Tsunami Mitigation as a Function of Alterations in Bottom Friction

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Purpose: The hypothesis that three methods of alterations in bottom friction might reduce shoaling wave amplitude before the wave arrives at the beach was tested. Alterations of the near-shore seafloor to absorb wave energy have not been previously examined. Procedure: An above ground swimming pool was used to house a 2 X 1 X 1 meter wooden impoundment tower that opened into a 4-meter experimental pool. Waves were generated by using a pneumatic system to raise a vertical floodgate. They passed over a 4% slope that could hold 10-centimeters deep of substrate. A laser was used to measure wave amplitude every ten milliseconds. Ten individual waves were observed for twenty seconds each, with the 2,000 water levels per wave transferred into Excel for analysis. Rock, pebbles and sand as well as near shore trench and three different semi-permeable “erosion” barriers were tested with seven configurations for each of the three substrates. Data: Each method of coastal modification, substrate alteration, near shore trench, and erosion barrier were individually shown to reduce wave amplitude. Wave amplitude was decreased by changing rock to sand by 6.5%, 15.5% for adding a trench and 7% for adding an erosion barrier. The use of all three in combination was additive and reduced wave amplitude by 29%. Almost all reductions in wave amplitude were high statistically significant. Conclusion: The hypothesis that increasing bottom friction would reduce wave amplitude was supported. The evidence provided here suggests that near-shore coastal modification might serve as an additional approach to tsunami mitigation.