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MODFLOW-OWHM Version 2: New Features and Improvements; The Next Generation of MODFLOW Conjunctive Management 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 brought about by the need to merge the multiple versions of MODFLOW-2005 that have been developed to yield an enhanced unified version capable of understanding conjunctive use and management, sustainability, climate-related issues, and the 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 the three recommend simulation programs for conjunctive use and management modeling. One-Water is also being used as the primary simulation engine for FREEWAT, which is 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 new sustainability analysis package that facilitates the estimation and simulation of reduced storage depletion and captured discharge, a conduit-flow process for karst aquifers and leaky pipe networks, a soil zone process that adds an enhanced infiltration process, interflow, deep percolation and soil moisture, and a new subsidence and aquifer compaction package. 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 by 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, so they require a more complete answer conjunctive-use management decisions.