Tsunami-Like Bores Generated from Storm Waves

Volker Roeber

International Research Institute of Disaster Science (IRIDeS), Tohoku University, Japan

Watanabe 112
(between HIG and University Health Services)

Wednesday, September 14
3:00-4:00 pm Seminar

Abstract

Many coastal communities are at constant risk from tsunamis, hurricanes, and storm surges. In recent decades, the increase in computational resources has helped to improve coastal resilience further protecting life and property. Despite research advances, unexpected wave phenomena still exist, which are unaccounted for in coastal hazard assessment, evacuation planning, and structural building codes. In November 2013, Typhoon Haiyan made landfall in the Philippines where it generated a tsunami-like bore that destroyed the entire village of Hernani in Eastern Samar. The destructive waves astonished both villagers and disaster managers, as the coast near Hernani is sheltered by a broad fringing reef. The lack of a shallow continental shelf prevented the generation of wind-driven storm surge and the coral reef was expected to serve as a reliable wave defense. However, under the extreme storm conditions of Typhoon Haiyan individual waves overtopped the reef and the generation of infra-gravity waves from wave breaking at the reef edge favored a strong surf beat over the reef flat and consequently an exacerbation of the flood hazard. The extreme surf beat caused tsunami-like surges of much longer period than regular swell waves that were responsible for the destruction of the village and the failure of its coastal defense structures. We have computed the wave conditions during the peak of the typhoon with a Boussinesq-type and a RANS-type numerical model. We will illustrate the mechanisms that are responsible for the outlined counter-intuitive wave phenomenon and discuss the applicability of numerical models to these scenarios.