

# Tsunami

## Tsunami risk for Queensland

### Instructions:

1. Provide students with a print out, or PDF of the journal article: Potential collapse of the upper slope and tsunami generation on the Great Barrier Reef margin, north-eastern Australia by Puga-Bernabe'u et al (2013).
2. Give students sufficient time to read the article, either within class time or as a homework task. Ask students to make notes of the key findings of the article, paying particular attention to the abstract, introduction, and discussion. Suggested reading time: 20 minutes.
3. Provide students with the following questions to review whilst reading the article. Suggested time for answering questions: 15 minutes
4. Following reading the article conduct an in-class discussion to go over students responses to the questions posed in the article. Suggested time for in class discussion: 15minutes
5. At the end of the discussion provide Cairns Regional Council storm tide surge maps to students, or present the storm tide surge map of the Cairns CBD to the class as a projector slide.

### Answers

- A1: The Noggin block, in the upper-slope offshore Cairns as part of the Noggin Passage region.
- A2: The refraction and reflection of wave energy by the reef matrix of the Great Barrier Reef.
- A3: Because they can be triggered much closer to land than co-seismic tsunami, which means that despite their slow energy release they can produce a wave of great height.
- A4: Critical peak horizontal accelerations of 0.2–0.4 g would lead to the failure of the Noggin block. This would require an earthquake with a magnitude of MW 7.0–7.5 ± 0.2, and would need to be generated within short hypocentral distances and short periods.
- A5: High sedimentation rates or gas hydrate dissociation may destabilise sediment by increasing pore-pressure. Groundwater seepage may also increase pore pressure.
- A6: 7-11m
- A7: Yes, halving the predicted height of the tsunami would still produce a wave with a height between 3-7m.
- A8: 20–370km/h depending on the range of shelf depths traversed, approximately 1 hour to reach the coast.
- A9: All red, orange and yellow storm tide zones would be severely affected. A wave of this height is likely to cause significant damage to the Cairns CBD and disruption to essential services.
- A10: No specified answer, the question is asked to generate thought on the real risk of tsunami to the Cairns region
- A11: No specified answer, the question is asked to generate thought on the real risk of tsunami to the Cairns region.

# Tsunami risk for Queensland

Read the journal article, "Potential collapse of the upper slope and tsunami generation on the Great Barrier Reef margin, north-eastern Australia by Puga-Bernabeu et al (2013)" and answer the questions below.

Answer questions 9-11 after viewing Cairns Regional Council storm surge maps with your class.

## Question 1:

What geological feature do the authors identify as a possible trigger for a tsunami in the Cairns region? (hint: read abstract)

## Question 2:

What do numerical models of the 2007 Solomon Island tsunami indicate as the reason for the small wave height felt along the North Queensland coast in 2007? (hint: read introduction)

## Question 3:

Why are landslide-induced tsunamis expected to pose more of a threat to the Queensland coast than co-seismic tsunamis? (hint: read introduction)

## Question 4:

What do the authors hypothesise would be needed to create a submarine landslide of the Noggin block? (hint: read section 5.1)

## Question 5:

What are the other possible triggers for a submarine landslide of the Noggin block identified by the authors?

## Question 6:

What is the predicted maximum wave height that could be produced if the Noggin block fails catastrophically? (hint: read section 5.2)

## Question 7:

Given that the Solomon Islands tsunami of 2007 was nearly halved in height by the Great Barrier Reef would the failure of the Noggin block be likely to produce a significant tsunami within the Cairns region?

## Question 8:

What is the predicted speed at which a tsunami wave could travel from the failure of the Noggin block, and approximately how long do the authors predict for the wave to reach the coast? (hint: read section 5.2)

## Question 9:

In class look over Cairns Regional Council storm tide surge maps and identify the areas that are likely to be affected by a tsunami of the height predicted by the authors, if the Noggin block failed. What impact do you think a wave of this height would have on the Cairns region?

- ▶ Red storm tide surge zones are up to 2m above AHD (sea level)
- ▶ Orange zones are 2-3m above AHD
- ▶ Yellow are 3-4.5m above AHD

## Question 10:

Does the research presented in this article change your perception of the risk tsunami may pose to the Cairns region?

## Question 11:

How do you think Cairns region residents could be better prepared for tsunamis?

No specified answer, the question is asked to generate thought on the real risk of tsunami to the Cairns region.