The small density contrast limit for multilayer shallow water systems

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Abstract

We will discuss the behaviour of the inviscid multilayer Saint-Venant (or shallow water) system in the limit of small density contrast. We will see that, under reasonable hyperbolicity conditions on the flow, the system is well-posed on a time interval independent of the small density contrast parameter, and that the solutions converge towards solutions of the rigid-lid system under the Boussinesq approximation. The asymptotic behaviour is similar to that of the incompressible limit for Euler equations, in the sense that there exists a small initial layer in time for ill-prepared initial data, accounting for rapidly propagating "acoustic" waves (here, the so-called barotropic mode) which interact only weakly with the "incompressible" component (here, baroclinic).

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