AN ANALYSIS AND IDENTIFICATION OF FLOODED AREAS WITH DATA FROM SENTINEL-1 SATELLITES

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ABSTRACT

Flooding in Thailand has caused damage to people including property, houses, commercial buildings, factories and agricultural land. Sukhothai is one of the provinces in Thailand that floods every year. The main purpose of this study was to analyze and identify flood areas with data from sentinel-1 satellites in Sukhothai province, conducting data analysis with SNAP and ArcGIS programs. The data analysis showed that the data from August 25, 2020 with flooding areas was 96.751 km^2. Compared to the flood area data obtained from Geo-informatics and Space Technology Development Agency (GISTDA), which has a total flood area of approximately 106.632 km^2, there was a difference of approximately 9.593%. The differences may be due to different actions taken in the management and creation of data, including the processing of data to determine the extent of the flooding. Moreover, it found that the geographical nature of Sukhothai province is that the river flows from north to south, passing about 170 km, which causes repeated flooding, especially in Si Satchanalai, Sawankhalok, Sri Samrong, Sukhothai, and Kong Krailat districts.

1. INTRODUCTION

Water is an important resource in the livelihoods of humans and living things. In the last 10 years, the world has had more natural disasters, especially water disasters. There are many forms of water-related hazards. Floods are a form of water hazard that cause social, economic, and environmental damage (Rotjanakusol et al., 2019). From the recent flooding situation in Thailand, especially in late 2010, there were floods in the northeastern region, early 2011 floods and land sledging in many provinces of the south and the most severe in 50 years were floods that occurred in central and Bangkok during 2011. When it is said that all regions of Thailand have experienced flooding, direct impacts on people's lives, property, buildings, buildings, and infrastructure, agriculture and pets.

It also indirectly affects natural conditions, human-social conditions, such as demographic changes, well-being, health and diseases, human development, and economic and political conditions. These days of impact will intensify. The damage and subsequent losses are beyond predictable (Rotjanakusol et al., 2020). The lowlands of the Yom River are important lowlands for farmers' agriculture in Sukhothai, but the area of agriculture has experienced flooding. A 1998 flood study by the Irrigation Department found that the river capacity of the Yom River from upstream to Mueang Sukhothai district would be between 1,500-3,000 m³/s, and since The District of Sukhothai has reduced its capacity to 300-600 m³/s. Due to the bottleneck, drainage in the water season is not as good as it should be. It caused flooding in two lowlands along the banks of the Yom River (Phrae News, 2007).

Flooding in Thailand has caused damage to property, houses, commercial buildings, factories, and agricultural land (Asian Disaster Reduction Center, 2012), which Sukhothai has flooded every year and is a lowland area with Yom River flowing through the province. When the rainy season comes, there is quite a lot of rainfall in the area, along with rainfall in the

northern regions that flow down to Sukhothai. This resulted in flooding in study areas and affected the lives of property and agricultural lands of the people in the area in order to build knowledge in planning to prevent natural disasters from expanding. If people have knowledge of software data and processing, it can effectively explore, analyze data, and process areas affected by flooding during disasters (Ministry of Agriculture and Cooperatives, 2017; Zhang et al., 2020; Gašparović & Klobučar, 2021). Remote sensing technology is a science and technology used to record the characteristics of objects in reflection and radiation of electromagnetic energy without direct contact (Uttaruk & Laosuwan, 2016; Laosuwan & Uttaruk, 2016; Singh & Singh, 2017; Uttaruk & Laosuwan, 2018; Rotjanakusol, T., & Laosuwan, 2018; Prohmdirek et al., 2020; Jomsrekrayom et al., 2021). Remote sensing technology is constantly evolving and with satellite data, it can be used to create spatial data to solve these flooding problems. Therefore, this research focuses on analyzing and identifying flood areas with data from the Sentinel-1 satellite to determine the extent and trends of flood areas, to provide prevention, surveillance, as well as to assess flood damage, and to reduce the impacts in a wider range of risks that may increase.

2. AREA OF THE STUDY

Sukhothai Province (Figure 1) has 9 main administrative regions: Mueang Sukhothai, KhiriMas District, Ban Dan Lan Hoi District, AmSri Samrong, Sawankhalok District, Thung Saliam District, Si Satchanalai District, Srinakharinwirot District. The total number of sub-districts is approximately 6,592 km^2.

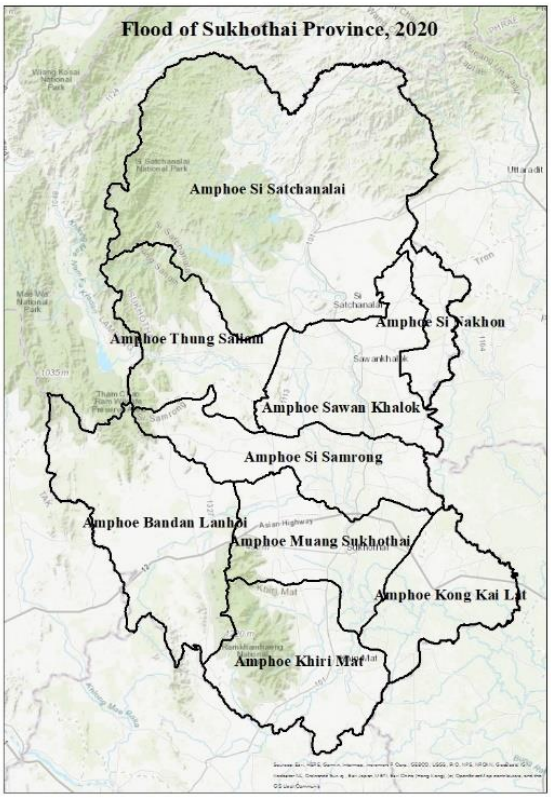

Figure 1. Sukhothai Province.

3. METHODOLOGY

The research was based on data from the Sentinel-1 satellite, recorded on August 25, 2020 in the Sukhothai area from the Copernicus Open Access Project Information Service website provided by the European Space Agency (ESA). The data used as Interferometric Wide Swath (IW) GRD level-1 data has a spatial resolution of 5x20 m, a orientation width of 250 km, which is an intberration. Therefore, the use of research requires increasing the quality of data from satellites in the SNAP program to analyze flood areas effectively.

The procedure is shown as follows:

1) Apply Orbit File updates the satellite's orbital data value to be more accurate because the receiver time has not been modified,

2) Noise Removal reduces the noise available in satellite image data. The next step is calibrate to calibrate the signal value of the resulting power. The result at this stage is Sigma0_vv,

3) Speckle Filtering eliminates interference found in Salt and Paper data by using a Lee Sigma 9x9 filter,

4) Terrain correction is an adjustment to the tolerances resulting from the terrain,

5) Create Vector creates a Vector data layer for Digital samples in the water area to collect Sigma0 statistics, then analyzes sigma0 statistics of flood areas,

6) Binarization by Thresholdization method with Sigma0 Mean in Study Area with Band Math, and

7) Export view as image of flood area export for analysis in Arc GIS program

4. RESULT

In this study, the researchers compared the flood area boundary results (Figure 2 - 5) using analytical data showing flood areas to analyze differences with GISTDA's published flood data.

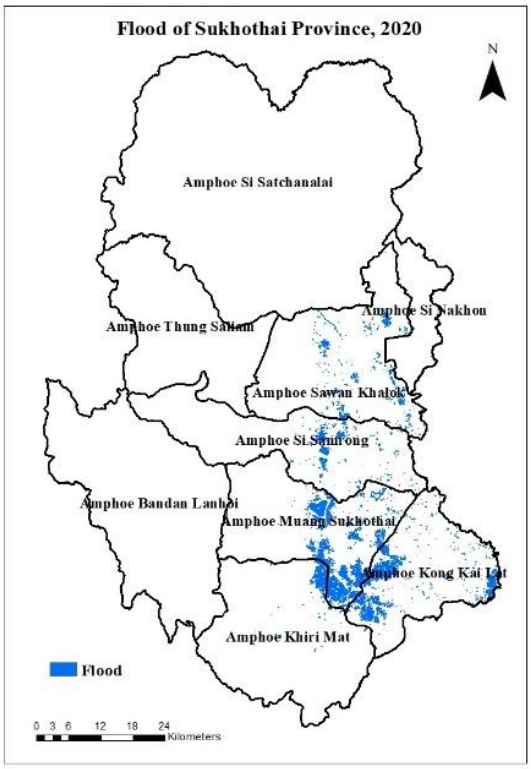

Figure 2. Area flooded by data analysis.

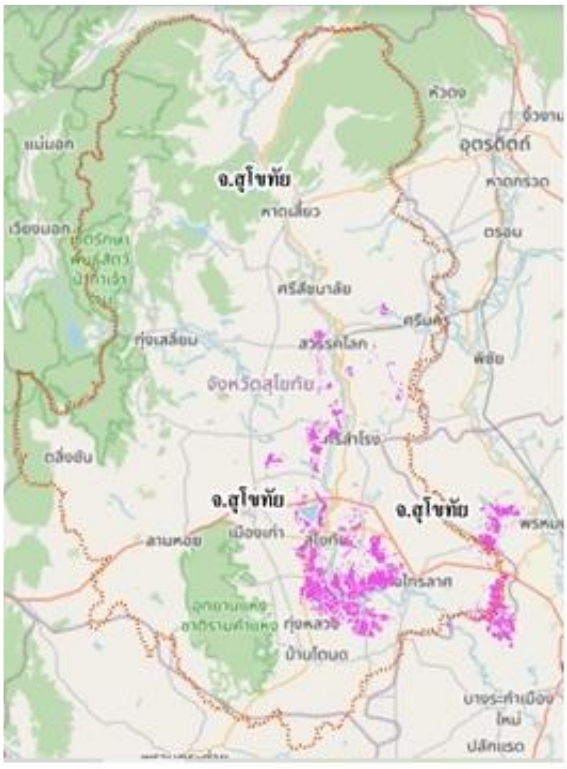

Figure 3. Area flooded by GISTDA.

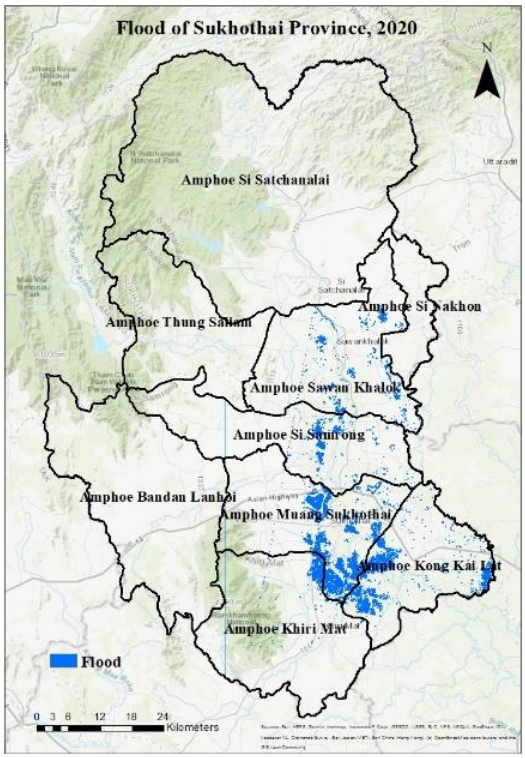

Figure 4. Area flooded by data analysis.

Figure 5. Area flooded by GISTDA.

When analyzing flood data from the Sentinel-1 satellite on August 25, 2020, the results showed a total flood area of 96.751 km^2 compared to flood area data obtained by GISTDA, which had a total flood area of approximately 106.632 km^2. As shown in Figure 2 , it is a map of flood-affected areas obtained from ArcMap program, Figure 3 is a flood-affected area, which is obtained from the data file from GISTDA. It can be opened with the Sukhothai Map, Figure 4 is a map of areas affected by flooding that have been analyzed and then opened in ArcMap based on an online map of Sukhothai, and Figure 5 is a flood-affected area from GISTDA.

5. CONCLUSION

Analyzing and identifying flooded areas with data from the Sentinel-1 satellite, Sukhothai province, which performs data analysis with SNAP and ArcGIS programs. Each program has different pros and cons, but for effective results, it shares the program, allowing for effective results, being able to find space and create flood maps from open sources and open code software. According to the data from August 25, 2020, the flood area was 96.751 km^2. Compared to the flood area data obtained from GISTDA, which has a total flood area of approximately 106.632 km^2, it was found to be about 9.593% difference. The differences may be due to different actions in data management and creation. Sukhothai's geographical characteristics are found to have rivers flowing from north to south, passing about 170 km, which causes repeated flooding, especially in Si Satchanalai, Sawankhalok, Sri Samrong, Sukhothai, and Kong Krailat districts. This research provides a way to process data from open sources with open code software to find flood areas of Sukhothai. This research can be applied to determine the likelihood of flood areas preparing prevention, surveillance, or immediate evacuation of populations to reduce the impact of a wider range, but the use of data from open sources must be carried out carefully and the accuracy of the data must be checked before use.

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