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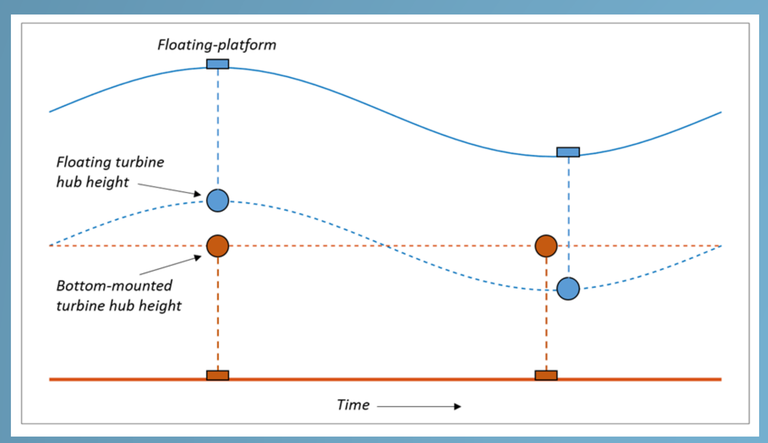
SEACAMS2:

Considering vertical variability in the tidal stream resource: a headland case study

AIMS: Using a high resolution tidal model and observational data to consider vertical variations in the tidal stream resource, and how it might vary with different device technologies

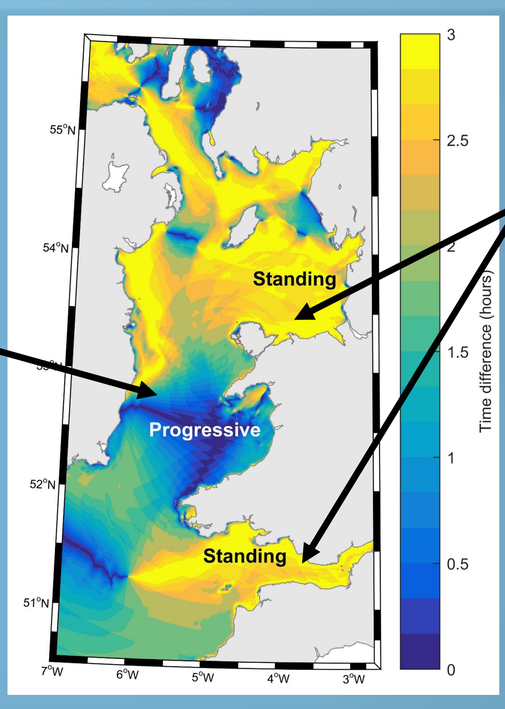
RATIONALE:

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 Pembrokeshire, 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**
- **Collection of tidal current data using an Acoustic Doppler Current Profiler, to validate the model and make theoretical power density calculations for various tidal stream devices**
- **Evaluation of how tidal current speeds (and hence power density) differ around Strumble Head depending on whether a device is bottom-mounted or floating, where 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.

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