How do highly fluctuating rivers affect solute transport in the groundwater?

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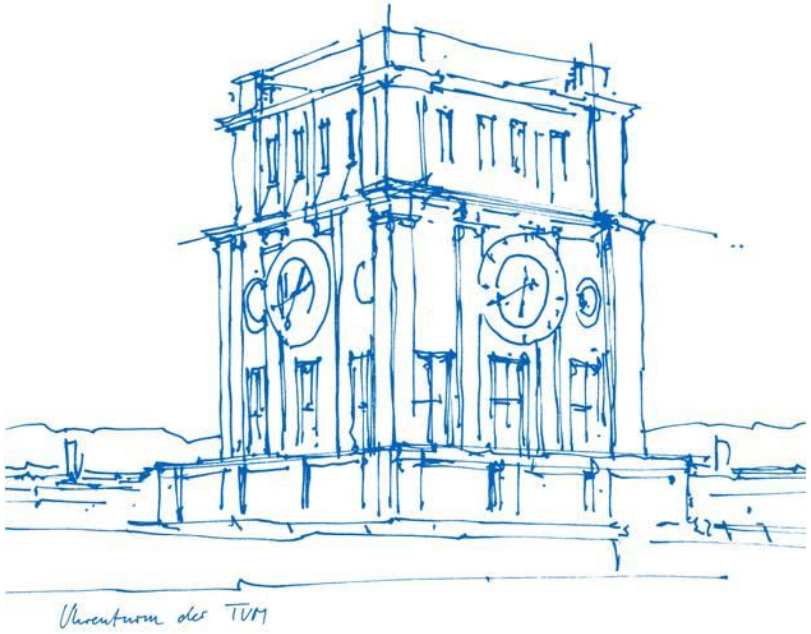
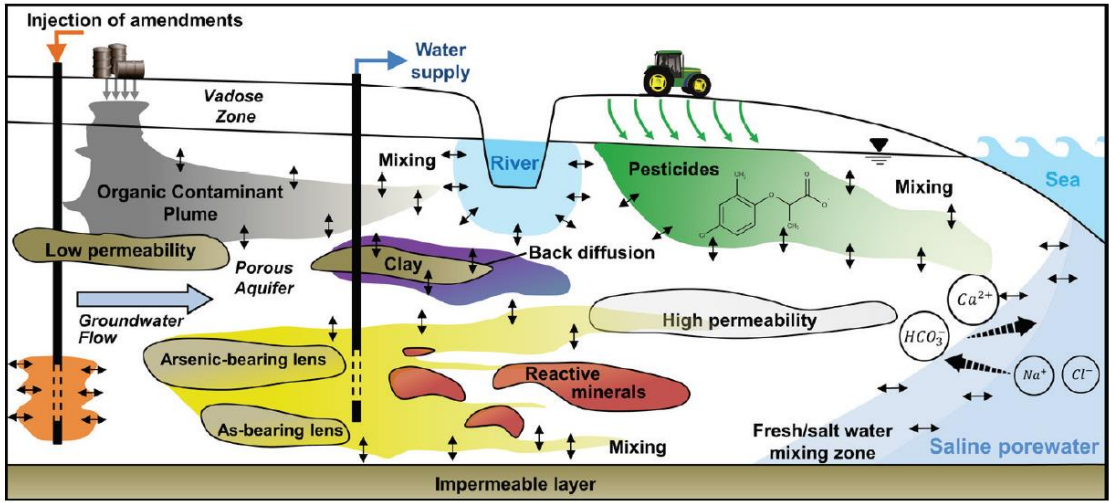
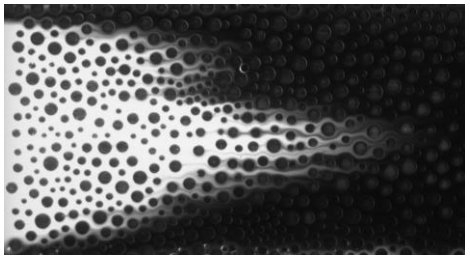


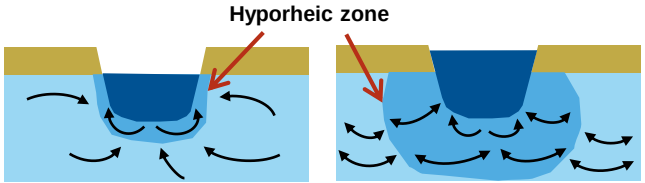
Factors controlling flow and transport in the subsurface



Rolle & Le Borgne, 2019

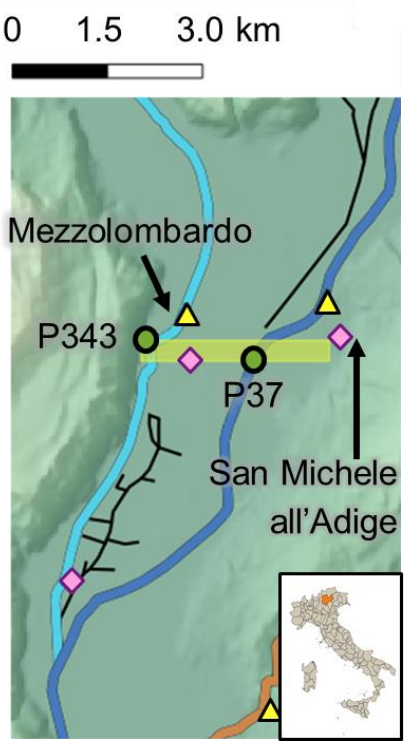


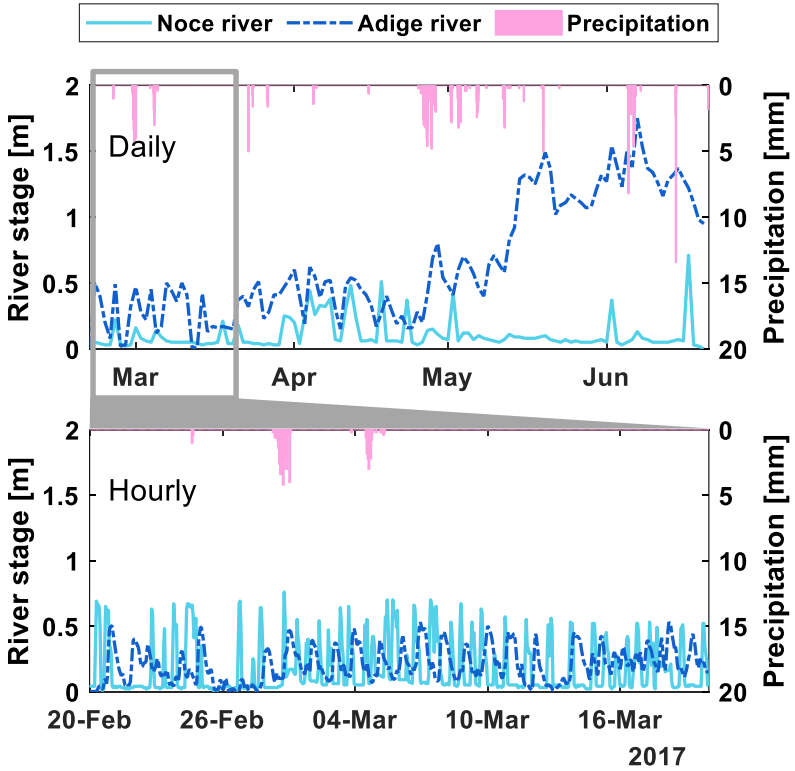
Cargèse 4th Summer School ,2018



Adapted from Sawyer et al., 2009

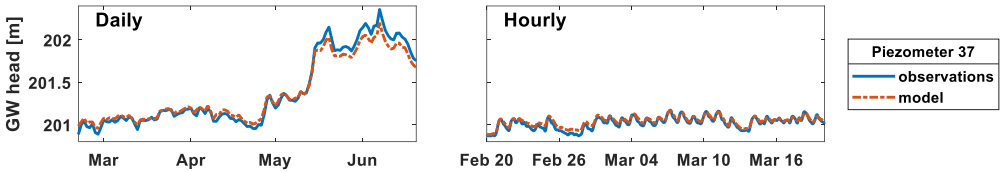
Adige Valley and hydropeaking



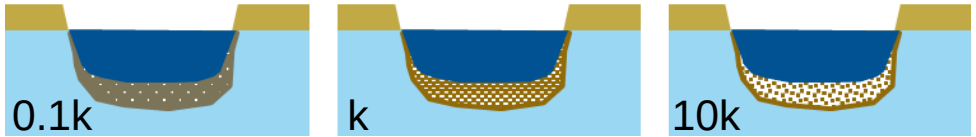


Methodology

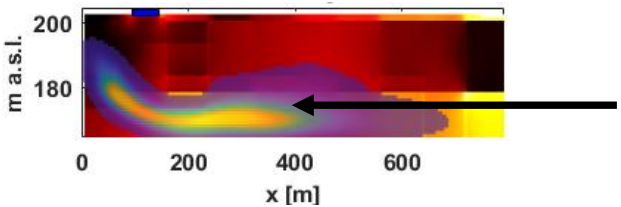
1. Model calibration
Sy, k, h_{rb}



2. Synthetic scenarios
0.01k, 0.1k, 0.2k,
0.5k, 10k



3. Transport model



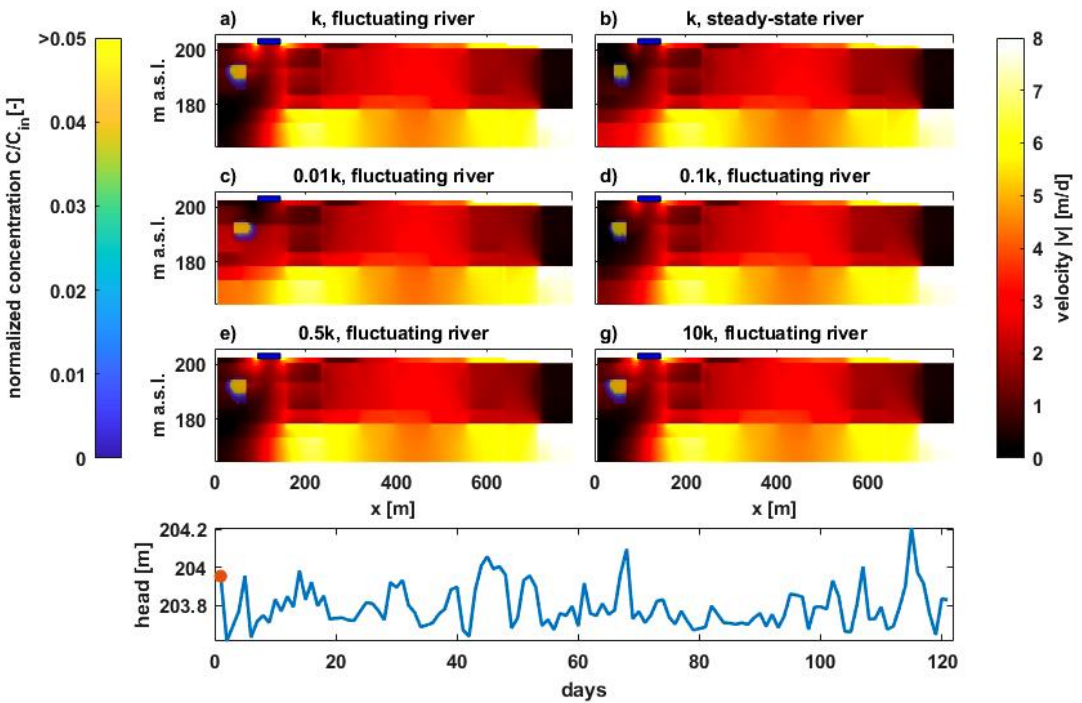
$$p(\boldsymbol{x},t) = \frac{C(\boldsymbol{x},t)}{\int_V C\,(\boldsymbol{x},t)dV}$$

4. Dilution index

$$E(t) = \exp\left[-\int_V p\,(\boldsymbol{x},t)\; ln\, p(\boldsymbol{x},t)\; dV\right]$$

Interplay of hydraulic conductivity, river fluctuations and riverbed conductance

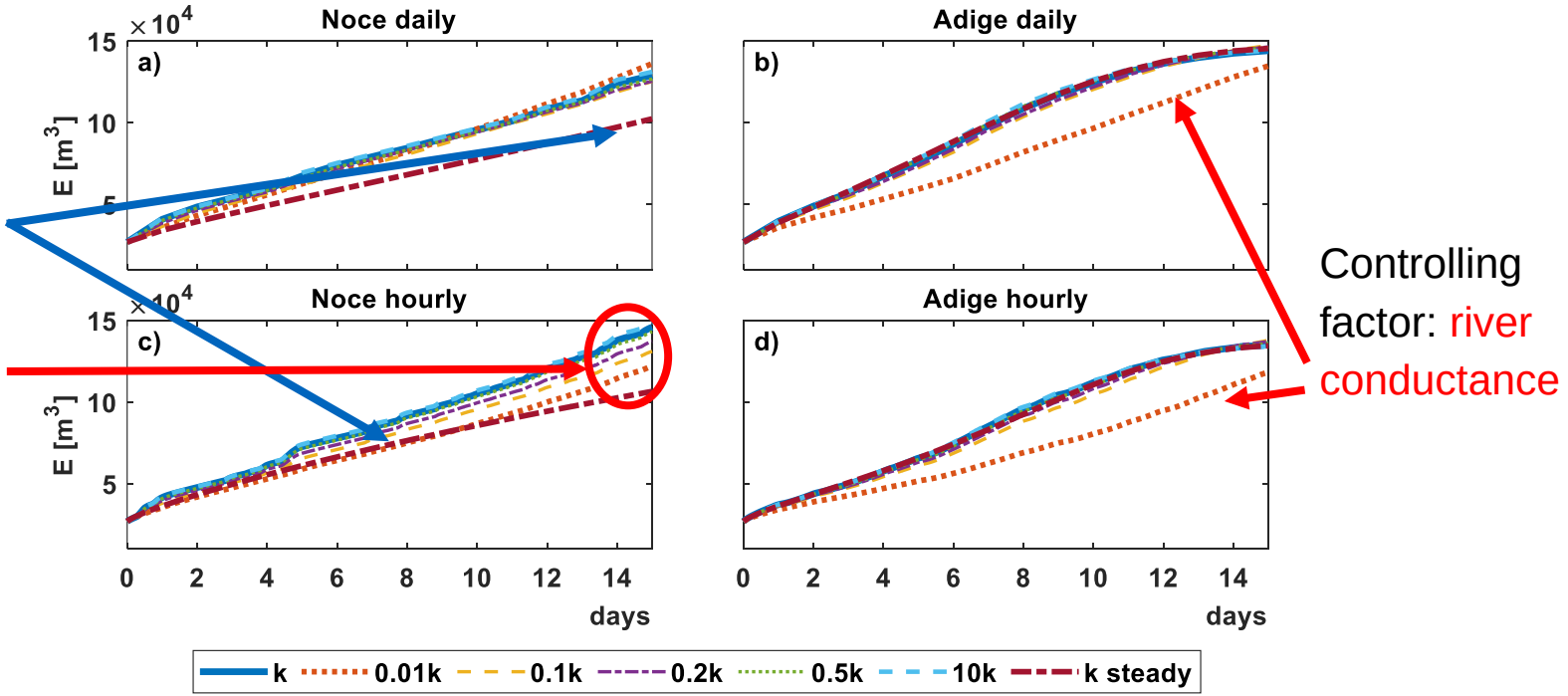
Noce River side daily resolution



k=calibrated hydraulic conductivity of the riverbed

Sensitivity of the dilution index to different time resolutions

Controlling factors: river dynamics and riverbed conductance



Controlling factor: river conductance

Conclusions

1. Solute transport is more sensitive than the groundwater head to river fluctuations.

2. Fluctuating rivers help the plume finding preferential paths as for the Noce River; but local aquifer heterogeneity may become the controlling factor as for the Adige River.

3. Interplay between the river fluctuations, and the hydraulic conductivity of the aquifer and of the riverbed can lead to complex transport dynamics, and when modeled, solute transport is affected by the time resolution.

Thank you!

Questions?

International Graduate School of Science and Engineering (IGSSE)

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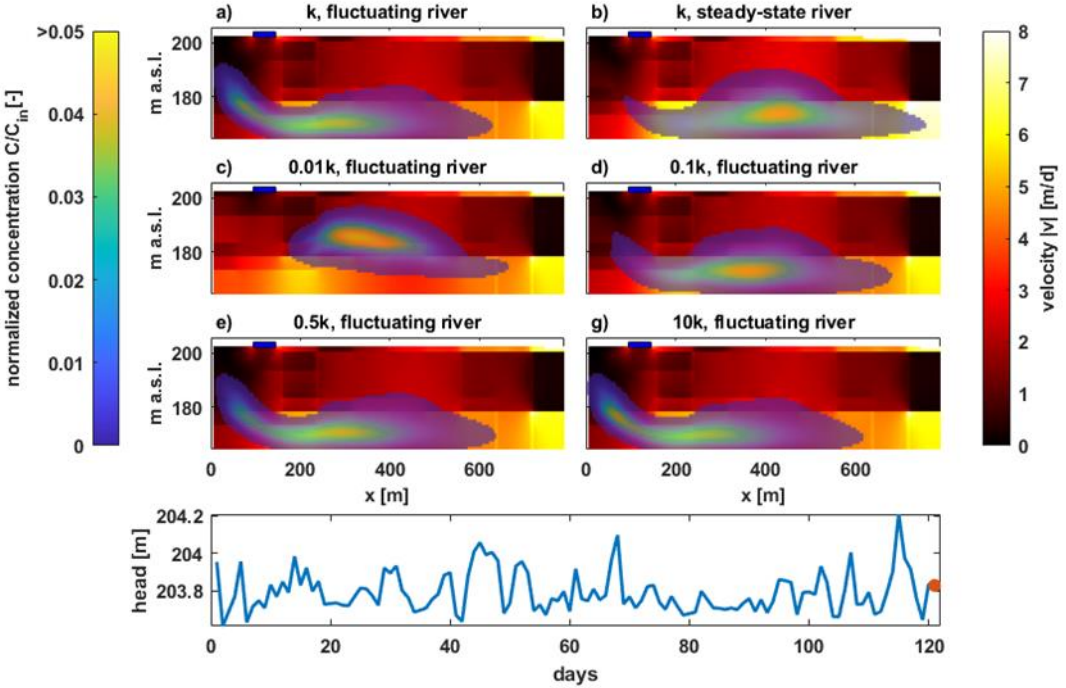
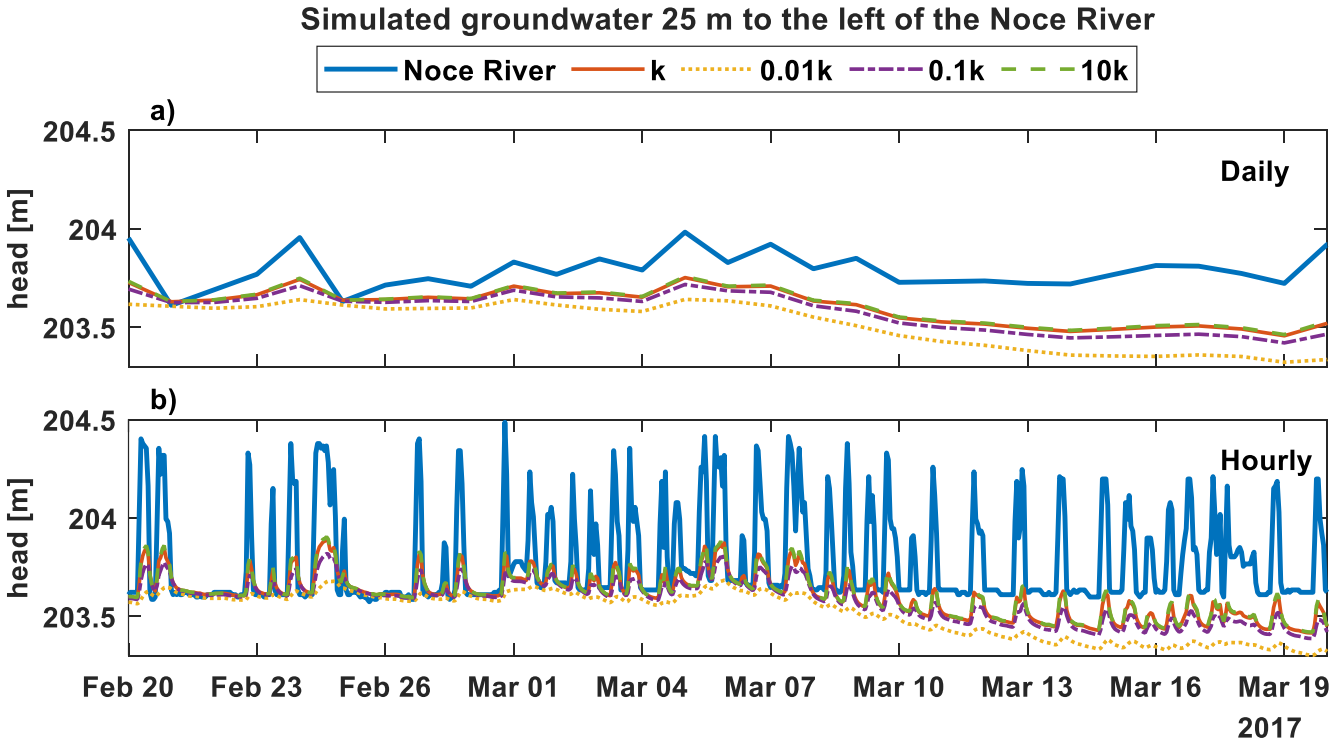
Interplay of hydraulic conductivity, river fluctuations and riverbed conductance

Noce River side daily resolution



k=calibrated hydraulic conductivity of the riverbed

River fluctuations and groundwater simulated heads on the Noce River



Aquifer cross section