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An Upscaled Modeling Framework for Reactive Transport: A Case Study - Dry Creek, Idaho

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Rivers and streams are important for transporting minerals, nutrients, and other chemicals throughout the natural environment. Introducing potentially toxic species into local water systems, e.g. agricultural-based pesticides, may have negative ecological consequences. Hence, understanding how materials are transported in hydrologic systems is important for developing more sustainable water management practices. The goal of this research is to validate a mathematical model that faithfully captures the transport of a reactive solute plume in a turbulent open channel with hyporheic exchange. To this end, field scale conservative (NaBr) and reactive tracer (NaNO3) experiments were conducted in Dry Creek, a small tributary in the Boise River watershed located in Idaho, USA. Reactive and conservative tracers were (pulse) injected into Dry Creek, and breakthrough curves were measured at 5.27m and 70.64m from the injection site. Here, we present analysis and results of the field study, linking creek characteristics to transport behavior. Then we develop a upscaled linear-reactive transport model using a CTRW framework to validate field study results. We compare the upscaled mathematical modeled breakthrough curves with observational measurements and use model insights to characterize the underlying governing process of reactive transport at the reach-scale. Specifically we explore the impact of the underlying sediment bed on channel transport in both the reactive and conservative cases.

Participation

In-Person

References

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