Inertial particles Rayleigh-Taylor turbulence

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The present work showcases the results of Direct Numerical Simulation of an inertial, particle-based Rayleigh-Taylor system modeled through an Immersed Boundary Method. Any Rayleigh-Taylor system is described at its core by two phases separated by an interface and distinguished by a single property based on which a force acts, causing relative accelerations of the phases. In the classic thermal case, where a colder fluid sits above a warmer one, the property is thermal-dependent density and the force is gravity. However, other scenarios that fit the above definition exist[1]. One of them consists of a heavy-particle laden fluid phase sitting atop of the same, particle-free, fluid. The evolving dynamics show the chaotic characteristics of turbulent behaviour. The effect of particle inertia in this system has been previously studied numerically in the case of infinitely small particles using the Saffman model, and it has been shown that Boussinesq symmetry breaking and particle clustering with local density higher than the original one may appear with highly inertial particles[2]. The current study aims to understand whether similar phenomena emerge in the case of small but finite-size particles modeled through IBM.

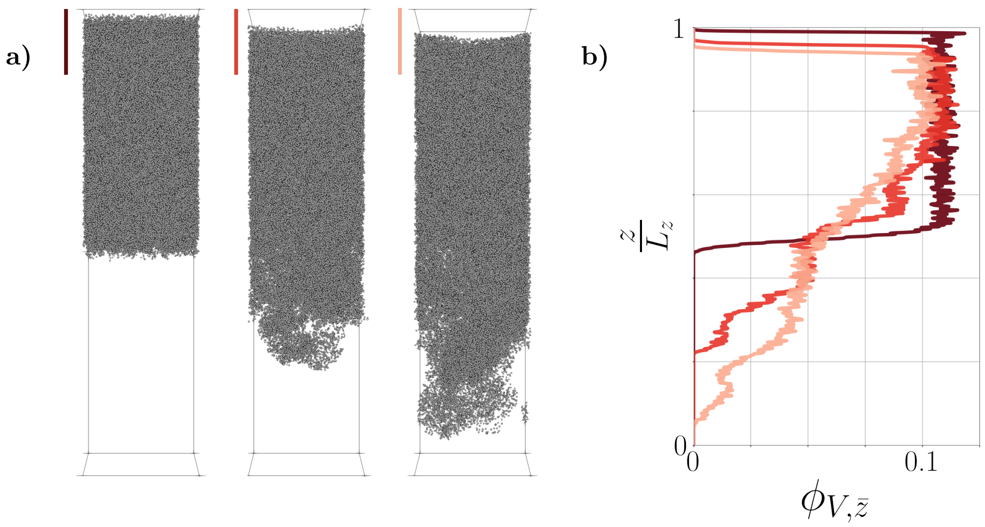

Figure 1: **a)** Time evolution of the inertial particles shown across three selected snapshots and **b)** their corresponding horizontal plane averaged solid volume fraction.

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[1]Boffetta and Mazzino, *Annu. Rev. Fluid Mech.* **49**, 119–143 (2017)
[2]Magnani et al., *J. Fluid Mech.* **926**, A23 (2021)