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Characterising the spatial variability of the tidal stream energy resource from floating turbines

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The shelf seas, in particular the northwest European shelf seas surrounding the UK, contain significant tidal power potential. Tidal stream energy is both predictable and reliable providing that sites are well-selected based upon the hydrodynamic regime and the device specifics. In this high resolution three-dimensional tidal modelling study, we investigate how the tidal stream resource around the Welsh coast (UK) varies with water depth and location, with particular focus on the Pembrokeshire region. The potential extractable energy for a floating tidal stream energy converter is compared with that for a bottom-fixed device, highlighting the need to vary the resource characterisation criteria based on device specifics. We demonstrate how small variations in the tidal current speeds – with hub depth or due to tidal asymmetry - can lead to substantial variations in potential power output. Further, the results indicate that power generation from floating tidal energy converters will be more significantly influenced by tidal elevations in regions characterised by a lower tidal range (more progressive waves) than regions that experience a high tidal range (standing waves). As numerical modelling capacity improves and tidal stream energy converter technologies develop, ongoing improved quantification of the tidal resource is needed, as well as consideration of the possible feedbacks of the devices and energy extraction on the hydrodynamic regime and the surrounding area.