

CHARACTERISING COASTAL SHELF WAVES ALONG THE NSW COAST

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INTRODUCTION

New South Wales (NSW) often experiences periods of coastal inundation and estuarine flooding. One of the causal mechanisms of these episodes are coastal shelf waves (CSW), generated by synoptic disturbances (Church et al., 2006). CSWs in Australia often result from wind stress, mostly along mid-latitudes (e.g., the Great Australian Bight) and propagate anticlockwise (Woodham et al., 2013). However, there are no tools available for identifying and characterising CSWs and as such there is very little information on the magnitude, frequency, duration, and spatiotemporal variability.

OBJECTIVES & METHODS

This paper aims to: (1) develop a method to identify and track CSWs using the existing ocean tide gauge network, (2) identify patterns in the frequency, duration, and magnitude of CSW, and (3) assess the factors that affect the frequency, duration, and magnitude of CSWs along the NSW coast.

The first stage of the study was to conduct an extreme value analysis on residual records of coastal water levels from ocean tide gauges along the NSW coast. Water level residuals are defined here as the difference between the observed water level and the predicted tide for each gauge. For each gauge, a moving average filter with a one-month duration was applied and this filtered record was subtracted from the original residual dataset to obtain a dataset with long-term fluctuations removed (hereafter referred to as the filtered residuals). This step is required to ensure all events are accurately characterized and identified. To identify extreme events (that may represent CSW), a peak over threshold (POT) analysis was conducted on the filtered residual datasets and an extreme event was defined as occurring when the POT had a minimum duration of six hours. An event occurred when the filtered residuals surpassed the threshold value. To define the duration of each event, a 13-hours moving average filter was applied on the filtered residuals. For each POT observed in the filtered residuals, the duration was defined as the period in which the 13-hour filtered residuals was greater than zero.

Once extreme events were identified, CSWs were considered as extreme events of 1-2 weeks duration with small amplitudes (0.25 - 0.45 m), with a signal across multiple gauges and a delay in the timing of the peak as the wave propagates northwards.

The synoptic conditions leading up to and during the events were also investigated by observing the evolution of possible low-pressure systems in the corresponding synoptic charts. In addition distributions were obtained including the histogram of the CSWs, and the joint distribution of the CSW and the duration.

RESULTS

The method developed was successful in identifying CSWs along the NSW coast. Importantly, the results show the frequency of CSWs have fluctuated over the last 30 years, with some CSWs with relatively short duration (five days). Preliminary analysis also revealed a connection between CSWs propagating along the NSW coast and low-pressure systems in the Bass Strait (Fig 1). Further, apparent that there is typically a preservation of event magnitude and duration of CSWs as they propagate northwards along the coast.

This research expands on our knowledge of CSWs by quantifying their frequency, duration, magnitude and driving mechanisms. The results of this study will assist in forecasting and updating risk profiles for coastal and estuarine flooding associated with CSWs. The method developed here can also be applied to other regions where CSWs occur.

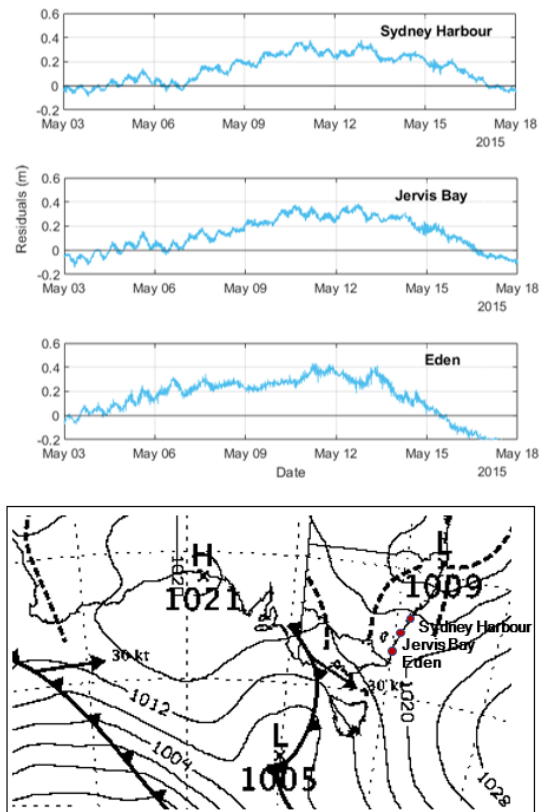


Figure 1 - Passage of CSW on NSW coast: Eden (south coast), Jervis Bay (south coast) and Sydney (mid-coast), and the synoptic conditions in Bass Strait associated with the generation of this CSW.

REFERENCES

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