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Progress on using a Lattice Boltzmann solver for water wave predictions[1] JANNETTE FRANDSEN, University of Hawaii — This research is focused on numerical model development to predict free-surface water wave behavior. The present numerical model is based on a Lattice Boltzmann (LB) formulation. The LB method simulates fluid flow by tracking particle distributions in a Lagrangian manner. We consider a model in which the collision processes are simplified to a single-time relaxation form. It is referred to as the Lattice Bhatnagar-Gross-Krook (LBGK) scheme. Further, the present model discretizes the nonlinear shallow water equations in rotational flows on uniform lattices. It is assumed that the waves do not overturn. It is notable that the LBGK model does not include the traditional boundary conditions at the free surface. Instead, the non-linear free-surface dynamics are accounted for through the non-equilibrium particle distribution function. In this contribution, we report on our recent experiences in which we have compared a standard LBGK solver and a high-order Finite Difference (FD) LB scheme. We shall demonstrate that various nonlinear free-surface flows are captured satisfactory. We recommend a second-order FD LB scheme to form a basis for free-surface water wave developments.

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