

Development of the PISALE Codebase for Simulating Flow and Transport in Large-scale Coastal Aquifer

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Abstract: The solution of partial differential equations (PDEs) on modern high performance computing (HPC) platforms is essential to the continued success of groundwater flow and transport modeling in Pacific islands where complex regional groundwater flow is governed by highly heterogeneous volcanic rocks and dynamic interaction between freshwater and seawater. The PISALE (Pacific Island Structured-AMR with ALE) project will provide access to software for simulations of complex groundwater flow processes in the Hawaiian islands. We use an innovative combination of advanced mathematical techniques for the solution of PDEs, including parallel software tools to dynamically adapt the grids and special Lagrangian-flow methods that allow for the solution of equations that can reproduce the sharp freshwater-seawater interface observed in seawater monitoring locations. The PISALE software is based on the techniques of Arbitrary Lagrangian Eulerian (ALE) methods with Adaptive Mesh Refinement (AMR) to create a publicly available sustainable branch of the software. The island-scale numerical groundwater flow modeling will play an important role in predicting the sustainable yields and potential contaminant transport for the volcanic aquifer systems and planning groundwater resources management. We present the status of our ongoing project

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