Direct Simulation of Ocean Hydro-acoustic Waves with the Lattice Boltzmann Method

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Abstract:
Ocean hydro-acoustics, (OH) which studies the evolution of pressure waves in sea, has recently gained a central role in the scientific literature mainly due to the possibility for exploiting the large amount of information contained in the pressure signals generated by earth-water interaction. In particular, the pressure signatures of bottom movements are extensively studied as precursors of tsunami waves since they travel much faster than the tsunami itself. For such reasons, they are natural candidates for setting up a tsunami early warning system.
So far, mainly due to the lack of computational methods able to readily yield useful results, hydro-acoustics waves have been modelled by means of vertically integrated mathematical models. Lattice Boltzmann Modelling, a kinetic approach for the solution of fluid dynamics problems, is getting popular thanks to its accuracy coupled with a low computational burden.
LB is here employed to solve the fully 3D problem at hand and is shown to be well capable of modelling generation and propagation of hydro-acoustic waves.