

How geomorphology shapes groundwater transit times at the hillslope scale?

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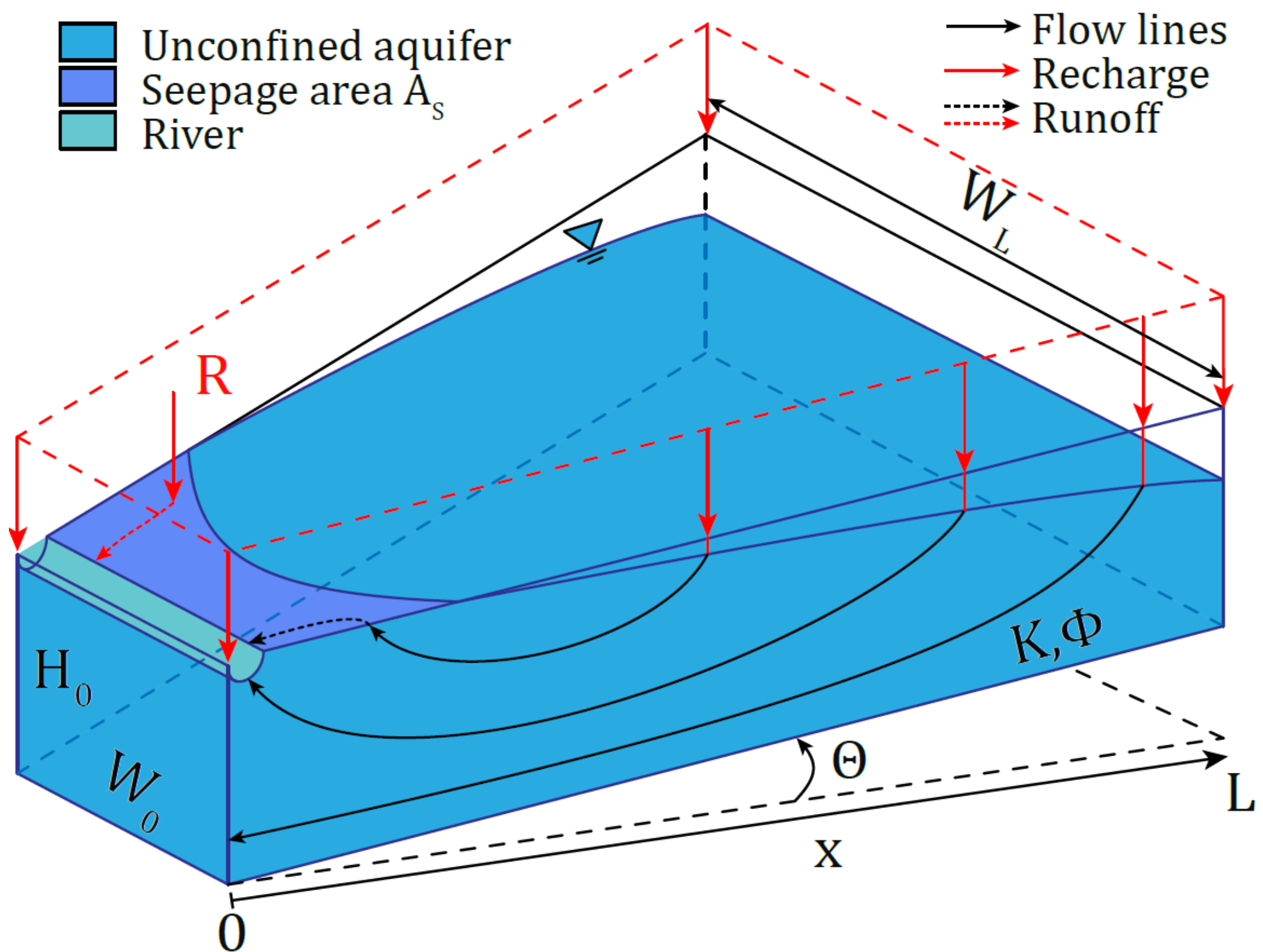
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Questions

Transit time distribution (TTD) at the hillslope scale? Control of geomorphology?

Hillslope Flow Model

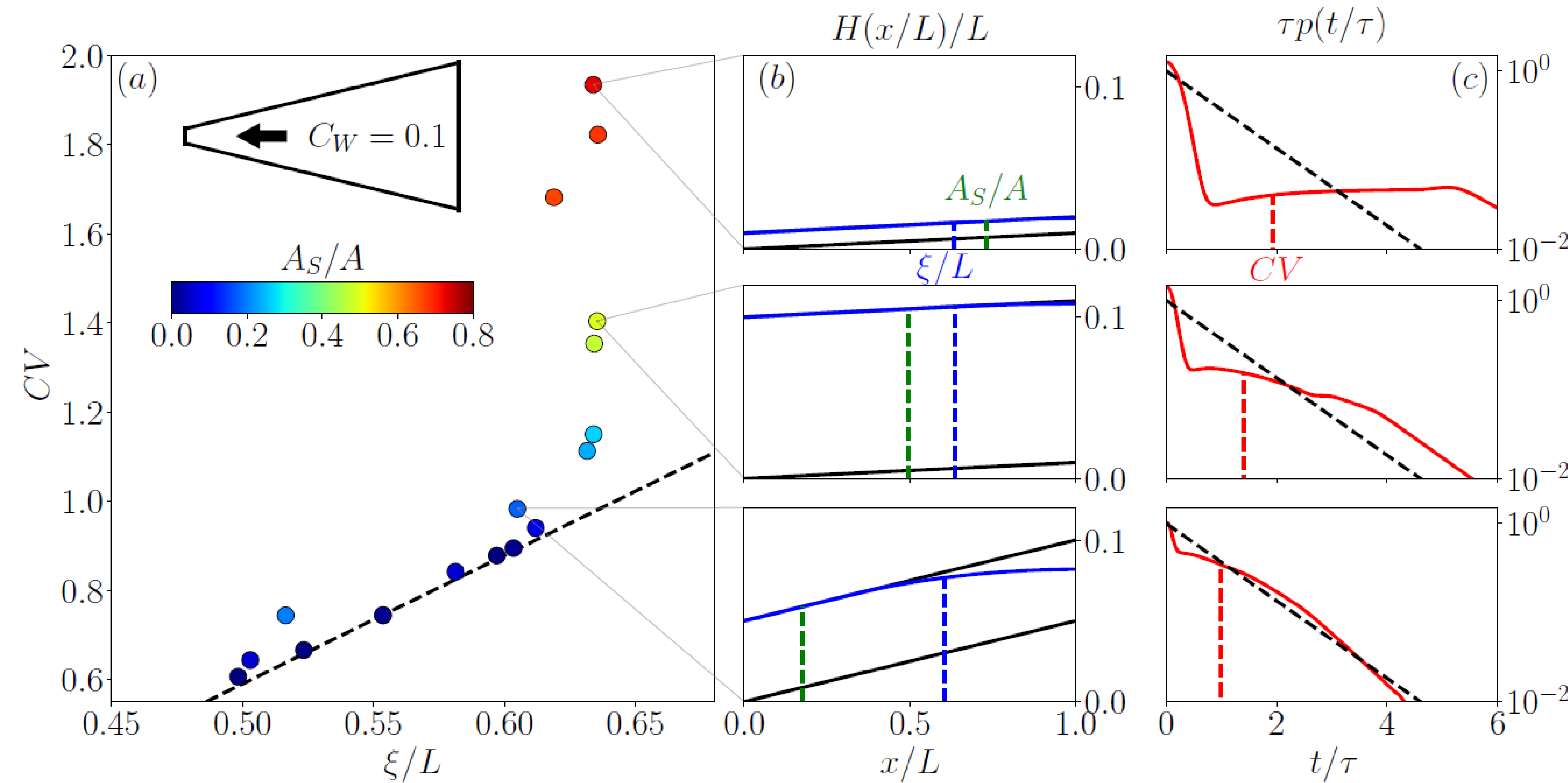
3D Simulations in convergent/divergent constant slope structures



Results

Transit Time mean μ is controlled by the
- The aquifer volume

Transit Times Variability is controlled by
- The barycenter of the aquifer volume ξ
- The extent of the saturated area A_s/A



$$\frac{\sigma}{\mu}(C_W, \xi, A_s/A) = \sqrt{(1 - A_s/A)^\alpha \left[1 - 0.42 \left(\frac{\xi - \xi_E(C_W)}{\xi_U(C_W) - \xi_E(C_W)} \right)^2 \right] + \frac{A_s/A}{1 - A_s/A}}$$

C_W : Convergence/Divergence ratio of the hillslope

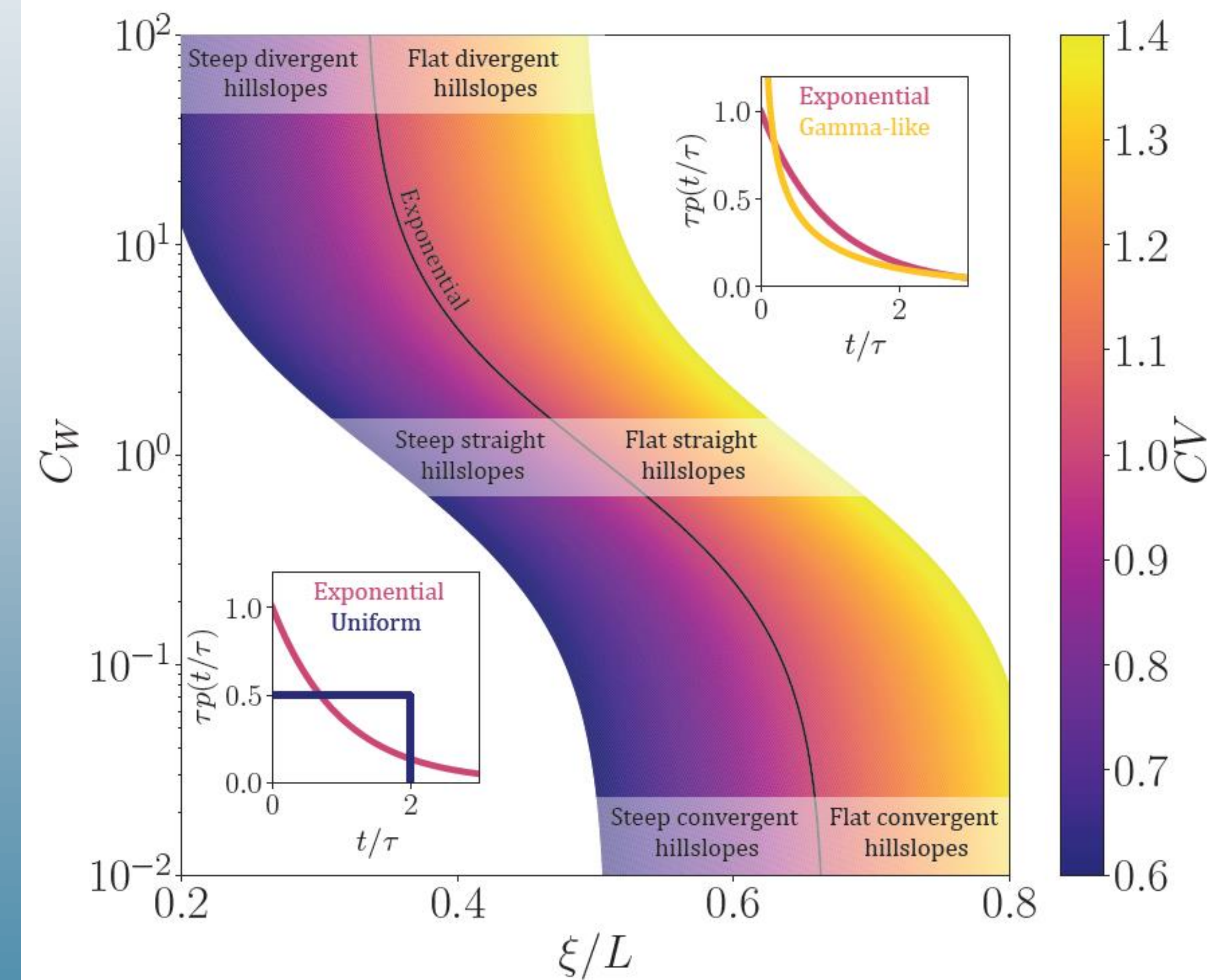
$\xi_U(C_W)$: Barycenter of the aquifer volume for steep hillslopes (uniform TTD)

$\xi_E(C_W)$: Barycenter of the aquifer volume for thick flat aquifers (exponential TTD)

α : Power-scale parameter function of the geomorphological structure

Application

Distribution shape (without seepage) from
- Uniform in steep hillslopes
- Gamma-like in thin flat hillslope



CV (Coefficient of Variation = σ/μ)

Reference

Geomorphological controls on groundwater transit times: a synthetic analysis at the hillslope scale, A. Gauvain et al., Water Resources Research, in review