A WATERSHED-BASED SPATIALLY-EXPLICIT DEMONSTRATION OF AN INTEGRATED ENVIRONMENTAL MODELING FRAMEWORK FOR ECOSYSTEM SERVICES IN THE COAL RIVER BASIN (WV, USA)

John M. Johnston, Mahlon C. Barber, Kurt Wolfe, Mike Galvin, Mike Cyterski, Rajbir Parmar, Luis Suárez[1]

We demonstrate a spatially-explicit regional assessment of current condition of aquatic ecoservices in the Coal River Basin (CRB), with limited sensitivity analysis for the atmospheric contaminant mercury. The integrated modeling framework (IMF) forecasts water quality and quantity, habitat suitability for aquatic biota, fish biomasses, population densities, productivities, and contamination by methylmercury in headwater watersheds. The CRB is an 8-digit hydrologic unit watershed facing widespread land use change, and the IMF simulates a network of 97 stream segments using the SWAT watershed model, a watershed mercury loading model, the WASP fate and transport model, the PisCES fish community model, a fish habitat suitability model, the BASS fish community and bioaccumulation model, and an ecoservices post-processer. The application of these models was facilitated by the automated data retrieval and model setup tool D4EM and updated model wrappers and interfaces for data transfers between these models. Results for each stream segment demonstrate three distinct groupings for flow. Baseline IMF predictions for all ecoservices are provided for 1990–2010 across all segments, with summary statistics compared to independent models and field data for the period 2001-2010 after model spin-up. Spin-up of the IMF is also addressed to reach dynamic steady state, corresponding to the age of the longest lived fish in the drainage.

[1]John M. Johnston, Supervisory Ecologist, US Environmental Protection Agency, Athens, GA 30605
Mahlon C. Barber, Research Ecologist, US Environmental Protection Agency, Athens, GA 30605
Kurt Wolfe, Computer Engineer, US Environmental Protection Agency, Athens, GA 30605
Mike Galvin, Computer Scientist, US Environmental Protection Agency, Athens, GA 30605
Mike Cyterski, Research Ecologist, US Environmental Protection Agency, Athens, GA 30605
Rajbir Parmar, Computer Engineer, US Environmental Protection Agency, Athens, GA 30605
Luis Suárez, Research Pharmacologist, US Environmental Protection Agency, Athens, GA 30605