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Physical assessment of coastal vulnerability under enhanced land subsidence in Semarang, Indonesia, using multi-sensor satellite data

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Abstract

Research has been conducted in Semarang, Indonesia, to assess coastal vulnerability under enhanced land subsidence using multi-sensor satellite data, including the Advanced Land Observing Satellite (ALOS) Phased Array type L-band SAR (PALSAR), Landsat TM, IKONOS, and TOPEX/Poseidon. A coastal vulnerability index (CVI) was constructed to estimate the level of vulnerability of a coastline approximately 48.68 km in length using seven physical variables, namely, land subsidence, relative sea level change, coastal geomorphology, coastal slope, shoreline change, mean tidal range, and significant wave height. A comparison was also performed between a CVI calculated using seven parameters and a CVI using six parameters, the latter of which excludes the land subsidence parameter, to determine the effects of land subsidence during the coastal vulnerability assessment. This study showed that the accuracy of coastal vulnerability was increased 40% by adding the land subsidence factor (i.e., CVI 6 parameters = 53%, CVI 7 parameters = 93%). Moreover, Kappa coefficient indicated very good agreement (0.90) for CVI 7 parameters and fair agreement (0.3) for CVI 6 parameters. The results indicate that the area of very high vulnerability increased by 7% when land subsidence was added. Hence, using the CVI calculation including land subsidence parameters, the very high vulnerability area is determined to be 20% of the total coastline or 9.7 km of the total 48.7 km of coastline. This study proved that land subsidence has significant influence on coastal vulnerability in Semarang.

Keywords: CVI; Semarang; Land subsidence; Remote sensing

1. Introduction

Coastal zones are dynamic and complex areas with multi-purpose uses, which often conflict with human socioeconomic activities (Turner et al., 2004). Coastal communities are usually distributed in lowland geographic ele-

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