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Inertial effects in an incompressible stratified Euler fluid in a channel GIOVANNI ORTENZI, Dipartmento di Matematica e Applicazioni, Universita' di Milano-Bicocca, via Cozzi, 53 - 20125 Milano, Italy, ROBERTO CAMASSA, SHENGQIAN CHEN, Carolina Center for Interdisciplinary Applied Mathematics, Department of Mathematics, University of North Carolina, Chapel Hill, NC 27599, USA, GREGORIO FALQUI, Dipartmento di Matematica e Applicazioni, Universita' di Milano-Bicocca, via Cozzi, 53 - 20125 Milano, Italy, MARCO PEDRONI, Dipartimento di Ingegneria dell'Informazione e Metodi Matematici, Universita' di Bergamo, Viale Marconi 5, 24044 Dalmine (BG), Italy — Inertial properties of an incompressible Euler fluid are discussed in the case of a stably stratified fluid confined between infinite rigid upper and lower horizontal plates in hydrostatic equilibrium at infinity. In this set-up, the possibility of non-conservation of horizontal momentum emerges, despite the fact that only vertical external forces act on the system (an apparent paradox seemingly first noticed by Benjamin, 1986). We show that this phenomenon is a consequence of the rigid lid constraint coupling through incompressibility with the infinite inertia of the far ends of the channel. When inertia is removed by eliminating the stratification or, remarkably, by using the Boussinesq approximation, horizontal momentum conservation is recovered. The pressure imbalance responsible for lack of horizontal momentum conservation and its comparison with direct numerical simulation is explicitly shown for: 1) a two-layer full Euler system with small velocities and density variations, and 2) a long wave one-dimensional model of the same set-up. A side effect detected by the model is the relevance of internal-wave dispersion at short times. Effects on the variation of physical quantities other than momentum, such us the total circulation of the fluid, will be discussed.

Giovanni Ortenzi
Dipartmento di Matematica e Applicazioni,
Universit'a di Milano-Bicocca, via Cozzi, 53 - 20125 Milano, Italy

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