Title: Robust Computational Models for Water Waves

Abstract:

The development of accurate and robust computational models for water waves is vital for the assessment of natural hazards such as tsunamis, storm surges and rogue waves. It is also essential for understanding many other related physical phenomena such as beach erosion, nutrient transport in marine environments and the break up of sea ice at the poles.

Previous work at the ANU in this area has included a collaboration with Geoscience Australia to develop ANUGA, which uses the Shallow Water Wave Equations (SWWE) to model water and has been used to model riverine floods, tsunamis and storm surges. However, as with all mathematical models the SWWE make some assumptions that limit its applicability as the length of waves relative to the depth of ocean increases. This is precisely the situation tsunamis experience as they approach the shoreline.

To remedy this we have been developing Numerical methods for a new set of equations; the Serre equations that model waves for a greater range of wavelength to depth ratios and therefore are more applicable for the shoaling of waves. Previously, Chris completed his PhD in which he developed well validated numerical methods that appeared to handle steep gradients in the flow very well.

I the previous work at the ANU by further demonstrating a systematic review of the numerical solutions of the Serre equations that demonstrated the applicability of our methods in this situation. I also further developed these numerical methods making them more robust in the presence of steep gradients and extended our solutions to dry beds.