Exploring the limits of conventional hydrograph separation

Paolo Benettin, EPFL (CH)
Tracer-based HYDROGRAPH SEPARATION is based on some assumptions. In particular: The signatures of the end members are constant through the event (or variations can be measured/characterized).

But how likely is that the tracer signature of pre-event water is constant during the event?
GENERATE “true” tracer data with a transport model and apply conventional HYDROGRAPH SEPARATION

\[ f_e = \frac{C_p - C_Q}{C_p - C_e} \]

- \( C_Q \): streamflow tracer composition
- \( C_e \): event water composition
- \( C_p \): pre-event water composition, assumed constant
- \( f_e \): fraction of event water
EXAMPLES from preliminary numerical tests

example event #2

$\delta^{18O}$: “true” and assumed pre-event water are very different due to input seasonality

EC: “true” and assumed pre-event water are different

(example)

example event #3

$\delta^{18O}$ and EC: “true” and assumed pre-event water are different BUT this difference is small compared to streamflow variability

(event fraction)

✓ event fraction is quite reliable

✗ event fraction is unreliable
While the composition of groundwater may not vary significantly at the event scale, soil water composition and contribution can have substantial variability.
PRELIMINARY conclusions

IF
   “young” and “old” pre-event waters have **different tracer signatures**
AND
   the relative contribution of “young” VS “old” pre-event water **changes** during the event
THEN
   the tracer composition of **pre-event water varies over time**

IS THIS LIKELY TO HAPPEN IN CATCHMENTS?
   more research coming soon