Sattelite LANDSAT for Eruption of Mt. Sinabung

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Sattelite LANDSAT for Eruption of Mt. Sinabung

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ABSTRACT

Volcano eruption at the moment and will still last one of them is the eruption of Mount Sinabung. Sinabung eruption many lives that need to be done on disaster mitigation in order to provide early information about when the eruption would occur and could predict when the eruption would take place. Mount Sinabung had geographic coordinates 3°10'12 "N 98°23'31" E with an altitude of 2,460 meters above sea level. The research methodology used remote sensing technology as well as data such as satellite images Landsat with the output data of June 7th, 2013, March 6th 2014, 21 February 2015, 29 June 2015. The results determined the distribution pattern of temperatures that could steer which direction the larva as well as determined areas that need to be done evacuation or disaster mitigation in order to avoid the danger of eruption.

Keyword : Volcanoes, Disaster Mitigation, Landsat 8 OLI, Sinabung

1. Introduction

Indonesia is a country which is composed by thousand islands and included a state that circle point earthquake the most active in the world, the path of the volcano and the line of plate collision that stretches 40,000 kilometers (pacific ring of fire), as well as into the earthquake belt very active number two in the world, belt alpide (alpide belt) (Blackett, 2014). This condition is exacerbated by the collision of three continental plates, the indo-australian of the south, eurasia from the north, and the pacific from the east. It is flanked by two extreme geophysical lines, Indonesia is home to some of the strongest natural disasters that have occurred on earth, one of them is a volcanic eruption.

Volcano in indonesia as many as 127, one of the volcanoes that are still active experienced the eruption is mount sinabung (Ministry Of Energy And Mineral Resources, 2011). The eruption of the volcano mount sinabung locates in karo district of north sumatera province with the geographical coordinates of mount sinabung, locates in karo district of north sumatra province with coordinates 3°10'12" n and 98°23'31" e, 2.460 masl (Central berau of statistic, 2014). Sinabung first eruption on september 2013. Until now incandescent lava and hot clouds glide up to a radius of 3 kilometers is still going on everyday. Geological agency predicts sinabung eruption is still going through five years ago (Anonym, 2015).

With this prediction we need a monitoring activity, impacts and mitigation temporally in the long run shall be done. Remote sensing is a new technology that can monitor a change temporally in the longterm, wide regional coverage, more efficient way to assess the impact, and can quickly provide assistance, in accordance with the impact of which is caused by the disaster, to the people who are affected by the disaster. Several studies on volcano eruptions, mitigating the impact of the volcanic eruption, volcanic eruption modeling uses remote sensing (Blackett, 2014; Bingwei, 2015; Ji L, 2010; Kriswati, 2011; P. Dash, 2015)With the remote sensing is expected to be petrified mitigation of the eruption impact of mount sinabung.

2. Study Area

The observation area in this case study is Mount Sinabung located in Karo district of North Sumatra province with coordinates 3°10'12" N 98°23'31" E and an altitude of 2,460 meters.

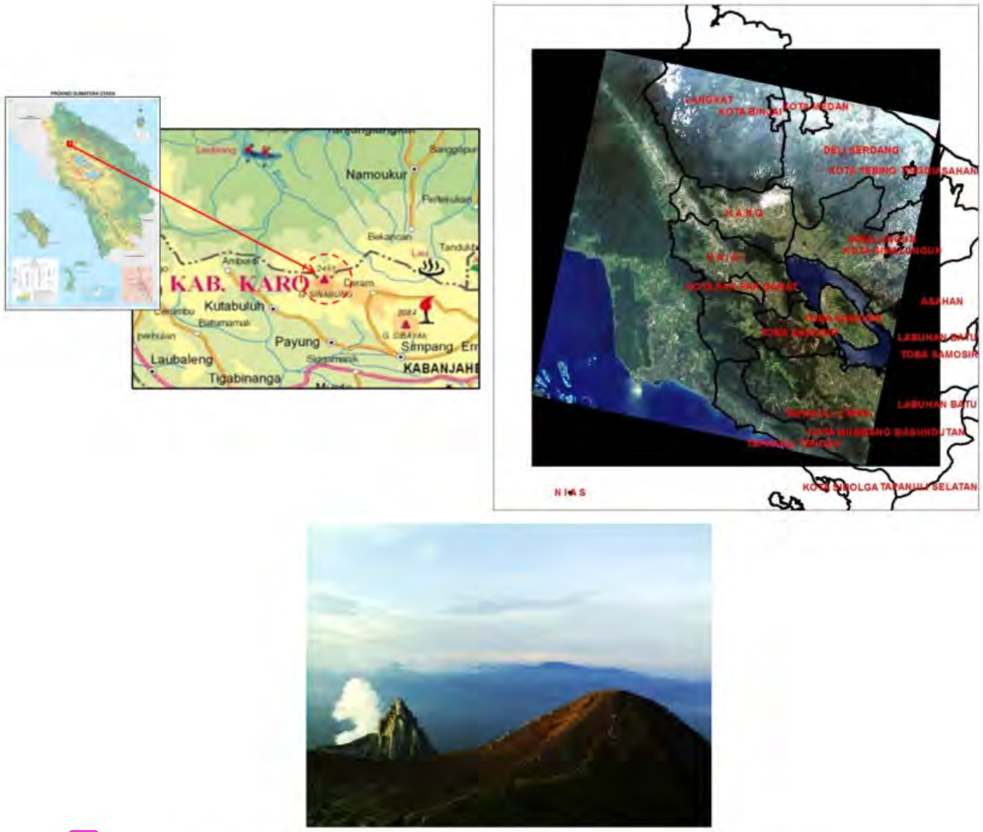


Fig. 1. Location of Study Area : MT. Sinabung of Map Topography, Landsat looking and Real pictrue

3. Methods

Research methods to look for changes in vegetation and temperature estimates, as follows

1. Tools and Data

The tools used for this study can be seen in Table 1.

Table 1. Table of tool research

No	Name	Spesification	Total
1.	Laptop 1. ArcGIS 10.0 2. ENVI 5.0	Intel core i3 HDD 500 MB RAM 2GB	1

The data used for this study can be seen in Table 2.

Table 2 . Research Data

No	Name	Spesification	Total
1.	Landsat 8 OLI path 129 row 058 (07 Juni 2013)	Band 10 Thermal Infrared – 100 m	1
2.	Landsat 8 OLI path 129 row 058 (06 Maret 2014)	Band 10 Thermal Infrared – 100 m	1
3.	Landsat 8 OLI path 129 row 058 (21 Februari 2015)	Band 10 Thermal Infrared – 100 m	1
4.	Landsat 8 OLI path 129 row 058 (29 Juni 2015)	Band 10 Thermal Infrared – 100 m	1
5.	Administration boundaries	Mt. Sinabung	1

2. Procedure of Research

Procedure of Research for calculating temperature estimates, as follows

Land surface temperature will use thermal infrared image of thermal infrared remote sensor (TIRS) to find geothermal resources of Landsat 8 OLI (Path 129 and Row 58). Thermal infrared image will be cropping with study area (Sinabung) and then calculating with correction radiometric formula, calculating land surface temperature (Kelvin) value, converting LST value with kelvin to celcius. Futhermore, it will be classified from low to highest temperature value for LST. Finally, areaof geothermal can be found.

3. Result

Monitoring research areas which used remote sensing method required a Landsat satellite image data which would be processed to produce a value of LST. Mount Sinabung, located in Karo district in the distribution of Landsat images located on Path 129 and Row 058 [8]. Map of Indonesia in the path and row could be seen in Figure 3.

Eruption of Mount Sinabung could be viewed by utilizing a combination of RGB Color on satellite images Landsat 8 OLI, where for R used Band Thermal Infrared (Band 10), G used Band Short Wave Infrared (Band 6), and G used the Band Near Infrared (Band 5) , The result of the combination was called Infrared Light, this served to see the path of the lava eruption of Mount Sinabung and could be seen in Figure 2.

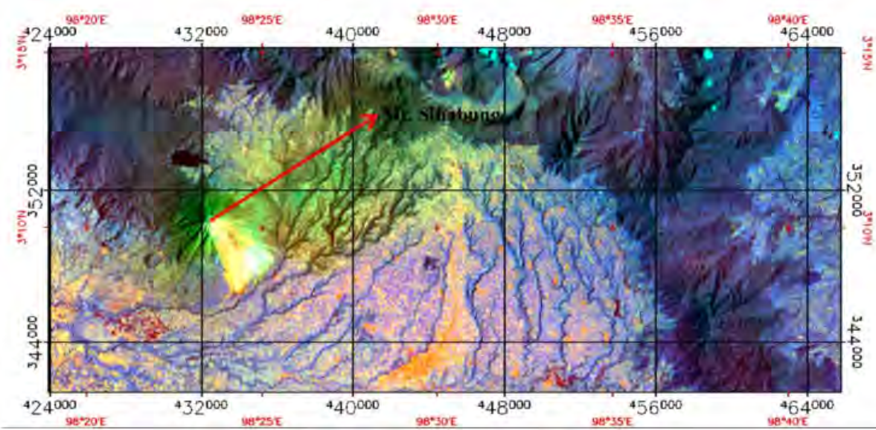


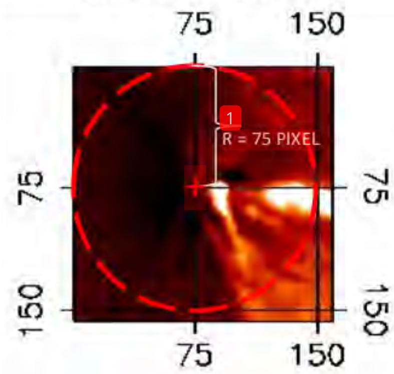
Fig. 2. Mt. Sinabung in InfraRed Light (Band 10,6,5)

This result used with 4 periods (June 7th 2013, March 6th 2014, February 21th 2015, and June 29th 2015), as shown Table 3.

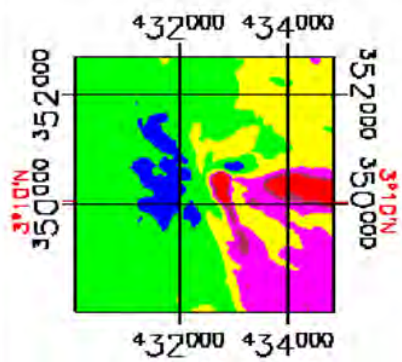
Table 3. Result of Research for 4 period of Sinabung's eruption

DATA	TEMPERATURE IMAGE	DISTRIBUTION TEMPERATURE IMAGES

June 29th 2015



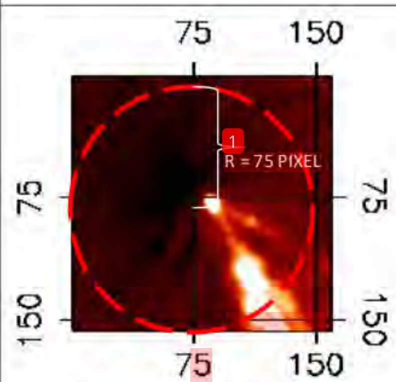
R = 75 PIXEL, 1 PIXEL = 100 m
75 x 100 = 7500 m = 7.5 Km



Temperature Maximum = 77.617340 °C
Classification of result :

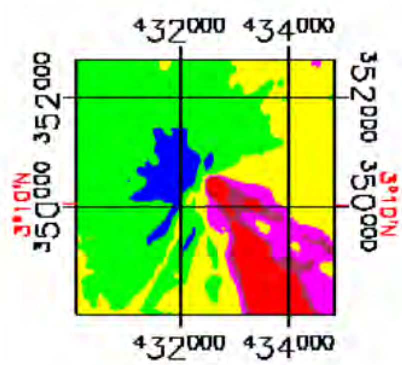
Temperature	Classification	Pixel	Color
< 20	Very Low	1.464	
20 – 25	Low	13.200	
25 – 30	Quite Low	5.482	
30 – 35	Moderate	3.457	
35 – 40	High	426	
>40	Very High	619	

21 Februari 2015



R = 75 PIXEL, 1 PIXEL = 100 m

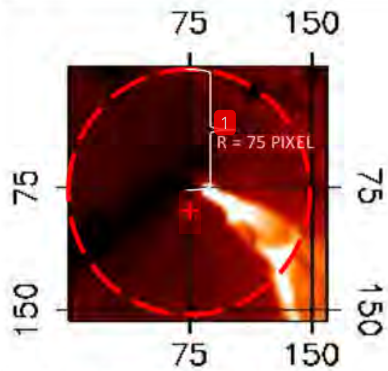
75 x 100 = 7500 m = 7.5 Km

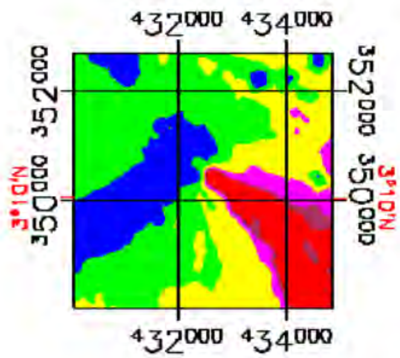


Temperature Maximum = 94. 645447 °C
Classification of result :

Temperature	Classification	Pixel	Color
< 20	Very Low	1.435	
20 – 25	Low	11.653	
25 – 30	Quite Low	7.052	
30 – 35	Moderate	1.930	
35 – 40	High	848	
>40	Very High	1.730	

March 6th 2014



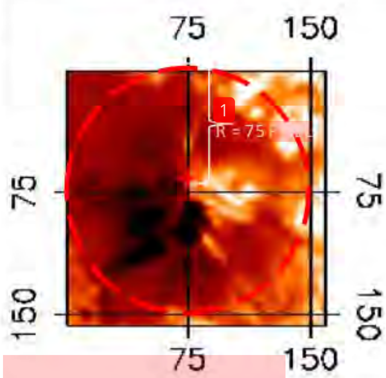


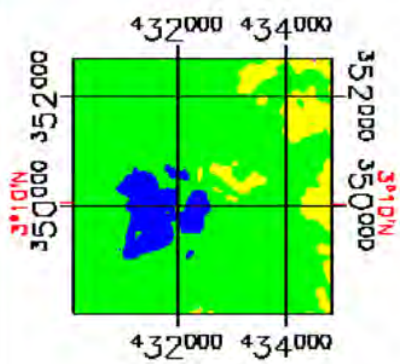
R = 75 PIXEL, 1 PIXEL = 100 m
75 x 100 = 7500 m = 7.5 Km

Temperature Maximum =90. 6060272 °C
Classification of result :

Temperature	Classification	Pixel	Color
< 20	Very Low	4.260	
20 – 25	Low	10.388	
25 – 30	Quite Low	5.682	
30 – 35	Moderate	1.222	
35 – 40	High	605	
>40	Very High	2.491	

June 7th 2013 (pra eruption)





75 x 100 = 7500 m = 7.5 Km

Temperature Maximum = 30.374054
Classification of result :

Temperature	Classification	Pixel	Color
< 20	Very Low	1.858	
20 – 25	Low	20.319	
25 – 30	Quite Low	2.466	
30 – 35	Moderate	5	

From Table 3. Result of research 4 time periode included temperature increased from pra up to pasca eruption.

From Table 4, result of research (pixel) must be converting to wide (area). So, the area calculations and results classification for each category have been using the formula

Area = (number of pixels x area per pixel) / 10000 ha

Pixel size = 100 x 100 = 10,000

The area values were same for 4 periods, as shown Table 4.

Table 4. Area of each classification of temperature distribution

DATA	KLASIFIKASI					
	Very Low	Low	Quite Low	Moderate	High	Very High
June 7th 2013	1.858	20.319	2.466	5	0	0
March 6th 2014	4.260	10.388	5.682	1.222	605	2.491
February 21st 2015	1.435	11.653	7.052	1.930	848	1.730
June 29th 2015	1.464	13.200	5.482	3.457	426	619

From Table 4.We could view the changes in each periode of data from pra up to pasca eruption. Persentation of area for june 7th 2013, for area with high catogery and very high categoryare 0%, cause for this time was eruption yet. For data of march 6th 2014, there was eruption, that had area for high temperature category and very high temperature category were 10% and 17%, for data of march 21st 2015, there was eruption, that had area for high temperature category and very high temperature category were 6% and 7%, and then for data of June 29th 2015, there was eruption, that had area for high temperature category and very high temperature categoty were 6% and 4%. From result for 4 time periods, we got area for high temperature category and very high temperature category with low persentage, cause direction of lava eruption was just one direction, that was east.

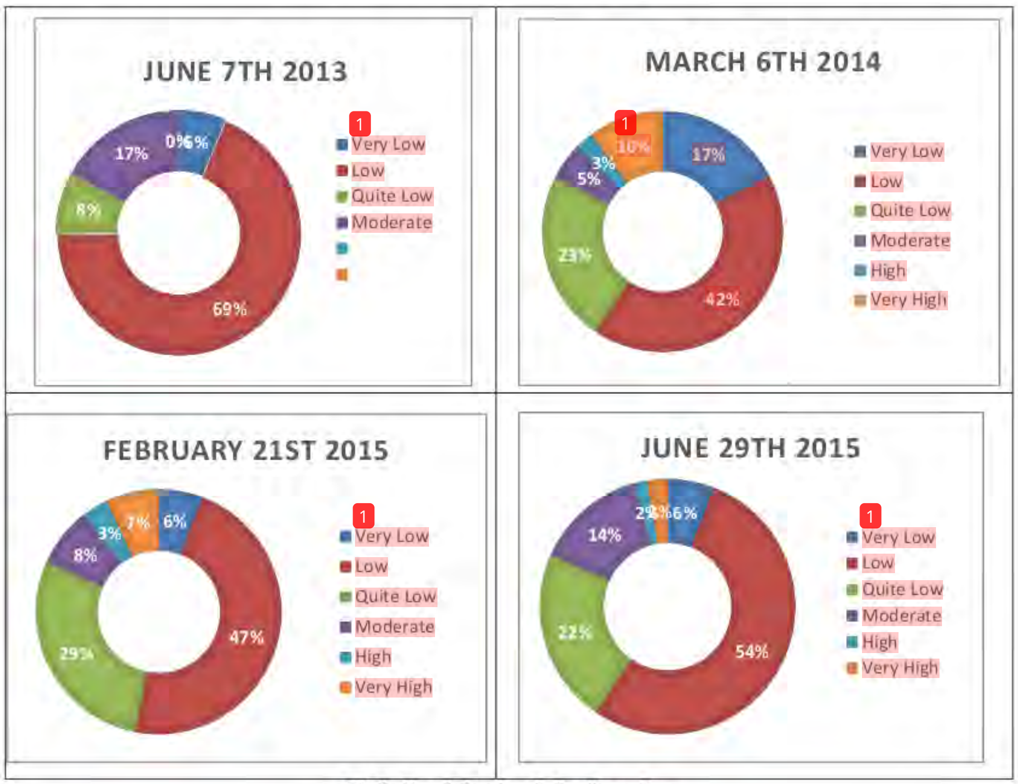


Fig 3. Graph for 4 periode of eruption

The results also shown the area within a radius of how many areas were included in the category should be evacuated or disaster mitigated, as shown in Figure

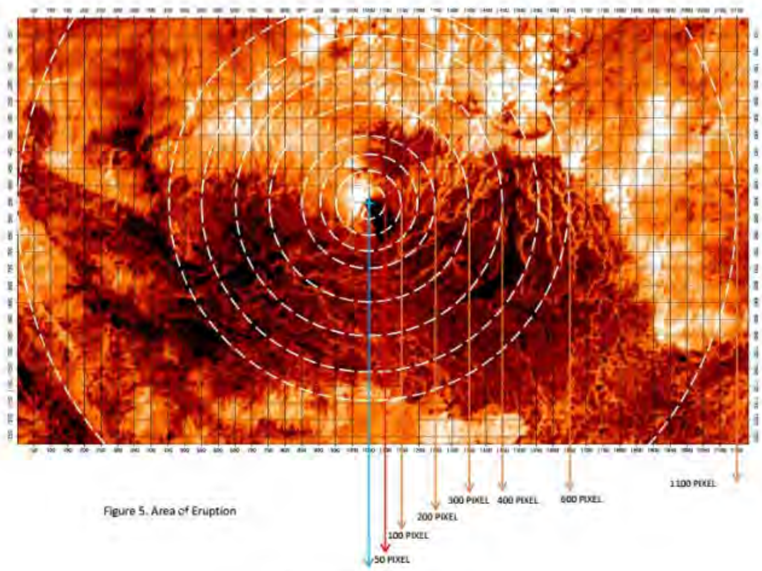


Fig. 4. Result of research

From Figure 4, the result of research for biggest area were classified for each categories as Very Low, Low, Quite Low, Moderate, High and Very High, as shown in Figure 5

4. Conclucion and Recommendation

The identification of eruption for disaster mitigation could be found with thermal infrared remote sensing method which were Land Surface Temperature. LST was used thermal infrared image of Landsat 8 that was published on june 7th 2013, March 6th 2014, February 21st 2015 and June 29th 2015. The maximum value of LST for data of on june 7th 2013 was 30.374054 °C, maximum value of LST for data of on june to March 6th 2014 was 90.060272 °C , maximum value of LST for data of on February 21st 2015 was 94.645447 °C and maximum value of LST for data of on June 29th 2015 was 77.617340 °C. It is likely that temperature was become increased.And broad of area are classification for each category were Very Low, Low, Quite Low, Moderate, High and Very High. High and very high category area were increasing for 4 times periode. The results showed an increasing in temperature of before and after the eruption, determined the distribution pattern of temperatures that could steer the larva direction as well as determined areas that need to be done evacuation or disaster mitigation in order to avoid the danger of eruption.

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