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Use of seagrass meadows as an adaptation measure to climate change for reducing port agitation

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One of the best-known consequences of the greenhouse effect and the resulting global warming is sea-level rise. However, sea level rise is not the only process of concern to coastal communities. The greenhouse effect and the complex interactions in atmospheric processes is expected to produce changes in near-surface wind and pressure patterns, which in turn can affect the pattern of another important coastal driver: the wave field. Changes in wave conditions can affect the wave pattern within harbours as shown by Casas-Prat and Sierra (2012), increasing port agitation and, as a consequence, reducing the safety and comfort of the users, decreasing operation performance or even generating port inactivity. This effect will be enhanced by an increase in mean sea level.

To avoid costly structural measure there are "green" options such as sea-grass that can attenuate wave energy (Koftis et al., 2013), since their roots induce sea bottom roughness and their stems and leaves increase the drag coefficient. The combined effect of vegetation is, thus, to create drag forces that dissipate part of the energy from incoming waves.

Casas-Prat and Sierra (2013) showed that wave patterns may change in the future in certain areas of the Catalan Coast (northwestern Mediterranean) and as a consequence port agitation could be affected by changes in wave height or direction as well in those areas. The suggested "green" measures can help to prevent potential negative effects on port operations. The adaptive approach, depending on the downscaled climatic projections, would combine vegetation (as for example the existence of a sea-grass meadow in the vicinity of the harbour entrance) with some structural reinforcement if required.

In this paper, the wave projections of Casas-Prat and Sierra (2013) are used together with a Boussinesq-type model to study wave propagation in several harbours of the Catalan Coast. This analysis of harbour oscillations is carried out for present conditions and the obtained wave projections to identify harbours where wave oscillation is expected to have a negative effect. One of these harbours, where agitation clearly increases, is selected to study the effectiveness of sea-grass for reducing wave heights within the harbour. Moreover, a sensitivity analysis is carried out to relate wave height decrease with sea-grass parameters such as meadow surface, plant density or submergence ratio (ratio between water depth and stem length).

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