EGU22-6349
https://doi.org/10.5194/egusphere-egu22-6349
EGU General Assembly 2022

Flow changes in the wake of a large sediment wave: helping to understand geological and ecological impacts of seabed infrastructure.

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During this pivotal time of energy transition, it is of crucial importance to unlock the potential of the seabed for offshore energy conversion and electrical power transport. With the construction of ever larger offshore windfarms plus other coastal infrastructure, a better understanding of the interactions between the infrastructure and the flow, the flow and the seabed, and all the above with marine life has never been more pressing, as they define feasibility and sustainability of the offshore projects.

To better understand the dynamics of the flow in the wake of a large object, the School of Ocean Sciences at Bangor University deployed a bed frame with an Acoustic Doppler Current profiler in the wake of a 10 m-high and steep-crested sediment wave on a seabed 60 meters deep. Vessel-mounted ADCP data was collected simultaneously in orthogonal transects. Velocity profiles near the seabed diverge from the standard law of the wall. On the flood tides, when the flow interacted with the large bedform, increased turbulence in the water column vertically mixed the suspended sediments (measured via the ADCP) into a vertically uniform suspension. On the ebb tides, without any interactions with the bedform, the backscatter shows a boundary layer bursting structure.

The enhanced turbulence can affect the sediment composition and bed mobility in these large wakes whether they are natural or anthropogenic, and to numerically model these effects is complex. We discuss the wider impacts of this work, as changes to sediment, seabed and water column properties can affect aggregations of prey that crucially depend on it. These changes can then extend through the food chain and contribute to the ecological impacts of windfarms, both as risks and as opportunities.