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# Particle Laden Gravity Currents dynamics in highconcentration regimes

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Particle-laden gravity currents (PLGC) are commonly found in estuaries where rivers discharge suspended matters into the oceans. The dynamics of these stratified flow is largely related to the properties of the suspended particles, such as their geometry, concentration, and particles size. While several studies have focused on low concentration regimes (e.g. [1]), the physical mechanisms controlled by particle size and concentration are largely unknown for volume fraction larger than 2 %.

In order to investigate how the dynamics of PLGC is influenced by particle concentration and particle size in high concentration regimes, we study the impact of different particle sizes ranging from 6µm to 85µm.

The experimental lock-release device is composed of a tilted tank at a controlled angle in which a particle loaded fluid is released on an environment with a controlled density. A particular focus is put on hypopycnal freshwater currents with high concentration suspended particles advancing through a heavier environment. We follow the progress of the current with a high frequency CCD camera. Quantitative data can then be determined using optical methods such as Light Attenuation Technique which is extended to multiphase flows.

Different flow regimes are observed depending on the concentration range and particle size. These regimes highlight the competition between advective transport controlled by density difference and convective sedimentation. Indeed four mechanisms are observed in these regimes, respectively horizontal advection at the surface, sedimentation, advection parallel to the tank bottom, and particle rise of due to buoyancy effects of the surrounding fluid.

References

[1] Bruce R. Sutherland et al. “Particle settling from constant-flux surface gravity currents and a near-stationary particle-bearing layer”. In: Physical Review Fluids 6.6 (June 10, 2021). Publisher: American Physical Society,

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