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The Power Spectral Density Based on Waveform Analysis for Computing Noise Level Humuntal Rumapea1*1, Marzuki Sinambela2**, Surianto Sitepu3, Nogar Silitonga4, Indra Kelana Jaya5 1,3,4,5Faculty of Computer Science, Universitas Methodist Indonesia, Medan, Indonesia 2Indonesia for Meteorology, Climatology, and Geophysics Agency (BMKG), Indonesia 2Department of Physics, FMIPA, Universitas Sumatera Utara, Indonesia E-mail : *hrumapea1608@gmail.com, **sinambela.m@gmail.com Abstract.

Digital signal recordings in the waveform bands contain the noise, which importantly can be attributed to ambient and instrumental noise of recording system. We not only used the power spectral density (PSD) method but also computing the waveform spectral to knows a new model and performance based on recordings of KLNI (Mataram, NTB, Indonesia) and TWSI (Taliwang, NTB, Indonesia) stations from the entire BMKG Network made over 1 month period on August 2018.

These cumulative PSD plots are generated, the good performance of each station based on the representative bedrock and cite of the noise level. The KLNI and TWSI stations have the highest background noise level. 1. Introduction Digital signal seismic frequency band not only has contained the noise but also essentially can attribute to instrumental noise or self-noise, of the recording broadband network system [1][2]. Noise level or background noise is defined as waveform signals in the absence of waveform from earthquakes.

In any paper, New Low Noise Model (NLNM) and New High Noise Model (NHNM) to use as reference model for background noise [3-6]. In general, the noise level constructed from a large number of component vertical seismograms from many broadband networks distributed stations. The representative of the noise level of a large set of power spectral density (PSD) of the vertical.

In this paper, we use the PSD by computing the waveform of the broadband network for one month in August 2018 from KLNI and TWSI station which recordings the signal of Lombok Earthquake in 2018. Our paper aim, to knows a new model and performance of each station based on recordings of Badan Meteorologi, Klimatologi dan Geofisika (BMKG)-IA Network.

1st International Conference of SNIKOM 2018 Journal of Physics: Conference Series 1361 (2019) 012003 IOP Publishing doi:10.1088/1742-6596/1361/1/012003 2 2. Data and Method 2.1 Data The waveform data were employed from BMKG-IA Network real-time monitoring on Indonesia Tsunami Early Warning System (Ina-TEWS). We use the waveform which recordings of KLNI and TWSI broadband station for one month in August 2018 and deployed in Nusa Tenggara Barat, Indonesia.

The location of the broadband station shown in Table 1. The raw data at this paper is the standard metadata exchange formats of Dataless SEED (MSEED) and the dataless SEED. Table 1. Station BMKG-IA Network and Location No Station Latitude Longitude 1. KLNI -8.42 116.09 2. TWSI -8.74 116.88 2.2

Method The available waveform data for one month in August 2018 by using Power Spectral Density. We computed the waveform at data center and observatories on python. It provides read/write support the most relevant waveform and formats. We use the McNamara Model [1][2] to generate the waveform by Power Spectral Density and to know the performance of each station. 3.

Result and Discussions The figure shows the result of PSD data from BMKG Network, which respectively plotted in power amplitude (dB) versus periods (s). The amplitude of background noise at each period that influences seismic recording at each station, shaping a light color pattern in the graph. The upper black solid line in each graph shows the New High Noise Model (NHNM) and the lower one show the New Low Noise Model (NLNM).

Color in the graph of PSD shows best fitting the station's background noise when compared to the result directly with Peterson Noise Model [7][8] and [2][4], whether the station had low background noise or not. In figure 1, showed the power spectral density result of TWSI station, the amplitudes ranging from - 170 dB to -100 dB, with the PDF about 10-14 %.

The segments stick closely to the New Low Noise Model, its mean that the TWSI has a low background noise. The highest peak of mean achieved during periods between 0.6 -10 seconds (1-0.06 Hz). 1st International Conference of SNIKOM 2018 Journal of Physics: Conference Series 1361 (2019) 012003 IOP Publishing doi:10.1088/1742-6596/1361/1/012003 3 Figure 1. PSD result of TWSI Station The cumulative maximum of the TWSI network in figure 2 shows that the waveform is presentative to figure 1.

There are several gaps in the period of TWSI, showed on red color. The gaps mean, the waveform on period was not available. Figure 2. Cumulative Maximum of TWSI Stations 1st International Conference of SNIKOM 2018 Journal of Physics: Conference Series 1361 (2019) 012003 IOP Publishing doi:10.1088/1742-6596/1361/1/012003 4 The amplitudes of the background noise at the cumulative maximum of TWSI that influence seismic recording at the station, shaping a light color pattern in the graph. Figure 3.

The PSD of KLNI station The power spectral density result of KLNI station, the amplitudes ranging from -150 dB to -100 dB, with the PDF about 9-13 %. The segments stick closely to the New Low Noise Model, its mean that the TWSI has a low background noise. The highest peak of mean archived during periods between 0.8 -20 seconds (2-0.08 Hz). Figure 4.

Cumulative Maximum of KLNI stations 1st International Conference of SNIKOM 2018 Journal of Physics: Conference Series 1361 (2019) 012003 IOP Publishing doi:10.1088/1742-6596/1361/1/012003 5 The cumulative maximum of KLNI station had been described the graphical representation of power spectral density can be displayed in the window. Compare with TWSI and KLNI array, we expected that the sensors places in different vault types would contrast noise levels by PSD estimated.

The cumulative maximum spectral both of the stations provide a means for estimating the total vibration power of the earth as said by [9]. The corresponding to the longest graphed value of the periods as called as the cumulative spectral power has significantly simplified the process of PSD generation [10]. 4.

Conclusions Compare with the BMKG network array for one month on August 2018, we expected that sensors placed in different vault types would display contrast in noise level defined by the PSD estimates. These cumulative PSD plots of TWSI and KLNI station are generated, the good performance of each station based on the representative bedrock and cite of the noise level. The KLNI and TWSI stations have the highest background noise level.

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