Reconciliation of catchment travel times derived from tritium and deuterium

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TRITIUM VS SWI DERIVED TRAVEL TIMES

Recently, it has been argued that the use of stable isotopes of O and H compared to tritium neglects the long tails of TTDs and thus truncates our vision on streamflow age. However, the reasons for the truncation of the TTD remain obscured by methodological and data limitations, including different mathematical models and sampling strategies.

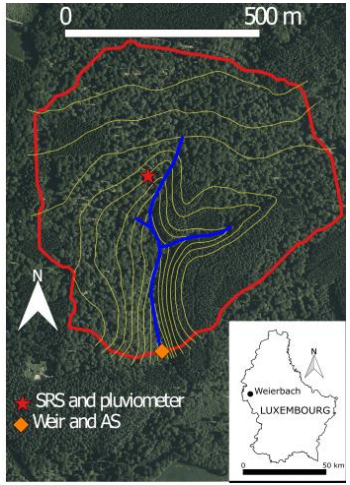
https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-501/

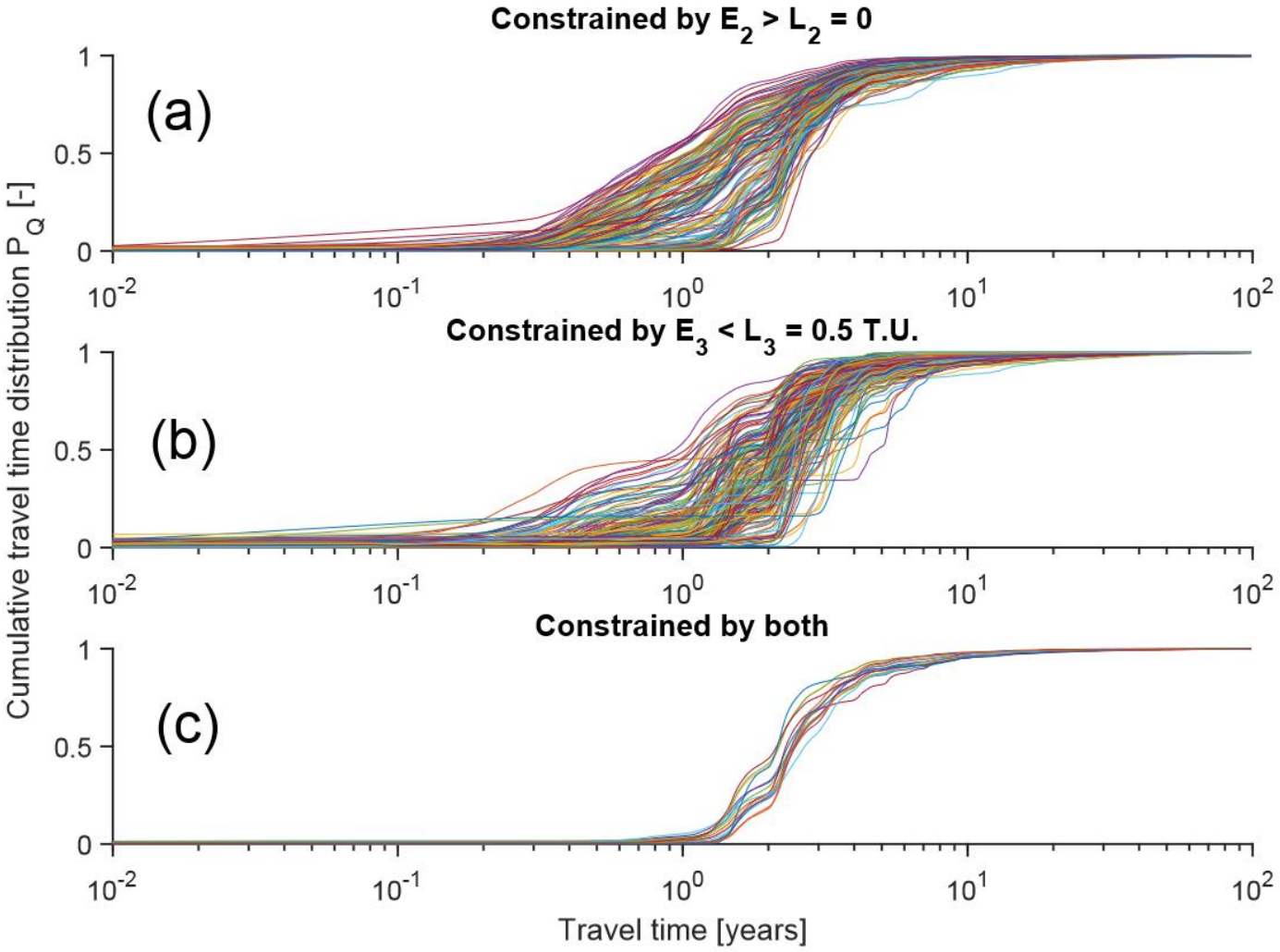
Evaluation of tritium and SWI derived travel times in a SAS framework. We rely on:

1.) A data set of 1088 ^{2}H and 24 ^{3}H stream samples,

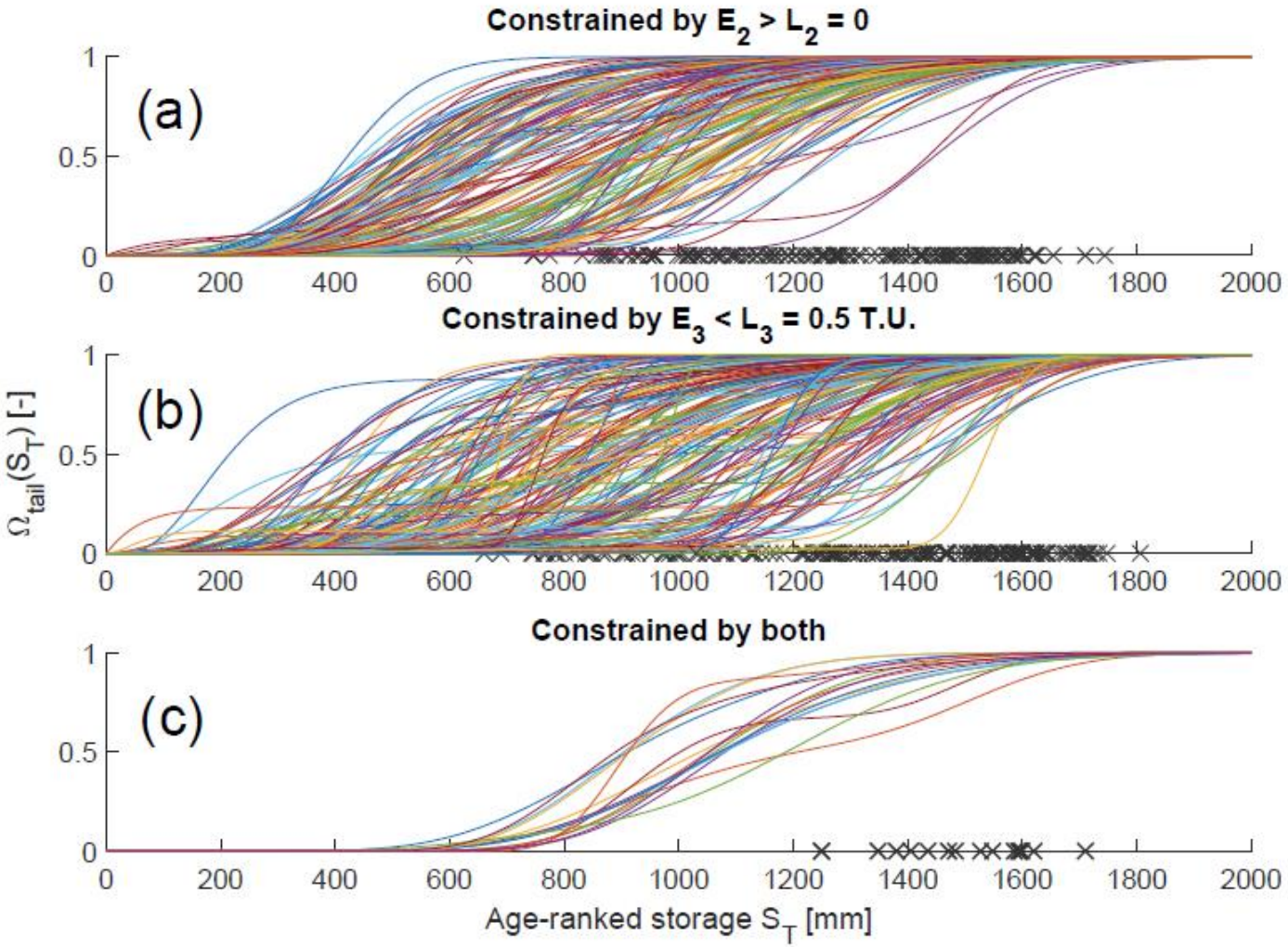
2.) Composite SAS functions,

3.) Monte-Carlo calibration for 12 parameters





Average Travel Time Distributions (flow-weighted) for the behavioural parameter sets of a Monte-Carlo simulations constrained by ^{2}H (a), by ^{3}H (b), and by both (c).



Cumulative right-hand tail Ω_{tail} of streamflow SAS functions for the behavioral parameter sets of a Monte-Carlo simulations constrained by ^2H (a), by ^3H (b), and by both (c).

Ω_{tail} is defined as the weighted sum of the two gamma components in Ω_Q. The black crosses indicate S95P for each curve, i.e. the 95th percentile of Ωtail

SIMILARITY BETWEEN TRAVEL TIMES

Age statistics	^{2}H ($E_2 > 0$) [mean ± std]	^{3}H ($E_3 < 0.5$ T.U.) [mean ± std]
10^{th} percentile [years]	0.78 ± 0.49	1.10 ± 0.57
25^{th} percentile [years]	1.16 ± 0.56	1.54 ± 0.59
Median age [years]	1.77 ± 0.55	2.19 ± 0.64
75^{th} percentile [years]	2.78 ± 0.61	3.07 ± 0.74
90^{th} percentile [years]	4.64 ± 1.27	4.79 ± 1.41
Mean age [years]	2.90 ± 0.54	3.12 ± 0.59
F_{yw}[a] [%]	1.5 ± 1.6	1.8 ± 2.3
F(T < 6 months) [%]	10 ± 8.6	6.3 ± 8.2
F(T < 1 year) [%]	24 ± 17	11 ± 12
F(T < 3 years) [%]	77 ± 8.5	71 ± 16

- Found differences are less compared to previous studies
- Differences can derive from different sampling frequencies and the lack of tritium sampling for event hydrographs
- Joint use of tracers provides robust constrained parameterisations for SAS functions