

## Background to model development

This project was commissioned to study at the national level the interactions between tidal turbine arrays and tidal barrages and to investigate cumulative and in combination effects of both tidal stream / turbine and tidal lagoon / barrage technologies. Both technologies are under active consideration in the UK and the cumulative impacts of build out of different scenarios in decades up to 2050 were considered in detail for their far-field and near-field effects. The ETI commissioned a project team led by Black & Veatch and supported by HR Wallingford and University of Edinburgh to undertake the tidal resource modelling, which was concluded in late 2012. The SMARTtide suite of models consists of three separate models which have different uses according to technology choice and project life cycle stage:

**Coarse Continental Shelf Model (CCSM)**  
for high level review and evaluation of tidal schemes

**Detailed Continental Shelf Model (DCSM)**  
for a feasibility assessment of project development

**Bristol Channel Detailed Tidal Range Model (DTRM)**  
for assessment of tidal barrage and lagoon schemes in the Severn Estuary

## SMARTtide modelling approach

### The software used

The SMARTtide suite of models is based on the open source, industry driven, TELEMAC system. It's 2D hydrodynamic module, TELEMAC-2D, solves the depth-averaged shallow water equations, also called the St Venant equations within finite element framework.

### Model Structure

Coarse and detailed resolution versions of a Continental Shelf Model of Northern European waters (CCSM and DCSM respectively, CSM generically) were developed. The Coarse resolution of the CCSM: 1 km at the coastline, on islands and locations of selected tidal range and tidal current energy schemes. The total number of elements is in excess of 300,000. The Detailed resolution of the DCSM starts from 200 m at the coastline, on islands and energy scheme sites. The total number of elements is in excess of 3,000,000. The model chosen for any individual assessment will depend on chosen technology and whether site selection has been completed, or not.

### Data sources

- > UK Tidal Gauge Network (British Oceanographic Data Centre)
- > TPXO's European Shelf subset model (Oregon State University, USA)
- > XTIDE database (created by David Flater, distributed open source GPLv3)
- > The bathymetry in the SMARTtide models was developed from processed Admiralty Chart data provided by SeaZone, HR Wallingford Ltd
- > T-TIDE (University of BC, Canada and IOS, Canada)

## Innovation

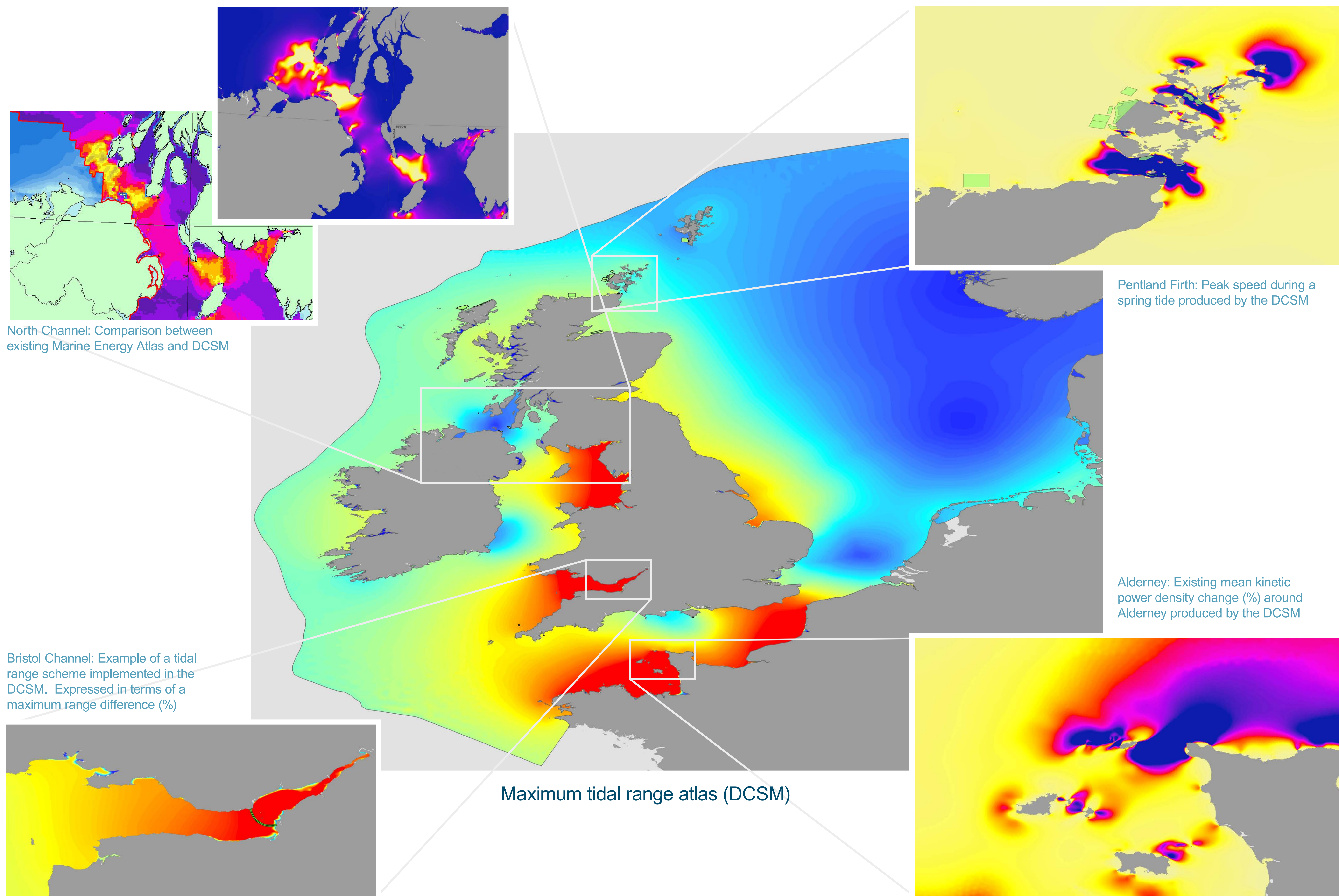
- > The model covers the entire UK and NW European Continental Shelf at a higher resolution than the current reference data set. The results are highly credible due to the fine resolution of the model
- > The model is dynamic allowing users to specify their own tidal energy schemes and to enable the industry to investigate interactions with other planned schemes. Use of common model parameters allows the generation of robust comparisons.
- > The model is accessible to anyone via a fee for service web application which gives access to model runs on high performance computers at an inexpensive entry point.
- > The SMARTtide suite accepts a scenario that may comprise one or many individual tidal energy schemes. The schemes can be located close to each other or anywhere within the model boundaries of the northern European continental shelf.

## SMARTtide model access

Anyone can access the SMARTtide Web User Interface ([www.hrwallingford.com/smarttide](http://www.hrwallingford.com/smarttide)), to remotely upload a tidal energy scenario of their design. Submission of the scenario automatically triggers a TELEMAC-2D simulation following a few simple checks of the inputs. Upon completion, the Web User Interface sends the simulation output which comprises GIS layer files as differences between results with scenarios and the base case without scenarios to the registered user automatically. The costs of model runs are charged based on computational usage but are significantly lower than creating a bespoke project model.



...scan to find out more



## References

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