Title: Offshore tidal bedforms interact with economic activities

Abstract: Shallow tidal seas, like the North Sea, show a variety in bedforms: largest are tidal sand banks and sand waves. Tidal sand banks appear in fields of elongated bed features with crests being tens of kilometres long and spaced about 5 km apart. The crests are located anticlockwise with respect to the tidal currents and their migration is minimal. Sand waves are smaller, spaced hundreds of metres apart, oriented perpendicular to the main tidal currents and moving up to tens of meters yearly. These features are both generated due to time-averaged tidal flow sediment interaction, in which the generation of sand waves is accompanied with vertical flow patterns and tidal sand waves with horizontal circulations. Such bedforms are also present in several Asian waters, like South Yellow Sea, Northern South China Sea and Bisanseto channel in Japan.

Due to economic activities, the offshore bed is increasingly used for sand mining, navigation channel deepening, offshore wind farm locations and positioning of telecommunication and pipelines. As the spatial and temporal scales of the interactions are similar to sand banks and sand waves, interaction in bed evolution is anticipated. Herein, more knowledge on such combined evolution can help designing more sustainable interventions.

Over the past years, much progress has been realised in modelling tidal sand banks and sand waves. Herein, often mathematical-physical techniques are applied in order to gain more understanding of the mechanisms behind evolution and migration. Such knowledge is also used in the predictive modelling using engineering models like Delft3D. In both modelling approaches the contributions of sediment types (cohesive and non-cohesive, fixed layers) and hydrodynamics (tides, waves) will be addressed. Also, the sea bed evolution of sand waves and/or sand bank patterns with large-scale sand mining, windfarms and pipeline trenching will be shown.