

# Key findings:

## Storm tides along east-coast Australia

### The event

Australia's coastal communities are vulnerable to coastal erosion and inundation as a result of major storm surges and storm tides.

Throughout the 1950s until the mid 1970s, Australia's east coast experienced a particularly stormy period. One of the worst years was 1967, when five Tropical Cyclones (TC) and three East Coast Lows (ECL) caused extensive damage during the first half of the year.

Many coastal communities experienced severe erosion and flooding. Since the mid 1970s, calmer weather has prevailed and the knowledge of how to prepare and respond to storm tide impacts is in danger of being forgotten as the memory of past events fades. This case study focuses on the adaptive response of three coastal communities – Gold Coast, Byron Bay and the Collaroy-Narrabeen regions – to the stormy period from the 1950s to the mid 1970s.

### Scale of the disaster

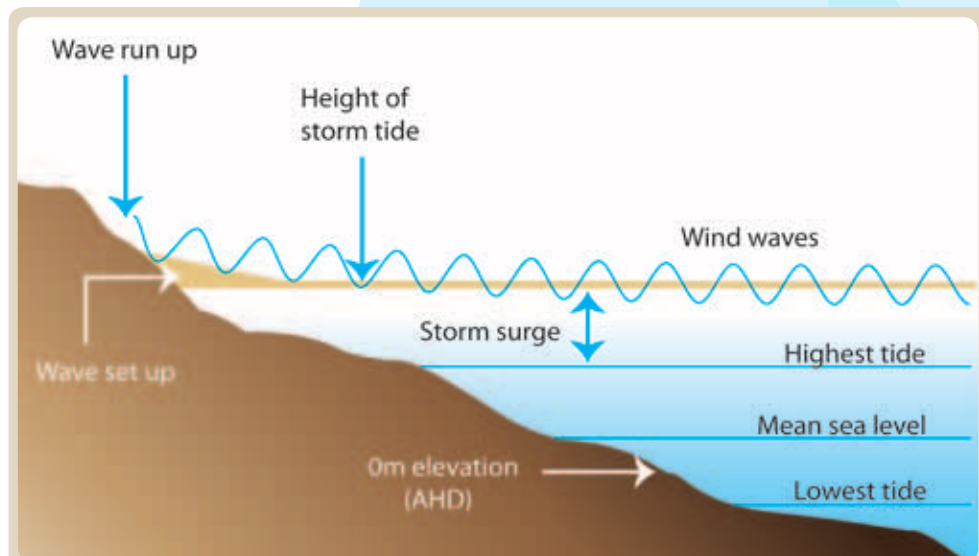
The **Gold Coast** had particularly severe beach erosion in 1967:

- In this year, five Tropical cyclones and three ECLs affected the Gold Coast;
- Tropical Cyclone Dinah was at the time considered a 1-in-100 year event, with a surge of 1.5 m;
- An estimated 8 million m<sup>3</sup> of sand was removed from Gold Coast beaches in the first half of 1967. Natural and economic recovery took three years.

**Byron Bay** experienced severe beach erosion throughout the stormy period. There was extensive damage to public infrastructure and coastal properties:

- The Byron Bay jetty and 22 vessels in the fishing fleet were destroyed, and part of the town flooded as a result of a Tropical Cyclone in 1954;
- Tropical Cyclone Pam struck in 1974. Storm surge breached the dunes, and destroyed permanent and holiday residences.

The **Collaroy – Narrabeen** beach front is the most highly capitalised in New South Wales, and nationally the third



Schematic of storm tide generation (Adapted from Middelmann 2007)

most vulnerable area to coastal erosion. It experienced severe erosion in 1967 and 1974, with beach loss and property damage. The impacts on coastal properties stemmed from the fact that initial sub-division was too close to the shore.

### Characteristics of storm tides

Storm tides are a natural hazard for coastal communities. Associated risks include: drowning, dune damage, foreshore structure damage, sewerage contamination, undermining of building foundations and erosion. Permanent changes to coastal features occur during high storm energy periods.

The occurrence of severe coastal storms, leading to storm tides, is widely variable in time, but phases of high storm energy are frequently related to the negative phase of the Inter-decadal Pacific Oscillation (IPO) and/or a predominantly positive Southern Oscillation Index (SOI).

Storm occurrence is highly variable e.g., the Gold Coast experienced more severe storms in the first six months of 1967 than in total over the last two decades.

### Adaptation during and after the event

Because of the high number of storms and the extent of impacts, councils in all three areas undertook protective actions and developed protection policies during and after this period. The following actions have been undertaken:

#### **Gold Coast**

- Formation of the Queensland Beach Protection Authority in 1968;
- Coming into force of the Queensland Coastal Management Act in 1973;
- A major coastal processes report (the Delft Report)

was commissioned in the 1960s. It was followed by gradual implementation of the recommendations, including building seawalls and groynes, entrance training and beach nourishment. Community protests in 2004 led to abandonment of these recommendations. A new strategy is enshrined in the Shoreline Management Plan;

- Note that Gold Coast City Council never considered a retreat policy.

### Byron Bay

- Study of coastal processes, identified long term coast recession;
- Identification of hazard lines based on storm event return periods, defining three development zones;
- Development of planned retreat policy.

### Collaroy - Narabeen

- Beach nourishment schemes have been introduced;
- New building lines were established, up to 23 m behind the old lines;
- There has been a voluntary Council buy-back scheme at market prices, but this has proved unsustainable long term;
- Plans to upgrade the seawall were dropped in 2003 following community protests;
- No private seawalls allowed.

## Vulnerability: pre and post event

Increased vulnerability is likely to result from rapid development of beach-front areas since the 1970s, increasing the population at risk and reducing designated coastal reserves.

Risks associated with storm tides are not generally reflected in planning or community attitude, generally because these conditions have not been experienced for 30 years. Loss of corporate memory (staff turnover) leads to a gradual easing of planning policy restrictions.

Planned retreat schemes (i.e., schemes which give ownership of the land on which a building stands until erosion endangers the building, at which time it must be relocated and the land surrendered) are difficult to implement because existing property rights do not support these arrangements.

If property buy-back schemes are relied on, arguably all properties in an at-risk area must be purchased to create a continuous buffer.

Oscillations between stormy and calm periods have created a cycle of coastline erosion and accretion. However, since the 1970s no accretion has occurred, possibly due to the effects of sea level rise. The inability of coastlines to 'recover' is likely to mean that low impact storms now present a greater risk of significant impacts.

## Lessons learnt

Past adaptive strategies have yet to be tested by severe weather. In 2009, the responses to Tropical Cyclone Hamish and a subsequent East Coast Low demonstrated the success of early warning and evacuation procedures.

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## Managing the event: successes and failures

### Successes

Army, State and local government were mobilised in some events to sandbag and place rocks.

### Failures

During the stormy period of the 1950s to early 1970s, actions were largely *ad hoc* and undertaken by individuals. Examples include:

- Dumping of car bodies, concrete blocks, old tyres etc. by residents to protect property and reduce dune erosion;
- Well constructed boulder walls, which had some success at curtailing erosion.

Some of the *ad hoc* actions taken by individuals would protect their property from erosion, but would create flow-on problems that exacerbated erosion elsewhere. The lack of a coordinated response is seen as a failure.

With few exceptions (e.g., major erosion on Fraser Island), only minor beach loss was experienced in south east Queensland due to these events.

With events that are sporadic, yet potentially devastating, the capacity to respond quickly afterwards to change policy or implement adaptive strategies is necessary to avoid the risk that calm-weather planning dominates due to loss of corporate memory.

There has until recently been a general failure by coastal communities to recognise the interaction between climate change (sea level rise) and multi-decadal climate variability. However, moves to incorporate climate change impacts into planning activities are beginning to emerge. Warringah Council (Collaroy-Narabeen) is revising its hazard lines to take into account sea level rise and coastal recession on 50 year timescales.

## About this study

This study is one of a suite of Historical Case Studies of Extreme Events conducted under Phase I of the NCCARF Synthesis and Integrative Research Program.

The authors of this study are: Peter Hellman, Griffith Centre for Coastal Management (GCCM); Christine Metusela and Frank Thomella, Macquarie University; Rodger Tomlinson (GCCM)

The study will be available online at [www.nccarf.edu.au](http://www.nccarf.edu.au)

National Climate Change Adaptation Research Facility  
Griffith University

Gold Coast Qld 4222

07 5552 9333

075552 7333

[www.nccarf.edu.au](http://www.nccarf.edu.au)



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Reference:

Middelmann MH ed. (2007) *Natural Hazards in Australia: Identifying Risk Analysis Requirements*, Geoscience Australia, Canberra.