Monitoring Flooded Areas in Bekasi Administrative Area Using Sentinel-1 Backscatter Analysis

Hammam Muhammad Amrullah*, Alfian, Mellinia Regina Heni Prastiwi, Wanda Nelwita Damayani, Fauzi Fahmi, Shofura Afanin Nuha, Agsha Dewantara, and Dinia Izza Rianti

Master Programme in Remote Sensing, Faculty of Geography, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia

*hammammuhammadamrullah@mail.ugm.ac.id

Abstract *Flooding constitutes one of the most devastating forms of hydrometeorological disasters, marked by rapid water flow, extensive destruction, and a high incidence rate. The Bekasi Administrative Area confronts progressively severe flooding difficulties annually, characterised by variable occurrence rates. This is instigated by a confluence of geographical conditions, anthropogenic activity, and the insufficiency of current disaster management systems. This study aims to delineate flood occurrences utilising synthetic aperture radar (SAR) data, specifically Sentinel-1 imagery, processed via the Google Earth Engine platform, employing backscatter differences to analyse the multi-temporal dynamics of flood inundation from 2020 to 2025. This study aims to delineate flood occurrences utilising synthetic aperture radar (SAR) data, specifically Sentinel-1 imagery, processed via the Google Earth Engine platform, employing backscatter differences to analyse the multi-temporal patterns of flood inundation from 2020 to 2025. This study aims to delineate flood events utilising Synthetic Aperture Radar (SAR) data, specifically Sentinel-1 imagery, processed via the Google Earth Engine platform employing backscatter difference, and to analyse the multi-temporal patterns of flood inundation from 2020 to 2025. The findings of the flood mapping study suggest that the Bekasi Administrative Area would undergo alterations in the flood-affected area till 2025. In 2025, the inundated area in this region will encompass 1,660.90 hectares in Bekasi Regency and 38.98 hectares in Bekasi City, demonstrating exceptional ROC accuracy indicated by an AUC curve of 0.960. The use of SAR images is an effective tool for monitoring flood inundation, particularly by capitalising on the spatial and temporal coverage of remote sensing data, which is a significant advantage for observing floods across large areas over defined timeframes. In the realm of sustainable development, remote sensing data is essential for risk assessment, hazard inventory creation, and monitoring advancements towards Sustainable Development Goals (SDGs), particularly in climate change mitigation (SDG 13) affecting communities and in the preservation of terrestrial ecosystems (SDG 15) for future generations.*

Keywords: Flood Monitoring, Sentinel-1, Bekasi Administative Area, Google Earth Engine

Introduction

Flood inundation is the phenomenon of water encroaching upon areas typically characterized by dryness. This may result from excessive rainfall or river overflow (Sahoo

& Sreeja, 2017). Flood inundation is mostly influenced by geographical factors, notably climate change, which affects flood risk (Skougaard Kaspersen et al., 2017), topographic factors and land use, especially urbanization, which to some extent alters drainage patterns (Qi et al., 2020; Seemuangngam & Lin, 2024). These elements may influence various significant dimensions, ranging from the environment to society. Flood inundation has a number of important parts that affect many areas, such as socio-economic elements, which mainly effect property damage, agriculture, and infrastructure, which in turn cause the economy to drop significantly (Satria, 2021). Social vulnerability, particularly among communities residing in flood-prone regions, is associated with an increased risk of susceptibility (Dryden et al., 2021), this impacts both the economic sector and public health as a result of the flooding that occurs. The environmental consequences of flooding can induce alterations in the natural ecosystem (Scott et al., 2019). Administrative regions in Indonesia, such as Bekasi City and Bekasi Regency, encounter the issue of flooding. The flooding in Bekasi City results from its topographic features and inadequate drainage systems (Damayanti & Dwiputra, 2019). Moreover, weather factors including rainfall distribution, intensity, duration, and frequency contribute significantly (Septian et al., 2023). Bekasi City, due to its geographical characteristics, experiences substantial rainfall, particularly in the rainy season, resulting in elevated precipitation levels that contribute to frequent flooding (Cahyaningtiyas et al., 2022). The topographical features of Bekasi City, categorized as a low-lying region and situated near rivers, may increase the likelihood of flooding (Trihono, 2019). Urbanization significantly alters impervious surfaces, diminishing natural infiltration and elevating surface runoff. This disruption affects the hydrological cycle, resulting in increased flood peaks, even during brief rainfall events (Yusuf et al., 2021). The floods in Bekasi Regency result from multiple factors, including the impact of upstream water flow (Juliastuti et al., 2024), the conversion of land for industrial purposes, along with coastal flooding and high tides in the northern coastal region, impedes the river's flow toward the sea, resulting in water overflow into nearby settlements.

Data from the West Java Provincial Disaster Management Agency (BPBD) indicates that floods constituted 13.56% of all natural disasters in West Java during the period from January to December 2021 (Septian et al., 2023). Bekasi City ranks among the most densely populated urban areas in West Java, housing a population of 2.64 million individuals (BPS Kota Bekasi, 2025). Bekasi City is undergoing significant population growth alongside infrastructure development (Kurniawan et al., 2024). Nevertheless, the environment is significantly affected by the rapid development rate, which includes the escalating frequency of flooding. Every year, Bekasi City encounters inundation challenges that are becoming more severe (Fitriyati et al., 2024b). Furthermore, meteorological elements include precipitation distribution, elevated rainfall intensity, duration of rainfall, and frequency of rainfall are other contributing variables (Hapsari, 2019; Septian et al., 2023). The erosion conditions in the upper reaches of the Bekasi River Basin result in elevated flow rates and sediment deposition. The average erosion rate in the Bekasi watershed is classified as light for forest land use, heavy for shrubland usage, and very heavy for other land uses (Trihono, 2019).

This research intends to delineate flood-impacted regions within the Bekasi Administrative Area from 2020 to 2025 by employing remote sensing techniques, specifically utilizing Synthetic Aperture Radar (SAR)-derived Sentinel-1 imagery processed via Google Earth Engine cloud computing, through the analysis of variations in backscatter values. A multi-temporal pattern analysis was undertaken by monitoring flood inundation from 2020 to 2025. Remote sensing techniques for monitoring flood inundation offer the benefits of extensive coverage and real-time data, facilitating the observation of floods across vast regions (Sun et al., 2022). The utilization of sensors, including Synthetic Aperture Radar (SAR) and optical sensors, facilitates monitoring that is unaffected by meteorological conditions, thereby enhancing the precision and efficiency of flood response (Hwang et al., 2024). The technological foundation of remote sensing, when associated with its capacity to facilitate the Sustainable Development Goals (SDGs), can assist in attaining SDG 13, which addresses climate change, by monitoring and addressing climate-related calamities such as floods (Tassopoulou et al., 2019). This measure was implemented to safeguard the terrestrial ecosystem in alignment with SDG 15 for environmental sustainability.

Literature Review

Flood Inundation in the Bekasi Administrative Area

Flooding is a significant environmental concern caused by climate change, accelerated urbanization, and insufficient infrastructure (Kang et al., 2021). This occurrence signifies a rise in the frequency and intensity of floods worldwide, which adversely affect urban regions (Fitriyati et al., 2024a; L. Wang et al., 2022). Flood inundation is typically instigated by natural elements including extended precipitation, intense rainfall, inclined terrain, and river overflow (Asiedu, 2020; Bravard, 2017; Syarifudin & Destania, 2020; X.

Wang et al., 2024). Moreover, human-induced variables including urbanization, land conversion, deforestation, and inadequate waste management might intensify flood inundation occurrences (Asiedu, 2020; Syarifudin & Destania, 2020; Wen et al., 2025).

The flood in Bekasi is caused by fast urbanization and insufficient drainage systems (Priyadi et al., 2024; Yuanita & Sagala, 2025). The flooding was intensified by upstream water flow and coastal flooding along the river's northern coast, leading to extended inundation. The Bekasi Administrative Area has undertaken various measures for flood risk management through a sustainable and integrated approach; however, it continues to encounter challenges, such as rapid urbanization affecting intensive land use without a proportional enhancement in urban capacity, and insufficient coordination among regional agencies. Consequently, management needs further recommendations, including flood monitoring in this region, to enhance flood resilience (Priyadi et al., 2024; Yuanita & Sagala, 2025). Additionally, the flooding was exacerbated by the influence of water flow from upstream and coastal flooding along the northern coast of the river toward the sea, resulting in prolonged inundation. The administrative region of Bekasi has already implemented several steps related to flood risk management using a sustainable and integrated approach, but still faces challenges in flood management, including rapid urbanization which impacts intensive land use without a corresponding increase in urban capacity, and a lack of coordination efforts between agencies in this region. Therefore, in its management, recommendations are still needed, including flood monitoring in this area, to increase flood resilience. The challenge of flooding events in administrative regions in Indonesia also occurs in Bekasi City and Bekasi Regency. According to the Indonesian Disaster Geoportal (BNPB), the flooding events in this area can be seen in Table 1.

Flooding events provide a challenge in the administrative regions of Indonesia, specifically in Bekasi City and Bekasi Regency. The Indonesian Disaster Geoportal (BNPB) indicates that the flooding incidents in this region are presented in Table 1.

Table 1: Flood Event Data in Bekasi City and Bekasi Regency, 2020-2025

Years	**Total Number of Flood Incidents**	**Date of the Flood Event**	**Total Impact of the Flood Event**				
			Fatalities			**House Flooded**	**Damaged House**
			Died Victim	**Missing Victim**	**Injured Victim**		
2020	149	January 1, 2020	16	1	-	129,117	4
2021	168	February 19, 2021	10	-	266	65,073	79

2022	19	January 18, 2022	-	-	-	9,443	-
2023	89	February 24, 2023	1	-	-	12,749	-
2024	39	December 14, 2024	-	-	-	13,883	8,973
2025	171	May 19, 2025	1	-	-	60,689	-

Source: BNPB Bekasi and News Portal

Table 1 presents statistics on flood events from 2020 to 2025, indicating considerable variations in the number of event points, the magnitude of impact, and the quantity of impacted homes. In 2020, 149 flood incidents were documented, with the most severe occurrence on January 1st, leading to 16 fatalities, 1 individual reported missing, 129,117 inundated residences, and 4 damaged homes. In 2021, the number of flood spots rose marginally to 168, with the peak on February 19th, which had the following impacts: 10 fatalities, 266 injuries, 65,073 flooded homes, and 79 damaged homes. A considerable reduction transpired in 2022 and 2023, with merely 19 and 89 flood points recorded respectively, and a significantly lower number of submerged houses (9,443 units on January 18, 2022, and 12,749 units on February 24, 2023), although there was still one fatality in 2023. Entering 2024, the number of flood points decreased to 39 compared to the previous year, with the peak on December 14, 2024, which resulted in 13,883 houses being submerged and 8,973 houses damaged. This period is the only year that recorded significant physical damage to homes and indicated more destructive flooding, although the scale was not very large. In 2025, there was a significant increase, culminating in a total of 171 flood points. The floods reached its zenith on May 19, 2025, resulting in 60,689 dwellings inundated and one fatality. This pattern suggests that although there was a drop in flood occurrences from 2022 to 2024, the likelihood of future surges remains significant, warranting an assessment of climatic variables, land utilization, and mitigating readiness to foresee comparable events ahead.

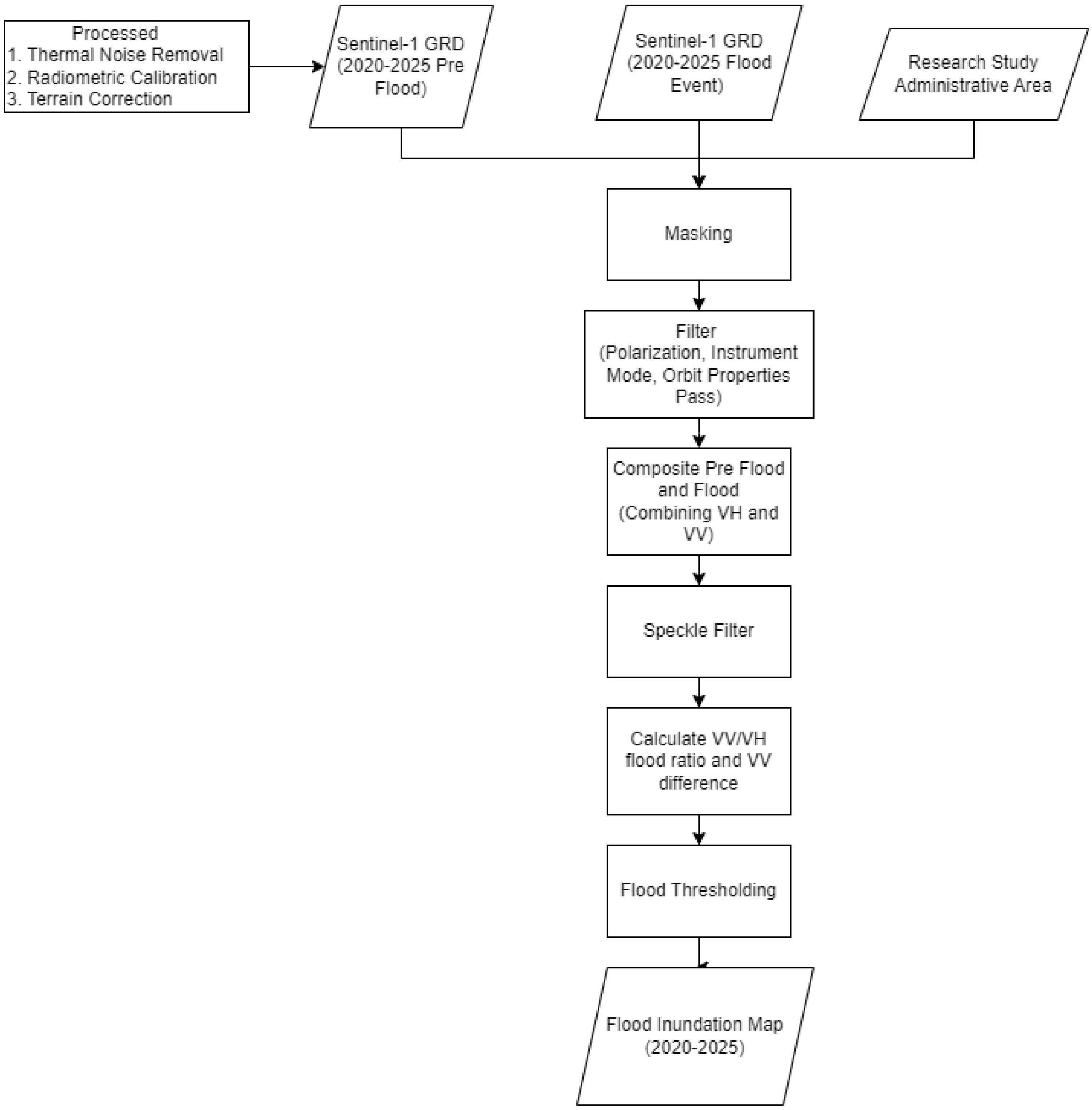
Utilizing Sentinel-1 Imagery for Flood Inundation Monitoring

Remote sensing, a technique for acquiring data without direct interaction with objects, has notable efficacy in flood inundation monitoring with Sentinel 1 imaging utilizing Synthetic Aperture Radar (SAR) technology, owing to its resilience against meteorological and temporal conditions (Atchyuth et al., 2023a), its enhanced spatial resolution facilitates precise identification of inundated regions (Chen & Zhao, 2022),and the facilitation of near real-time flood surveillance. Numerous studies have employed Sentinel-1 using diverse methodologies, including Change Detection and Thresholding (CDAT) in Central Java Province (Pangi et al., 2024), histogram-based thresholding in Dar es Salaam (Demissie et al., 2023), and the Otsu method in India (Atchyuth et al., 2023a). Sentinel-1 imagery enhances precision and efficacy in flood monitoring, aiding in disaster management and risk reduction. This work involved the processing and analysis of Sentinel-1 data through backscatter analysis, comparing pre- and post-event imagery to accurately detect changes and delineate flood extent. Numerous studies employing a backscatter analysis methodology have been extensively undertaken, including those in Madagascar (Johary et al., 2023) and the Klawing River located in Purbalingga Regency (Adi Fikri et al., 2025).

Methodology

Research Flow

The research stages begin with pre-field data collection and data processing. Pre-field activities are carried out as a step for collecting secondary data, followed by data processing using the Google Earth Engine platform. The research flow is shown in Figure 1.

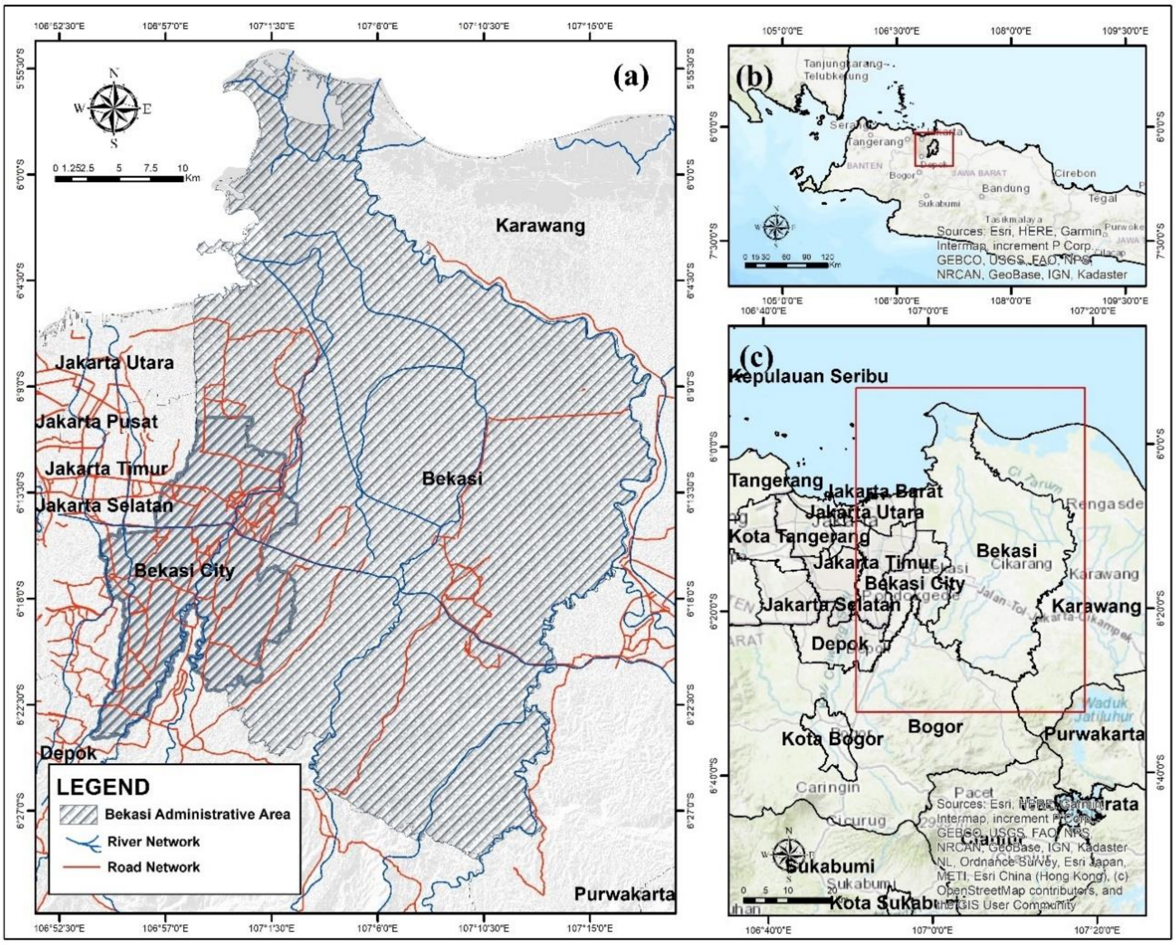


Source: Author, 2025

Figure 1: Research Flow

Research Location

Research aimed at mapping flood-affected areas from 2020 to 2025 was conducted in the administrative region of Bekasi, specifically Bekasi City and Bekasi Regency. This area faces annual challenges of inundation flooding, necessitating non-structural efforts thru periodic inundation mapping. The research area can be seen in Figure 2.



Source: Author, 2025

Figure 2: Research Location: (a) Bekasi Administrative Area; (b) Bekasi Administrative Area at Java Island Scale; (c) Bekasi Administrative Area at District

Data Collection

This research uses data in the form of Sentinel-1 SAR GRD imagery: C-band Synthetic Aperture Radar (SAR) with several different recording dates from 2020-2025, as shown in Table 2.

Table 2: Flood Event Data in Bekasi City and Bekasi Regency Years 2020-2025

Year of Occurrence	Date of the Worst Flood Event	Date of Recording of the Worst Flood Event (Pre-Monsoon)	Recording Date After the Worst Flood Event
2020	January 1, 2020	April 1, 2019 – May 31, 2019	January 1, 2020 – January 7, 2020
2021	February 19, 2021	April 1, 2020 – May 31, 2020	February 15, 2021 – February 22, 2021
2022	January 18, 2022	April 1, 2021 – May 31, 2021	January 15, 2022 – January 18, 2022
2023	February 24, 2023	April 1, 2022 – May 31, 2022	February 23, 2023 – February 24, 2023
2024	December 14, 2024	April 1, 2023 – May 31, 2023	February 23, 2023 – February 24, 2023
2025	May 19, 2025	April 1, 2024 – May 31, 2023	May 19, 2025 – May 20, 2025

Source: BNPB Bekasi

This image is sourced from Copernicus data and processed using the Google Earth Engine platform, with the image data specifications detailed in Table 2.

Table 3: Sentinel-1 Image Specifications

Image Characteristics	Sentinel-1 SAR
Polarization	VV, VH polarization
Band	1
Wavelength	5.5 cm
Spatial Resolution	10 m
Swath	250 km
Temporal solution	12 days
Instrument Mode	IW (Interdeometric Wide Swath)
Direction of the orbit	Ascending and Descending

Source: European Union/ESA/Copernicus and Earth Engine Data Catalog

Each Sentinel-1 scene has undergone data pre-processing using the Sentinel-1 toolbox, including thermal noise removal, radiometric calibration, and topographic correction using SRTM 30 or ASTER DEM for areas with latitudes greater than 60 degrees if SRTM is unavailable. The corrected topographic values were then converted to decibels through logarithmic scaling ($10^{*}log10(x)$). In this study, the polarizations used are Vertical-

Horizontal receive (VH) and Vertical-Vertical (VV) with the IW mode used to detect flooding. In general, the use of VV has higher sensitivity to surface roughness and small waves on the water surface, which can lead to higher backscatter values (Kianfar, 2019). This contrasts with the use of VH, which is not very sensitive, especially to small surface waves, making VH polarization more reliable for flood detection under various conditions (Bekele et al., 2022; Yusoff et al., 2020). The differences in backscatter coefficient values for VH polarization are quite stark. For water, the values are very low with a dark appearance in SAR images, while for land, the values range from high to medium depending on vegetation, infrastructure, and soil conditions. Compared to VV polarization, VH polarization often provides a better signal-to-noise ratio in distinguishing water from wet vegetation or muddy soil. Using a combination of both polarizations can be used to improve flood detection; using both polarizations can enhance flood extent mapping and provide better comparisons with optical data (Akhtar et al., 2021; Atchyuth et al., 2023b).

Tools and Materials

In this study, the tools and materials used can be seen in Table 4 and 5.

Table 4: Research Tools

Tools	Name of the Tool	Function
Hardware	Laptop	The main tool for data processing and research output preparation
Software	ArcGIS Pro application	Pre-processing satellite image data and visualizing flood inundation maps for Bekasi City and Bekasi Regency
	QGIS 3.20.1 Application	
	Cloud Computing Google Earth Engine	Data processing for flood inundation mapping in Bekasi City and Bekasi Regency
	Microsoft Excel	Analysis of flood area results for Bekasi City and Bekasi Regency

Table 5: Research Materials

Material	Source	Function
Administrative Map Scale 1:25,000	Geospatial Information Agency (https://tanahair.indonesia.go.id/)	Basic Map Requirements
Sentinel-1 SAR GRD: C-Band Synthetic Aperture Radar (SAR)	Google Earth Engine Data Catalog, Copernicus (https://sentinel.esa.int/web/sentinel/user-guides/sentinel-1-sar/)	Flood Inundation Map Creation for the Years 2020-2025

Source: Geospatial Information Agency and Google Earth Engine Data Catalog

Data Analysis

Backscatter Analysis

Backscatter analysis on Sentinel-1 images is very effective for flood inundation mapping because of the radar's ability to detect changes occurring on the ground surface due to waterlogging, and because radar can also penetrate clouds. Flooded areas typically show higher backscatter on Sentinel-1 images, especially in regions with flat surfaces and little vegetation, due to the significant difference in reflective properties between the water surface and the ground. The thresholds used in this study for VV are -17 dB and for VH are -23 dB. These values were chosen because the backscatter value for water is relatively lower than that for land in VV polarization. Then, in VH polarization, this threshold is used and designed to detect lower backscatter values associated with water to help distinguish between areas flooded and not flooded by water (Agnihotri et al., 2019; Febrianti et al., 2019).

Flooding can cause changes in backscatter patterns across the entire flooded area. Sentinel-1 can detect these differences in repeat imagery, allowing for the mapping of flood inundation changes over time. Thus, by processing the radar images obtained over several periods, valuable information can be obtained for real-time flood monitoring and identification of the most affected areas.

Results and Discussion

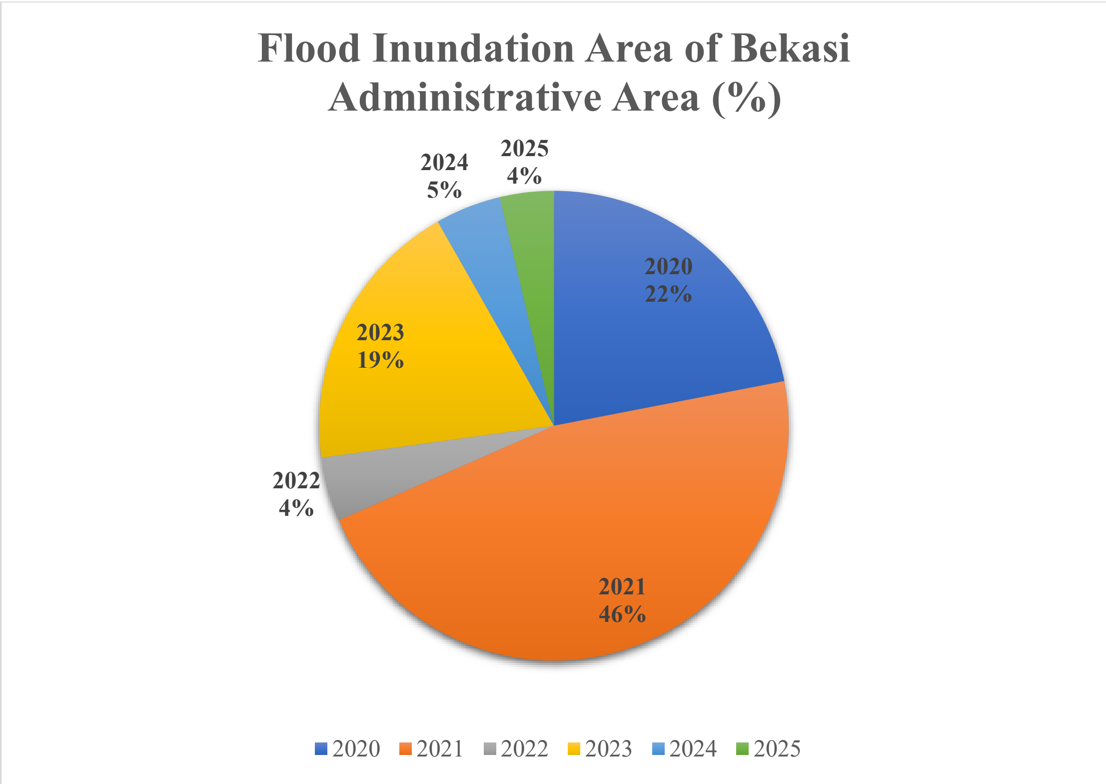
Monitoring of Bekasi Administrative Area Flood Inundation 2020-2025

Based on the processed and obtained results, there is a variation in the flood-affected areas with the proportion of affected areas as presented in Table 6 and Figure 3.

Table 6: Monitoring of Bekasi Administrative Area Flood Inundation 2020-2025

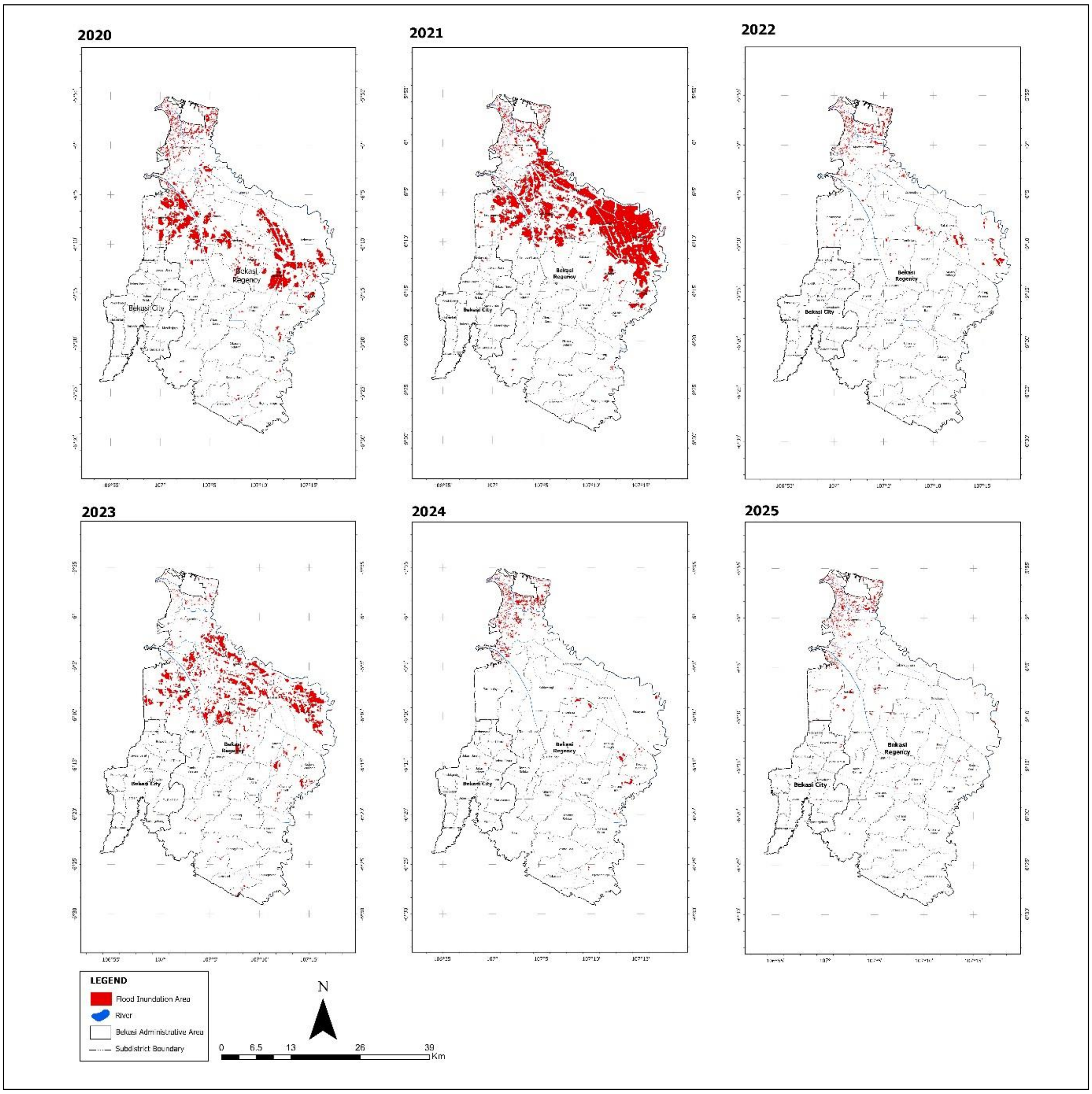
Classification	2020	2021	2022	2023	2024	2025
Flood Inundation Area (ha)	10,056.54	21,278.85	2,020.82	8,672.43	2,073.67	1,699.37

Source: Data Processing, 2025



Source: Data Processing, 2025

Figure 3: Percentage of Flood Inundation Area 2020-2025



Source: Data Processing, 2025

Figure 4: Visualization of Flood Area in 2020-2025

Figure 4 indicates that flooding is concentrated in the region north of Bekasi Regency, suggesting proximity to the Java Sea. The distribution on January 1, 2020, is confined mostly to the central and eastern regions, exhibiting a scattered influence throughout an area of 10,056.54 hectares (22%). In 2021, a substantial rise was observed, with an area expansion of 21,278.85 hectares (46%). The magnitude of the inundation exhibits a more concentrated spatial distribution, mostly focused on the principal floodplains in the northern and northeastern regions. In 2022, the waterlogged area significantly diminished, with the extent confined to the eastern part at 2,020.82 hectares (4%). In 2023, the inundated area expanded by 8,672.43

hectares (19%), exhibiting a very even distribution from the northern to central regions, along with more extensive flood features. In 2024, the flood extension diminished by 2,073.67 hectares (5%), particularly in the northwestern region, exhibiting a more concentrated geographical distribution. In 2025, flood distribution is confined, predominantly hitting the northern region, which demonstrates a spatial tendency of heightened concentration in the northern coastal area, impacting 1,699.37 hectares (4%).

Flood Inundation in the Bekasi Administrative Area in 2025

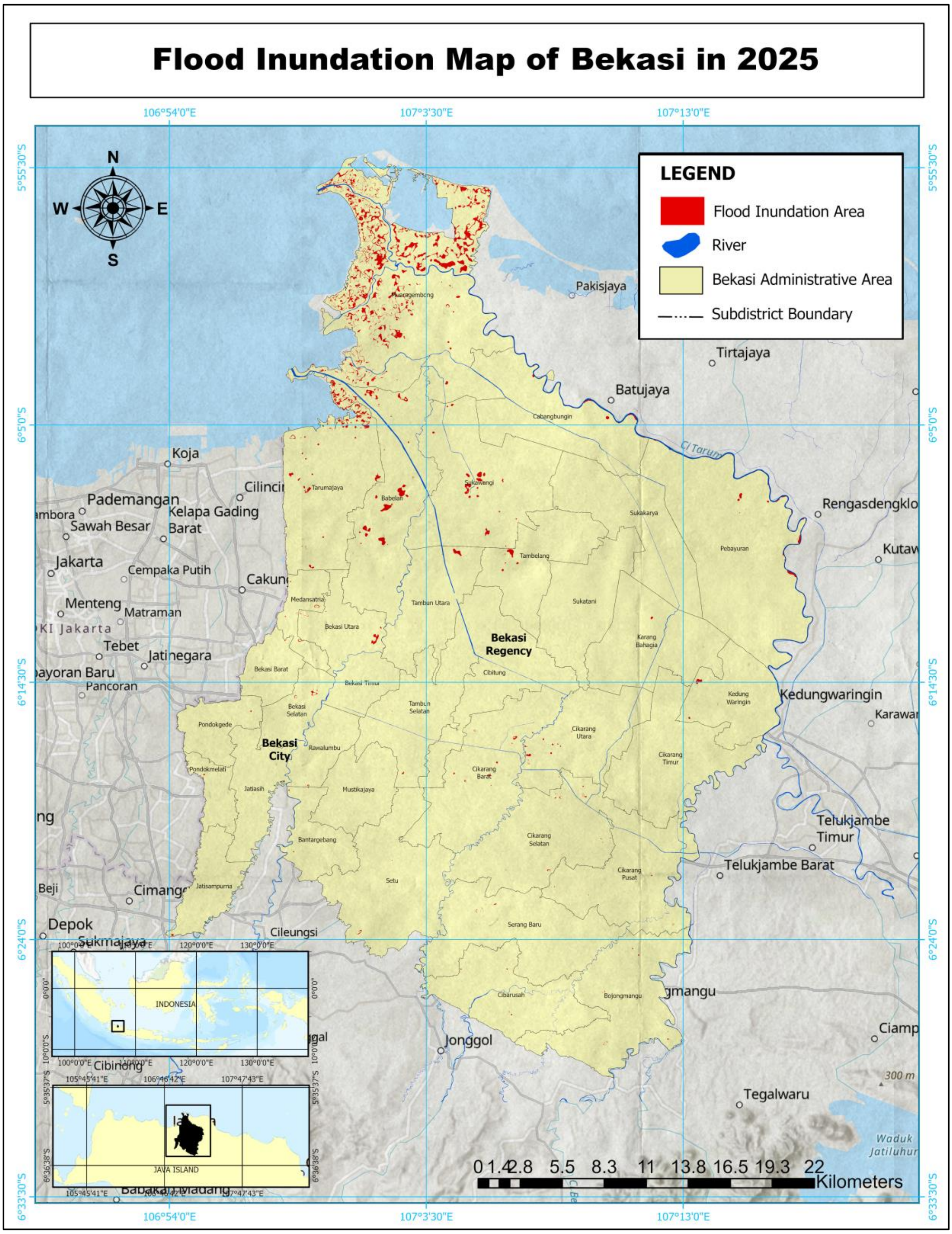
According to Table 7 below, the area impacted by floods in Bekasi in 2025 totals 1,660.90 hectares in Bekasi Regency and 38.98 hectares in Bekasi City. The data tabulation findings indicate that the regions most significantly impacted by flooding in Bekasi Regency include Muaragembong District (1,156.16 Ha), Babelan District (172.80 Ha), Tarumajaya District (104.65 Ha), and Bekasi Utara District (18.68 Ha) for Bekasi City. Refer to Figure 5 for a depiction of the regions impacted by flooding in Bekasi.

Table 7: Areas Affected by the 2025 Bekasi Administrative Area Flood Inundation

No	Bekasi Regency		Bekasi City	
	Subdistrict	**Area (Ha)**	**Subdistrict**	**Area (Ha)**
1	Tarumajaya	104.65	Bekasi Barat	0.69
2	Babelan	172.80	Bekasi Utara	18.68
3	Sukawangi	63.39	Bekasi Selatan	6.68
4	Tambelang	18.69	Rawalumbu	1.14
5	Tambun Utara	13.22	Medansatria	6.37
6	Tambun Selatan	1.81	Bantar Gebang	1.48
7	Cikarang Barat	12.08	Pondokgede	0.91
8	Cikarang Utara	11.78	Jatiasih	2.10
9	Karang Bahagia	2.19	Pondokmelati	0.93
10	Kedung Waringin	10.23		
11	Pebayuran	47.59		
12	Cabangbungin	24.16		
13	Muaragembong	1,156.16		
14	Setu	2.95		
15	Cikarang Selatan	7.87		
16	Cikarang Pusat	1.92		
17	Serang Baru	2.81		
18	Cibarusah	1.97		

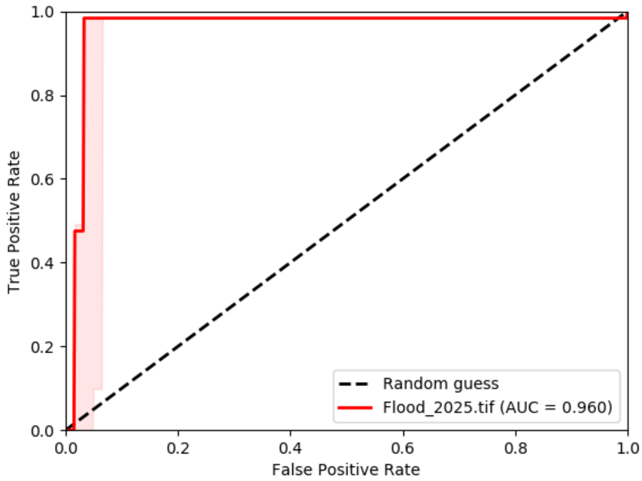
19	Bojongmangu	4.12		
Total Area		**1,660.99 Ha**	**Total Area**	**38.98 Ha**

Source: Data Processing, 2025



Source: Author, 2025

Figure 5: Flood Inundation Map 2025



Source: Data Processing, 2025

Figure 6: AUC Curve for Flood Inundation in Bekasi Administrative Area

The outcomes of the flood inundation study can be corroborated by ROC analysis employing the AUC curve, a crucial instrument in flood inundation mapping that offers a dependable framework for assessing and contrasting the efficacy of different predictive models. The ROC and AUC curve serve as dependable metrics for assessing the efficacy of flood prediction models, with a higher AUC value signifying superior model performance (Shawky & Hassan, 2023). The application of ROC in assessing the results acknowledges that the research findings pertain to binary classification, recognizing that the identified results exclusively categorize areas as either flood or non-flood, aligning with the binary classification framework essential for ROC analysis (Saleh et al., 2020).

The inundation map results for the Bekasi Administrative Area were subsequently confirmed by the ROC curve, utilizing the region Under Curve (AUC) method via the ArcSDM toolkit in ArcGIS. According to Figure 6, the graph exhibits an AUC value of 0.960, accompanied with a 95% confidence interval of 0.921 to 0.959. This score approaches 1, which aligns with the classification of accuracy levels based on (Nurlaela, 2020), which means the flood inundation mapping results used in the study to assess flood inundation areas in the Bekasi Administrative Area have excellent accuracy. Generally, the AUC value ranges from 0.5 to 1.0. A value of 0.5 in the evaluation results indicates that the model is no better than random guessing, and a value of 1.0 indicates perfect separation (Kohn & Newman, 2023).

According to the record of the 2025 flood disaster (Figure 7). Flood-prone locations in the Bekasi Administrative Area are predominantly situated in the northern coastal zone of Bekasi Regency, where communities are submerged by high tides. Conversely, urban flooding is typically dispersed along river courses, particularly in densely populated metropolitan locales.

Source: News Portal, 2025

Figure 7: Documentation of Flooding in the Bekasi Administrative Area

To effectively address the problem of flooding, an integrated approach is needed that combines structural (physical development) and non-structural (policy and management) approaches (Abdi-Dehkordi et al., 2021). Structural strategies for coastal flooding may involve the construction of extensive sea barriers, polder and pump systems, and the promotion or mandate of stilt housing development, as well as elevating essential infrastructure such as highways, schools, and health centers in areas of significant danger (Saputra, 2023). Meanwhile, for urban floods, which are generally caused by river overflow, several measures are needed, such as river normalization and dredging, river embankment construction and bank reinforcement, reservoir and pond construction, and optimization of urban drainage (Joga et al., 2024). Simultaneously, non-structural recommendations pertaining to policy and governance may encompass various proposals, including the creation of a reliable early warning system readily accessible to coastal communities and the implementation of spatial planning regulations that prohibit or limit new construction in regions most susceptible to tidal flooding (BAKORNAS PB, 2007). In metropolitan regions where flooding typically results from river overflow, many recommendations might be instituted, including a waste management program (Phonphoton & Pharino, 2019), as well as the construction of infiltration wells or biopores so that rainwater seeps into the ground and does not flow directly into drains or rivers (Mustopa et al., 2023). An additional suggestion is to enhance public understanding regarding the causes of floods and promote community involvement in preserving environmental purity and watercourses (Warsari & Iswan, 2023). This combination of structural and non-structural approaches is expected to sustainably address the flood problem.

The Role of Flood Inundation Monitoring for the Environment

Monitoring flood inundation is essential for attaining many sustainable development goals by addressing environmental, economic, and social aspects of sustainability. Remote sensing for flood inundation detection can aid in environmental conservation, specifically in advancing SDG 15 (life on land). This corresponds with the potential of remote sensing to identify floods, which can be utilized for environmental conservation, particularly in safeguarding ecosystems (Nasir et al., 2024), and can contribute to environmental sustainability (Tarpanelli & Benveniste, 2019). Then, the use of remote sensing for flood monitoring to support SDG 8 (Decent Work and Economic Growth). Monitoring flood inundation is essential for attaining many sustainable development goals by addressing environmental, economic, and social aspects of sustainability. Remote sensing for flood inundation detection can aid in environmental conservation, specifically in advancing SDG 15 (life on land). This corresponds with the potential of remote sensing to identify floods, which can be utilized for environmental conservation, particularly in safeguarding ecosystems (Rajabi et al., 2020).

Conclusion and Recommendation

Flood inundation mapping in the administrative area of Bekasi using Sentinel-1 SAR GRD data: C-Band Synthetic Aperture Radar (SAR) shows fluctuating changes from 2020 to 2025, with the largest flood area in 2021 having a percentage of 46% and the lowest flood area in 2020 and 2022 with a percentage of 4%. Based on data processing using Google Earth

Engine cloud computing, it is known that flooding in the Administrative area of Bekasi in 2025 covers an area of 1,660.90 Ha in Bekasi Regency and 38.98 Ha in Bekasi City. This processing has an ROC value realized using the AUC curve, which has a value of 0.960 with a 95% confidence interval of 0.921 – 0.959 and very good accuracy. Therefore, the findings of this study can serve as input for the Bekasi Regional Development Planning Agency (BAPPEDA), the Regional Disaster Management Agency (BPBD), and policy planners to formulate policy directions that are appropriate for the region's characteristics in order to reduce flooding, particularly in coastal and urban areas, using both structural and non-structural approaches.

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