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Modelling potential changes in marine biogeochemistry due to large-scale offshore tidal energy extraction

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Tidal power generation through submerged turbine-type devices is in an advanced stage of testing, and large-scale applications are being planned in areas with high tidal current speeds. The potential impact of such large-scale applications on the hydrography can be investigated using hydrodynamical models. In addition, aspects of the potential impact on the marine ecosystem can be studied using biogeochemical models. In this study, the coupled hydrodynamics-biogeochemistry model GETM-ERSEM is used in a shelf-wide application to investigate the potential impact of large-scale tidal power generation in the Pentland Firth. A scenario representing the currently licensed power extraction suggested i) an average reduction in M2 tidal current velocities of several cm/s within the Pentland Firth, ii) changes in the residual circulation of several mm/s in the vicinity of the Pentland Firth, iii) an increase in M2 tidal amplitude of up to 1 cm to the west of the Pentland Firth, and iv) a reduction of several mm in M2 tidal amplitude along the east coast of the UK. A second scenario representing 10 times the currently licensed power extraction resulted in changes that were approximately 10 times as large. Simulations including the biogeochemistry model for these scenarios are currently in preparation, and first results will be presented at the the conference, aiming at impacts on primary production and benthic production.