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Three-dimensional physical modelling of subaerial landslide-generated waves and comparison with two-dimensional experiments

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Subaerial landslide-generated waves are among natural hazards that have attracted attention in recent years, in particular after the 2018 Anak Krakatau volcanic tsunami (Indonesia), which left a death toll of over 450. This has increased the application of physical modelling on subaerial landslide tsunamis to cope with the risks of such hazards and to develop knowledge of their generation mechanisms. Physical experiments in two-dimensional flumes are generally more cost-efficient, less time consuming and allow better control on the set-up. As a result, landslide–tsunamis are considerably investigated in 2D rather than in 3D. However, it is important to note that 2D physical modelling of subaerial landslide–tsunamis could be associated with some uncertainties and may slightly overestimate the wave amplitudes. By using 3D physical models, it is possible to investigate wave amplitude attenuations in both radial and angular directions, which would improve the understanding of wave propagation. In this research, we conduct 2D and 3D experiments on subaerial landslide tsunamis. The physical experiments were conducted in a 2.5 m wide, 0.50 m deep and 2.5 m long wave basin at the Brunel University London (UK). The experimental setup included five different slope angles (i.e. 25^{o},35^{o},45^{o},55^{o} and 65^{o}). The solid blocks had four different volumes in a range of 0.5×10^{-12} km^3-3.0×10^{-12} km^3. The generated water waves were measured using six precision capacitance wave gauges located in both near- and far-fields. The 2D and 3D results are compared to quantify the effects of dimensions on the wave amplitudes and attenuations.