IDEAS-Watersheds Continental Modeling Platform and Simulations

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BER Program: SBR

Project: IDEAS-Watersheds (University)

Project Website: https://ideas-productivity.org/ideas-watersheds/

Project Abstract: This project seeks to develop a high resolution, integrated hydrologic modeling platform for the Continental US (CONUS) that bridges across the IDEAS-watersheds study areas and provides a scaling framework from the reach scale up to watershed and regional systems. We are applying a phased approach to explore multiscale, multi-physics treatments of terrestrial hydrology modeling from the bedrock into the atmosphere. The continental research falls under three categories: (1) domain development, (2) software development and sustainability, and (3) simulations.

Domain Development - For the new CONUS domain we have been testing topographic smoothing and slope processing choices to improve runoff performance and simulations times. We have explored the impact of topographic parameterizations on watershed representation across spatial scales. We are also working on an improved subsurface representation combining multiple geologic datasets on, and developing reservoir operations datasets.

Software Development – This year we implemented two new overland flow boundary conditions in ParFlow. These were designed to improve performance by increasing consistency between surface and subsurface solution approaches, and to facilitate new model couplings by increasing the flexibility in boundaries.

Simulations – This year we published the warming simulations we completed on the first- generation domain. This study is a follow up to the simulations we did to quantify the impacts of human groundwater development. Combined these analyses allow us to compare top down and bottom up controls on groundwater surface water interactions. We have also been developing tools to subset and run watershed simulations from the CONUS domain. We demonstrated this with the Upper Colorado River Basin (UCRB) domain which was used to complete decadal simulations exploring the relationship between lateral groundwater flow and flooding.