Title MSc project:
Discrete element modelling of the grain size sorting process in wind-driven sediment transport affected by moisture

Assignment number: 08.23	**Internal/external project** internal
Head graduation committee prof.dr. K.M. Wijnberg	**Daily supervision** Xiuqi Wang dr.ir. G.H.P. Campmans
Involved organisations	**Start of the project** Asap

Short description project aim and motive:
Coastal sandy dunes, located at the rear of beaches throughout the world, are important morphological forms that protect the hinterland from flooding. In natural conditions, wind continuously carries the erodible sediment across the beach towards the dunes. In this process, the sediment size is sorted by wind, given the fact that smaller grains are easier to lift off the bed. It is known that moisture can make the grains glue together, potentially limiting the sediment availability for erosion. The vertical grain size sorting process of dry sediment has been studied numerically [1]. But still little is known about the coupled effect of sediment size distribution and moisture on the wind-driven sediment sorting process.

In this project, we want to investigate the vertical sediment sorting process when moisture is present, using a CFD-DEM (Computational fluid dynamics-Discrete element modelling) model developed by Wang. It couples DEM with CFD and includes a liquid bridge model, which can simulate wind-driven sediment transport in diverse situations, such as, varying grain size distribution, moisture content and wind strength (See the figure below). The gained knowledge will be highly helpful for describing the sediment sorting and beach armoring in the supply-limited zone on beach. The model is implemented in the open-source particle simulation tool MercuryDPM [2]. The simulations are ready to go and you will learn how to use the software. If interested, you will have the opportunity to get involved in developing the code.

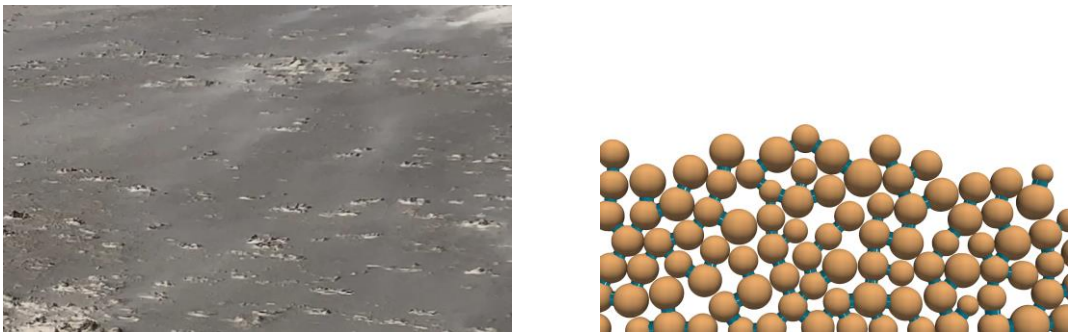

Figure : Left) Aeolian sand streamers across a moist beach surface at Sand Motor, the Netherlands. Right) Sand particle model with liquid in between developed in MercuryDPM [2].

The following aspects are to be investigated:

- The behaviour of the moist particles in transport, e.g., glued together or separated.
- The coupled effect of grain size distribution and moisture on the size selection in unsaturated and saturated transport states.

We are looking for a student enthusiastic about coastal sand dynamics, ideally good at programming

and numerical modelling.

Recommended courses:
Mathematical physics in water systems; Programming in Engineering (C++).

[1] Campmans, G. H. P., & Wijnberg, K. M. (2022). Modelling the vertical grain size sorting process in aeolian sediment transport using the discrete element method. *Aeolian Research*, 57, 100817.
[2] http://www.mercurydpm.org