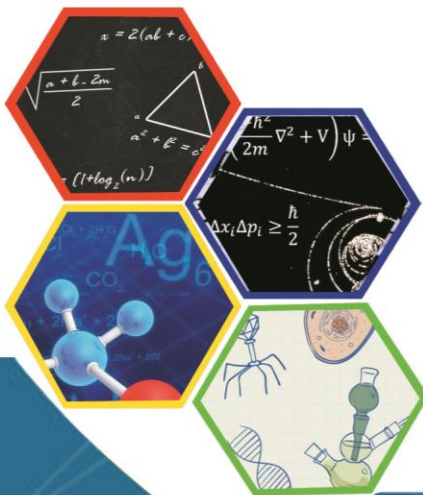




PROCEEDING

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



PROCEEDINGS

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
2016**

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

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Mathematic and Natural Science Faculty
Universitas Pattimura
Ir. M. Putuhena St.
Kampus Poka-Ambon
Pos Code 97233
Email:fmipa_unpatti@gmail.com

2nd edition

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The 2nd International Seminar of Basic Science

May, 31st 2016

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

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

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The following personal and organization are greatly
acknowledgment for supporting
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Hotel Mutiara Ambon

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

Contents

	<i>Page</i>
Welcoming Address by The Organizing Committee	ii
Opening Remarks by Dean of Mathematic and Natural Science Faculty	iii
Acknowledgment	iv
Contents	v–vii
Papers	
1. Hyperthermophilic Cellulase from Deep-Sea Microorganisms Surviving in Extreme Environment <i>Kazuhiko Ishikawa</i>	1–6
2. Challenges for Risk Assessment Associated with Waste Disposal and Mineral Activities in Deep Sea Environments <i>Amanda Reichelt-Brushett</i>	7–12
3. The Importance of Geophysics Education at The University of Pattimura, Ambon <i>Kirbani Sri Brotopuspito</i>	13–18
4. The Lost Paradise: Term Observation of Coral Reef in Ambon Bay <i>Gino V. Limmon</i>	19–24
5. Mathematical Model for The Sustainable Development in Exploring The Sea-Island Resources <i>Marjono</i>	25–36
6. Quality Characteristics of Redtail Scad (<i>Decapterus kurroides</i>) SMOKE Pressure Using Different Liquid Smoke and Mechanical Mixing <i>Joice P. M. Kolanus, Sugeng Hadinoto</i>	37–48
7. Antidiabetic and Antioxidant Activity of Endophytic Fungi From Sirih Hitam Plant (<i>Piper betel</i> L) <i>Edward J. Dompeipen</i>	49–57
8. Influence Each Stages by Processed on Quality Dry Sea Cucumber (<i>Holothuria scabra</i>) <i>Voulda D. Loupatty, R. V. Tehubijuluw</i>	58–64
9. Exploration For Fishing Areas Through SPL (<i>Suhu Permukaan Laut</i>) <i>Pentarina Intan Laksmitawati</i>	65–68
10. Development of Algorithm Model for Estimating Chlorophyll-a Concentration Using <i>In Situ</i> Data and atmospherically corrected landsat-8 Image By 6SV (Case Study: Gili Iyang'S Waters) <i>Resti Limehuwey, Lalu Muhamad Jaelani</i>	69–77
11. Earthquake Epicenter Positioning With Inversion Method In Central Maluku District <i>R. R. Lokollo, J. R. Kelibulin</i>	78–83
12. Spatial Distribution Analysis of Oxygen (O ₂) By Using <i>In Situ</i> Data and	

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

	Landsat 8 Imagery (Study Case: Gili Iyang, Sumenep) <i>Rovila Bin Tahir, Lalu Muhamad Jaelani</i>	84–90
13.	Interpretation of Geothermal Reservoir Temperature In The Nalahia Nusalaut, Central of Moluccas <i>Helda Andayany</i>	91–96
14.	Temporal Statistical Analysis of The Volcanic Eruption in Mt. Banda Api, Banda Islands, Moluccas <i>J. R Kelibulin, R.R Iokollo</i>	97–103
15.	FTIR Spectrum Interpretation of Vegetable That Contains Pesticide <i>Diana Julaidy Patty, Grace Loupatty, Lorenzya Mairuhu</i>	104–109
16.	Landslide Susceptibility Analysis using Weighted Linear Combination (WLC) Combined with The Analytical Hierarchy Process (AHP) <i>Romansah Wumu, Teguh Hariyanto</i>	110–116
17.	Application of Principal Component Analysis Based on Image for Face Recognition <i>Y. A. Lesnussa, N. A. Melsasail, Z. A. Leleury</i>	117–130
18.	Learning Mathematics By Involving The Left and The Right Brains In Processing Information <i>Magy Gaspersz</i>	131–139
19.	The Total Irregularity Strength of The Corona Product of A Path With A Wheel <i>Faldy Tita, F. Y. Rumlawang, M. I. Tilukay, D. L. Rahakbauw</i>	140–145
20.	Spectrum Analysis Near-Infrared Spectroscopy (NIRs) of Cajuput Oil <i>Gian Kirana Efruan, Martanto Martosupono, Ferdy S. Rondonuwu</i>	146–152
21.	Analysis Aromatic Compounds of Citronella Oil by Using Near Infrared Spectroscopy (NIRS) and Gas Chromatography-Mass Spectroscopy (GC-MS) <i>Welmince Bota, Martanto Martosupono, Ferdy S. Rondonuwu</i>	153–159
22.	The Study of Waters Quality at Rosenberg Strait, Tual City, Maluku <i>Marsya Jaqualine Rugebregt</i>	160–168
23.	The Relationship Between Physical-Chemical Factors and Diversity of Sea Urchin (Echinodea) in The Kampung Baru Coastal of Banda Island Central Moluccas <i>Deli Wakano, Mechiavel Moniharapon</i>	169–178
24.	Volume and Production of Bee Propolis on Various Media <i>Trigona Spp</i> Natural Nest in The Village Waesamu Kairatu West District District West Seram <i>Debby D. Moniharapon, Jacobus S. A. Lamerkabel, Thresya S. Kwalomine</i>	179–186
25.	The Effect of Essence Red Fruit (Pandanus Conoideus Lam) To Gastric Mucosa Rat (<i>Rattus novergicus</i>) Induced Type of Alcohol Drinks Sopi <i>Mechiavel Moniharapon, Pieter Kakisina, Jantje Wiliem Souhaly</i>	187–195

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

26. Inventory of Medicinal Plants and Its Utilization Potential In Pombo Island, Central Moluccas
Adrien Jems Akiles Unity, Veince Benjamin Silahooy 196–199
27. Extraction of Timbal (Pb) from Sediment at Inside of Ambon Bay with Bioleaching Method by Using Bacteria *Thiobacillus ferrooxidans*
Yusthinus T. Male, Martha Kaihena, Rodrich R. Ralahalu 200–206
28. Histological of Haemocyte Infiltration Changes During Pearl Sac Formation in *Pinctada maxima* Host Oysters Reared at Different Depths
La Eddy, Ridwan Affandi, Nastiti Kusumorini, Wasmen Manalu, Yulvian Tsani, Abdul Rasyid Tolangara, Cornelia Pary 207–212
29. Isolation and Identification of Lipase Producing Thermophilic Bacteria From a Hot Spring at Seram Island, Moluccas
Edwin T. Apituley, Nisa Rachmania Mubarik, Antonius Suwanto 213–218
30. Effect of Ethanol Extract Gambir Laut Leaves (*Clerodendrum inerme* L) To Ovaries Weight of Mice
Chomsa Dintasari Umi Baszary, Feliks Pattinama 219–221
31. The Performance of Morphological and Physiological Effect of Three Accessions of Cowpea on Drought Stress
Helen Hetharie 222–230
32. Relationship of Length-Weight and Size Structure of Skipjack (*Katsuwonus pelamis*) In Marine Waters of Moluccas, Indonesia
Immanuel V. T. Soukotta, Azis N. Bambang, Lacmuddin Sya'rani, Suradi Wijaya Saputra 231–237

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

EARTHQUAKE EPICENTER POSITIONING WITH INVERSION METHOD IN CENTRAL MALUKU DISTRICT

R. R. Lokollo and J. R. Kelibulin*

Physics Department, Faculty of Mathematics and Natural Sciences
Universitas Pattimura, Ambon, Moluccas, Indonesia

*Email: kelibulin_ronny_josephus@yahoo.com

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 method, 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.

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

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.

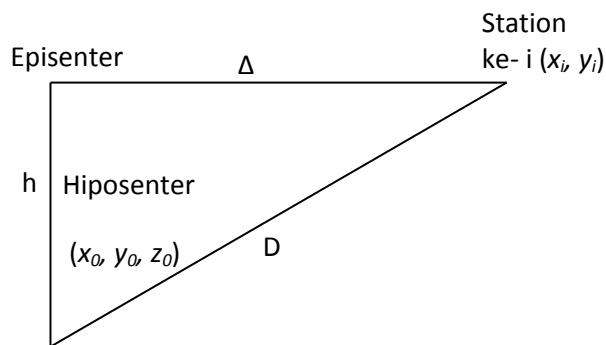


Figure 2. Illustration of the i-th position of stations, and the epicenter and hypocenter.

Equations $\mathbf{d} = \mathbf{\check{G}} \mathbf{m}$ can be displayed in the matrix equation:

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

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 listing 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).

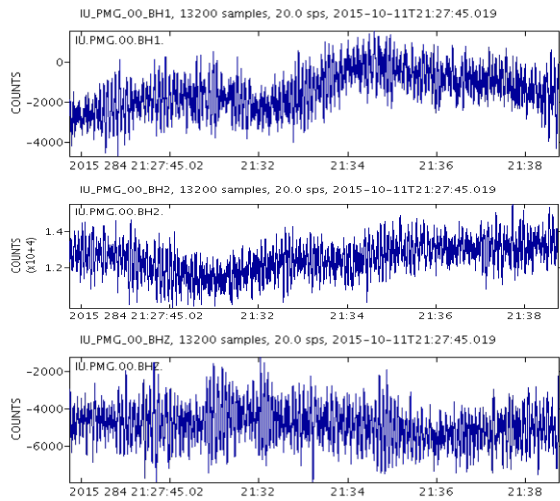


Figure 3. Station 1 (KAPI)

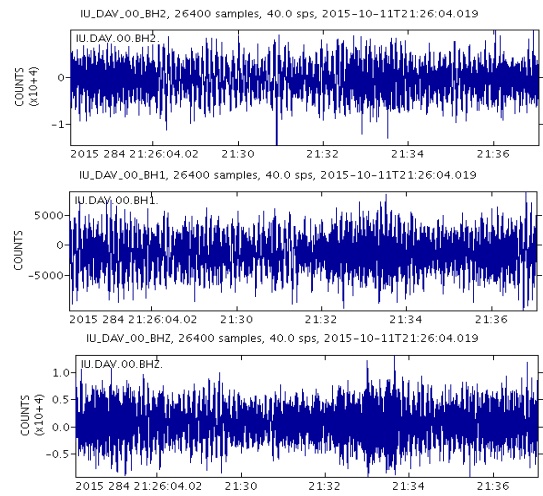


Figure 4. Station 2 (DAV)

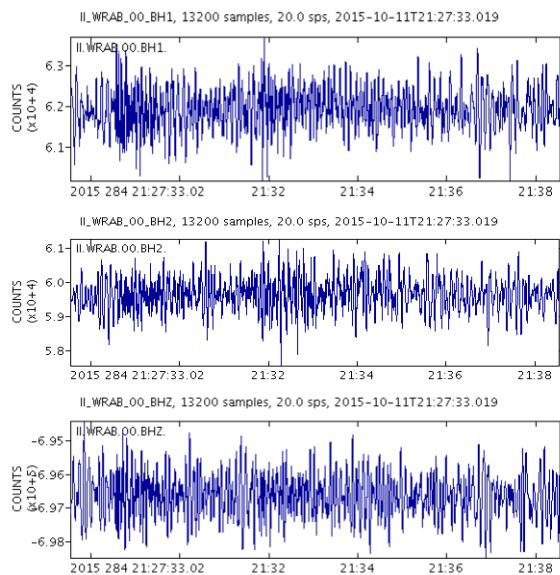


Figure 5. Station 3 (WRAB)

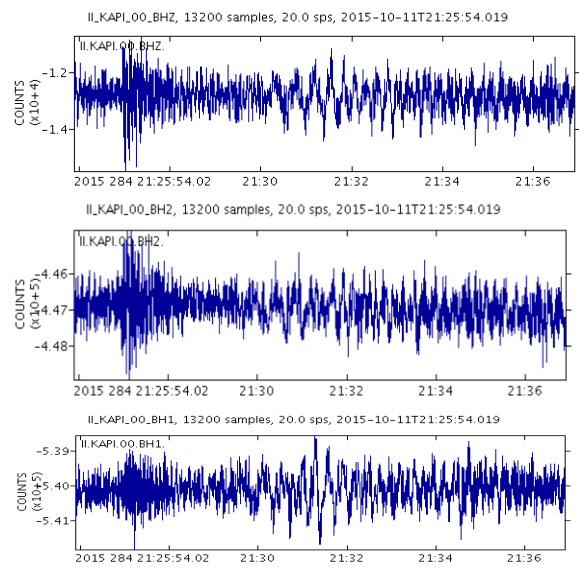


Figure 6. Station 4 (PMG)

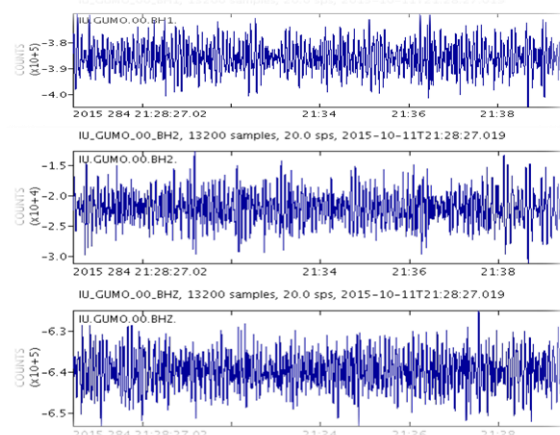


Figure 7. Station 6 (GUMO)

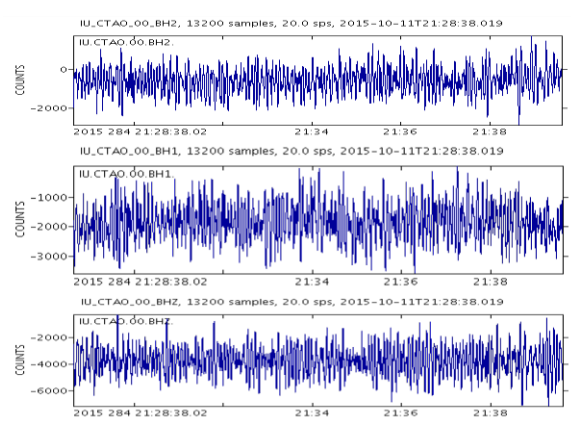


Figure 8. Station 7 (CTAO)

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

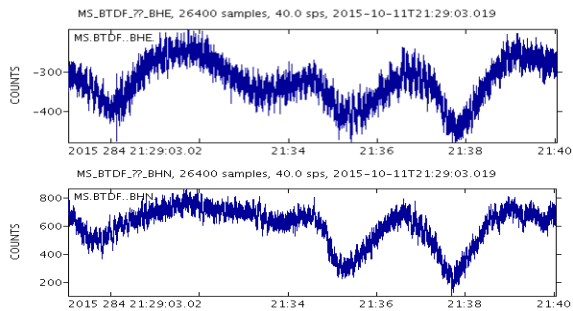


Figure 9. Station 8 (BTDF)

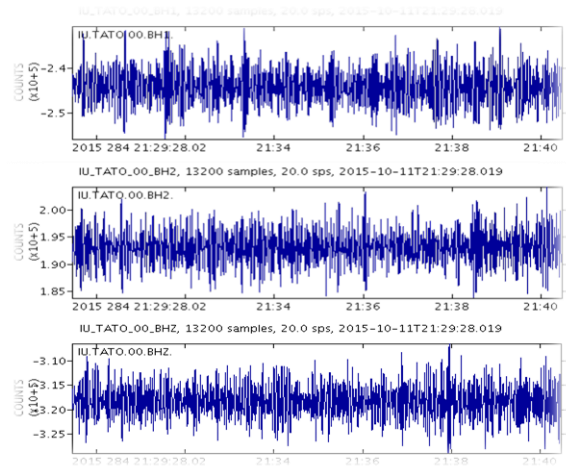


Figure 10. Station 9 (TATO)

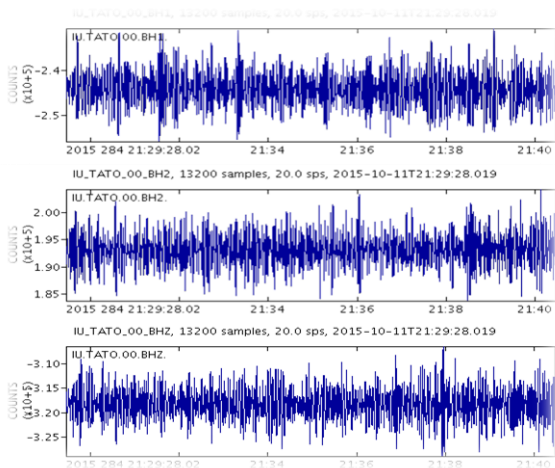


Figure 11. Station 9 (TATO)

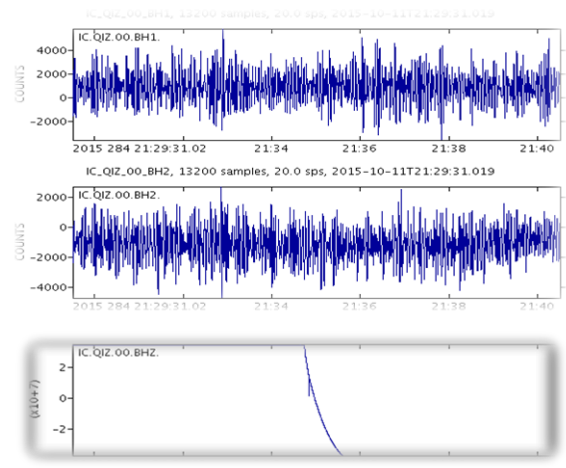


Figure 12. Station 10 (QIS)

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

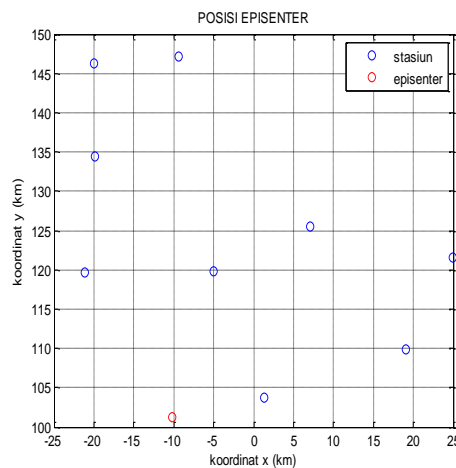


Figure 13. The position of the earthquake epicenter

PROCEEDINGS

The 2nd International Seminar of Basic Science

May, 31st 2016

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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