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Jeremy L Marzuola*, Department of Mathematics, CB #3250, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599. *Numerical algorithms for water waves with background flow over obstacles and topography.*

With David Ambrose, Jon Wilkening, Roberto Camassa, Rich McLaughlin and Quentin Robinson, we have developed fast and efficient algorithms for solving the incompressible, irrotational Euler equations with a free surface for a water layer that includes multiple stationary obstacles, resulting in non-simply connected fluid domains, as well variable bottom topography, in two-dimensions. One approach uses Layer Potentials and has the ability to be generalized to three dimensions. The other approach uses Cauchy Integrals and is fast and efficient for computing conserved quantities. We present convergence data, energy conservation, stabilization methods, as well as explore various dynamical regimes with non-simply connected fluid domains. The methods generalize to 3D as well. (Received August 14, 2020)