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XBeach-G: a tool for predicting gravel barrier response to extreme storm conditions

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Gravel beaches protect low-lying back-barrier regions from flooding during storm events and their importance to society is widely acknowledged. Unfortunately, breaching and extensive storm damage has occurred at many gravel sites and this is likely to increase as a result of sea-level rise and enhanced storminess due to climate change. Limited scientific guidance is currently available to provide beach managers with operational management tools to predict the response of gravel beaches to storms. The New Understanding and Prediction of Storm Impacts on Gravel beaches (NUPSIG) project aims to improve our understanding of storm impacts on gravel coastal environments and to develop a predictive capability by modelling these impacts.

The NUPSIG project uses a 5-pronged approach to address its aim: (1) analyse hydrodynamic data collected during a proto-type laboratory experiment on a gravel beach; (2) collect hydrodynamic field data on a gravel beach under a range of conditions, including storm waves with wave heights up to 3 m; (3) measure swash dynamics and beach response on 10 gravel beaches during extreme wave conditions with wave heights in excess of 3 m; (4) use the data collected under 1-3 to develop and validate a numerical model to model hydrodynamics and morphological response of gravel beaches under storm conditions; and (5) develop a tool for end-users, based on the model formulated under (4), for predicting storm response of gravel beaches and barriers.

The aim of this presentation is to present the key results of the NUPSIG project and introduce the end-user tool for predicting storm response on gravel beaches. The model is based on the numerical model XBeach, and different forcing scenarios (wave and tides), barrier configurations (dimensions) and sediment characteristics are easily uploaded for model simulations using a Graphics User Interface (GUI). The model can be used to determine the vulnerability of gravel barriers to storm events, but can also be used to help optimise design criteria for gravel barriers to reduce their vulnerability and enhance their coastal protection ability.