

A model for predicting coastal storm damage in the North Sea

July 7 2016

A system for predicting storm damage by waves in northern areas of the North Sea has been developed by mathematicians at the University of Strathclyde.

Densely populated areas on the sea's coast are particularly vulnerable to severe wave conditions, which can rise above or damage sea defences, leading to dangerous flooding.

The Strathclyde researchers have devised a model of north-east Scottish coastal waters which simulates waves and the effect upon them of tidal currents.

Inland areas in Scotland experienced extensive flooding owing to [heavy rainfall](#) during Storm Frank in December 2015. However, in coastal areas such as Aberdeen the effects of the storm were mainly due to high waves.

Alessandro Sabatino, a Research Student in Strathclyde's Department of Mathematics & Statistics, led the research. He said: "The combination of spring tides, strong winds and high waves can be extremely threatening to coastal areas.

"Modelling has been used to help develop forecasting systems to predict flood risk around the shallower southern regions of the North Sea, where the coastal margin is low-lying and population density is high. Coastal areas of the deeper northern North Sea are subject to regular [storm](#)

[damage](#) as well but there have been few, if any, wave models developed for these waters.

"Our results indicate that interactions between waves from different directions, and between waves and currents, play a fundamental role in the wave climate.

"Models such as this are needed for better forecasting of damaging wave conditions in coastal waters."

The study examined three North Sea storms in 2010 - on 26-27 February, 30-31 March and 19 June, for interactions between waves and currents. The model included swell waves which are generated by distant storms, and waves generated more locally, and the combination of these interacting with tidal currents.

During these storms, locally generated wind-waves were up to 3.5m high, and the swell waves, often travelling from distant waters in the Norwegian Sea, could be up to 5m high. Interactions between these different wave systems, and between the waves and the tidal current were found to add or reduce the wave height at the coast by up to 2m. The most dangerous conditions occurred during high spring tides, when currents were flowing in opposite direction to the waves.

The north-east Scottish coast was found to be more exposed to swell arriving from the North Atlantic and the Norwegian Sea, while the central and southern coasts were more exposed to local wind-sea [waves](#) and to storms generated in the wider North Sea.

More information: Alessandro D. Sabatino et al, Modelling wave–current interactions off the east coast of Scotland, *Ocean Science* (2016). [DOI: 10.5194/os-12-875-2016](https://doi.org/10.5194/os-12-875-2016)

Provided by University of Strathclyde, Glasgow

Citation: A model for predicting coastal storm damage in the North Sea (2016, July 7) retrieved 11 May 2024 from <https://phys.org/news/2016-07-coastal-storm-north-sea.html>

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