

## INTERANNUAL VARIABILITY OF STORM SURGE

### INTRODUCTION AND RESEARCH SIGNIFICANCE:

Flooding causes widespread damage to the Australian Coastal zone, which is an area of significant economic, social and environmental importance (DCC 2009). Coastal flooding can result from both heavy rainfall, and or 'storm surge', which is a rise in ocean levels due to low atmospheric pressure and persistent winds (BOM 2011).

Currently, most coastal planners rely on exceedance statistics such as the 100 year Average Recurrence Interval (ARI) storm surge estimate as an acceptable level of risk. This risk estimate informs planning controls such as floor heights and is also a base for calculating future sea level rise hazard areas. Exceedance statistics such as the ARI are calculated based on the assumption of a 'stationarity' climate – that is, the assumed chance of an extreme event occurring is the same from one time period (season, year, decade) to another. However, recent research has shown that the ARI of extreme climatic events (e.g. heavy rainfall, floods, droughts etc) may be significantly under or over estimated depending on the climate state (e.g. Franks and Kuczera 2002, Kiem et al 2003) and that non-stationarity exists within historical Australian rainfall and streamflow records (e.g. Verdon et al 2004; Verdon and Kiem 2010).

This research aims to extend this previous work by (a) investigating whether non-stationarity exists in historical storm surge (or sea level anomaly)

**Figure 1:** Relationship between storm surge (as represented by tidal residuals) and ENSO (a) around Australia represented by the significance (large star 99%, small star 95%) of the difference between storm surge associated with El Niño and storm surge associated with La Niña and (b) at Freemantle as represented by the comparison of box plots showing storm surge during En Niño, La Niña and Neutral.

**Figure 2** illustrates the significance of difference in tidal heights between the negative and positive phase of the IOD. Generally, tidal heights are different between the extreme phases of the IOD across the southern to mid latitude regions. However this significance is less so the tropical north regions. When looking at the means and quantiles, it was found that there is no difference between phases of the IOD in the north-eastern regions

**Figure 3:** Relationship between storm surge (as represented by tidal residuals) and SAM (a) around Australia

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