

Cullen Scholarship: Seasonal to decadal sea level and ocean waves predictions through numerical modelling and statistical analysis (PhD Award)

Background

Ireland, as an island in the North Atlantic, is prone to sea-level and climate change and its effects on the coasts. With 40% of the population within 5 km of the coast, it is essential for economic planning and adaption to understand the short and long-term effects of changes on coastal structures. With the storm surges and extreme waves during storm events being the main factors in altering the coasts through flooding and erosion, understanding the overall statistics of present and future changes in waves, sea-level and wave overtopping is required to enable effective climate adaptation planning and prepare Ireland for the changes ahead.

The field of seasonal-to-decadal (S2D) scale forecasting has advanced greatly in recent years. However, coastal changes happen on the local scale and are, in most cases, below the resolution of S2D model runs. Application of dynamical downscaling complemented by statistical post-processing can optimize the results for specific locations and bridge this gap.

Proposal

We propose a structured four-year PhD project on a full-time basis with the overarching aim to provide forecasts of sea level and ocean surface wave changes along the Irish coast on S2D time scale through downscaled numerical modelling and advanced statistical analysis. The more specific objectives include:

- Adapt the Marine Institute's modelling framework to climate simulations. This may include the use of one or more of the Institute's existing numerical models or the development of a tailored model(s) for this specific research.
- Identify appropriate datasets for model forcing (atmospheric and open ocean boundary conditions) that will be applied to downscale to the Irish regional to local scale. Process these datasets to the format usable by the downscaled model(s)
- Perform the ensemble simulations using various climate forcing. This may include various RCP scenarios, same scenarios with datasets from various sources, perturbed forcing, in order to enable statistical assessments and account for uncertainties
- Carry out advanced statistical analysis of predicted sea level and wave trends and draw conclusions on anticipated changes on seasonal to decadal time scales

Outcome

The expected outcomes from the project include the predictions of S2D changes in the sea level and ocean waves along the coasts of Ireland with the information disseminated in the format usable in the process of informing policy and developing climate adaptation plans.

It is expected that the methods and tools will be developed in a transferrable framework and can be used in future national and international projects. The numerical model(s) should be compatible with the existing Institute's modelling framework.

Project outputs should inform national climate actions and initiatives including the Climate Research Coordination Group, Climate Action Regional Offices and thus contribute to the development and implementation of the sectoral adaptation plans under the National Adaptation Framework. Results should be

relevant to the UN Sustainable Development Goal 13 “Climate Action” and to Ireland’s government climate actions under the UNFCCC. The project is expected to expand Ireland’s capacity in regional climate modelling, scenario development, forecasting and climate impact risk assessment.

Links to the MI Strategy

The proposed research fits into the Strategic Focus Areas: 1 “Scientific Advice & Services, 2 “Forecasting Ocean, and Climate Change”, and 3 “Research and Innovation” of the Marine Institute’s Strategic Plan (2018 to 2022) “Building Ocean Knowledge. Delivering Ocean Services”, and in particular to the initiatives: “Meeting the Needs of Decision Makers”, “Deepening Our Knowledge” and “Forecasting Ocean and Climate Change”.

Specific Requirements

The scholar should preferably have a primary degree in oceanography or closely related field with advanced skills in programming and statistics and/or mathematics. Alternatively, a graduate in mathematics and/or Information Technology with strong interest and/or background in marine science is also considered suitable.

Financial Details

Scholarships will be up to €25,000 per annum (maximum funding of €100,000 over four years). This amount comprises a maintenance award of €16,000 (Irish Research Council rate) to the student as well as payment of fees to the host higher education institution (HEI). The maximum fees payable to the HEI will be €6,000 per annum. The scholarship award also includes a budget of up to €3,000 per annum for eligible research costs (travel & subsistence, publication costs, consumables and other costs e.g. laptop) for the sole use of the student, and are payable on a reimbursement basis direct to the host institution where the postgraduate student (scholar) is registered. There are no overheads payable on the scholarship. Publication costs are intended to cover publications on which the scholar is listed as first author and are published under Open Access.

Marine Institute Co-Supervisor(s)

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