Tsunami Impact Assessment on Coastal Zone Infrastructure Case studies & ITIS2012 application to high and moderate intensity events

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ABSTARCT

As a result of population growth, urbanization and a movement towards the coast, the vulnerability of coastal areas has greatly increased. Besides coastal ecosystems, there are nowadays many human and economic resources at risk. Coastal zones of modern organized cities usually include, port and industry facilities as well as vital lifelines, increasing the risk in case of a natural disaster occurrence. Tsunami waves hits par excellence coastal zones. This work aims to highlight and quantify the tsunami impact on coastal zone infrastructure by applying the Integrated Tsunami Intensity Scale ($ITIS_{2012}$) in recent high and moderate intensity events.

INTRODUCTION

The coastal area is defined by Sorenson and McCreary (1990) as the interface or transition zone, specifically 'that part of the land affected by its proximity to the sea and that part of the ocean affected by its proximity to the land … an area in which processes depending on the interaction between land and sea are most intense'. Coastal cities located in tectonic active areas face the tsunami hazard, mostly after an off-shore earthquake. The $ITIS_{2012}$ has been purposed by Lekkas et al (2013), based on field work data, collected from the mega-tsunamis in the Indian Ocean in 2004 and Tohoku 2011. $ITIS_{2012}$ is assesses a large number of objective criteria, grouped in six categories (tsunami quantities and impact on human, displaced objects, infrastructure, the environment and structures). $ITIS_{2012}$ has been applied in recent tsunami events, using the wide range of damage quality and quantity characteristics they provided.

METERIALS & METHODS

Data have been collected from field work, Google Inc. web applications' imagery, airphotos, the literature, official reports, the press and the web. Data have been mapped, evaluated against the $ITIS_{2012}$ criteria and have been used to create thematic impact maps.

RESULTS

A. Ishinomaki Bay is located about 100 km from the 9 Mw March 11, 2011 earthquake epicenter, and the tsunamigenic source. Damages on bridges and road parts, railway line, several lifelines' nodes, industry and airport and port facilities have been observed. Port facilities alternating with coastal forests compose a coastline firewall. However, lack of protection facilities at the Matsushima Bay caused severe shoreline changes. Maximum intensity assigned at XIIITIS-2012 –grade by Katsetsiadou et al (2016). Mainly based on fishing, fishing products' industry and agriculture, local economy suffered severe and long-term damage.

B. Shortly after the Mw 6.6 July 21, 2017 earthquake occurred off-shore the Kos Island, Greece, tsunami waves hit the south-east coast of Kos and the coast of Mugla province in the Gokova Bay area. As a result limited damages on telecommunications, road parts and marine facilities have been reported in the inundation area, causing a short-term and moderate damage to the local tourism-based economy. Maximum intensity of the tsunami is attributed to grade VII by Gogou et al (2019).

C. The Mw 7.5 September 28, 2018 earthquake in the central-western Sulawesi Island, Indonesia caused a tsunami attributed to the synergy of coseismic seabed displacement, submarine landslides and liquefied gravity flow. Shoreline changes and damage on tourism facilities, a bridge, and lifelines of many villages along the Palu bay coast have been reported, strongly affecting the local economy. The maximum intensities assigned at $XII_{ITIS\text{-}2012}$ –grade by Mavroulis et a (2019).

CONCLUSIONS

Applying an intensity scale on disaster events is an integrated approach to the event's impact. Detailed understanding the natural phenomenon behavior, evaluating the weaknesses of the affected areas, learning lessons and urban planning upgrading compose the added values of the procedure.

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