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ANALYSIS OF FLOOD EVENTS IN THE BATANG KURANJI WATERSHED ENVIRONMENT BASED ON WEATHER RADAR

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ABSTRACT

Floods often occur in several parts of Indonesia, including the city of Padang. The potential for flooding is very high because of the Batang Kuranji watershed. The main trigger for flooding is high-intensity rain that occurs over a long period. To understand the occurrence of heavy rains, one of the efforts made is weather radar analysis so that it can support the creation of impact-based weather early warnings. This study aims to 1) analyze the ability of weather radar to support impact-based weather early warnings; 2) Knowing what factors cause flooding; and 3) Knowing whether the weather early warning information has been disseminated to the public. The method used is Mixed Method. Radar data is processed using Rainbow Dart to obtain several products. The data is analyzed both quantitatively and qualitatively. The results show that weather radar can be used to analyze local scale weather and short duration so that it can be used as a reference for making weather early warnings. physical rivers, erosion, and sedimentation. Weather early warning information has not yet reached all levels of society.

Keywords: Flood, Weather Radar, Rainbow Dart, Kuranji Watershed, Environment.

INTRODUCTION

Floods are one of the most common types of hydrometeorological disasters. The frequency of flood events is increasing from year to year, even the intensity and distribution are also increasing. Besides being influenced by global climate change, especially rainfall, it is also influenced by changes in land use, utilization of riverbanks for settlements and industry, damage to watersheds, and so on. of the many natural disasters, floods are disasters with the greatest frequency and cause great losses (Gupta, 2003; Putra et al, 2017). Until now, the problem of flooding has not been completely resolved the problem indicates that it is increasing, both in intensity, frequency, and distribution.

Flood disaster is an environmental problem that threatens and disrupts people's lives. This flood disaster resulted in the loss of life, environmental damage, and property loss. The impact of the flood affects the location of the flood distribution and the socio-economic conditions of the community after the flood. This flooding problem can disrupt the ecosystem in the watershed. An ecosystem consists of biotic and abiotic components that interact to form a system. Watersheds can be considered as an ecosystem (Asdak, 2004; Putra, 2012; Putra et al, 2017). The environment is composed of three components which are often called the A-B-C Environment which consists of the Abiotic Environment or physical environment components, the Biotic Environment or the biological environment, and the Culture Environment or the socio-cultural environment.

Changes in the condition of the watershed area due to human activities occur as a result of the development of a region. In its development, certain areas require more land for housing, offices, regional development, and so on. This will have an impact on changes in land cover in the watershed area. This change is due to the use of natural resources that do not pay attention to the environmental balance, which will reduce the water catchment area, and accelerate the flow process on the surface when there is very high rain.

The main trigger for flooding is rain with high intensity which lasts for quite a long time. So to understand the occurrence of heavy rain, one of the efforts is to analyze radar data (dBz) at various elevations which are used to predict the rainfall that falls in an area. Rainfall is one of the elements of weather and climate that has a very important role in life on earth (Bayong Tjasyono, 2008), in this case besides being a natural resource that is needed but can also be a source of disaster (Basuki et al., 2009). Early warning of the intensity of rain is very necessary for an area, especially areas that often flood, airport areas, ports, cities, residential areas, and others.

At this time, remote sensing has become an idol to help forecasters make predictions from meteorological parameters. (Annisa et al., 2016). Weather radar can measure rainfall with much better spatial and temporal resolution than rain gauges. conventional or automatic (Sebastianelli et al., 2013; Putra et al., 2013). Facts on the ground show that with topographical conditions and high average rainfall in the city of Padang, it is very possible for runoff flooding from the main river of Padang City and flash floods as has occurred until 2020. With this research, it is hoped that weather radar can be an alternative that can be used as an alternative. can support early warning of weather that has the potential to flood to minimize the impact and risks that occur in the community.

METHODS

The research was conducted in the Batang Kuranji watershed using the Mixed Method. Mixed research is a research approach that combines qualitative research and quantitative research (Creswell, 2010). This study used a purposive sampling technique (Bayong Tjasyono et al., 2008). The primary data collection in this study used interview, observation, and documentation techniques, while the secondary data was obtained from the relevant agencies. Data validation using triangulation technique. Quantitative analysis techniques using descriptive analysis techniques, data analysis techniques using qualitative data analysis developed by Milles & Huberman (1992) consists of three components, namely data reduction, data presentation, and conclusions.

RESULTS

1. Analysis of radar image

From the analysis of several flood events in the Batang Kuranji watershed, there are several patterns of rain events that cause flooding in the Batang Kuranji watershed. The flood incident on August 1, 2016 from the MAX image analysis recorded a reflectivity value of 55-60 dBz which identifies heavy rain occurring from 06.39 - 07.59 UTC (13.39 - 14.59 WIB). Rain intensity fluctuates from light rain to heavy rain from 03.08 - 10.00 UTC. Heavy rain only occurs in the upstream and middle parts of the Kuranji watershed, while the lower part only rains with light intensity.

In the flood incident on February 28, 2017, the intensity of the rain that occurred was only in the light to moderate rain category, but the duration of the rain lasted longer than the previous pattern. The analysis of the MAX image only shows reflectivity values between 35-45 dBZ with total rain in the Kuranji watershed ranging from 6.1 - 50.1 mm/day. In the flood incident on September 6, 2018, heavy intensity rain occurred only for a short time but reached a high-intensity value of 24.7 mm/hour. With a recorded reflectivity value of 55 - 60 dBz.

The analysis of the spatial distribution of clouds carried out through the MAX product shows changes in the horizontal distribution and changes in the location of the cloud that is the object of research. The collection of clouds seen in the study area at a mature stage, covering the study area is categorized as convective clouds that have the potential to cause heavy rain. The mature stage is the phase when the cloud form begins to stabilize and its size is constant in the cloud system (Anggoro & Pramujo, 2017). The image of the MAX product from this cloud shows an increase in maximum reflectivity compared to the previous stage. The distribution of reflectivity with higher values is spread more evenly over the entire cloud.

The dissipation stage is a phase where the cloud experiences a decrease in the maximum reflectivity value (Anggoro & Pramujo, 2017). The vertical structure of the clouds in the study area began to experience a decrease in intensity as shown by the MAX product. The maximum intensity of this cloud reaches 35 - 45 dBz and the reflectivity decreases in the range of 5 - 30 dBZ.

2. Watershed Environment of Batang Kuranji

The growing development and various human activities in the Batang Kuranji watershed area are a consequence of human activities that will lead to changes in land use.

Tabel 1. Land use change from 2010 -2020 in the Kuranji watershed

Land Use	Land Area Ha		Land Use Change Ha
	2010	2020	
Settlement	6335,703	2947,575	3388,128
Ricefield	6.822,27	2004,81	4817,46
open ground	875,38	168,199	707,181
Mixed garden	8059,858	1550,4365	6509,4215
Shrubs	3572,64	2301,775	1270,865
Secondary Forest	4355,315	1925,25	2430,065
Primary Forest	23666,382	8529,524	15136,858

This change results in reduced land cover, which also affects the amount of vegetation decreasing. Reduction of forest area will increase the rate of erosion. As a result of this erosion, the soil becomes compacted, and much of the lost topsoil is transported to a lower place, this soil becomes sediment that can shallow rivers. The topography of the Batang Kuranji watershed consists of sloping plains to mountains, with varying steepness of slopes. The slope of the slope is very influential on the speed of erosion in a watershed area, this is because the average slope of the watershed is one of the factors that greatly affect surface runoff.

Floods that occur in the Batang Kuranji watershed often occur in the downstream area, the areas that are subject to flooding are low-lying areas such as Tabing banda Gadang, Lapai, Alai, Sungai sapih. Floods occur because the river overflows due to high rainfall intensity, the river is unable to accommodate the water discharge, this can happen because upstream of the river the water flow is disrupted due to cliff landslides. People are still not too concerned about the environment as there are still people who throw household waste into the river. Extreme weather early warning is a series of activities to provide information as soon as possible to the public containing predictions of the possibility of extreme weather (BMKG, 2010). Early warning is a major factor in disaster risk reduction to prevent loss of life and reduce the economic and material impact of a disaster. The dissemination of this information has not yet reached all levels of society, as many as 56% of the community have not received this information and only 36% have obtained this information.

The problem now is how to anticipate the impact that will be caused by extreme weather, a good early warning system greatly influences and is the key to not repeating the same disaster or flood every year. BNPB especially for flood early warning should be handled as a form of disaster prevention by using data from BBWS PU-Pera and BPDAS KLHK, BMKG provides early warnings related to weather and other meteorological and climatological information.

CONCLUSION

From the results of the study it can be concluded: 1) Weather radar can be used in analyzing fluctuating weather conditions, it needs to be a concern if the MAX product shows that the maximum reflectivity range possessed by this cloud reaches 55-60 dBz and has the potential to cause extreme weather resulting in flooding, so that it can be a reference for making impact-based weather early warnings; 2) Flooding in the Batang Kuranji watershed is caused by high rainfall intensity, changes in land use in the watershed, physical physiography such as the shape and slope of the watershed, as well as erosion and sedimentation; and 3) Weather early warning information has not reached all levels of society, a good early warning system is needed to reduce the impact of flood risk.

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