Geophysical Research Abstracts
Vol. 17, EGU2015-8149, 2015
EGU General Assembly 2015

Landslide tsunami hazard in New South Wales, Australia: novel observations from 3D modelling

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This paper examines the potential of tsunami inundation generated from two case study sites of submarine mass failures on the New South Wales coast of Australia. Two submarine mass failure events are investigated: the Bulli Slide and the Shovel Slide. Both slides are located approximately 65 km southeast of Sydney and 60 km east of the township of Wollongong.

The Bulli Slide ($\sim$20 km^3) and the Shovel Slide (7.97 km^3) correspond to the two largest identified erosional surface submarine landslides scars of the NSW continental margin (Glenn et al. 2008; Clarke 2014) and represent examples of large to very large submarine landslide scars. The Shovel Slide is a moderately thick (80-165 m), moderately wide to wide (4.4 km) slide, and is located in 880 m water depth; and the Bulli Slide is an extremely thick (200-425 m), very wide (8.9 km) slide, and is located in 1500 m water depth.

Previous work on the east Australian margin (Clarke et al., 2014) and elsewhere (Harbitz et al., 2013) suggests that submarine landslides similar to the Bulli Slide or the Shovel Slide are volumetrically large enough and occur at shallow enough water depths (400-2500 m) to generate substantial tsunamis that could cause widespread damage on the east Australian coast and threaten coastal communities (Burbidge et al. 2008; Clarke 2014; Talukder and Volker 2014).

Currently, the tsunamogenic potential of these two slides has only been investigated using 2D modelling (Clarke 2014) and to date it has been difficult to establish the onshore tsunami surge characteristics for the submarine landslides with certainty.

To address this knowledge gap, the forecast inundation as a result of these two mass failure events was investigated using a three-dimensional model (ANUGA) that predicts water flow resulting from natural hazard events such as tsunami (Nielsen et al., 2005). The ANUGA model solves the two-dimensional shallow water wave equations and accurately models the process of wetting and drying thus making it ideal for simulating inundation due to tsunami. The model generates a surface wave profile based on the dimensions of the submarine mass failure event using the method of Ward et al. (2005). Inundation maps are shown for these two slides and sensitivity analysis is conducted to identify the characteristics of the slides that are most influential on inundation areas and depths.