



BRIN
BADAN RISET
DAN INOVASI NASIONAL



North Coast of Java Land subsidence, Changing and the Future Conditions

Bangkok, 7 December 2022

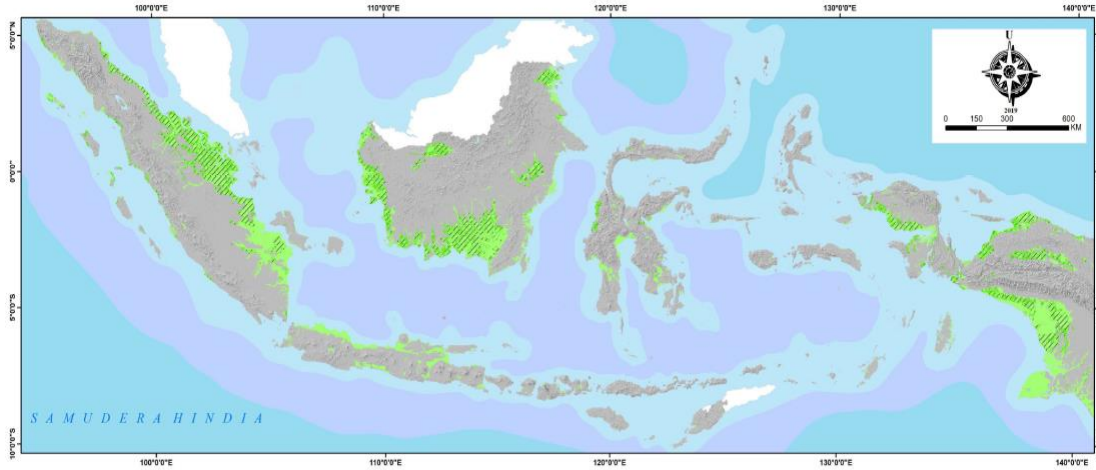
Presented by : M. Rokhis Khomarudin

Presentation outlines

Part 1 : North Coast of Java Land subsidence and prediction in 2031

Part 2 : Case of Sinking Village

PETA SEBARAN TANAH LUNAK INDONESIA



Sumber gambar: Badan Geologi KemenESDM, 2019



Pekalongan



LANDSAT 1993

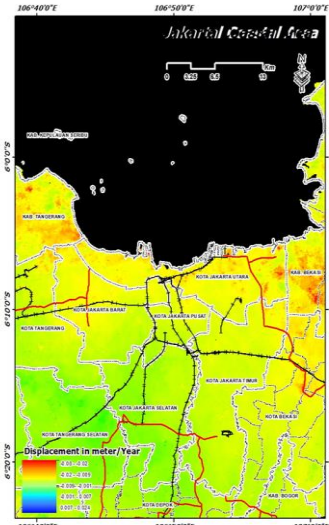
Pekalongan



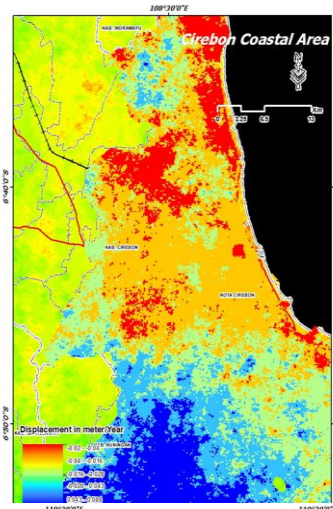
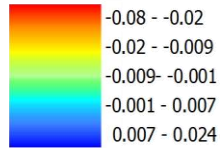
LANDSAT 2021

Notes:

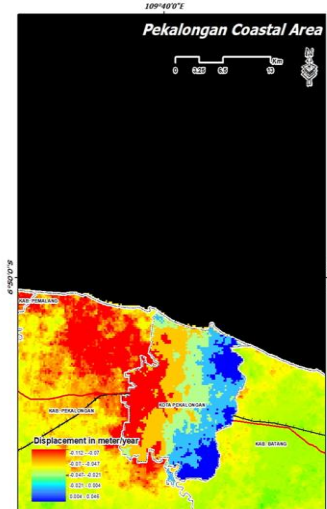
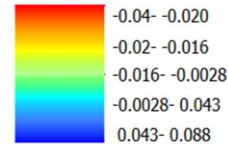
- North coast of Java is under attention of the government of Indonesia
- High land subsidence
- The dominance of soft soils composed of alluvial deposits
- Relatively fast development and exploitation of land use (many big cities on the coast of Java: Tangerang, DKI Jakarta, Bekasi, Karawang, Cirebon, Tegal, Pekalongan, Semarang, Surabaya)
- Settlement changes, mangrove changes, shoreline changes



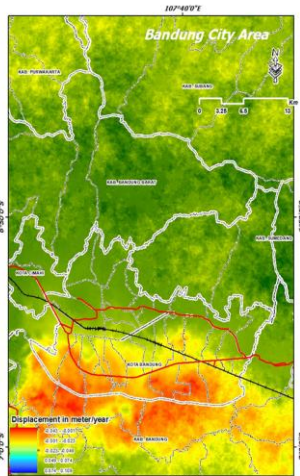
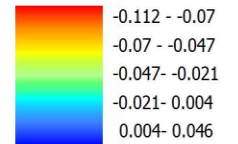
Land subsidence rata-rata (m/tahun)



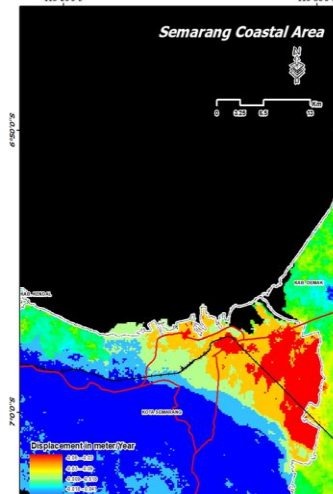
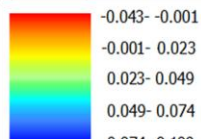
Rata-rata land subsidence (m/tahun)



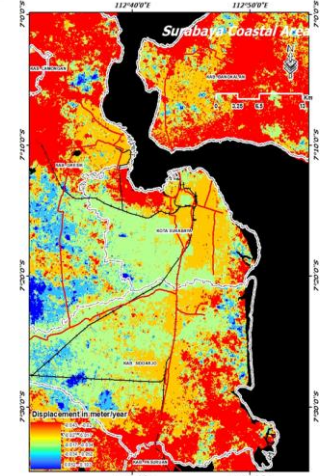
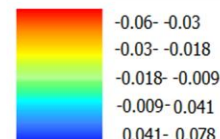
Rata-rata land subsidence (m/tahun)



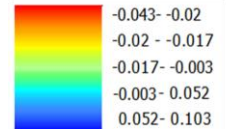
Rata-rata land subsidence (m/tahun)

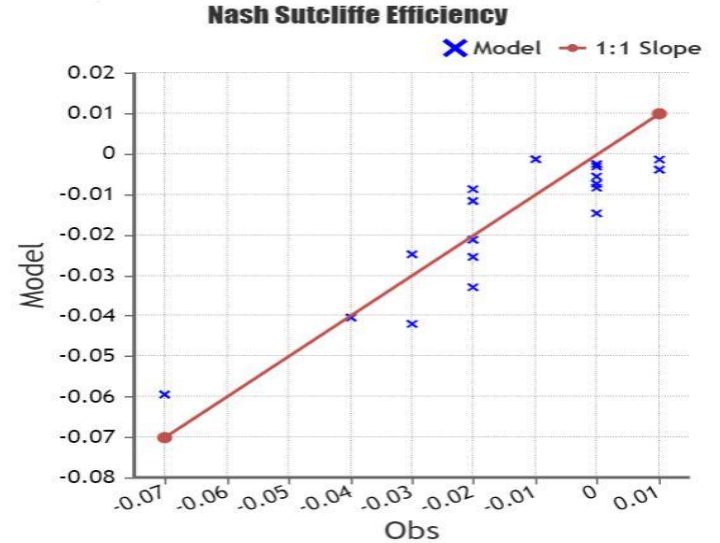


Rata-rata land subsidence (m/tahun)



Rata-rata land subsidence (m/tahun)





NSE test formula is then carried out and it is found that the test results between field data and DInSAR data are around 0.787.

Actual conditions compared to the dinSAR data

$$X1 = X0 - (Y * (tn - t0)) - P$$

X1= Estimated inundated area

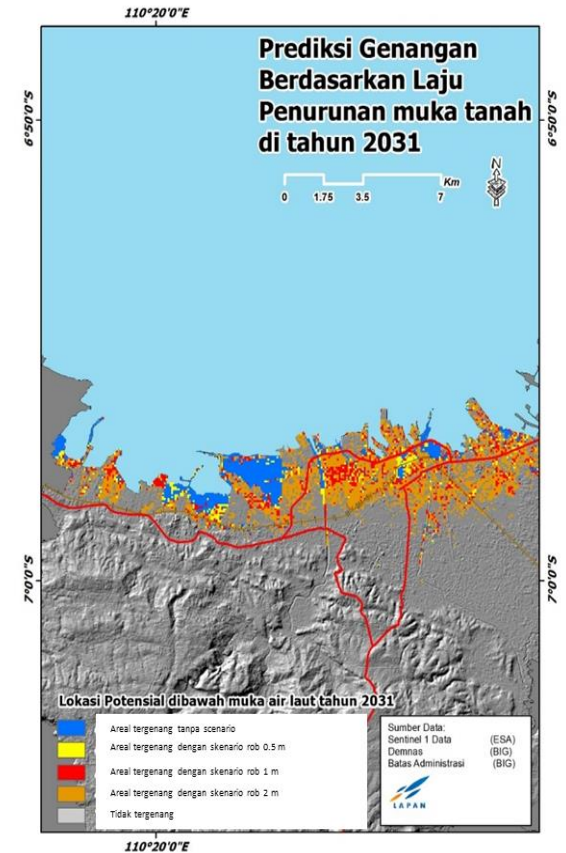
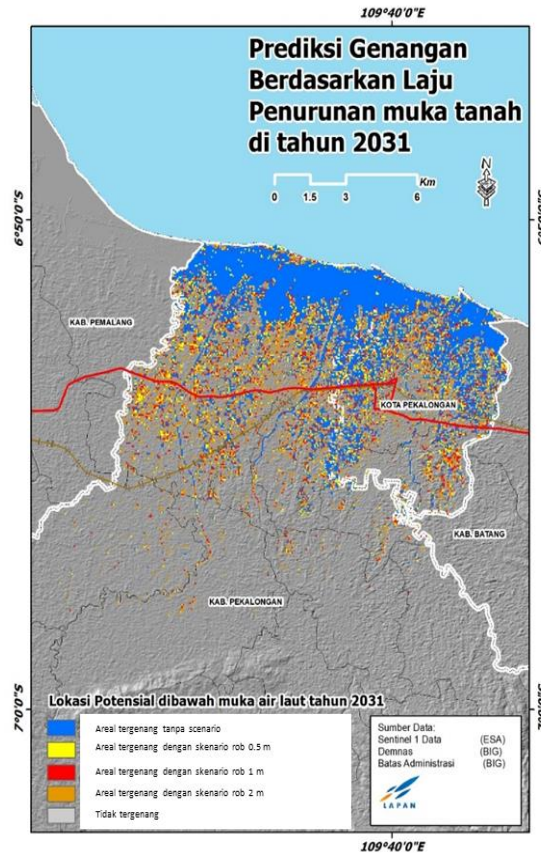
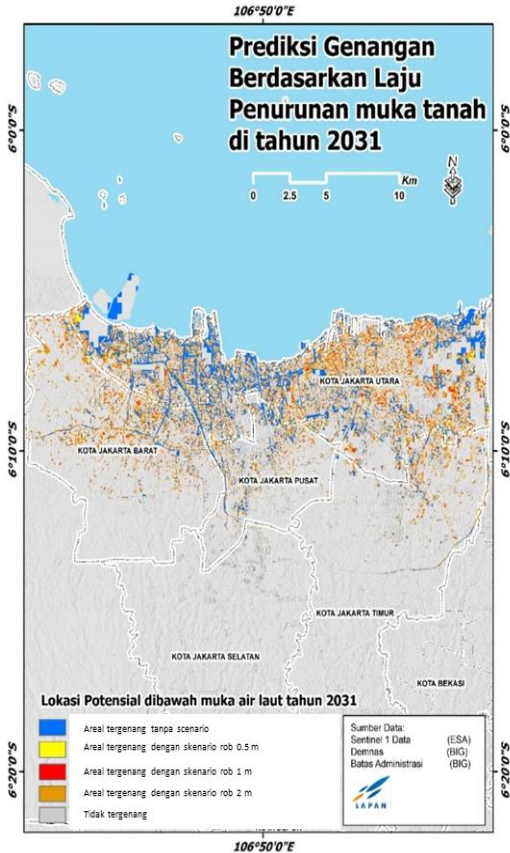
X0 = National Digital Elevation Model (BIG 2018)

Y= Land subsidence rate per year

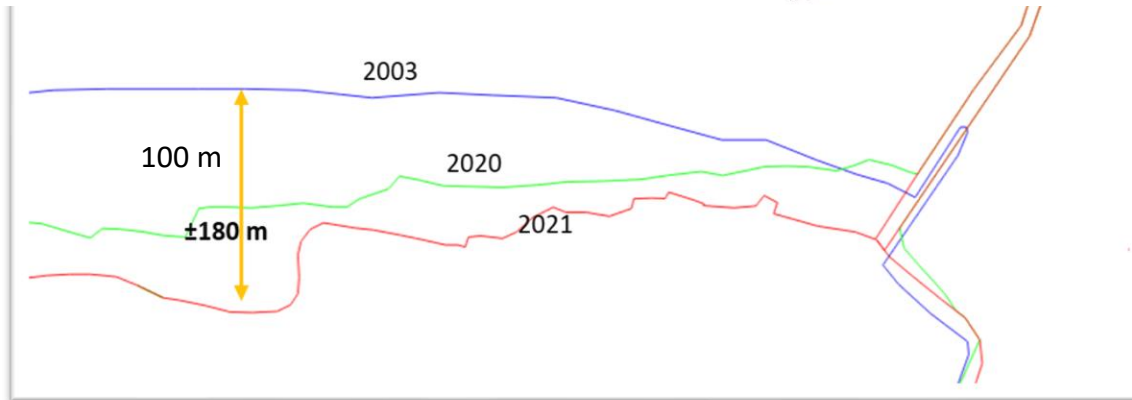
tn= Predicted year

t0= National Education Year

P= Highest tide (simulation model)



Sinking area prediction in 2031 based on landsubsidence in Jakarta, Pekalongan dan Semarang (Sources :Ardha, Khomarudin, Yulianto, dan Suhadha (2021))

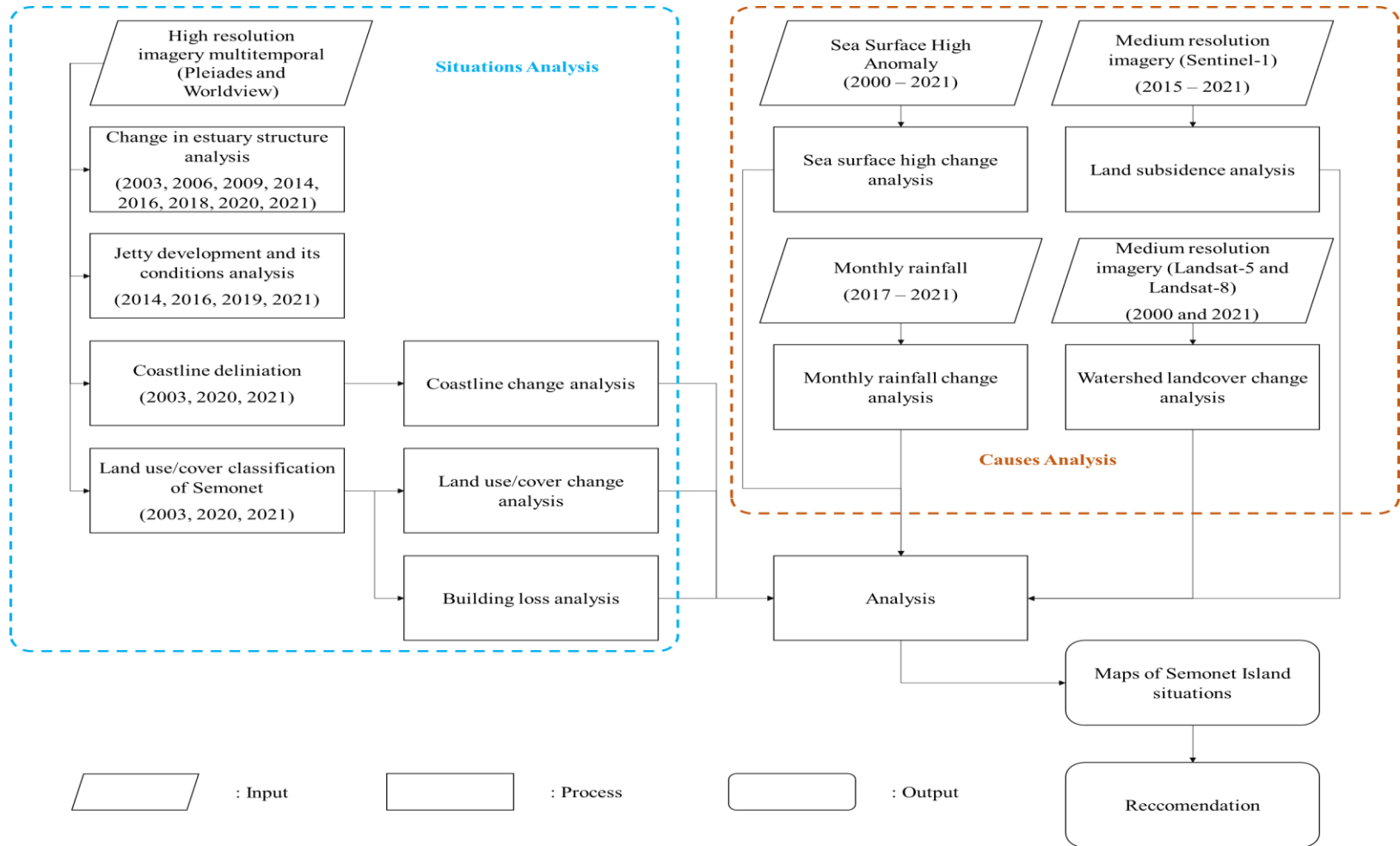


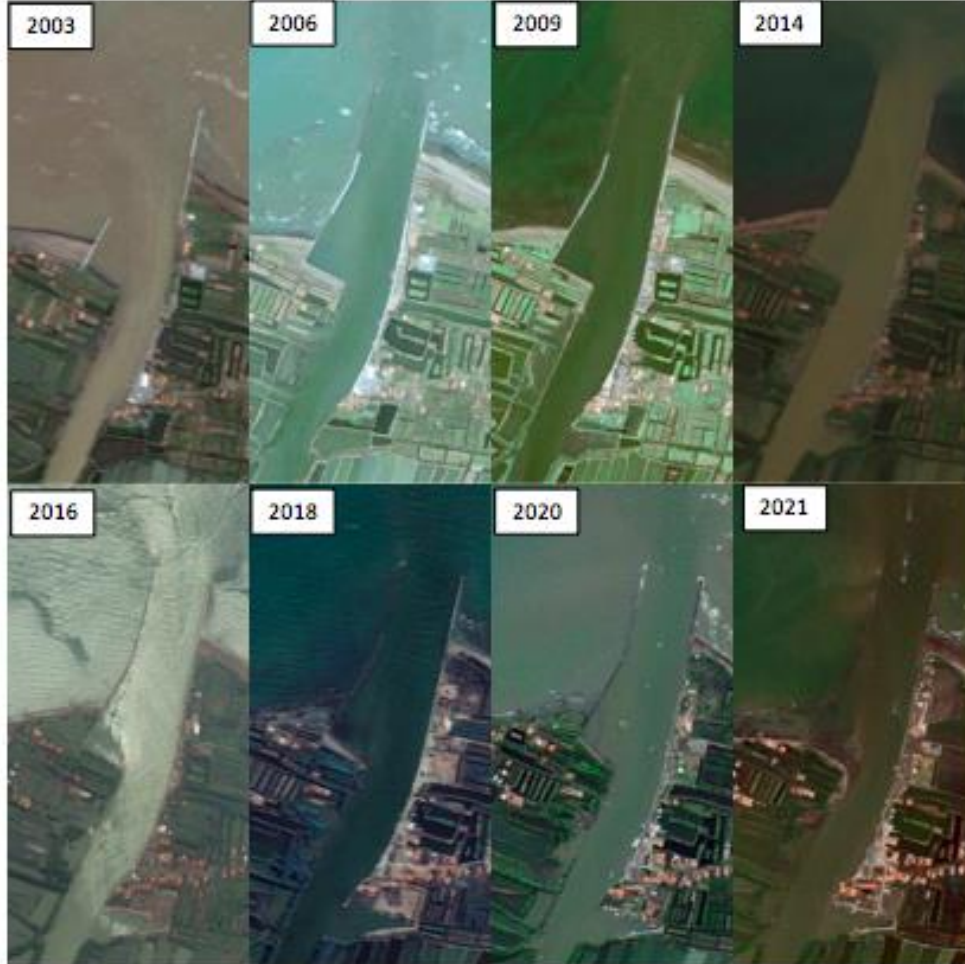
- The village is sinking
- Shoreline changes from 2003 -2021 is 180 m (2003-2020 : 100 m, 2020-2021: 80 m)
- Around 75 families

The objectives of this research are:

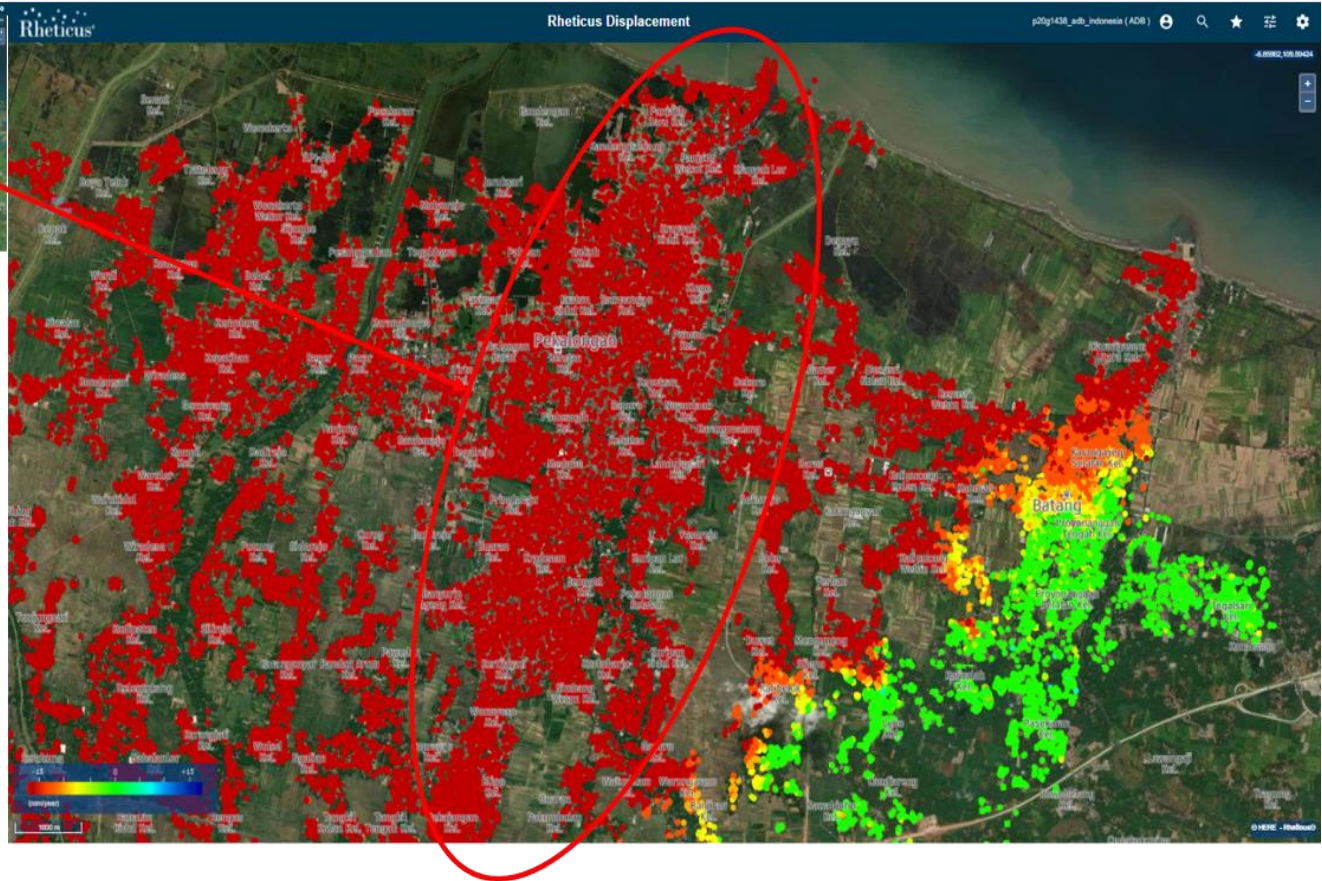
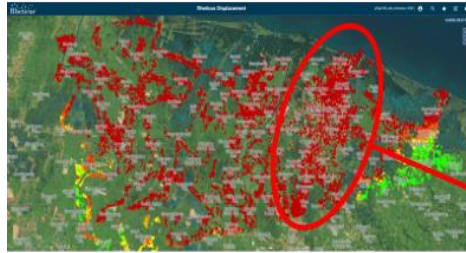
- To determine the causes of the sinking of Semonet Island in Pekalongan region

Data	Years	The uses	Source
Very high-resolution imagery (Pleiades, Wordview)	2003, 2006, 2009, 2014, 2016, 2018, 2020, 2021	Analysis of changes in shoreline, land cover, and potential inundation, analysis of damage to jetties	Google Earth
Surface Elevation Anomaly	2000 - 2021	Analysis of sea level anomaly	National Ocean Partnership Program (NOPP)
Landsat	2000-2021	Analysis of land cover change	Google Earth Engine
Rainfall Data	2017-2021	Analysis of changes in the amount of precipitation	Regency of Pekalongan Statistical Beurau
Sentinel 1A	2015 - 2020	Analysis of changes in land subsidence	ESA
Sentinel 1A/1-B	2015 -2021	Subsidence monitoring through the Rheticus® Displacement service	Planetek Italia



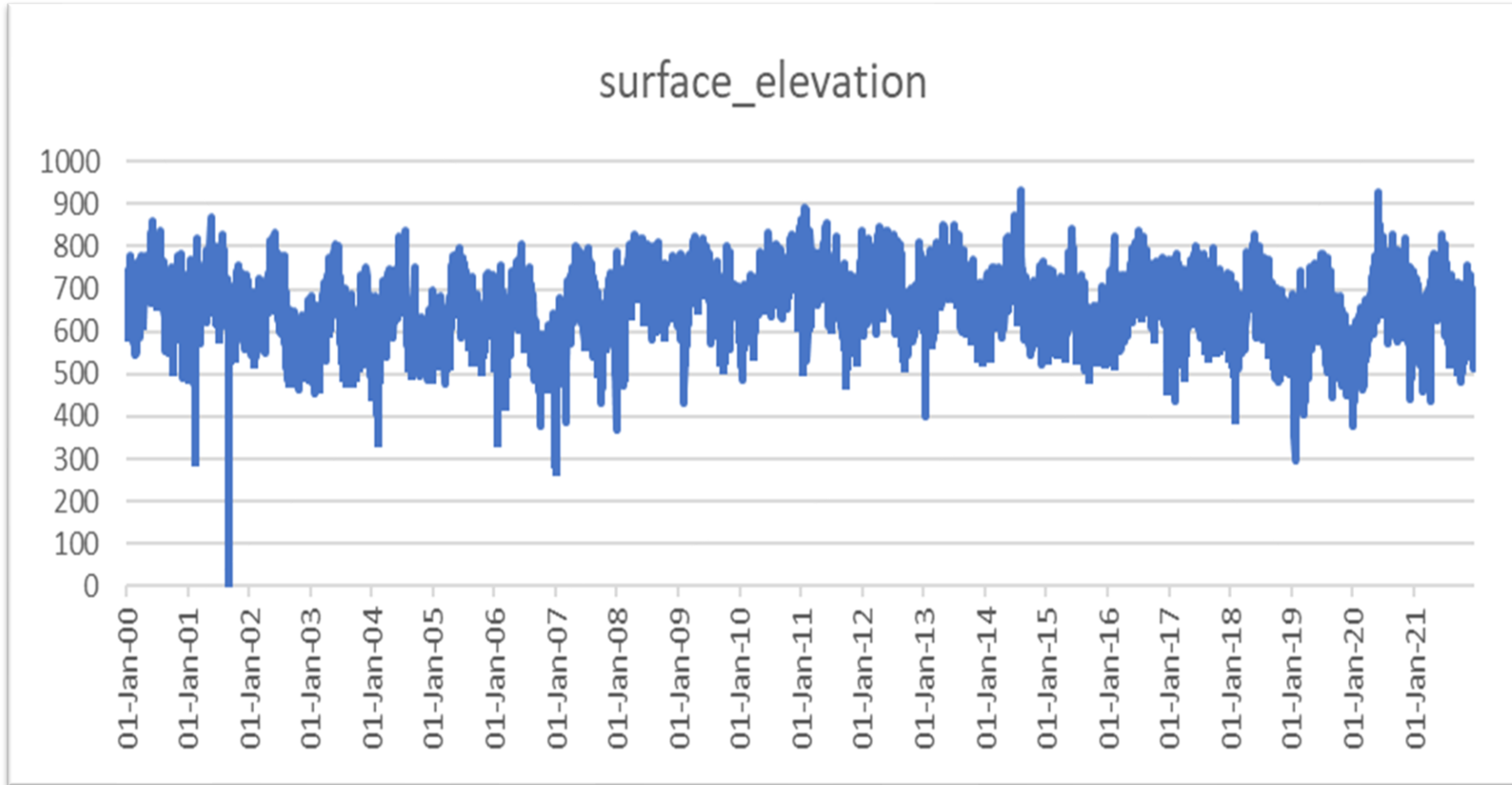


1. There was a breakwater development in estuary near the village
2. The breakwater change the sea and river current directions
3. The villages destroyed slowly by the changes of sea and river directions
4. The village and and also breakwater are sinking now

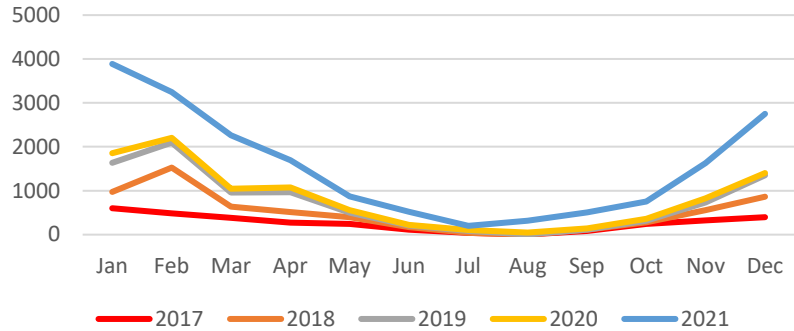


Statistics of ground motion
over the Pekalongan urban
area

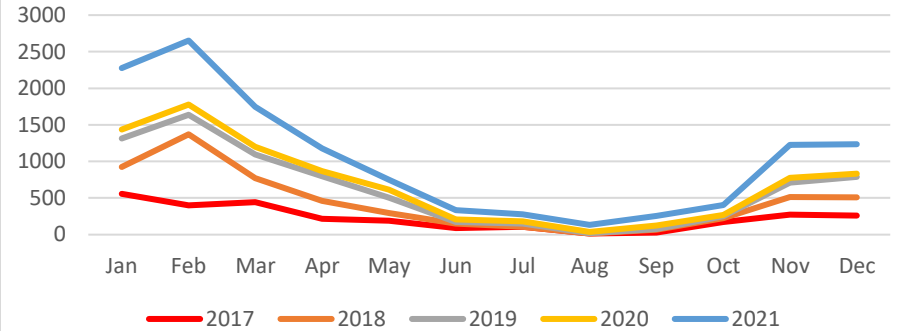
Number of PS Asc:	Number of PS Desc:
81375	102393
V_LOS statistics	V_LOS statistics
(mm/year):	(mm/year):
'MAX': -10.3	'MAX': -5.4
'MEAN': -70.5	'MEAN': -72.3
'MIN': -136.7	'MIN': -138.2
V_LOS_STD < 1.2	V_LOS_STD < 1.2
Coherence Min: 0.77	Coherence Min: 0.77



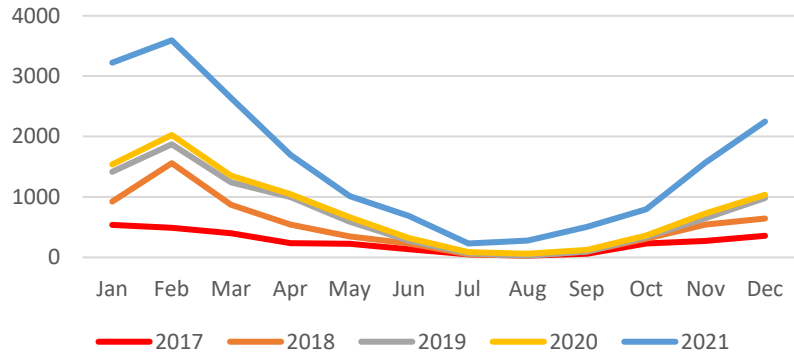
Monthly Rainfall (mm): DORO



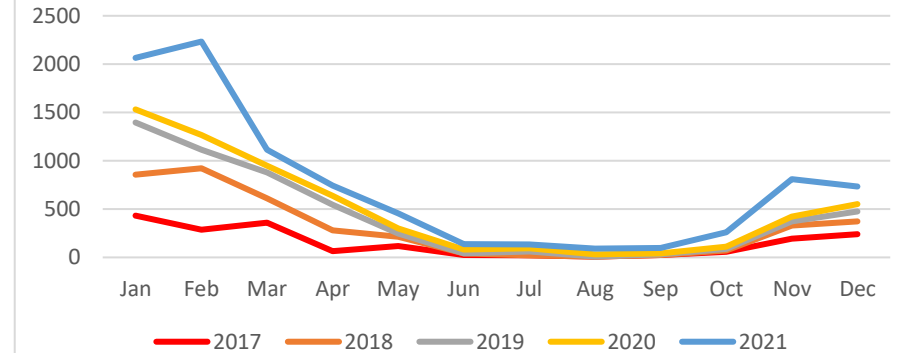
Monthly Rainfall (mm): KAJEN



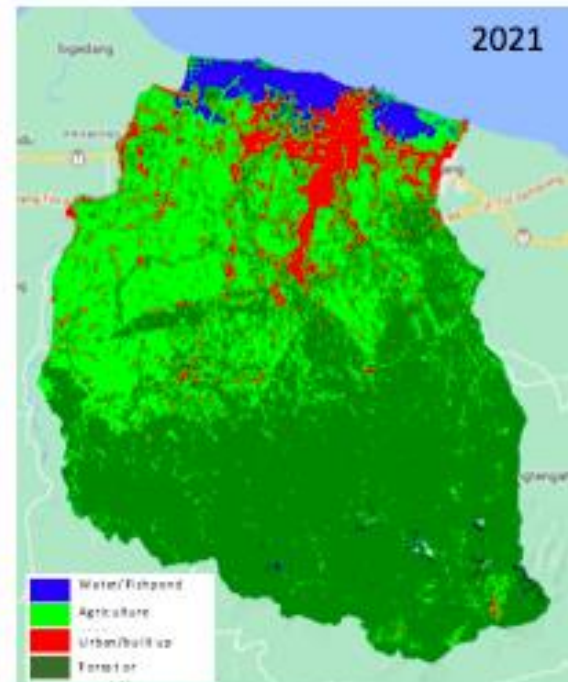
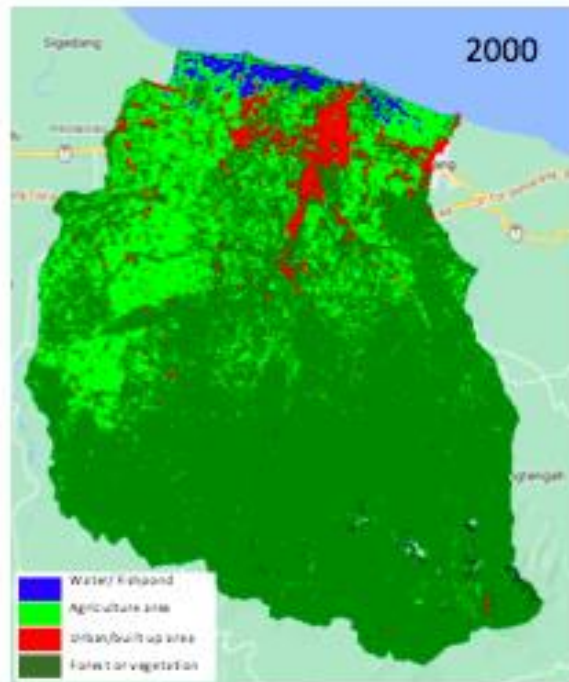
Monthly Rainfall (mm): KARANGANYAR



Monthly Rainfall (mm): WIRADESA



No.	Land Cover	Area (Hectare)		Changes	Percent of change (%)
		2000	2021		
1	Water/Fishpond	1,300.28	2,977.23	1,676.95	128,97
2	Agriculture area	18,044.03	29,547.70	11,503.67	63,75
3	Urban/built up area	4,367.15	8,511.65	4,144.50	94,90
4	Forest or vegetation	68,336.91	51,559.29	-16,777.62	-24,55



- The sinking of Semonet Island is real with very significant changes.
- The results of the research show that the influence of land subsidence, the construction of breakwaters that change the coastal structure, changes in land cover in the watershed, and high rainfall caused the sinking of Semonet Island.
- High rainfall in January-February 2021 answers the drastic events in 2020-2021.

- Considering that massive changes in land subsidence have occurred, it is recommended to relocate the people who still live on the island by providing social assistance so that they can live a better life.
- Further research still needs to be done to model the current direction correctly and to continuously monitor the evolution of the subsidence phenomena



THANK YOU