An integrated data-model hub for the North Sea: Towards automated seabed level predictions

The North Sea is under continuously growing pressure of multiple users and with limited carrying capacity. It fulfils various functions in the domains of shipping, ecology, sand mining, fishing, oil & gas, recreation, aquaculture, energy, etc. Nowadays, offshore wind developments are very prominent and embedded in between the existing functions of the North Sea (Figure 1). In the future, offshore developments may also include energy hubs, floating solar, artificial reefs, autonomous and emission-free dredging and survey activities, etc.

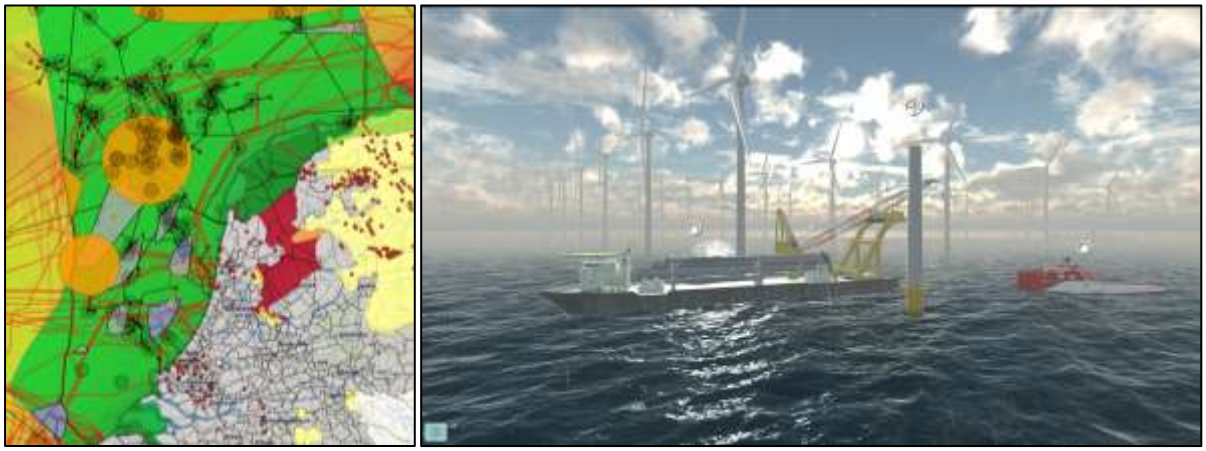

Figure 1 Digital Twin (left) and Virtual Twin (right) for the North Sea, as developed with DigiShape platform partners.

Many critical components of offshore developments such as wind turbine monopiles, bed protection, export and inter-array cables, jackets, offshore platforms, pipelines and other features rely upon the ambient seabed for their support or burial. Therefore, seabed levels are typically a crucial design parameter. However, seabed levels can be very dynamic (i.e. changing over time), posing a threat to the integrity and/or the support or burial of critical components (see Figure 2). Dynamic future seabed levels therefore demand to be quantified over the lifetime of offshore developments, in order to reduce risks and optimize designs, operations and maintenance.

Figure 2 Examples of critical features susceptible to bed level change: offshore wind developments (left) and export cable (right)

The prediction of future seabed levels over several decades is however not a straightforward task. Future seabed levels may be influenced by a very large number of physical processes such as sand wave dynamics, soil liquefaction, storm erosion, large-scale gradients in sediment transport, etc. However, practical experience exists on a project to project basis. This has resulted in various data-driven techniques, as well as the first state-of-the-art numerical modelling applications (Figure 3).

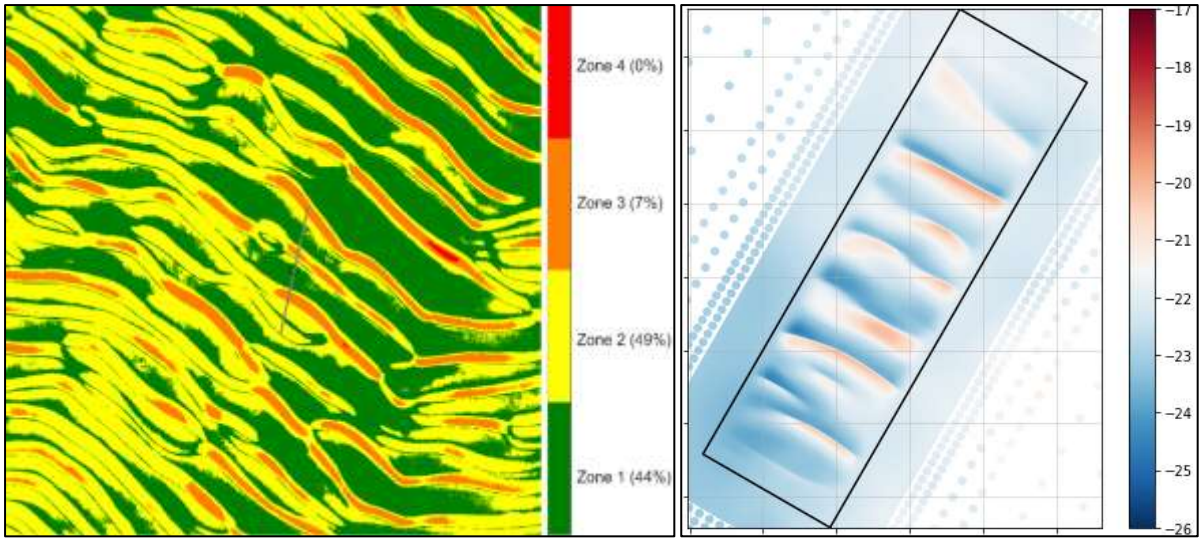

Figure 3 State-of-the-art data-driven techniques (left) and numerical modelling (right) to predict sand wave dynamics

We are ready to take the next step with data-driven and machine learning techniques, as well as state-of-the-art numerical modelling applications. Therefore, we propose to develop an integrated data-model hub in which different stakeholders share data, automate state-of-the-art operational data-driven techniques, while coupling to numerical models, to be able to quantify effects on human interventions. The hub will be used as an online exchange platform, with the ultimate aim to provide future seabed level predictions for the entire North Sea that autonomously improves as more information is available and (anonymously) shared. This will lead to cost savings in designs, reductions of risks, optimized O&M contracts, and a smoother certification process.