PROCEEDING

The 2nd International Seminar of Basic Science

Natural Science For Exploration The Sea-Island Resources

Ambon, May 31st 2016

Organized by

Faculty of Mathematics and Natural Science

Pattimura University

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The 2nd International Seminar of Basic Science

"Natural Science for Exploration The Sea-Island Resources"

Poka-Ambon, 31st May 2016

Mathematic and Natural Science Faculty
Universitas Pattimura
Ambon
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2nd edition

Welcoming Address By The Organizing Committee

Today, We have to thank the The Almighty Allah SWT for the implementation of this international seminar. This is the second seminar about Basic Science in The Faculty of MIPA Pattimura University. The seminar under the title “Natural Sciences for Exploration the Sea-Island Resources” will be carried out on May 31st 2016 at Rectorate Building, Pattimura University. There are 200 participants from lecturers, research institute, students, and also there are 34 papers will be presented.

My special thanks refer to the rector of Pattimura University and the Dean of MIPA Faculty, Prof. Dr. Pieter Kakissina, S.Pd., M.Si. I also would like to express my deepest gratitude to Prof. Amanda Reichelt-Brushett, M.Sc., Ph.D. ; Kazuhiko Ishikawa, Ph.D. ; Nicolas Hubert, Ph.D. ; Prof. Dr. Kirbani Sri Brotopuspito ; Prof. Dr. Marjono, M.Phil. ; Gino V. Limon, M.Sc., Ph.D. as the keynote speakers.

The last, We hope this international seminar usefull for all of us, especially Mollucas People and very sorry if any mistake. Thank you very much.

Dr. La Eddy, M.Si.
Chairman of Organizing Committee

Opening Remarks
By Dean of Mathematic and Natural Sciences Faculty

I express my deepest gratitude to The Almighty God for every single blessing He provides us especially in the process of holding the seminar until publishing the proceeding of International Seminar in celebrating the 18th anniversary of MIPA Faculty, Pattimura University. The theme of the anniversary is under the title "Natural Sciences for Exploration the Sea-Island Resources". The reason of choosing this theme is that Maluku is one of five areas in Techno Park Marine in Indonesia. Furthermore, it is expected that this development can be means where the process of innovation, it is the conversion of science and technology into economic value can be worthwhile for public welfare especially coastal communities.

Having the second big variety of biological resources in the world, Indonesia is rich of its marine flora and fauna. These potential resources can be treated as high value products that demand by international market. Basic science of MIPA plays important role in developing the management of sustainable marine biological resources.

The scientific articles in this proceeding are the results of research and they are analyzed scientifically. It is expected that this proceeding can be valuable information in terms of developing science and technology for public welfare, especially people in Maluku.

My special thanks refer to all researchers and reviewers for your brilliant ideas in completing and publishing this proceeding. I also would like to express my gratefulness to the dies committee-anniversary of MIPA Faculty for your creativity and hard working in finishing this proceeding, God Bless you all.

Prof. Dr. Pieter Kakisina, S.Pd., M.Si.
Dean of Mathematic and Natural Sciences Faculty

ACKNOWLEDGMENT

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Hotel Mutiara Ambon

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EARTHQUAKE EPICENTER POSITIONING WITH INVERSION METHOD IN CENTRAL MALUKU DISTRICT

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ABSTRACT

Central Maluku district is one of the areas in the province of Maluku. Most of its area is in Ceram. An earthquake measuring 6.9 shook the area in Central Maluku district on Wednesday 9 December 2015 earthquake was caused by the activity of the subduction zone formed by a collision or subduction of the Indo-Australian Plate against the Eurasian Plate. Based on the results released BMKG that the earthquake occurred at a distance of 99 Km south-east of Central Maluku district at coordinates 3.98, latitude and 129.56 east with the strength and depth of the earthquake was 10 km. BMKG recorded their 4 times other earthquakes with a magnitude range of 5.0 to 5.2 magnitude at a depth of 10 km, starting at 18:15:29 am to 21:57:00 pm. Based on the results of monitoring by the media, after the earthquake and later 30 minutes later there the tides with a height of 2 meters. The purpose of this study is to determine the epicenter and the earthquake hypocenter based on data recorded from many stations with liner inversion method based on MATLAB.

Keywords**:** *earthquake, earthquake epicenter, linear inversion methode, seismic stations and spectrum*.

INTRODUCTION

Central Maluku district is one area in Maluku Province .Its located at position 127.250 to 132.5 0 East Longitude and 2.50 to 7.50 south latitude, the northern limit of the Seram Sea, the eastern boundary of the district spooky east, and the west boundary spooky western districts.

Figure 1. An earthquake measuring 6.9.

Shake in Regency Maluku.Tengah (Malteng) Wednesday 9 December at about 19:21 o'clock wit. The quake was not a potential tsunami. based on the position and depth of earthquakes is caused by the activity of the subduction zone formed by the Indo-Australian plate collision against the Eurasian plate. According to BMKG, the earthquake felt by IV MMI (Modified MercalliIntensity) in Banda Naira, III-IV MMI in Ambon, II-III MMI in Amahai and II MMI in Sorong. The earthquake was also recorded at seismic stations volcano Banda with an amplitude of 55 mm.

The area closest to the epicenter is mostly composed by sediment Quaternary Alluvium old, and Tertiary sediments. In the area compiled by alluvium and Tertiary sediments terlapukkan estimated goncabgan earthquakes will be stronger this caused these rocks to be explained, loose, yet compact and amplify the effects of vibration, making it vulnerable to earthquake shaking.

Based on the results released BMKG that the earthquake occurred at a distance of 99 Km south-east of Central Maluku district at coordinates 3.98 0 latitude and 129.560 east with the strength and depth of the earthquake was 10 km. BMKG recorded their 4 times earthquake aftershock with a magnitude range of 5.0 to 5.2 magnitude at a depth of 10 km starting at 18:15:29 am to 21:57:00 pm.

While the USGS recorded 12 times of earthquake aftershocks with a magnitude range of 4.6 to 5.3 mb starting at 17:50:14 am to 00:07:51 pm on the following day. Based on the results of monitoring by the media, after the earthquake and later 30 minutes later there the tides with a height of 2 meters, It is also felt by the people in the Banda Islands and Nusa Tehoru Sea and coastal subdistrict Amahai.

MATERIALS AND METHODS

Theory of Linear Inversion

Modelling Inversion (Inverse Modelling)

Modelling inversion (inverse modeling) is a modeling technique model parameters obtained directly from the data. This is the opposite of modeling forward gain parameter model by 'trial and error'. Theory inversion by Menke (1984) is defined as a unified engineering / mathematical and statistical methods to obtain useful information on a physical system based on the observation of the system. Physics system in question is a phenomenon that we review, the observation of the system is the data while the information to be obtained from the data is the model or model parameters.

Then look for the model parameters to generate a response that fits the observational data. Thus, the inversion modeling is often referred to as a data matching (fitting). Correspondence between the response moel with observational data in general, expressed by an objective function to be minimized. In the rules of the calculus of a function reaches a minimum if the derivative of the parameter / unknowns are worth zero. It is used to estimate the model parameters. The model is modified so that the response of the model becomes fit to the data. In the process the necessary response models obtained by modeling the future so that inversion modeling can be done if the relationship between the data and the model parameters (modeling ahead) has been known.

Formulation of Linear Inversion to the case of determining the location of the epicenter

If we apply to the issue of determining the location of the epicenter with many stations, let us display data arrival time in the form of a matrix in = [t1, t2, ..., tn] T, then we try to give solutions guesses M0 = [x0, y0 , z0, t0] figure 2.

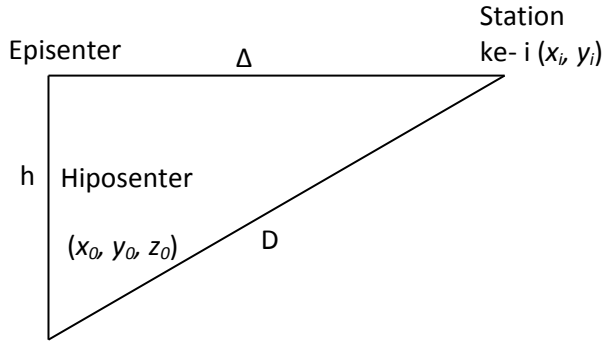

Figure 2. Illustration of the i-th position of stations, and the epicenter and hypocenter.

Equations **d = Ğ m** can be displayed in the matrix equation:

$$\begin{bmatrix} t_1 \\ t_2 \\ \vdots \\ t_N \end{bmatrix} = \begin{bmatrix} G_{11} & G_{12} & \cdots & G_{1M} \\ G_{21} & G_{22} & \cdots & G_{2M} \\ \vdots & \vdots & & \vdots \\ G_{N1} & G_{N2} & \cdots & G_{NM} \end{bmatrix} \begin{bmatrix} x_0 \\ y_0 \\ z_0 \\ t_0 \end{bmatrix}$$

where $t_i = t_0 + \frac{R}{v}$ and $R = \sqrt{(x_0 - x_i)^2} + (y_0 - y_i)^2 + (z_0 - z_i)^2$

Further search solution using linear inversion as described above.

RESULTS AND DISCUSSION

Based on the earthquake that occurred in the middle of the embarrassment on Wednesday 9 December 2015, it is necessary to do a review of the location or position of the earthquake epicenter. The initial steps will be undertaken to address the above problem is to gather information from the Internet about seismic events that have occurred, then to obtain a spectrum of the earthquake can be obtained by accessing the website USGS (United States Geological Survey).

The next step is to make lisning program to acquire or to see the position of the epicenter of the earthquake with're using the programming language MATLAB (Matrix Laboratory) matlab is a high-level language that is used for general usability engineering computation of MATLAB. Here is the result of earthquake spectra recorded at 10 stations earthquake (Figure 4-12).

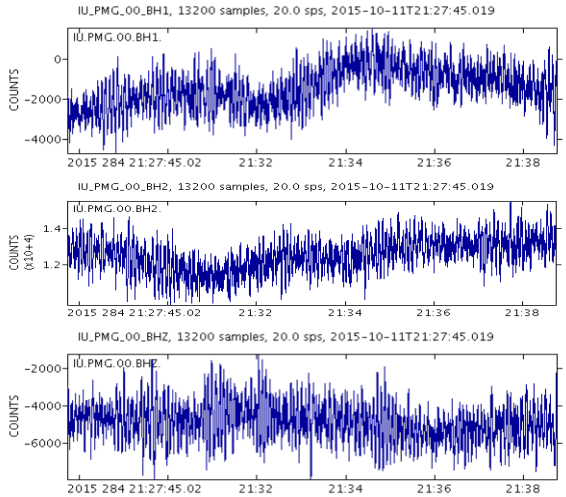

Figure 3. Station 1 (KAPI)

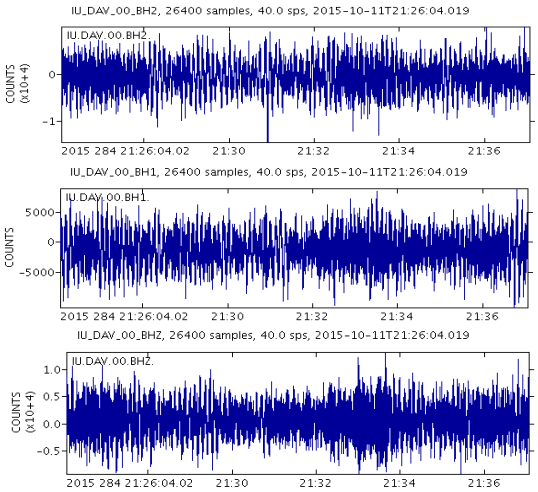

Figure 4. Station 2 (DAV)

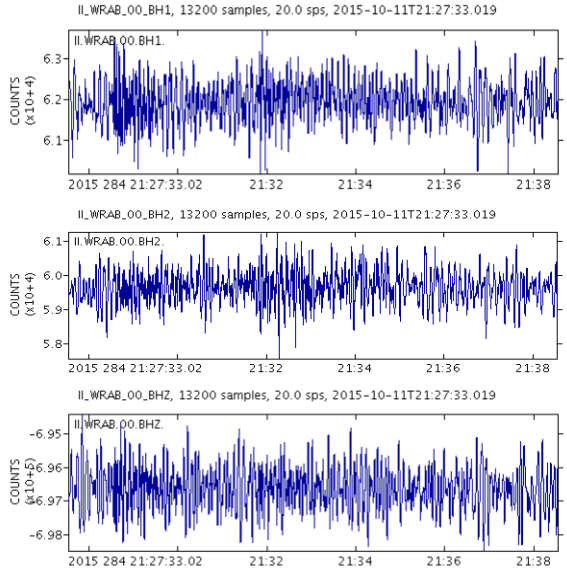

Figure 5. Station 3 (WRAB)

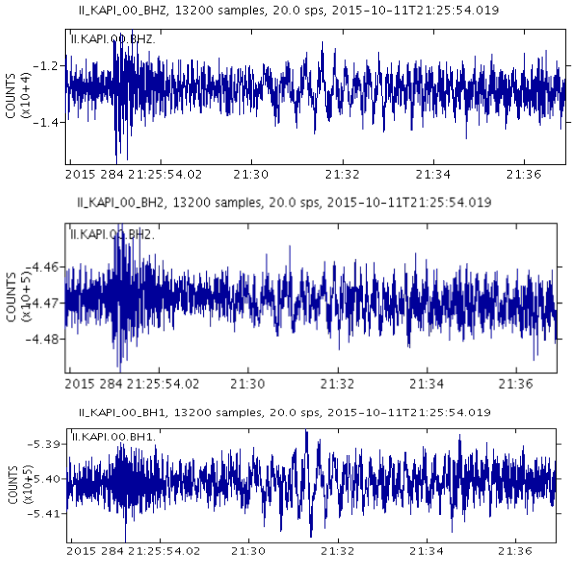

Figure 6. Station 4 (PMG)

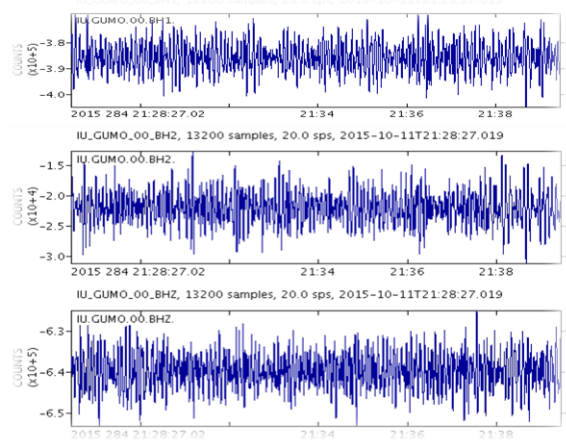

Figure 7.Station 6 (GUMO)

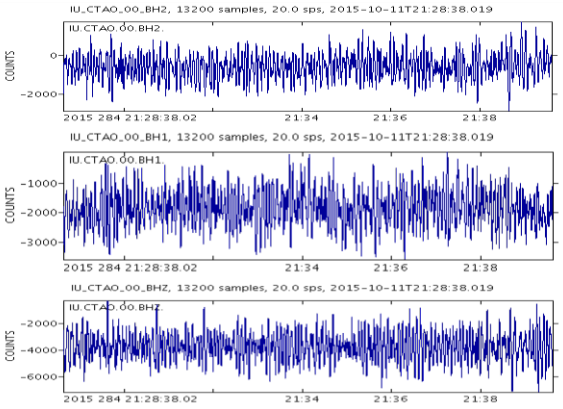

Figure 8. Station 7 (CTAO)

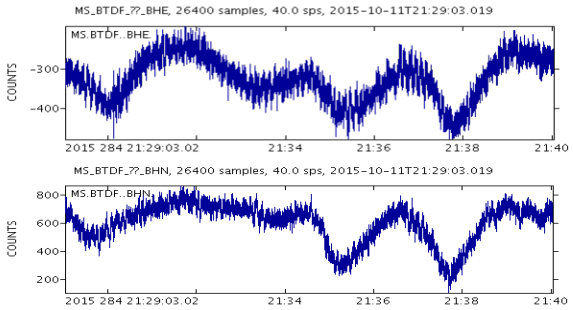

Figure 9. Station 8 (BTDF)

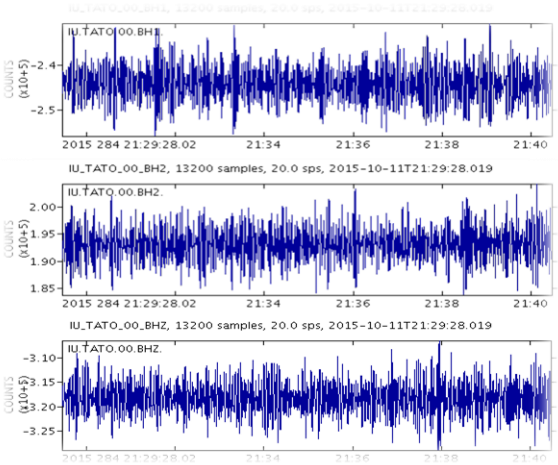

Figure 10. Station 9 (TATO)

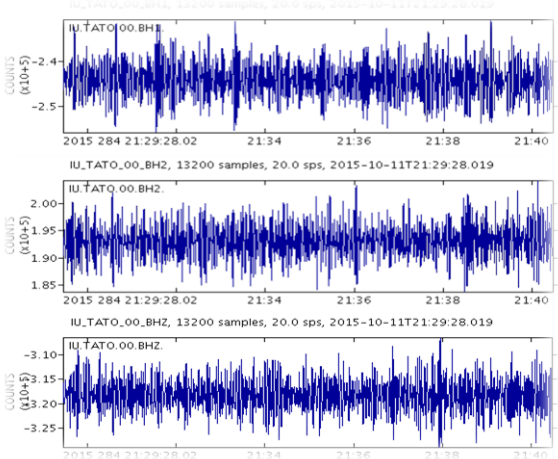

Figure 11. Station 9 (TATO)

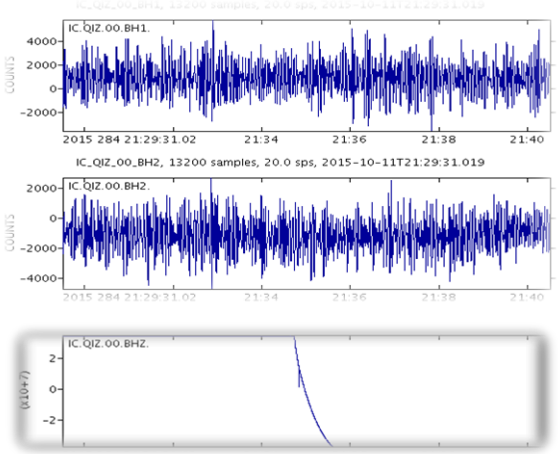

Figure 12. Station 10 (QIS)

Based on the data that has been acquired, the position of the earthquake epicenter in central Maluku can be seen as shown below.

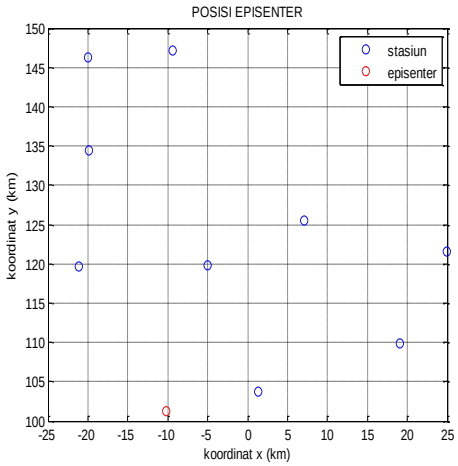

Figure 13. The position of the earthquake epicenter

CONCLUSION

Linear inversion method is a simple inversion methods. There are difficulties encountered when using this method, which is how do we choose the right guess value. If the value is too far from the solution guesses settlement often singular. Simple easiest way is to choose the value of the conjecture of the midpoint position of the stations that recorded earthquake. It is expected that way the value of a guess is not too far from the settlement of the matrix.

The epicenter was in the sea. The area closest to the epicenter is mostly composed by alluvium old quarter and sediments of tertiary In the area collated by alluvium and sediments tertiary terlapukan estimated earthquake shaking will be stronger because the sight of these rocks is explained loose, yet compact and strengthen the effect of vibration that are vulnerable to earthquake shaking.

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