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Abstract: Various numerical methods such as CFD, BEM and RANS models have been used to study the interaction between tidal turbines and the tidal flow, and to investigate the performance of the tidal turbines. However, most of these studies consider idealised cases that cannot easily be translated to unsteady and non-uniform flow through a real channel [1]. Coastal tidal models provide an efficient and comprehensive approach to simulate tidal stream arrays in more realistic conditions. On the other hand, most of the studies which adopt this approach rely on 2D depth-averaged simulations to assess the performance of different tidal array layouts. 2D models ignore the effects of the turbine's vertical position in the water column and the close proximity to the seabed or the surface on the overall performance. Contrary to 2D models, 3D models can better represent the various technologies and provide a more robust tool to assess tidal array performance.

Tidal turbines are represented in the TELEMAC-2D as a drag force (similar to increasing the seabed friction) using DRAGFO subroutine. The drag force is applied as a friction stress spread out over an area representing the turbine. This area is defined as the sum of the area of the nodes inside the turbine envelope [2]. Building on this approached, we developed a code to capture the effects of the drag force, which is exerted by the turbines on the flow, and apply it as a head loss in TELEMAC-3D. This stress is treated as a source term in the shallow water equations.

This paper describes the modelling approach of tidal turbines in TELEMAC-3D using SOURCE subroutine. Implementation of this approach will be assessed against a real measurements downstream Alstom DG4 tidal turbine, which was deployed in Fall of Warness, Orkney as part of ReDAPT project.

Proposed session: Waves, tidal renewable and hydro power energy assessment
Key words: TELEMAC-3D, Tidal turbines, Tidal energy assessment
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