A spatiotemporal analysis of seabed morphodynamics in a constrained flow environment: A case study of an open tunnel valley in the Western Irish Sea

Muireann Walsh<sup>1</sup>, Shauna Creane<sup>2</sup>, Katrien Van Landeghem<sup>3</sup>, Jennifer Keenahan<sup>2,4</sup>, and Mark Coughlan<sup>1,4</sup>

<sup>1</sup>University College Dublin, School of Earth Sciences, Dublin, Ireland (Muireann.walsh2@ucdconnect.ie), <sup>2</sup>University College Dublin, School of Civil Engineering, Dublin, Ireland, <sup>3</sup>Bangor University, School of Ocean Sciences, Bangor, Wales, <sup>4</sup>Research Ireland Centre for Applied Geosciences (iCRAG), University College Dublin, Dublin, Ireland.

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## 1. Research background and area overview

A comprehensive understanding of sediment transport at different spatial scales is needed for sustainable marine spatial planning, as it can have a role in coastal management<sup>1</sup>, marine habitat management<sup>2</sup> and de-risking offshore renewable energy<sup>3</sup>.

Recent work has shown complex sediment transport pathways in the Western Irish Sea (WIS; Figure 1), with particular emphasis on sediment exchange between sediment banks and sediment wave assemblages<sup>4,5,6,7,8</sup>. In the region, Wicklow Trough<sup>9</sup> (WT) is an open tunnel valley (OTV) forming a prominent bathymetric low, potentially supplying sediment to a sediment bank (Arklow Bank)<sup>7,8</sup>.

## 3. Preliminary results and discussion

Temporal studies (Figure 2.C., Figure 3.) indicate that trochoidal sediment waves in the WT, previously identified as immobile bedforms<sup>13</sup>, display migration under modern hydrodynamic conditions. This begs the question "does the WT act as a conduit, significantly enhancing hydrodynamic flow leading to an increase in local sediment mobilisation and transport?". As OTVs occur in different continental shelf settings<sup>14,15,16</sup>, it emphasises the need to gain a better insight into their local seabed morphodynamic behaviour to understand their importance in regional STSs and support marine spatial planning.

To support the research aims, a future offshore survey will provide up-to-date data for a MIKE 21 and 3 hydrodynamic and sediment transport model. Expected model outputs will include an understanding of bed level change, current behaviour and bed shear stresses



2005), ISMA<sup>18</sup>

(Data

collected:

## 2. Research motivation and aims

Different aspects of the seabed morphodynamics within OTVs have been researched<sup>10,11,12</sup>, however, there is an absence of understanding of their role as part of wider, sub-regional sediment transport systems (STSs).

The aims of this research are divided across two scales, specifically:

- **Local scale (Figure 2):** Determine a sediment budget for the WT, which includes locating sediment source and sink pathways, estimating the net loss and gain of sediment at these localities, and understanding temporal fluctuations in the budget.
- Sub-regional scale (Figure 1): Apply an understanding of the sediment budget to the sub-regional STSs.



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Hypothesis from Figure 2.C. and Figure 3:

Over a 16 year period, the SW assemblage has undergone net

sediment deposition and has become more populated with