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## Effects on hydrodynamics and ecological costs of climate change and tidal stream energy extraction in a shelf sea

Michela De Dominicis<sup>1</sup>, Judith Wolf<sup>1</sup>, Dina Sadykova<sup>2,3</sup>, Beth Scott<sup>2</sup>, Alexander Sadykov<sup>2,3</sup>, and Rory O'Hara Murray<sup>4</sup>

<sup>1</sup>National Oceanography Centre, Liverpool, UK (micdom@noc.ac.uk)

<sup>2</sup>Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen, UK

<sup>3</sup>School of Biological Sciences, Queen's University Belfast, Belfast, UK

<sup>4</sup>Marine Scotland Science, Aberdeen, UK

The aim of this work is to analyse the potential impacts of tidal energy extraction on the marine environment. We wanted to put them in the broader context of the possibly greater and global ecological threat of climate change. Here, we present how very large (hypothetical) tidal stream arrays and a "business as usual" future climate scenario can change the hydrodynamics of a seasonally stratified shelf sea, and consequently modify ecosystem habitats and animals' behaviour.

The Scottish Shelf Model, an unstructured grid three-dimensional ocean model, has been used to reproduce the present and the future state of the NW European continental shelf. While the marine biogeochemical model ERSEM (European Regional Seas Ecosystem Model) has been used to describe the corresponding biogeochemical conditions. Four scenarios have been modelled: present conditions and projected future climate in 2050, each with and without very large scale tidal stream arrays in Scottish Waters (UK). This allows us to evaluate the potential effect of climate change and large scale energy extraction on the hydrodynamics and biogeochemistry. We found that climate change and tidal energy extraction both act in the same direction, in terms of increasing stratification due to warming and reduced mixing, however, the effect of climate change is ten times larger. Additionally, the ecological costs and benefits of these contrasting pressures on mobile predator and prey marine species are evaluated using ecological statistical models.

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