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COMPUTATIONAL TOOLS TO SIMULATE AQUIFER STORAGE AND RECOVERY IN SOUTH FLORIDA

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Summary. The Comprehensive Everglades Restoration Program (CERP) supports the restoration and preservation of the South Florida ecosystem while supplying the water needs of the region. One component of CERP is the Aquifer Storage and Recovery (ASR) plan, which proposes to store fresh water underground when excess water is available and recover the same water when it is needed. Fresh water will be injected into saline aquifers through as many as 333 ASR wells; each rated at 5 million gallons per day. Groundwater models are being used to evaluate the proposed ASR system and refine its operation. The ambitious modeling effort simulates regional groundwater flow beneath an area approximately 40,000 square miles, coupled with inset models near selected well fields. The Jacksonville and Philadelphia offices of the Corps of Engineers are performing the modeling using tools developed in the System-Wide Water Resources Program at the Engineer Research and Development Center.

Specifically, the modeling needs for this project have included (1) parallel computation to handle very large computational meshes, (2) dynamic mesh refinement and coarsening to permit efficient calculation with intermittent well activity, (3) multi-objective error indicators to trigger mesh adaption, (4) density-dependent flow to approximate freshwater injection into saline aquifers, (5) a well model to distribute the extraction or injection along well screens that span many computational nodes, and (6) pre- and post-processing tools to permit boundary condition assignment and analysis on very large meshes. These components will be described and simulation results presented. Additionally, the model results should allow an assessment of low-order, stabilized, Eulerian finite element methods for capturing the saltwater/freshwater interface and faithfully representing the in-aquifer mixing.