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If the riparian zone is so important – does it pay to model it?

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The tension between simple and complex models is a characteristic feature of the efforts to improve our ability to predict the impact of both society and natural variability on water resources as well as aquatic ecosystems. Conceptual models of hydrochemistry lie in a grey zone between simple statistical models and more complex, "physically-based" models. The appeal of great verisimilitude with respect to observed structures and processes pushes conceptual models towards more parameters and complexity. What is actually gained, and what is lost by increasing the complexity of a conceptual model? More fundamentally, how do we evaluate "gain and loss"? This paper considers that question by examining one specific modeling issue, namely the choice between a two-box mixing model representation of runoff chemistry and a more complex representation (the riparian convolution concept) of how the predictable architecture of riparian soils and hydrology in till catchments interact to generate the dynamics of stream runoff chemistry. Criteria for comparison of the simpler and more complex approach include 1) prediction of observed data, 2) usefulness in hypothesis testing, and 3) potential as a predictive tool