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DYNAMIC COASTS

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

Jane Sexton

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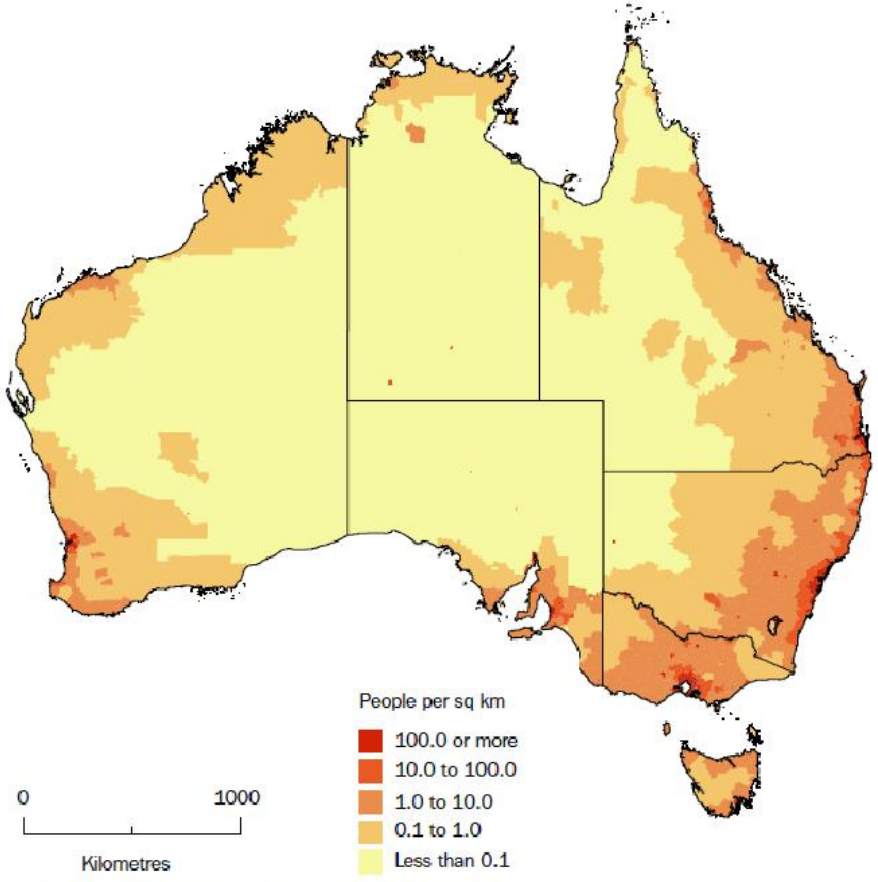
Australian Government
Department of Industry, Innovation and Science
Business Cooperative Research Centres Programme

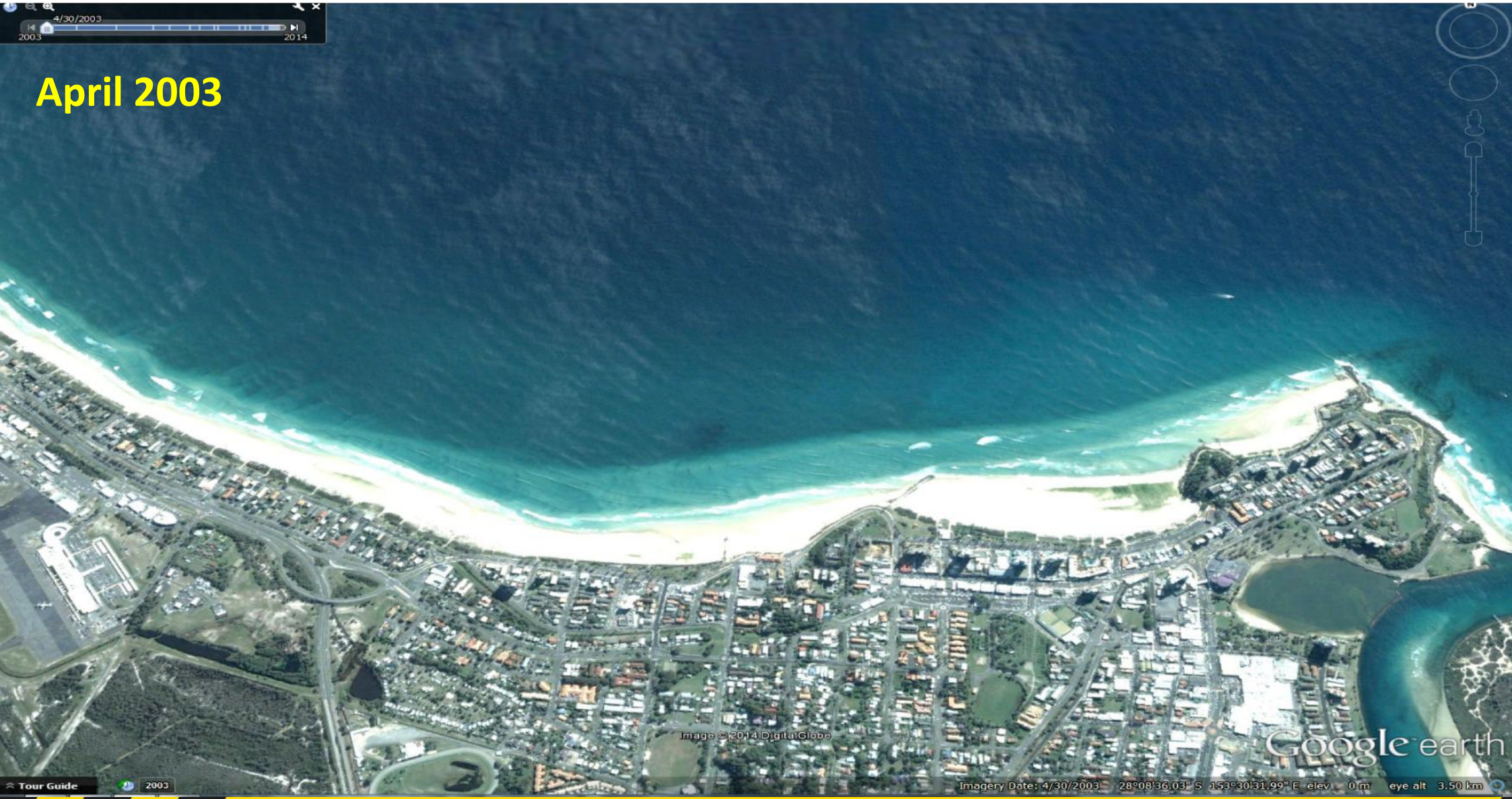
Australian Government
Geoscience Australia

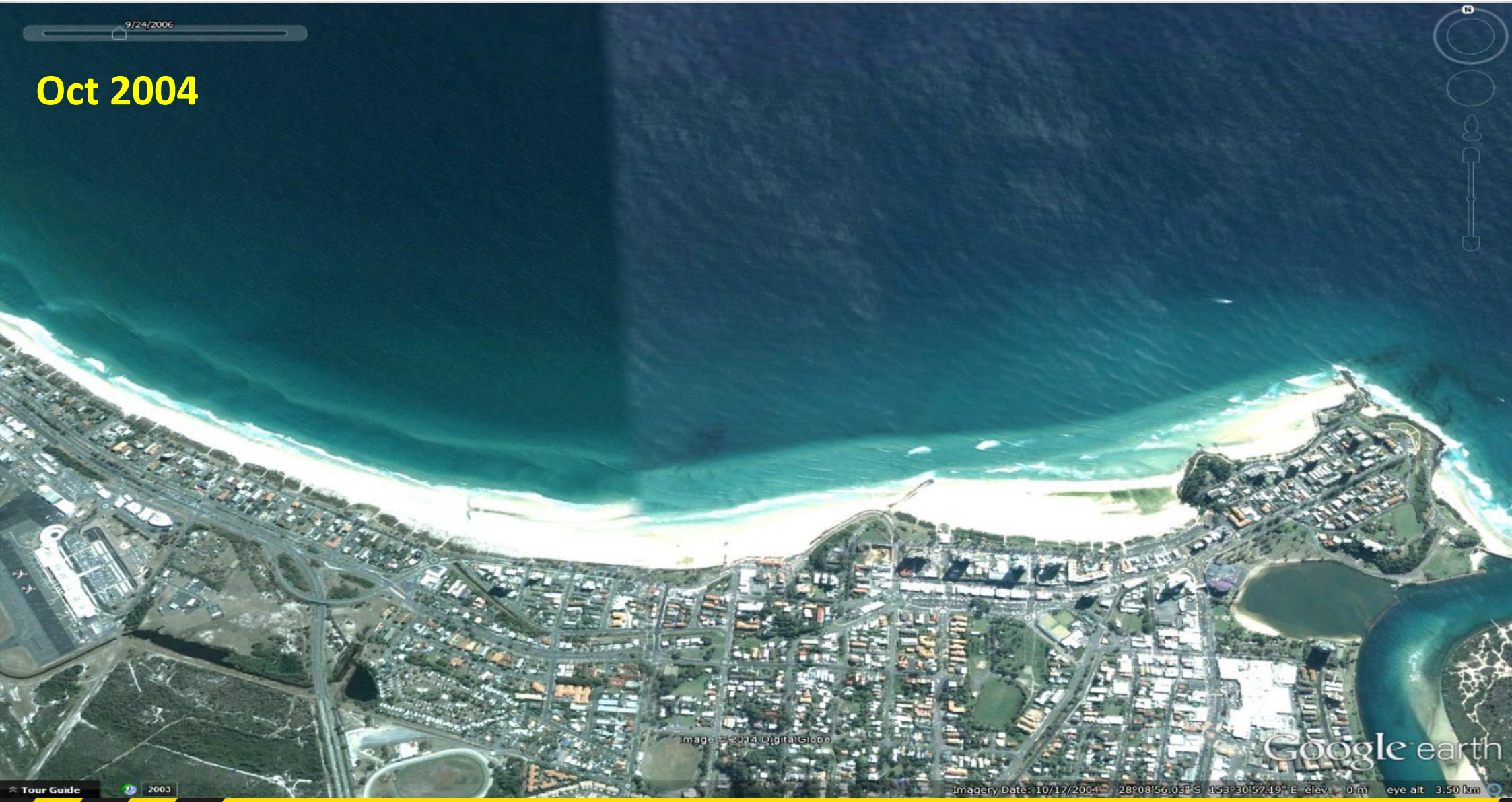
AUSTRALIA IS A COASTAL SOCIETY

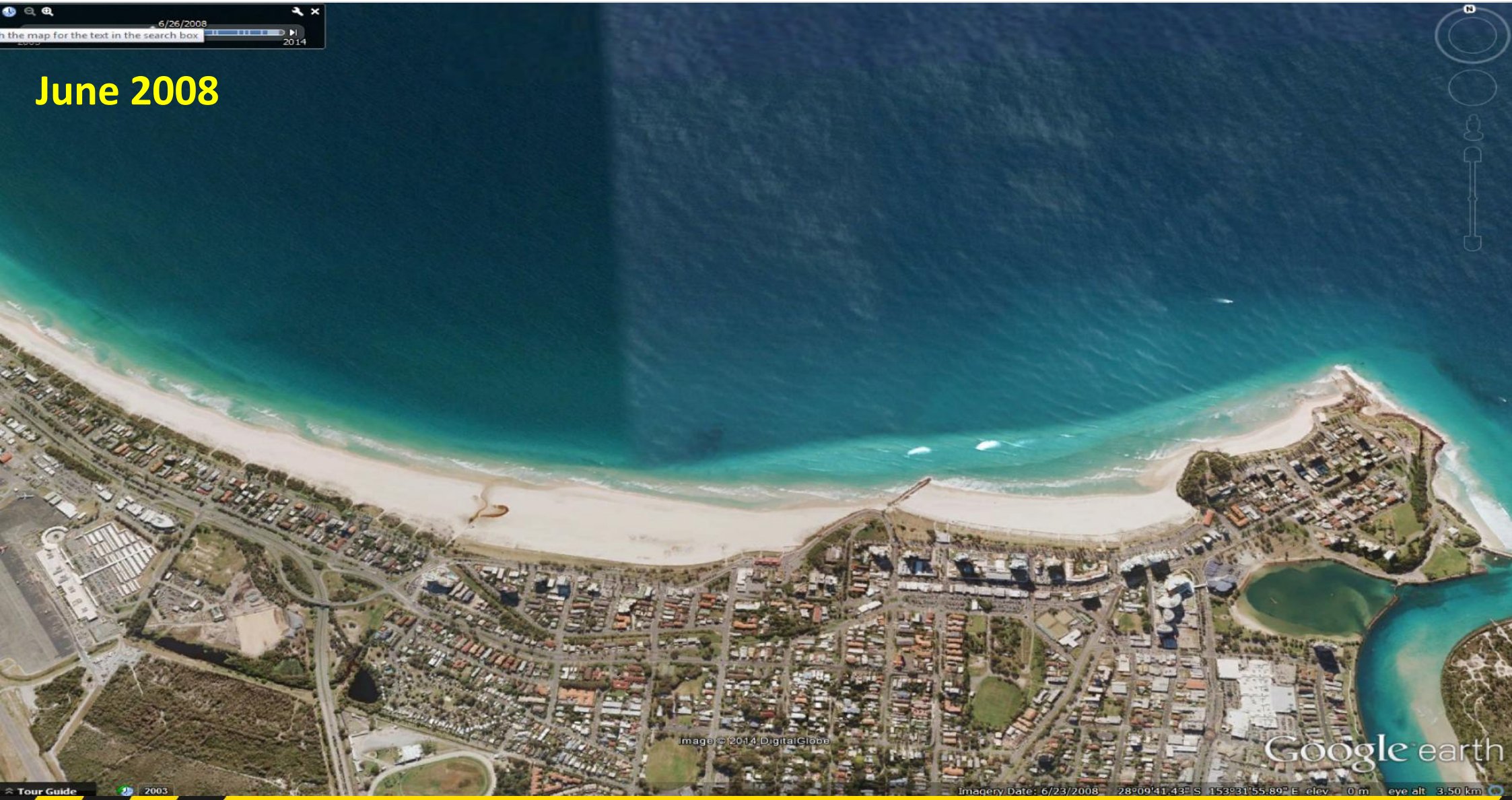
~85% of Australia's population lives within 50 km of the coast

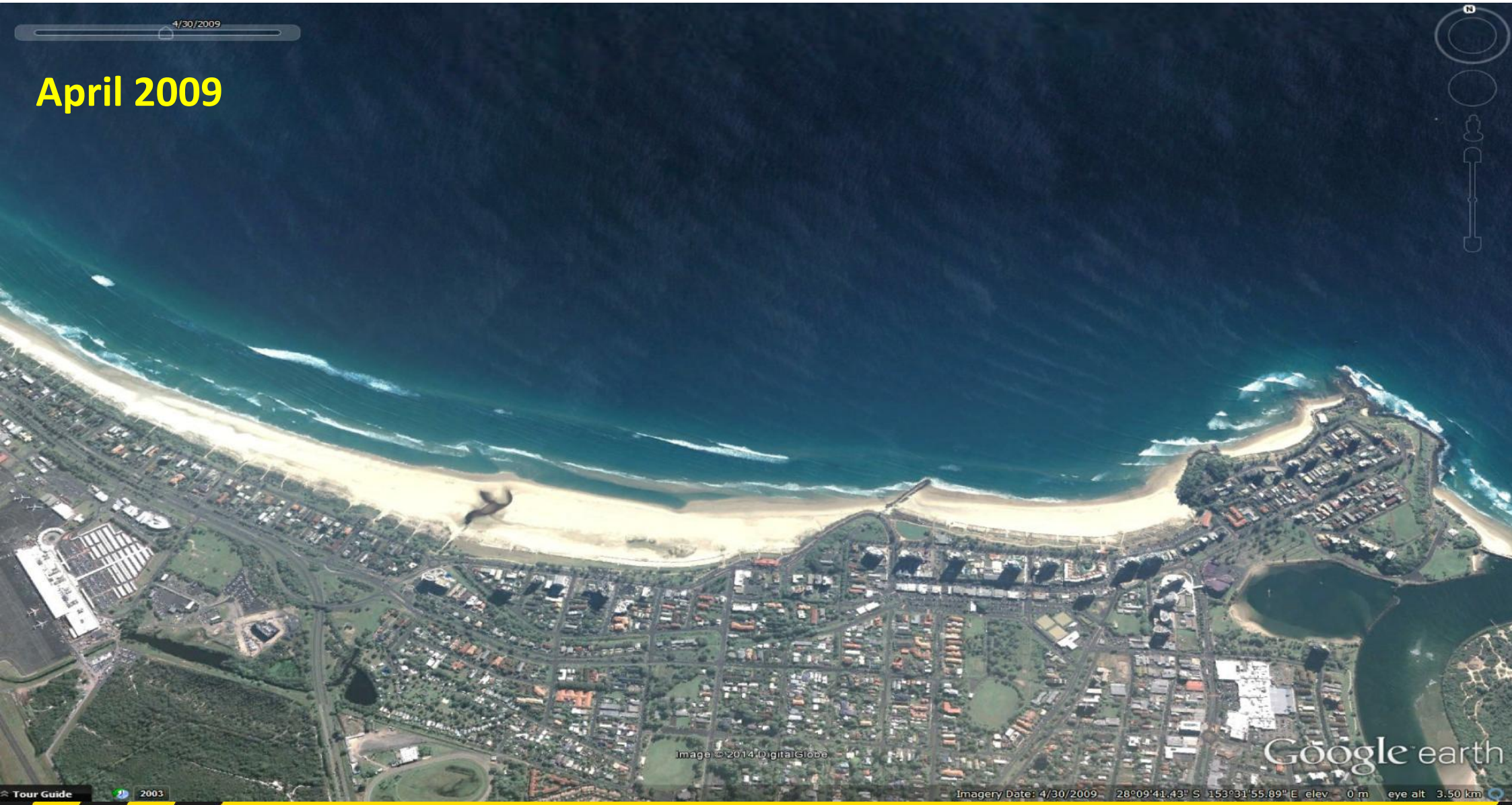


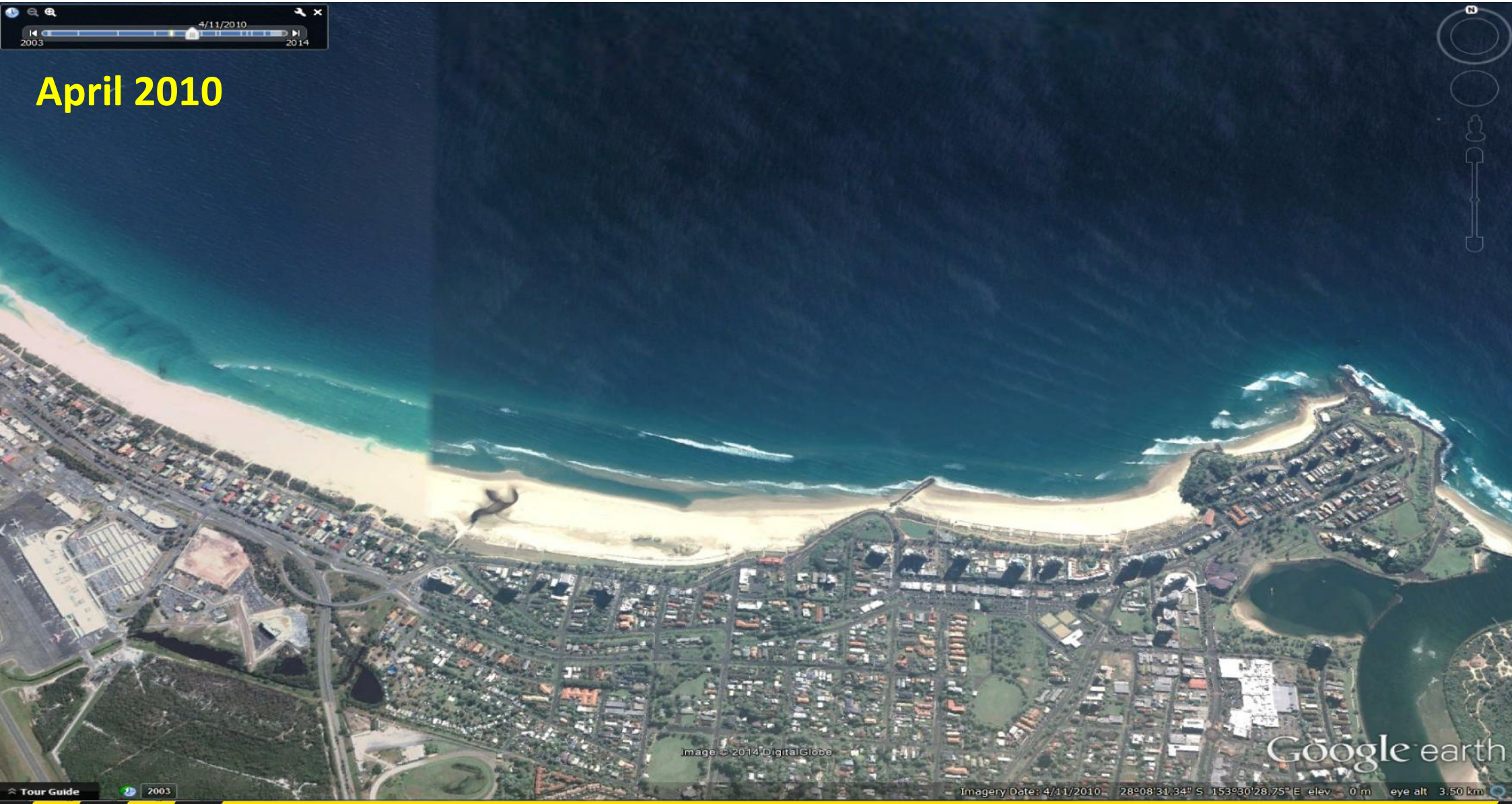
Source: Regional Population Growth, Australia (3218.0).

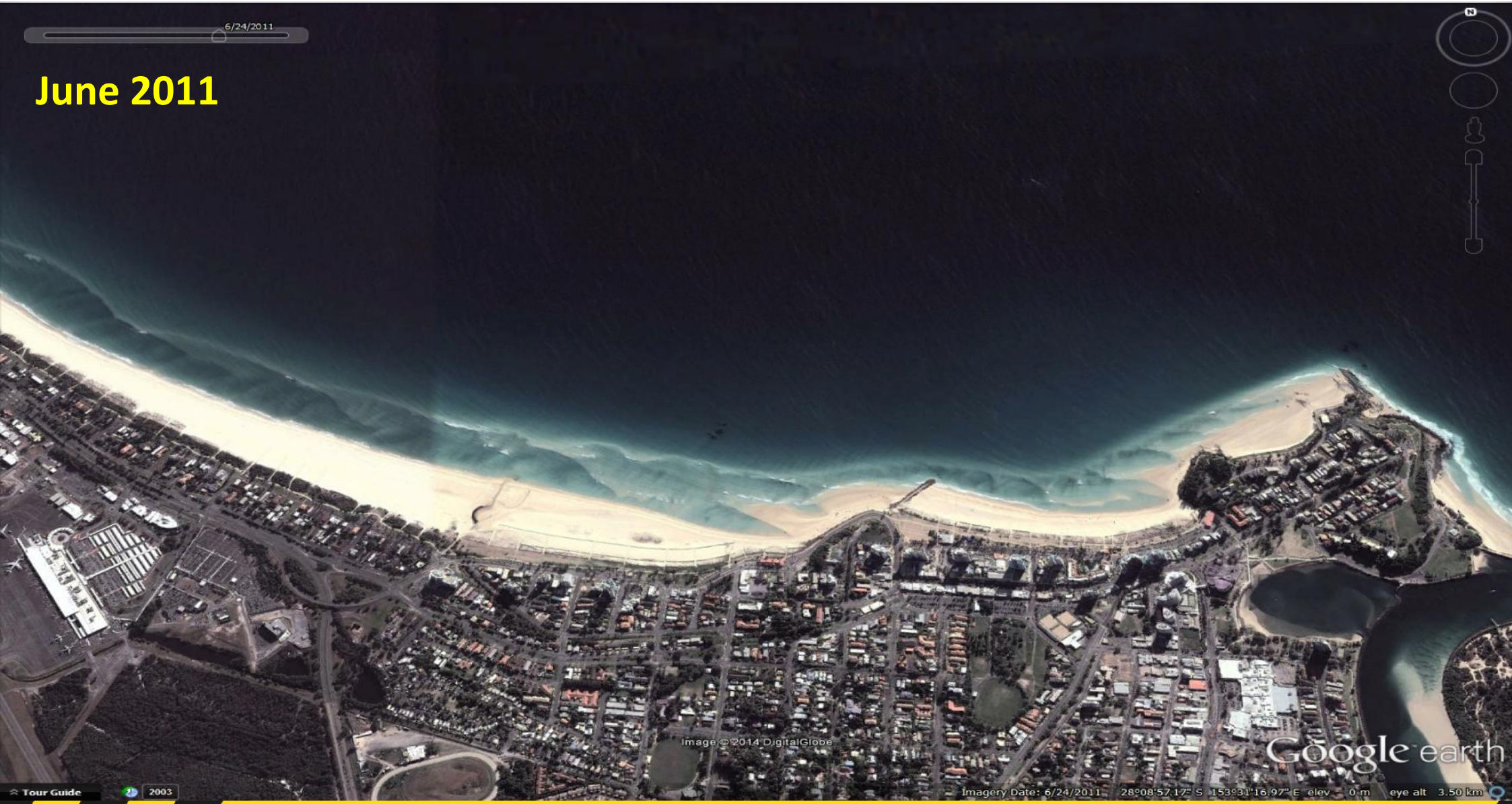


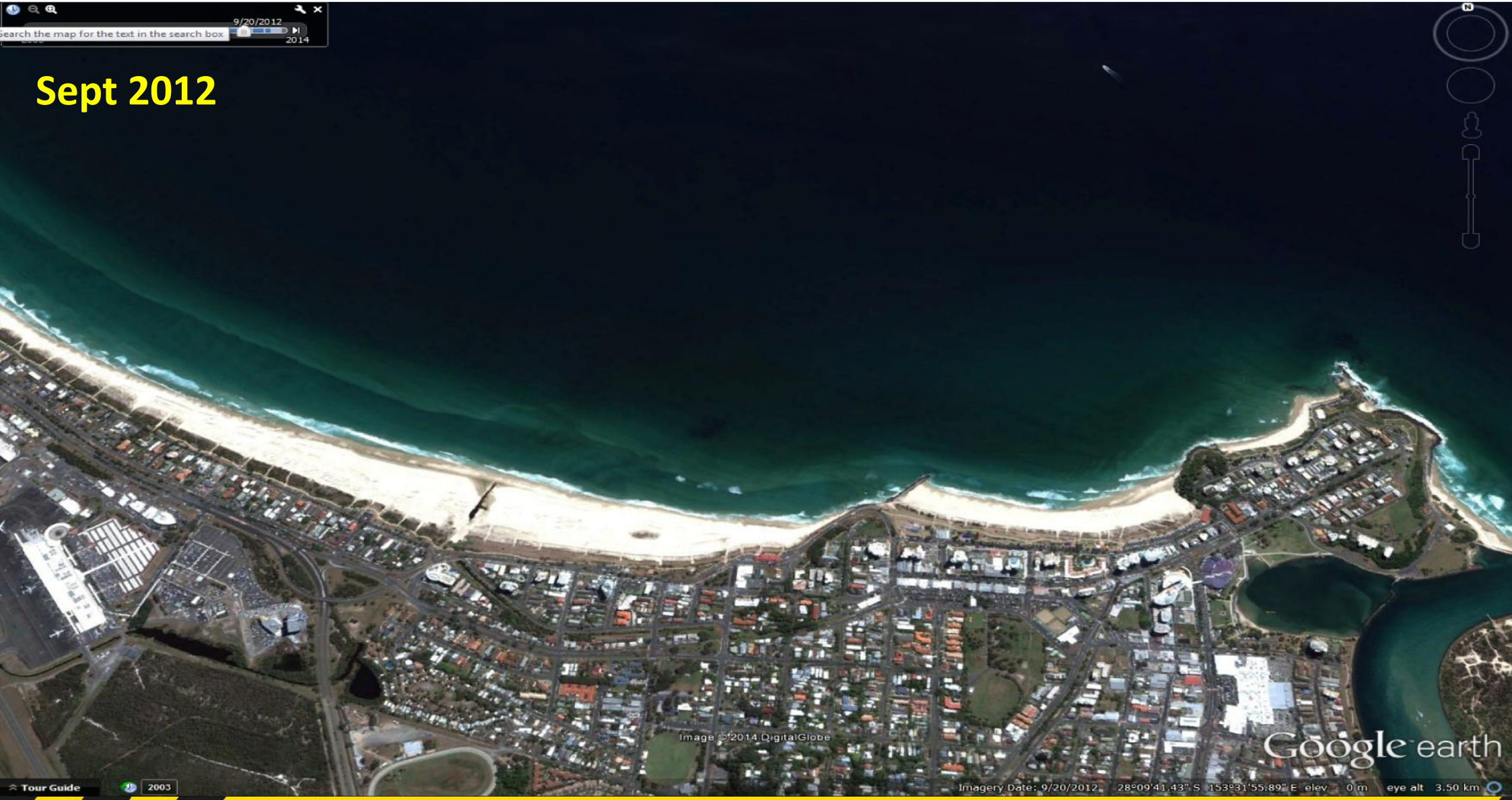


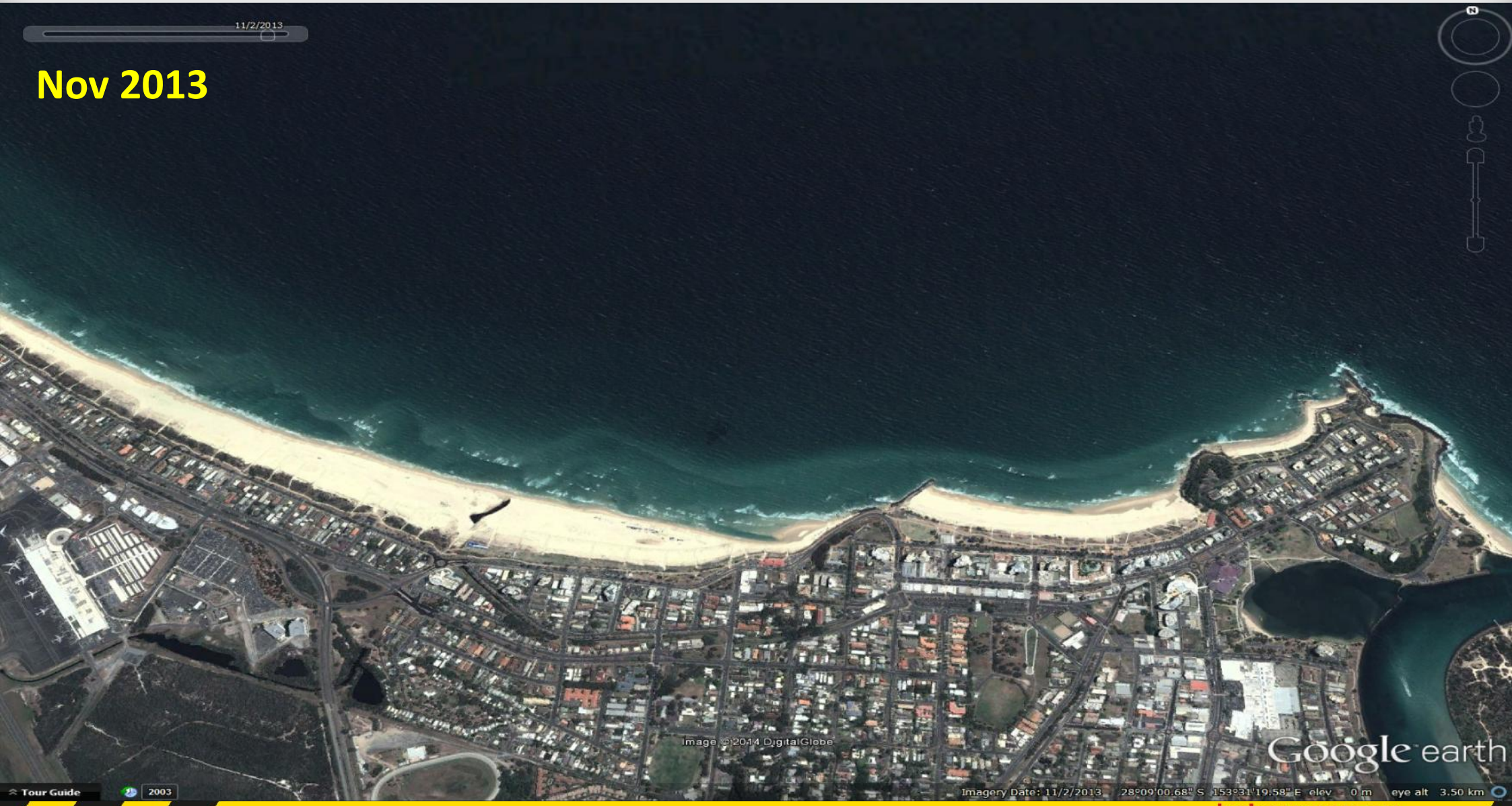


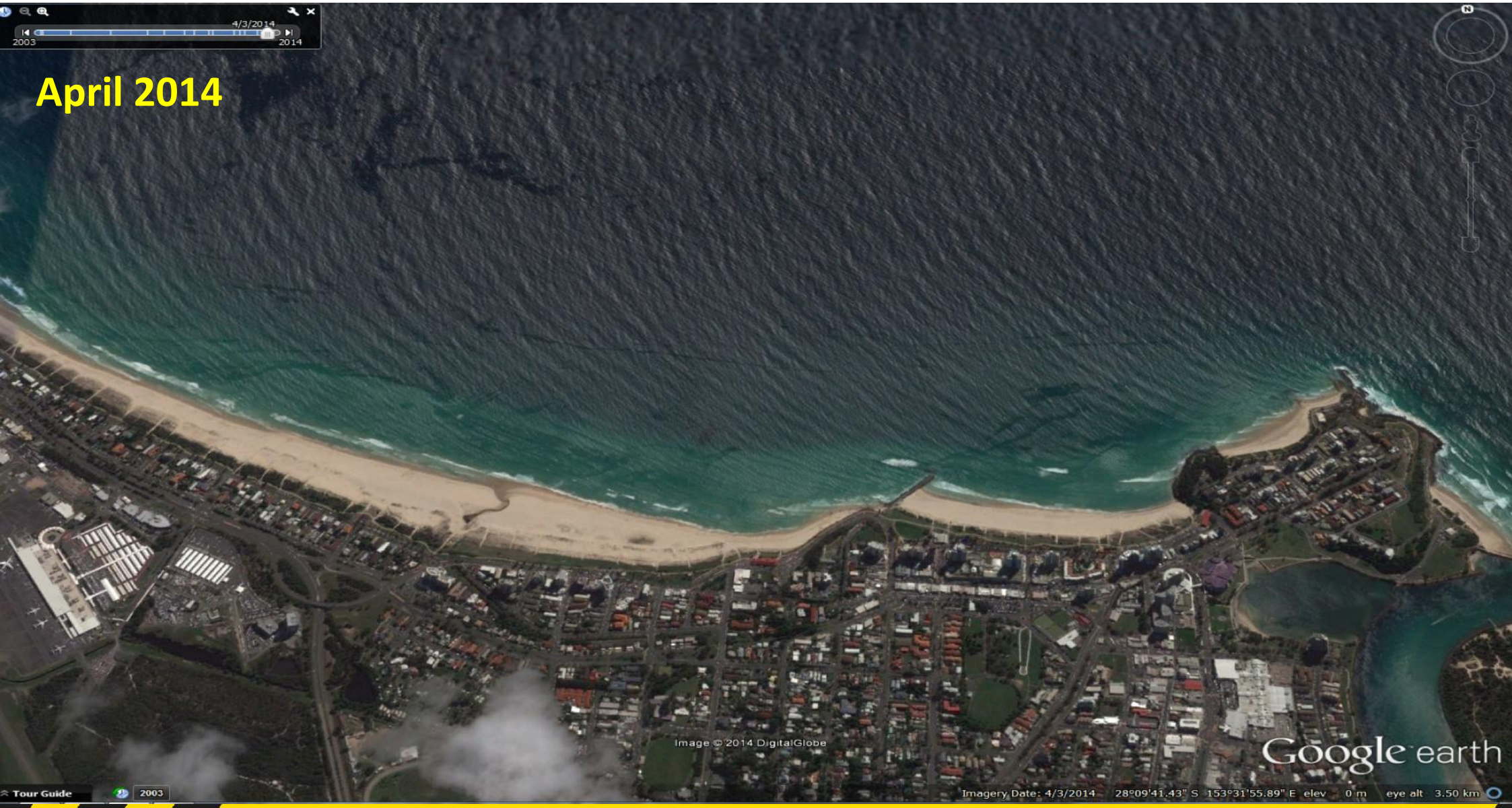




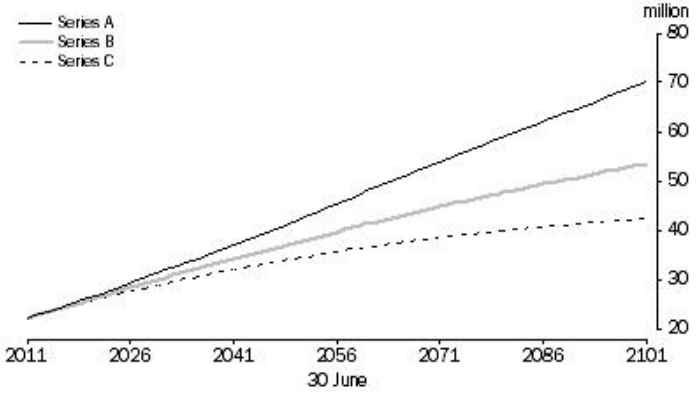




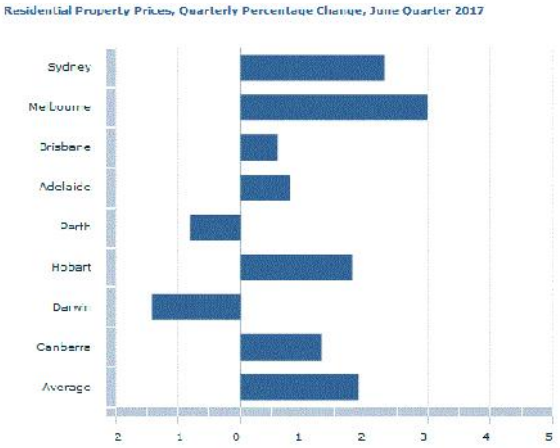


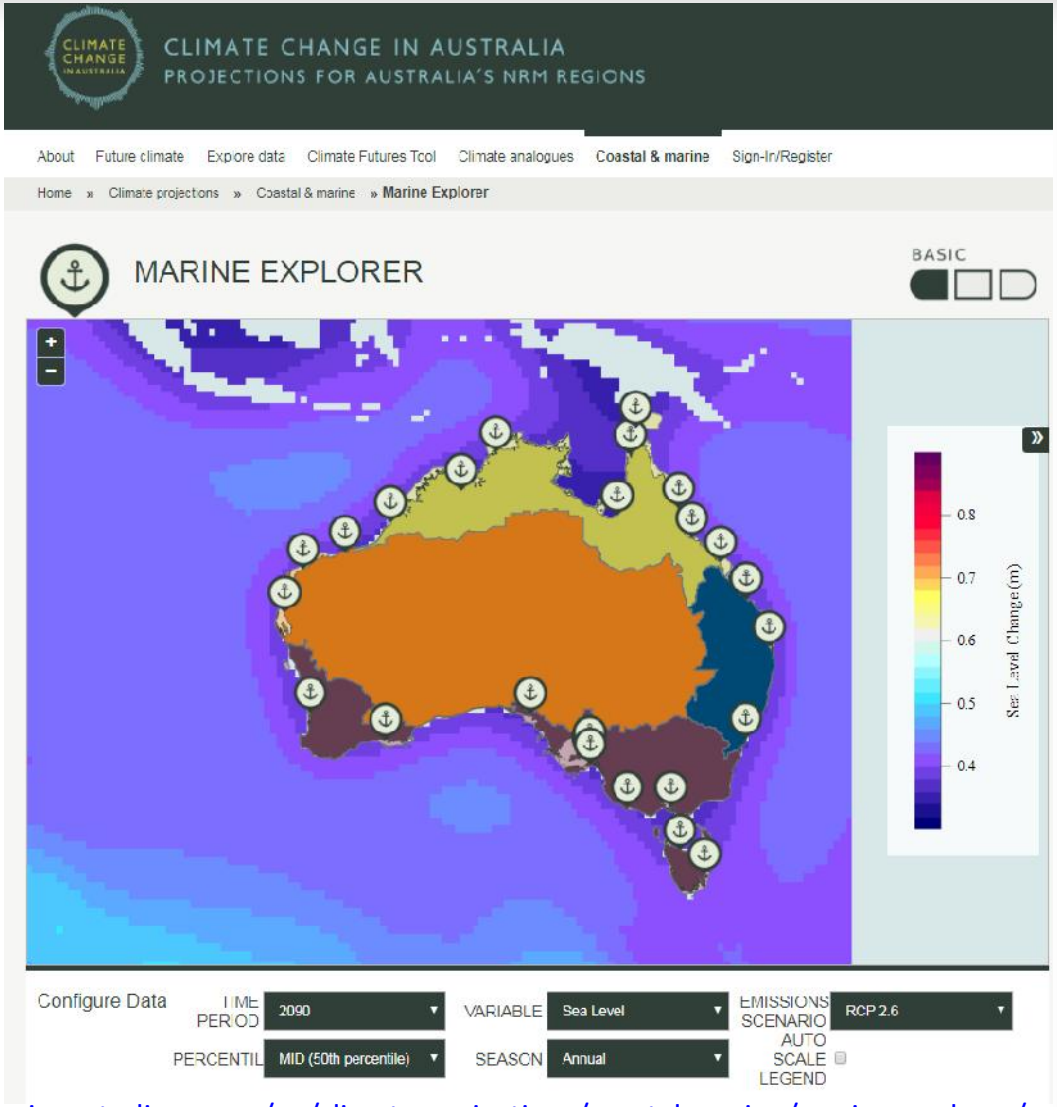


INCREASING VULNERABILITY



ABS





Source https://www.climatechangeinaustralia.gov.au/en/climate-projections/coastal-marine/marine-explorer/

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

Collaroy Beach, Sydney

EVENTS IN 2017: TC DEBBIE

Shute Harbour, Whitsunday's

Mackay

Sunshine Coast

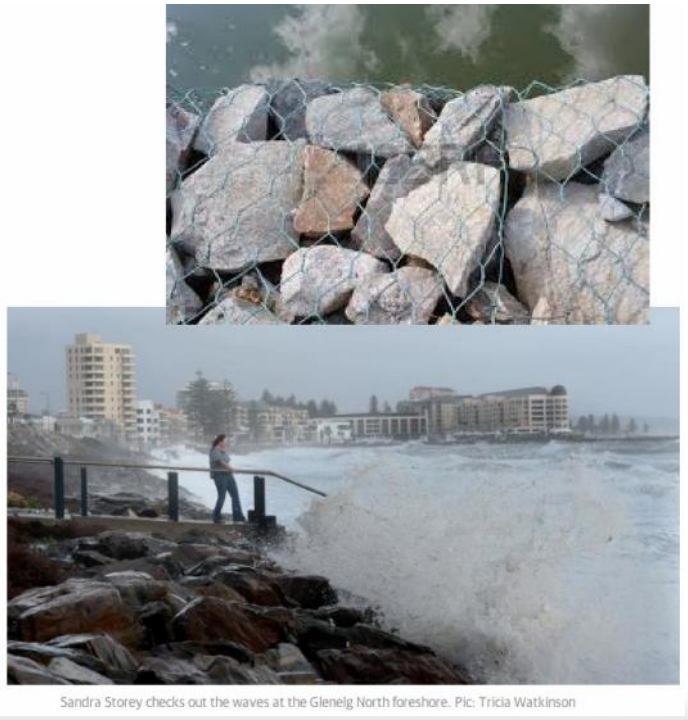
FACTS AND FIGURES ON COSTS

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.



Sandra Storey checks out the waves at the Glenelg North foreshore. Pic: Tricia Watkinson

DEVELOPING BETTER PREDICTIONS FOR EXTREME WATER LEVELS

Research Team

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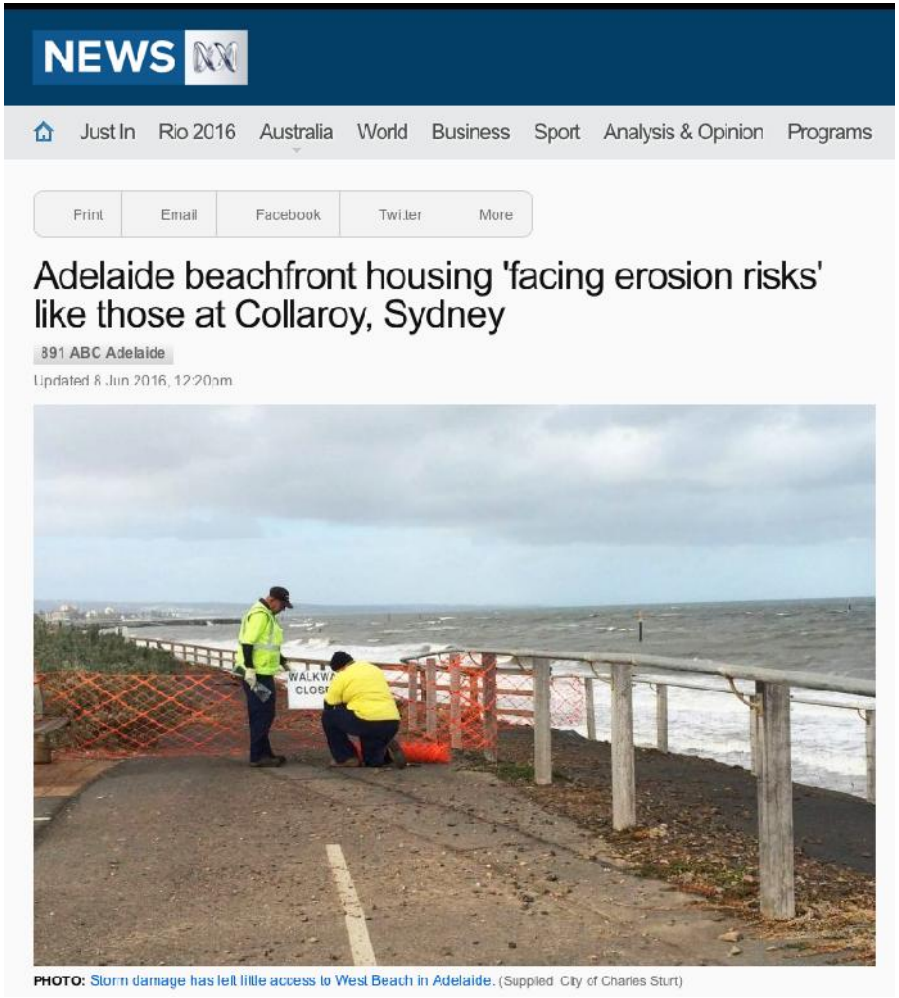
THE UNIVERSITY OF WESTERN AUSTRALIA

End users

Queensland Government	Robert Schwartz
NSW Office of Environment & Heritage	David Hanslow
NSW SES NSW STATE EMERGENCY SERVICE	Kaylene Jones
Government of Western Australia Department of Fire & Emergency Services	Steve Gray
Government of South Australia Department of Environment, Water and Natural Resources	James Guy

PROJECT IMPORTANCE

- 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?

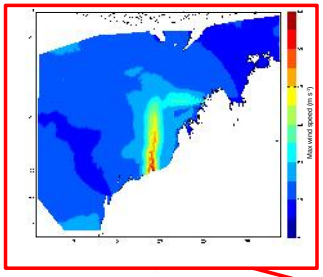
- An advanced coupled surge-wave model for the Australian coastline
  - Allows for estimation of wave setup over large areas
  - Output: 60 year time series of water levels
- Improved extreme sea level predictions

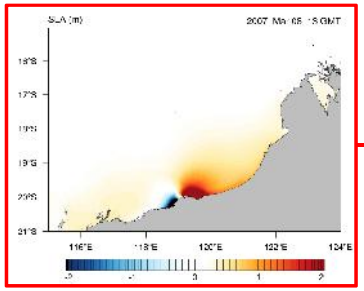
Damian Shaw Daily Telegraph

FIVE EVENTS - MODEL VALIDATION

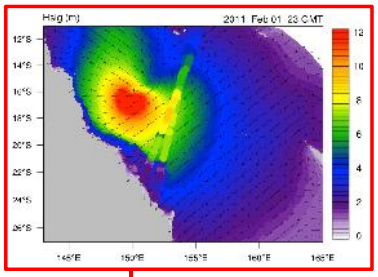
TROPICAL CYCLONE GEORGE

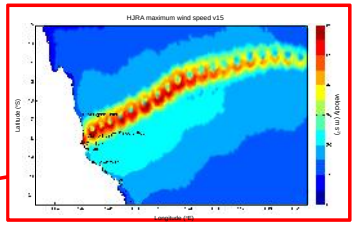
APRIL 2007

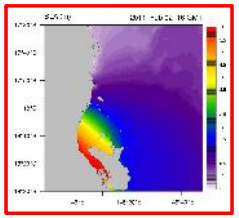


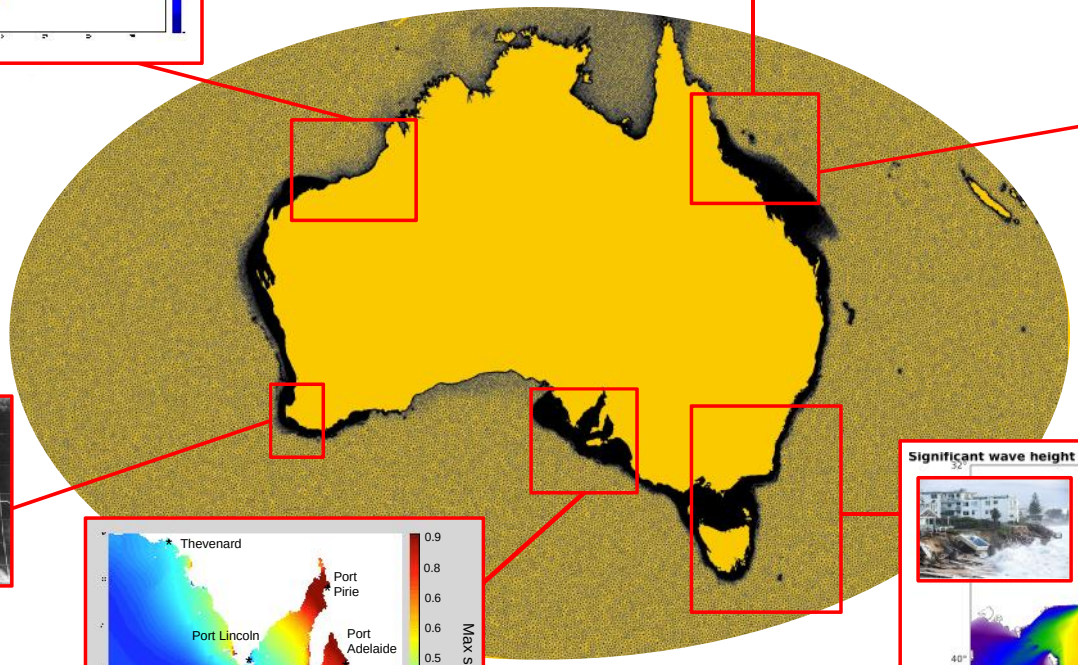


TROPICAL CYCLONE YASI FEBRUARY 2011

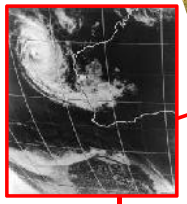


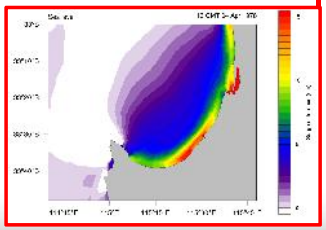


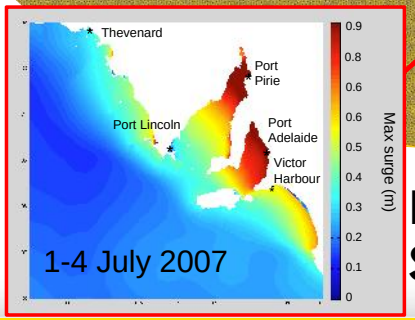




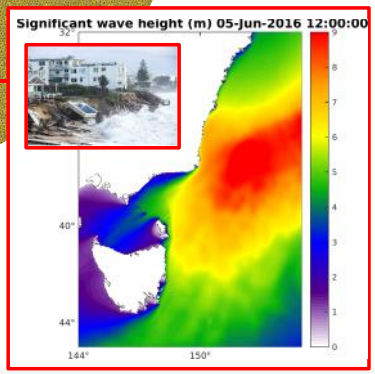
CYCLONE ALBY APRIL 1978







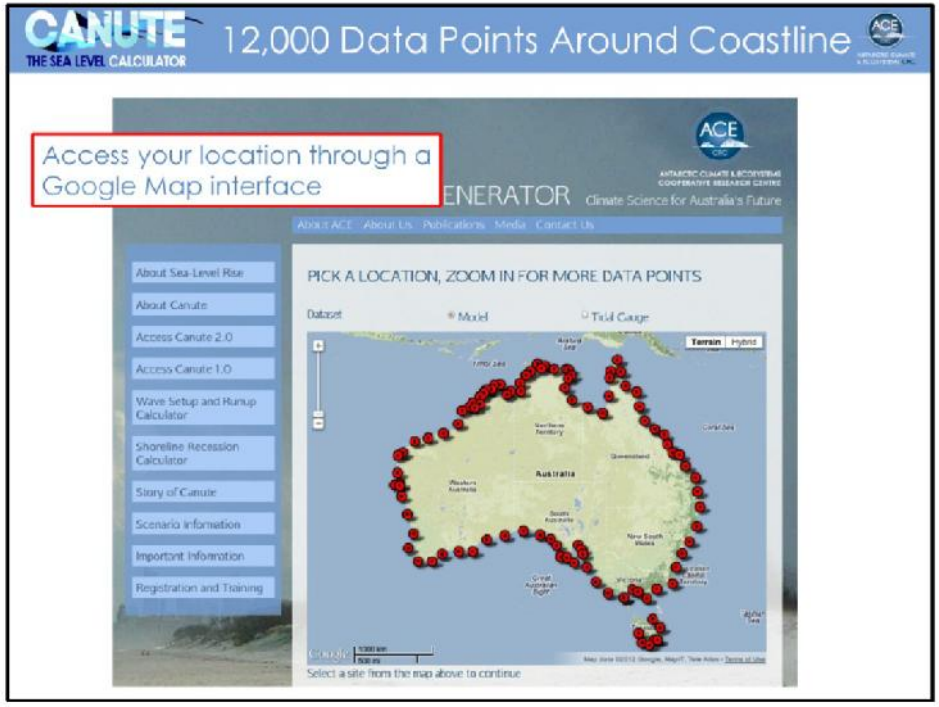
EXTRATROPICAL STORMS



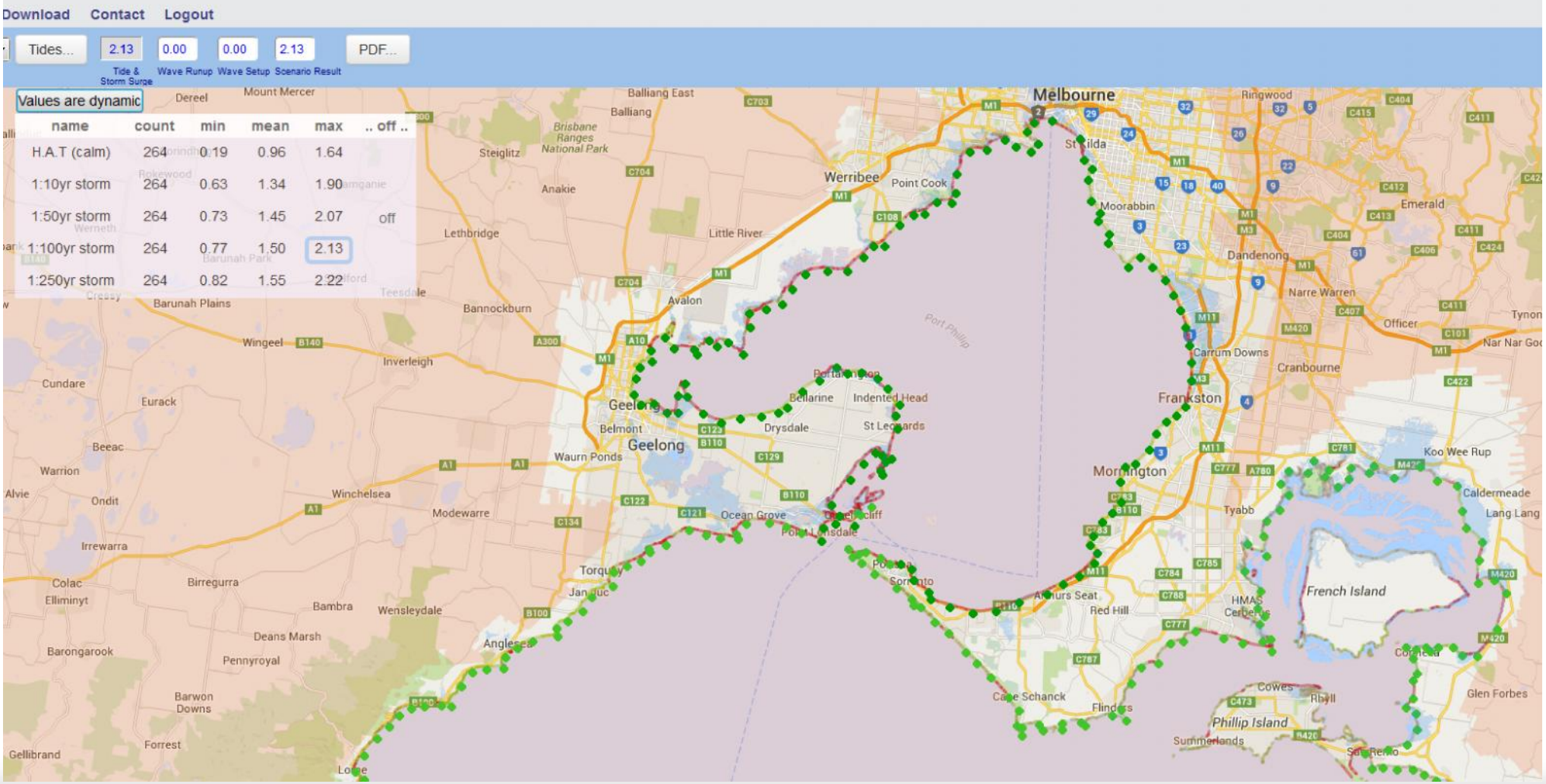
EAST COAST LOW JUNE 2016

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

Research Team

Dr Scott Nichol (Leader)
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Dr Andrew McPherson
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Floyd Howard
Duncan Moore
Dr Jane Sexton (Manager)

Professor Tom Baldock
Dr David Callaghan
Dr Uriah Gravois

Australian Government
Geoscience Australia

The University of Queensland
AUSTRALIA

End users

NSW Government Office of Environment & Heritage — Dave Hanslow

Queensland Government — Robert Schwartz

Paul Boswood

Government of South Australia
Department of Environment, Water and Natural Resources — James Guy

CONTEXT

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

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

Tweet 0

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

RELATED NEWS/ARCHIVE

Yep, 2017 hurricane season really is more intense than normal
1 Month Ago

Maria upgraded to hurricane; Jose lingering in the Atlantic
1 Month Ago

Hurricane Irma lashes Cuba, with Jose close behind

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

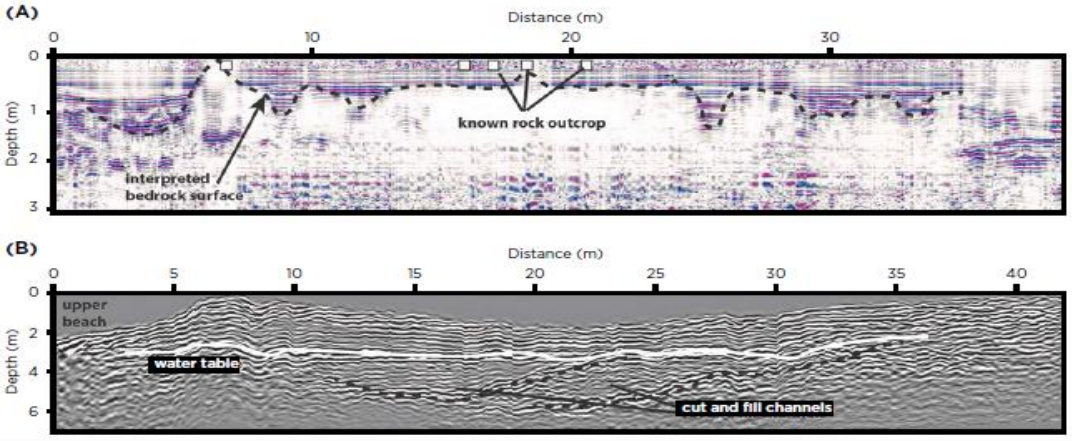
Coastal managers require information & tools to better understand coastal erosion → **Where? How much? Why?**

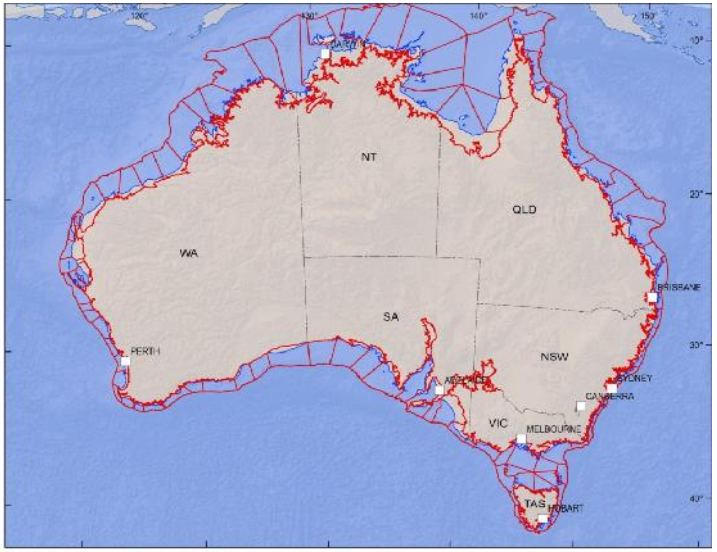
Images:
- TC Debbie March 2017 – Shute Harbour
- Ex-TC Debbie April 2017 – Gold Coast (Surf Life Saving QLD)
- Storms May 2016 - Adelaide
- East Coast Low June 2016 - Collaroy Beach, Sydney

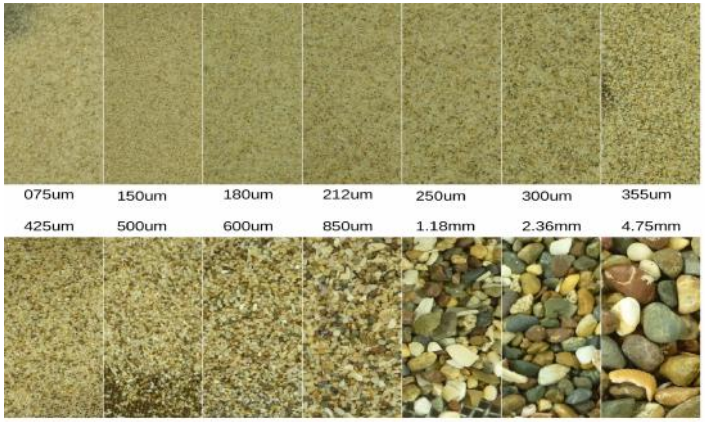
WHAT ARE THE OUTPUTS/PRODUCTS?

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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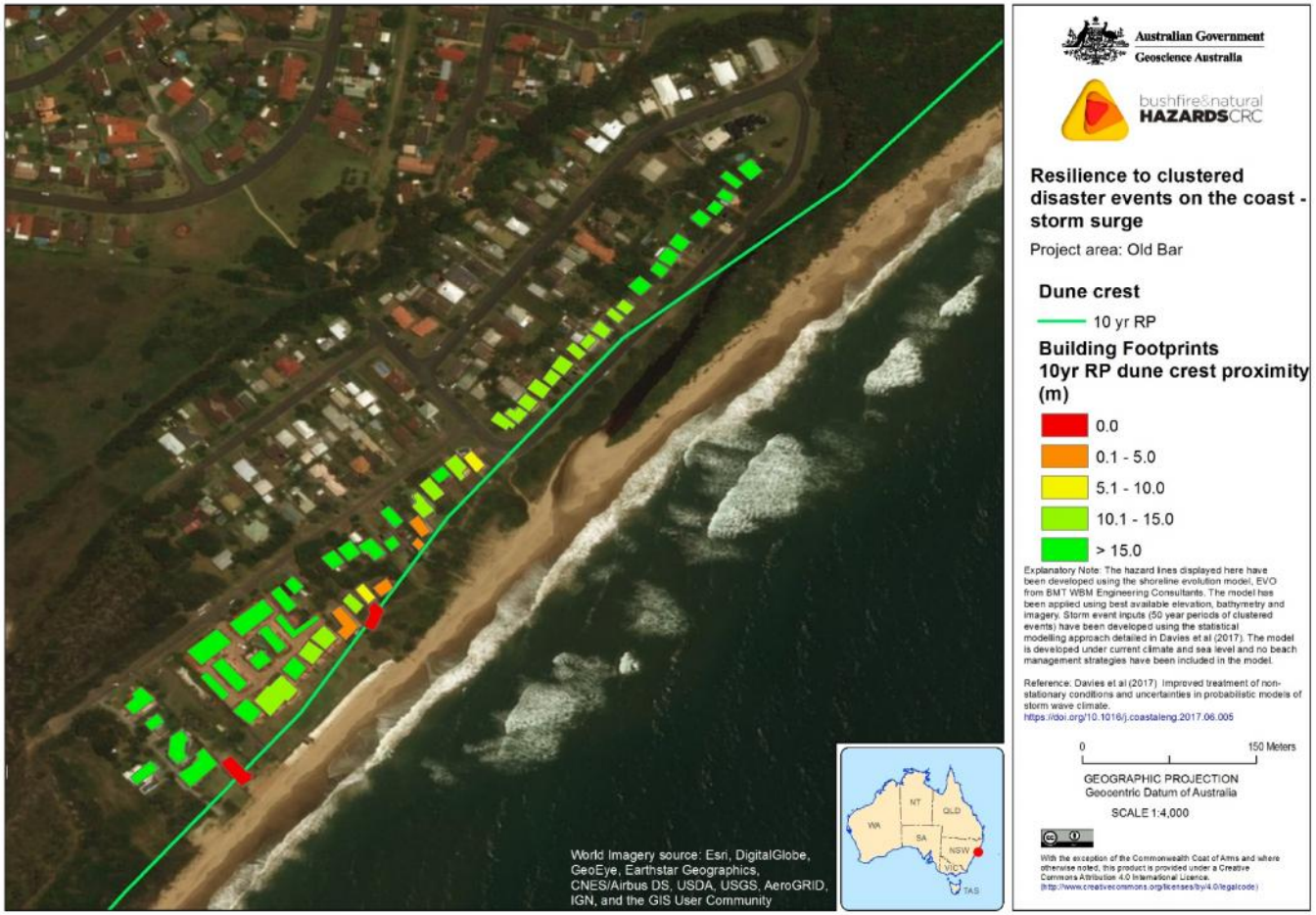

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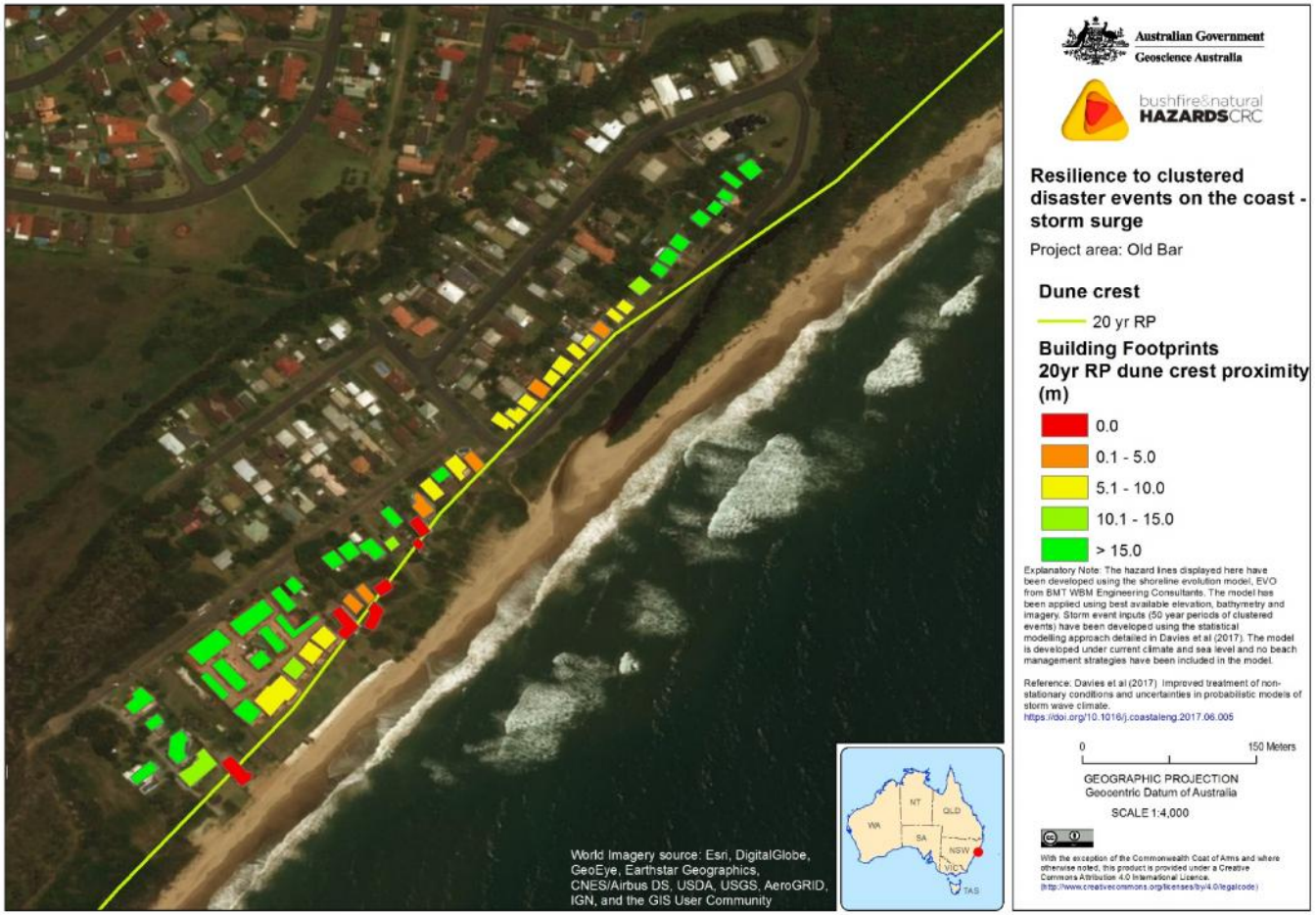

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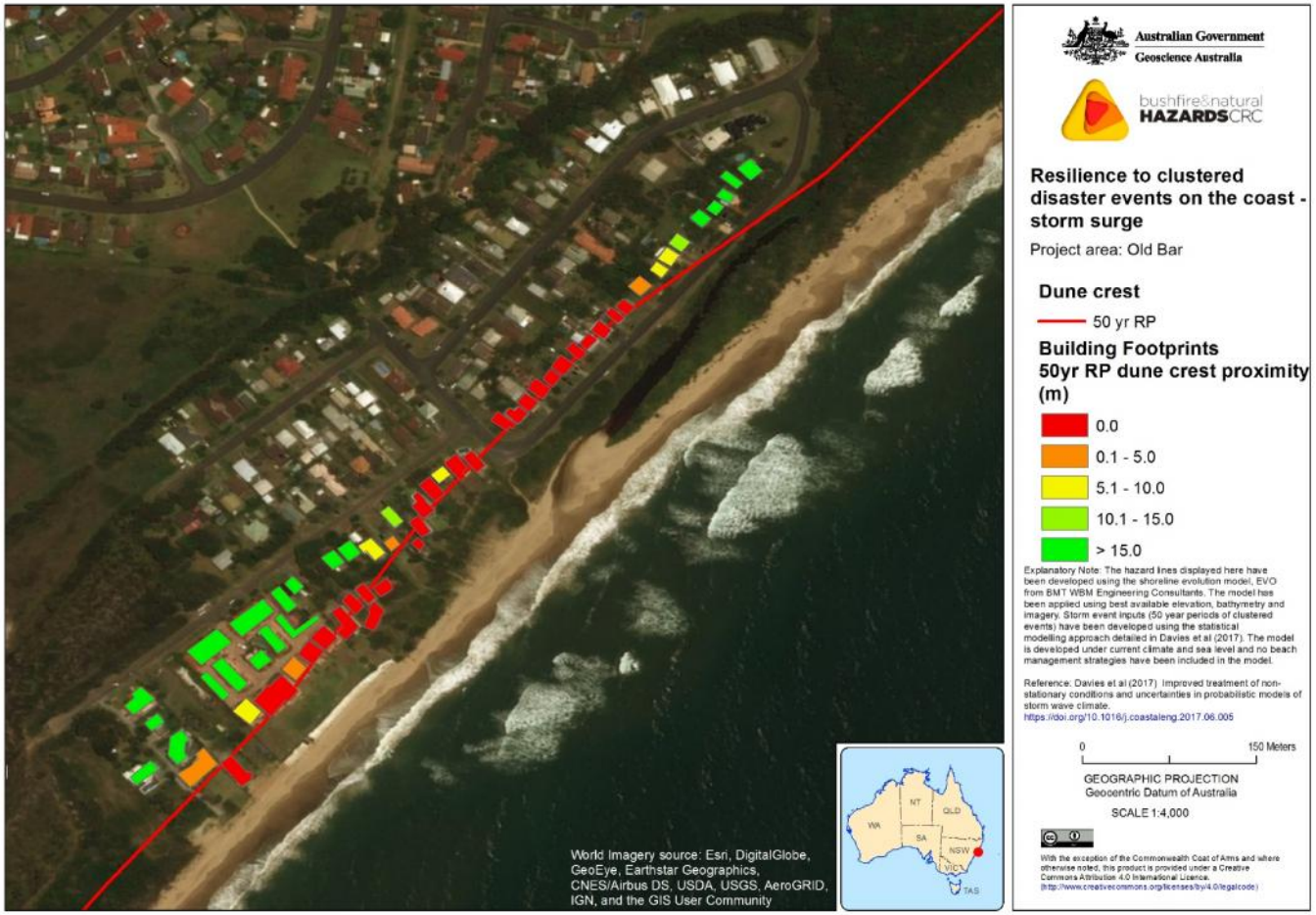

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WHERE HAS THIS WORK TAKEN US?

- 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

QUESTIONS