Evaluating Predictive Uncertainty of Simulated Hyporheic Exchange

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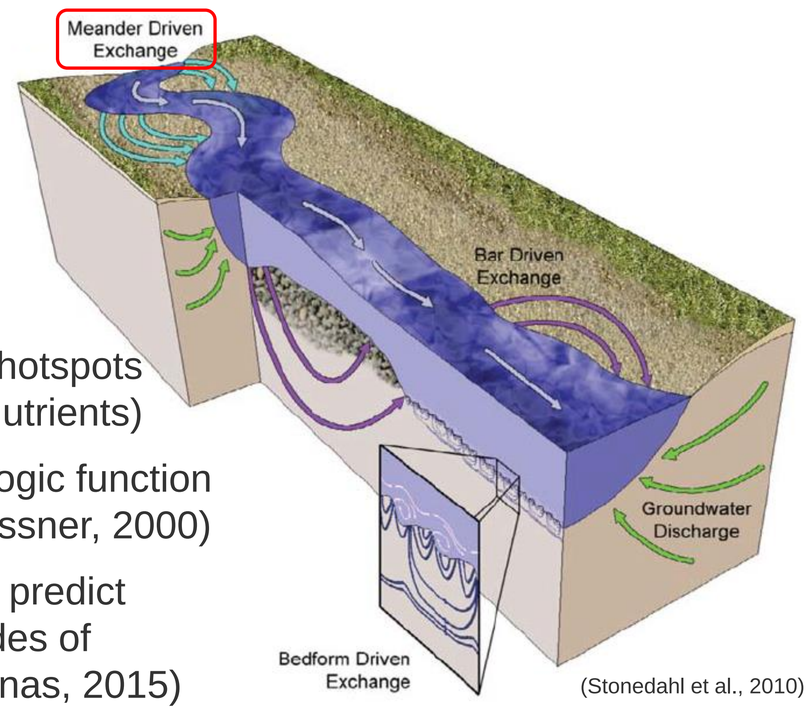
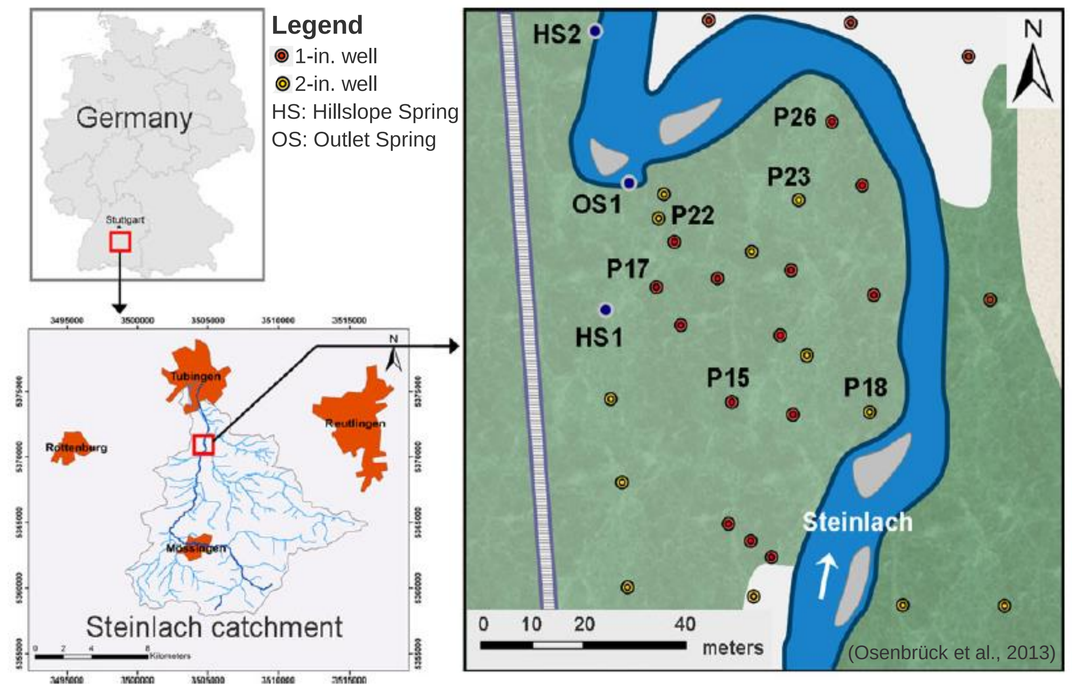
1) Why is Hyporheic Exchange (HE) Important?



(Stonedahl et al., 2010)

- Biogeochemical hotspots (temperature & nutrients)
- Useful for hydrologic function restoration (Woessner, 2000)
- Residence times predict relative magnitudes of reactions (Cardenas, 2015)

2) Steinlach River Meander Test Site

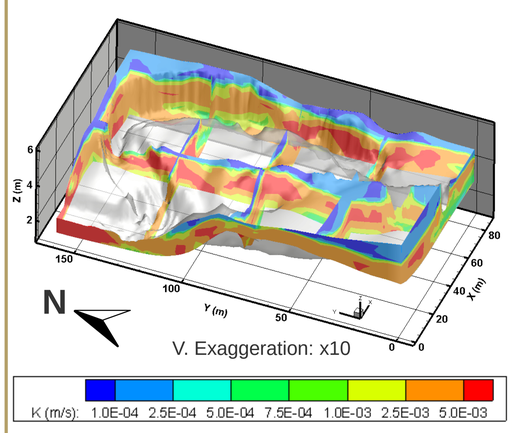


(Osenbrück et al., 2013)

3) Fully Coupled Hydrogeological Model

HydroGeoSphere (Aquanty Inc., 2017)

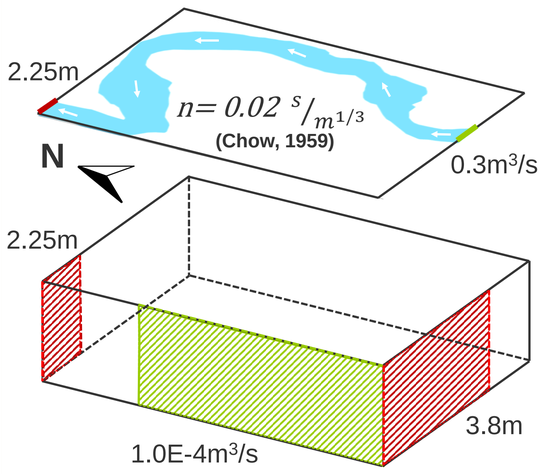
Hydraulic Conductivity (K) Multiple-Point Geostatistics
(Straubhaar et al., 2011)



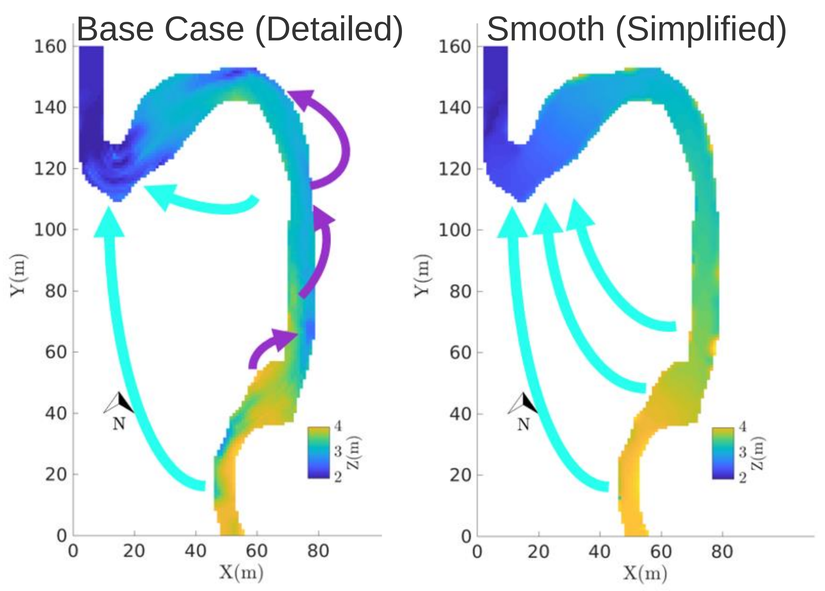
Surface BCs
- Constant Q
- Constant H

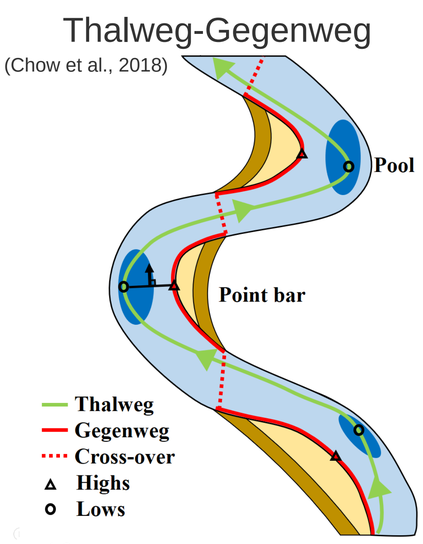
Subsurface BCs
- Constant Q
- Constant H

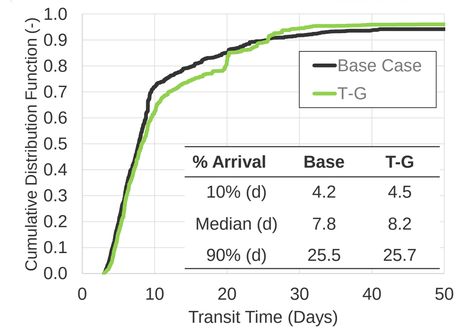
Q = Flux (m^3/s); H = Head (m)



4) Sensitivity of HE to River Bathymetry



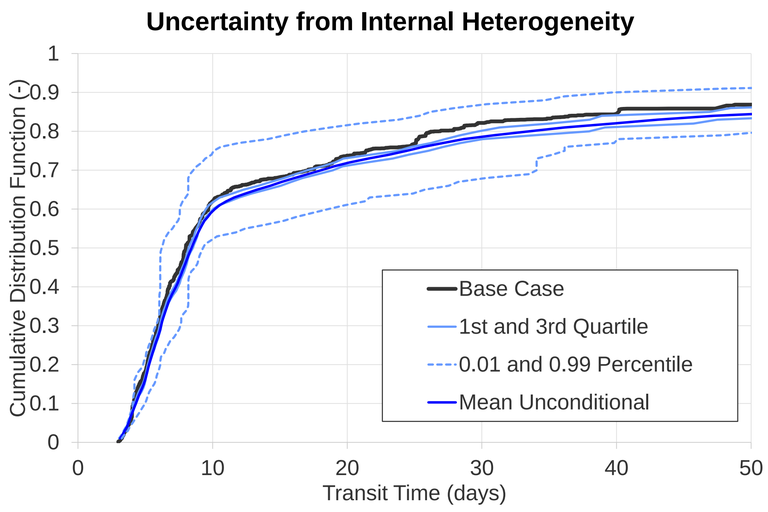




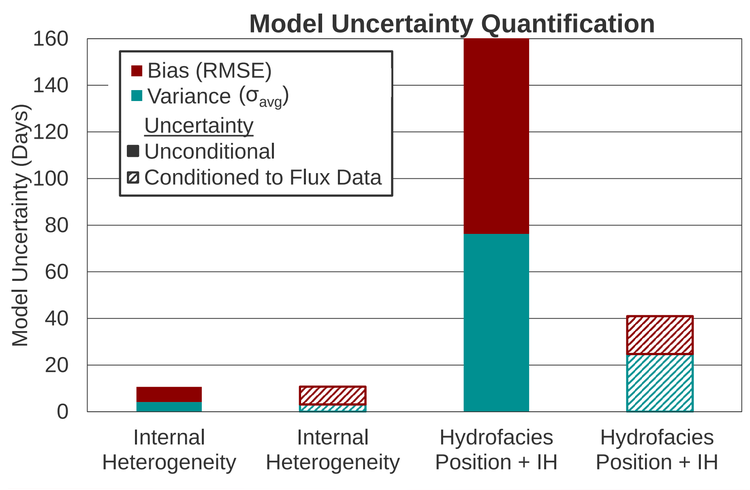
% Arrival	Base	T-G
10% (d)	4.2	4.5
Median (d)	7.8	8.2
90% (d)	25.5	25.7

- Detailed bathymetry ► nested multi-scale HE
- Less bathymetry data ► bias scale of HE
- Reduced effective survey points by 90% (540►54) from Base Case to Thalweg-Gegenweg Bathymetry

5) Uncertainty of HE from K Heterogeneity

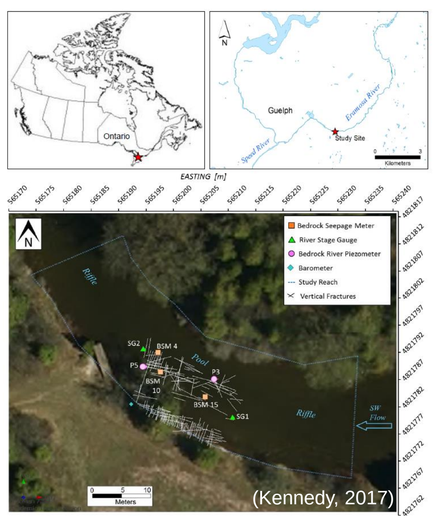


Hydrofacies Uncertainty
1. Positions (Multi-Point Statistics)
2. Internal heterogeneity (Multi-Gaussian)



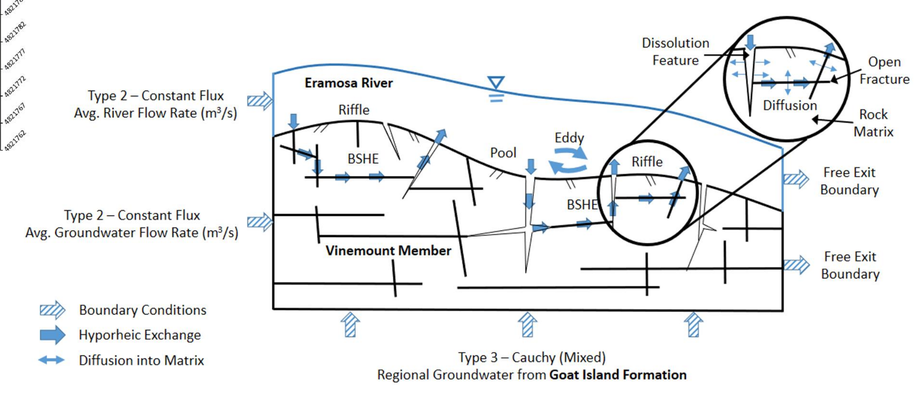
- Uncertainty from Hydrofacies Position >> IH
- Flux measurement more informative than heads

6) HE in Fractured Bedrock River



Eramosa Bedrock River Field Site at Barber Scout Camp (Steelman et al., 2015)

- Determine factors controlling HE fluxes and residence time distributions:
  - Fracture network and rock matrix heterogeneity in layered dolostone
  - Diffusive/dispersive properties along riffle-pool-riffle sequence
- Calibrate to available site data using adapted DFN-M approach (Parker et al., 2012)



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