Poster #183

A Vegetative Facies-Based Multiscale Approach to Modeling Nutrient Transport

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The impact of submerged vegetation on nutrients and contaminants distribution in the Columbia Plateau region has been generally overlooked in recent multiscale modeling efforts. Yet, vegetation is the regulatory layer between many hydrological and ecological functions and plays a pivotal role in fluvial systems. One common challenge in modeling transport in vegetated rivers is the lack of predictive models linking vegetation type and topology with effective transport properties of the vegetative layer itself and its dynamic linkages to its surroundings (i.e. groundwater and surface waters). Specifically, existing models provide only limited understanding of the mechanistic connection between vegetation topology and its function. We address this challenge by modeling the vegetated layer as a porous medium. Such an underlying hypothesis allows us (i) to establish a mechanistic relationship between vegetation structure (e.g. LAI, height, density) and function (permeability, effective dispersion and reaction rates of the canopy layer), and (ii) to construct a framework, and corresponding mathematical machinery, to model the impact of vegetation on nutrient cycling.