UQ plans for the next big wave – tsunami defence

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A new tsunami impact model developed by The University of Queensland will help emergency response teams plan what to do if the next big wave hits.

The mathematical model, developed by Dr Tom Baldock, PhD student Paul Guard and Associate Professor Peter Nielsen from UQ's Coastal Engineering Group, can predict the initial run-up and impact as the leading waves hit the coast.

On the eve of the anniversary of the 2004 Boxing Day tsunami that devastated parts of south and east Asia, the model represents a significant leap forward from classical tsunami impact research that is based on non-breaking waves (those that are offshore - they break as they steepen up in shallow water).

By watching videos of the Boxing Day tsunami, the researchers realised that conventional non-breaking wave models were not suitable for describing the leading breaking waves.

Dr Baldock said the new research was able to calculate the motion of the leading edge of the breaking wave run-up on dry land, together with the flow depth and flow velocities in the inland region during the inundation (water coverage).

“The model can help with planning for a tsunami event by providing estimates of inundation depths, the force exerted by the water on structures and forces on debris that may be picked up and carried in the flow,” Dr Baldock said.

“Rates of inundation and flow depths are important in planning evacuation and determining appropriate shelter locations.

“Knowing the force exerted by the flow is important in designing buildings and defences to resist tsunami impact.”

The new model only requires information about water depths at the original shoreline location, which is usually the most widespread data available.

Dr Baldock said this enabled different wave scenarios to be modelled quickly and efficiently and localised wave run-up and impact forces to be modelled more accurately.

“This model predicts that the maximum flow velocities and peak force occurs at first impact, whereas the classical model predicts these occur later in the run-up or during the drawdown after maximum run-up,” Dr Baldock said.

Previous models underestimated the height of the Boxing Day tsunami above sea level by up to 20 metres in Western Sumatra and overestimated by as much as 10 metres in Bangladesh.

Dr Baldock said the new model would help engineers and architects planning new buildings and tsunami shelters, where the key aspect was to minimise the time required for occupants to reach a higher elevation.

“The available evacuation time may be quite different for non-breaking and breaking tsunami fronts,” he said.

The team is currently carrying out experiments using a recently built tsunami generator in UQ's Coastal Wave Flume, which forms part of the Division of Civil Engineering's Geo-Hazard Research Laboratory. The generator can produce non-breaking and breaking tsunami type waves on a laboratory scale.

For more information visit www.uq.edu.au/coastal

Source: University of Queensland

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