Sophie L. Ward[1], Peter Robins[1], Gerallt Llewelyn Jones[2]
1. School of Ocean Sciences, Bangor University, Menai Bridge, LL59 5AB
2. Menter Môn, Anglesey

UNDEB EWROPEAIDD EUROPEAN UNION
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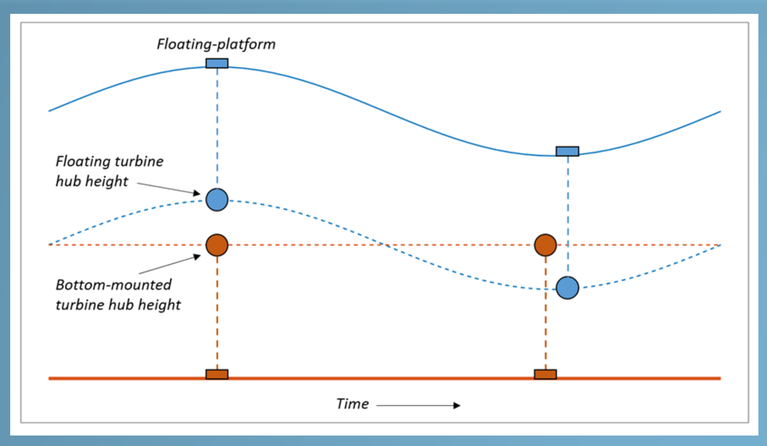
SEACAMS2:

Tidal stream resource characterisation: progressive vs standing wave systems

AIMS: Tidal energy assessment of the Morlais Tidal Demonstration Zone, with a novel focus on floating tidal stream energy converters

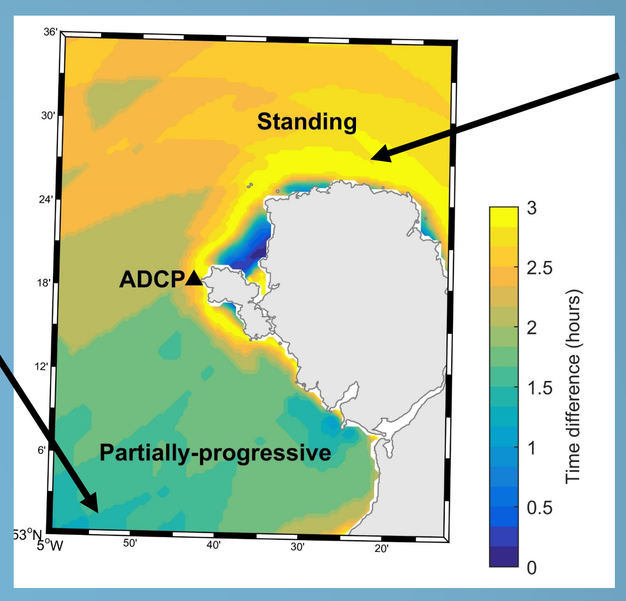
RATIONALE:

The tidal stream resource varies considerably around the Welsh coast: in this project we consider how varying tidal dynamics can result in power-asymmetry, and how this effect differs between bottom-mounted (i.e. fixed height) vs floating (i.e. depth-varying) tidal energy devices. Device designers and tidal stream energy developers need to consider the variability of the resource with water depth, and how this varies depending on the difference in timing between high/low water and peak speeds.



Schematic showing different configurations of floating-platform (blue) and bottom-mounted (red) turbines in the water column.

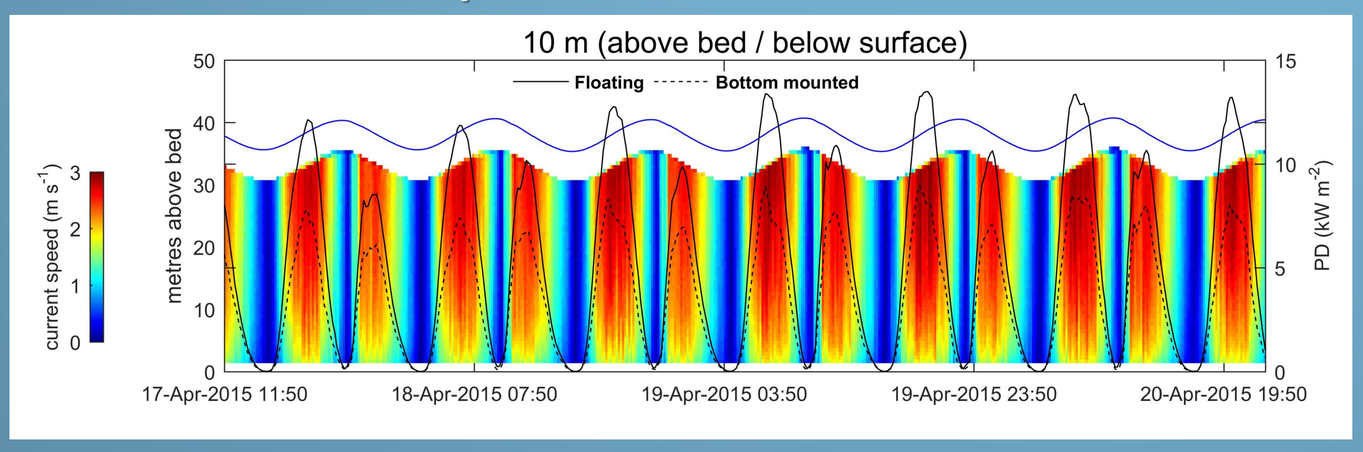
Progressive wave system:
Maximum flow asymmetry and hence power asymmetry. Effect is exacerbated for floating devices.



Standing wave system:
Flow asymmetry is minimised. Neither floating nor fixed technologies favoured.

METHODS:

- **High resolution 3-D tidal modelling of the North Wales coast, using the Regional Ocean Modelling System (ROMS). Calculation of the nature of the tidal wave in the region, by considering the time difference (in hours) between high water and the closest peak current flow**



Time series of observed tidal current speeds and elevations during spring tides at the ADCP location – with calculations for Power Density from fixed vs floating tidal stream devices, at 10 m above bed / below surface

- **Evaluation of how tidal current speeds (and hence power density) differ in the Morlais Tidal Demonstration Zone, depending on whether a device is bottom-mounted or floating - the latter experiences a depth-varying hub height.**

OUTCOME:

Greater tidal current asymmetry, and hence power asymmetry, is observed in progressive wave systems than in standing wave systems. It is hypothesised that such power asymmetry found to have more of an affect on floating tidal devices, where the depth of an assumed turbine tracks the sea surface.

Contact: Sophie Ward
Email sophie.ward@bangor.ac.uk
Tel 01248 383 978

PRIFYSGOL BANGOR UNIVERSITY