Coupled Wave-Ocean Model for Galway Bay
MÉRA Workshop

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2nd May 2019
Scope of the thesis

- Set-up a coupled wave-current model for Galway Bay
- Improve the numerical implementation of the wave-current interaction

- How strong is the current interaction in Galway Bay?
- How well are the processes modelled? Can it be improved?
Observations

- Observations have shown that waves and currents can be strongly correlated and interact with each other.

Figure: Mean significant wave height gradient and Mean Geostrophic current vorticity, from [Quilfen et al., 2018]
Theoretical framework

Figure: Water waves energy spectrum, slide from Dr. Olabarrieta’s COAWST Workshop presentation.
Galway Bay

- The Marine Institute is already running an ocean model for Galway Bay
- A coupled model was tried but only went past the first validation steps

**Figure:** Operational ROMS models run by the Marine Institute.
The Coupling system: COAWST

- From the wave model: wave parameters, dissipation terms
- From the ocean model: current field, surface elevation

**Figure:** The coupling between currents (ROMS) and waves (SWAN) inside COAWST
## Model description

<table>
<thead>
<tr>
<th>Grid</th>
<th>Geographic curvilinear grid (200m×200m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathymetry</td>
<td>Infomar and Gebco - 20 levels</td>
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<tr>
<td>Forcing</td>
<td>NE Atlantic MI model - 10min freq</td>
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<td></td>
<td>River climatologies - 1day freq</td>
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<td>MÉRA atmospheric forcing - 1hr freq</td>
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<tr>
<td>Hindcast Period</td>
<td>01/10/2016 to 29/01/2017 - 15s time-step</td>
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</tbody>
</table>

**Figure:** Bathymetry and position of measurements stations
First results

Figure: Model and tidal gauge surface elevation in Galway Port - ROMS only

Depth issue (wet/drying)
Bad agreement after 90 days
Work plan

- Obtain an optimal parametrization for ROMS
- Run and obtain an optimal parametrization for SWAN/WW3
- Run the couple model and investigate the coupling

Figure: Finite Size Lyapunov Exponents, Mediterranean Sea - [Sayol et al., 2013]
Acknowledgements: This project (Grant-aid Agreement No. CF/17/01/01) is carried out with the support of the Marine Institute and funded under the Marine Research Programme by the Irish Government.