

## MODFLOW-OWHM v2: The Next Generation of MODFLOW Conjunctive Use Simulation

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The One-Water Hydrologic Flow Model (One-Water) is a MODFLOW-based integrated hydrologic flow model designed for the analysis of a broad range of conjunctive-use and sustainability issues. It was motivated by the need to merge the multiple variants of MODFLOW-2005 to yield an enhanced unified version capable of simulating conjunctive use and management, sustainability, climate-related issues, and managing the relationships between groundwater, surface water, and land usage. One-Water links the movement and use of groundwater, surface water, and imported water for consumption by agriculture and natural vegetation on the landscape, and for potable and other uses within a supply-and-demand framework. The first version, released in 2014, was selected by The World Bank Water Resource Software Review in 2016 as one of three recommended simulation programs for conjunctive use and management modeling. One-Water is also being used as the primary simulation engine for FREEWAT, a European Union sponsored open-source water management software environment.

The next version of One-Water will include a new surface-water operations module that simulates dynamic reservoir operations, a conduit-flow process for karst aquifers and leaky pipe networks, and a set of sustainability analysis tools that facilitate the estimation and simulation of reduced storage depletion and captured discharge. It will also include enhancements to local grid refinement, and additional features to facilitate easier model updates, faster execution, better error messages, and more integration/cross communication between the traditional MODFLOW packages. The new structure also helps facilitate the new integration into a “Self-Updating” structure of data streams, simulation, and analysis needed for modern water resource management.

By retaining and tracking the water within the hydrosphere, One-Water accounts for “all of the water everywhere and all of the time.” This philosophy provides more confidence in the water accounting to the scientific community and provides the public a foundation needed to address wider classes of problems. Ultimately, more complex questions are being asked about water resources, requiring tools that more completely answer conjunctive-use management questions.