The Probabilistic Power Spectral Densities for Combination of Broadband Seismic Network

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Abstract. The time series approach is commonly used to access the estimation of the power spectral densities of waveform data. This paper is concerned with the presentation of the assessment of waveform noise to measure the probability density function be done internally, we used the metadata from an inventory, a parser instance of DNP (Denpasar, Bali, Indonesia), IGBI (Ingas, Bali, Indonesia), and PLAI (Plampang, NTB, Indonesia) from BMKG IA-Networks and calculations are based on the routine used by McNamara Model. The consistency of the spectra is presented the DNP, IGBI, and PLAI network to verify the quality of data and also acts as a test performance broadband network to the time taken by the broadband network in the field and analysis the Lombok earthquake in 2018.

1. Introduction
The empirical probability of the power spectral density as a tool to assess the field performance of earthquake monitoring system and the statistical distribution of noise levels across the frequency spectrum [1]. The more statistically approach requires large sample sizes, which become the norm as advances in probability power spectral density [2]. In this studies, we use the datasets of the broadband network from DNP, IGBI, and PLAI which deployed in BMKG network, Indonesia. Datasets on seismic background noise are collected, amongst others, for assessing the suitability of sites for permanent seismic recordings. One of the most important steps to be undertaken prior to the selection of suitable seismological recording sites is the investigation of seismic background noise.

The power spectral density spectrum estimation, periodogram is not a consistent estimate of the power spectrum [3]. So non-parametric methods are used for power spectrum estimation by smoothing and averaging operations which are directly implied on the periodogram or on the autocorrelation [4][5].
2. Data and Method
2.1 Data
The time series data were recorded in three locations in Indonesia: Denpasar-Bali, Ingas - Bali, and Plampang - Nusa Tenggara Barat (NTB) for one month in August 2018. The waveform data were employed from Indonesia Tsunami Early Warning System (Ina-TEWS) – BMKG-IA network in Table 1.

| No | Station | Latitude | Longitude |
|----|---------|----------|-----------|
| 1  | DNP     | -8.68    | 115.21    |
| 2  | IGBI    | -8.62    | 115.15    |
| 3  | PLAI    | -8.83    | 117.78    |

2.2 Method
The time series data in mini-SEED format obtained from the three stations were used for this study. An average of an hour-long Z component data for one month on August 2018 from each station and their respective noise spectra were plotted using spectral analysis methods. We use the power spectra to amplitude measurements [6][7]. The spectral analysis is commonly used to make the correction of attenuation and instrument displacement spectrum and determine the flat spectral level and corner frequency from which the seismic [8].

3. Result and Discussions
The figure [1-3] shows the result of probability power spectral density, which respective plotted in power amplitude (dB) versus periods (s) [9][10]. The upper black solid line means that the New High Noise Model (NHNM) and the lower means that the New Low Noise Model. The DNP in figure 1 and PLAI in figure 3 networks are represented the spectral probability density closer to the upper line or the network means the new high noise model. In this case, the DNP and PLAI have a characterization of outliers and their influence on the noise level.

Figure 1. The PSD plots for DNP Broadband Network
In figure 2, the IGBI Network performed the frequency spectral using the spectral probability density. The spectra show the profile of the maximal recorded levels, while the average of the waveform more closely reflects the mode [11].

Figure 2. The PSD plots for IGBI Broadband Network

In this case, the spectrum probability density of IGBI network is too smooth, it means that there are several of the waveforms in August is missed, it’s related to the gap of the waveform. The gaps can be represented in the period in figure 2. The other case, the spectral probability density is represented between the NHNM and NLNM. The green patches in periods represent available data, and red
patches represent gaps in the stream that were added to the probability power spectral density [12][13][7].

Figure 4. The Spectral Probability Density value of DNP

Figure 5. The spectral probability density value of IGBI
In figure [4-6] show the information on metadata will be correctly picked for the respective start time of the data trace. This means that DPN, IGBI and PLAI instrument changes are correctly taken into account during response removal. The time series of power spectral density of DPN, IGBI and PLAI network values can also be extracted from the probability power spectral density by accessing the property PSD values and plotted using the plot temporal method [14].

4. Conclusions
The consistency of the spectral probability density is presented the DNP, IGBI, and PLAI network to verify the quality of data and also acts as a test performance broadband network to the time taken by the broadband network in the field and analysis the Lombok earthquake in 2018.

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