# WATER INFORMATICS SCIENCE & ENGINEERING
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# Modelling the transport and dynamic decay of FIOs in estuarine and coastal waters

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## Introduction

The EU revised Bathing Water Directive (2006/7/EC) came into force in 2015, imposing a more stringent, water quality classification system for bathing waters on member states. This relates to the monitored concentration of *E.coli* and *Intestinal enterococci (IE)* [1].
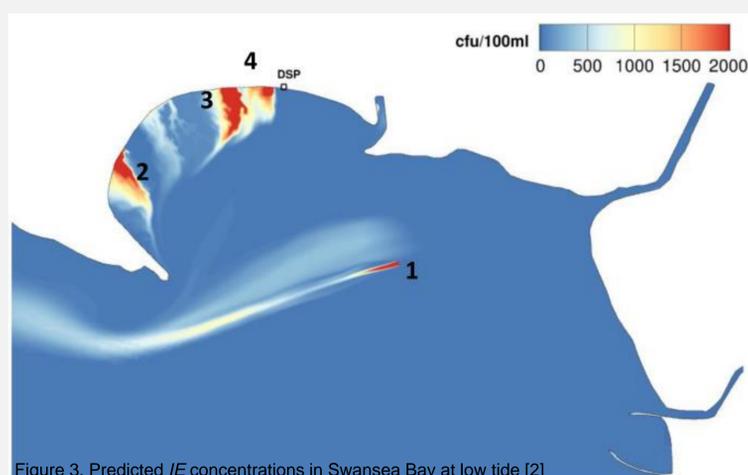
## Key Questions

- Is bathing safe?
- How can we accurately model & predict water quality?
- How can water quality be improved?



Figure 1. Severn Estuary bathymetry [2]

Figure2. Swansea Bay
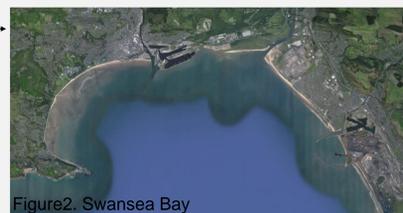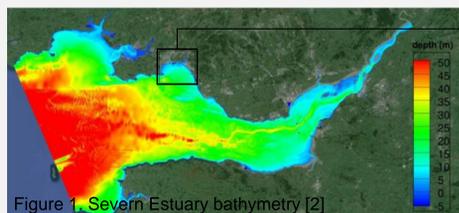
## Swansea Bay

The main focus of this study is on Swansea Bay with the Ribble Estuary also of interest. In previous studies on Swansea Bay FVCOM and DIVAST were used to simulate the nearshore coastal water quality based on two processes [2]:

- Hydrodynamic transport
- Bacterial decay



Figure 3. Predicted *IE* concentrations in Swansea Bay at low tide [2]



Figure 4. Observed geometric mean *IE* concentrations at Swansea Bay DSP from August – September 2011 (A) and predicted values from hydrodynamic modelling (B & C)

All days (07:00-16:00 - *n* = 33, 16:30-19:00 - *n* = 24)
days with *p*GI ≤ 0.1 (07:00-16:00 - *n* = 13, 16:30-19:00 - *n* = 11)
days with *p*GI > 0.1 (07:00-16:00 - *n* = 20, 16:30-19:00 - *n* = 13)

## Discussion

The issue with the studies carried out to date is the implementation of a constant or day/night bacteria decay rate. Combined with the exclusion of processes such as sediment – bacteria interactions this leads to inaccurate representation of sub-daily and diurnal variations in FIO concentrations. However mean daily FIO concentrations are accurately replicated.

## Future Work

A model will be set up in Delft3D with a focus on accurately representing the dominant processes that determine nearshore coastal water quality such as dynamic bacterial decay and sediment - bacteria interactions. Areas of focus will include:

- Real time T90 values based on:
  - Temperature, solar radiation, turbidity
- Adsorption & desorption of bacteria to sediment particles
- Sedimentation & resuspension
- Improved representation of bathymetry within intertidal areas
- Generation of atmospheric forcing parameters using the Met Office Unified Model (MetUM)

### References

[1] (CEU) European Parliament, C. of the E. U. (2006). Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC. Official Journal of the European Union, L 064(1882), 37–51
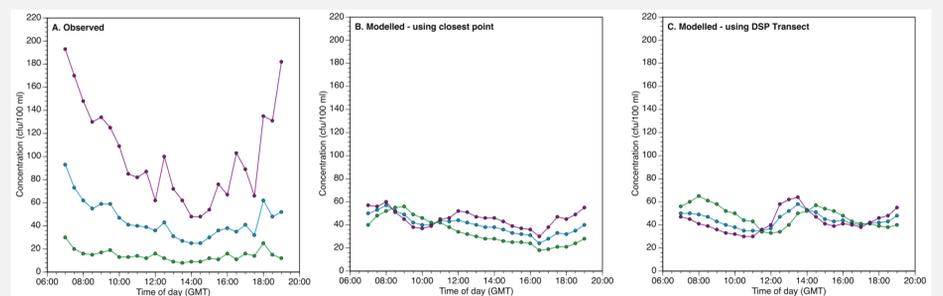
### References

[2] Ahmadian, R., Bomminayuni, S., Falconer, R., & Stoesser, T. (2013). SSC Numerical modelling of flow and faecal indicator organism transport at Swansea Bay, UK. A report from the Interreg 4a Smart Coasts – Sustainable Communities Project.

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