

## Poster #21-14

### Advances in Hyper-Resolution Integrated Modeling of the Continental US and Connections to the National Water Model

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Understanding water flow at the continental scale helps untangle critical questions at the energy-water nexus. Our team has developed a fully integrated groundwater-surface water simulation of the Continental US (CONUS). Building from our existing work, this year we have been (1) continuing experiments with our simulations of current 6.2 million square kilometer domain, (2) expanding the simulation domain to extend to the coastlines and encompass the entire contributing area of the continental US, (3) directly comparing ParFlow-CONUS and WRF-Hydro configured as the National Water Model (NWM) and (4) coupling ParFlow and WRF Hydro to facilitate integration with the NWM.

A suite of 1-4 degree warming scenarios have been simulated with the existing CONUS domain. Results from these tests are used to evaluate the role of groundwater surface water interactions in watershed response to warming stress. Additional simulations with more recent climate forcing data are also used to evaluate hydrologic impacts of insect infestation and compare to GRACE satellite observations. In parallel, we have also been developing the next generation domain, which is roughly 25% larger than previous simulations and includes the entire surface water domain of the National Water Model (NWM). The grid for the new domain is aligned with the NWM, and topographic processing ensures that stream segments are consistent between models to facilitate direct comparison of approaches. Here we present progress on the development and initialization of the ParFlow model for the new domain.

The NWM represents the state-of-the-art in operational water prediction, and coupling to ParFlow allows for exploration of additional flow processes important for understanding and modeling the nation's water resources. Collaborating with the IDEAS team, we are exploring the benefits of appointing a software engineer dedicated to facilitating best practices as we work to couple ParFlow into the WRF-Hydro modeling framework (the platform for the NWM). This physically based approach is a significant advancement beyond the currently implemented conceptual baseflow bucket model within the NWM. We illustrate proof of concept for the PF-WRF-Hydro model on several test beds as well as comparisons between the NWM and the existing CONUS domain.