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Experimental studies on particles settling in low Reynolds number regime

Magdalena M. Mrokowska[1]

[1] Institute of Geophysics Polish Academy of Sciences
Ks. Janusza 64, 01-452 Warsaw, Poland
email: m.mrokowska@igf.edu.pl

ABSTRACT

Preliminary results obtained in a new Hydrodynamic Micromodels Laboratory are presented to demonstrate the objectives of the lab. The focus of laboratory research is the study of fluid dynamics problems present in micro-scale geophysical flows. The main area of research is particle – flow interactions. Presented set-up is a starting point for further studies.

Settling is the mechanism of transport of mineral and organic matter in natural waters, and plays a significant role in biogeochemical cycle. In oceans and lakes, settling of microparticles such as marine snow, plankton, and minerals constitutes a large portion of this transport. Knowledge on settling behaviour of particles, especially settling velocity, is necessary to evaluate the effectiveness and speed of sedimentation processes. Particles present in nature are of a large variety of shapes, both symmetric and asymmetric.

Here, I present experimental set-up and sample results from experiments on a disk falling in quiescent fluid at a terminal velocity. The experiments are conducted in a settling tank with transparent walls. The settling of a particle is recorded using camera with macro lenses. Custom image-processing scripts in MATLAB have been developed to assess the particle 2D morphometry, shape, path, velocity, and settling angles from recorded images. The linear relationship between Reynolds and Archimedes numbers is confirmed for presented measurements, as expected for steady vertical settling regime.