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Seminar Presentation by

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Join Zoom Meeting: https://usc.zoom.us/j/98766114432

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Maximizing our leverage for making reliable predictions in hydrobiogeochemical systems with model translation

Abstract:

The tools for coupled simulations of water resources systems have drastically expanded in the last two decades. Scientists and engineers can now represent physical systems and their feedbacks with extraordinary detail, and we now have sufficient computational power that such simulations are feasible. The tradeoff is that complex, distributed models of even moderately sized water resource systems can require massive numbers of parameters to describe the hydraulic, geologic, eco/biological, and geochemical processes. Further, the computational demand of these coupled simulations is so high that standard model calibration procedures are not practical. The high degree of parameterization and lack of calibration mean the models are highly uncertain, and this raises our two main questions: 1) can the results of these “integrated” models be trusted for real-world water resource problems, and 2) how can we get more bang for our bucks out of these labor and data intensive models?

This presentation critically explores the process of designing and building a coupled model of watershed-scale flow, transport, and geochemical cycling. We will qualitatively assess the sources and impacts of uncertainty and consider when, where, and how these models can be applied to real-world systems. The key point is that the models are extremely powerful for research and can be very useful in application when they are not oversold, but their uncertainty and lack of calibration are major limitations that cannot be overlooked. However, the models do offer a unique possibility for making predictions in data poor regions, or watersheds where there may not be enough time to develop a detailed model due to an impending perturbation like wildfire. New techniques for upscaling watershed scale transport require models of correlation, which, to date, have basically required one to completely model the system, relegating such upscaling to a descriptive exercise. Recently, it has become clear that most of the upscaled model components can be inferred from similar watersheds, and this is exciting because it raises the possibility of model translation; the ability to develop a model at one site, then use it to make reliable estimates of hydrobiogeochemical cycling at another. This emerging technique is currently under development, but we include some of our preliminary findings to show this promising, yet unexpected, application of coupled watershed models.

Host: Dr. Felipe de Barros