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PARALLEL DEVELOPMENT OF MODFLOW AND SUTRA MODELS IN COASTAL GEORGIA, U.S.A.: AN APPROACH TO STUDY REGIONAL GROUND-WATER FLOW AND LOCAL SALTWATER INTRUSION

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ABSTRACT

To characterize regional ground-water flow and localized encroachment of saltwater into groundwater, the U.S. Geological Survey, in cooperation with the Georgia Department of Natural Resources, is developing regional-scale ground-water flow and local-scale variable-density transport models for coastal Georgia, U.S.A., using MODFLOW2000 and SUTRA version 2D3D.1. The objectives of these models are to predict the effects of future changes in pumping on 1) the regional ground-water flow system; and 2) localized areas of known and potential saltwater intrusion. A product of this effort will be publicly available, three-dimensional models that can be used as-is or updated as water use patterns change and more is learned about the flow system. Three models are being developed: a regional-scale flow model, using MODFLOW and SUTRA in parallel; and two local-scale, variable-density transport models, both using SUTRA. The parallel development of the regional-scale model is facilitated by the use of a common GIS-based interface and is designed to take advantage of the strengths of the two simulation codes used. MODFLOW is a constant-density flow simulator that is widely used and offers integrated parameter estimation and sensitivity analysis tools that facilitate model calibration. SUTRA is capable of explicitly simulating the effects of variable fluid density, which control the position the saltwater-freshwater interface and local-scale saltwater intrusion. Accordingly, model calibration is performed primarily using the MODFLOW version of the model, while the SUTRA version is used to assess the effects of variable-density flow on the boundary conditions used in the MODFLOW version, particularly the condition used to represent the pre-development, offshore saltwater-freshwater interface. After the regional-scale model is developed and calibrated with sufficient consistency between the two versions, the SUTRA version will be modified by increasing grid density in the area of greatest concern for saltwater intrusion (in the areas of Savannah and Brunswick), and by decreasing grid density outside of this area. The results will be used to conveniently specify boundary conditions for the local-scale transport models.

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