Predicting future geomorphological change along Victoria's Coastline, using innovative numerical modelling techniques

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Introduction

Coastal environments are increasingly being influenced by processes of climate change that can induce geomorphological change. Sea level rise, changing patterns of storm activity and variance in the wave climate can alter sediment dynamics, including pathways and supply. This can lead to an increased risk of coastal erosion and flooding in vulnerable localities.

Understanding the response of coastal systems to changes in environmental conditions is key to predicting their future evolution and the potential impact this could have on enviro socioeconomic factors. Our ability to predict long-term climate driven morphodynamics could lead to more informative decisions concerning management practices and adaption measures.

Forming part of the Victorian Coastal Monitoring Program (VCMP), this research uses innovative modelling techniques to predict the future morphodynamics of the Victorian coastline, south east Australia. Numerical models provide powerful tools for understanding and predicting behaviours in coastal systems, although a compromise is often found between model complexity and scale.

Research Questions

- What primary processes are influencing coastal morphodynamics along the Victorian Coast?
- How might sediment transport pathways change over time?
- How might each of the study sites (Figure 1) behave under changing environmental conditions (including wave climates, storm activity and sea level change)?
- Will the shoreline recede with sea level rise and what is the nature of that recession?

Sites of Interest

1—Port Fairy | 2—Warrnambool | 3—Mounts Bay | 4—Apollo Bay | 5—Inverloch | 6—Seaspray | 7—Gippsland

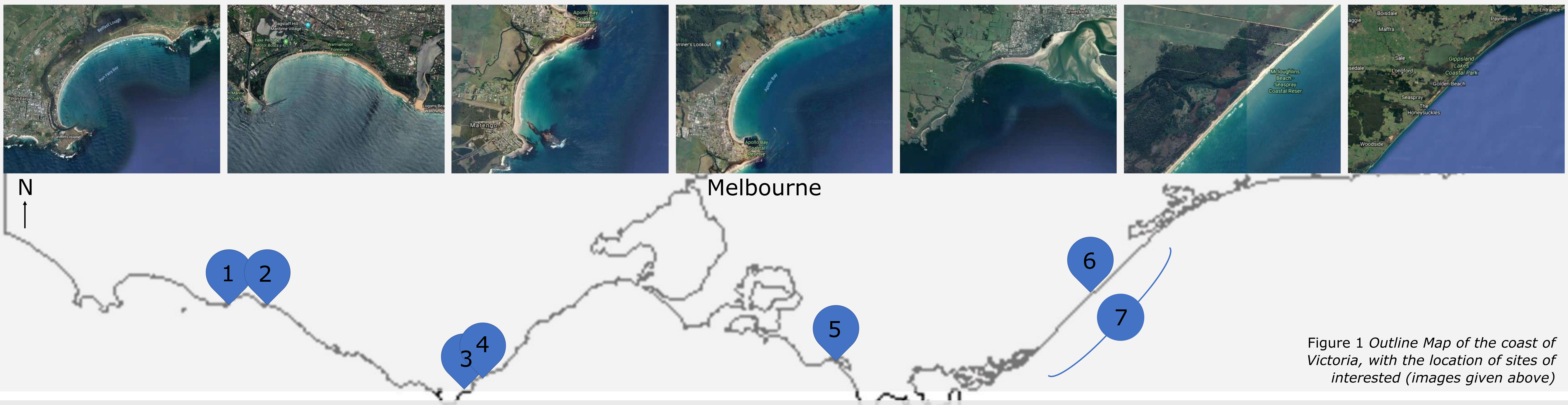

Figure 1 *Outline Map of the coast of Victoria, with the location of sites of interested (images given above)*

Models of Interest

Numerical models are designed to address specific types of coastal systems and the dominating processes over varying spatiotemporal scales. Each site of interest (Figure 1) presents a different modelling challenge and as such, a range of models have been selected to suit each study site. Four principle models have been selected at this preliminary stage:

COVE	CEM2D	XBeach	Delft3D
One-line vector model	2D 'smudge line' model	2D wave and sediment transport	3D flow and sediment transport
10—100 km, 10—1000 years	10—100 km, 10—1000 years	Kms, storm scale	1—10 km, 0-1 years

PhD Research - CEM2D

University of Hull (UK)

CEM2D was developed as part of my PhD research into the morphodynamic behaviour of sandy, wave-dominated coastal systems. In Figure 2 the role of different wave and water level scenarios on two-dimensional coastal morphodynamics is presented. These processes influence the sediment budget, the direction of sediment transport and the balance between supply and submergence. This influences the coasts evolution including the shape of the planform shoreline and it's morphology.

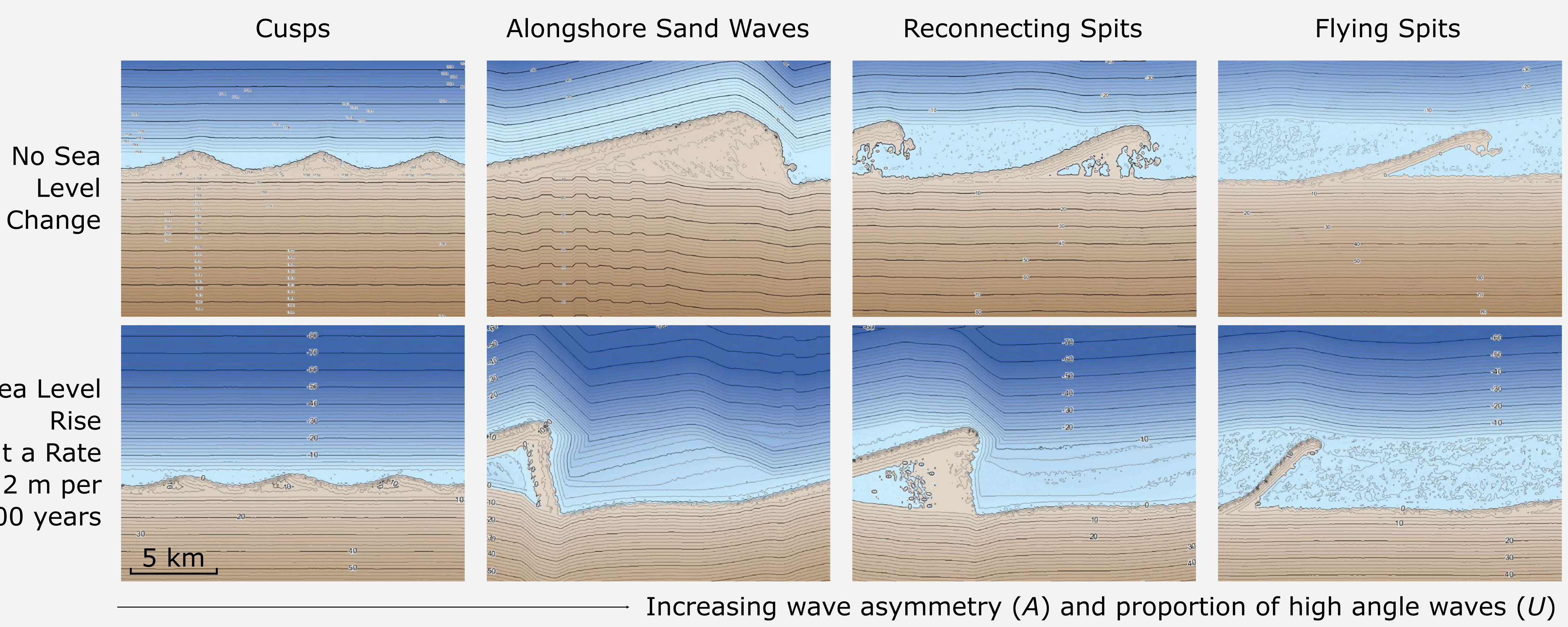

Figure 2 *Outputs from CEM2D showing the influence of different wave conditions and sea level change on coastal morphodynamics*

CEM2D and the results of my PhD research will be used to explore the morphodynamics behaviour of the Victorian Coastline, forming the first site-specific application of this model.

Conclusion

This study will explore the short to long-term geomorphological evolution of the Victorian Coastline under changing environmental conditions. The project will focus on a number of key sites of interest (Figure 1) to decipher more specific evolutionary behaviours.

The use of numerical models to investigate the behaviour of the systems to date is limited in this region and so the results will provide an advanced insight into how this stretch of coastline may evolve in the future.

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