Poster #22-13

IDEAS-Watersheds Partnership with the Critical Interfaces SFA: Progress and Plans

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The next phase of the Interoperable Design of Extreme-scale Application Software project (IDEAS-Watersheds) will focus on development and demonstration of critical modeling capabilities needed to further advance process-rich watershed hydro-biogeochemical models. To help advance that capability, the project has adopted concrete watershed modeling use cases in partnerships with interdisciplinary watershed-focused Science Focus Areas (SFAs). A common modeling challenge for watershed hydro-biogeochemical models is how to tractably represent the effects of processes associated with spatially localized metabolically active transient storage zones. The IDEAS-Watershed partnership activity with the Critical Interfaces SFA is addressing that multiscale modeling challenge using the transport of Hg and its microbially mediated transformation to the neurotoxin methylmercury (MeHg) in East Fork Poplar Creek (EFPC), Tennessee as a use case. The partnership is developing a new multiscale modeling approach (Painter 2018) that extends highly successful residence-time approaches to accommodate nonlinear multicomponent reactions and transient flows. Building on previous capabilities developed by the IDEAS project, the approach has been implemented as a hyporheic-zone subgrid model in the integrated surface/subsurface hydrology code ATS (Coon et al. 2016). A non-reacting tracer test (Ward et al. 2016) at the HJ Andrews Experimental Forest that was strongly affected by transient channel flow has been successfully modeled. We are developing tools to perform parameter estimation from the tracer tests, focusing on hyporheic exchange rates and non-parametric estimation of the hyporheic travel-time distributions. Longer term, we plan to do reach-scale reactive transport demonstration simulations for the HJA Watershed 01 and EFPC, develop interfaces that will allow output of the USGS NEXSS model (Gomez-Velez, 2014) to be ingested into ATS for the purpose of river-basin–scale biogeochemical simulations, and perform river-basin–scale demonstration simulations.

References:

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