

Coastal defences could contribute to flooding with sea-level rise

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A combination of coastal defences and rising sea levels could change typical UK tidal ranges, potentially leading to a higher risk of flooding, say scientists.

The researchers wanted to find out how tides around the UK might respond to changes in sea level over the next century depending on the level of coastal defences in place.

The study, published in *Continental Shelf Research*, shows for the first time that local coastal defences, such as sea walls, could cause tides to change dramatically. It suggests flood defences need to be reassessed on an international scale as they may lead to an increased risk of flooding.

'We wanted to see how [sea level rise](#) would affect the tidal range- the

difference between high water and low water - and to see if it would cause any potential changes in the time of [high water](#) and tidal velocities,' explains Dr Holly Pelling of Bangor University, lead researcher on the study.

The researchers used computer models to simulate how the tides would change if the sea level was one metre higher than present day. They then assessed how three stages of coastal defences affected those tidal changes: no coastal defences; coastal defences similar to the levels in place today; and a version where the entire coast was protected by a wall.

If there were no coastal defences in place, then allowing the sea level to rise by up to a metre caused little change in tides. But the tides changed dramatically if they added walls around the coast allowing only part of the countryside to flood.

'We saw a small change in tides if no flooding was allowed, but we were surprised to find that we recorded the largest response when flood defences are implemented that allow only part of the coastline to flood,' Pelling says.

She suspects that the walls in place around the coast could cause the tides to reflect and amplify, which could lead to flooding.

'The tide is basically a wave with a certain amount of energy and it dissipates energy as it travels. For example if it enters the North Sea by the time it reaches the southern North Sea you have a low tidal energies and the tides not doing much,' says Pelling. 'But if it builds up behind coastal defences you get this honeycomb effect with narrow channels which funnel the water, and the walls which could cause the tidal energy to be reflected and this could change where the energy is dissipated. So some areas will find the tidal amplitude is higher while others will find they are lower.'

Pelling's research suggests a more unified approach needs to be taken to building coastal defences, since the tidal impacts of [sea level](#) rise doesn't occur on a local scale.

'Flood defences are very localised, they only protect the bit of land they are in front of, but potentially there could be wider implications seaward since, unfortunately, the oceanography doesn't respect country or county boundaries. We really need to look at defences on a basin-wide perspective to see how to implement them,' she says.

The team were surprised to find that coastal defences had any impact on the [tides](#) as they didn't set out originally to study their impact but chose to include it as part of the model.

'We're not making predictions, just showing that this mechanism could be important. More detailed research needs to be done.'

More information: Pelling, H.E., Mattias Green, J.A., "Impact of flood defences and sea-level rise on the European Shelf tidal regime." *Continental Shelf Research* (2014), [dx.doi.org/10.1016/j.csr.2014.04.011](https://doi.org/10.1016/j.csr.2014.04.011)

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