Integration of Numerical Models and InSAR Techniques to Assess Land Subsidence Due to Excessive Groundwater Abstraction in the Coastal and Lowland Regions of Semarang City

Publons ID	(not set)
Wos ID	WOS:000758505000001
Doi	10.3390/w14020201
Title	Integration of Numerical Models and InSAR Techniques to Assess Land Subsidence Due to Excessive Groundwater Abstraction in the Coastal and Lowland Regions of Semarang City
First Author	
Last Author	
Authors	Lo, WC; Purnomo, SN; Dewanto, BG; Sarah, D; Sumiyanto;
Publish Date	JAN 2022
Journal Name	WATER
Citation	17
Abstract	This study was carried out to assess land subsidence due to excessive groundwater abstraction in the northern region of Semarang City by integrating the application of both numerical models and geodetic measurements, particularly those based on the synthetic aperture radar interferometry (InSAR) technique. Since 1695, alluvial deposits caused by sedimentations have accumulated in the northern part of Semarang City, in turn resulting in changes in the coastline and land use up to the present. Commencing in 1900, excessive groundwater withdrawal from deep wells in the northern section of Semarang City has exacerbated natural compaction and aggravated the problem of land subsidence. In the current study, a groundwater model equivalent to the hydrogeological system in this area was developed using MODFLOW to simulate the hydromechanical coupling of groundwater flow and land subsidence. The numerical computation was performed starting with the steady-state flow model from the period of 1970 to 1990, followed by the model of transient flow and land subsidence from the period of 1990 to 2010. Our models were calibrated with deformation data from field measurements collected from various sources (e.g., leveling, GPS, and InSAR) for simulation of land subsidence, as well as with the hydraulic heads from observation wells for simulation of groundwater flow. Comparison of the results of our numerical calculations with recorded observations led to low RMSEs, yet high R-2 values, mathematically indicating that the simulation outcomes are in good agreement with monitoring data. The findings in the present study also revealed that land subsidence arising from groundwater pumping poses a serious threat to the northern part of Semarang City. Two groundwater management measures are proposed and the future development of land subsidence is accordingly projected until 2050. Our study shows quantitatively that the greatest land subsidence occurs in Genuk District, with a magnitude of 36.8 mm/year. However, if the suggested groundwater management can be implemented, the rate and affected area of land subsidence can be reduced by up to 59% and 76%, respectively.
Publish Type	Journal
Publish Year	2022
Page Begin	(not set)
Page End	(not set)
Issn	
Eissn	2073-4441
Url	https://www.webofscience.com/wos/woscc/full-record/WOS:000758505000001
Author	Dr Ir SUMIYANTO, S.T, M.T