

The CONCERT-Japan RAPSODI project

Risk Assessment and design of Prevention Structures fOR enhanced tsunami DIaster resilience

The Tohoku tsunami 2011 event showed the potential for massive destruction of buildings, infrastructure, and coastal protection by tsunamis. Moreover, a huge amount of data has been collected during and after the event, allowing a retrospective analysis. The CONCERT-Japan RAPSODI (Risk Assessment and design of Prevention Structures fOR enhanced tsunami DIaster resilience) project (<http://www.ngi.no/en/Project-pages/RAPSODI/>) is a project coordinated by NGI (Norway) with the partnership of PARI (Japan), TU Braunschweig (Germany), and METU (Turkey) aiming to use these data to develop a framework for quantitative tsunami risk analysis and to design tsunami mitigation structures to improve resilience against tsunami impacts. RAPSODI commenced in 2012, finished in June 2015, and has involved about 15 researchers from the four participating research institutes.

The project focused on various research issues such as the analysis of loads on structures, post-tsunami field surveys of the 2011 Tohoku tsunami, failure mechanisms of coastal protection structures, numerical modelling of tsunamis in harbours and shallow waters, laboratory experiments on breakwaters in wave flumes, as well as quantitative assessment of tsunami mortality. These issues should intentionally lead to improved infrastructures, coastal protection measures, and overall preparedness of coastal communities exposed to tsunamis.

To achieve the objectives of the project, coastal structures and mitigation strategies against tsunamis in Europe and Japan were compared. In addition, a matrix presenting different failure mechanisms of coastal protection structures exposed to tsunamis (in terms of water level difference and wave force) was produced based on field data and experiments by various research groups. This matrix further presents the knowledge gaps on failure modes of different structures under different tsunami loading conditions and is believed to be the first of its kind for tsunami damage on coastal structures. The tsunami mortality risk analysis included numerical modelling of tsunami inundation using high-resolution digital elevation data and empirical relations for fatalities as a function of flow depth. A thorough search for available and appropriate data on the 2011 Tohoku tsunami was carried out. The results of the mortality risk hindcast for the 2011 Tohoku tsunami substantiate that the tsunami mortality risk model can help to identify high-mortality risk areas, and to identify the main risk drivers. The results of the tsunami wave-flume laboratory experiments were used to assess structure resilience against tsunami impact and to establish guidelines for tsunami-safe structures.

A strong focus was put on cooperation between the partners, networking and exchange of knowledge by small-scale joint scientific events, dissemination of scientific results, and utilization of complementary expertise between Japan and the European partners. Several meetings were arranged in Norway, Turkey, South Korea, Japan, Austria, and Germany. Moreover, the RAPSODI project was presented at the November 2014 final joint workshop for the five CONCERT-Japan Disaster Resilience projects in Tokyo and at international symposiums and assemblies of other projects. A RAPSODI field trip to the fjords in western Norway exposed to rockslide tsunamis was arranged in September 2014. The RAPSODI project will establish the partners as a stronger consortium for future joint Euro-Japan research.

Carl B. Harbitz,
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