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Energy

Numerical modelling of the response of the tidal resource to barrage developments

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Introduction

Various barrage proposals for the exploitation of tidal energy are currently receiving significant attention, with major developments now underway globally. In the UK, proposals for the Severn estuary are the subject of keen political interest and popular debate [1].

Exploitation of the rise and fall of tides has been ongoing for hundreds of years [2]. In more recent times, large scale tidal barrage projects for energy generation have been proposed around the world in sites of extreme tidal range, and various prototype tests have been conducted in France (figure 1) and Canada (figure 2).

Fig 1: La Rance tidal barrage, France (240 MW)

Fig 2: Annapolis Royal tidal barrage, Canada (20 MW)

Tidal energy is becoming an increasingly viable option within the field of renewable energy due to its reliability, predictability and the size of the resource. Government commitments to reducing carbon emissions, increasing energy demand and an uncertain security of supply of more traditional energy sources ensure that tidal energy is viewed as a feasible alternative.

Although tidal barrages are a secure and predictable source of energy, they are currently a highly controversial option. Thigh capital cost, lengthy construction times and environmental implications ensure that public, scientific and political opinions are divided leading to delays in device development.

Research Agenda

This project focuses on applying the latest tools, techniques and understanding to the Severn barrage question.

The history of tidal barrage development for energy production amply demonstrates the need to conduct extremely thorough analysis of the potential impact of development on the hydrodynamic resource and hence ecosystem dynamics. Given the apparent government interest in the Severn barrage proposal, it is timely that analysis of the potential impact is based on state-of-the-art analysis and interpretation. Even the most recent studies rely on numerical modelling output from 30 years ago.

Important aims include to:

• Determine the feedback of various barrage placement and operational modes on the underlying tidal hydrodynamics.

• Examine the impact of altered tidal hydrodynamics on water quality and ecosystem dynamics, and potential for flood protection.

The ROMS numerical model [3] will be the workhorse analysis tool adopted for this investigation (see figure 3).

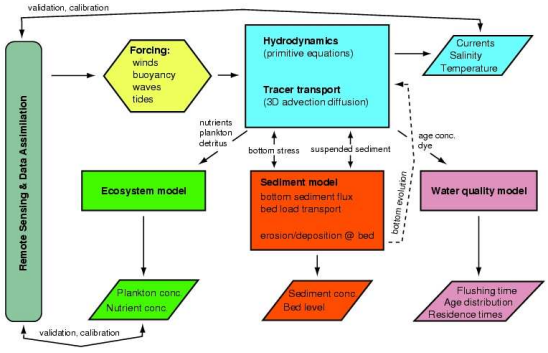

Fig 3: Architecture and interactions of the 'community-based' ROMS numerical model platform

References

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3. Shchepetkin, A.F. & McWilliams, J.C. (2005). "The regional oceanic modeling system (ROMS): a split-explicit, free-surface, topography-following-coordinate oceanic model", *Ocean Modelling*, **9** pp. 347-404.

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