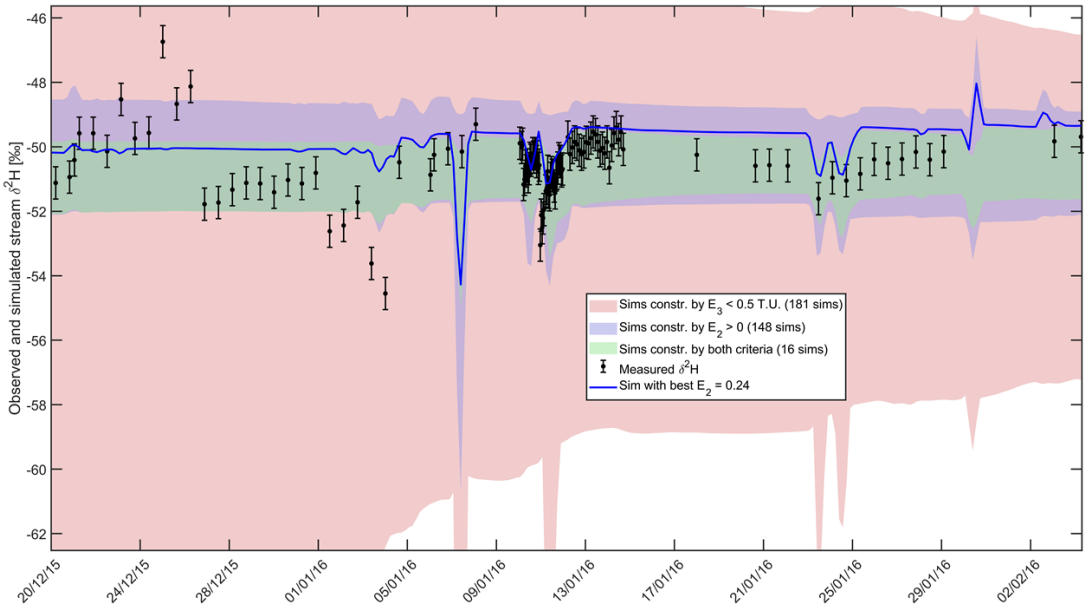

Figure S4. Zoom on δ^2H simulations in early 2016. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

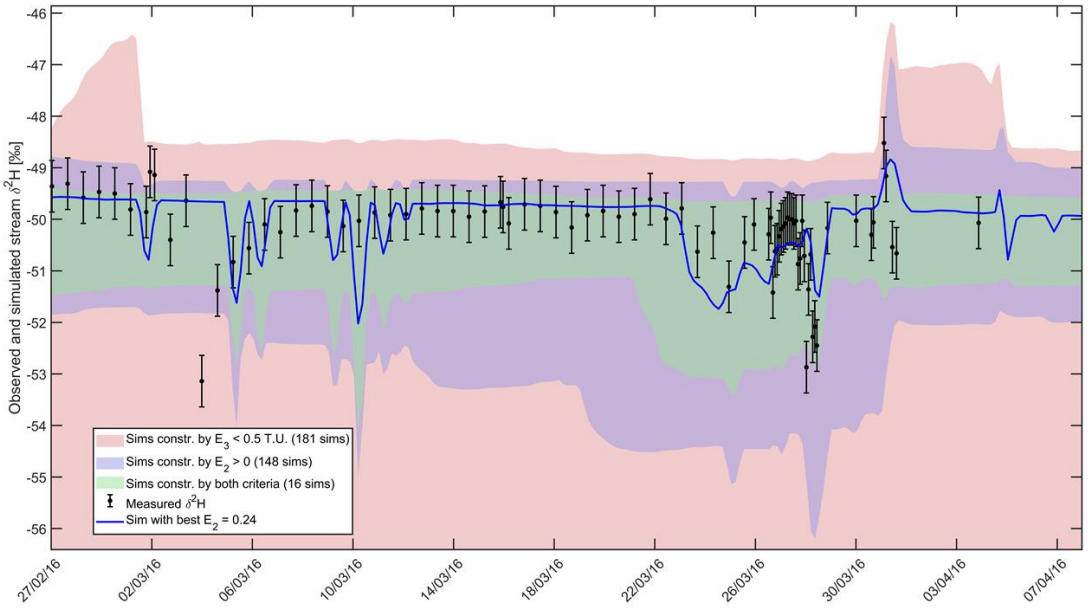

Figure S5. Zoom on δ^2H simulations in May-June 2016. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

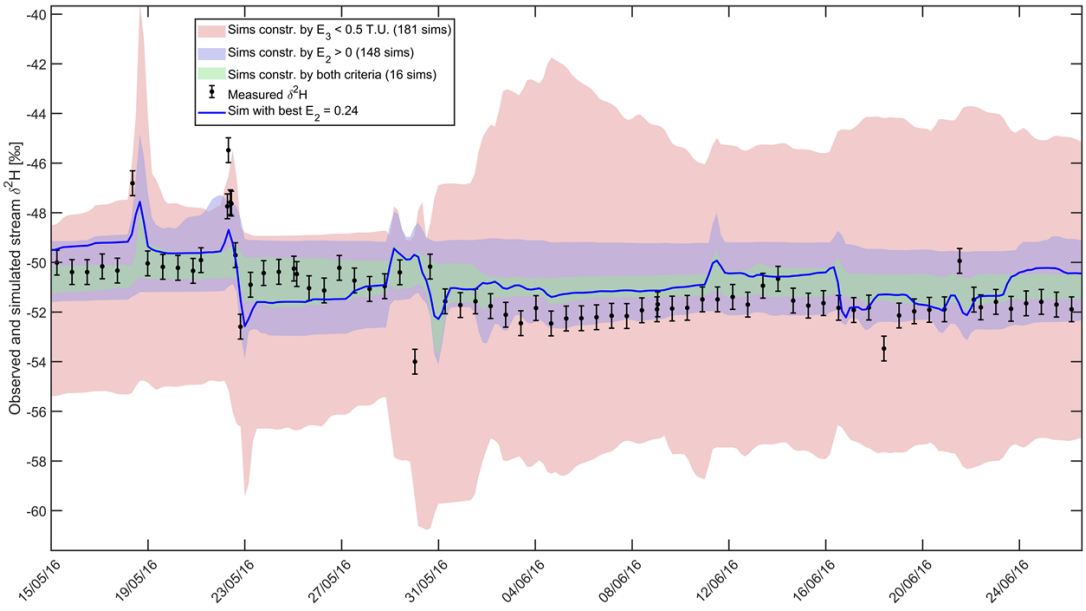

Figure S6. Zoom on δ^2H simulations in Jul.-Oct. 2016. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

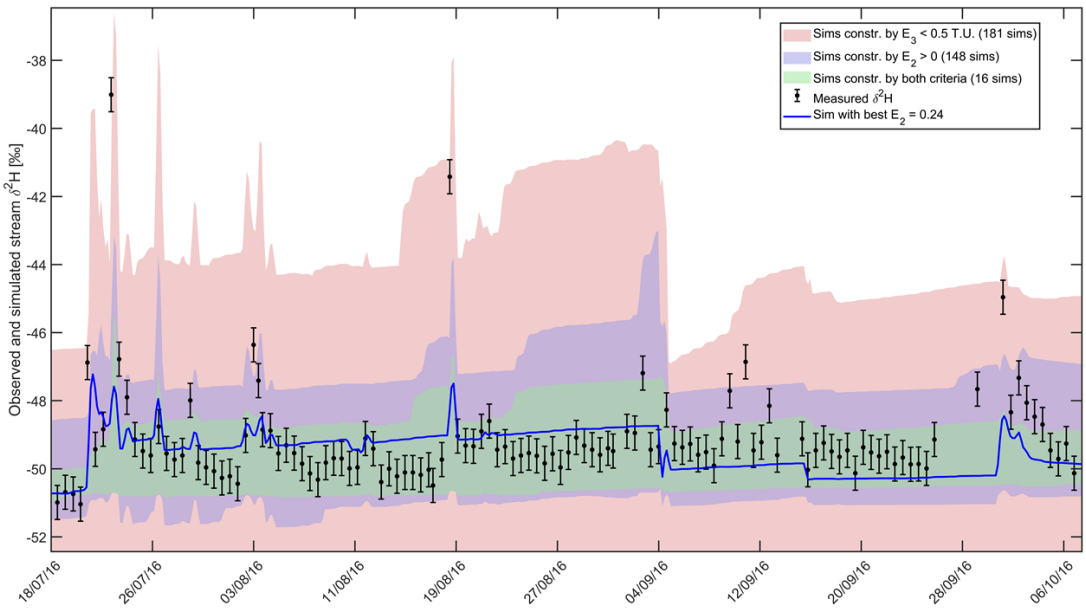

Figure S7. Zoom on δ^2H simulations in Oct.-Nov. 2016 (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

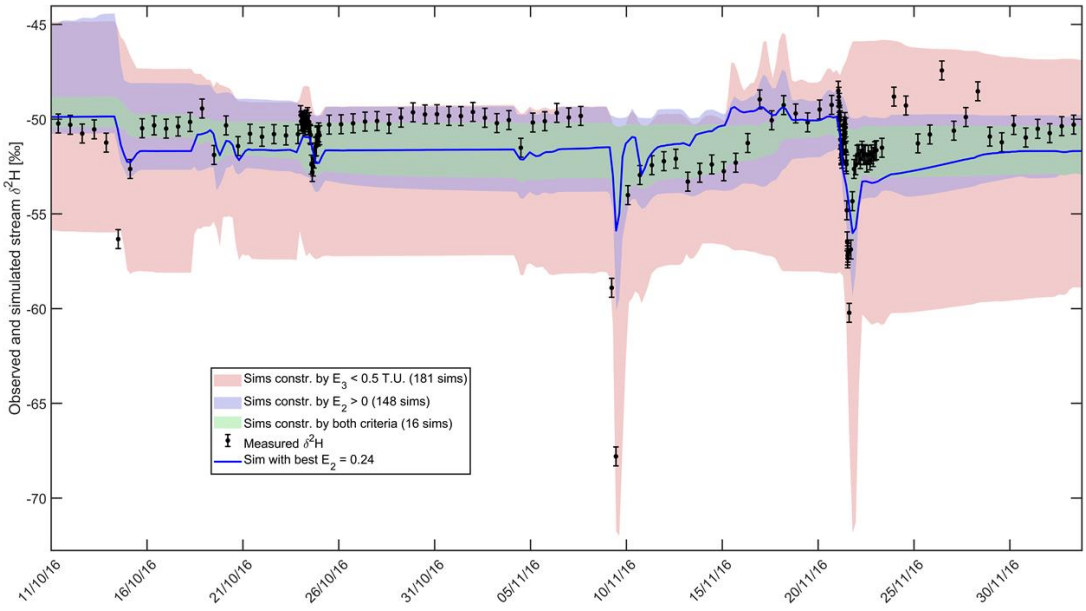

Figure S8. Zoom on δ^2H simulations in Winter 2016-2017. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

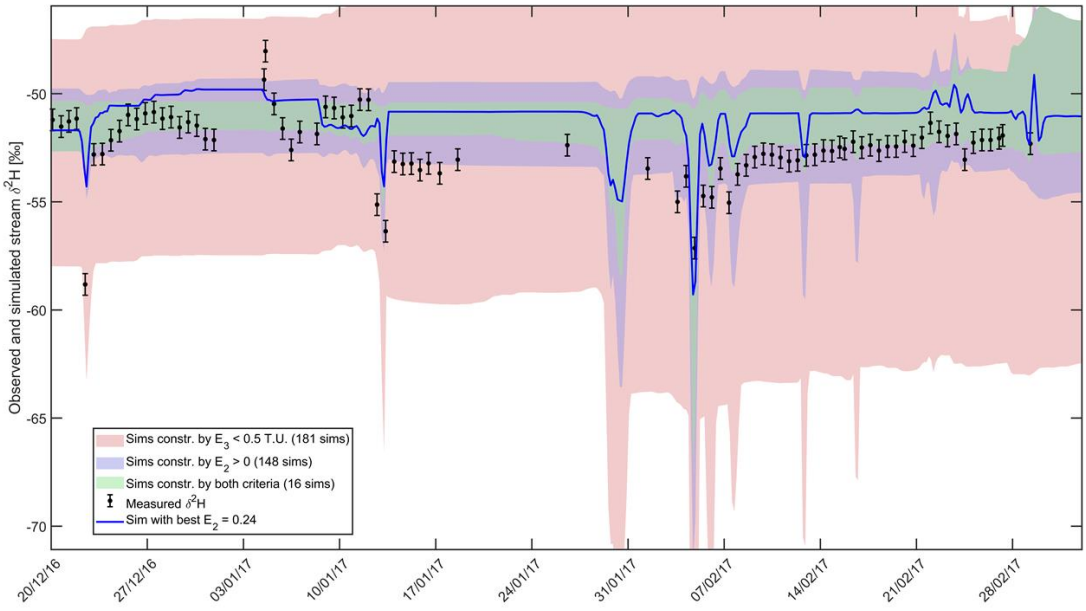

Figure S9. Zoom on δ^2H simulations in Summer 2017. (blue curve: best fit). δ^2H measurement uncertainties are indicated with the error bar representing ±0.5‰ (above and below).

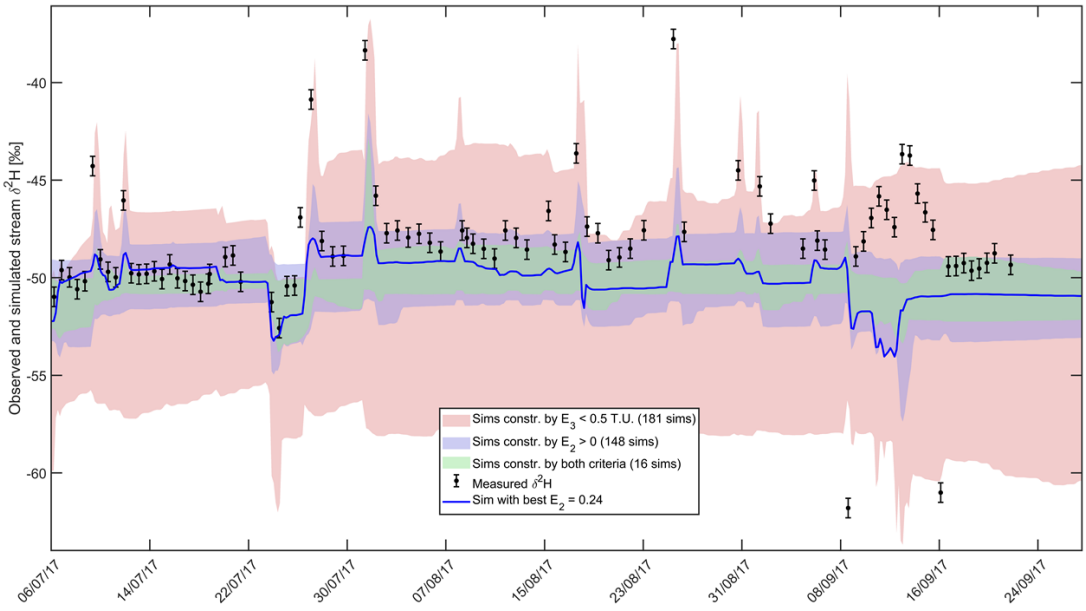

Figure S10. Deuterium in precipitation against deuterium in the stream (2015-2017). The stream flows were used to select samples during “dry” conditions (red dots, Q<0.02 mm/h). The Pearson correlation coefficient between precipitation and stream isotopes is 0.30 (0.42 for “dry” conditions). All p-values are very close to 0.

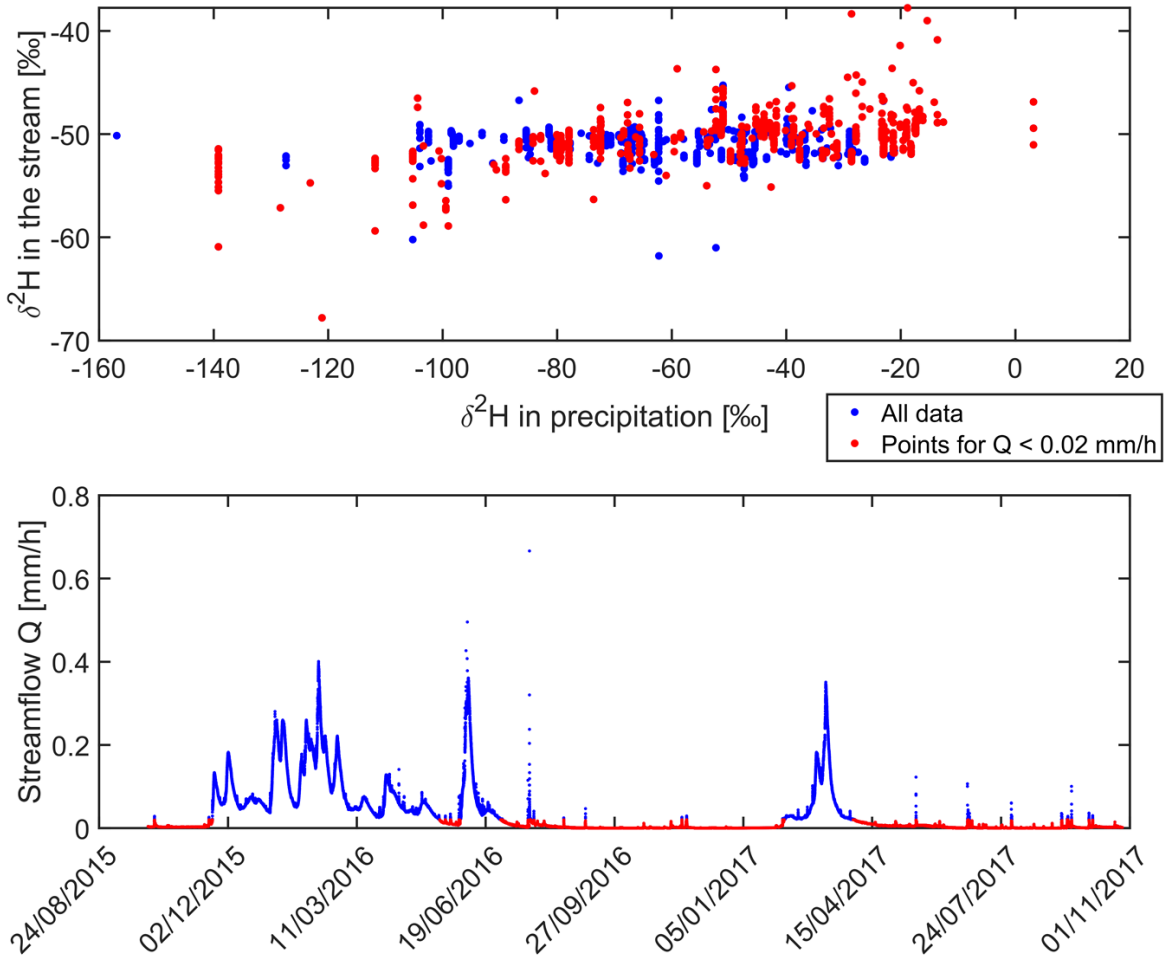

Figure S11. Deuterium in precipitation against deuterium in the stream (2015-2017). The stream flows were used to select samples during “dry” conditions (red dots, Q<0.005 mm/h). The Pearson correlation coefficient between precipitation and stream isotopes is 0.30 (0.44 for “dry” conditions). All p-values are very close to 0.

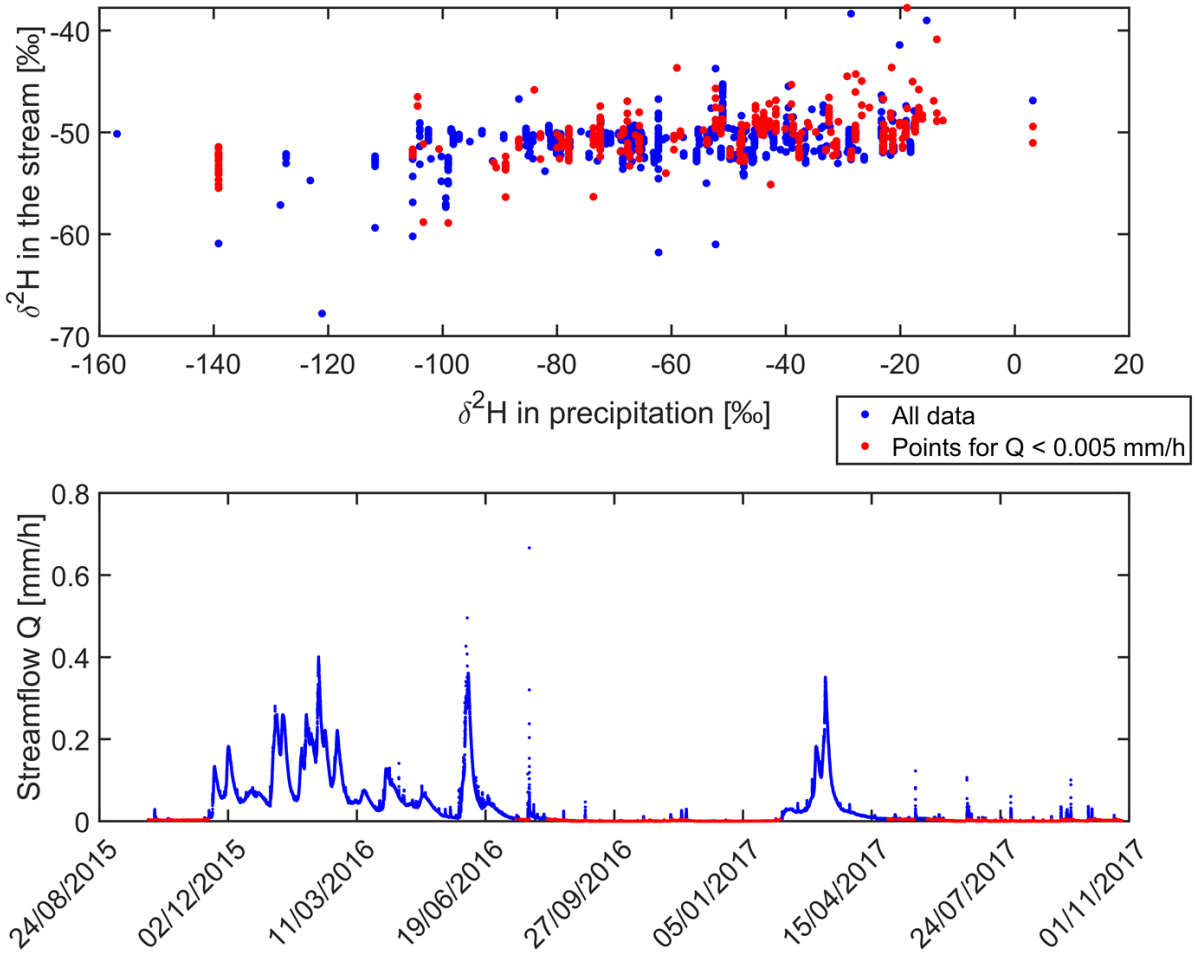

Figure S12: Posterior parameter distributions constrained by stream δ^2H (performance criterion $E_2>0$, 148 parameter sets). The smoothed distributions are obtained by smoothing the histograms of behavioural parameters with a kernel distribution.

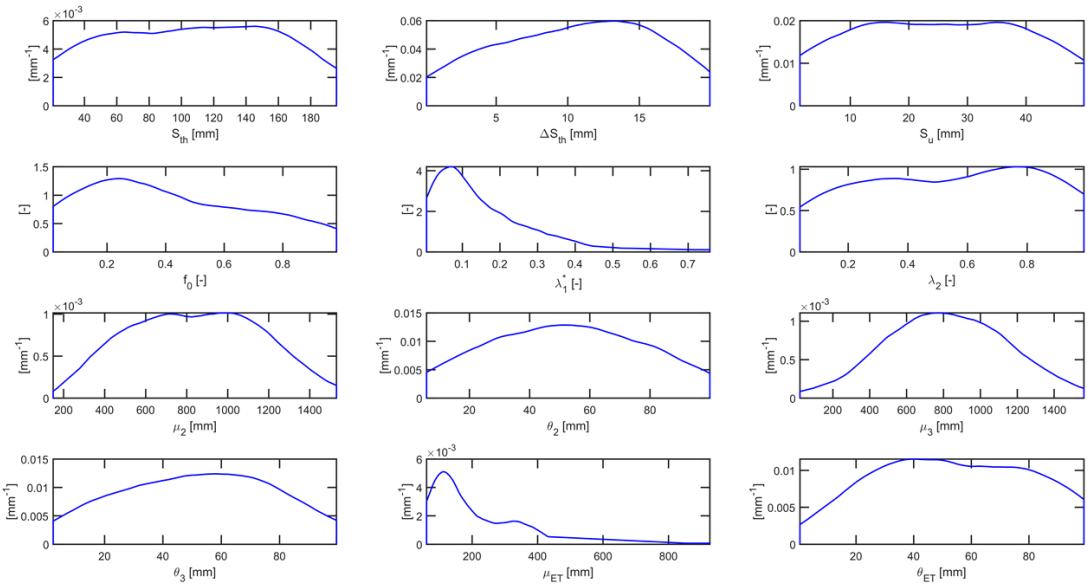

Figure S13: Posterior parameter distributions constrained by stream ^3H (performance criterion $E_3<0.5$ T.U., 181 parameter sets). The smoothed distributions are obtained by smoothing the histograms of behavioural parameters with a kernel distribution.

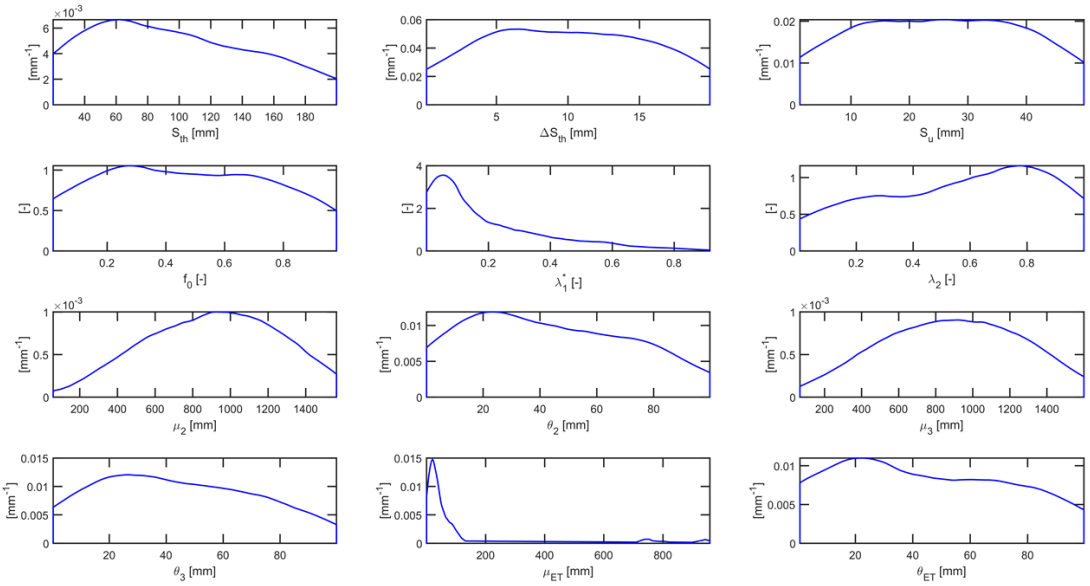

Table S1. Information measures before and after calibration to isotopic data, for new calibration criteria: Mean Absolute Error (MAE) < 1.3‰ for δ^2H and/or MAE < 0.5 T.U. for ^3H. See Table 2 for parameter units, ranges, and the employed binning. H and D_{KL} are expressed in bits.

Parameter	S_{th}	ΔS_{th}	S_u	f_0	λ_1*	λ_2	μ_2	θ_2	μ_3	θ_3	μ_{ET}	θ_{ET}
H(X)	3.17	3.32	3.32	3.32	3.71	3.32	4.00	3.32	4.00	3.32	5.00	3.32
H(X|^{2}H)	3.12	3.24	3.27	3.22	2.83	3.17	3.45	3.26	3.64	3.23	2.81	3.25
H(X|^{3}H)	3.10	3.30	3.31	3.30	3.23	3.24	3.73	3.26	3.83	3.25	1.53	3.22
H(X|^{2}H and ^{3}H)	2.52	2.95	2.50	2.70	2.41	2.70	2.35	1.73	2.90	2.84	0.75	2.41
D_{KL}(X|^{2}H, X)	0.05	0.08	0.04	0.10	0.32	0.15	0.55	0.06	0.36	0.09	2.18	0.07
D_{KL}(X|^{3}H, X)	0.07	0.02	0.01	0.02	0.13	0.08	0.27	0.07	0.17	0.07	3.45	0.10
D_{KL}(X|^{2}H and ^{3}H, X)	0.64	0.37	0.79	0.62	0.78	0.61	1.65	1.59	1.11	0.48	4.24	0.91
D_{KL}(X|^{2}H and ^{3}H, X|^{2}H)	0.40	0.40	0.64	0.49	0.42	0.35	1.37	1.56	0.87	0.43	1.41	0.87
D_{KL}(X|^{2}H and ^{3}H, X|^{3}H)	0.50	0.38	0.83	0.57	0.43	0.52	1.20	1.32	0.88	0.30	2.07	0.75

Table S2. Information measures after calibration to isotopic data (**δ^2H only**), for new calibration criteria: Mean Absolute Error (MAE) < 1.3‰ for δ^2H and/or NSE > 0 for δ^2H. See Table 2 for parameter units, ranges, and the employed binning. D_{KL} is expressed in bits.

Parameter	S_{th}	ΔS_{th}	S_u	f_0	λ_1*	λ_2	μ_2	θ_2	μ_3	θ_3	μ_{ET}	θ_{ET}
D_{KL}(X|MAE and NSE, X|NSE)	0.01	0.00	0.01	0.00	0.02	0.01	0.02	0.00	0.02	0.01	0.00	0.01
D_{KL}(X|MAE and NSE, X|MAE)	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.00

Figure S14. Information learned about water ages from each tracer (points) and potential relationships
between the number of samples and the (necessarily) growing information content (dashed lines).

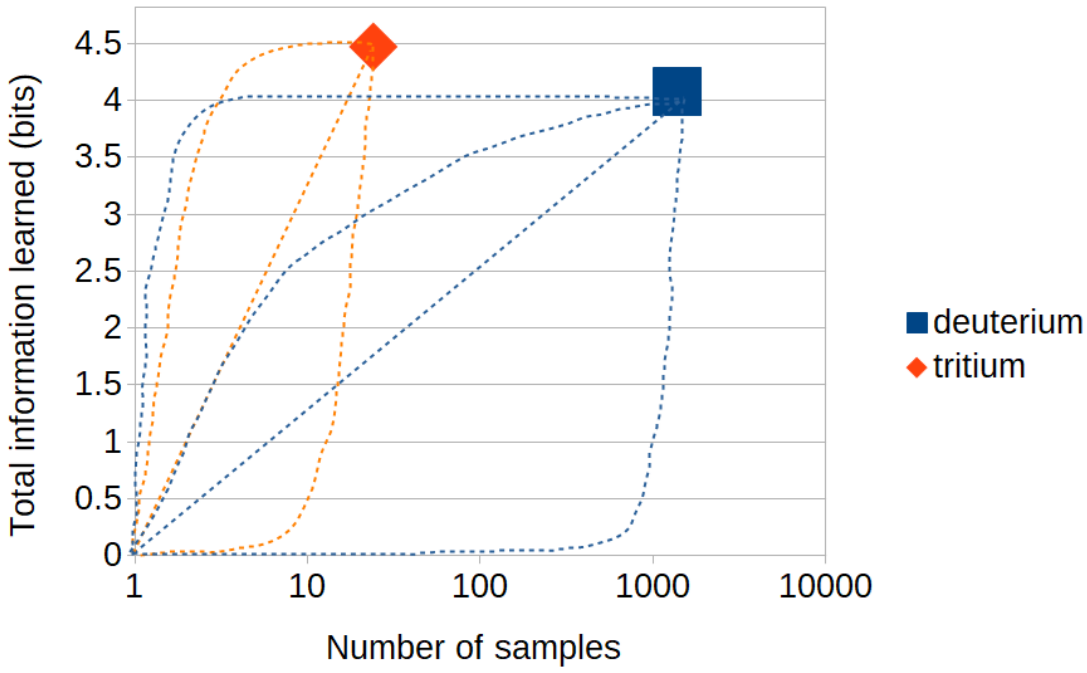

Figure S15. Simulated flow-weighted average concentrations (2015-2017) in the stream for the behavioral model simulations constrained by deuterium samples (E_2>0, 148 simulations) or by tritium samples (E_3<0.5 T.U., 181 simulations).

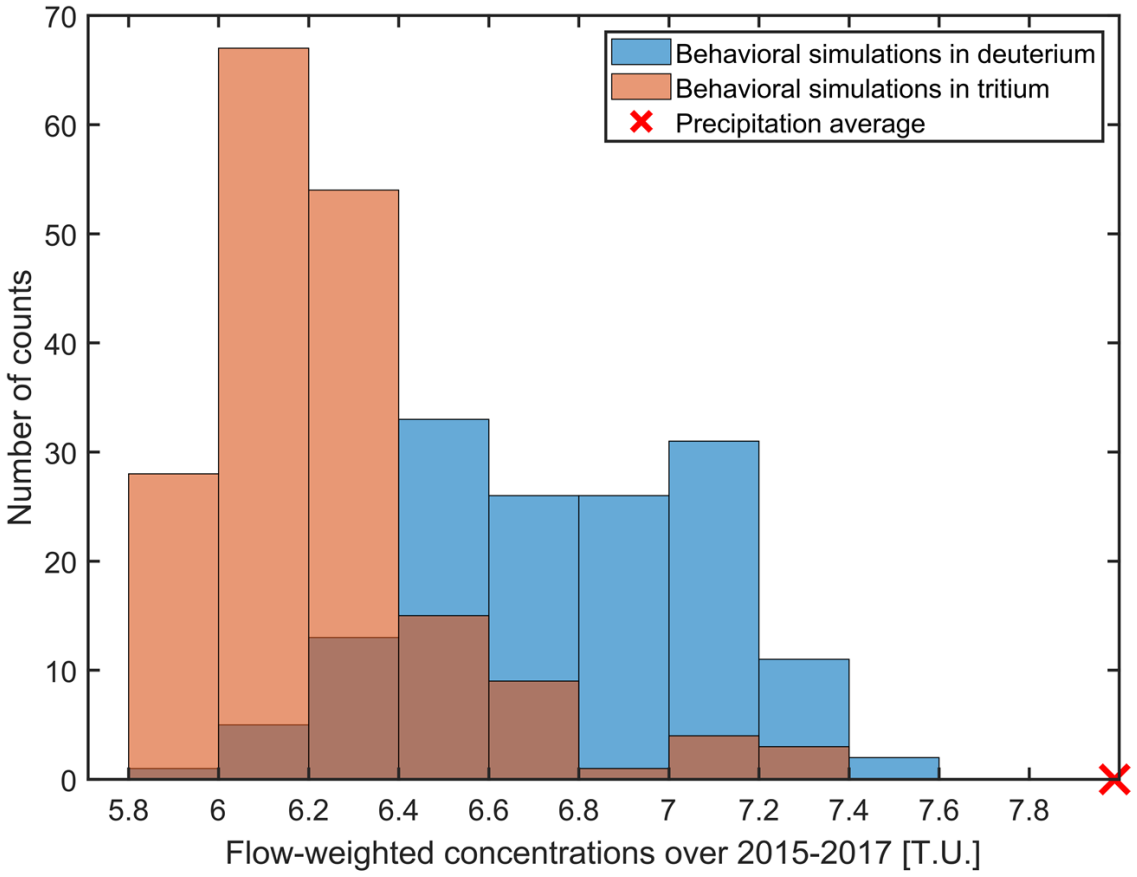

Figure S16. Spin-up data used in the model for deuterium (δ^2H). The 2010-2015 measured data is looped back many times over the 1915-2015 period (black curve, only one repetition is shown). The 2015-2017 data is not used in the spin-up.

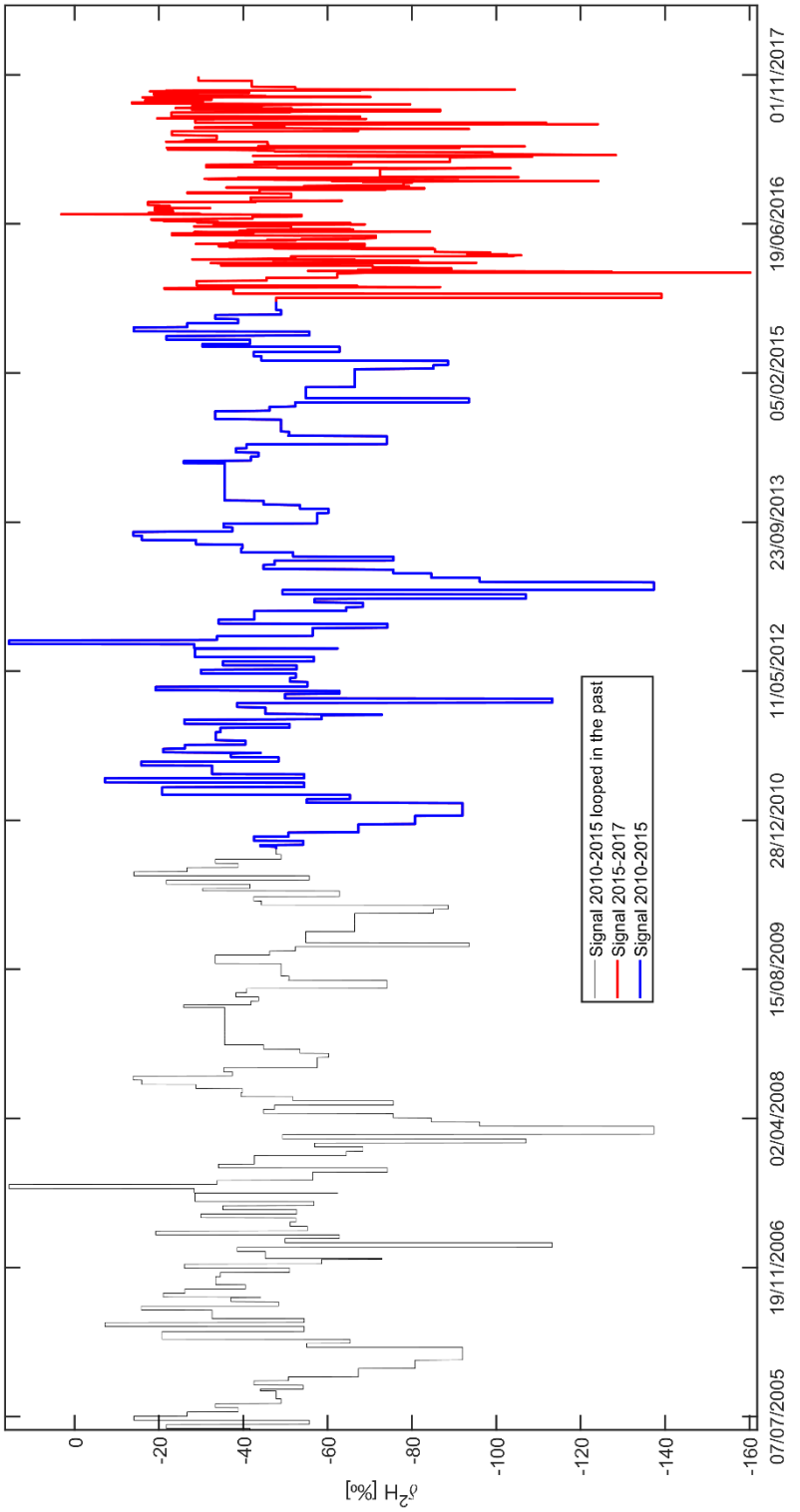

Figure S17. Spin-up data used in the model for streamflow (Q) and precipitation (J). The 2010-2015 measured data is looped back many times over the 1915-2015 period (black curve, only ~1 repetition is shown). The 2015-2017 data is not used in the spin-up.