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An interactive online tool (PALTIDE) for sea level and ocean model simulations of the northwest European shelf seas since the Last Glacial Maximum

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Introduction

Climate data and numerical model simulations are often available in the published literature, but the data can be difficult to extract. To overcome the intractability of such data we have developed 'PALTIDE', a novel online visualisation tool. **Our new, novel 'PALTIDE' tool enables users to interrogate, download and visualise relative sea level and palaeotidal data for any location on the northwest European continental shelf for the period since the Last Glacial Maximum (LGM, the past 21,000 years).**



During the Last Glacial Maximum (LGM), global eustatic mean sea levels were ~130 meters lower than present, as major ice sheets such as those over North America, Fennoscandia and the British Isles pushed down the land beneath them. With the melting of these ice sheets, the solid earth rebounded - a process known as glacial isostatic adjustment (GIA) - which modified the pattern of sea-level change resulting from the addition of meltwater to the oceans. Relative sea level (RSL) change is the alteration in ocean height relative to land, impacting ocean dynamics, especially in shelf seas such as the northwest European shelf seas, which have expanded significantly since the LGM.

RSL predictions, GIA simulations, and palaeotidal models are available in published literature and data repositories, but accessing specific data can be challenging, often necessitating requests from corresponding authors.

Access the PALTIDE tool

PALTIDE, freely available online, simplifies access by letting users visualize and analyse datasets directly.

 <https://shiny.bangor.ac.uk/paleotidal/>



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Development of PALTIDE

This interactive visualization tool covers the northwest European continental shelf from the Last Glacial Maximum (LGM) to the present, utilizing GIA simulations from Bradley et al. (2011) and hydrodynamic simulations from Ward et al. (2016).



Developed in R, it uses packages like shiny and bslib for the frontend and arrow, raster, and tidyverse for backend data processing. Users can visualize and download RSL, tidal amplitude, and tide-dependent parameters for any location within the model domain across 1000-year timesteps from the LGM to the present.

Explore PALTIDE: interactive, engaging, freely-available

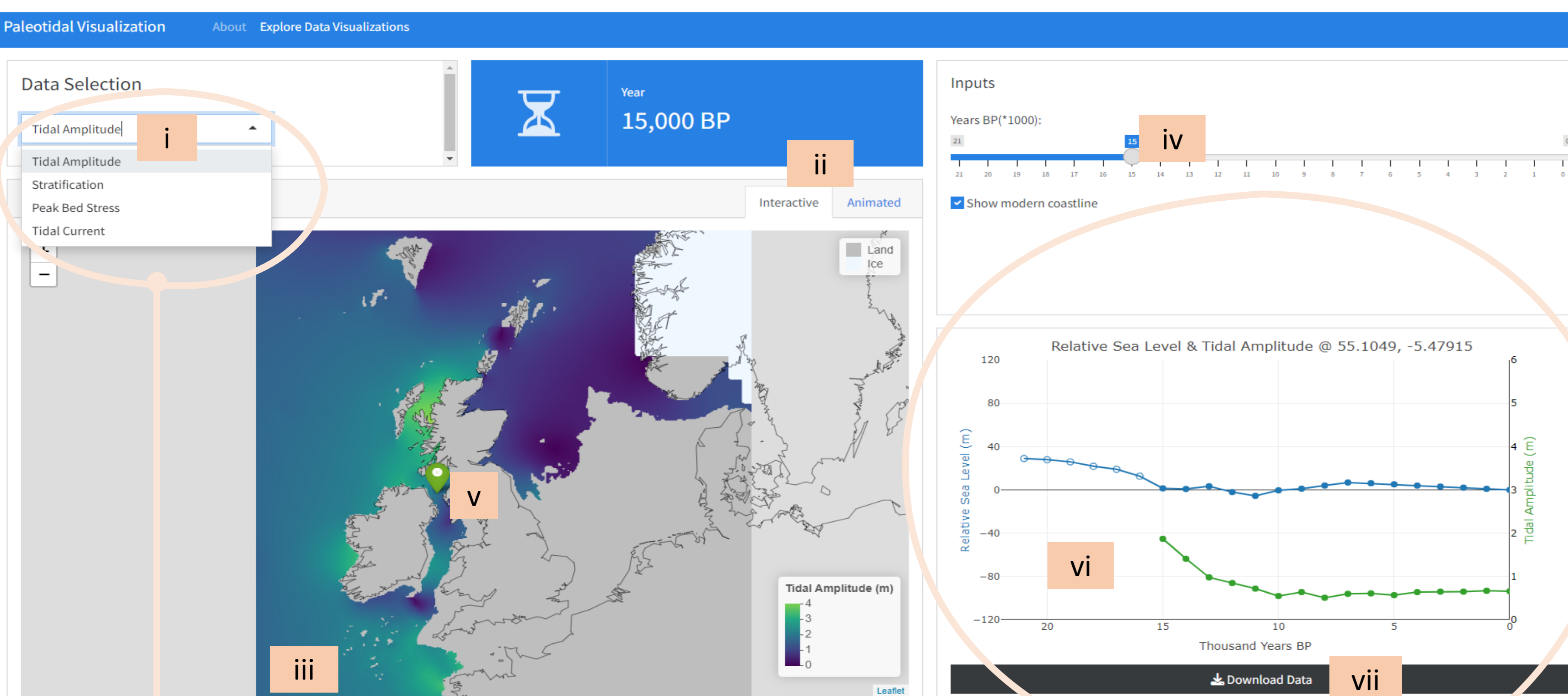


Figure 1. Data visualisations page showing (i) choice of model variable to load and (ii) option to explore the map or load an animation of the selected variable. While on the interactive maps (iii) are further user-defined options including (iv) simulation timeslice to load and view. For any user-defined point (v) within the map, the timeseries data for RSL and tidal elevation amplitude is plotted for that location (vi). Data download is also available (vii).

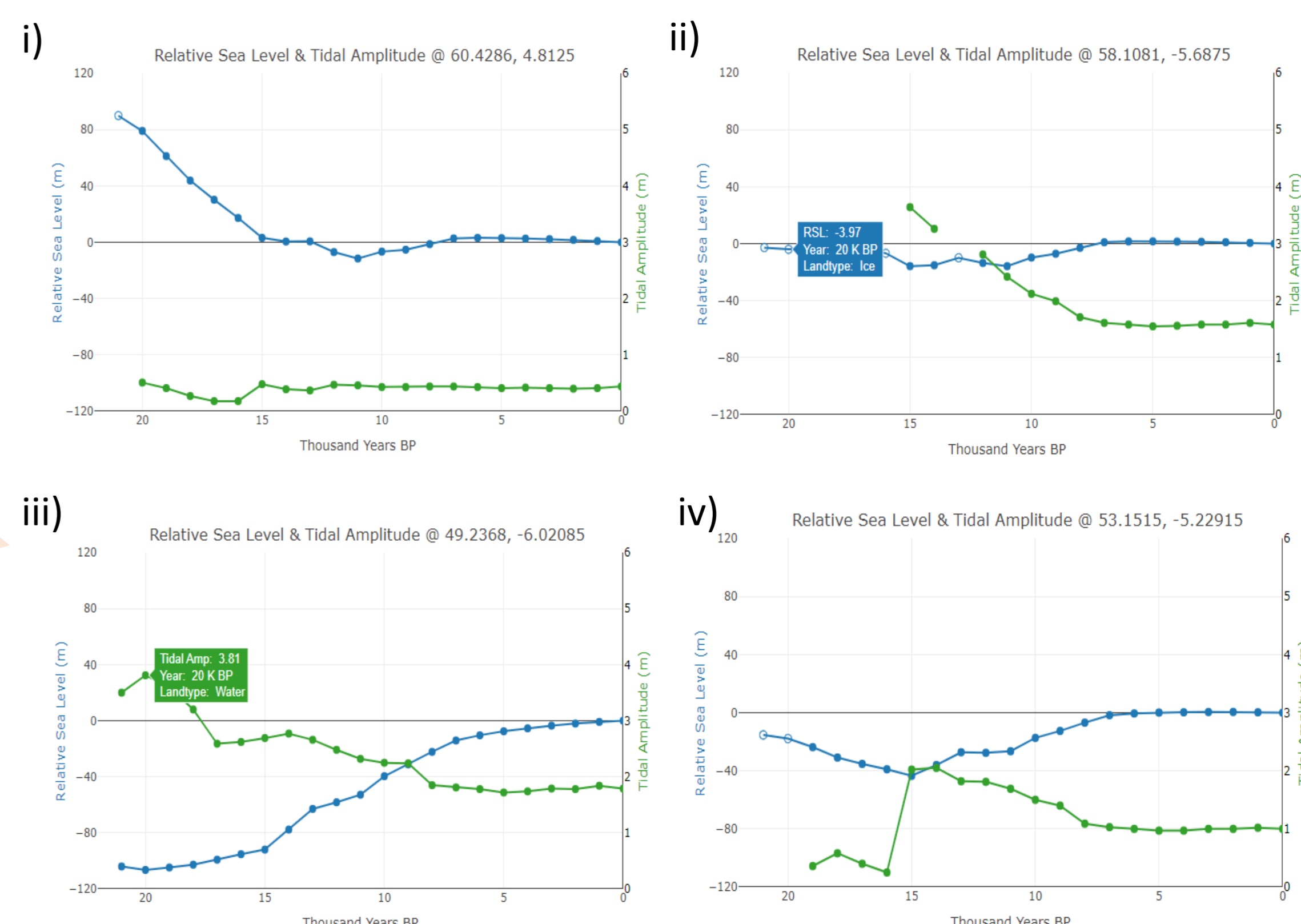


Figure 2. Example plots of changes in RSL (left y-axes, blue lines) and tidal elevation amplitudes (right y-axes, green lines) with time (x-axes). The approximate point locations (i-iv) for which these data are plotted are given in Figure 3a.

Who is PALTIDE for?

In addition to being a valuable source of data for scientific research, PALTIDE is a powerful tool for use in science outreach and engagement endeavours, raising awareness of climate-related issues such as sea-level rise through easily accessible and striking visualisations. The tool will be updated as new simulations become available.

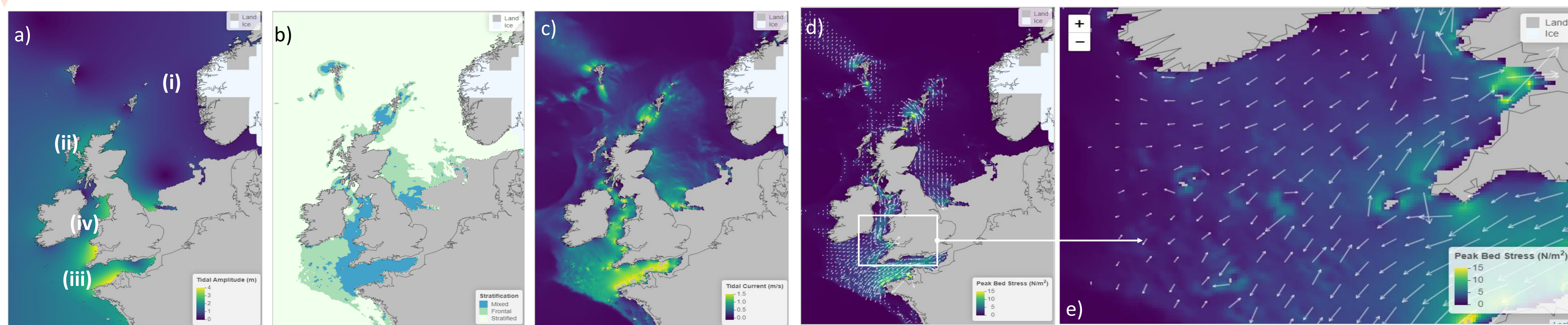
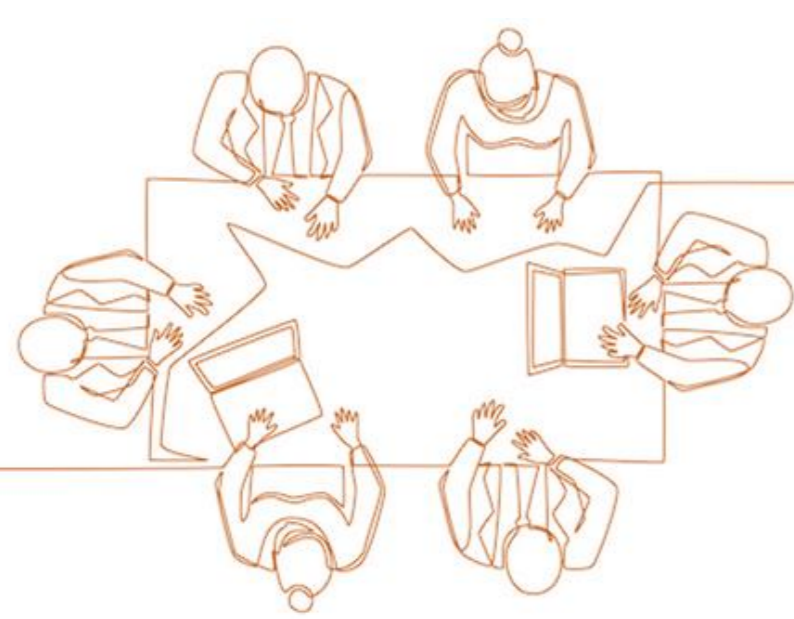
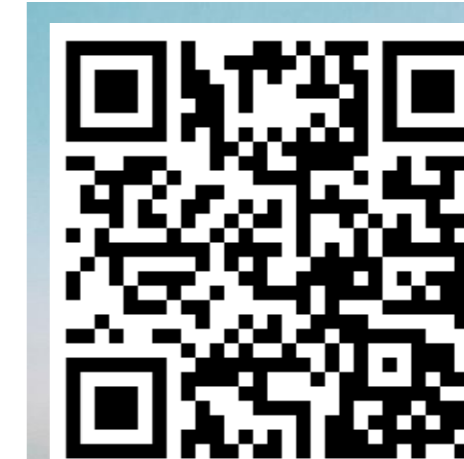


Figure 3. Example 2-dimensional raster plots (maps) for 10,000 years ago a) tidal elevation amplitude, b) seasonal stratification, c) tidal current speeds and d) bed shear stress speed (colour-scale) and direction (white vector arrows). e) A zoomed-in illustration of the bed shear stress vectors, for the area indicated by the white bounding box in panel d).

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References

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The Convex Seascape Survey is a 5-year programme (2022-2027), developed by project partners, University of Exeter, Blue Marine Foundation and Convex Group Ltd. The Survey will provide open-access data on the world's shelf seabed carbon stores.