



## Twenty-first Century Wave Climate Projections for Ireland: Assessing the Future Wave Energy Potential

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Ireland is uniquely placed in terms of its ocean renewable energy resource, with a highly energetic wave and wind climate. The western coast of Ireland possesses one of the best wave energy resources in the world and consequently, is a promising location for the future deployment of Wave Energy Converters (WECs). Due to the potential importance of this marine resource to Ireland, it is important to quantify: (i) the present wave climate and wave energy resource of Ireland, its seasonal and annual variability, and (ii) how the wave climate may change in the future. Identifying the wave climate trends over past decades is a first step towards quantifying how global climate change will impact the future wave climate. Global climate models predict warming of the Earth's atmosphere and oceans, which will consequently affect mean sea-levels, the frequency and severity of extreme weather events, winds and ocean waves. Such changes need to be carefully assessed for long-term marine and coastal planning. We derived an ensemble of future wave climate projections for Ireland using the EC-Earth global climate model and WAVEWATCH III wave model, by comparing the future 30-year period 2070-2099 to 1980-2009 for the RCP4.5 and the RCP8.5 forcing scenarios. This dataset is currently the highest resolution wave projection dataset available for Ireland. EC-Earth predicts decreases in means (up to 3%) and extremes (up to 14% for the 95th percentile) of 10m wind speeds over the North Atlantic Ocean (5-75N, 0-80W) by the end of the century, which will consequently affect swell generation for the Irish wave climate. However, the model projections show no statistically significant changes in the frequency and intensity of wind storms crossing Ireland. The WAVEWATCH III model predicts an overall decrease in mean (up to 15%) and extreme (up to 15% for the 95th percentile) annual, Boreal winter and summer significant wave heights around Ireland. The changes to winds and waves are projected to be small and are within the ranges of natural variability.