



Rectilinear Motion Anomaly (Garavity Anomaly) Around Mount Kelud

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Received: June 25, 2025	Revised: July 14, 2024	Accepted: July 14, 2024	Online: August 06, 2024
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ABSTRACT

Indonesia is a country that is prone to geological disasters due to volcanic eruptions, ground movements, earthquakes and tsunamis, due to its location at the meeting point of three active tectonic plates: the Eurasian, Pacific and Indo-Australian plates. Geophysical research is important in understanding this phenomenon by utilizing physical parameters to study the earth beneath the surface. Gravity methods show potential in providing detailed images of geological structures and rock density contrasts, especially in geothermal investigations. Mount Kelud, as one of the active volcanoes in Indonesia, is the focus of this research. By using a geophysical method approach, this research aims to analyze the gravity anomalies around Mount Kelud. It is hoped that this study will provide a deeper understanding of the gravitational anomaly phenomenon in the region, which can be useful in future disaster mitigation and management efforts.

Keywords: *Geological Disasters, Geophysical Research, Gravity Anomalies*

Journal Homepage <https://journal.ypidathu.or.id/index.php/ijnis>

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How to cite: Nisa'I, K., Nisak, R, A., Afif, O & Permatasari, T, I. (2024). Rectilinear Motion Anomaly (Garavity Anomaly) Around Mount Kelud. *Journal of Biomedical and Techno Nanomaterials*, 1(3), 101-105. <https://doi.org/10.55849/jbtn.v1i1.172>

Published by: Yayasan Pedidikan Islam Daarut Thufulah

INTRODUCTION

Indonesia is located at the meeting point of three active tectonic plates, namely the Eurasian, Pacific and Indo-Australian plates, which result in the formation of volcanoes, hilly morphology and earthquake sources. These conditions make Indonesia vulnerable to geological disasters such as volcanic eruptions, land movements, earthquakes and tsunamis. Indonesia, which is on this route, has 129 volcanoes and 76 volcanoes are declared very active, which are marked as having erupted since 1600 until now. Active volcanoes in Indonesia are spread from the northern tip of Sumatra, Java, Nusa Tenggara, Maluku, North Sulawesi. One of the active volcanoes in Indonesia is Mount Kelud, precisely in East Java.

Geophysics is the science that studies the earth using physical parameters. In this case, the target is the subsurface earth. The physical parameters used are mechanical parameters which include seismic, gravity and magnetic methods. The gravity method has an advantage for initial surveys because it can provide quite detailed information about geological structures and rock density contrasts. In the geothermal case, the difference in rock density is a reference in gravity method investigations.

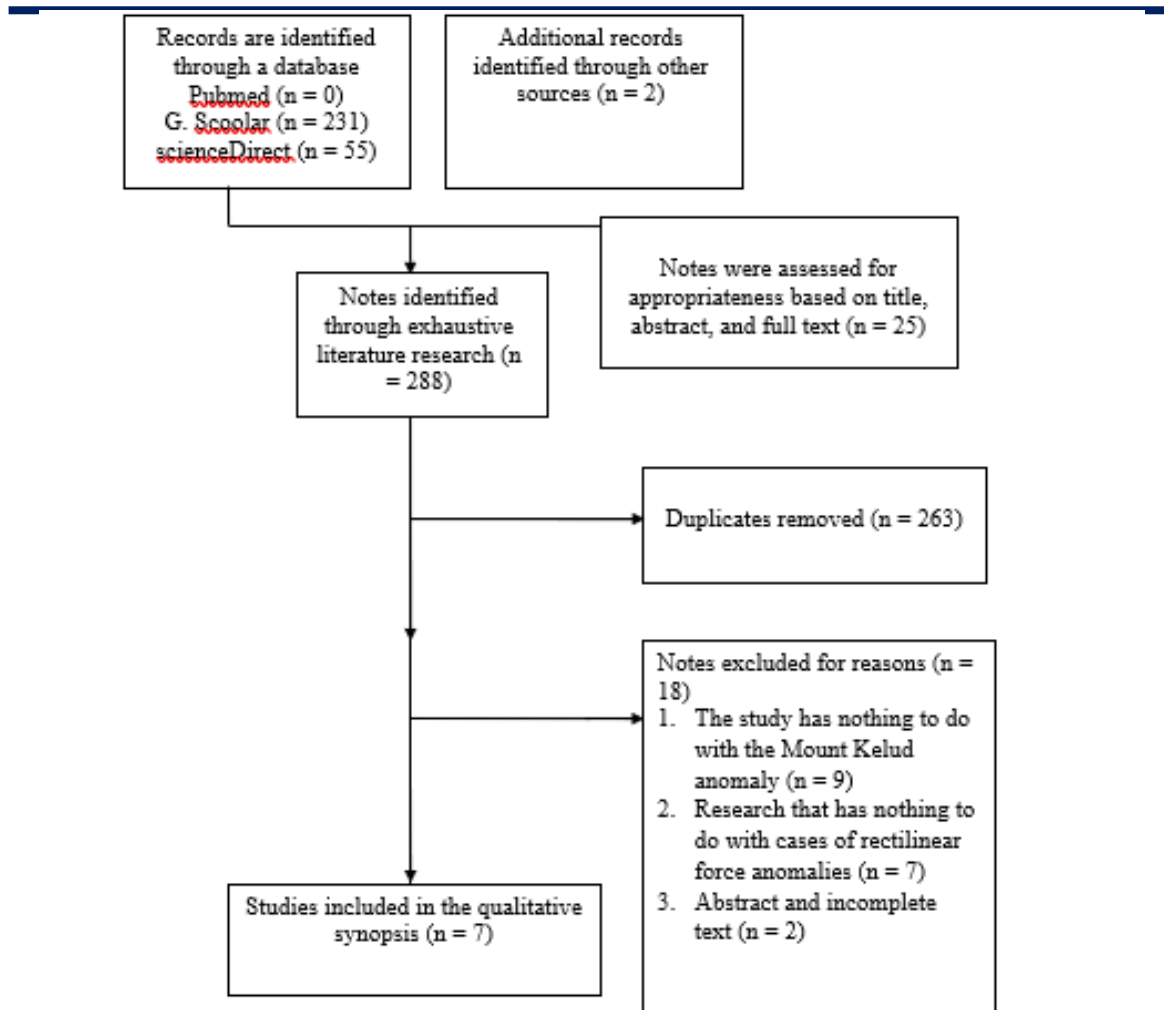
Mount Kelud is a stratovolcano. Its location is at 7 degrees 56 minutes south latitude and 112 degrees 18 minutes 30 seconds east longitude. Mount Kelud has a height of 1,731 meters above sea level. On Mount Kelud, magnetic mechanical parameters were found, where a vehicle can drive to higher ground without the engine starting.

Several studies that are almost similar have been published in a journal entitled "ANALYSIS OF GRAVITY ANOMALIES OF MOUNT SEMERU POST ERUPTION 4 DECEMBER 2021". Data from measurements using a geophysical method approach from the research area can interpret physical quantities based on certain objects near and below the surface. The model created can simplify the conditions of an area to make it easier to carry out calculations and analyze the response of the Earth's layered structure using physics concepts. In the gravity method, modeling can be illustrated with various lateral variations in rock density.

This research was carried out to find out the actual cause of the gravitational anomaly that occurred in this area. It is hoped that this research will provide useful information regarding gravity anomalies in the area around Mount Kelud.

RESEARCH METHODOLOGY

The literature search identified 286 records through three sources: 0 from PubMed, 55 from ScienceDirect, and 231 from Google Scholar with a span of the last 5 years. After removal of duplicates, eligibility of the remaining studies (N=54) was assessed based on title. In total, 43 records were excluded because they did not meet the selection criteria. A total of 11 studies were involved in this qualitative research.



to another in a place caused by the distribution of mass below the surface of the research area. However, the data obtained in the field is a complex result of the contribution of many things. Differences in latitude in each place, the shape of the earth's topography which is not flat, and the attraction of other planets such as the sun and moon are things that influence the value of the gravitational field caused by anomalous objects below the actual surface.

The subsurface structure of Mount Kelud after the eruption in 2007, based on the results of research using the gravity method, has similar results to previous research conducted by Musafak (2009) using the magnetic method, this is due to the similarity of structural lithology. Based on the results of this research, using magnetic methods, a model of the subsurface structure of Kelud Volcano after the 2007 eruption was obtained, which was interpreted as andesite and basalt.

In the Sugihwaras area, Ngancar sub-district, Kediri regency, there is a mystery road about 100 meters long. Along the road it appears to be uphill so that vehicles passing the road go uphill by themselves without starting the engine.

RESULT AND DISCUSSION

Basically, the gravitational method of investigation is looking for differences in gravitational field values from one point A study was conducted regarding this rare phenomenon. This research was carried out by a lecturer who is also an earth expert at the Surabaya Institute of Technology named Ir. Amin Widodo MT. According to his statement, it turns out that the event that the car was able to run while it was dead was just an illusion. This research was conducted on April 5 2007. He invited several students to participate in the research. They deliberately carried out this research because they were very curious about the story of this rare phenomenon. When the road was measured per meter, it turned out that there was a flat road. According to the lecturer at the Faculty of Civil Engineering and Planning, when someone is on the south side of the road, the "Mystery Road" will appear to be going downhill. Even though this is wrong. However, he said, this was only a temporary guess and the plan was to measure the high and low levels in the area using the "Paedolis" tool. Meanwhile, in another research conducted by brother Seno Puji Sarjono, who is also a Geophysics lecturer, and Darminto, a Physics lecturer also made the same conclusion. The conclusion from both is that the mystery road that leads to Mount Kelud does not contain a magnet that can enable the vehicle to drive itself when the engine is off. Indeed, at first glance when looking at the road it looks like it is going downhill, but after taking measurements it turns out that the road is going downhill with a slope of around 5 degrees. By using a geological compass, the location of the road which was thought to be uphill, turned out to be that this mystery road with a length of 200 is in a downhill condition and has a slope of around 5 degrees. So you can be sure that when a vehicle passes this road with the engine off, it will definitely be able to move on its own. When examined using a magnetometer, no magnetic content was found around the road.

In this area the law of the magnetic field still applies at various points in the area. This phenomenon is an optical illusion or visual illusion. The illusion he creates makes the descending highway look like it is going uphill. So, when we turn off the car engine and release the brake, the car actually obeys the law of gravity by moving along a downward path. but the eyes do not accept the reality that is happening

CONCLUSION

Straight motion abnormalities on Mount Kelud can be caused by a variety of factors, including extreme weather changes, volcanic activity, or seismic activity. Volcanic eruptions are natural events that occur frequently on Mount Kelud and can cause significant changes in the morphology of the mountain and its surroundings. Seismic activity, although Mount Kelud is not located in a highly active earthquake zone, can also affect the anomalies of direct motion around it. The phenomenon of the "magnetic path" on Mount Kelud remains a mystery and is controversial among scientists, with some of the explanations proposed including iron levels in volcanic rocks, geological activity, and electromagnetic effects. Research using magnetic methods has been carried out to determine the subsurface structure around Mount Kelud, with the results of interpretations

suggesting the presence of magnetic dipole anomalies on the east side and the domination of basalt rocks under Mount Kelud crater. Thus, in-depth monitoring and understanding of the various factors and natural phenomena around Mount Kelud is essential for risk mitigation and effective disaster management.

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