DYNAMIC COASTS
Improving Community Resilience to Storms and Extreme Water Levels along the Coast

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AUSTRALIA IS A COASTAL SOCIETY

~85% of Australia’s population lives within 50 km of the coast
Oct 2004
INCREASING VULNERABILITY

EVENTS IN 2016: EAST COAST LOW, 4-5 JUNE

Collaroy Beach, Sydney
EVENTS IN 2017: TC DEBBIE

Shute Harbour, Whitsunday’s

Mackay

Sunshine Coast
FACTS AND FIGURES ON COSTS
Extreme water levels (meteotsunami, storm surge)

• Historically low economic cost per event, however potential for large losses:
  • A tropical cyclone crossing over one of the more densely populated parts of the coast at high tide can be devastating.
  • Cost largely in ongoing management of beaches experiencing ongoing erosion.
IMPORTANCE OF MITIGATION

• Mitigation is imperative to reduce loss of life & property. Mitigation reduces the impact of disasters.
DEVELOPING BETTER PREDICTIONS FOR EXTREME WATER LEVELS

Research Team

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bnhcrc.com.au
Coastal communities & infrastructure are at increasing risk from the impacts of extreme water level events (e.g. tides, storm surges, meteotsunamis).

To better prepare, coastal engineers, emergency managers & planners require accurate estimates of extreme water levels.
WHAT HAS IT ACHIEVED?

• An advanced coupled surge-wave model for the Australian coastline
  • Allows for estimation of wave setup over large areas
  • Output: 60 year time series of water levels
• Improved extreme sea level predictions
FIVE EVENTS - MODEL VALIDATION

TROPICAL CYCLONE GEORGE
APRIL 2007

CYCLONE ALBY
APRIL 1978

EXTRATROPICAL STORMS

TROPICAL CYCLONE YASI
FEBRUARY 2011

EAST COAST LOW JUNE 2016
WHAT ARE THE OUTPUTS/PRODUCTS?

• A web-based tool is being developed to disseminate results of the study – includes ~100,000 coastal ‘stations’ around Australia & estimates of likelihood of extreme water levels.
WHERE HAS THE WORK TAKEN US?
RESILIENCE TO CLUSTERED DISASTER EVENTS AT THE COAST: STORM SURGE
Leading to improved knowledge in the coastal zone

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Harvey, Irma, Jose, Maria: No, the 2017 hurricane season is not normal

By Maggie Astor, New York Times
Wednesday, September 20, 2017 5:14pm

It was only 27 days ago that Hurricane Harvey made landfall.

You could be forgiven for thinking it’s been longer. After all, that was four hurricanes ago.

We crunched the numbers and talked to an expert, and it’s not your imagination: The 2017 Atlantic hurricane season has been unusually active.

NASA/NOAA GOES Project via New York Times
Sept. 8: Tropical Storm Katia, from left, Hurricane Irma and Jose, not yet a hurricane. Nine days later, Maria would become a hurricane.
HURRICANE IRMA, SEPTEMBER 2017

Vilano Beach, Florida, following TC Irma, 2017, Reuters.

Public walkway destroyed by TC Irma, 2017, Brad Nettles/Staff.
STORM SURGE AND COASTAL INUNDATION

Gerben Van Es/Dutch Defense Ministry/AFP/Getty Images

Inundation in Miami during Hurricane Irma, 2017. Pedestrian TV.

Hurricane Irma inundation on St Martin Island, 2017. Rinsy Xieng / Twitter
PROJECT IMPORTANCE

• Coastal communities & infrastructure are at risk from the impacts of storm surge
• Clustered surge events reduces time for recovery of the coastline
• Not accounting for the impact of clustered events underestimates the risk to coastal assets

Coastal managers require information & tools to better understand coastal erosion → Where? How much? Why?

Images:
- TC Debbie March 2017 – Shute Harbour
- Ex-TC Debbie April 2017 – Gold Coast (Surf Life Saving QLD)
- Storms May 2016 - Adelaide
- East Coast Low June 2016 - Collaroy Beach, Sydney
WHAT ARE THE OUTPUTS/PRODUCTS?

Data for coastal managers

- The ‘where’
  - Australian coastal sediment compartments dataset
- The ‘how much’
  - Wave & sediment data for study sites
- The ‘why’
  - Shoreline response models with maps
  - Supporting software (GITHUB)
EXAMPLE RESULTS: OLD BAR, NSW

50 yr return period ‘storm series’ event

Assumes no shoreline management strategies in place (e.g. sand bagging)
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WHERE HAS THIS WORK TAKEN US?

- Recognition that application of the method will be typically applied by consultants working for emergency management & coastal management sector
  - Provide guidance, use-cases where possible to increase potential for up-take

- Knowledge base has been improved for end-users
  - Continue to communicate & promote outputs for broader knowledge transfer

- Modelling is improving the fundamental understanding of coastal processes in erosion hotspots
WHAT WILL IT ACHIEVE?

Hazard Assessment – Existing Development:
• Improved assessment of existing hazard

Protection of Future Development:
• Improved assessment of erosion buffers

Improved management of Australia’s Urban Beaches
ISSUES REMAINING – COASTAL PROJECTS
Implementation challenges for national application

• Availability of national datasets at appropriate scales
  • Coastal infrastructure
  • Wave & sea level observations that are of sufficient duration (i.e. 10+ yrs)
  • High resolution bathymetry & elevation
• Uptake of highly technical methods that rely on data & capability of users
• Construction of coastal inundation maps for extreme water levels (including climate change effects)
ISSUES REMAINING – COASTAL PROJECTS

Science Challenges

• Model coastal processes at longer time scales (decades & longer) to fully understand coastal behavior
• Translate/communicate the science (and uncertainty) to decision makers so that effective mitigation strategies are adopted
• Impact of climate change