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## The formation of patterns in subaqueous sediment

### Summary:

Under certain circumstances, small undulations in a flat subaqueous sediment bed are observed to be amplified and give rise to regular wavy patterns commonly termed as ripples or dunes. An accurate prediction of the formation and characteristics of the sediment patterns is highly important from an environmental or engineering point of view, but at the same time challenging, due to the complex interaction between the sediment particles and the driving turbulent flow. The aim of my work is to contribute to the understanding of the fundamental mechanisms behind this phenomenon. In this talk, I will present the results of novel direct numerical simulations of pattern formation in a channel flow configuration, in which the mobile sediment bed is represented by a very large number of spherical particles. I will address aspects of the initial bed instability, such as the selection of a critical wavelength, and the subsequent evolution process.

Moreover, I will talk about our simulation strategy to determine a cutoff length for pattern formation below which, a given bed will remain stable. Furthermore, I will present the results of dune-conditioned statistical analysis of the driving turbulent flow and associated particle motion over and inside the evolving sediment bed. Based on such an analysis, we are able, among other aspects, to accurately determine the spatial variation of the bottom boundary shear stress along the fluid-bed interface.