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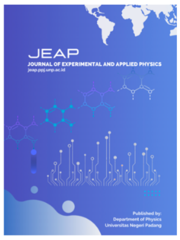

Mapping the Peak Ground Acceleration Value and Seismic Intencity In The South Pesisir District Area Using The Empirical Formulation Of SI and Midorikawa

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Abstract: The South Pesisir is an area that is prone to earthquakes, because it is in a zone that is traversed by the Sumatran fault system, subduction zone and Mentawai fault. The 3 earthquake zones are areas that have an active level of seismicity from which the maximum ground acceleration value and earthquake intensity can be calculated. The aim of this research is to determine and map the peak ground acceleration and seismic intensity values to support development planning and spatial planning in the South Pesisir District area. Descriptive research is conducted by collecting earthquake catalog data sourced from the USGS (United States Geological Survey) in the period 1973-2023 with coordinates -2.35°S – -1.04°N and 99.32°E – 101.27°E. The magnitude considered is M ≥ 5 SR with a maximum depth of 300 Km. The peak ground acceleration data is processed using the empirical formulation of Si and Midorikawa attenuation, and the output of peak ground acceleration and seismic intensity data is displayed using ArcGis 10.8 software. The highest peak ground acceleration values were found in Lengayang District, Air Pura District, Pancung Soal District, and Basa IV Balai Tapan District with values ranging from 225.53 – 526.57 gal, while the lowest ground acceleration values were observed in Koto XI Tarusan District, Bayang District, North Bayang District, and Silaut District with values ranging from 16.15 – 27.91 gal. Meanwhile, the highest seismic intensity is observed in Lengayang District VIII MMI, and the smallest seismic intensity is observed in Bayang District, North Bayang District, and Silaut District, namely IV MMI.

Keywords: Earthquake, Peak Ground Acceleration, Seismic Intensity

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1. Introduction

South Pesisir is one of the areas in West Sumatra. Geographically, the South Pesisir is situated along the shore of West Sumatra which straightforwardly borders Bengkulu Territory toward the south, Padang City toward the north, Solok Regime south toward the east and Mentawai Islands Rule toward the west. On the South Pesisir there are numerous vacation spots that have extraordinary potential as drivers of the local area's economy, including the Mandeh Region, Carocok Ocean side, Salido Ocean side, Bayang Sani Cascade, Otherwise known as Scaffold, etc. Because of the enormous the travel industry potential in the South Pesisir, the South Pesisir Rule Government has made an exceptional Territorial Guideline with respect to improving the travel industry potential in the South Pesisir, namely regional regulation number 2 of 2015 concerning the master plan for tourism development for 2015-2025 [1].

However, on the other hand, the South Pesisir district itself is one of the districts that is prone to potential disasters, one of which is earthquakes. This is because the South Pesisir is tectonically traversed by the Sumatran fault. Apart from that, off the sea the South Pesisir also faces the subduction zone and Mentawai fault. This would be very risky for an earthquake to occur on the South Pesisir itself [2].

According to a geographical point of view, the South Pesisir district region is flanked by two seismic Earthquake paths, since it is situated in one of the areas where two structural plates meet (the plate subduction zone) which is situated in the ocean toward the west of the Mentawai Islands and the Sumatran shortcoming zone which is situated along Bukit Barisan [3].

Aside from that, the construction of the Sumatran shortcoming is extremely mind boggling and includes the Australian, Sunda, Eurasian, and numerous other little structural plates which bring about issue developments along the west shoreline of focal and northern Sumatra which can set off flaws or plate moves that happen triggers a earthquake [4].

Earthquake happen because of movements in the world's covering, and generally happen in regions where the world's outside is blamed. The most common way of delivering seismic earthquake energy happens because of development between plates which causes the amassing of pressure in the stones inside the earth. Subsequently, the state of the stones around the plate limits encounters a compressive power which makes the stones become pressed and locked so there is a development of energy or stress which gets increasingly big over a significant stretch of time [5]. The place of the west shoreline of the island of Sumatra, which is the gathering region of the Eurasian and Indo-Australian plates, penetrates under the Eurasian plate with a sideways course of around 40-45 degrees so it has high seismicity because of its structural action [6].

Earthquake itself is a catastrophic event that can't be halted and comes out of nowhere. Up to this point there is no unequivocal technique for deciding when a quake will happen in a space. Be that as it may, the risks and dangers brought about by earthquake can be stayed away from and decreased with suitable relief against the danger of earthquakes [7].

An Earthquake will negative adversely affect parts of human existence, one of which is the effect of harm. The effect of harm can be affected by a few elements, including the force of the quake and the Peak Ground Acceleration (PGA) esteem in a space. Where the more noteworthy the PGA esteem in a space, the more noteworthy the effect of the damage [8].

The fundamental boundaries of a earthquake are earthquake time direction and depth, hypocenter, epicenter and magnitude. Earthquake time is the point at which a seismic Earthquake happens at its source at a specific profundity in the world's outside layer. The heading of the quake shows the bearing of the earthquake source as per the cardinal bearings, while the profundity of the earthquake or likewise called hypocenter is a proportion of the separation from the focal point estimated opposite to the surface. The focal point is the focal point on the world's surface as the projection of the focal point of the seismic earthquake on the earth is opposite to the hypocenter. Extent is a earthquake strength scale that demonstrates how much energy delivered when an earthquake occurs [9].

Therefore, it is necessary to analyze and map the maximum land acceleration value which will later be able to provide a reference for the government and private sector in development and spatial planning efforts in the South Pesisir district.

Mapping Peak ground acceleration is using to likely see and grasp the most extreme effects of an area. The more prominent the worth of the peak ground acceleration that happens at an area, the higher the risk and hazard of a quake happening. Because peak ground acceleration is an important component that has an impact on building design and is the starting point for calculating earthquake resistant buildings [10].

The peak ground acceleration value can be calculated based on the magnitude and distance of the source of the earthquake that occurred at the measurement point. Peak Ground Acceleration is the ground acceleration value measured during an earthquake. Peak ground acceleration can be calculated from the magnitude and depth of an earthquake, and uses empirical formulas [11].

Previously Dwi Romadiana [12], research was carried out regarding the mapping of peak ground acceleration in 2018 by Dwi Romadiana using 3 empirical equations, namely the Mc Guire, SI and Midorikawa and Donovan empirical equations. Dwi Romadiana researched and mapped the maximum ground acceleration values in the West Sumatra region in general. The results obtained by Dwi Romadiana's research were based on the 3 formulas used. The highest peak ground acceleration value in West Sumatra was in Agam Regency with a value of 59.71 gal based on the Mc Guire formula calculation, 90.80 gal using the Si and Midorikawa formula calculation, and 58.22 gal based on Donovan's calculation formula. Meanwhile, the lowest peak ground acceleration value was in South Solok Regency with a value of 11.94 gal based on the Mc Guire formula calculation, 5.58 gal using the Si and Midorikawa formula calculation, and 11.38 gal based on the Donovan formula calculation. For the Pesisir Selatan Regency area, the highest peak ground acceleration value obtained was 17.92 gal based on the Mc Guire formula calculation, 12.69 gal using the Si and Midorikawa formula calculation, and 17.17 gal based on the Donovan formula calculation The author believes that this research has not focused on a particular district. Because the research that the author is conducting this time is set in the South Pesisir district, the author needs to research further and focus on mapping the maximum ground acceleration value in the South Pesisir district [12].

Furthermore, similar research was also carried out [6] by Daz Edwiza in 2008 using Kanai's formulation. Daz Edwiza researched and mapped the peak ground acceleration values in the Padang Panjang City area with the aim of being a reference for spatial planning in the Padang Panjang City area. This research has focused on a District/City, namely Padang Panjang City. However, because the city of Padang Panjang has very different geographic and tectonic conditions from the conditions in the South Pesisir districts, the author considers that the method used by Daz Edwiza will not be suitable for reuse in research in the South Pesisir districts [6].

Then, similar research was also researched by Adya Mustika [13] in 2021 in Padang City with a similar aim to what was researched by Daz Edwiza, namely so that it could become a reference for spatial planning. Adya uses the SI and Midorikawa method. Interestingly, the research carried out by Adya Mustika has gone through a process of validation and correction of the formula using data on peak ground acceleration values recorded by the Accelograph tool at the Teluk Bayur BMKG station. So the research carried out by Adya Mustika has explained that the most ideal formula used to map the maximum ground acceleration value in Padang City is the SI and Midorikawa formula. Because the geographical and tectonic conditions in Padang City are similar to the South Pesisir District, the author is interested in using the same formulation as the research conducted by Adya Mustika but in a different research area [13].

Nofaslah [14] has also conducted research using the empirical formulation of Si and Midorikawa and Mc. Guire for estimating the value of land acceleration in Aceh Province. From the results of determining the land acceleration value, it is known that the area with the largest land acceleration value is the Southeast Aceh Regency area and the area with the smallest land acceleration value is the Aceh Jaya Regency area [14].

The formulation that will be used in this research is the empirical formulation of SI and Midorikawa, with the following formulation details:

$$log\, A = 0{,}5Mw + 0{,}0036D + \sum d_i s_i - log\, X_{eq} - 0{,}003X_{eq} + e + \varepsilon \qquad (1)$$

Where A is the ground acceleration (gal), Mw is the moment of earthquake magnitude (SR), D is the depth of the earthquake, Xeq is the hypocenter distance (km), d is the distance from the earthquake center to the location (crust = 0.00; inter-plate = 0.09; intra-plate = 0.28), S is a dummy variable for the type of fault (S=1), e is the regression coefficient (0.6) and ε is the standard deviation (0.24) [15].

The empirical formulation of Si and Midorikawa (1999) is a suitable formula for determining the maximum ground acceleration value in the Mentawai Islands. This is because the formulation by Si and Midorikawa (1999) was carried out in the Japanese Islands using the maximum ground acceleration value from 21 earthquakes that had occurred. In terms of tectonic conditions, the shape of the plate faults in the Japanese Islands is almost similar to the shape of the plate faults on the west coast of Sumatra.

Seismic intensity is a proportion of the degree of harm to an area because of vibrations beginning from seismic tremors. The size of seismic tremor power can be determined in view of perceptions made straightforwardly on the harm brought about by quakes and can be a delineation of the worth of tremor strength at the focal point [16]. The region nearest to the focal point generally has the highest power. The scale used to show force should be visible in Table 1 underneath [17].

Table 1. MMI (Modified Mercally Intensity) Scale Size

No.	MMI Scale	PGA(gal)	Description
1.	I-II	< 2.9	Not felt or felt by just a few people but recorded by tools.
2.	III-V	2.9-88	It is felt by the crowd but does not cause damage. The light things that were hung swayed and the glass windows shook.
3.	VI	89-167	Non-structural parts of the building suffered minor damage such as hair cracks on the walls, tiles shifted down and some fell off.
4.	VII-VIII	168-564	Many cracks occurred in the walls of simple buildings, some collapsed, and glass shattered. Part of the wall plaster came off. Almost most tiles slide down or fall off. The structure of the building suffered mild to moderate damage.
5.	IX-XII	> 564	Most of the walls of the permanent building collapsed. The structure of the building suffered heavy damage. The railway tracks are curved.

2. Materials and Method

This type of research involves descriptive analysis utilizing secondary data, specifically earthquake data obtained from the U.S. National Earthquakes Information Center catalog, United States Geological Survey (USGS). The maximum ground acceleration value in the South Pesisir district area is examined in order to identify areas vulnerable to earthquake-induced damage.

Two types of variables are present in this research: the independent variable and the dependent variable. The independent variables, including longitude, latitude, year, month, date, time, depth, and magnitude of the earthquake, remain unaffected by other variables. Meanwhile, the dependent variable in this research is the peak ground acceleration value, which is subject to influence from other variables.

The instrument used in this research is a laptop equipped with ArcGis software which is useful for creating earthquake seismicity maps, maximum ground acceleration and earthquake intensity in the South Pesisir district area.

Earthquake data comes from the United States Geological Survey (USGS) Earthquake Information Center catalogue. The earthquake data used is earthquakes with a magnitude ≥ 5 SR and a maximum depth of 300 km. The earthquake data used consists of latitude, longitude, depth, magnitude, date, month, year and time of the earthquake. In this study, there were 184 earthquake data which is displayed in table 2.

Table 2. Preliminary data sourced from the United States Geological Survey (USGS)

No	Time	Latitude	Longitude	Depth	Mag	Place
1	01-03-2023	-1.5655	100.8384	93.325	5	Southern Sumatra, Indonesia
2	24-06-2022	-1.8368	100.4097	50.54	5.1	98 km S of Padang, Indonesia
3	05-05-2021	-1.9554	99.7862	30	5.7	127 km SSW of Padang, Indonesia
4	02-05-2021	-2.3244	99.79	21	5.5	Kepulauan Mentawai region, Indonesia
5	05-03-2021	-1.7567	99.2329	25	5.6	153 km SW of Padang, Indonesia
6	18-11-2020	-1.8125	100.4271	15.62	5.2	95 km S of Padang, Indonesia
7	04-08-2020	-1.7797	100.1815	48.42	5.1	93 km SSW of Padang, Indonesia
8	10-06-2020	-2.5751	101.152	41.7	5.1	63 km SSW of Sungai Penuh, Indonesia
9	22-05-2020	-2.4966	99.5207	10	5.1	194 km SSW of Padang, Indonesia
10	14-11-2019	-1.8917	100.2621	63.9	5	104 km S of Padang, Indonesia
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180	18-10-1990	-1.897	100.102	68	5.4	108 km SSW of Padang, Indonesia
181	10-10-1990	-1.602	99.479	57	5.2	121 km SW of Padang, Indonesia
182	09-08-1988	-1.336	100.746	104.4	5.1	60 km S of Solok, Indonesia
183	16-03-1988	-1.097	99.939	77.1	5	49 km WSW of Padang, Indonesia
184	07-03-1988	-2.283	99.976	28.2	5	Kepulauan Mentawai region, Indonesia

Sources : Catalog USGS

In table 2, it can be seen that there are 184 earthquake data along with earthquake variables including magnitude, latitude, longitude and depth of the earthquake. in the time period 1973 - 2023. Then this initial data is used to obtain the hypocenter distance which is then followed by determining the peak ground acceleration and seismic intensity values.

This study is graphic sort utilizing optional information, to be specific quake information in the Pesisir Selatan Rule Region with organizes (- 2.35°S - - 1.04°N and 99.32°E - 101.27°E) and acquired upwards of 184 earthquake occasions. The extent of the earthquake utilized is ≥ 5 SR and a most extreme profundity of 300 km. This exploration information is obtained from the US Topographical Study (USGS) from 1973-2023 with a most extreme profundity of 300 km beneath the surface and a base size of 5 SR. The first thing to do in quite a while handling is to sort the earthquake information that has been gotten from the USGS list then get the hypocenter distance of the quake.

$$D^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 \quad (2)$$

Where D is the separation from the focal point of the seismic earthquake to Padang Panjang station, x1 is the scope of the quake, x2 is the scope of the reference point of the Padang Panjang station, y1 is the longitude of the focal point and y2 is the longitude of the reference point of the Padang Panjang station. The units for D, x1, x2, y1, and y2 are in degrees (°). The distance of the focal point got should be in km, so the outcome got from the estimation utilizing the above condition should initially be changed over where 1° = 111 km. In the wake of ascertaining the separation from the focal point, the hypocenter distance is determined from the directions utilizing the accompanying condition:

$$R = \sqrt{\Delta^2 + h^2} \quad (3)$$

In the event that all boundaries have known values, estimations are performed to find the greatest ground speed increase esteem involving the exact recipes Si and Midorikawa as in Condition (1). Then, at that point, investigate the greatest soil speed increase worth and convert the most extreme soil speed increase esteem into a Changed Mercalli Power (MMI) scale to decide the greatest force utilizing Murpy and O'Brien's experimental recipe utilizing the condition:

$$MMI = 2.86\log(PGA) + 1.24 \quad (4)$$

Then proceed with making a map of the peak ground acceleration and seismic intensity utilizing ArcGis 10.8, then create a contour map of the largest peak ground acceleration and seismic intensity then describe the consequences of the most extreme peak ground acceleration and seismic intensity. increasing vibration speed and strength to determine the level of vibration risk. guide to the form of the most extreme peak ground acceleration and seismic intensity using the ArcGis 10.8 program, after creating a guide to the form of the largest peak ground acceleration and seismic intensity then, at that time, describe the consequences of the greatest peak ground acceleration and seismic intensity to determine the level of seismic earthquake risk.

3. Results and Discussion

Based on U.S. National Earthquakes Information Center catalog data. Geology Survey (USGS) for the period 1973-2023 which was downloaded and transferred into Microsoft Excel 2010, obtained earthquake distribution map contained in the consequences of examination in the South Pesisir Regime region, there are a few focuses considered should be visible in figure 1.

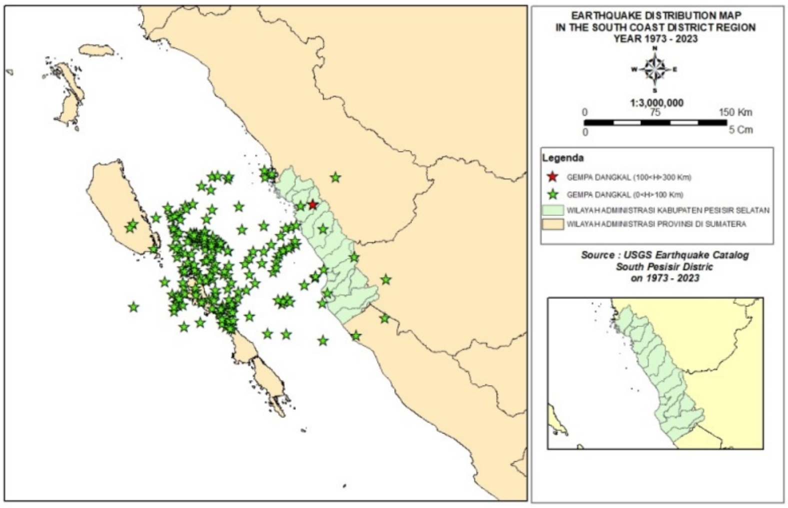

Figure 1. Map of earthquake distribution on South Pesisir

Figure 1 shows two form tones, to be specific green and red. The green tone is a shallow earthquake with 183 quake focuses and the red tone is a moderate quake with 1 earthquake point. From the earthquake appropriation map, it tends to be seen that shallow quakes have more seismicity focuses than moderate quakes.

The shallower the earthquake that happens, the more prominent the degree of harm brought about by the quake . Notwithstanding the shallow profundity of the seismic earthquake, even huge sizes can cause harm brought about by quakes. [18] expressed that shallow earthquake have an extremely impressive development horrendous power, because of the distance of the hypocenter moderately near the surface so quake vibrations feel areas of strength for exceptionally the surface.

Concerning the aftereffects of the review, there are quake peril factors that are impacted by greatest ground speed increase or Pinnacle Ground Speed increase (PGA). The greatest soil speed increase esteem (PGA) got in view of estimations utilizing the experimental recipe of Si and Midorikawa at extent ≥5 SR with a profundity of ≤ 300 km kept in the period 1973 - 2023 in the South Seaside Regime region should be visible in Table 1. In the wake of getting the greatest soil speed increase esteem as in Table 1 above, it is gone back over to deliver a guide of the most extreme soil speed increase for the South Waterfront Locale region involving ArcGis 10.8

Formulation The maximum PGA value obtained at each point with the results as shown in Table 1 is as follows:

Table 2. Peak Ground Acceleration Data of Pesisir Selatan District Area

No	Time	Latitude	Longitude	Depth (Km)	Magnitude(SR)	PGA Value
1	3/1/2023	-1.5655	100.8384	93.325	5	18.947
2	6/24/2022	-1.8368	100.4097	50.54	5.1	21.376
3	5/5/2021	-1.9554	99.7862	30	5.7	40.765
4	5/2/2021	-2.3244	99.79	21	5.5	30.879
5	3/5/2021	-1.7567	99.2329	25	5.6	35.663
6	11/18/2020	-1.8125	100.4271	15.62	5.2	21.317
7	8/4/2020	-1.7797	100.1815	48.42	5.1	21.307
8	6/10/2020	-2.5751	101.152	41.7	5.1	20.788
9	5/22/2020	-2.4966	99.5207	10	5.1	18.111
10	11/14/2019	-1.8917	100.2621	63.9	5	19.187
….	……..	…………..	………...	……….	………...	……...
182	8/9/1988	-1.336	100.746	104.4	5.1	20.823
183	3/16/1988	-1.097	99.939	77.1	5	19.149
184	3/7/1988	-2.283	99.976	28.2	5	17.602

In Table 2, there are 184 peak ground acceleration (PGA) data in the South Pesisir District area. Then get the highest maximum soil acceleration value of 526,574 gal, while the lowest peak ground acceleration value is 16,168 gal. Based on the results of these calculations, a map of the peak ground acceleration in the South Pesisir District area was obtained as shown in Figure 2.

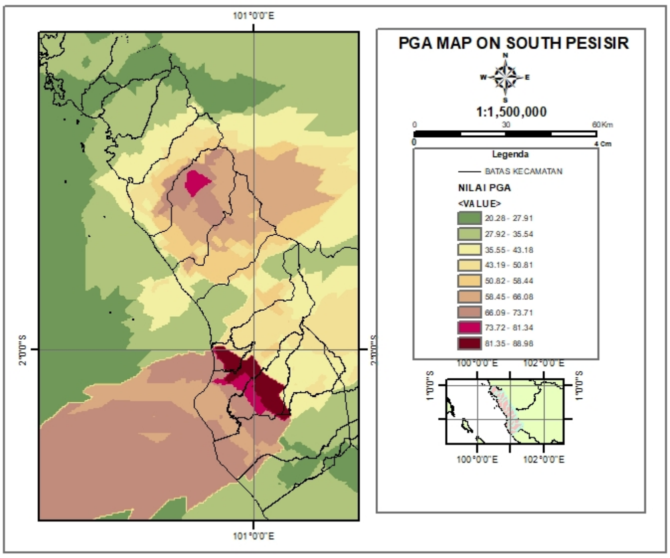

Figure 2. Map of Maximum Land Acceleration of Pesisir Selatan District Area

In Figure 2 it is illustrated that the peak ground acceleration value in the Pesisir Selatan area ranges from 16.15 - 526.57 gal. The highest peak ground acceleration value is in Lengayang District, Air Pura District, Pancung Soal District, and Basa IV Balai Tapan District which is marked with a dark red contour color worth 225.53 – 526.57 gal, while the area with the lowest maximum peak ground acceleration ranges from 16.15 – 27.91 gal which is in Koto XI Tarusan District, Bayang, North Bayang District, and Silaut District. The highest peak ground acceleration value can affect the intensity of earthquakes in the study area.

The peak ground acceleration value obtained from the calculation results using the empirical formula of Si and Midorikawa is converted into the MMI scale which is useful for determining the level of earthquake intensity that occurs in the Pesisir Selatan District area The peak ground acceleration magnitude shows the higher the intensity scale due to the earthquake that occurs. And the wider the zone that is on the MMI scale, the higher the risk that will be faced. The following is a map of earthquake intensity in the Pesisir Selatan District area.

The peak ground acceleration esteem acquired from the consequences of computations utilizing equation (1) is proceeded to formula (4) and changed over completely to the MMI scale as indicated by table (1). The consequences of the seismic force in the South Pesisir Selatan locale region are as displayed in table 3.

Table 3. Seimic intencity Data in the South Pesisir district

No	Latitude	Longitude	MMI
1	-1.5655	100.8384	4.894
2	-1.8368	100.4097	5.044
3	-1.9554	99.7862	5.845
4	-2.3244	99.79	5.500
5	-1.7567	99.2329	5.679
6	-1.8125	100.4271	5.040
7	-1.7797	100.1815	5.040
8	-2.5751	101.152	5.009
9	-2.4966	99.5207	4.838
10	-1.8917	100.2621	4.909
…	…….	……..	…..
182	-1.336	100.746	5.011
183	-1.097	99.939	4.907
184	-2.283	99.976	4.802

In accordance with table 3, a seismic intensity map was created in the South Pesisir District which can be seen in figure 3.

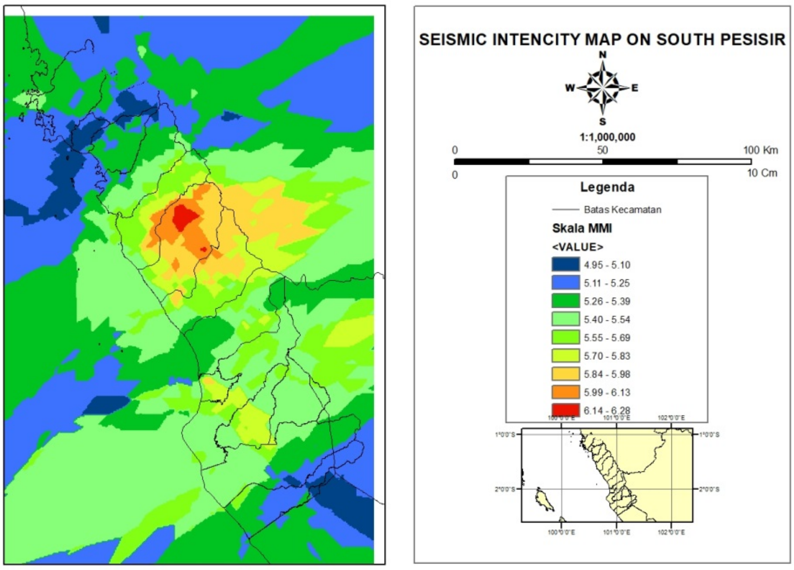

Figure. 3. Map of Earthquake Intensity in South Pesisir District Area

In light of Figure 3, it tends to be seen that the Pesisir Selatan region has a power level that isn't sufficiently high. The estimation results show that the subsequent force esteem goes from 4.72 MMI to 9.02 MMI with the biggest power being in Lengayang Locale, while the littlest force is in Bayang, North Bayang Region, and Silaut Area. The power of the seismic earthquake in the Pesisir Selatan Rule region should be visible in Reference section 2. Side effects brought about by the earthquake can be felt by many individuals however don't cause harm, and light articles that are hung influence and glass windows shake.

By getting the peak ground acceleration and highest seismic intensity values in the South Pesisir region, the connection among peak ground acceleration and seismic intensity can be determined. The higher the greatest tremor power esteem, the higher the pinnacle ground speed increase esteem, with the goal that there is a corresponding connection between the most extreme force esteem and the pinnacle ground speed increase.

The intensity of the earthquake in the Pesisir Selatan Regency area was on the VII MMI scale with the greatest intensity in the Lengayang District area. This is also influenced by geological factors referring to the dominant soil and rock data in this sub-district including Regosol, Litosol, Orgosol soils which have a weak vulnerability to earthquake waves. Areas that have a low level of seismic risk are Bayang District, North Bayang District, and Silaut District. This area has a low earthquake impact because the seismic intensity value is on the IV MMI scale. This is also influenced by the geological conditions in these 3 sub-districts which are dominated by the Alluvial soil type.

4. Conclusion

South Pesisir district area which has the highest peak ground acceleration value is in Lengayang district, Air Pura district, Pancung Soal district, and Basa IV Balai Tapan district with a value of 225.53 – 526.57 gal, the vibrations are resulting in serious damage felt by the community. Meanwhile, the lowest peak ground acceleration values are in the Koto The vibrations were felt by the public but did not cause any damage, light objects hanging swayed and glass windows shook. Meanwhile, the South Pesisir district area which has the highest intensity value is in Lengayang district with a VII MMI scale, while the lowest intensity values are in Bayang district, North Bayang district, and Silaut district with a IV MMI scale. Then the author also made a map of peak ground acceleration and seismic intensity which is attached in the appendix.

Acknowledgment

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References

[1] W,Yozki , "Profil Daerah Kabupaten Pesisir Selatan". Kepala Bapedalitbang Kab. Pesisir Selatan.2018

[2] K. Sieh and D. Natawidjaja, "Neotectonics of the Sumatran fault , Indonesia ' Now," vol. 105, 2000.

[3] Karim Sutarman , "Geografi sumatera Barat dan Bencana Alam Gempabumi". UNP.Padang. 2011

[4] Akmam, "Formula Percepatan Tanah Gempa Tektonik Untuk Sumatera Barat".UNP.Padang.2000

[5] Delfebriyadi, "Rekayasa Gempa Teknik Sipil". CV.Ferila. Padang.2010

[6] A.Fandu, "Analysis of B-Value and Peak Ground Acceleration (PGA) in West Sumatra Province Using Maximum Likelihood Method and Empirical Formula (Earthquake Data Period 2007-2020)". Pillar of Physics. Vol. 15 (1), 2022, page. 61-68

[7] E.Daz , "Pemetaan Percepatan Tanah Maksimum dan Intensitas Seismik Kota Padang Panjang Menggunakan Metode Kanai". Geofisika Jurusan Teknik Sipil Unand.No. 29 Vol.2 Thn. XV April 2008 ISSN: 0854-8471.2008

[8] F. Gustiana, D. Pujiastuti, and M. Minangsih, "Pemetaan Percepatan Tanah Maksimum dan Intensitas Gempa Kota Padang Menggunakan Rumusan Fukushima-Tanaka," J. Fis. Unand, vol. 7, no. 4, pp. 346–352, 2018, doi: 10.25077/jfu.7.4.346-352.2018

[9] Subardjo, and Ibrahim, G.,, "Pengetahuan Seismologi" Badan Meteorologi dan Geofisika. 2004.

[10] T. Zera, "Mapping of Peak Ground Acceleration (PGA) using The Kawashumi Model for Sumatera," vol. 4, no. 2, pp. 83–88, 2021.

[11] Leviana, Mia, Syafriani and A. Z. Sabarani. "The estimation of maximum ground acceleration value in West Sumatra region based on the M 8.8 SR earthquake scenario using MC Guire (1963) and Donovan (1973) empirical formula". Pillar of Physics, 55 – 62.2017.

[12] R.Dwi , "Analisis Nilai Percepatan Tanah Maksimum di Wilayah Sumatera Barat Menggunakan Persamaan Empiris Mc Guire ,SI, and Midorikawa dan Donovan". Pillar of Physics.Vol.11,No.1.2018

[13] A. Mustika Sari, H. Rifai, and F. Syukur Rahmatullah, "Correction of the Empiricalof Peak Ground Acceleration and Earthquake Intensity of Padang City Using Accelerograph Data," Pillar Phys., vol. 14, no. 2, pp. 59–66, 2021, [Online]. Available: http://dx.doi.org/10.24036/12134171074.2021

[14] N.Rido, "Estimasi Nilai Percepatan Tanah Maksimum Provinsi Aceh Berdasarkan Data Gempa Segmen Tripa Tahun 1976 – 2016 Dengan Menggunakan Rumusan Mcguire". Jurnal Fisika Unand Vol. 6, No. 2, April 2017 ISSN 2302-8491.2017

[15] Si, H. & Midorikawa, S. New Attenuation Relationships for Peak Ground Acceleration and Velocity Considering Effects of Fault Type and Site Condition. J. Struct. Constr. Eng. (Transactions AIJ) 64, 63–70 .1999.

[16] Lowrie, W, "Fundamentals of Geophysics. In Fundamentals of Geophysics". 2007

[17] Sunarjo., Gunawan, M. T., & Pribadi, S. "Gempabumi Edisi Populer". BMKG. 2010.

[18] N.Zaimi , "Pemetaan Bahaya Gempabumi Deterministik Dengan Pendekatan Peak Ground Acceleration (PGA) Di Kota Padang". Pillar of Physics, Vol. 11 No. 2, 2018