Computational Fluid Dynamics modelling of sedimentation on Mars

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Gravity affects sedimentation of particles suspended in water and gases in two ways: directly by the gravitational force that pulls a particle towards the surface and indirectly by the flow conditions of water or gas around the particles. The latter create a drag which is affected by the settling velocity. Consequently, drag coefficients observed on Earth sand-sized particles cannot be used on Mars because they are likely to overestimate the drag generated by the turbulent flow around the particle on Earth may shift into a more laminar state that generates lower drag. The effect of gravity on settling velocity is not linearly related to particle size, which may affect the sorting of the sand grains deposited from running water. Experiments carried out during parabolic flights at reduced gravity indicate that the potential error in particle settling and sorting is significant, i.e. leading to wrong interpretations of the flow velocities at the time of deposition. This in turn has implications for reconstruction of Martian environmental conditions from rock textures determined from close-up imagery. This study uses computational fluid dynamics (CFD) modelling to independently assess the effect of gravity on sediment settling velocities and sediment sorting. The CFD modelling also offers a wide capability for reconstruction sedimentation on Mars and thus supports the reconstruction of it's environmental past, as well as the search for traces of life.