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# Effect of particle shape and polydispersity on sediment pattern formation

Ramandeep Jain, Silvio Tschisgale, and Jochen Fröhlich
TU Dresden, Institute of fluid mechanics, Mechanical engineering, Dresden, Germany (ramandeep.jain@tu-dresden.de)

In many natural streams, sediment patterns, also known as dunes or simply bedforms, are commonly observed. The rate of sediment transport in such a stream is directly proportional to the celerity of the particle clusters. Additionally, the shape of the dunes greatly influences the behaviour of the surrounding fluid and varies the channel roughness [1,2]. Thus, fundamental understanding of such pattern formation is crucial for many fields of science and engineering. Recently conducted Direct Numerical Simulations (DNS) with resolved particles of the sediment transport has provided many important insights into the complex interaction between the bedforms and the driving turbulent flow [1,2]. However, most of these studies used monodisperse spherical particle to represent the sediment [1,2]. This reduces the numerical efforts but implies simplification of physics. The present study quantifies the effect of particle shape and polydispersity on the dune formation.

Four simulations with different particle shapes (sphere, prolate, oblate, ellipsoid) and one simulation with polymorph particles, i.e. particles of different shapes and sizes mimicking a realistic sample of a beach are carried out. All other parameters such as domain size, fluid and particle properties, bulk Reynolds number, and particle volume fraction are kept constant in all the simulations. The results show that the amplitude and wavelengths associated with the bedforms depend hugely on the particle shape. Case Sphere and Oblate feature only one dune in the computational domain with smallest and highest amplitudes, respectively. Whereas, there are two dunes observed in case of prolate spheroids and three in case of ellipsoids. Case Polymorph is very similar to the case Ellipsoid. In the final presentation, dune conditioned fluid and particle fields of all the cases will be compared.

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[2] A. G. Kidanemariam, M. Uhlmann: Formation of sediment patterns in channel flow: minimal unstable systems and their temporal evolution, Journal of Fluid Mechanics, 818:716-743, 2017