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ENHANCING COASTAL PROCESSES UNDERSTANDING AT NEARSHORE BREAKWATERS USING NUMERICAL MODELLING: A CASE STUDY FOR ELMER BEACH, WEST SUSSEX

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Predicting beach morphodynamics at composite beaches is challenging with existing capabilities; even more so when coastal defences are present. A bespoke methodology was developed to enhance expert judgment for Elmer, where historically ongoing low level beach loss in one location started to pose a risk in 2014 and an initial scheme in 2020 did not result in higher beach stability. Two mitigation options are considered, a breakwater extension and a rock island. The preferred option should maintain a dynamically stable beach in one critical location to reduce flood risks whilst maintaining existing longshore drift rates to avoid negative downdrift impact. To aid options appraisal a novel conceptual model was developed to assess beach response. A 2D-XBeach model was used to obtain nearshore hydrodynamics (free surface elevation and flow velocities) which were combined with beach orientation along the frontage to derive a longshore sediment transport metric. This metric enabled relative comparisons of potential beach responses to develop erosion, salient or tombolo. Two aspects were key for the methodology development: (1) representation of wave transmission through the structures, achieved using the vegetation module as a permeability surrogate and (2) derivation of representative physical parameters for option appraisal. A range of scenarios were simulated including existing structures only (1996-2024, different topography) and with the two options for both present-day beach and a recharge scenario. Acknowledging modelling limitations, this approach offered an informed basis that would not be achievable through use of empirical formulations and supported engineering decisions for the preferred option.