Developing a multi-model workflow for assessing beach dynamics

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Urban beaches in semi-sheltered harbor environments are highly valued public spaces that require detailed understanding of coastal dynamics for appropriate management. However, such coastal environments present a challenge for understanding natural coastal dynamics and hazards due historic management interventions. Commonly applied coastal modelling and hazard assessment methods for open coast beaches are not necessarily appropriate for applying to semi-sheltered urban beaches, without site specific calibration.

This paper focuses on the calibration and application of three different numerical modelling methods to better understand coastal processes on semi-sheltered urban beach system in Port Phillip Bay, Victoria. First, the shoreline position model *ShorelineS* was applied to understand beach rotation, seasonal trends in shoreline movement and long-term rates of change. Model calibration was informed using monthly monitoring data, including drone based topographic surveys and measured wave buoy data. Next, a storm response model in *XBeach* was calibrated using observed wave events and measured changes in the coastal profile. The models were collectively used to give new insight on the beach sediment budget, including long-term trends, the seasonal envelop of change, and storm response.

Outputs of the *XBeach* and *ShorelineS* modelling were used to inform variables for projecting beach terrain adjustments with sea level rise using the *ShoreTrans* model, where the sensitivity to different trajectories of barrier rollover and translation was assessed. Isolating the cross-shore adjustment in *ShoreTrans* allowed the idealised beach topography to be reconstructed for a sea level rise scenario representing 2100. Balance of alongshore sediment flux was achieved by passing volume from profile to profile according to the net sediment balance in the system, informed by long-term rates.

The result is a calibrated multi-model workflow that can be used to explore present day and future management scenarios, including concept design for beach nourishment and control structure.