Mapping and Analysis of Land Subsidence Impacts in Jakarta Area



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Land Subsidence

- Land subsidence is the downward displacement of the land surface relative to certain reference surface, such as mean sea level (MSL) or reference ellipsoid.
- It may occurs in active volcanic and tectonic areas, mining areas, oil and gas exploration areas, and large urban areas.
- Can be caused by natural and/or human activities.











IMP. II	ACTS OF LAND SUBSIE N URBAN AREAS (CITI	DENCE ES)
Cracking of buildings and infrastructure	Cracking of buildings and infrastructureThe wider expansion of inland & coastal flooding areas	
Increasing the n the affected build	Changes in river canal and drain flow systems	
Lowering the (e.g. health and	e quality of living enviro sanitation condition) in	nment and life the affected areas





MAIN OBJECTIVES OF RESEARCH

- to map the spatial and temporal rates of land subsidence in Jakarta area from the results of Leveling, GPS surveys and InSAR methods;
- to map spatially the land subsidence impacts in Jakarta area; and
- to spatially analyse the impacts of land subsidence in Jakarta area, especially in relation with possible causes of land subsidence in various regions of Jakarta.

Karakteristik Penurunan Tanah di Wilayah Jakarta Dari Estimasi Metode Geodetik

Measurement and Observation of Land Subsidence in Urban Areas

- ✓ Leveling Survey
- ✓ GPS Survey
- ✓ InSAR
- ✓ Microgravity
- ✓ Geometric-historic

City	Leveling	GPS	InSAR	Gravity
JAKARTA	Since 1982	Since 1997	Since 2005	Since 2008
BANDUNG	Limited	Since 2000	Since 2007	Since 2008
SEMARANG	Since 1999	Since 2008	Since 2007	Since 2002

Observed Subsidence Rates in Jakarta (the rates vary both spatially and temporally)				
Method	Period	Subsidence Rates (cm/year)		
	1982-1991	1 - 9		
Levening surveys	1991-1997	1 - 25		
GPS surveys	1997 - 2011	1 - 28		
InSAR	2006 - 2007	1 - 12		
		Hasanuddin Z. Abidin, 2011		































Dampak Penurunan Tanah di Wilayah Jakarta

1	N URBAN AREAS (CITI	ES)
Cracking of buildings and infrastructureThe wider expansion of inland & coastal flooding areasMalfunction drainage syst		Malfunction of drainage system
Increasing the r the affected build	Changes in river canal and drain flow systems	
Lowering th (e.g. health and	e quality of living enviro sanitation condition) in	nment and life the affected areas









































Penyebab Penurunan Tanah di Wilayah Jakarta

Land Subsidence

Land subsidence in urban areas (cities) can be caused by the following factor(s) :

- excessive groundwater extraction
- load of constructions and infrastuctures
- (i.e. settlement of high compressibility soil)
- natural consolidation of alluvium soil
- tectonic activity





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Population Growth of DKI Jakarta [Lo and Yeung, 1995; BPS, 2011]					
Year	Population ('000)	Year	Population ('000)		
1948	≈ 2,000	2002	8,379		
1961	2,973	2003	8,603		
1971	4,579	2004	8,725		
1980	6,503	2005	8,864		
1990	8,259	2010	9,588		
			Hasanuddin Z. Abidin, 2011		

Population Growth of Jakarta					
Definition	Population ('000)				
Area	1971	1980	1990	2000	2010
Special Capital City District (DKI) of Jakarta	4,546	6,072	8,228	8,347	9,588
DKI Jakarta, Kotamadya Bogor, and Kabupaten Bogor, Bekasi and Tanggerang (Jabotabek)	8,374	11,485	17,105	20,438	27,940
Hasanuddin Z. Abidin, 2011	Sources : 1	971, 1980, 199	0, 2000 and 2	010 Censuses	of Indonesia























GEOSPATIAL	LAND SUBSIDENCE			
INFORMATION	Characteristics	Causes Impacts		Cost
Leveling data	Observed height			
GPS data	differences in	Location of land subsidence features in the field		
InSAR data	spatial and			
Gravity data	temporal domain			
Satellite images		spatial distribution of man-made and natural		
Aerial photos		features (e.g. built-up areas, industries, buildings		
Topographic		and		
maps		infrastructures, forest, paddy fields, etc.)		
Hydro-geological information	Numerical estimation and	spatial characteristi groundwater, aqui	cs and dynamics of fers and confining	
Geotechnical information	modeling of subsidence	physical properties spatial	of soil and rock in domain	
Socio-economy information		spatial distribution and characteristics of population and economic activities		



Publikasi Terkait Riset

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