

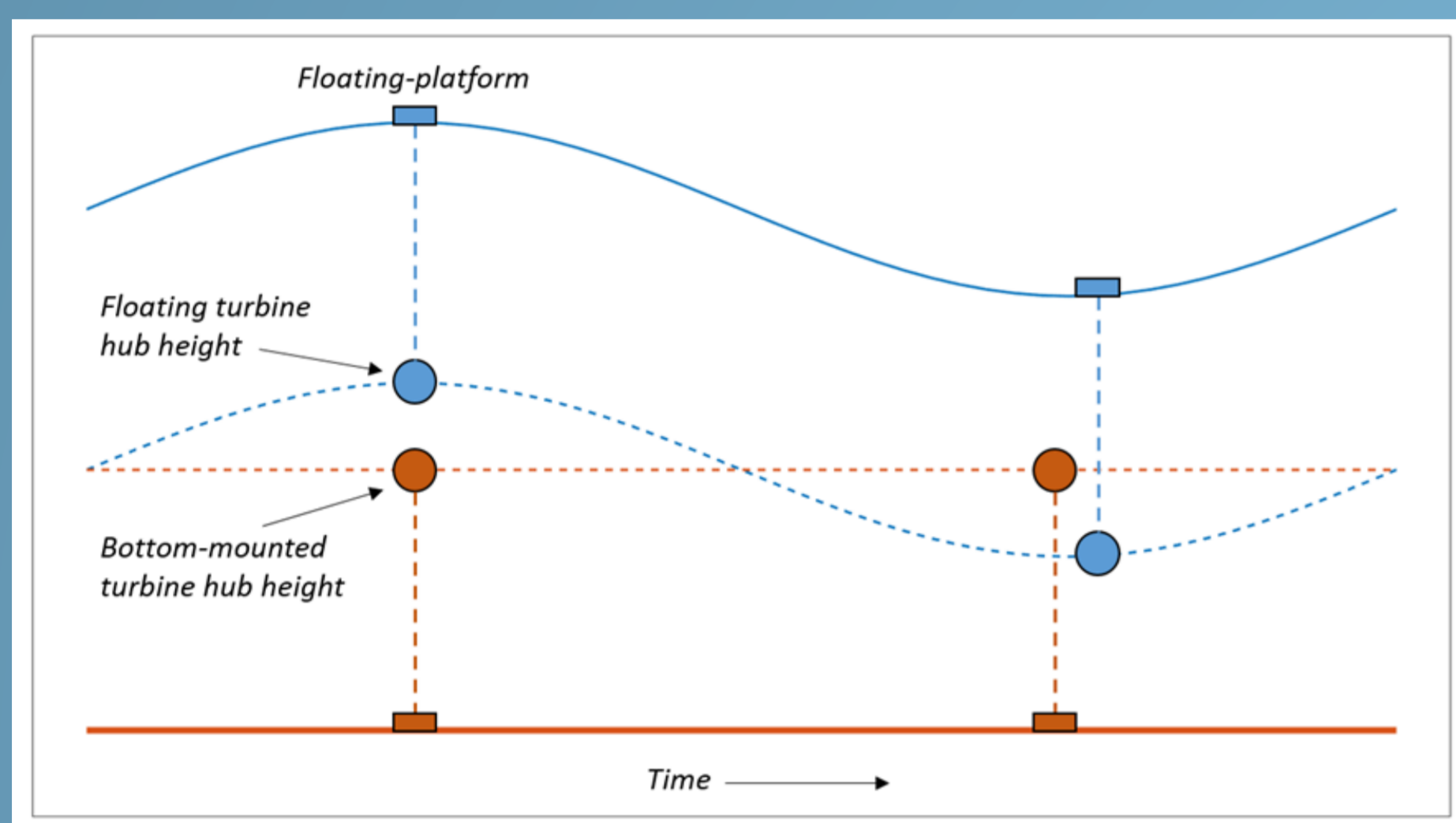
SEACAMS2:

Tidal stream resource characterisation: progressive vs standing wave systems

AIMS: To assess the influence on potential extractable tidal stream energy, and tidal energy device suitability, of contrasting progressive and standing tidal wave systems.

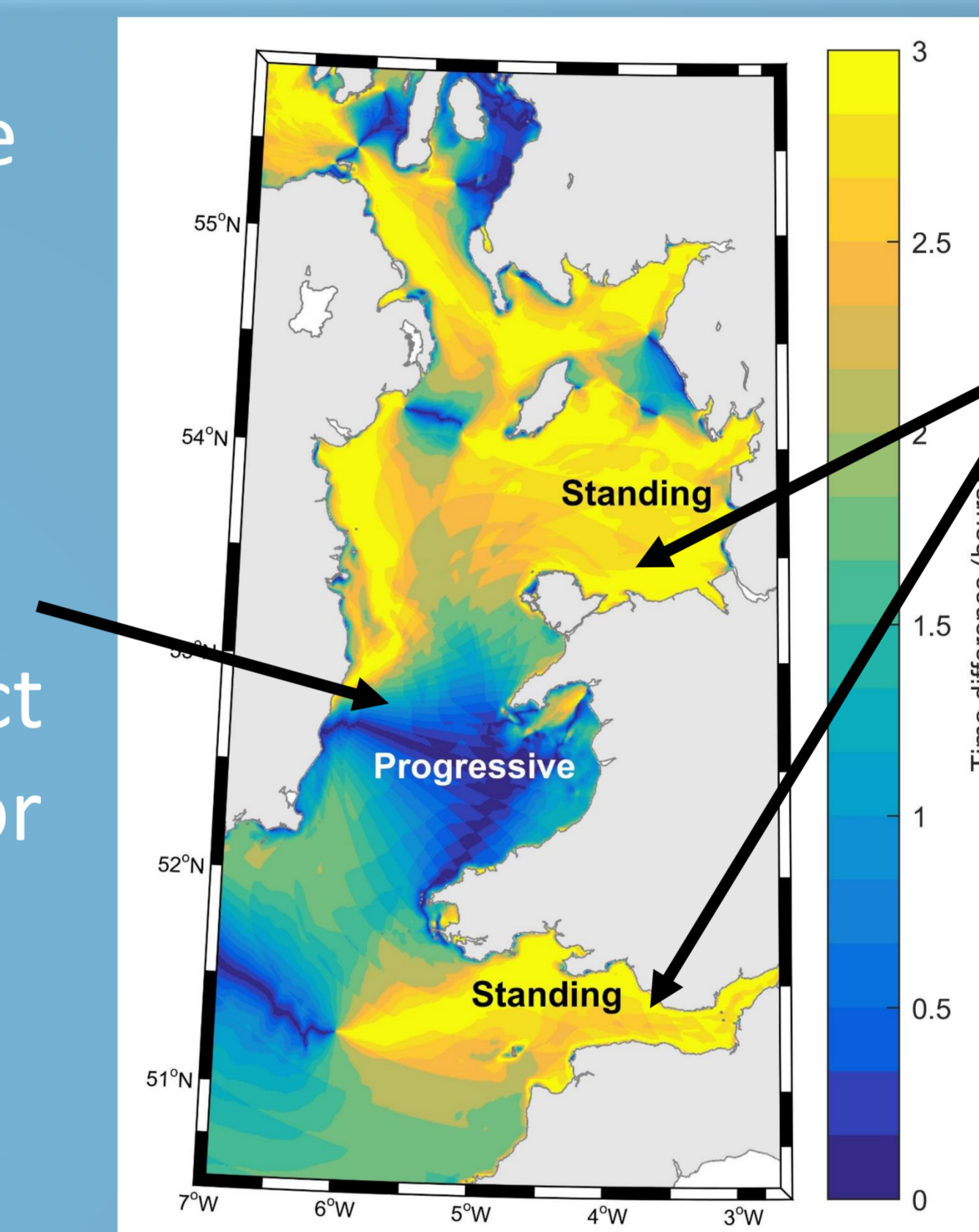
RATIONALE:

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 using the Regional Ocean Modelling System (ROMS)
- Calculation of the nature of the tidal wave, by considering the time difference (in hours) between high water and the closest peak current flow: definition of regions as standing, progressive, or partially-progressive tidal wave systems.
- Evaluation of how tidal current speeds (and hence power density) differ at specific locations 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, was observed in progressive wave systems than in standing wave systems. Such power asymmetry was found to have more of an affect on floating tidal devices, where the depth of an assumed turbine tracks the sea surface.

Progressive wave systems tended to favour bottom-mounted devices, whereas standing wave systems, where flow asymmetry is minimised, did not particularly favour either technology.

