國立臺灣大學工學院土木工程學系

碩士論文

Department of Civil Engineering

College of Engineering

National Taiwan University

Master Thesis

# 台灣地震動數據中反應譜值相關性之研究

# A study of Correlation of Response Spectral Values using Taiwan Ground Motion Data

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# 國立臺灣大學碩士學位論文
# 口試委員會審定書

**National Taiwan University Master Thesis**

**Oral Examination Committee Approval**

台灣地震動數據中反應譜值相關性之研究

A study of Correlation of Response Spectral Values using Taiwan Ground Motion Data

本論文係林昶佑（R05521108）在國立臺灣大學土木工程學系大地工程組完成之碩士學位論文，於民國 112 年 7 月 26 日承下列考試委員審查通過及口試及格，特此證明。

The undersigned, appointed by the Department of Civil Engineering Geotechnical Engineering on July 26, 2023, have examined a Master's thesis entitled above presented by Lin, Chang-Yu (R05521108) candidate and hereby certify that it is worthy of acceptance.

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# 誌謝

延宕了這麼多年總算是完成研究以及論文，從 2016 年入學至今終於畢業，常被開玩笑說這樣的時間跨度都能唸完一輪醫學系了，這些年發生了很多事情，風風雨雨、大起大落，有時候也會羨慕校園內應屆的研究生，他們能單純的將大部分心力放在學生生活跟學業上，但每個人的人生軌跡與考驗皆不同，對我來說這段時間能將這份論文完成，最大的收穫就是重新找回生活的初心，用正確的態度將事情完成。

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# 摘要

臺灣位於環太平洋地震帶上，每年都有許多地震事件發生，這些地震可能導致嚴重的損害，在實務上主要進行地震反應分析以獲取水平方向上的反應譜值。然而垂直方向上的地震動也可能導致結構嚴重損壞，例如在 1971 年的聖費爾南多地震中，許多橋樑倒塌正是因為巨大的垂直地震動所致，因此進一步探討水平向反應譜值和垂直向反應譜值之間的關係，可以在抗震工程中提供更多實質上的應用及幫助。

為了評估水平向和垂直向反應譜值之間的相關性，本研究從臺灣強地動觀測網(TSMIP)收集了 47 個強震事件的地震數據，共計 10,880 個記錄，彙整一份地震目錄並結合強震測站場址工程地質資料庫(EGDT)提供的場址參數，建立一地震動資料庫，接著選擇適合的強地動預估計算地震動分量在不同周期或方向（水平向與垂直向、垂直向與垂直向、水平向與水平向）之間的皮爾森相關係數，並對其進行探討，為了在實務上應用，使用非線性最小二乘迴歸方法，將計算得到的相關係數值迴歸分析，提出在不同情況下反應譜相關性之預測方程模型。

關鍵字：反應譜值、相關係數、垂直地動值、強地動預估式、相關性模型



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# ABSTRACT

Taiwan is located on the Ring of Fire. Many earthquakes occur every year and may cause severe damages. Ground motion prediction models are often developed for the spectral response values in the horizontal direction, while only a few are for the vertical direction. However, the ability to predict vertical ground motion is necessary as it also has the potential to cause substantial structural damage. For example, a lot of bridges collapsed because of the huge vertical ground motion during the 1971 San Fernando earthquake. In this study, the relationship between horizontal and vertical spectral response values is examined. To evaluate the correlation between the horizontal and vertical spectral response values, the ground motion data from 47 strong motion events, amounting to 10880 records, from the Taiwan Strong Motion Instrumentation Program (TSMIP) network, are collected. The earthquake attributes were compiled, and the site parameters provided by the Engineering Geological Database for TSMIP (EGDT) were utilized. Appropriate ground-motion prediction equations were selected, enabling the calculation of the Pearson correlation coefficient among spectral accelerations with differing periods and orientations such as horizontal-vertical, vertical-vertical, and horizontal-horizontal ground motion components. For practical application, a predictive models were developed for the correlation coefficients using the nonlinear least squares regression method.

Keywords: Response Spectral Values, Correlation Coefficient, Vertical Ground Motion Component, Ground Motion Prediction Equations, Correlation Model



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# TABLE OF CONTENTS





doi:10.6342/NTU202303258

doi:10.6342/NTU202303258

# LIST OF FIGURES





doi:10.6342/NTU202303258

doi:10.6342/NTU202303258

doi:10.6342/NTU202303258

doi:10.6342/NTU202303258

doi:10.6342/NTU202303258

# LIST OF TABLES





doi:10.6342/NTU202303258

# Chapter 1 Introduction

## 1.1 Background

Taiwan is located at the intersection of two tectonic plates: the Philippine Sea Plate to the southeast and the Eurasian Plate to the northwest. The border of these two plates traverses Taiwan from the Ryukyu Trench in the north and extends southwards to the Manila Trench.

Beginning about 15 million years ago, the Philippine Sea Plate has continuously moved in a northwest direction and continues to do so at a pace of 7-8 centimeters per year toward the Eurasian Plate. To the northeast of Taiwan, the western edge of the Philippine Sea Plate subducts beneath the Eurasian Plate along the Ryukyu Trench, forming a northwest-dipping subduction zone. Conversely, in southern Taiwan, the direction of subduction is reversed as the Eurasian Plate subducts eastward beneath the Philippine Sea Plate, Figure 1.1 illustrates the tectonic diagram of Taiwan, as a result, Taiwan experiences numerous earthquake events annually, which lead to severe damage to infrastructure and buildings as well as causes casualties among the population.

In order to enhance the planning and design related to seismic engineering, the Central Weather Bureau (CWB) of Taiwan has established free-field stations across the country, the signals recorded by these free-field stations are the ground motion acceleration data caused by earthquakes. After collecting the acceleration data, we can implement Response Spectrum Analysis to derive Response Spectral Values. These values are the synthesis of the peak response of single-degree-of-freedom (SDOF) structures with variable periods, but consistent damping ratios subjected to a specified ground motion, these values such as Spectral acceleration values can further contribute to



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Seismic Hazard Analysis and the evaluation of structural response. Seismic design of structures mainly focuses on response from horizontal ground motions However, the potential for significant structural damage due to vertical ground motions should not be underestimated.

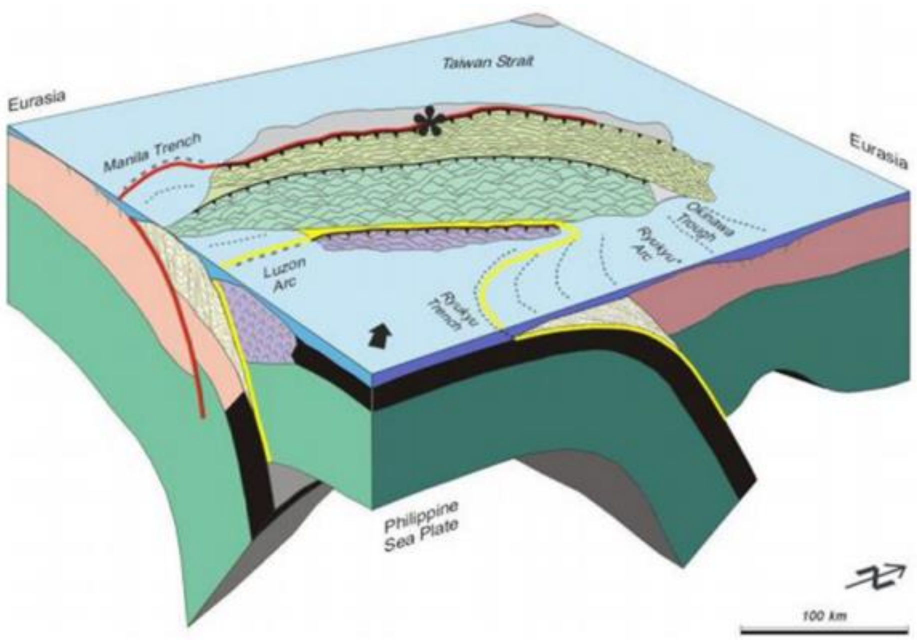


Figure 1.1 Tectonic diagram of Taiwan

Sources: Angelier et al. (1986)

## 1.2 Motivation

Ground-Motion Prediction Equations (GMPEs) predict the median and standard deviation of the logarithm of spectral acceleration values, such empirical formulas are utilized to estimate the potential ground shaking levels that may occur during future seismic events. They are commonly employed in probabilistic seismic hazard analyses (PSHA). However, the equation itself only provides distributions for specific periods and does not account for correlations between spectral accelerations at different periods or orientations. For instance, the correlation between horizontal spectral acceleration and vertical acceleration at various periods is of particular interest, but not accounted for by



doi:10.6342/NTU202303258

the equation.

The application of Ground-Motion Prediction Equations can be enhanced by considering correlations among response spectral values at different periods or orientations. Incorporating these correlations enables the utilization of existing ground motion models to predict the joint distribution of spectral acceleration values at multiple periods. This is particularly valuable the generation of Conditional Mean Spectrum.

The current Uniform Hazard Spectrum used in seismic hazard analysis tends to overestimate ground motions, which can impact subsequent structural design results. Replacing the Uniform Hazard Spectrum with the Conditional Mean Spectrum to determine the target response spectrum may yield better analysis results. To achieve this goal, it is essential to derive applicable correlation models.

## 1.3 Objective

Because the correlations of spectral values are significantly affected by the earthquake database used. Previous studies have focused on developing region-specific correlation models, such as those for the United States, Japan, and Europe. However, relatively little research has been conducted in Taiwan.

The objective of this study is to investigate the correlation of spectral values using earthquake data from Taiwan and propose a new correlation model for 5% damped spectral accelerations that are suitable for application in the Taiwan region.

## 1.4 Thesis Organization

This thesis is composed of five chapters, Chapter 1 introduces the research background, motivation, and objectives, Chapter 2 presents a literature review on the computation of empirical correlation coefficients, previous correlation models developed



doi:10.6342/NTU202303258

by other scholars, and the Ground-Motion Prediction Equations used for Taiwan in this study. Chapter 3 details the process of data collection and the establishment of a Ground Motion Database and analysis methods. Chapter 4 presents the results of the correlation coefficients, explores the parameters that influence these coefficients, and proposes a Parametric Predictive Correlation model. Finally, Chapter 5 provides a conclusion based on the research results, along with recommendations for future research, Figure 1.2 shows the flow chart of this study.

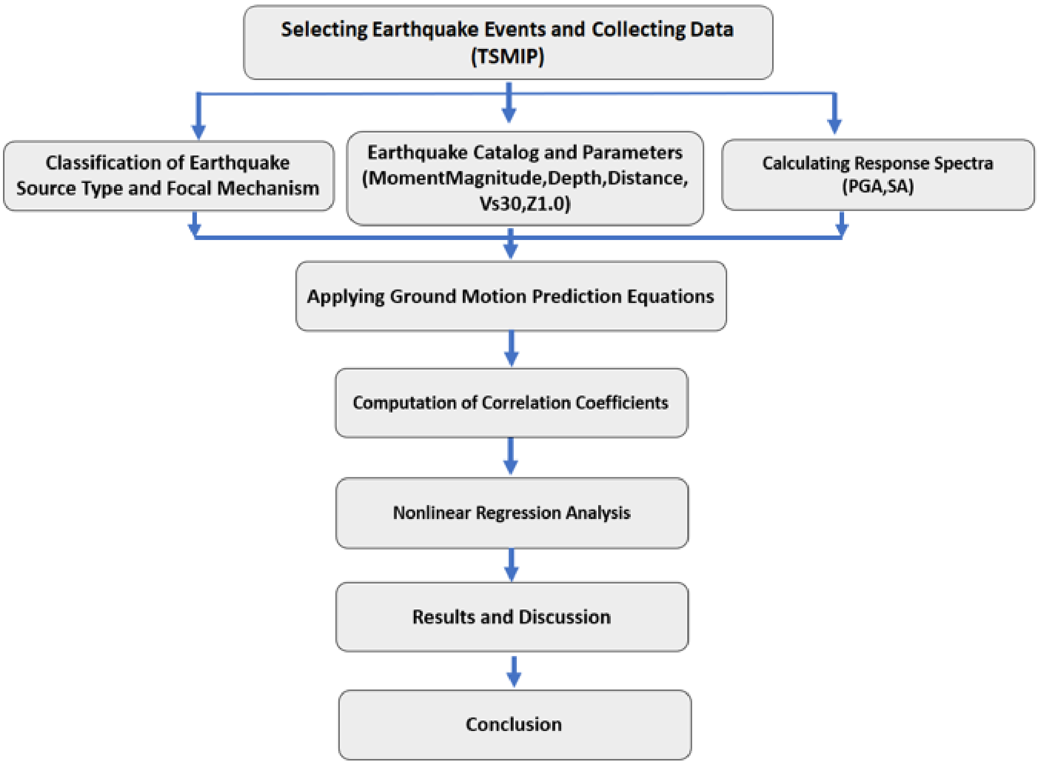


Figure 1.2 Flow chart of this study



doi:10.6342/NTU202303258

# Chapter 2 Literature Review

## 2.1 Computation of Empirical Correlation Coefficients

Baker and Cornell (2006) proposed a method for calculating the Correlation of Response Spectral Values. To evaluate the correlation between spectral values at different directions and periods, we first need to consider the typical form of a Ground Motion Prediction Equations (GMPEs). the predictions of spectral accelerations are expressed using the following form:

$$ln(Sa) = f(M, R, \theta) + \varepsilon_T \cdot \sigma_T(M, R, \theta) \tag{2.1}$$

Where $f(M, R, \theta)$ is the predicted median of the natural log of spectral acceleration (Sa) as a function of earthquake magnitude (M), source-to-site distance (R), and other parameters such as local site conditions and focal mechanism, $\sigma_T(M, R, \theta)$ represents the predicted standard deviation of ln (Sa), which is also provided by the GMPEs. Meanwhile, $\varepsilon_T$ is a standard normal random variable that represents the number of standard deviations by which the actual logarithmic spectral acceleration ln (Sa), deviates from its predicted median value $f(M, R, \theta)$.

If a ground motion response spectral value has been observed, and the associated earthquake magnitude, distance, and the other ground motion parameters required by the GMPEs are known, the values of ln (Sa) and $f(M, R, \theta)$ can also be determined, solving equation (2.1) for $\varepsilon_T$, we can compute $\varepsilon_T$ using the following equation:

$$\varepsilon_T = \frac{ln(Sa) - f(M, R, \theta)}{\sigma_T(M, R, \theta)} \tag{2.2}$$



doi:10.6342/NTU202303258

These $\varepsilon_T$ values vary with period and are specifically represented as a function of period in the equation mentioned above, Figure 2.1 visually represents the components of equation (2.2), including the observed and predicted spectral values, as well as the range of standard deviations around the predicted values. It demonstrates the variation of $\varepsilon_T$ for actual response spectra, showing the numerical fluctuations as they change across different periods.

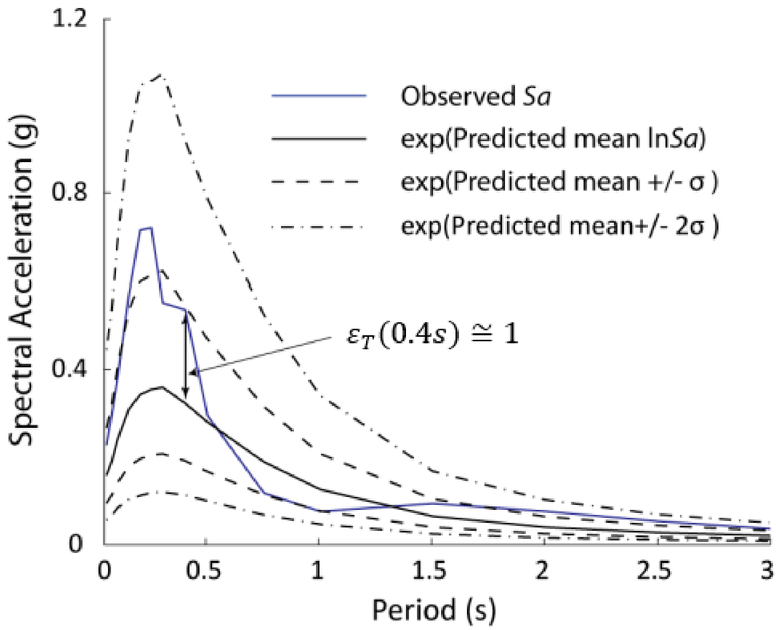


Figure 2.1 Response Spectrum of a Ground Motion from the 2000 Western Honshu Earthquake

Sources: Baker and Jayaram (2010)

Because of the linearity between $\varepsilon_T$ and ln (Sa) in Equation (2.1), $\varepsilon_T$ is the primary factor contributing to the uncertainty in ln (Sa). Therefore, the correlation between two different spectral acceleration values can be determined by estimating the correlation between their corresponding normalized residuals, to estimate correlation coefficients between these $\varepsilon_T$ values at two periods $\varepsilon_T(T_1)$ and $\varepsilon_T(T_2)$, use the



doi:10.6342/NTU202303258

Pearson-product-moment correlation estimator (Ang and Tang, 2007):

$$\rho_{x,y} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}} \tag{2.3}$$

where $x_i$ and $y_i$ are generic variables (i.e., in this case $\varepsilon_T(T_i)$ and $\varepsilon_T(T_j)$), $\bar{x}$ and $\bar{y}$ are the sample means of x and y, and n is the total number of observations.

Due to the increasing complexities in the development of GMPEs, modern GMPEs refine Equation (2.1) by separating the total residual of $\varepsilon_T \cdot \sigma_T$ into two independent terms: an inter-event residual and an intra-event residual:

$$\varepsilon_T \cdot \sigma_T = \eta \cdot \tau + \varepsilon \cdot \sigma \tag{2.4}$$

where η and ε are the normalized inter-event and intra-event residuals, respectively, and τ and σ are the inter- and intra-event standard deviations. The approach described by Baker and Jayaram (2010) is employed in this study to estimate $\eta \cdot \tau$, which represents the inter-event residual, for each earthquake, and $\varepsilon \cdot \sigma$, denoting the intra-event residual, for each site in the database where the ground motion of that earthquake has been recorded, finally, the correlation between the total residuals can be computed from the inter-event and intra-event correlations using the following equation:

$$\rho_{\varepsilon_{T,i},\varepsilon_{T,j}} = \frac{1}{\sigma_{T,i}\sigma_{T,j}}\left[\rho_{\eta_i,\eta_j}\tau_i\tau_j + \rho_{\varepsilon_i,\varepsilon_j}\sigma_i\sigma_j\right] \tag{2.5}$$

The indices i and j refer to the two spectral accelerations in this study.



doi:10.6342/NTU202303258

## 2.2 Ground Motion Prediction Equations

Ground Motion Prediction Equations (GMPEs), also known as ground motion models, play a crucial role in the estimation of correlation coefficients. This section provides a brief introduction to GMPEs, a review of GMPEs specifically developed for the Taiwan region, and an overview of the selected GMPEs used in this study.

GMPEs are mathematical equations used to describe the variation of ground motion vibrations with earthquake magnitude, distance, and site characteristics. They consider the effects of the earthquake source, propagation path, and site conditions to assess the attenuation of ground motion with distance. A suitable attenuation model not only helps us understand the attenuation characteristics in a specific region for the purpose of predicting strong ground motions but also serves as a foundation for seismic design in important engineering projects, for example, in seismic hazard analysis, it is common to employ the Probabilistic Seismic Hazard Analysis (PSHA) method. As part of this approach, a set of GMPEs is typically chosen, and weights are assigned to these GMPEs within the logic tree as a standard practice.

Earlier attempts to develop GMPEs for Taiwan were made by Tsai et al. (1987), Wu et al. (2001), Liu and Tsai (2005), Lin and Lee (2008), and Lin et al. (2011). Although these models made significant contributions, they do have certain limitations when applied to engineering applications. Consequently, recent research has focused on creating a new set of GMPEs specifically designed for PSHA studies. This research was carried out in accordance with the guidelines of a Senior Seismic Hazard Analysis Committee (SSHAC) level 3 Project (National Center for Research on Earthquake Engineering (NCREE), 2015).

To conduct a correlation analysis of response spectrum values for different



doi:10.6342/NTU202303258

orientations, it is essential to select appropriate GMPEs specific to both horizontal and vertical movements in Taiwan for the subsequent computation of correlation coefficients. In this study, I choose the GMPEs developed by Chao et al. (2020). This model encompasses both median and sigma models, accounting for ground motion in horizontal and vertical orientations. It has the capacity to predict spectral accelerations with a 5% damping ratio under various earthquake conditions. The model is applicable to structural periods ranging from 0.01s to 5s, with a total of 20 periods considered, and is adaptable specifically to two types of earthquakes: crustal and subduction earthquakes, the Sigma Model incorporates the Standard Deviation Model of Event- Specific Residuals, as well as the Station-Specific and Record- Specific Residuals.

The GMPEs consist of several predictive parameters that characterize the intensity of an earthquake. These parameters individually describe various aspects, including the earthquake source, the path from the source to the site, and the site conditions. This is significant because the seismic signal that a seismograph record is dictated by the source effect, the path effect, and the site effect, collectively impacting the ground motion at a specific location, as illustrated in Figure 2.2, Subsequently, Table 2.1 provides a list of these input prediction parameters, while Table 2.2 summarizes the applicable parameter range for the GMPEs based on different earthquake source types.



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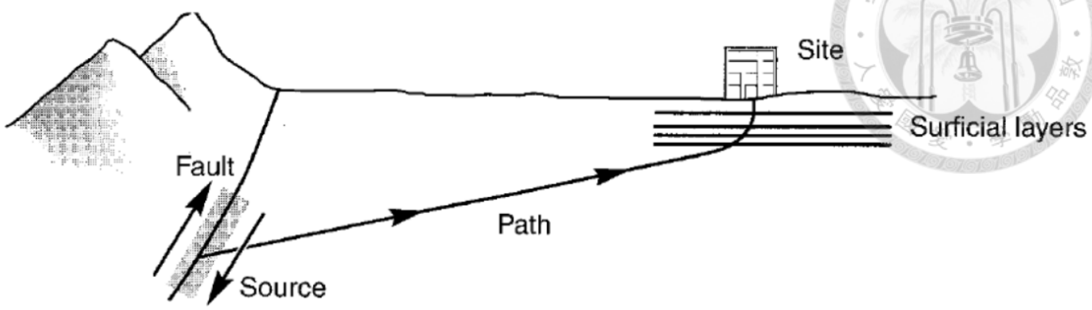


Figure 2.2 Seismic Waves Propagation from Seismic Source to a Local Site

Sources: Kramer (1996)

Table 2.1 List of Input Prediction Parameters of the GMPEs

| Type | Input Prediction Parameters |
|---|---|
| Earthquake Source | 1. Mw<br>2. Ztor<br>3. Style of Faulting<br>4. Earthquake Types<br>5. Ryukyu or Manila subductions<br>6. Mainshock or Aftershock |
| Path from source to site | 7. Rrup |
| Site conditions | 8. Vs30<br>9. Z1.0 |

Sources: Chao et al. (2020)

The following will offer a brief introduction to the prediction parameters listed in Table 2.1. More in-depth discussion about these parameters and the data collection process will be provided in Chapter 3, during the establishment of the ground motion database.

*Mw*: Moment magnitude.

*Ztor* (km): Rupture Top Depth, The depth to the shallowest point on an earthquake



doi:10.6342/NTU202303258

Rupture Surface.

Style of faulting: Normal Fault, Reverse Fault, Strike-Slip Fault, Reverse-Oblique Fault, and Normal-Oblique Fault.

Earthquake types: Crustal earthquake, subduction earthquake.

Ryukyu or Manila subductions: Determining the location of the subduction earthquake within the Manila subduction zone or Ryukyu subduction zone.

Mainshock or aftershock: Events occurring within a 3-day period and with a hypocenter distance of 5 km are categorized as part of the same earthquake series. The event with the highest magnitude within this series is identified as the mainshock, while the remaining events are considered aftershocks.

*Rrup* (km): The shortest distance from a site to a rupture surface.

*Vs30* (m/): The average shear wave velocity (Vs) from the surface to a depth of 30 meters

*Z1.0* (m/s): The depth at which the shear wave velocity reaches 1.0 km/s

Table 2.2 Applicable Parameter Range of the GMPEs

| **Source Type / Range** | **Crustal** | **Subduction Interface** | **Subduction Intraslab** |
|---|---|---|---|
| Mw | 4 – 8 | 4 – 9 | 4 – 8 |
| Rrup | 0.1 – 200 km | 10 – 200 km | 35 – 300 km |
| Ztor | 0 – 50 km | 0 – 35 km | 35 – 200 km |
| Vs30 | 180 – 1000 m/s | | |
| Z1.0 | 5 – 1000 m | | |
| $\hat{S}_{a760}$ for T 0.01 sec | < 0.5 g while considering nonlinear site effect for the site with Vs30 < 760 m/s | | |
| Period | 0.01 – 5 sec | | |

Sources: Chao et al. (2020)



doi:10.6342/NTU202303258

## 2.3 Mixed-Effects

The attenuation models commonly used in the regression analysis of past GMPEs considered only a single fixed residual term $\varepsilon_{ij}$ , i.e., they conducted regression analysis solely based on fixed effects. Each parameter within the attenuation formula was understood to have a constant influence, represented by the respective coefficients (θ). The portion that couldn't be predicted was expressed as a constant term.

Recognizing that our data is composed of ground motion values measured at various seismic stations during different earthquake events, it becomes clear that there are differences between these earthquakes and that each earthquake's effect on the measured ground motion values at each station varies. For instance, earthquakes of the same magnitude may exhibit different seismic intensities. Therefore, the discussion shouldn't be confined to fixed effects, but should also include the influence of random effects. Random effects imply that each different earthquake has its unique characteristics, which are random. Abrahamson & Youngs (1992) pointed out that it is not necessary to compute an exact value to represent this effect; the simple act of isolating it can fulfill our objective.

To calculate equation (2.5), the inter- and intra-event residuals were determined by implementing a mixed-effects regression on the total residuals, utilizing the method introduced by Baker and Jayaram (2010).

GMPEs were originally treated as fixed-effects models that take the form:

$$\ln\left(Y_{ij}\right) = f\left(M_i, R_{ij}, \theta\right) + \varepsilon_{ij} \tag{2.6}$$

$Y_{ij}$ represents the ground motion intensity parameter, for example, the spectral acceleration at period T at site j during earthquake event i. $f\left(M_i, R_{ij}, \theta\right)$ refers to the



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predicted median by GMPEs using the predictive parameters $M_i, R_{ij}$, coefficient set θ. $\varepsilon_{ij}$ is the total residual term at site j during earthquake event i. Given that the entire equation is a logarithmic function, $\varepsilon_{ij}$ is also referred to as the log-residual and its distribution is a normal distribution, considering the mixed-effects, Equation (2.6) is rewritten as follows:

$$\ln(Y_{ij}) = f(M_i, R_{ij}, \theta) + \eta_i + \varepsilon_{ij} \tag{2.7}$$

$\eta_i$ denotes the random effect of the ith earthquake event, representing the magnitude of the inter-event variance, whereas $\varepsilon_{ij}$ indicates the fixed effect of the ith earthquake event at the jth site, representing the magnitude of intra-event variance. Both $\eta_i$ and $\varepsilon_{ij}$ are assumed to be normally distributed, with variance as $\tau^2$ and $\sigma^2$, respectively. Searle (1971) derived the likelihood function of equation (2.6), under the assumption that residuals are normally distributed. The derived likelihood function is as follows:

$$\ln(L) = \frac{N}{2}\ln(2\pi) - \frac{1}{2}\ln(|C|) - \frac{1}{2}(y-u)^T C^{-1}(y-u) \tag{2.8}$$

where N is the total number of data points, C is the covariance matrix of the total residuals, μ is the vector representing predictive values, and y is the vector representing observed values. Abrahamson and Youngs (1992) assume that the intra-event residuals are independent of each other and of the inter-event residuals. Hence, the covariance matrix C can be expressed as:



doi:10.6342/NTU202303258

$$C = \sigma^2 I_N + \tau^2 \sum_{i=1}^{M} I_{n_i} \tag{2.9}$$

$I_N$ is the identity matrix of size N × N, $I_{n_i}$ is a matrix of ones of size $n_i$ × $n_i$, $\Sigma^+$ is a direct sum operation, M is the number of earthquake events, and $n_i$ is the number of earthquake data received from the ith earthquake, The matrix C can be expanded as:

$$= \begin{bmatrix} \sigma^2 I_{n_1} + \tau^2 I_{n_1} & 0 & \cdots & 0 \\ 0 & \sigma^2 I_{n_2} + \tau^2 I_{n_2} & \cdots & 0 \\ \vdots & \vdots & \ddots & 0 \\ 0 & 0 & 0 & \sigma^2 I_{n_M} + \tau^2 I_{n_M} \end{bmatrix} \tag{2.10}$$

The maximum likelihood estimations for σ and τ are the ones that maximize the likelihood function L and can be acquired via numerical optimization. When θ is given and the maximum likelihood estimates of σ and τ are in place, the random-effects term $\eta_i$ is also estimated using the maximum likelihood methodology. The process for obtaining the maximum likelihood estimate of $\eta_i$ is as follows, as described by Abrahamson and Youngs (1992):

$$\eta_i = \frac{\tau^2 \sum_{j=1}^{n_i} y_{ij} - \mu_{ij}}{n_i \tau^2 + \sigma^2} \tag{2.11}$$

The obtained results can be used to calculate Equation (2.5), Figure2.3 illustrates the relationship between the inter-event residual $\eta_i$ and the intra-event residual $\varepsilon_{ij}$ for two earthquakes of the same magnitude.



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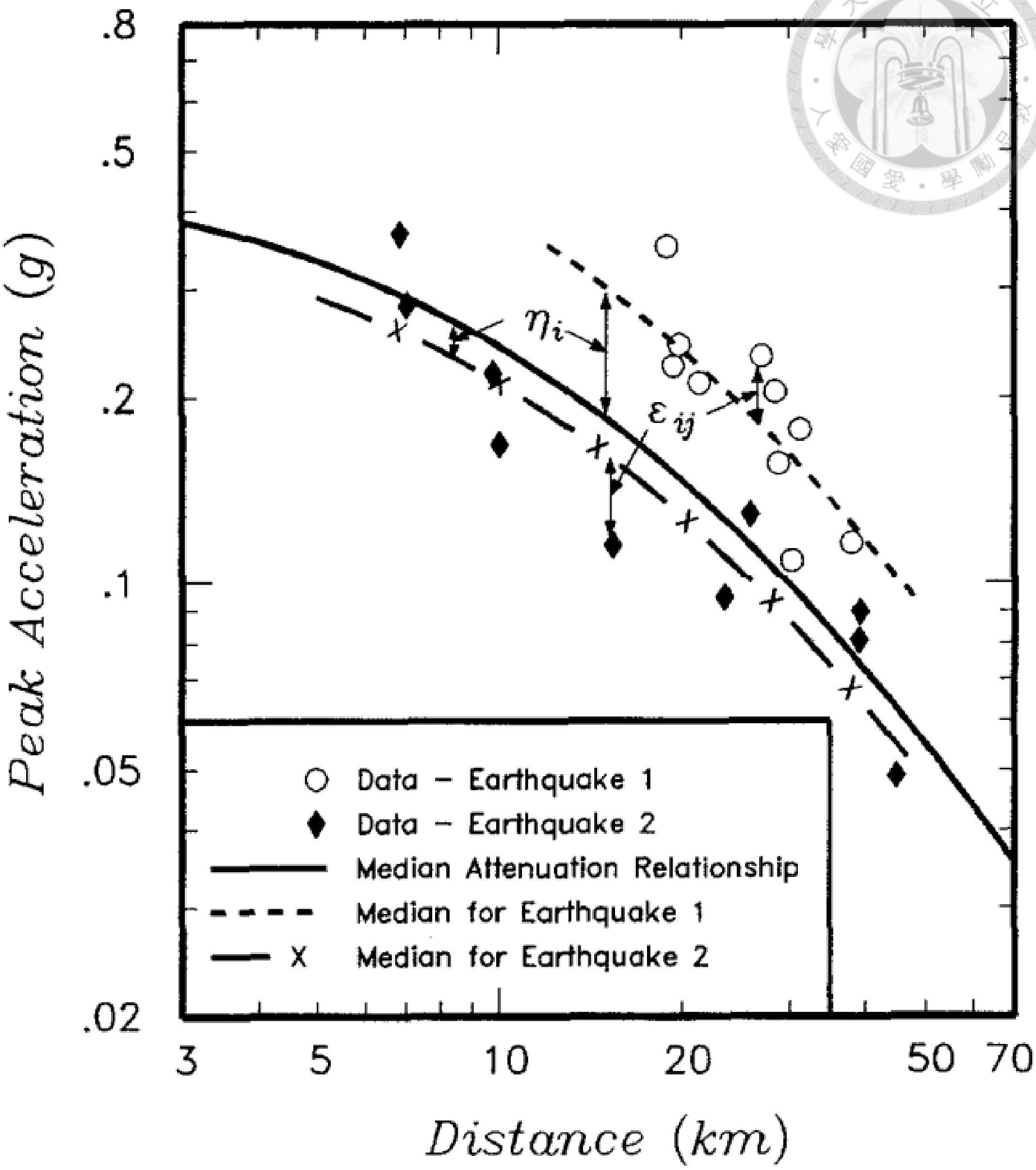


Figure 2.3 Relationship betwee $\eta_i$ and $\varepsilon_{ij}$ for Two Same-Magnitude Earthquakes

Sources: Youngs et al. (1995)

## 2.4 Previous Correlation Models

The initial investigation on the correlation of response spectral values for multicomponent ground motions was carried out by Baker and Cornell (2006), followed by Baker and Jayaram (2008) using the NGA-West database (Chiou et al., 2008), and presented empirical cross-correlation models for vertical-to-vertical and vertical-to-



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horizontal spectral accelerations.

Gülerce and Abrahamson (2011) computed the correlation between horizontal spectral accelerations and vertical-to-horizontal spectral accelerations (V/H ratios) using the NGA West database.

Bozorgnia and Campbell (2016) presented a tabulated correlation model specifically for same-period spectral accelerations of vertical-to-horizontal components. However, they did not include the cross-correlations of spectral accelerations at different periods.

Gülerce et al. (2017) focused on computing the correlations between vertical-to-vertical spectral accelerations while developing the GKAS16 GMPE.

Kohrangi et al. (2020) presented correlation coefficient models that specifically focus on the correlation between vertical-to-vertical and vertical-to-horizontal ground motion components using data from the NGA-West2 database.



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# Chapter 3 Data Collection and Analysis Methods

## 3.1 Data Collection and Database Construction

This section outlines the process of data collection and the establishment of the ground motion database. The database includes pre-processing ground motion data, earthquake data, predictive parameters of the GMPEs as mentioned in Table 2.1, and ground motion intensity parameter.

### 3.1.1 Collection and Processing of Strong-Motion Earthquake Data

The ground motion data used in this study was collected from the Geophysical Database Management System (GDMS) established by the Central Weather Bureau (CWB). This data service system features an international standard exchange format and an automated data processing workflow. It offers an open network data service to everyone, providing services such as Earthquake observation data downloads, station information, instrument response information, and earthquake catalog searches. The Strong-Motion Earthquake Data used in this study comes from the Taiwan Strong Motion Instrumentation Program (TSMIP) network.

Since 1991, the Central Weather Bureau has been installing numerous free-field strong-motion stations throughout Taiwan, forming the TSMIP network, this program gathers strong-motion data from various metropolitan areas across Taiwan, covering both geological strata and soil, and has led to the establishment of a Taiwan strong-motion record database. Currently, TSMIP operates around 700 free-field strong-motion stations, Figure 3.1. shows the distribution of TSMIP network stations.

Taiwan regularly experiences earthquakes of various magnitudes, including those that cause severe damage. The high-quality digital earthquake records data observed by



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TSMIP contribute significantly to research in earthquake engineering, facilitating the development of appropriate seismic design standards and reducing disaster losses brought about by earthquake events.

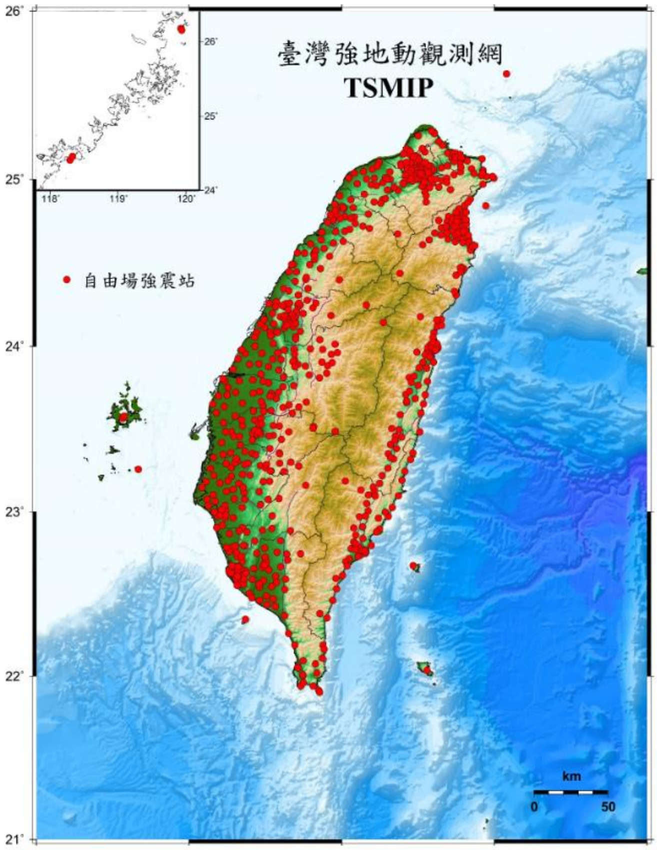


Figure 3.1 Distribution map of TSMIP network stations

In this study, I have selected and analyzed a total of 47 strong earthquake events in Taiwan with Richter magnitudes (ML) greater than 5.6, occurring from 2020 through the end of 2022, these events consisted of a total of 11,000 records. Figure 3.2 illustrates the distribution of earthquake epicenters used in this study, while earthquake catalog employed in this study is detailed in Table 3.1.

The original strong motion data that was collected needed to be filtered and selected based on specific criteria.



doi:10.6342/NTU202303258

Criteria for strong motion data selection:

1. Because the calculation of the response spectrum uses the entire history of acceleration, any records that are of poor quality or incomplete must be discarded.
2. Not every station captures the acceleration data for all three directions—North-South (N), East-West (E), and vertical direction (Z)—after an earthquake. Only those records that have complete data in all three directions are included.

After data selection, two corrections are processed. The first correction is the instrumentation correction, performed to eliminate the influence of the instrument response on the original data. The second is the baseline correction, which is important because if the acceleration data demonstrates baseline drift, this shift could greatly amplify through the process of integrating the velocity time history and the displacement time history, Figure 3.3 illustrates the acceleration time history data before and after baseline correction.



doi:10.6342/NTU202303258


Figure 3.2 Epicenter distribution of earthquakes used in this study

Table 3.1 List of earthquake events used in this study.

| Number | Date | Time | Longitude | Latitude | Depth(km) | $M_L$ |
|---|---|---|---|---|---|---|
| 1 | 2020/12/10 | 1:19:59 PM | 24.74 | 122.00 | 75.71 | 6.64 |
| 2 | 2020/12/10 | 6:15:09 PM | 24.53 | 121.97 | 62.74 | 5.75 |
| 3 | 2021/1/9 | 11:35:53 AM | 24.73 | 122.02 | 72 | 5.84 |
| 4 | 2021/2/4 | 8:14:02 AM | 21.47 | 121.87 | 50.36 | 5.77 |
| 5 | 2021/2/6 | 5:36:03 PM | 24.66 | 122.61 | 111.27 | 6.21 |
| 6 | 2021/2/8 | 4:58:03 PM | 24.37 | 122.02 | 24.67 | 5.67 |
| 7 | 2021/3/2 | 9:23:01 AM | 21.91 | 121.16 | 27.63 | 5.89 |
| 8 | 2021/4/18 | 2:11:40 PM | 23.87 | 121.48 | 16.3 | 5.8 |
| 9 | 2021/4/18 | 2:14:38 PM | 23.86 | 121.48 | 14.42 | 6.26 |
| 10 | 2021/8/4 | 9:50:45 PM | 24.80 | 122.32 | 6.97 | 6.08 |
| 11 | 2021/8/6 | 8:11:05 AM | 24.79 | 122.19 | 13.28 | 5.68 |
| 12 | 2021/9/6 | 2:00:26 PM | 23.85 | 122.08 | 41.09 | 5.94 |
| 13 | 2021/9/13 | 10:41:28 AM | 24.12 | 121.01 | 46.1 | 5.61 |
| 14 | 2021/9/25 | 10:21:20 PM | 24.32 | 121.68 | 46.13 | 5.78 |
| 15 | 2021/10/24 | 5:11:35 AM | 24.53 | 121.78 | 65.6 | 6.54 |



doi:10.6342/NTU202303258

| | | | | | | |
|---|---|---|---|---|---|---|
| 16 | 2022/1/3 | 9:46:37 AM | 24.02 | 122.17 | 22.35 | 6.06 |
| 17 | 2022/1/16 | 8:15:42 AM | 24.18 | 122.25 | 55.47 | 5.65 |
| 18 | 2022/1/18 | 7:10:07 PM | 21.32 | 122.15 | 190.43 | 5.64 |
| 19 | 2022/2/7 | 10:58:25 AM | 24.41 | 121.94 | 34.59 | 5.62 |
| 20 | 2022/2/11 | 4:43:13 PM | 24.03 | 122.27 | 26.36 | 5.65 |
| 21 | 2022/3/9 | 12:22:14 PM | 23.26 | 121.43 | 33.37 | 5.71 |
| 22 | 2022/3/22 | 5:41:39 PM | 23.40 | 121.61 | 25.73 | 6.7 |
| 23 | 2022/3/22 | 5:42:39 PM | 23.44 | 121.49 | 28.41 | 5.79 |
| 24 | 2022/3/22 | 5:43:25 PM | 23.42 | 121.43 | 22.63 | 6.21 |
| 25 | 2022/3/22 | 7:35:04 PM | 23.48 | 121.50 | 28.88 | 5.87 |
| 26 | 2022/3/22 | 8:29:59 PM | 23.42 | 121.43 | 22.57 | 6.04 |
| 27 | 2022/3/24 | 12:38:26 AM | 23.44 | 121.43 | 25 | 5.71 |
| 28 | 2022/4/7 | 11:36:10 PM | 21.61 | 120.98 | 39.42 | 5.86 |
| 29 | 2022/4/19 | 7:06:07 AM | 25.32 | 123.51 | 189.66 | 5.92 |
| 30 | 2022/4/24 | 10:23:50 AM | 23.49 | 123.20 | 50.46 | 5.76 |
| 31 | 2022/5/9 | 6:23:03 AM | 23.97 | 122.53 | 16.76 | 6.27 |
| 32 | 2022/6/7 | 1:57:54 AM | 25.53 | 123.57 | 229.74 | 6.34 |
| 33 | 2022/6/20 | 1:05:08 AM | 23.69 | 121.45 | 7 | 6.09 |
| 34 | 2022/8/22 | 2:53:04 AM | 25.08 | 123.49 | 155.37 | 5.93 |
| 35 | 2022/9/17 | 1:41:19 PM | 23.08 | 121.16 | 8.61 | 6.6 |
| 36 | 2022/9/17 | 2:45:28 PM | 23.12 | 121.19 | 5.84 | 5.84 |
| 37 | 2022/9/18 | 5:19:19 AM | 23.13 | 121.18 | 12.13 | 6.15 |
| 38 | 2022/9/18 | 6:32:03 AM | 23.14 | 121.20 | 7.81 | 5.7 |
| 39 | 2022/9/18 | 6:44:15 AM | 23.14 | 121.20 | 7.81 | 6.83 |
| 40 | 2022/9/18 | 8:46:32 AM | 23.12 | 121.18 | 13.94 | 5.64 |
| 41 | 2022/9/18 | 9:39:56 AM | 23.27 | 121.30 | 11.49 | 5.85 |
| 42 | 2022/9/19 | 2:07:45 AM | 23.44 | 121.30 | 13.38 | 6.02 |
| 43 | 2022/10/10 | 7:24:43 PM | 24.00 | 122.22 | 20.95 | 6.06 |
| 44 | 2022/11/1 | 8:30:12 AM | 24.70 | 122.55 | 109.75 | 5.81 |
| 45 | 2022/11/26 | 5:38:04 PM | 23.86 | 121.64 | 35.96 | 5.64 |
| 46 | 2022/12/7 | 4:54:28 PM | 23.80 | 121.60 | 29.72 | 5.67 |
| 47 | 2022/12/15 | 4:03:16 AM | 23.78 | 121.85 | 16.3 | 6.51 |



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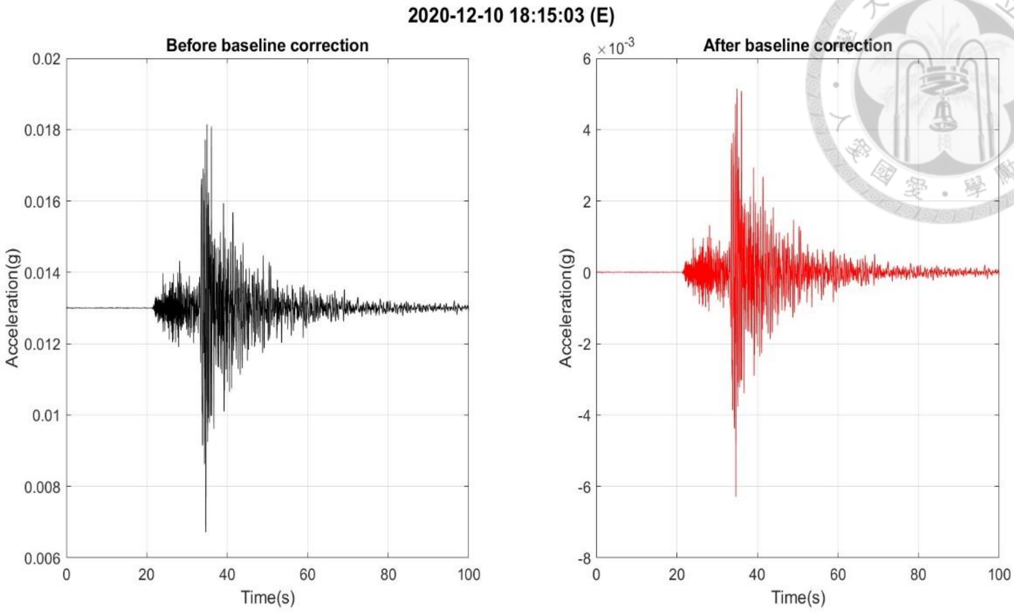


Figure 3.3 Examples before and After baseline correction

When considering large-magnitude earthquakes, using $M_L$ as the scale parameter can lead to a saturation problem. To avoid this issue, we can use the moment magnitude (MW), which is directly related to the fault rupture area and the earthquake energy, as the scale parameter. This parameter can be obtained from the AutoBATs website.

The Ztor parameter, representing the top depth of the rupture plane, is determined using the methodology introduced by Chiou and Youngs (2008). This methodology involves calculating the Ztor value based on the moment magnitude, source classification, and hypocenter location, this calculation can be performed using OpenSHA (https://opensha.org/), an open-source, Java-based platform for conducting Seismic Hazard Analysis.



doi:10.6342/NTU202303258

### 3.1.2 Classification of Earthquake Focal Mechanism

To understand and categorize the focal mechanisms of earthquakes, Focal Mechanism solutions are commonly used to determine the type of fault involved in the earthquake. These solutions are primarily composed of three parameters: the strike, dip, and rake angles. Among these, one plane is identified as the rupture plane, and another is the auxiliary plane. Generally, these 3D spatial data are projected onto a circle, leading the fault and auxiliary planes to be represented as arcs. This separation of compression and tension zones forms a three- dimensional ellipsoid that describes the seismic stress state and fault movement, a representation akin to a beach ball is commonly used to describe the Focal Mechanism solutions.

In this study, the Focal Mechanism solutions for the analyzed earthquakes were obtained from the AutoBATS (https://tecdc.earth.sinica.edu.tw/FM/AutoBATS/), this site collects data following an earthquake event and provides real-time Focal Mechanism solutions and Fault Plane Solutions, Figure. 3.4 demonstrates an example of focal mechanism solutions provided by AutoBATS.

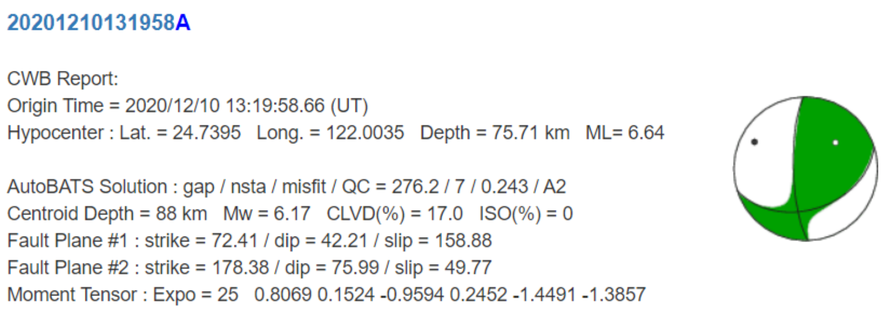


Figure 3.4 Example of focal mechanism solutions provided by AutoBATS

Once the focal mechanism is determined using this data, the next step is to classify the types of earthquakes. The reference table for classification, developed by Cronin (2004), is presented below:



doi:10.6342/NTU202303258

Table 3.2 Focal Mechanism Classification

| Rake of slip angle (°) | Fault type |
|---|---|
| 0° or 180° | Pure strike-slip |
| 90° | Pure dip-slip reverse |
| -90° | Pure dip-slip normal |
| -20° to 20° | Left-lateral strike-slip |
| 20° to 70° | Reverse left-lateral oblique |
| 70° to 110° | Reverse |
| 110° to 160° | Reverse right-lateral oblique |
| -110° to 160° | right-lateral strike-slip |
| -110° to -160° | Normal right-lateral oblique |
| -70° to -110° | Normal |
| -20° to -70° | Normal left-lateral oblique |

Sources: Cronin (2004)

### 3.1.3 Classification of Earthquake Types

Earthquake Types can be classified into crustal earthquakes and subduction zone earthquakes. Crustal earthquakes, also known as shallow earthquakes, are seismic events that occur within the Earth's crust. They are characterized by their relatively shallow focal depths. Subduction zone earthquakes, on the other hand, can be further categorized into two types: subduction zone interface earthquakes and subduction zone intraslab earthquakes, Figure 3.5 shows the Occurrence Locations for these two types of earthquakes.

Subduction zone interface earthquakes are low angle thrust earthquakes that typically occur at the interface between the subducting and the overriding plate. Conversely, subduction zone intraslab earthquakes occur within subducting oceanic plate itself.

According to the research by Tichelaar and Ruff (1993), subduction zone interface earthquakes often occur at depths of less than 50 kilometers. Earthquakes with focal



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depths greater than 50 kilometers can be classified as subduction zone intraslab earthquakes, this study classifies earthquakes according to the categorization process for subduction zone earthquakes organized by Lin et al. (2008), as shown in Figure 3.6.

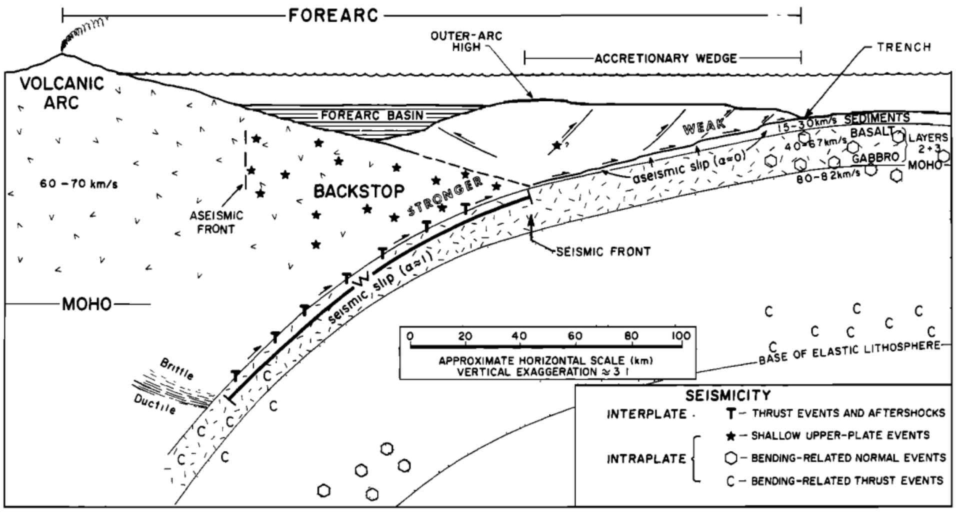


Figure 3.5 Schematic diagram of the occurrence locations for subduction zone intraslab and interface earthquake

Sources: Byrne et al. (1988)



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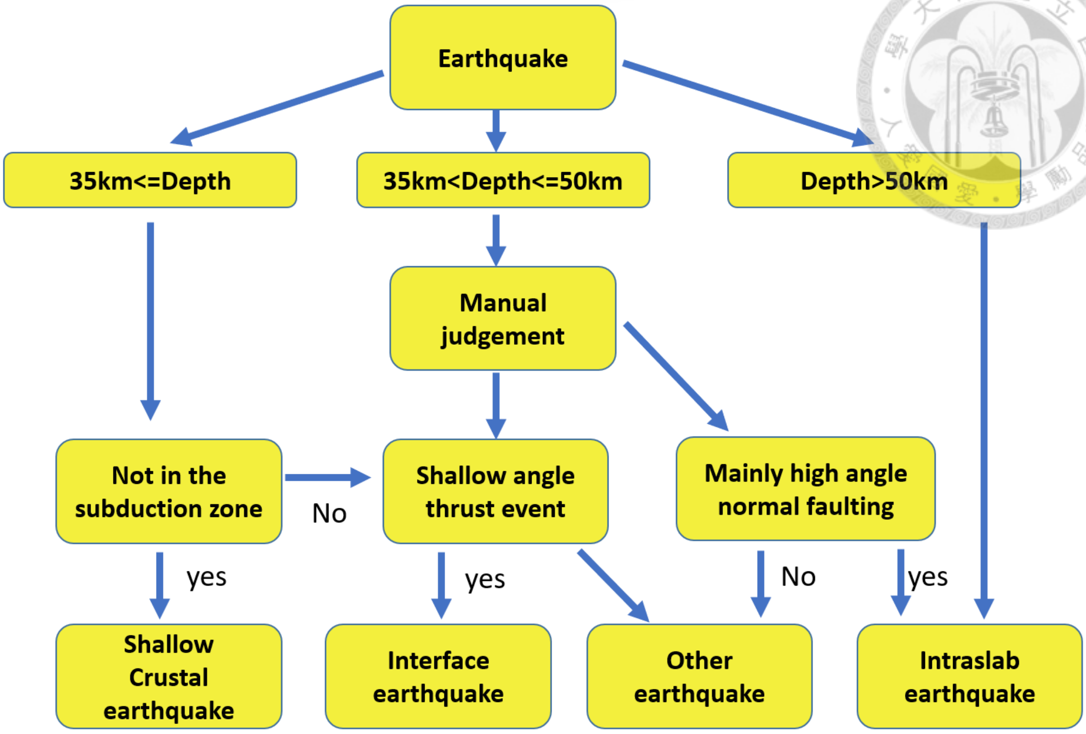


Figure 3.6 The classification process of subduction zone earthquakes in this study

Sources: Lin et al. (2008)

### 3.1.4 TSMIP Station Site Parameters

Local site effects, which account for the variable response at different locations when an earthquake occurs, are a significant factor to consider when evaluating the response of various sites to earthquakes. This variability, observable as an amplification of seismic wave amplitude upon transmission to the ground surface, can be attributed to differing geotechnical characteristics across regions, a single seismic event can showcase notable amplification within distinct frequency ranges upon propagation. If the structure's natural vibration period aligns with the amplification period of the ground, resonance can occur, which can result in more severe structural damage. Hence, understanding a site's geotechnical characteristics is crucial in engineering practice and contributes significantly to earthquake disaster prevention planning.



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Currently, the most used site parameters worldwide are Vs30 and Z1.0. Vs30 represents the average shear wave velocity from the surface to a depth of 30 meters, while Z1.0 represents the depth at which the shear wave velocity reaches 1.0 km/s.

Past classification studies suggest that the geotechnical characteristics within 30 meters below the surface largely dictate the behavior of strong ground motion (Anderson et al.1996), particularly the influence of shear wave velocity. However, Vs30 provides limited differentiation for sites where the depth of the alluvial layer exceeds 30 meters. Consequently, scholars have recently incorporated site parameters representing basin effects, such as Z1.0, into strong ground motion prediction equations. These equations can now consider both average shear wave velocity and the thickness of the alluvial layer.

The National Center for Research on Earthquake Engineering (NCREE) has integrated and established an Engineering Geological Database for TSMIP (EGDT), which provides accurate and reliable site parameters for each station of the strong motion monitoring network. This database is primarily used for reference in ground motion prediction and seismic hazard analysis.

The site parameter data linked to the TSMIP stations utilized in this study were all procured from the EGDT website(https://egdt.ncree.org.tw/). By utilizing Vs30, we further classified the geotechnical properties of the sites. Most site classification-related studies published worldwide adopt the National Earthquake Hazards Reduction Program (NEHRP) or a similar standard. Therefore, the geotechnical classification of the site characteristics database in this study is based on the NEHRP site classification standard, Table 3.2 presents this classification:



doi:10.6342/NTU202303258

Table 3.3 NEHRP Site Classification Standard

| NEHRP Site Class | Range of Vs30 (m/sec) | Geological general description |
|---|---|---|
| A | Vs30 > 1500 | Hard rock |
| B | 1500 ≥ Vs30 > 760 | Firm to hard rock |
| C | 760 ≥ Vs30 > 360 | Dense soil and soft rock |
| D | 360 ≥ Vs30≥180 | Stiff soil |
| E | 180 > Vs30 | Soft soil |

### 3.1.5 The Shortest Distance from a Site to a Rupture Surface.

Figure. 3.7 presents a schematic diagram illustrating the definitions of various path from source to site distances. It provides a clear depiction of the definition of Rrup, which represents the shortest distance from the site to the rupture plane. the calculation of Rrup is conducted following the steps outlined in the NGA project. The steps are briefly described as follows:

**Step 1**: Estimating the fault rupture area based on the earthquake magnitude.

The fault rupture area is determined using the empirical relations between magnitude and rupture area proposed by Wells and Coppersmith (1994). The empirical formula is as follows:

$$\log(Area) = -3.49 + 0.91M_W \tag{3.1}$$

**Step 2**: Estimating the aspect ratio of the fault rupture area based on earthquake magnitude and focal mechanism, The empirical formula for the aspect ratio ($A_R$) of the fault rupture from the NGA project is used. The focal mechanism and earthquake magnitude are inserted to obtain the aspect ratio of the rupture area. The empirical formula is as follows:



doi:10.6342/NTU202303258

$$\log(A_R) = (0.01752 - 0.00472F_{NM} - 0.01099F_{RV})(M_W - 4)^{3.097} \quad (3.2)$$

1. For the condition of a strike-slip fault, $(F_{NM}, F_{RV}) = (0, 0)$
2. For the normal fault condition, $(F_{NM}, F_{RV}) = (1, 0)$
3. For the reverse fault condition, $(F_{NM}, F_{RV}) = (0, 1)$

**Step 3**: Defining a Numerical Fault Rupture Plane.

A plane is defined, assuming the epicenter is at its center. The plane is then rotated according to the strike and dip angle of the fault rupture, resulting in the fault plane and the coordinates of each point on the plane. The rotation matrix for each point's calculation is as follows:

Rotating the fault plane along the Y-axis:

$$\begin{bmatrix} x_1 \\ y_1 \\ z_1 \end{bmatrix} = \begin{bmatrix} Cos\beta & 0 & -Sin\beta \\ 0 & 1 & 0 \\ Sin\beta & 0 & Cos\beta \end{bmatrix} \begin{bmatrix} x_0 \\ y_0 \\ z_0 \end{bmatrix} \quad (3.3)$$

Rotating the fault plane along the Z-axis:

$$\begin{bmatrix} x_2 \\ y_2 \\ z_2 \end{bmatrix} = \begin{bmatrix} Cos\delta & Sin\delta & 0 \\ -Sin\delta & Cos\delta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \\ z_1 \end{bmatrix} \quad (3.4)$$

where $\beta$ represents the dip angle and $\delta$ represents the strike angle.

**Step 4**: Calculating Rrup

Calculate the distance from each point on the fault plane to the station, the minimum value is Rrup.



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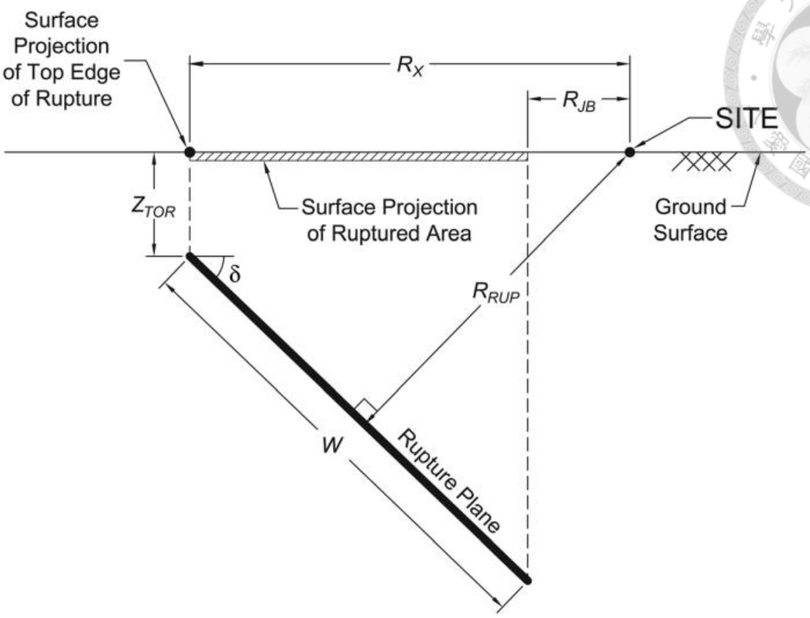


Figure 3.7 Illustration of Earthquake Source and Distance Measures

Sources: Kaklamanos et al. (2011)

### 3.1.6 Ground Motion Parameters

In this study, the ground motion parameters being used include Peak Ground Acceleration (PGA) and Spectral Acceleration (SA). For a particular seismic force, single-degree-of-freedom systems with different natural periods and damping ratios will show various responses.

The earthquake response spectrum is a plot that captures the maximum response values produced by single-degree-of-freedom system structures at different natural periods on the y-axis against their corresponding natural periods on the x-axis.

When calculating the response spectrum, each recording is used to compute the response spectrum with a 5% critical damping ratio. The selection of periods should align with the GMPEs model in use. In this context, periods range from 0.01s to 5s. The chosen periods include 0, 0.01, 0.02, 0.03, 0.05, 0.075, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.5, 0.75, 1, 1.5, 2.0, 3.0, 4.0, 5.0 seconds -a total of 20 periods.



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Typically, earthquake records are composed of two horizontal components: North-South (N) and East-West (E) directions. In this study, the geometric mean of these two horizontal components is used as the ground motion parameter.

Figure 3.8 and Figure 3.9 display the horizontal and vertical PGA distribution with respect to the Rrup, as well as their respective fitted trendlines.

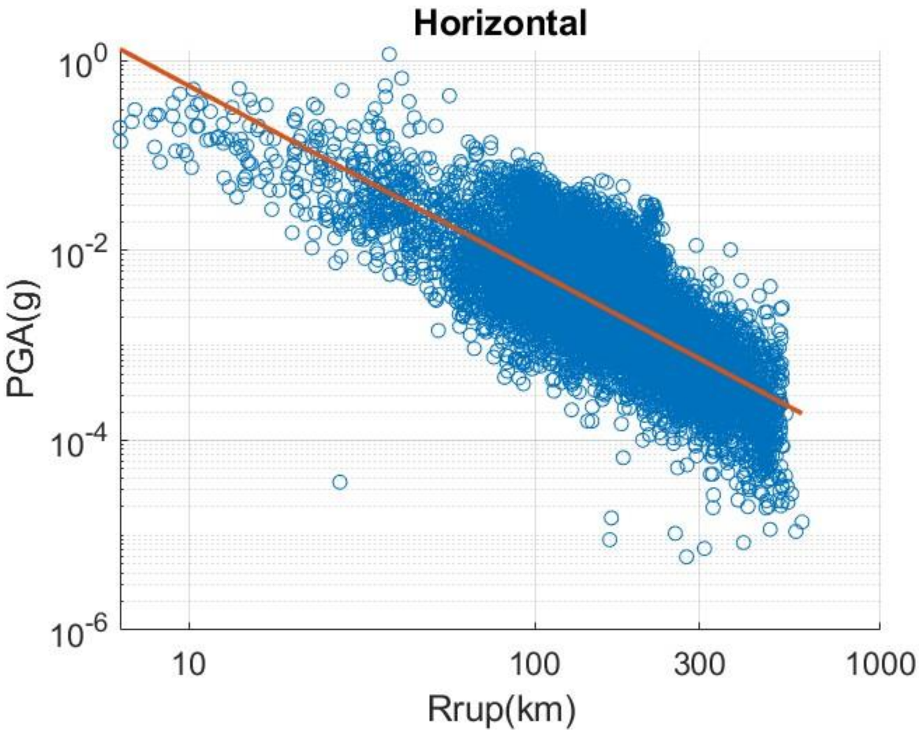


Figure 3.8 Horizontal PGA Distribution with Rrup



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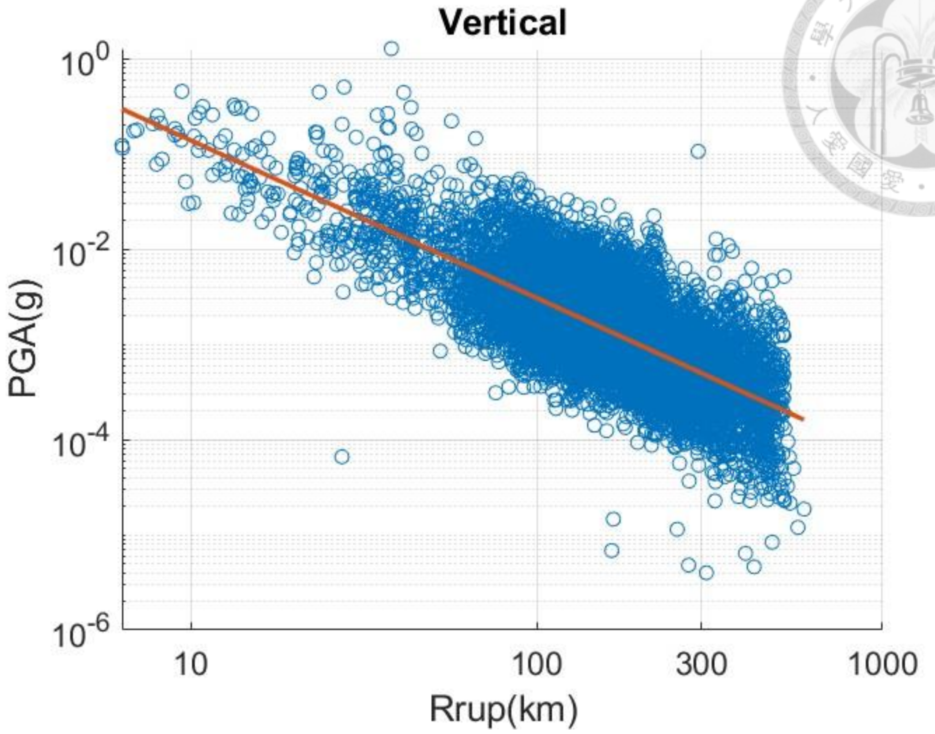


Figure 3.9 Vertical PGA Distribution with Rrup

Figure 3.10 and Figure 3.11 present the horizontal and vertical SA distribution with respect to the Rrup at five periods (0.1s, 0.3s, 1s, 3s, 5s), along with their corresponding trendlines.

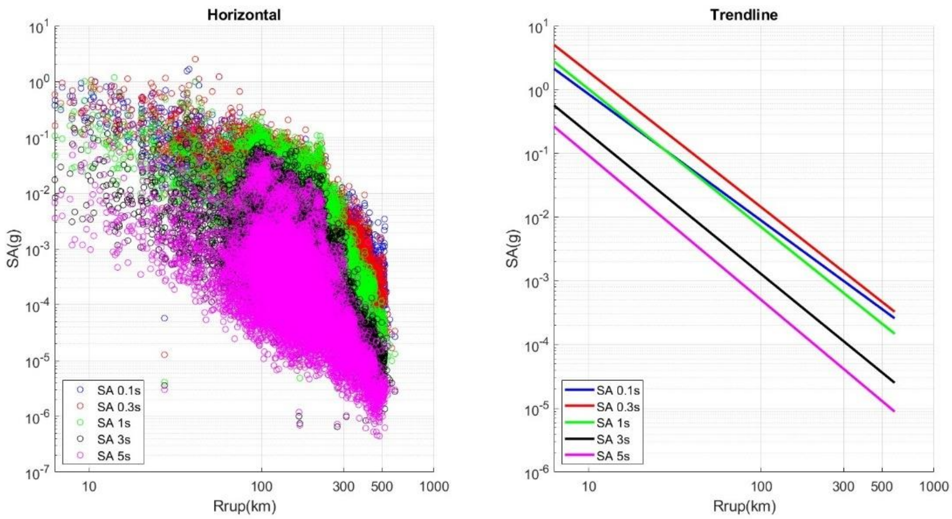


Figure 3.10 Horizontal PGA Distribution with Rrup



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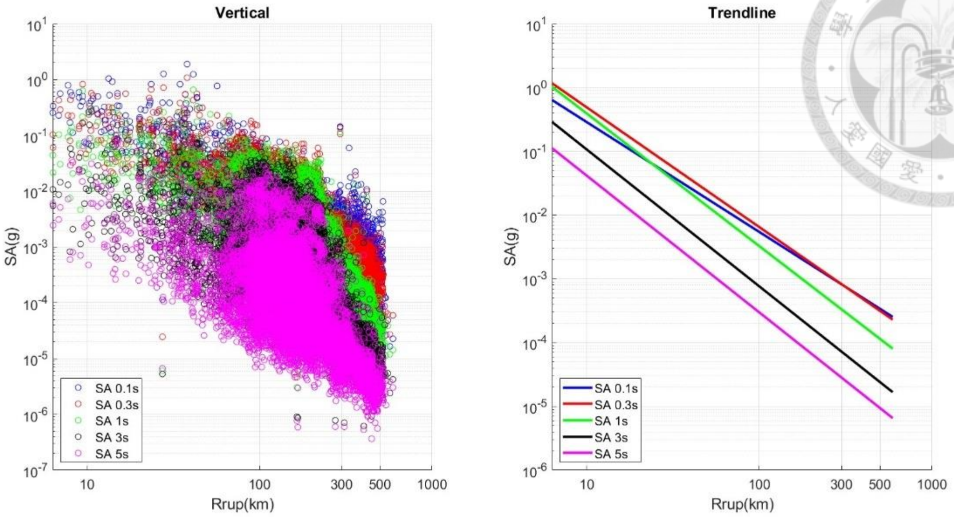


Figure 3.11 Vertical SA Distribution with Rrup

### 3.1.7 Statistical Distribution of the Strong-Motion Earthquake Data

This section presents the statistical distribution of parameters for the collected records in our database. Figurer 3.12 illustrates a bar chart displaying the distribution of earthquake moment magnitude bins for the selected 47 earthquakes. Figure 3.13 shows the distribution of earthquake moment magnitude and rupture distance Rrup. Figure 3.14 depicts the distribution of earthquake moment magnitude and the top depth of the rupture plane Ztor. Figure 3.15 is a histogram showcasing the distribution of Vs30 bins for TSMIP stations with recorded data. Figure 3.16 presents a histogram indicating the distribution of Z1.0 bins for TSMIP stations with recorded data. Figure 3.17 is a bar chart detailing site classification using the National Earthquake Hazards Reduction Program (NEHRP) Site Classification standard. Additionally, Figure 3.18 is a bar chart demonstrating earthquake source types. Among them, Crustal earthquakes can be categorized into three types: Reverse or Reverse-oblique fault (R/RO), Strike-slip fault (SS), and Normal or Normal-oblique fault (N/NO). Subduction zone earthquakes, on the other hand, are



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divided into interslab and intraslab, note that this study does not include any Crustal earthquakes of the N/NO type.

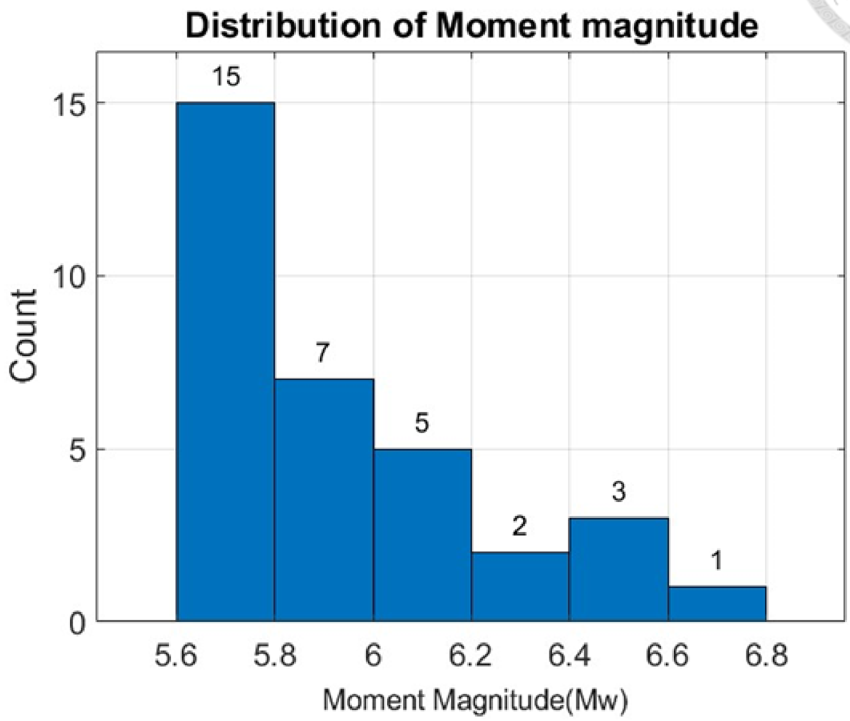


Figure 3.12 Distribution of Earthquake Moment Magnitude

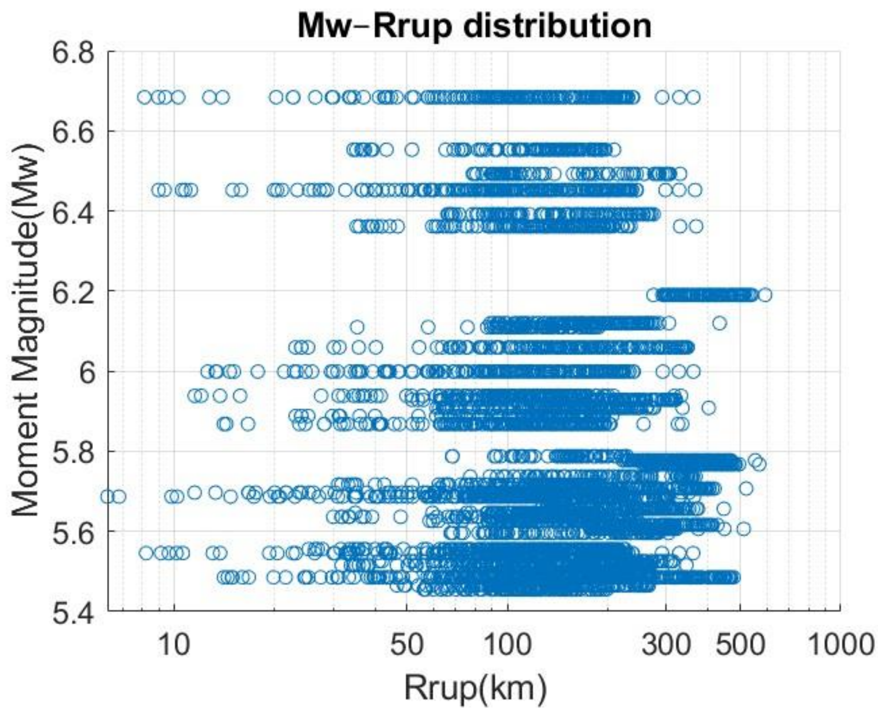


Figure 3.13 Distribution of Earthquake Moment Magnitude and Rrup



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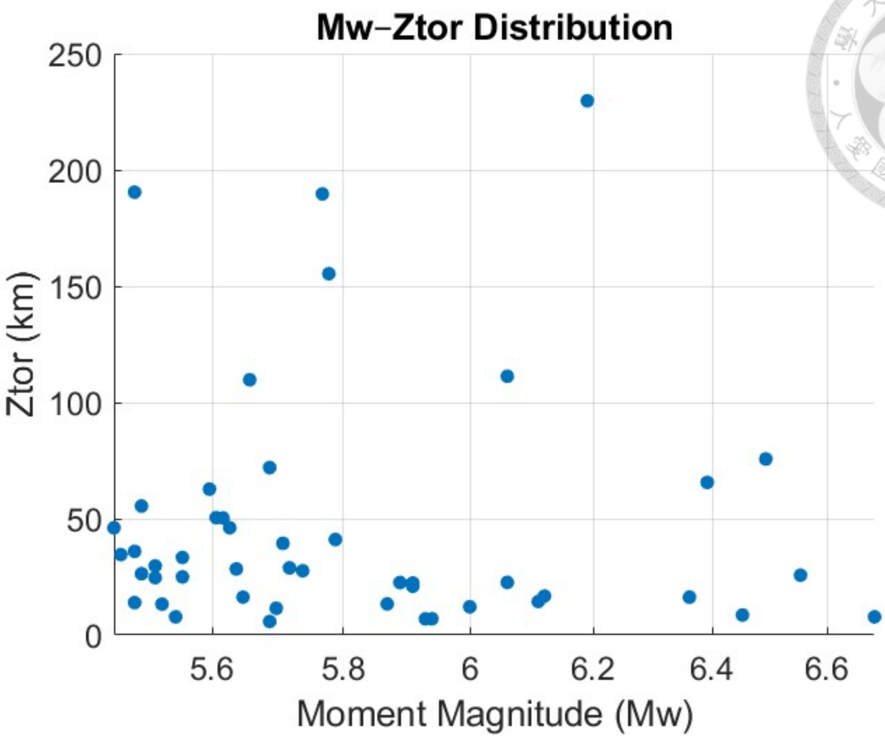

Figure 3.14 Distribution of Earthquake Moment Magnitude and Ztor

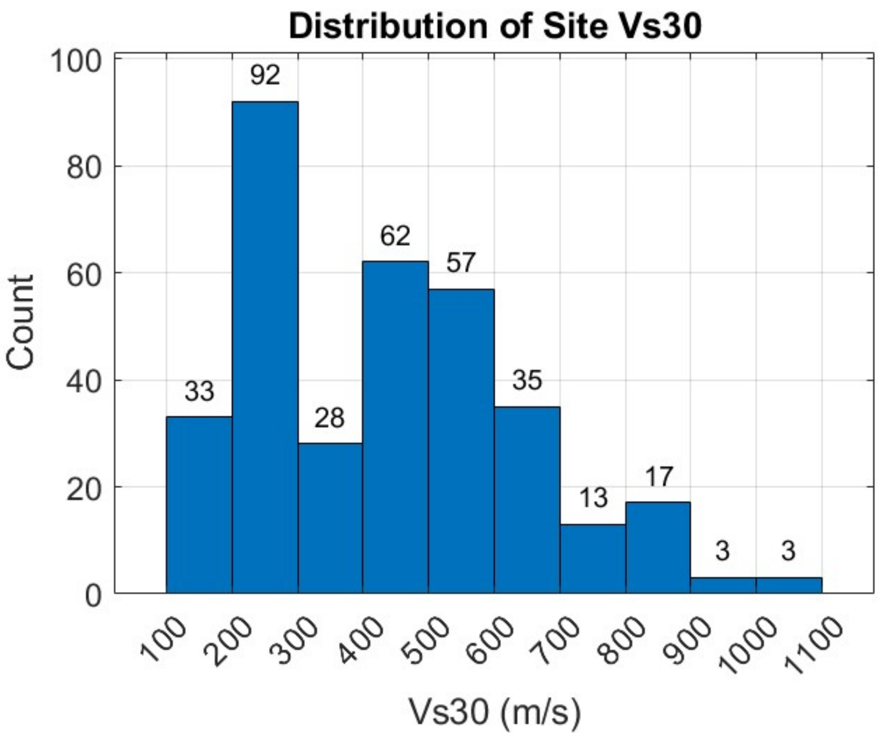

Figure 3.15 Distribution of Vs30 Bins for TSMIP Stations Histogram



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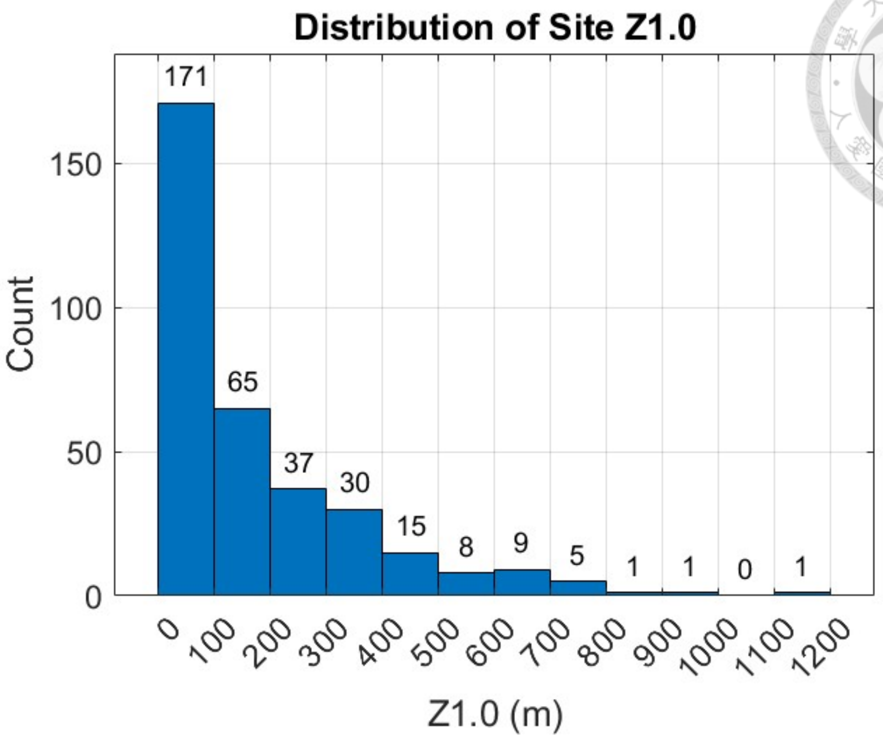


Figure 3.16 Distribution of Z1.0 Bins for TSMIP Stations Histogram

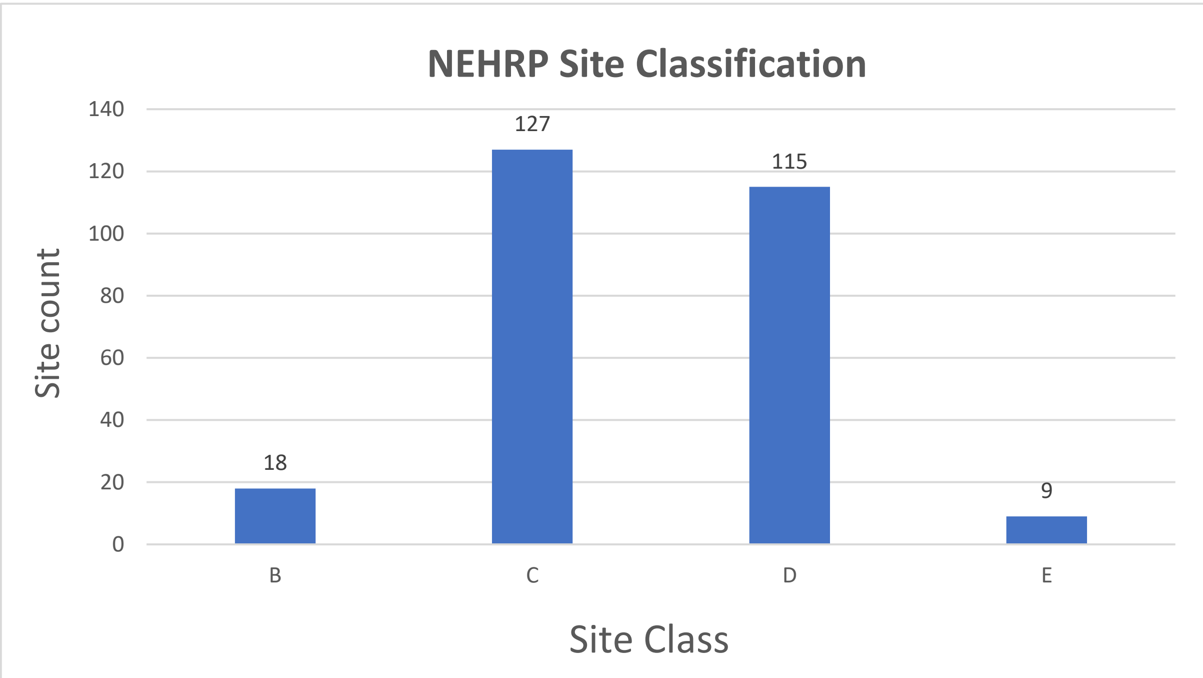


Figure 3.17 Site Classification Using NEHRP Standard Bar Chart



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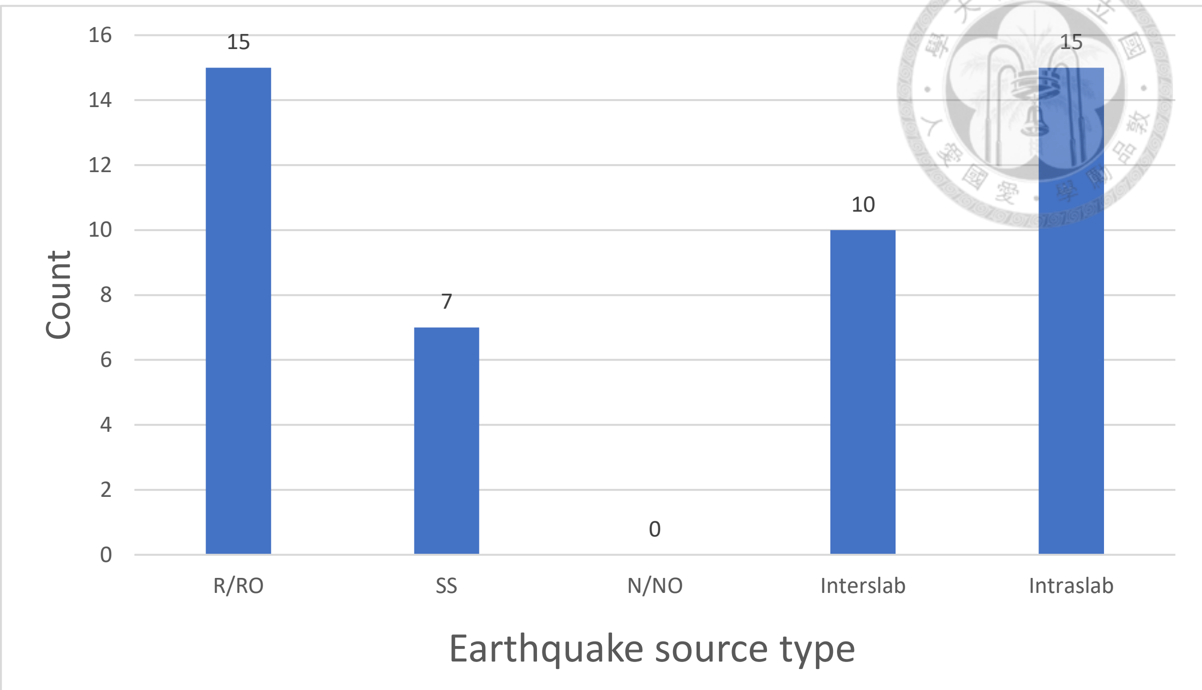


Figure 3.18 Earthquake Source Type Bar Chart

## 3.2 Apply Ground Motion Predict Equations

### 3.2.1 Function form of Median Model

Chao et al. (2020) employed the same function form for both vertical and horizontal Ground Motion Prediction Equations. This includes a calculated reference ground motion intensity corresponding to a specified reference scenario, supplemented by various scaling relationships. The function form is presented as follows:

$$\ln(S_a) = \ln(S_a)^{ref} + S_{source} + S_{path} + S_{site,lin} + S_{site,non} + \delta_e + \delta_s + \delta_r \qquad (3.5)$$

In the given equation, $\ln(S_a)$ represents the logarithmic value of the observed spectral acceleration, expressed in g units. Meanwhile, $\ln(S_a)^{ref}$ stands for the logarithmic value of the predicted median reference spectral acceleration for the reference



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ground-motion scenario, also in g units, $S_{source}$ and $S_{path}$ are the source and path scaling, respectively, explaining their individual effects on the median ground-motion intensity. Additionally, $S_{site,lin}$ and $S_{site,non}$ illustrate the linear and nonlinear site effects on the median ground-motion intensity, respectively. Residuals specific to the event, station, and record are denoted by $\delta_e$, $\delta_s$, and $\delta_r$ respectively.

The complete functional form of the median model encompasses the projected reference spectral acceleration for the reference ground-motion scenario, a variety of scaling relationships, and the functional form of the standard deviation model for different residual terms which will be detailed in the following text.

The spectral acceleration pertaining to the reference ground-motion scenario can be calculated as per the following equation:

$$\ln\left({S_a}^{ref}\right) = E^{ref} + S^{ref} \tag{3.6}$$

In this formula, $E^{ref}$ and $S^{ref}$ are constants that denote the event and station terms for the reference ground-motion scenario. The functional form of the event term for the reference ground-motion scenario is expressed as follows:

$$E^{ref} = c_1F_{cr,ro} + c_2F_{cr,ss} + c_3F_{cr,no} + c_4F_{sb,inter} + c_5F_{sb,intra} + c_6F_{as} + c_7F_{manila} \tag{3.7}$$

Here, $c_j$ stands for the jth model coefficient. Flags are employed to denote distinct earthquake categories: $F_{cr,ro}$ is assigned a value of 1 for crustal earthquakes with a reverse fault and 0 in all other cases; $F_{cr,ss}$ takes a value of 1 for crustal earthquakes featuring a strike-slip fault and 0 otherwise; $F_{cr,no}$ receives a value of 1 for normal fault



doi:10.6342/NTU202303258

crustal earthquakes and 0 for the rest; $F_{sb,inter}$ is given a value of 1 for subduction interface earthquakes and 0 in other situations; $F_{sb,intra}$ has a value of 1 for subduction intraslab earthquakes and 0 for the rest; $F_{as}$ designates aftershocks with a value of 1 and mainshocks with 0; Lastly, $F_{manila}$ is used to specify subduction earthquakes in the Manila subduction zone with a value of 1 and subduction earthquakes in the Ryukyu subduction zone with a value of 0.

The functional form of the station term for the reference ground-motion scenario is as follows:

$$S^{ref} = c_{26}F_{measured} + c_{27}F_{geology} + c_{28}F_{seismic} \tag{3.8}$$

In this formula, $F_{measured}$ is a flag with a value of 1 for the measured Vs30 value (Kuo et al., 2017) and 0 otherwise; $F_{geology}$ represents the inferred Vs30 value determined through geological data (Kwok et al., 2018) with a value of 1, and 0 for the rest; $F_{seismic}$ is a flag for the Vs30 value inferred from receiver function analysis using seismic data (Lin et al., 2018) with a value of 1, and 0 otherwise.

The functional form of source scaling can be formulated as:

$$S_{source} = S_{mag} + S_{Ztor} \tag{3.9}$$

Here, $S_{mag}$ denotes the magnitude scaling, which illustrates the change in the ground-motion intensity as a result of variation in the earthquake magnitude, while $S_{Ztor}$ represents the depth scaling that portrays the variation in the ground-motion intensity due to shifts in the earthquake depth.

Magnitude scaling can be presented as follows:



doi:10.6342/NTU202303258

$$S_{mag} = S_{mag,cr}F_{cr} + S_{mag,sb}F_{sb} \tag{3.10}$$

Here, $F_{cr}$ is a flag assigned a value of 1 for crustal earthquakes and $F_{sb}$ is a flag with a value of 1 for subduction earthquakes and 0 for others. The magnitude scaling for crustal and subduction earthquakes are depicted by $S_{mag,cr}$ and $S_{mag,sb}$, respectively.

The magnitude scaling of a crustal earthquake is denoted as:

$$\begin{aligned} S_{mag,cr} = {} & c_8\left(M_w - {M_w}^{ref}\right) + c_{10}\left(M_w - {M_w}^{ref}\right)^2 \\ & - c_{10}(M_w - 7.6)^2 u(M_w - 7.6) + c_{11}(5 - M_w)u(5 - M_w) \end{aligned} \tag{3.11}$$

In this case, $u$ represents the Heaviside function, which can take a value of 0 or 1. The reference magnitude ${M_w}^{ref}$ is set as 6.5.

The magnitude scaling of subduction earthquakes is represented as:

$$\begin{aligned} S_{mag,sb} = {} & c_9\left(M_w - {M_w}^{ref}\right) + c_{12}(5 - M_w)u(5 - M_w) \\ & + c_{13}(6 - M_w)u(6 - M_w) \\ & + c_{29}F_{sb,inter}(M_w - M_c)u(M_w - M_c) \\ & + c_{30}F_{sb,intra}(M_w - M_c)u(M_w - M_c) \end{aligned} \tag{3.12}$$

The depth scaling can be presented as follows:

$$\begin{aligned} S_{Ztor} = {} & c_{14}F_{cr}\left(Z_{tor} - Z^{ref}{}_{tor,cr}\right) + c_{15}F_{sb,inter}\left(Z_{tor} - Z^{ref}{}_{tor,sb,inter}\right) \\ & + c_{16}F_{sb,intra}\left(Z_{tor} - Z^{ref}{}_{tor,sb,intra}\right) \end{aligned} \tag{3.13}$$



doi:10.6342/NTU202303258

For crustal earthquakes, the reference depth to the top of the rupture plane $Z^{ref}{}_{tor,cr}$ is set at 0 km. For subduction interface earthquakes $Z^{ref}{}_{tor,sb,inter}$, it's also set at 0 km, whereas for subduction intraslab earthquakes $Z^{ref}{}_{tor,sb,intra}$, it's set at 35 km, reflecting the shallowest possible depth for each source.

The path scaling for the proposed ground-motion model can be expressed as:

$$S_{path} = S_{geom} + S_{anel} \tag{3.14}$$

$S_{geom}$ illustrates the geometric attenuation scaling, which reflects the geometric attenuation of the ground-motion intensity. In contrast, $S_{anel}$ signifies the anelastic attenuation scaling that explains the anelastic attenuation of the ground-motion intensity.

The geometric attenuation scaling of the suggested ground-motion model can be presented as follows:

$$S_{geom} = S_{geom,cr}F_{cr} + S_{geom,sb}F_{sb} \tag{3.15}$$

$$S_{geom,cr} = \left[c_{17} + c_{19}\left(M_w - M_w{}^{ref}\right)\right]\ln\left(\frac{\sqrt{R_{rup}{}^2 + H^2}}{\sqrt{\left(R^{ref}{}_{rup}\right)^2 + H^2}}\right) \tag{3.16}$$

$$S_{geom,sb} = \left[c_{18} + c_{20}\left(min\{M_w, M_c\} - M_w{}^{ref}\right)\right]\ln\left(\frac{\sqrt{R_{rup}{}^2 + H^2}}{\sqrt{\left(R^{ref}{}_{rup}\right)^2 + H^2}}\right) \tag{3.17}$$

Here, $S_{geom,cr}$ represents the geometric attenuation of crustal earthquakes and



doi:10.6342/NTU202303258

$S_{geom,sb}$ denotes the geometric attenuation of subduction earthquakes. The finite-fault term, H, can be obtained from the following equation:

$$H = hF_{cr} + hF_{sb,inter}exp\left(c_{4_{inter}}(M_w - M_c)u(M_w - M_c)\right) + hF_{sb,intra}exp\left(c_{4_{intra}}(M_w - M_c)u(M_w - M_c)\right) \quad (3.18)$$

In this equation, h, $C_{4inter}$, and $C_{4intra}$ are model coefficients. The anelastic attenuation scaling of the proposed ground-motion model can be presented as follows:

$$S_{anel} = c_{21}F_{cr}\left(R_{rup} - {R_{rup}}^{ref}\right) + c_{22}F_{sb}\left(R_{rup} - {R_{rup}}^{ref}\right) \quad (3.19)$$

For this equation, the reference shortest distance from the station to the rupture plane ${R_{rup}}^{ref}$ is established at 0 km.

The linear site effect model can be presented as follows:

$$S_{site,lin} = c_{24}\ln\left(\frac{Vs_{30}}{{Vs_{30}}^{ref}}\right) + c_{25}\ln\left(\frac{Z_{1.0}}{{Z_{1.0}}^{ref}}\right) \quad (3.20)$$

In this formular, the Vs30 value of the reference ground-motion scenario ${Vs_{30}}^{ref}$ is determined as 760 m/s. The Z1.0 value of the reference ground-motion scenario ${Z_{1.0}}^{ref}$ can be calculated using the Z1.0 versus Vs30 relationship developed by Kuo et al. (2017):

$$ {Z_{1.0}}^{ref} = exp\left(\frac{-4.08}{2}\ln\left(\frac{{Vs_{30}}^2 + 355.4^2}{1750^2 + 355.4^2}\right)\right) \quad (3.21)$$



doi:10.6342/NTU202303258

Finally, the functional form of the scaling of the nonlinear site effect can be presented as follows:

$$S_{site,non} = c_{23}u({Vs_{30}}^{ref} - Vs_{30})\left\{-1.5\ln\left(\frac{Vs_{30}}{{Vs_{30}}^{ref}}\right) - \ln\left(\hat{S}_{a1180} + 2.4\right) + \ln\left(\hat{S}_{a1180} + 2.4\left(\frac{Vs_{30}}{{Vs_{30}}^{ref}}\right)^{1.5}\right)\right\} \quad (3.22)$$

In this case, Sa1180 refers to the estimated ground-motion intensity for a rock site with a Vs30 value of 1180 m/s, under the same source and path conditions as in the ground-motion scenario.

### 3.2.2 Function form of Sigma Model

The Sigma Model by Chao et al. (2020) is partitioned into three distinct terms: the event-specific residual term, the site-specific residual term, and the record-specific residual term. The event-specific residual, denoted as $\delta_e$, is identified as a normal random variable with a mean value of zero and a standard deviation of $\tau$. The functional form of the event-specific residual is as follows:

$$\delta_e = N(0, \tau) \quad (3.23)$$

Here, $N(0, \tau)$ represents a normal random variable with a mean of μ and a standard deviation of $\tau$. The model for $\tau$ is presented as follows:

$$\tau = \tau_{cr}F_{cr} + \tau_{sb}F_{sb} \quad (3.24)$$

Within this equation, $\tau_{cr}$ and $\tau_{sb}$ symbolize the standard deviation of the event-



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specific residual for crustal earthquakes and subduction earthquakes respectively. Their functional forms are articulated as:

$$\tau_{cr} = \tau_{1,cr} + \left(\tau_{2,cr} - \tau_{1,cr}\right) f(M) \tag{3.25}$$

$$\tau_{sb} = \tau_{1,sb} + \left(\tau_{2,sb} - \tau_{1,sb}\right) f(M) \tag{3.26}$$

$$f(M) = 0.5\left\{min\left\{6.5, max\{4.5, M_w\}\right\} - 4.5\right\} \tag{3.27}$$

The terms $\tau_{1,cr}$, $\tau_{2,cr}$ and $\tau_{1,sb}$, $\tau_{2,sb}$ are the standard deviations of the event-specific residual for crustal and subduction earthquakes with Mw values of 4.5 and 6.5, respectively. These are model coefficients of the proposed $\tau$, derived from the regression analysis. The station-specific residual, $\delta_s$, is assumed to be a normal random variable with a mean value of zero and a standard deviation of ϕs2s. It is expressed as follows:

$$\delta_s = N(0, \Phi_{s2s}) \tag{3.28}$$

The standard deviation $\Phi_{s2s}$ is derived from the regression analysis. The record-specific residual, $\delta_r$, is a normal random variable with a zero mean value and a standard deviation of $\Phi_{ss}$. It is presented as follows:

$$\delta_r = N(0, \Phi_{ss}) \tag{3.29}$$

The model for $\Phi_{ss}$ can be expressed as:



doi:10.6342/NTU202303258

$$\Phi_{ss} = \Phi_{ss,cr}F_{cr} + \Phi_{ss,sb}F_{sb} \tag{3.30}$$

Within these equations, $\Phi_{ss,cr}$ and $\Phi_{ss,sb}$ stand for the standard deviations of the record-specific residuals for crustal and subduction earthquakes, respectively. They are presented as:

$$\Phi_{ss,cr} = \Phi_{ss1,cr} + \left(\Phi_{ss2,cr} - \Phi_{ss1,cr}\right)f(M) \tag{3.31}$$

$$\Phi_{ss,sb} = \Phi_{ss1,sb} + \left(\Phi_{ss2,sb} - \Phi_{ss1,sb}\right)f(M) \tag{3.32}$$

The terms $\Phi_{ss1,cr}$, $\Phi_{ss2,cr}$, $\Phi_{ss1,sb}$, and $\Phi_{ss2,sb}$ are the standard deviations of record-specific residuals for crustal and subduction earthquakes with Mw values of 4.5 and 6.5, respectively. These coefficients of the proposed $\Phi_{ss}$ are derived from the regression analysis.

In conclusion, the standard deviation of the total residual can be symbolized as:

$$\sigma_T = \sqrt{\tau^2 + {\Phi_{s2s}}^2 + {\Phi_{ss}}^2} \tag{3.33}$$

$\tau$ is the standard deviation of the inter-event residual, while the standard deviation of the intra-event residual σ can be calculated using the following formula:

$$\sigma = \sqrt{{\Phi_{s2s}}^2 + {\Phi_{ss}}^2} \tag{3.34}$$

Table 3.3 presents a summary of the required input parameters and output results for both the Median Model and the Sigma Model used in GMPEs.



doi:10.6342/NTU202303258

Table 3.4 GPMEs Input and Output Parameters

| Input Parameters Definition | Output Parameters Definition |
|---|---|
| 1. Period (s)<br>2. Moment Magnitude<br>3. Rrup (km)<br>4. Ztor (km)<br>5. Vs30 (m/s)<br>6. Z1.0 (m)<br>7. FRO: Flag for the R/RO fault of crustal earthquake.<br>8. FSS: Flag for the SS fault of crustal earthquake.<br>9. FNO: Flag for the N/NO fault of crustal earthquake.<br>10. FInter: Flag for the interface earthquake.<br>11. FIntra: Flag for the intraface earthquake.<br>12. Fas: Flag for the aftershock earthquake.<br>13. Fma: Flag for the Manila Subduction.<br>14. FVS30: Flag for the source of Vs30 (measured or inferred) | 1. Spectral Acceleration(g)<br>2. $\tau$ : Between event standard deviation.<br>3. $\varphi_{ss}$: Single station standard deviation.<br>4. $\varphi_{s2s}$: Between site standard deviation |

### 3.2.3 Residuals Analysis

Each seismic record includes information such as magnitude, distance, depth, earthquake source type and Focal mechanism, VS30, and Z1.0. By inputting these parameters into the GMPEs, we can obtain the predicted ground motion value for the earthquake. The difference between this predicted value and the actual observed value is known as the total residual. As detailed in Section 2.3, the total residual can be further decomposed into inter-event residuals and intra-event residuals. Positive residuals indicate under-prediction, while negative residuals denote over-prediction.



doi:10.6342/NTU202303258

Insufficient earthquake characteristics or the use of different types of parameters in GMPEs may be potential sources of error. We can examine the assumptions and appropriateness of the model through the distribution of residuals, thus ensuring the suitability of the analysis results and the data.

Residual histograms can be used to assess whether the residuals approach a normal distribution. By plotting the residuals against various parameters and corresponding trendlines, we can observe the state of the mean and whether the data exhibits any significant trends.

The outcomes of the residual analyses are presented in Figure 3.19 through Figure 3.60. Based on these Figures; the following observations are made.

1. The Histogram of Horizontal and Vertical Total Residuals for different periods suggests that the residuals approach a normal distribution. The mean values of the total residuals for both directions are nearly negative: approximately -0.6 for the horizontal direction and around -0.4 for the vertical direction. This implies that the results of the incorporated GMPEs are over-predicted. However, the averages of total residuals in both directions fall within the range of the total standard deviation (approximately 0.7-0.8), and the distribution of residuals is roughly symmetrical about the mean.
2. In the analysis of residual values against parameters, the Moment Magnitude vs. Total Residual Distribution Plot shows that the distribution of residuals is symmetric around the mean with no apparent trend. Some outlier earthquake residuals stand out. Upon inspection of the data, these are mostly intraslab type earthquakes in the offshore areas of Yilan and Hualien. In contrast, the depth vs. total residual distribution plot shows that with increasing depth, there is a downward trend in residuals.



doi:10.6342/NTU202303258

3. The analysis of residuals against site parameters Vs30 and Z1.0 shows that the distribution of residuals is roughly symmetric around the mean. As the period increases, the average of all residuals comes closer to the horizontal line at mean = 0.

4. The analysis of the Rrup vs. total residual distribution plot reveals a clear trend in the distribution of residuals. There is a distinct downward trend in residuals when Rrup exceeds 200KM, with residuals almost always falling into negative values. The degree of deviation in the horizontal direction is more noticeable than in the vertical direction.

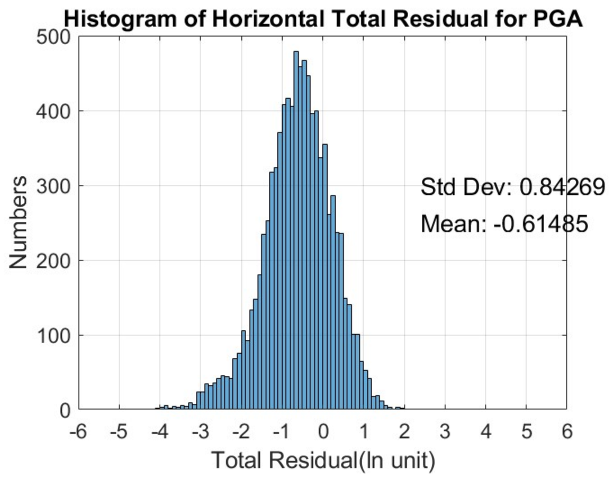

Figure 3.19 Histogram of Horizontal Total Residual for PGA

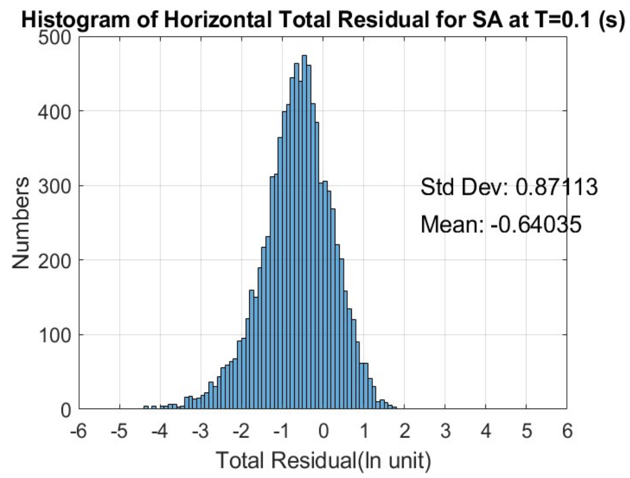

Figure 3.20 Histogram of Horizontal Total Residual for SA at T=0.1(s)



doi:10.6342/NTU202303258

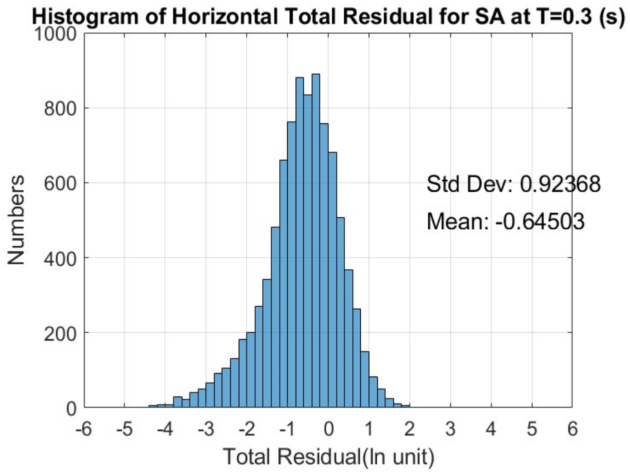


Figure 3.21 Histogram of Horizontal Total Residual for SA at T=0.3(s)

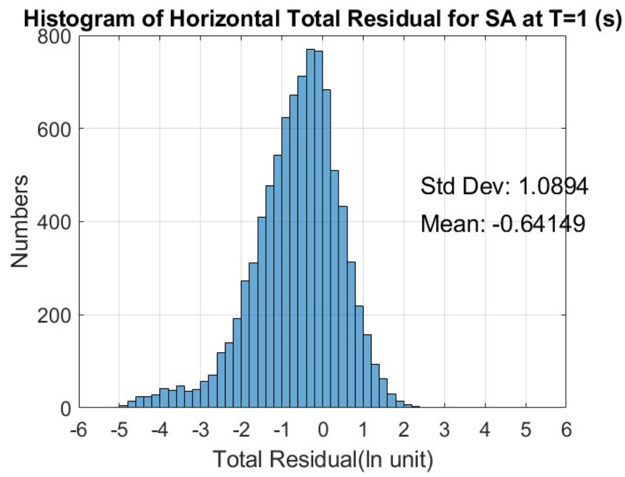


Figure 3.22 Histogram of Horizontal Total Residual for SA at T=1(s)

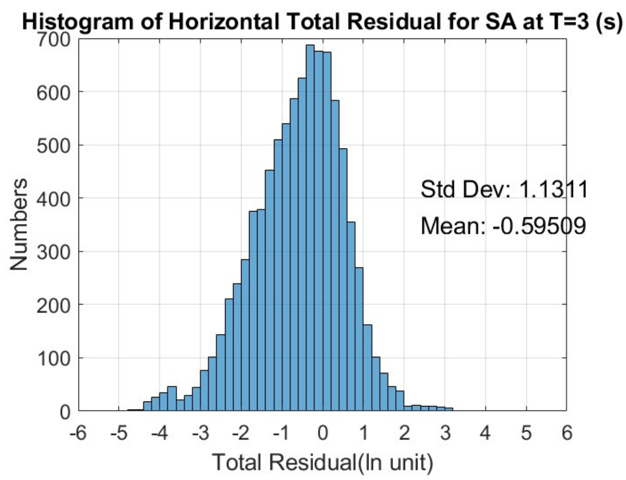


Figure 3.23 Histogram of Horizontal Total Residual for SA at T=3(s)



doi:10.6342/NTU202303258

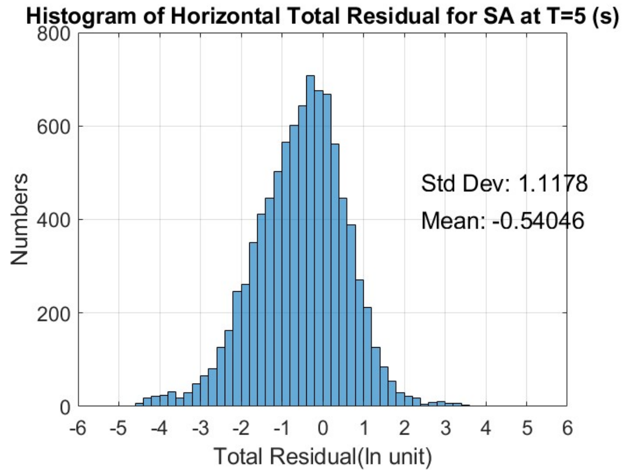

Figure 3.24 Histogram of Horizontal Total Residual for SA at T=5(s)

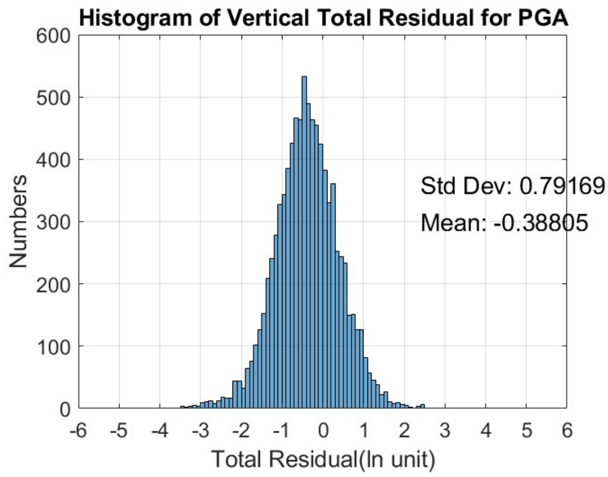

Figure 3.25 Histogram of Vertical Total Residual for PGA

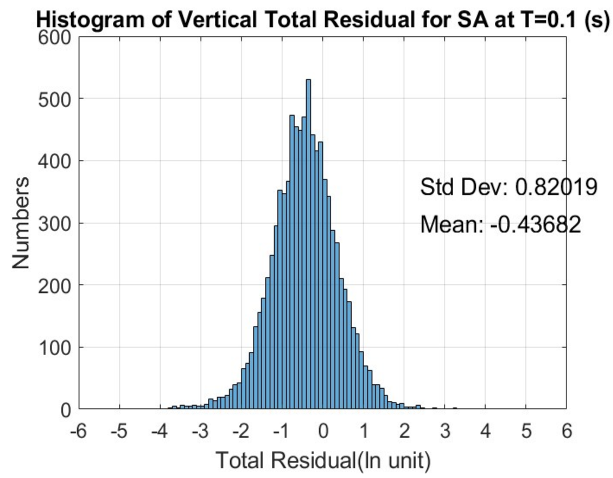

Figure 3.26 Histogram of Vertical Total Residual for SA at T=0.1(s)



doi:10.6342/NTU202303258

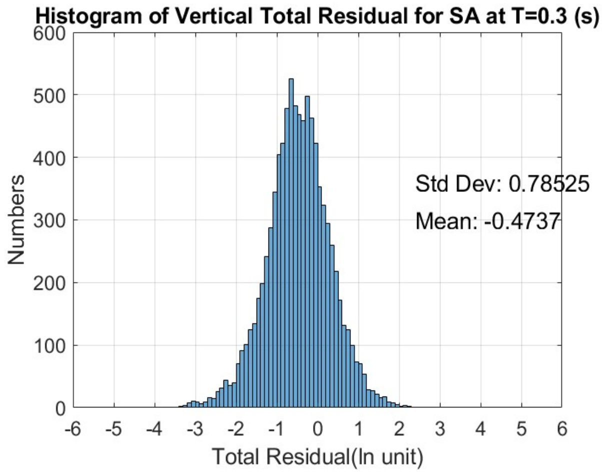


Figure 3.27 Histogram of Vertical Total Residual for SA at T=0.3(s)

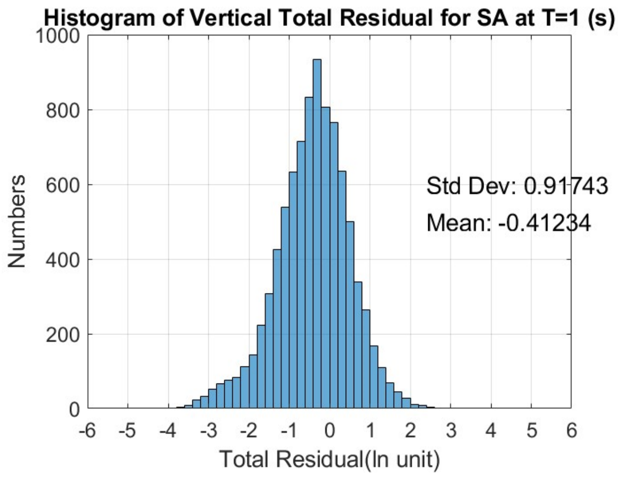


Figure 3.28 Histogram of Vertical Total Residual for SA at T=1(s)

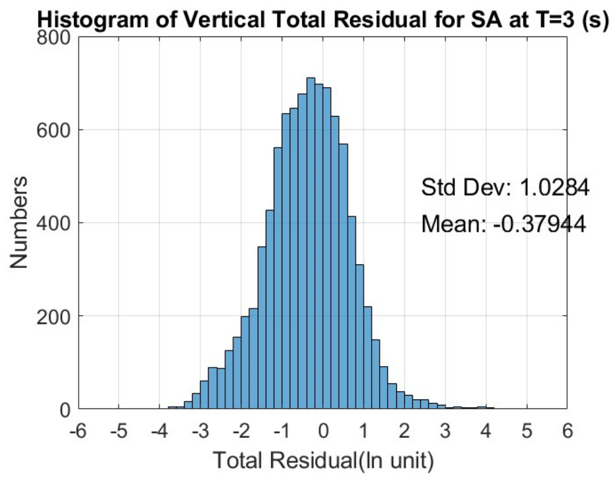


Figure 3.29 Histogram of Vertical Total Residual for SA at T=3(s)



doi:10.6342/NTU202303258

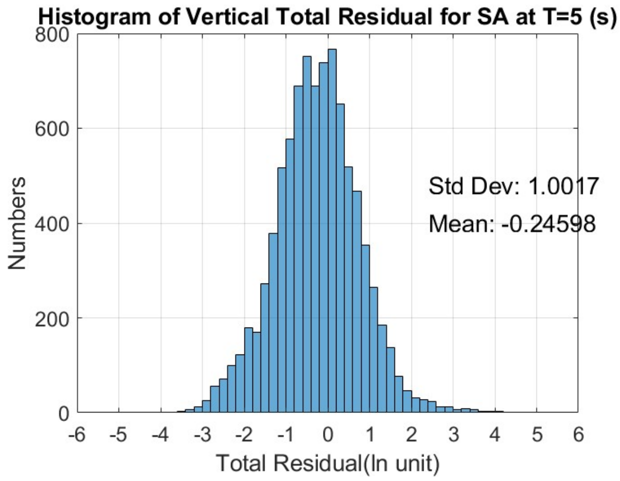


Figure 3.30 Histogram of Vertical Total Residual for SA at T=5(s)

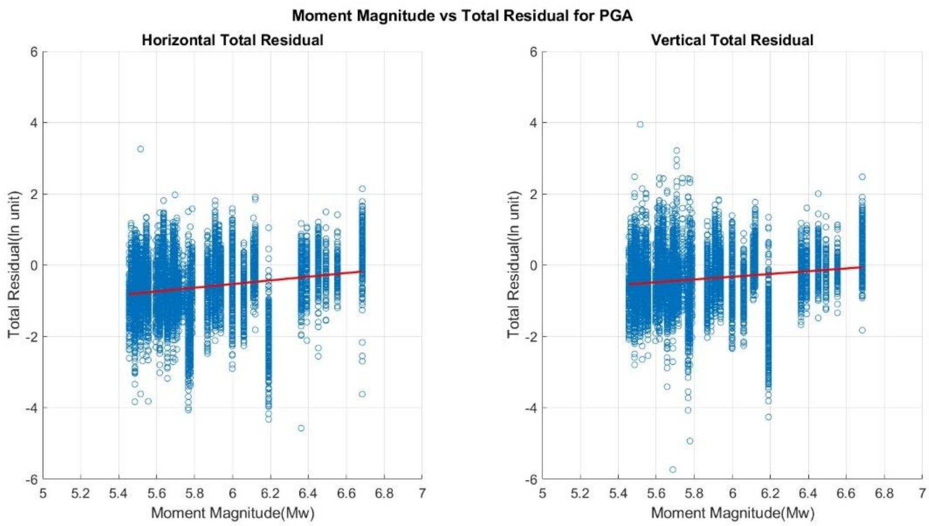


Figure 3.31 Moment Magnitude vs. Total Residual Distribution Plot for PGA



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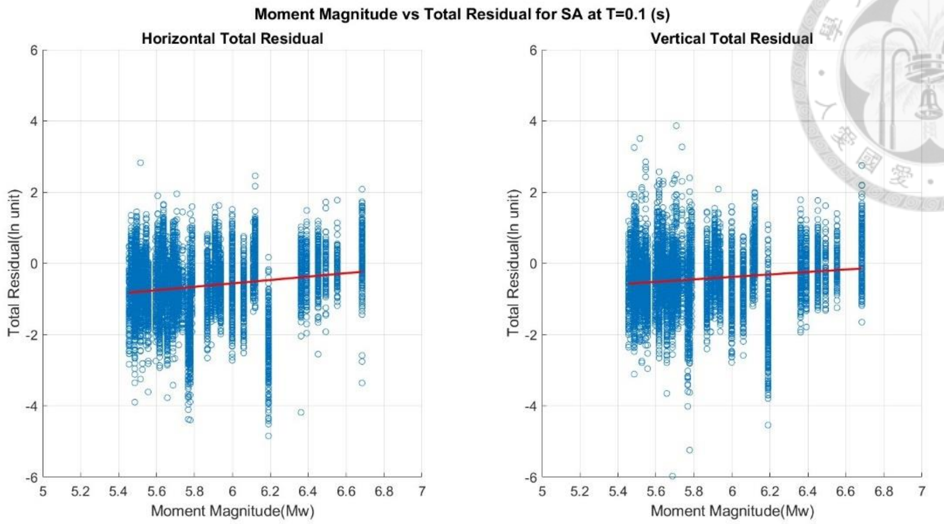


Figure 3.32 Moment Magnitude vs. Total Residual Distribution Plot for SA at T=0.1(s)

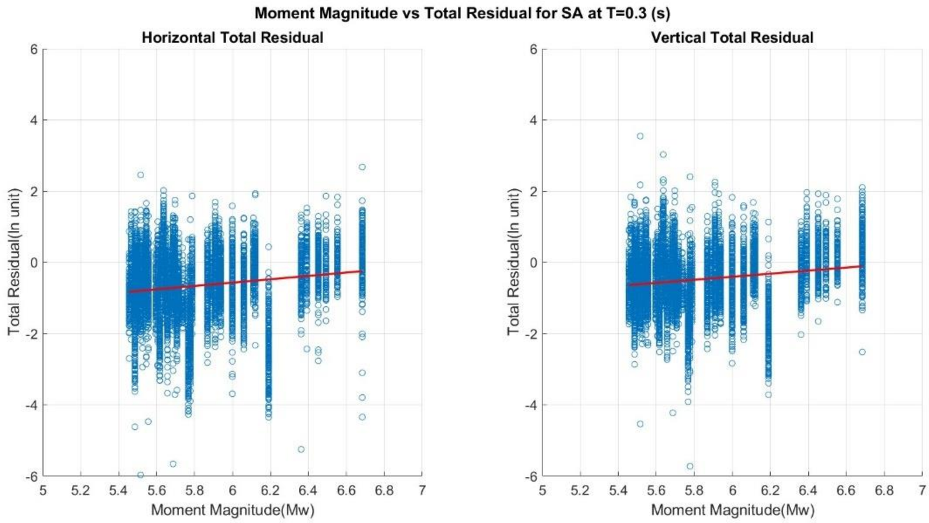


Figure 3.33 Moment Magnitude vs. Total Residual Distribution Plot for SA at T=0.3(s)



doi:10.6342/NTU202303258

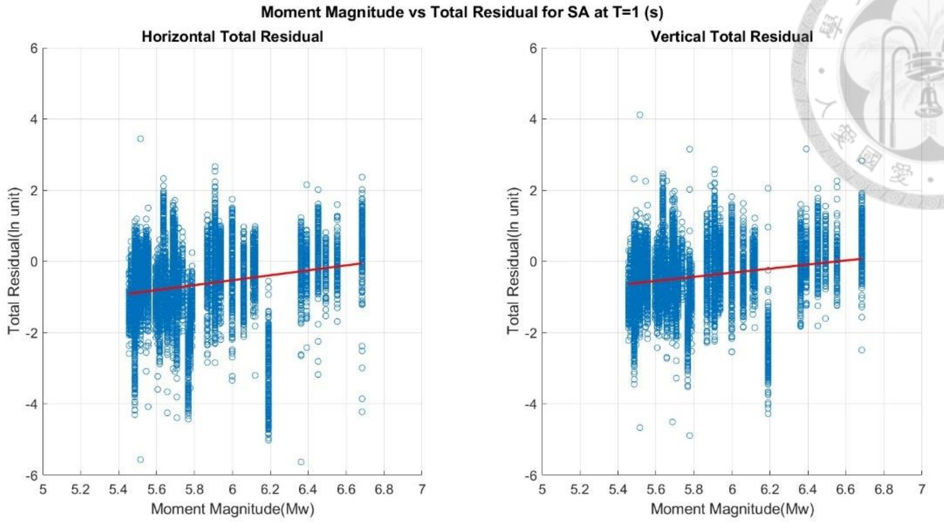


Figure 3.34 Moment Magnitude vs. Total Residual Distribution Plot for SA at T=1(s)

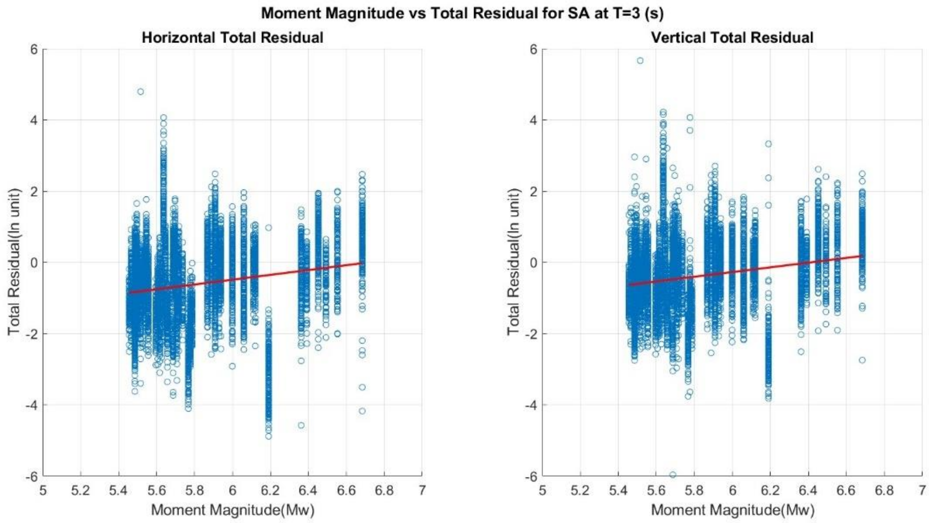


Figure 3.35 Moment Magnitude vs. Total Residual Distribution Plot for SA at T=3(s)



doi:10.6342/NTU202303258

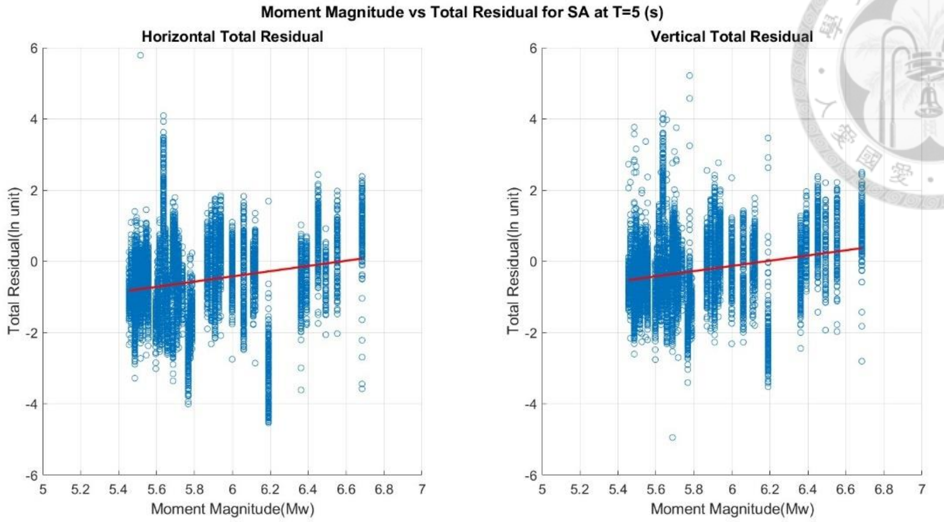


Figure 3.36 Moment Magnitude vs. Total Residual Distribution Plot for SA at T=5(s)

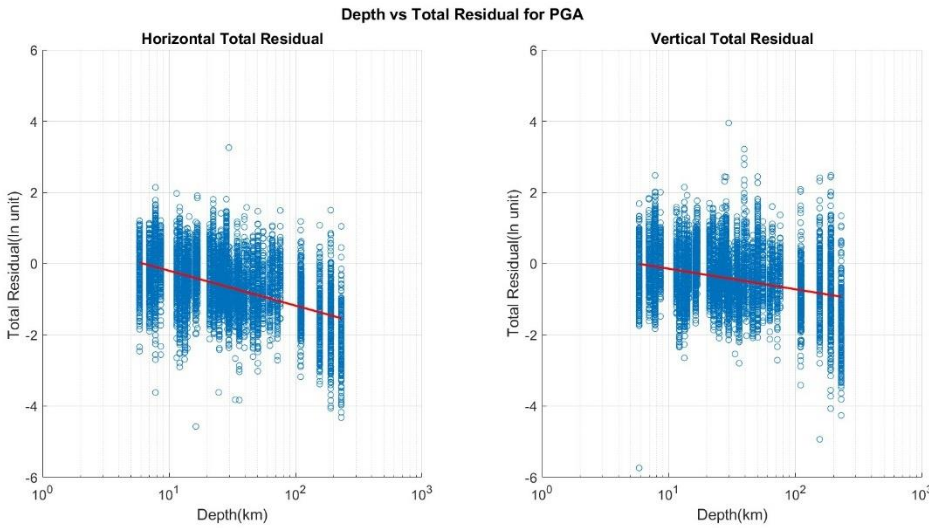


Figure 3.37 Depth vs. Total Residual Distribution Plot for PGA



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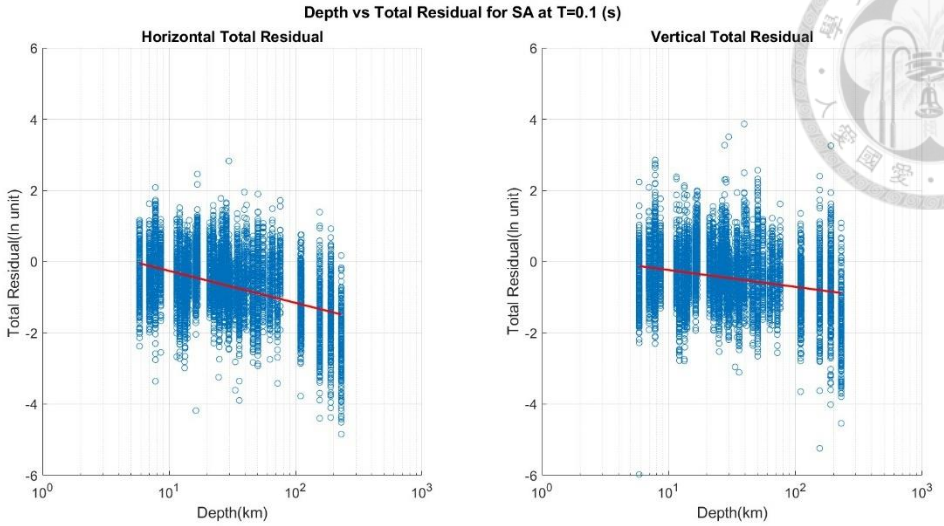


Figure 3.38 Depth vs. Total Residual Distribution Plot for SA at T=0.1(s)

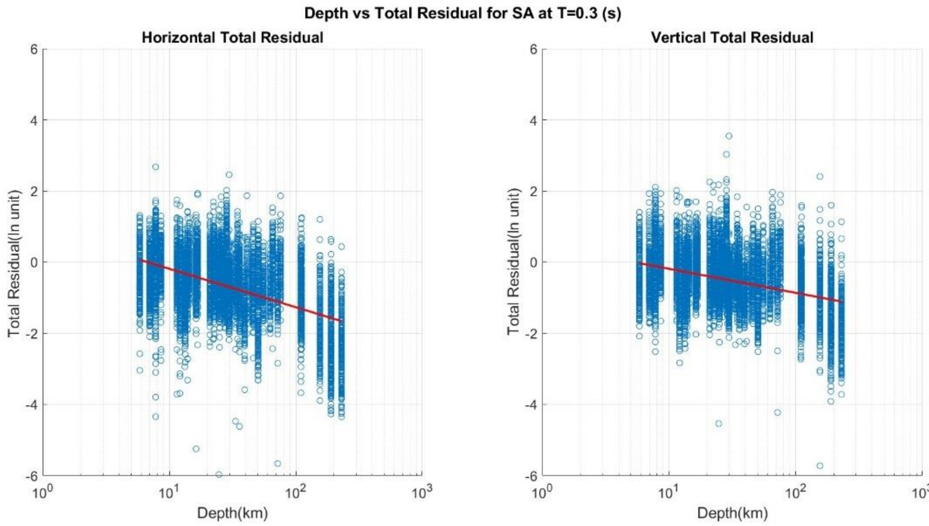


Figure 3.39 Depth vs. Total Residual Distribution Plot for SA at T=0.3(s)



doi:10.6342/NTU202303258

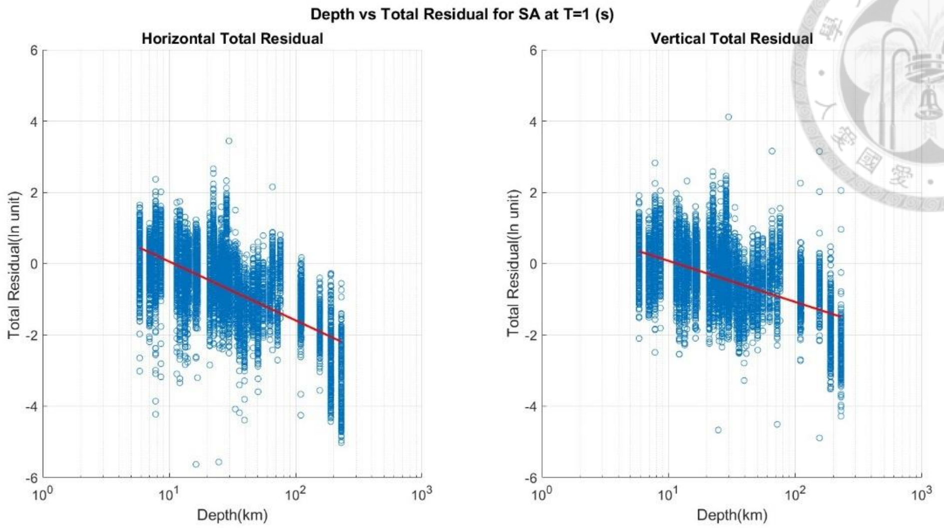


Figure 3.40 Depth vs. Total Residual Distribution Plot for SA at T=1(s)

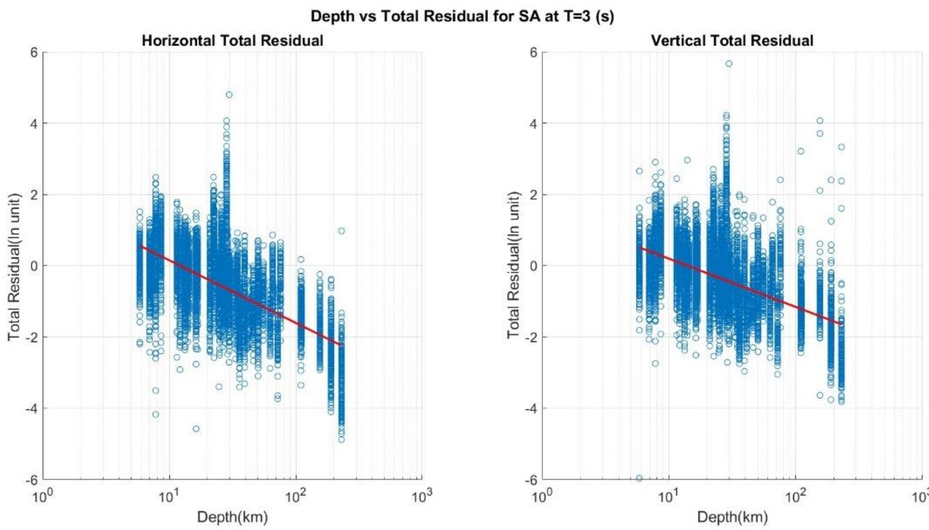


Figure 3.41 Depth vs. Total Residual Distribution Plot for SA at T=3(s)



doi:10.6342/NTU202303258

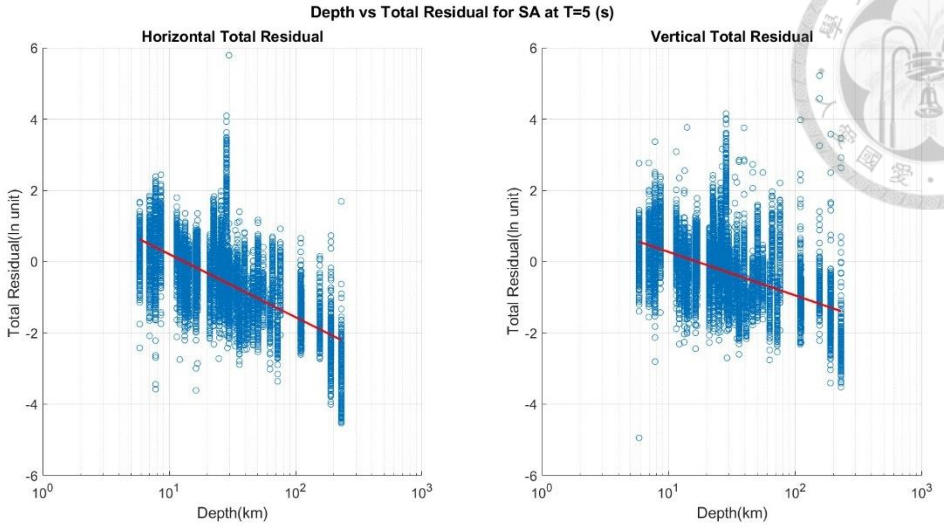


Figure 3.42 Depth vs. Total Residual Distribution Plot for SA at T=5(s)

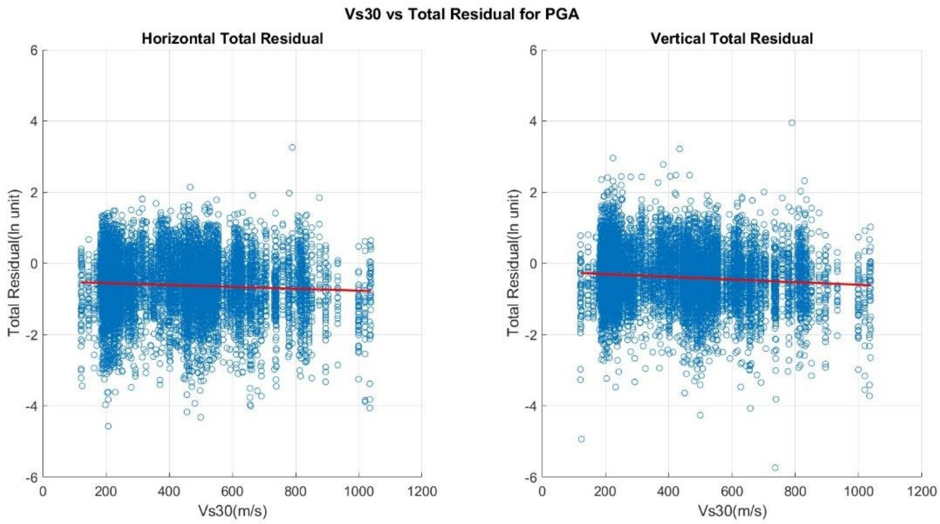


Figure 3.43 Vs30 vs. Total Residual Distribution Plot for PGA



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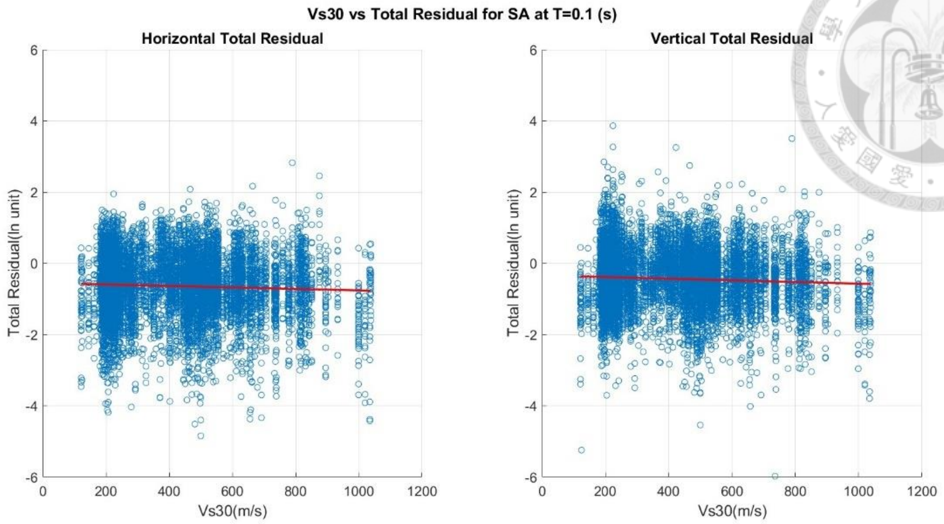


Figure 3.44 Vs30 vs. Total Residual Distribution Plot for SA at T=0.1(s)

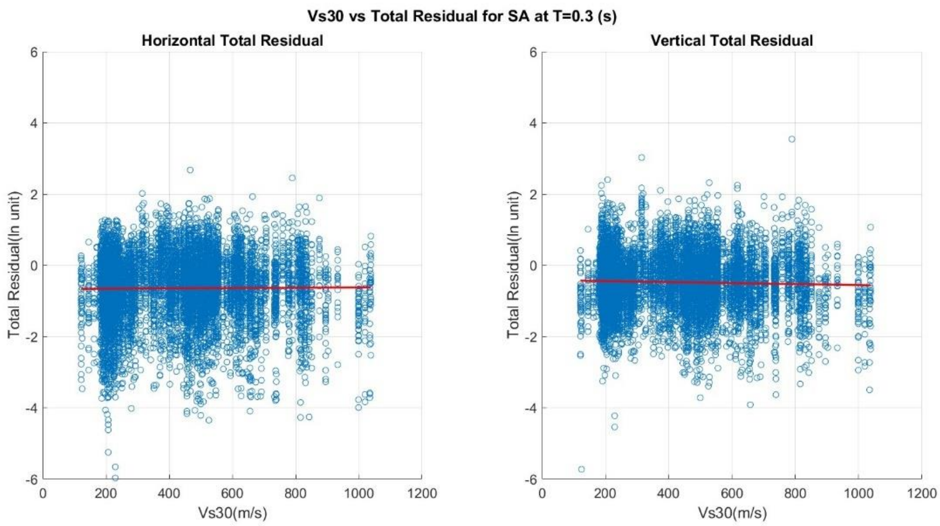


Figure 3.45 Vs30 vs. Total Residual Distribution Plot for SA at T=0.3(s)



doi:10.6342/NTU202303258

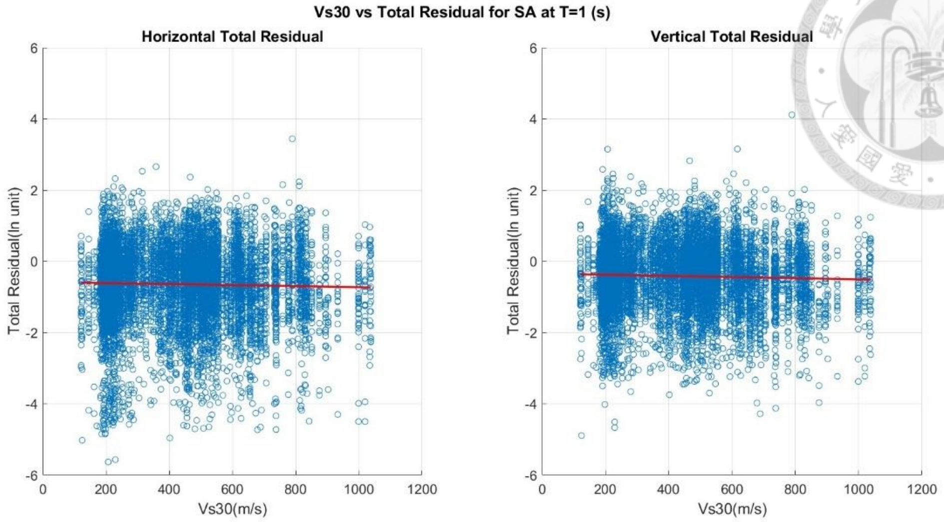


Figure 3.46 Vs30 vs. Total Residual Distribution Plot for SA at T=1(s)

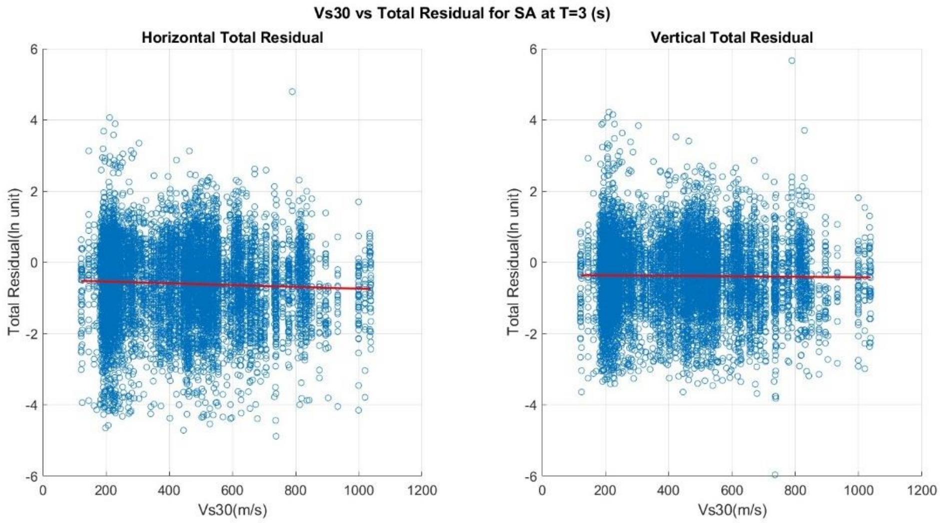


Figure 3.47 Vs30 vs. Total Residual Distribution Plot for SA at T=3(s)



doi:10.6342/NTU202303258

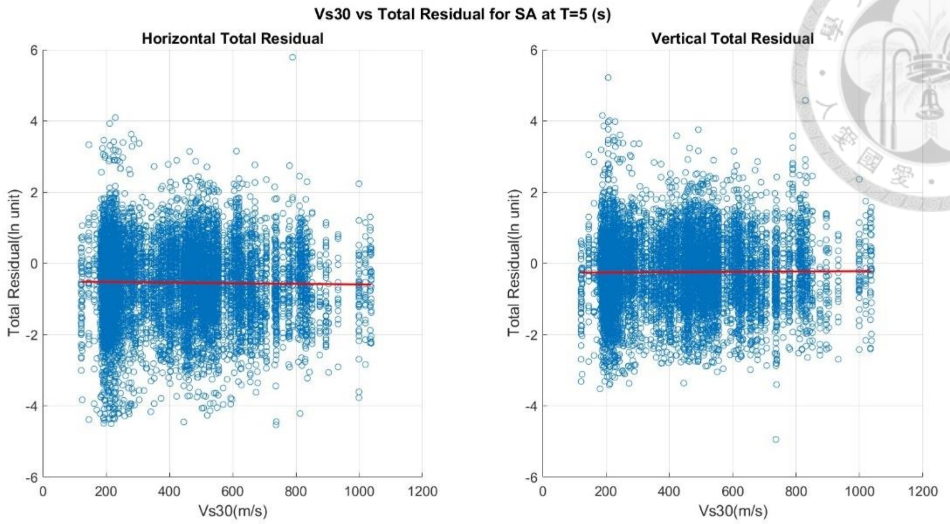


Figure 3.48 Vs30 vs. Total Residual Distribution Plot for SA at T=5(s)

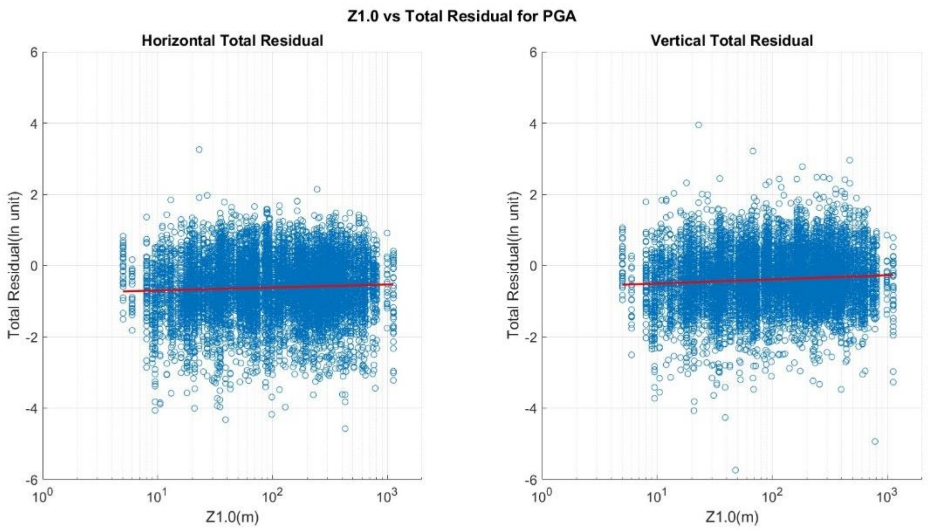


Figure 3.49 Z1.0 vs. Total Residual Distribution Plot for PGA



doi:10.6342/NTU202303258

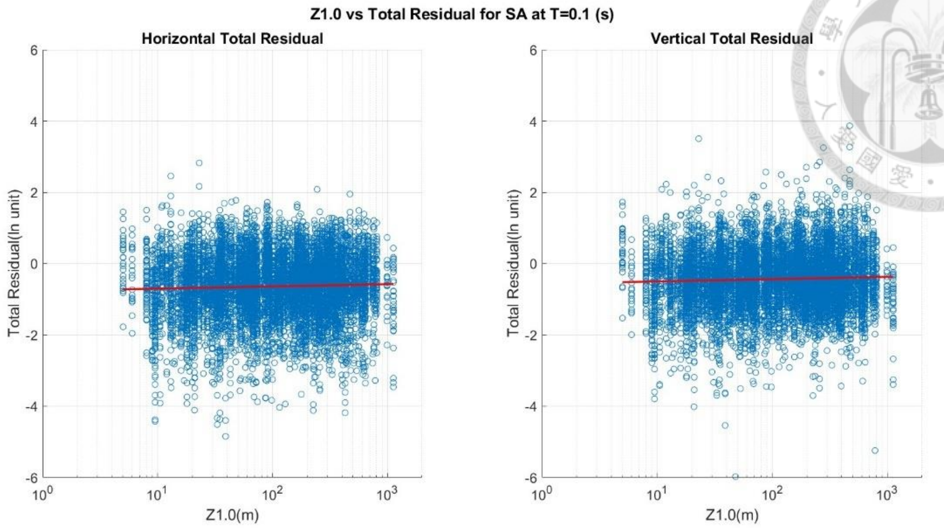


Figure 3.50 Z1.0 vs. Total Residual Distribution Plot for SA at T=0.1(s)

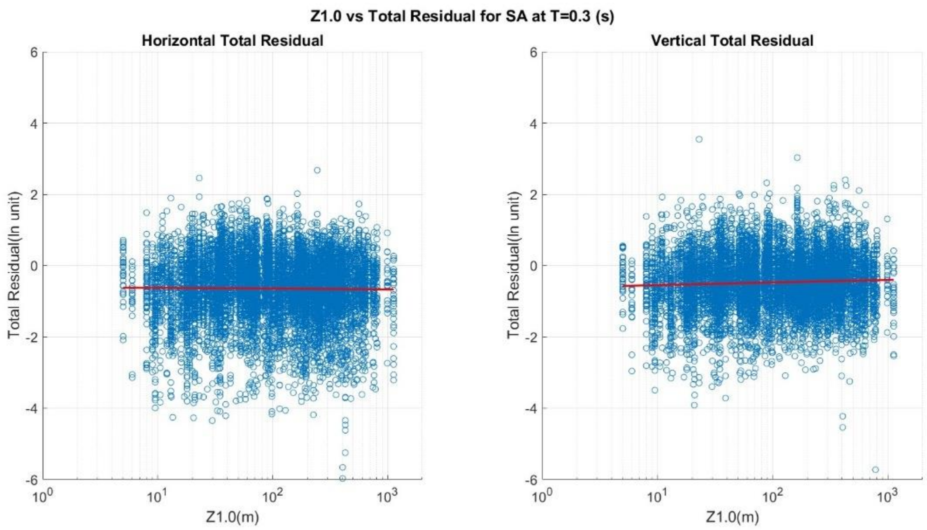


Figure 3.51 Z1.0 vs. Total Residual Distribution Plot for SA at T=0.3(s)



doi:10.6342/NTU202303258

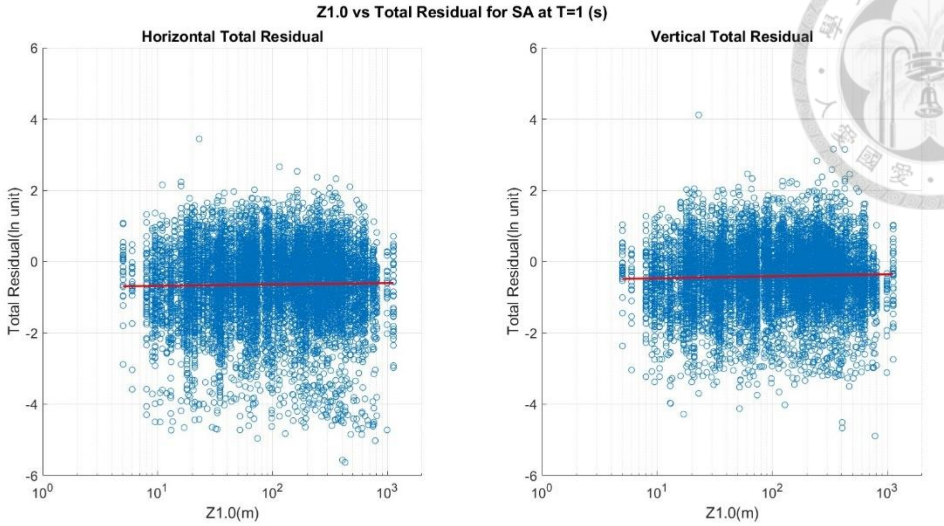


Figure 3.52 Z1.0 vs. Total Residual Distribution Plot for SA at T=1(s)

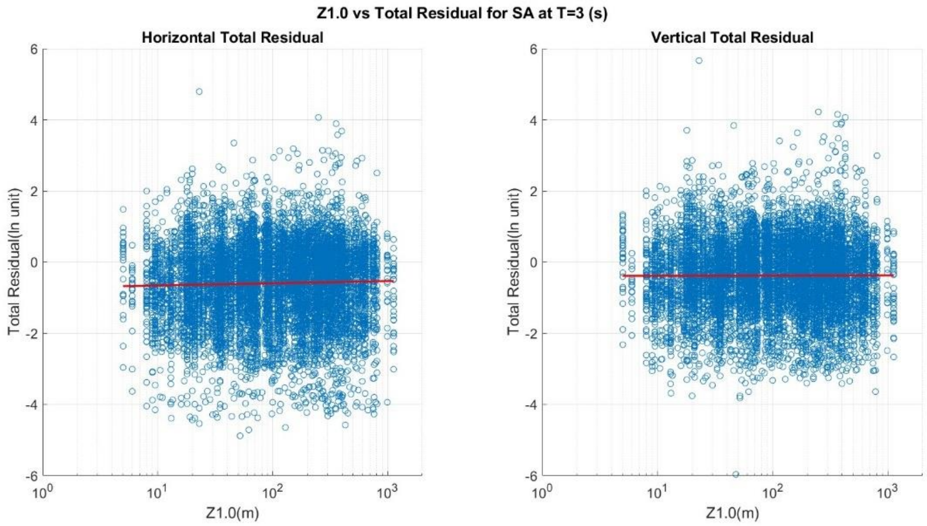


Figure 3.53 Z1.0 vs. Total Residual Distribution Plot for SA at T=3(s)



doi:10.6342/NTU202303258

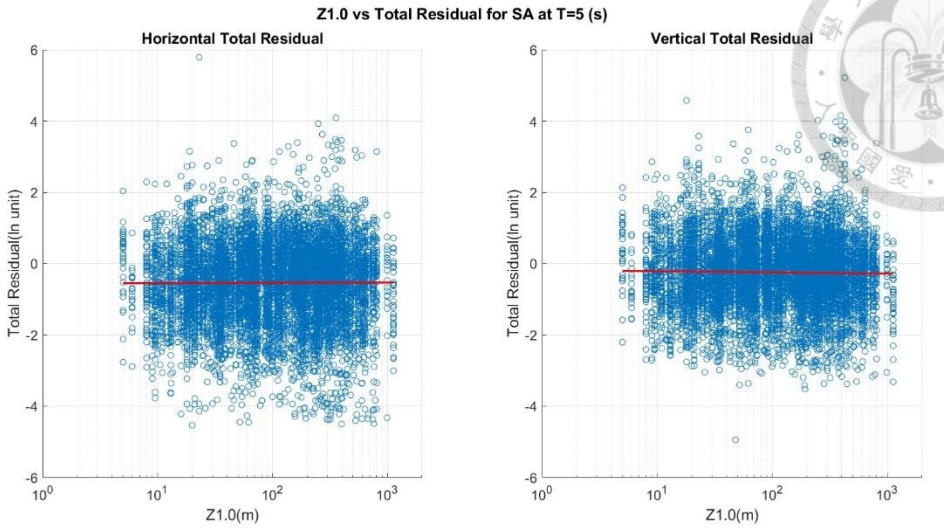


Figure 3.54 Z1.0 vs. Total Residual Distribution Plot for SA at T=5(s)

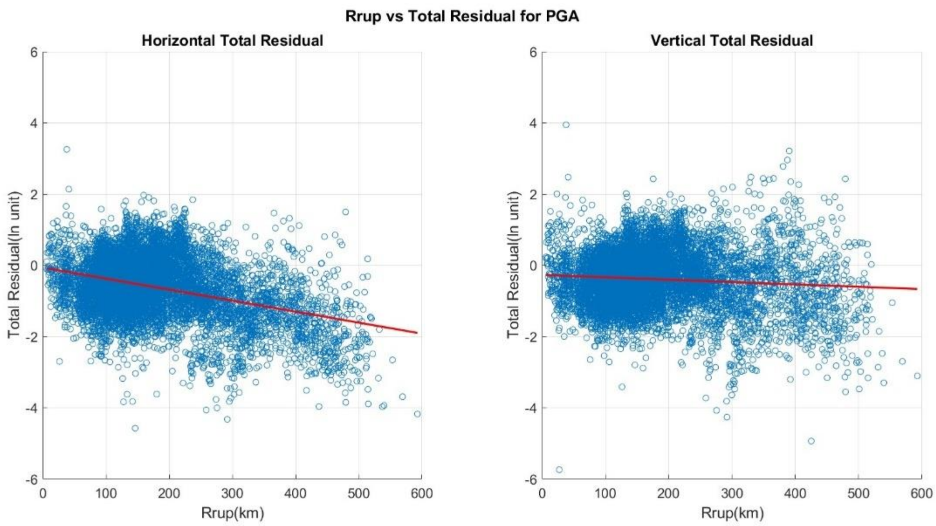


Figure 3.55 Rrup vs. Total Residual Distribution Plot for PGA



doi:10.6342/NTU202303258

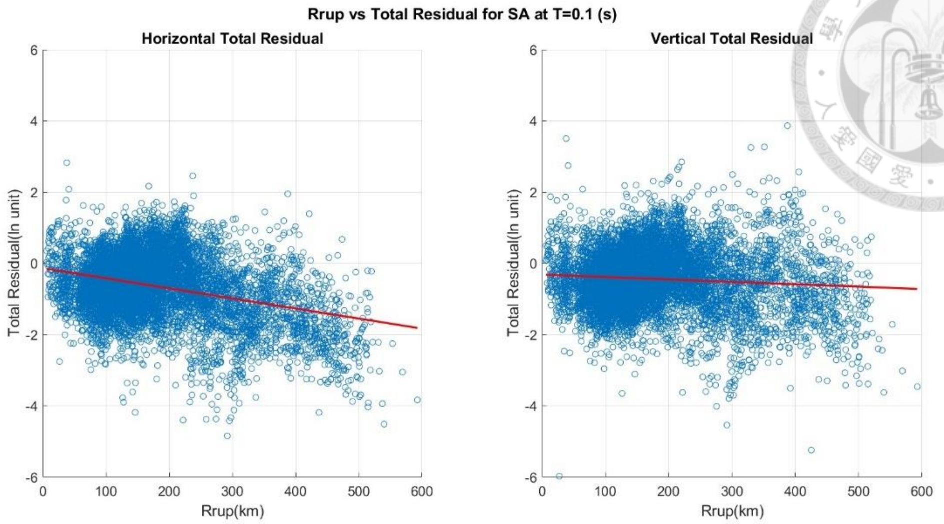


Figure 3.56 Rrup vs. Total Residual Distribution Plot for SA at T=0.1(s)

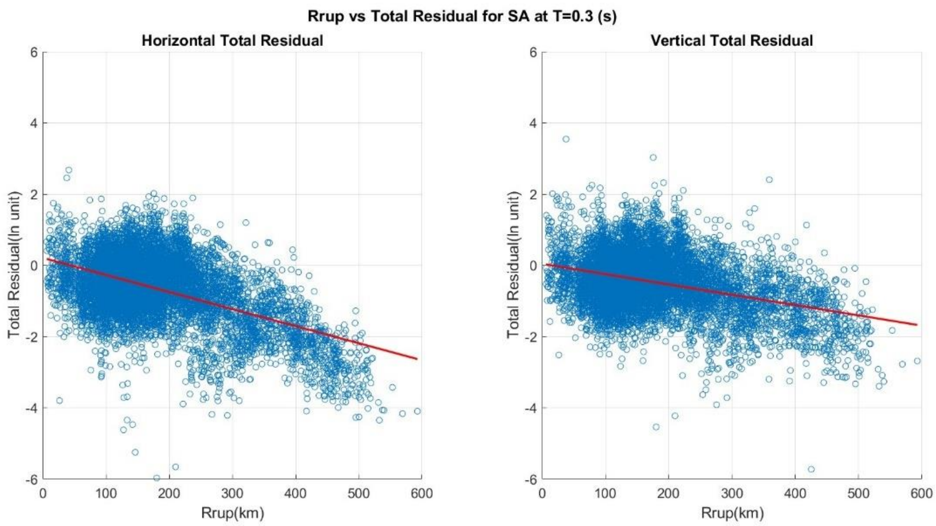


Figure 3.57 Rrup vs. Total Residual Distribution Plot for SA at T=0.3(s)



doi:10.6342/NTU202303258

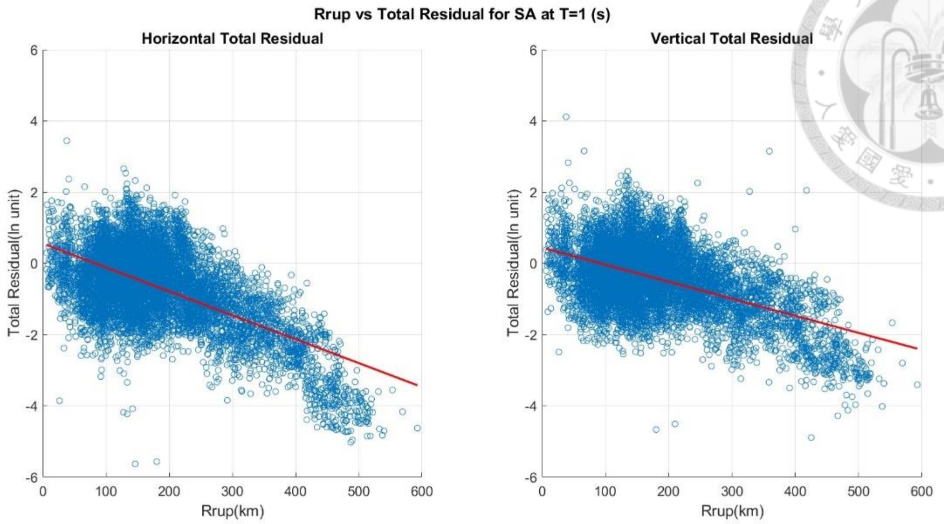


Figure 3.58 Rrup vs. Total Residual Distribution Plot for SA at T=1(s)

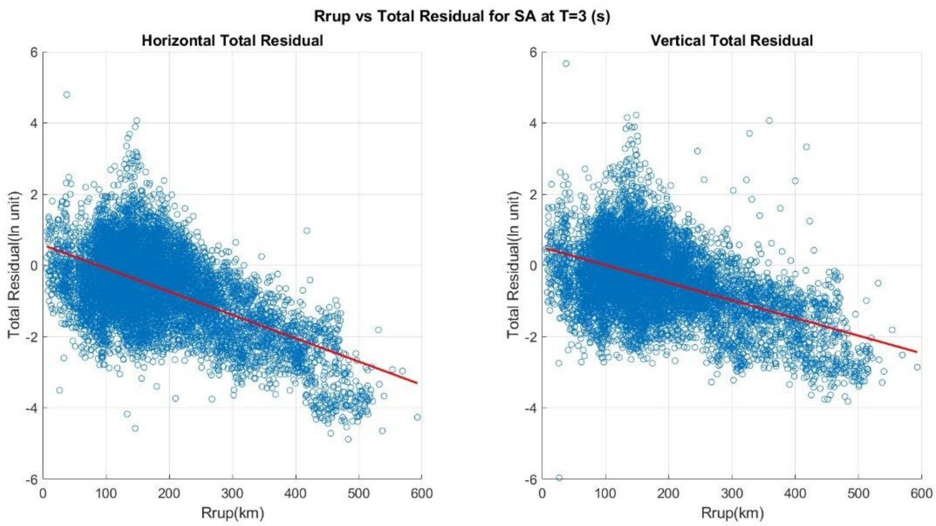


Figure 3.59 Rrup vs. Total Residual Distribution Plot for SA at T=3(s)



doi:10.6342/NTU202303258

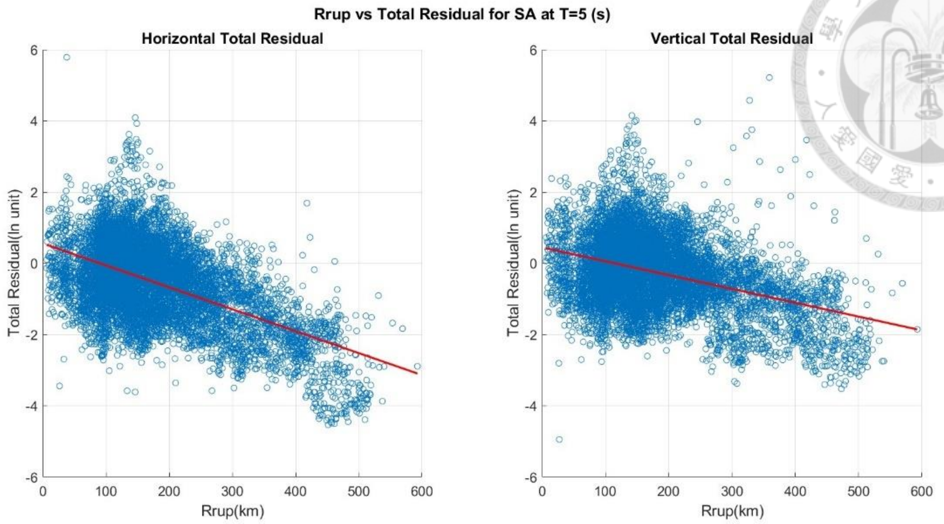


Figure 3.60 Rrup vs. Total Residual Distribution Plot for SA at T=5(s)

### 3.2.4 Compute Correlation Coefficient

At this stage of the research, we have obtained all the necessary data for calculating the correlation coefficients of response spectral values at different periods or directions. Here, we compute the correlation coefficients by using Equation (2.5): The total residuals are separated into inter-event residuals and intra-event residuals before proceeding with the correlation coefficient computation. The calculated results are output to the established Ground Motion Database. Subsequent nonlinear regression analysis and the development of a correlation model are based on these results.

## 3.3 Nonlinear Regression

### 3.3.1 Nonlinear Least-Squares Regression

To make the application of correlation coefficients more practicable, this study applies nonlinear least-squares regression to derive a set of parametric equations, which are then fitted to the empirical computation of the total residual correlation coefficients.



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Baker and Jayaram (2008) pointed out that the standard errors are not constant for correlation coefficient point estimates. This means that higher confidence is placed in observed correlations that are close to 1 or -1, and less in those close to 0. As a result, the Fisher-z transformation must first be applied. Then, nonlinear least-squares regression is performed on the transformed values. The formula for the Fisher-z transformation is as follows:

$$z = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right) \tag{3.35}$$

Where $\rho$ represents the total residual correlation coefficients as estimated by Equation (2.5), and z denotes the transformed data. This process results in z-values with constant standard errors, thus optimizing the least-squares algorithm. The coefficients for the predictive equations were chosen to minimize the squared prediction errors across the range of periods of interest as follows:

$$\min_{\beta} \sum_{i=1}^{n}\sum_{j=1}^{n}\left(\frac{1}{2}\ln\left(\frac{1+\rho_{i,j}}{1-\rho_{i,j}}\right) - \frac{1}{2}\ln\left(\frac{1+\hat{\rho}_{i,j}(\beta)}{1-\hat{\rho}_{i,j}(\beta)}\right)\right)^2 \tag{3.36}$$

$\rho_{i,j}$ represents the empirical correlation coefficient computed using Equation (2.5) for the period pair $T_i$,$T_j$, while $\hat{\rho}_{i,j}(\beta)$ stands for the predicted correlation. This study adopts the analytical equation functional forms used in Baker and Jayaram (2008) and Kohrangi et al. (2020). The symbol $\beta$ refers to the vector of associated coefficients.

The final outcomes and the parametric correlation model derived from these computations will be discussed in Chapter 5.



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### 3.3.2 SAS Software

The nonlinear regression analysis required by the Predictive Correlation model in this study was conducted using the Statistical Analysis System (SAS) software. SAS is a comprehensive statistical analysis software suite developed by North Carolina State University in 1966. It consists of various statistical computation modules and boasts an array of practical statistical application features. With its powerful performance, it has a broad and deep range of practical applications.

Specifically, the NLIN procedure in SAS was utilized for this research. The NLIN procedure is designed to fit nonlinear regression models and estimates parameters by means of nonlinear least squares. The output from these calculations was further examined for the model's P-value and R-square, serving as a check for the model's fit. Residual plots were also generated as part of the analysis.



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# Chapter 4 Discussion of Results

## 4.1 Correlation Coefficient Results

This section presents correlation coefficient results for spectral accelerations under three scenarios: Horizontal-Vertical ($SA_H$-$SA_V$), Horizontal-Horizontal ($SA_H$-$SA_H$), and Vertical-Vertical ($SA_V$-$SA_V$). These results have been computed for each pair of periods of interest, with 20 periods ranging from 0 to 5 seconds. The correlation coefficient matrix could be tabulated, however, displaying it as a contour plot proves to be more intuitive and comprehensible.

The correlation coefficients were smoothed using a moving average. This procedure removes the noise from the dataset and allows for important patterns in the correlation matrix stand out more clearly.

Figure 4.1 to Figure 4.3 present the total correlation coefficients for SAH-SAV, SAH-SAH, and $SA_V$-$SA_V$ respectively. Each figure presents a chosen selection of periods (specifically at 0.01, 0.1, 0.3, 1.0, 3.0, and 5.0 seconds) plotted against their corresponding values, which range between 0.01 and 5.0 seconds. In Figure 4.1, these are vertical periods $T_V$ for $SA_H$-$SA_V$; in Figure 4.2, these are horizontal periods $T_H$ for $SA_H$-$SA_H$; and in Figure 4.3, these are vertical periods $T_V$ for $SA_V$-$SA_V$. The three figures show similar trends for the ($T_V$,$T_H$), ($T_H$,$T_H$), and ($T_V$,$T_V$) period pairs. In the lower period range for the former, as the latter's period increases, the correlation coefficient values decrease, but the degree of change tends to saturate around 0.4. In the higher period range for the former, a larger period of the latter corresponds to higher correlation coefficient values. Moreover, the degree of correlation in the $SA_H$-$SA_H$ condition is higher than in the $SA_V$-$SA_V$ condition.



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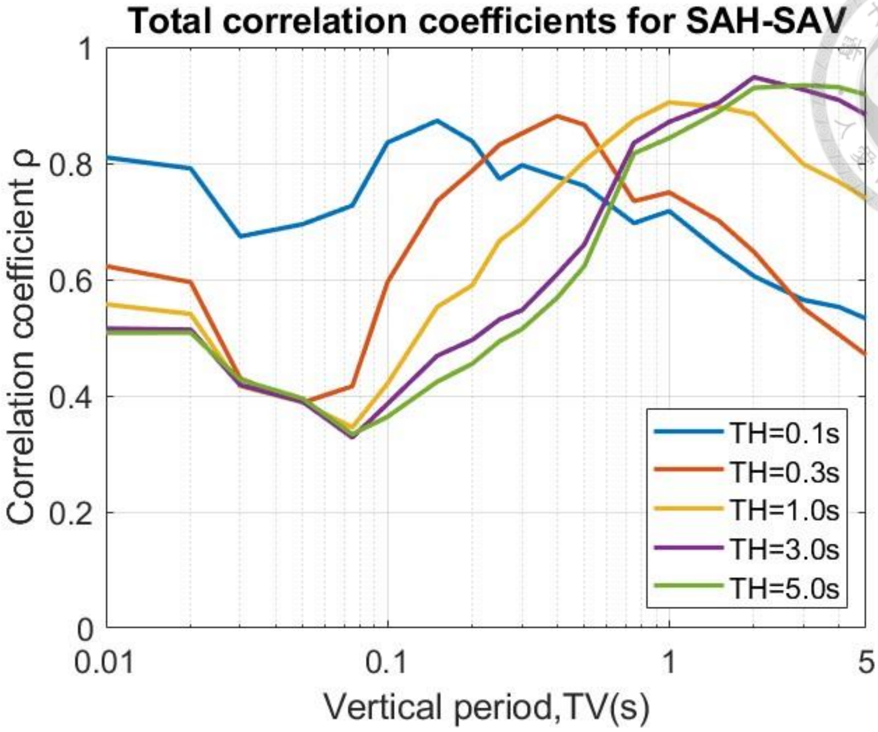


Figure 4.1 Total correlation coefficients for $SA_H$-$SA_V$

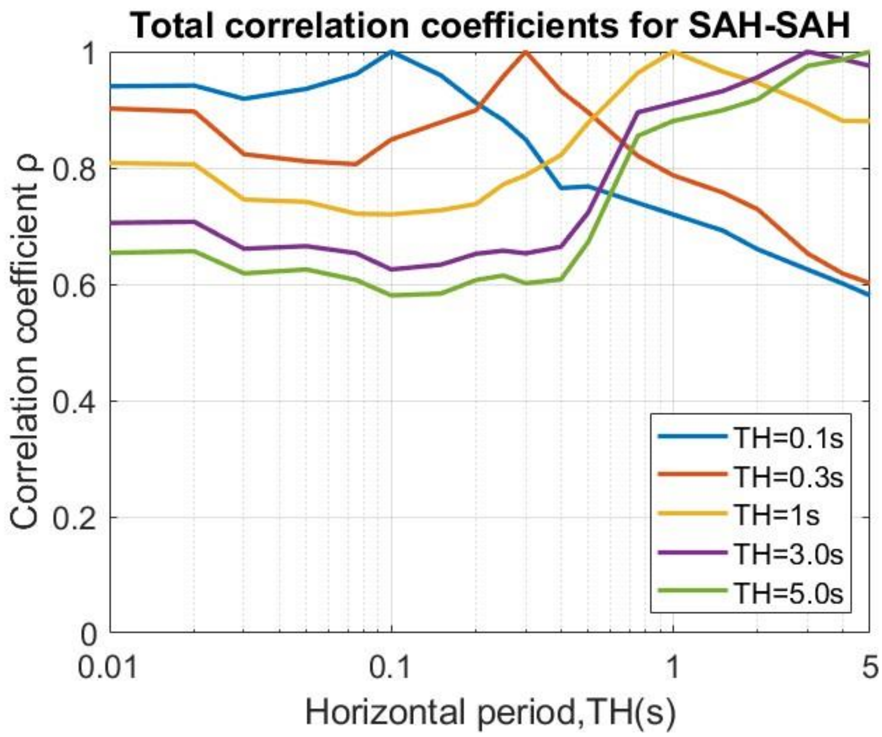


Figure 4.2 Total correlation coefficients for $SA_H$-$SA_H$



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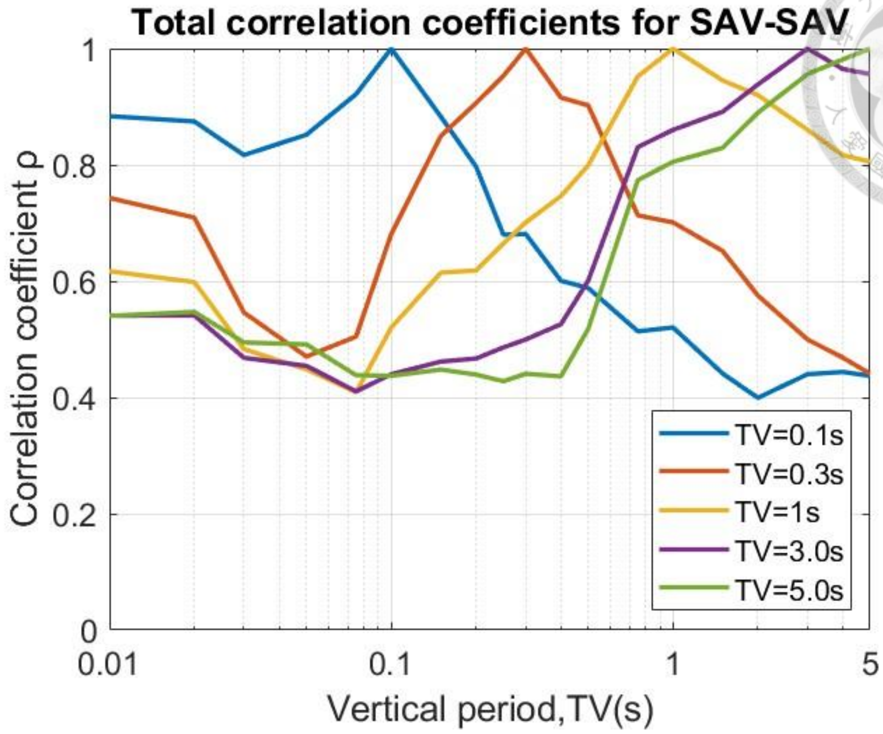

Figure 4.3 Total correlation coefficients for $SA_V$-$SA_V$

Figure 4.4 through Figure 4.6 Display total correlation coefficient contour plot for the three scenarios after the smoothing process, over a period range of 0.01 to 5.0 seconds. As the correlation between any pair of $SA_H(T_i)$–$SA_H(T_j)$ or $SA_V(T_i)$–$SA_V(T_j)$ is identical to that of their respective reverse pairs, the correlations for $SA_H$-$SA_H$ and $SA_V$-$SA_V$ are perfectly symmetrical. In contrast, the pair $SA_H(T_i)$–$SA_V(T_j)$ is distinct from $SA_V(T_i)$–$SA_H(T_j)$, resulting in more complex and irregular distribution patterns in the $SA_V$–$SA_H$ contour plots. This could be inherent to the natural system or partly a consequence of the limitations in the regression models used in the GMPEs. The values of SAH-SAH are significantly larger than those of SAH-SAV, with the lowest correlation coefficients still exceeding 0.6 in the graphs. A plateau is present in the SAV-SAV graph, representing the lowest point of correlation, with values approximately between 0.35 and 0.4.

Figure 4.7 through Figure 4.9 Display Inter- and Intra-coefficient contour plot for



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the three scenarios. The intra-event, inter-event, and total residuals all exhibit a similar correlation structure. The value of the inter-event is greater than that of the intra-event, However, we can observe that the intra-coefficient contour plot and the total correlation coefficient contour plot are strikingly similar. This is because the intra-event standard deviations, σ, are known to be significantly larger than the inter-event standard deviations, τ, making intra-event standard deviations the dominant contributor to the total correlation coefficient as per Equation (2.5). Additionally, as the standard deviation of the intra-event residual, σ, is a function of the moment magnitude and earthquake source type and faulting type, it can be anticipated that these parameters have a significant impact on the total correlation coefficient.

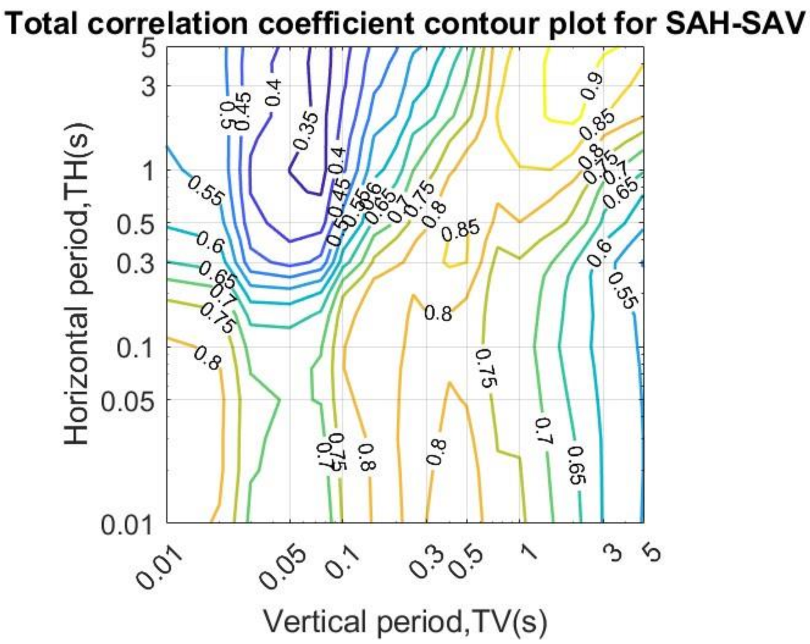


Figure 4.4 Total correlation coefficient contour plot for $SA_H$-$SA_V$



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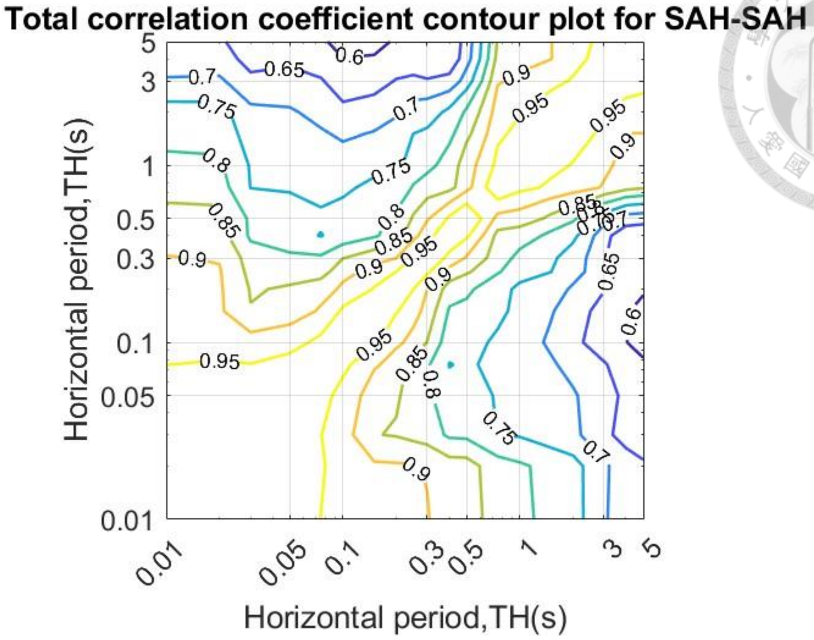


Figure 4.5 Total correlation coefficient contour plot for $SA_H$-$SA_H$

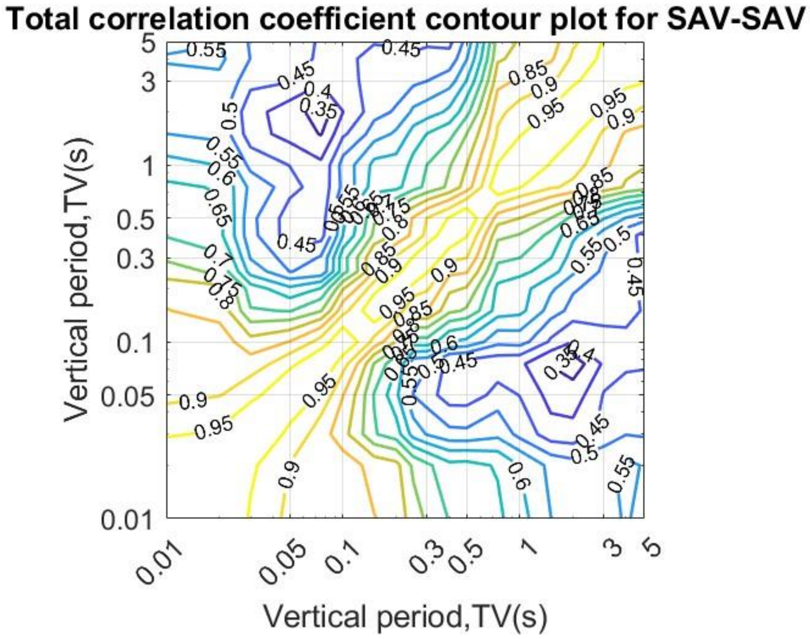


Figure 4.6 Total correlation coefficient contour plot for $SA_V$-$SA_V$



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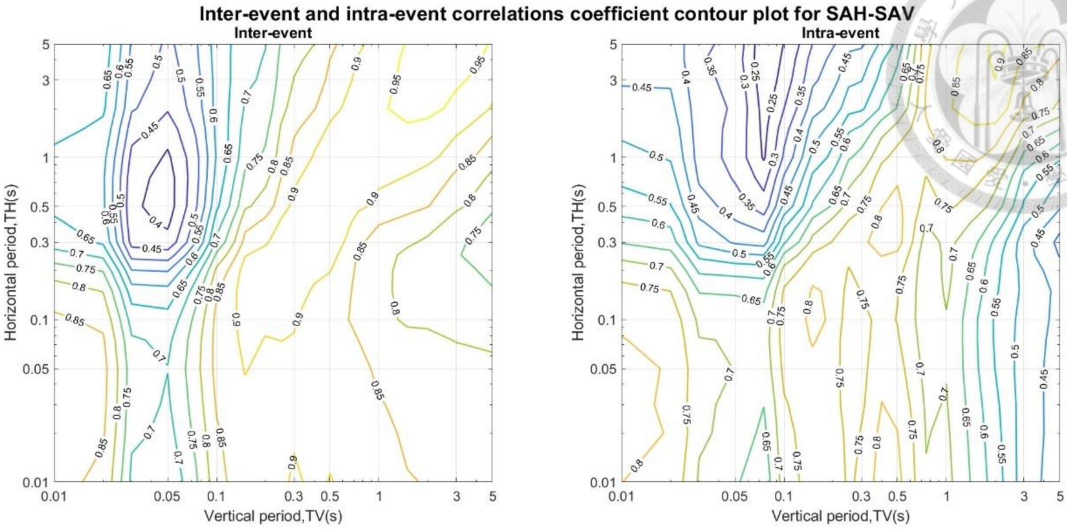


Figure 4.7 Inter-event and Intra-event correlations coefficient contour plot for $SA_H$-$SA_V$

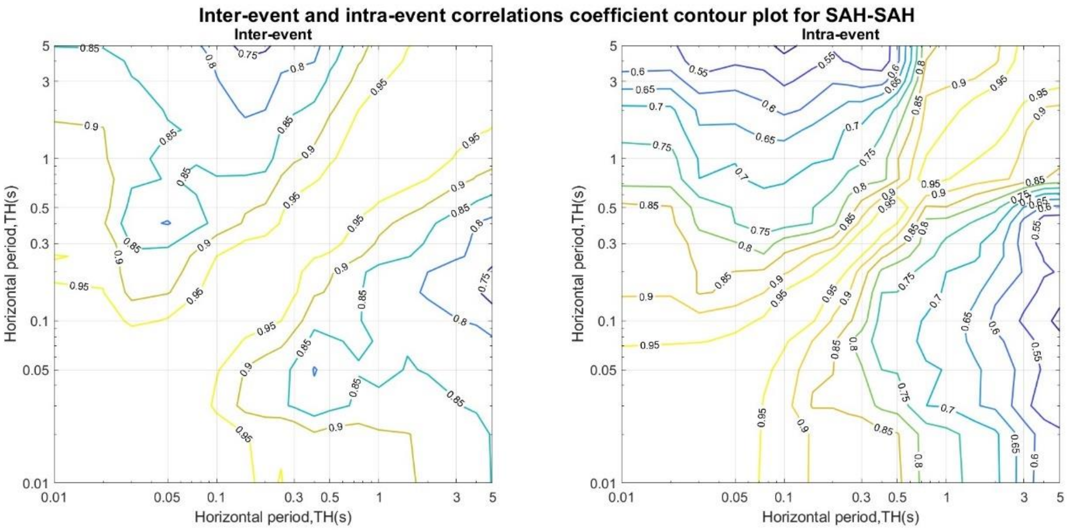


Figure 4.8 Inter-event and Intra-event correlations coefficient contour plot for $SA_H$-$SA_H$



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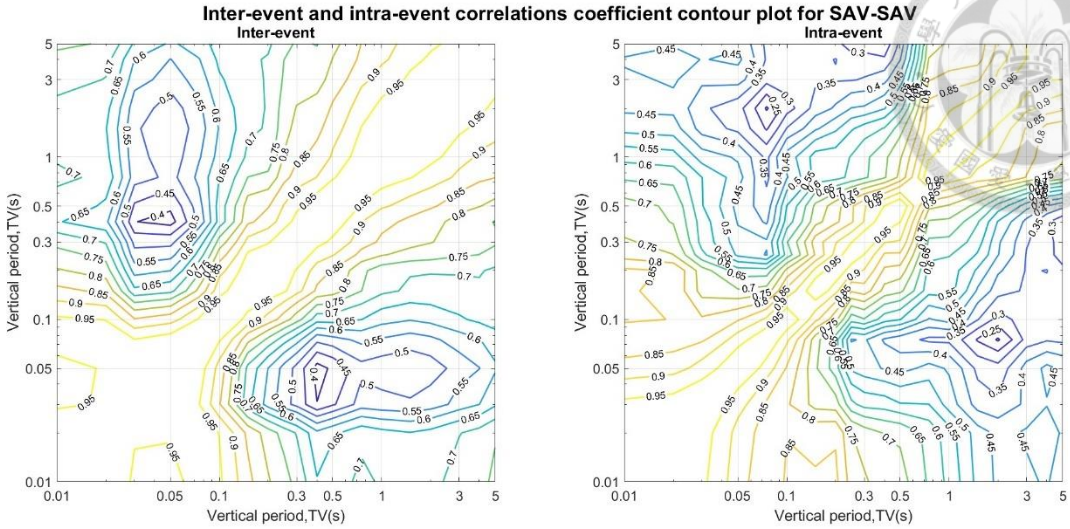


Figure 4.9 Inter-event and Intra-event correlations coefficient contour plot for $SA_V$-$SA_V$



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## 4.2 Parameters Influencing the Correlation Coefficients

In this section, we analyze the correlation coefficients' dependency in our study on parameters such as Moment Magnitude, Vs30, and earthquake types. To facilitate this, we categorize all records from the database based on the parameters of interest, then recalculate the correlation coefficients for each scenario.

For Moment Magnitude, we divide the records into two groups: Mw between 5.4-6 and Mw greater than 6. In terms of Vs30, following the NEHRP Site Classification Standard, the records are divided into four Site classes (B, C, D, E), noting that our study does not have any records from Site class A. As for the earthquake types, the records are classified into Interslab, Intraslab, Crustal Reverse, and Crustal Strike-slip. However, it should be noted that no Crustal normal earthquake types are included in our study.

### 4.2.1 Moment Magnitude

As mentioned in the last section, because the Sigma model is a function of the moment magnitude, Figure 4.10 through Figure 4.12 demonstrate a certain degree of dependence between the total correlation coefficient and moment magnitude. The data set with Mw > 6 shows total correlation coefficient, approximately 0.2 higher than that of Mw between 5.4 and 6 in both the $SA_H$-$SA_V$ and $SA_V$-$SA_V$ scenarios. The difference in the $SA_H$-$SA_H$ scenario is smaller, at around 0.1. Moreover, the differences between different periods when Mw is between 5.4 and 6 are larger than those for Mw > 6.



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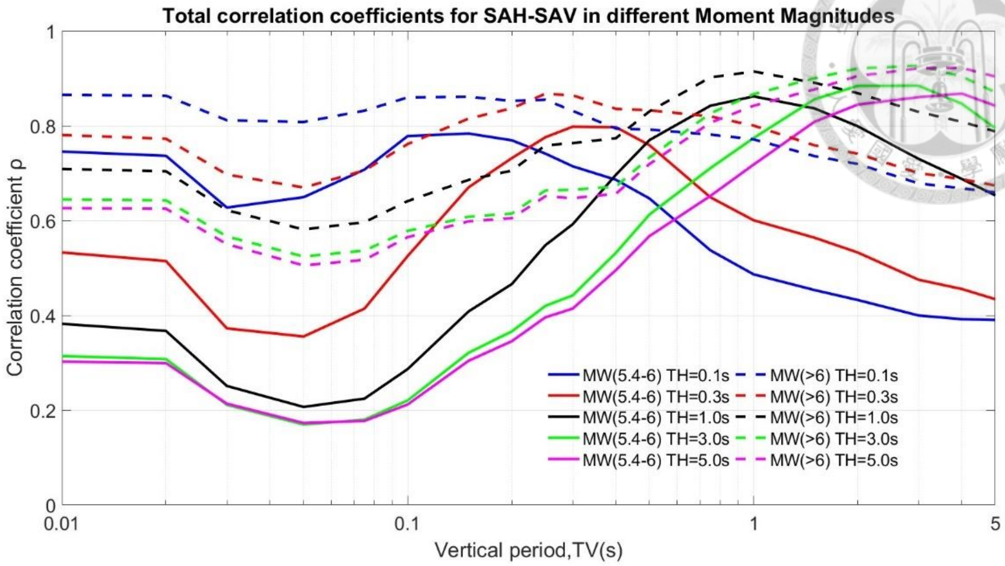


Figure 4.10 Total correlation coefficients for $SA_H$-$SA_V$ in two moment magnitudes: 5.4 < Mw < 6 and Mw > 6

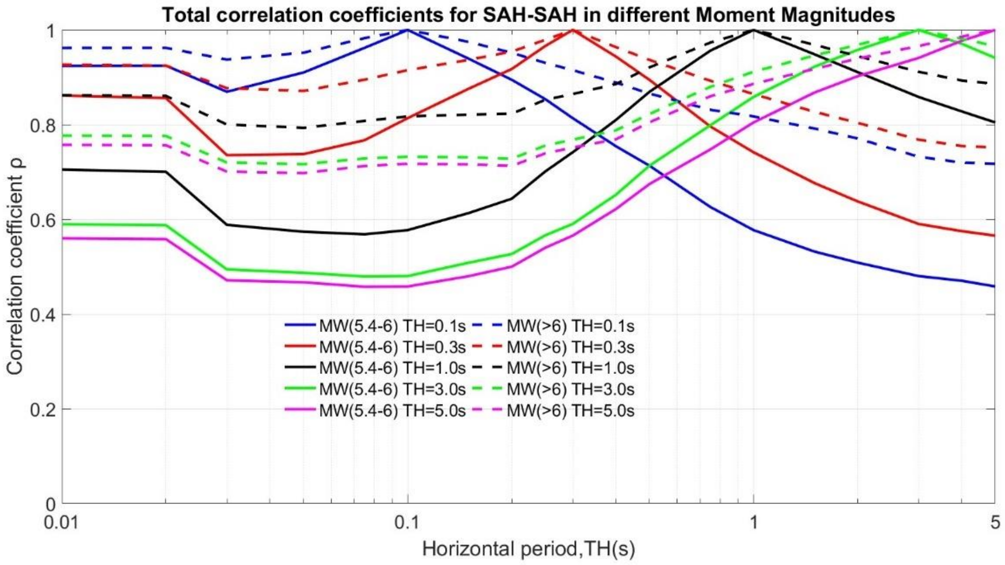


Figure 4.11 Total correlation coefficients for $SA_H$-$SA_H$ in two moment magnitudes: 5.4 < Mw < 6 and Mw > 6



doi:10.6342/NTU202303258

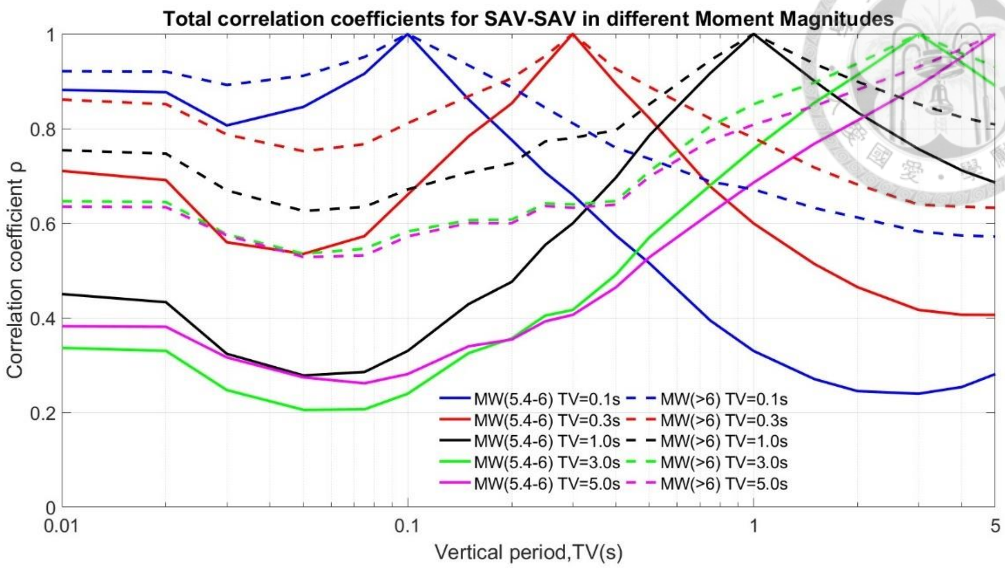


Figure 4.12 Total correlation coefficients for $SA_V$-$SA_V$ in two moment magnitudes: 5.4 < Mw < 6 and Mw > 6

### 4.2.2 NEHRP Site Class.

The NEHRP Site Class can represent the range of the site parameter Vs30, as well as the general geological description of the site. Figure 4.13 through Figure 4.15 also demonstrate a certain degree of dependence between the total correlation coefficient and Vs30.When the horizontal axis is in the lower period range, a larger Vs30 results in a higher correlation coefficient. However, when the horizontal axis reaches the high period range, the differences converge and become almost negligible. Moreover, under the $SA_H$-$SA_H$ scenario, Vs30 has almost no impact on the total correlation coefficient, in contrast to the other two scenarios.



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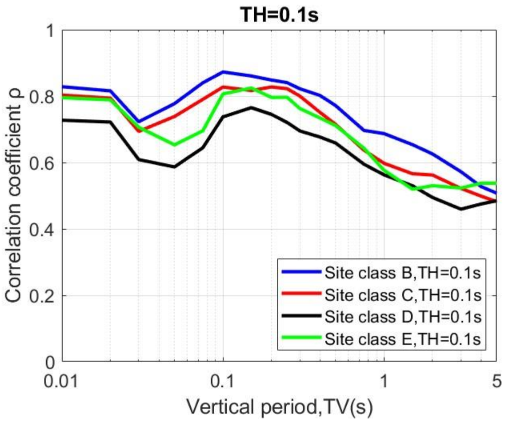
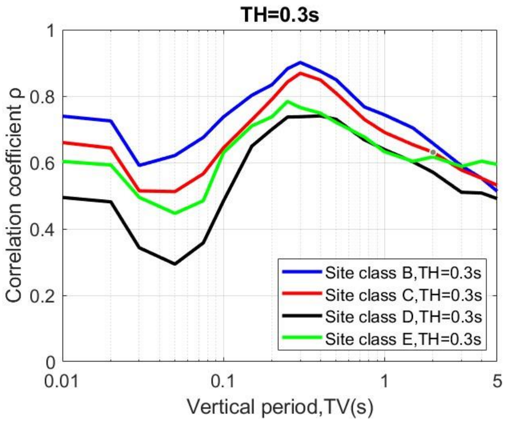
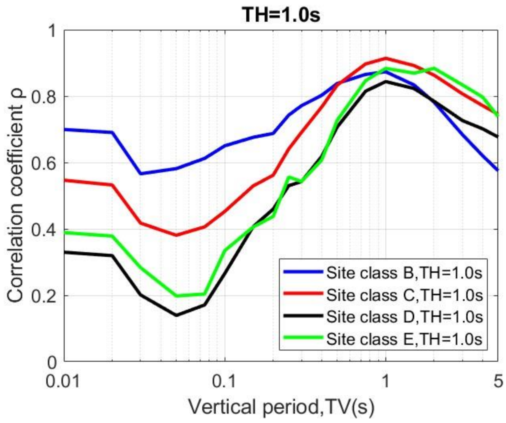


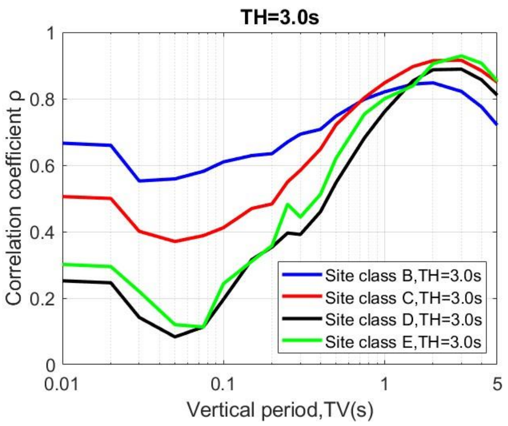

(a)



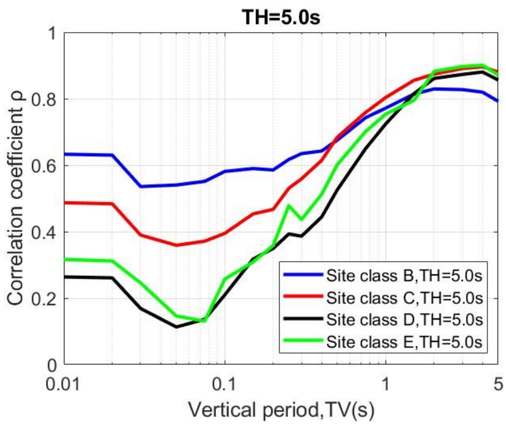

(b)




(c)




(d)




(e)

Figure 4.13 Total correlation coefficients for $SA_H$-$SA_V$ in four different site classes at:

(a) TH = 0.1s, (b) TH = 0.3s, (c) TH = 1.0s, (d) TH = 3.0s, (e) TH = 5.0s.



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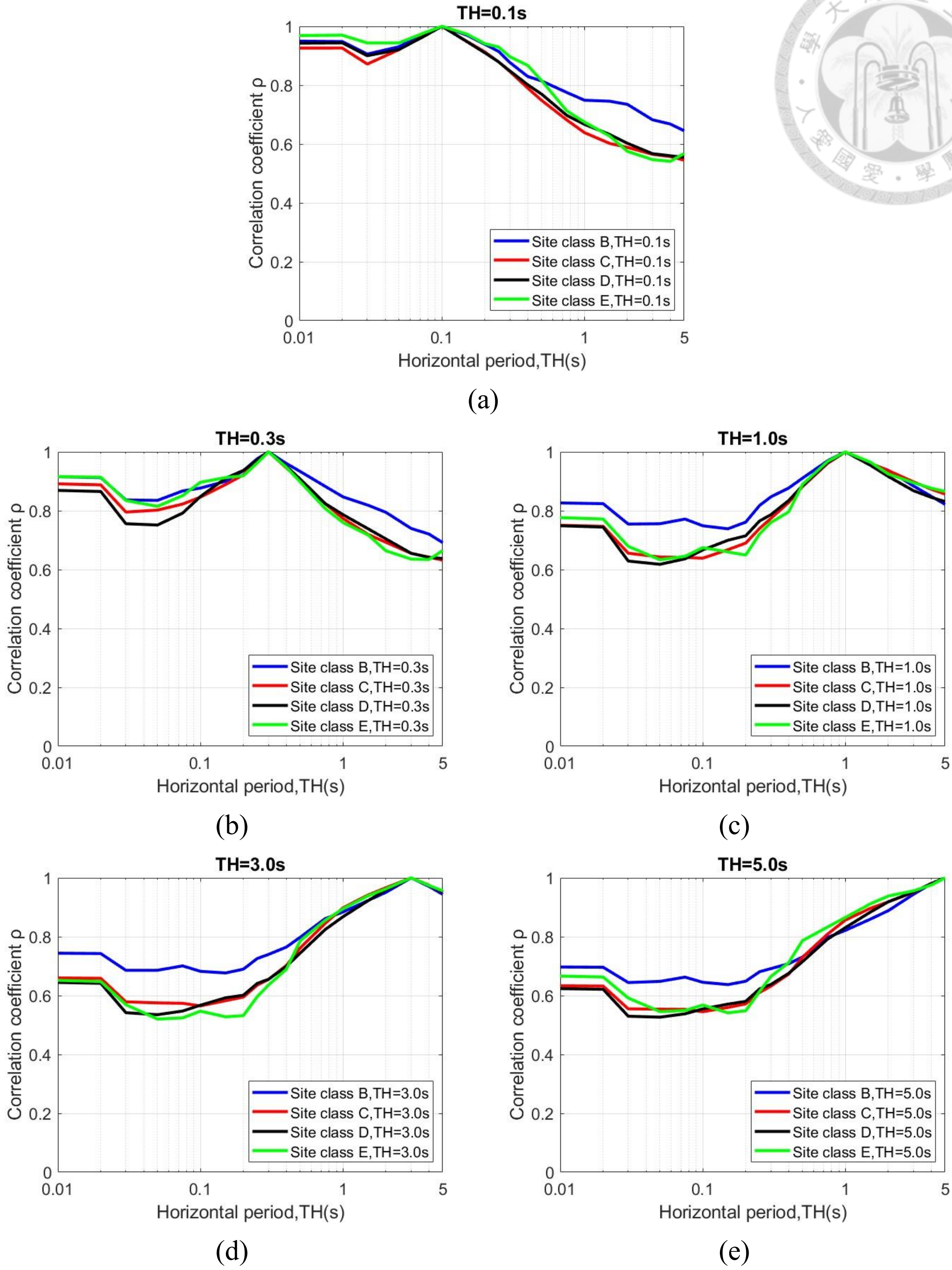
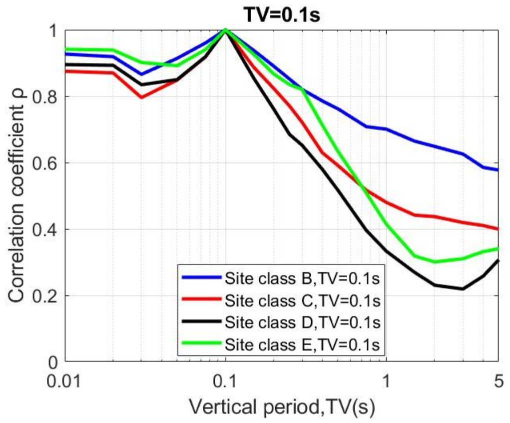



Figure 4.14 Total correlation coefficients for $SA_H$-$SA_H$ in four different site classes at:

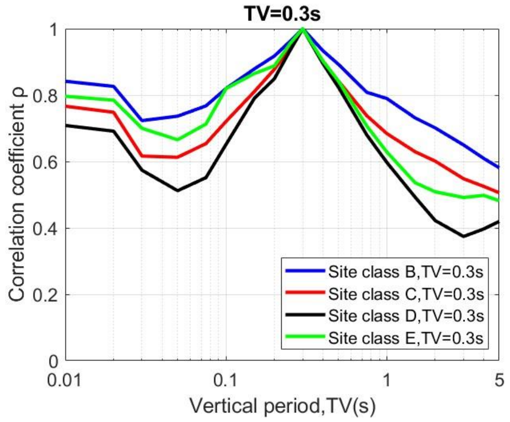
(a) TH = 0.1s, (b) TH = 0.3s, (c) TH = 1.0s, (d) TH = 3.0s, (e) TH = 5.0s.

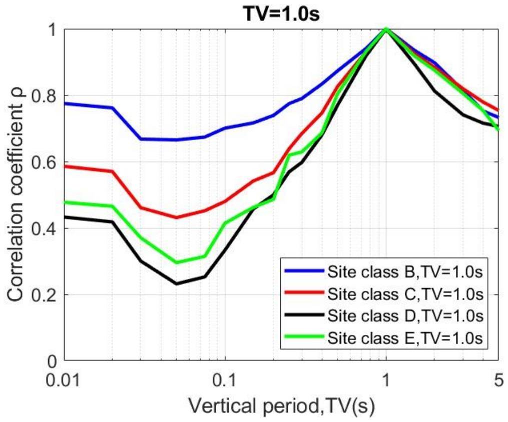


doi:10.6342/NTU202303258

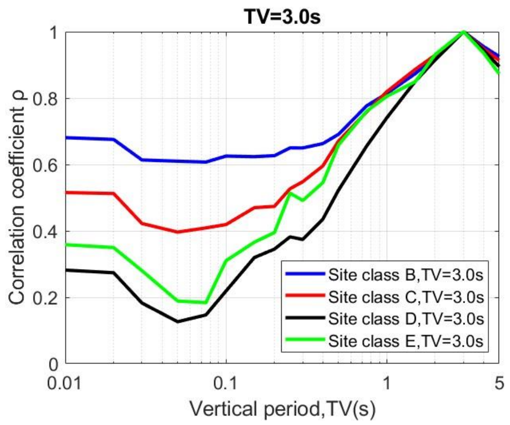


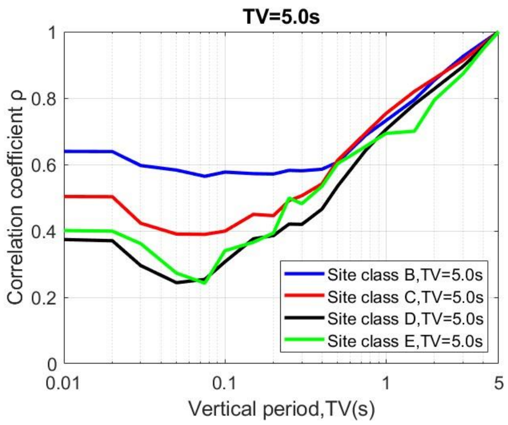

(a)




(b) (c)




(d) (e)

Figure 4.15 Total correlation coefficients for $SA_V$-$SA_V$ in four different site classes at:

(a) TV = 0.1s, (b) TV = 0.3s, (c) TV = 1.0s, (d) TV = 3.0s, (e) TV = 5.0s.



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### 4.2.3 Earthquake Types

Figure 4.16 through Figure 4.18 show the influence of earthquake type on the total correlation coefficient. A clear distinction can be observed in the distributions for Crustal and Subduction Zone earthquakes. Within the former category, the correlation coefficient for crustal reverse is slightly higher than that for crustal strike-slip, while in the latter category, the correlation coefficient for interslab is higher than intraslab.

Among Crustal earthquakes, the correlation coefficient of Crustal Reverse is slightly higher than that of Crustal Strike-slip. Within subduction zone earthquakes, the correlation coefficient of Intraslab is higher than Interslab. However, as the horizontal axis gradually moves to high periods, the impact of earthquake type on correlation coefficient diminishes. The influence of earthquake type on the correlation of $SA_H$-$SA_H$ itself is less than the other two scenarios. The pattern of change in $SA_V$-$SA_V$ is similar to that of $SA_H$-$SA_V$.



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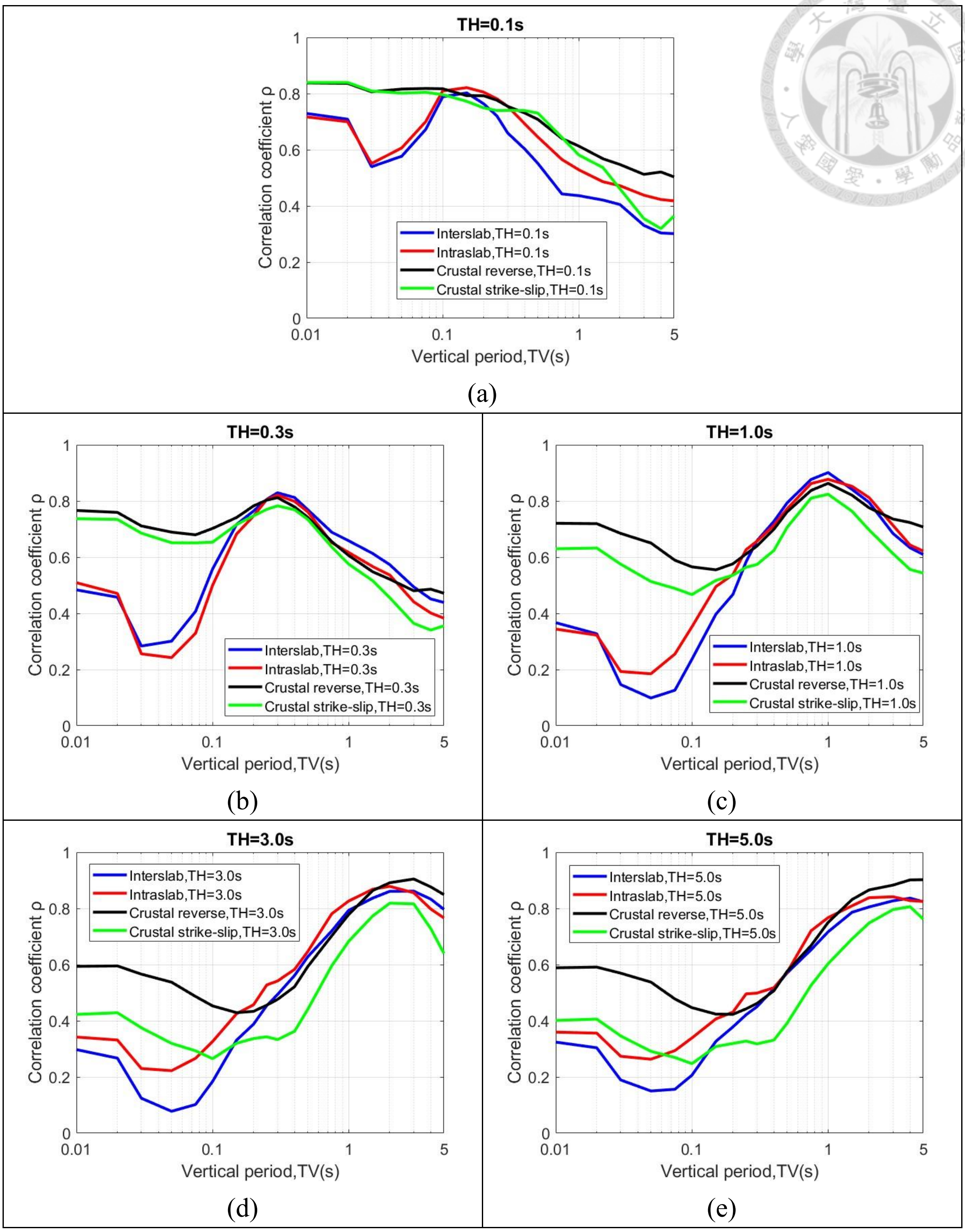


Figure 4.16 Total correlation coefficients for $SA_H$-$SA_V$ in four different earthquake types: (a) Interslab, (b) Intraslab, (c) Crustal Reverse, (d) Crustal Strike-slip



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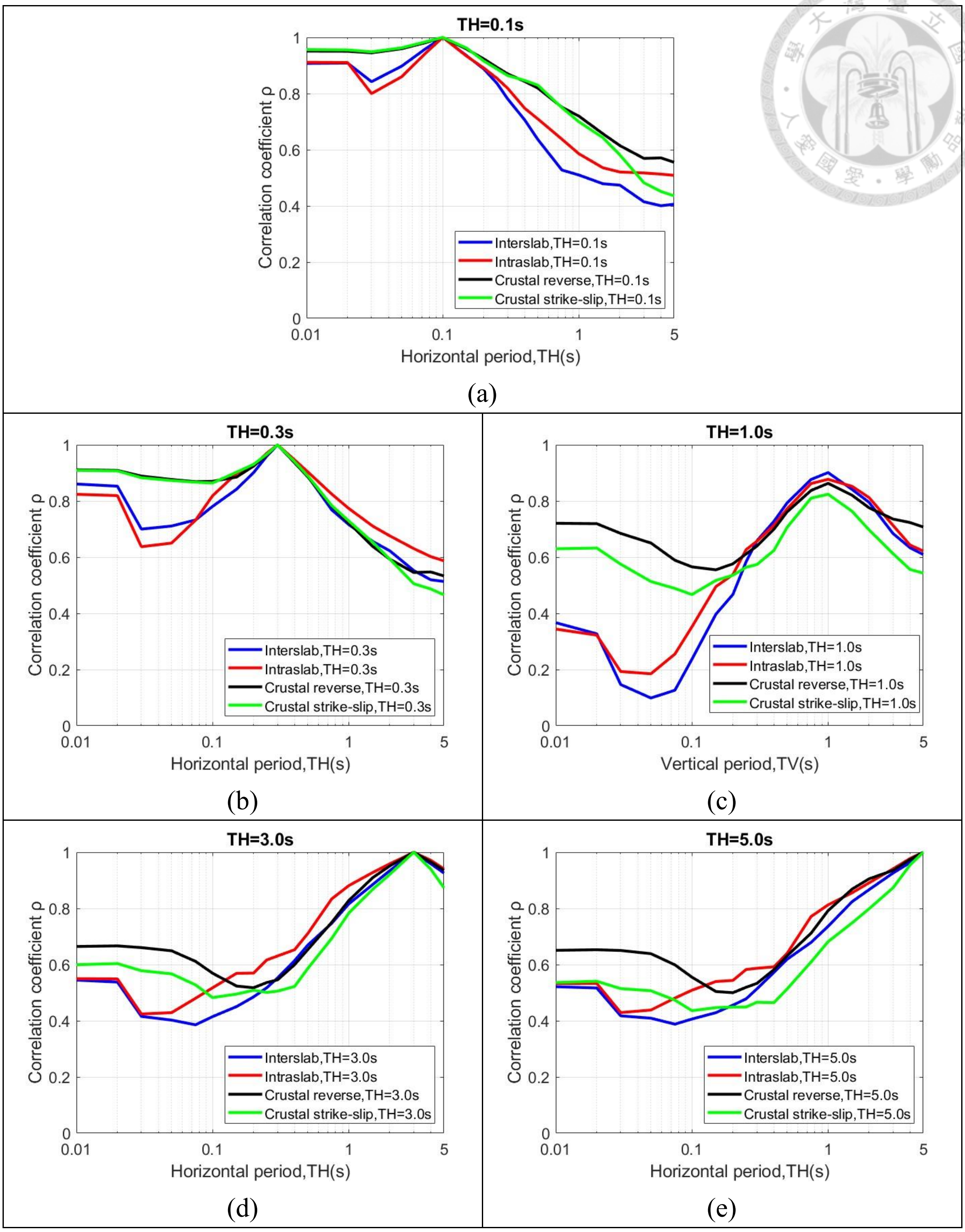


Figure 4.17 Total correlation coefficients for $SA_H$-$SA_H$ in four different earthquake types: (a) Interslab, (b) Intraslab, (c) Crustal Reverse, (d) Crustal Strike-slip



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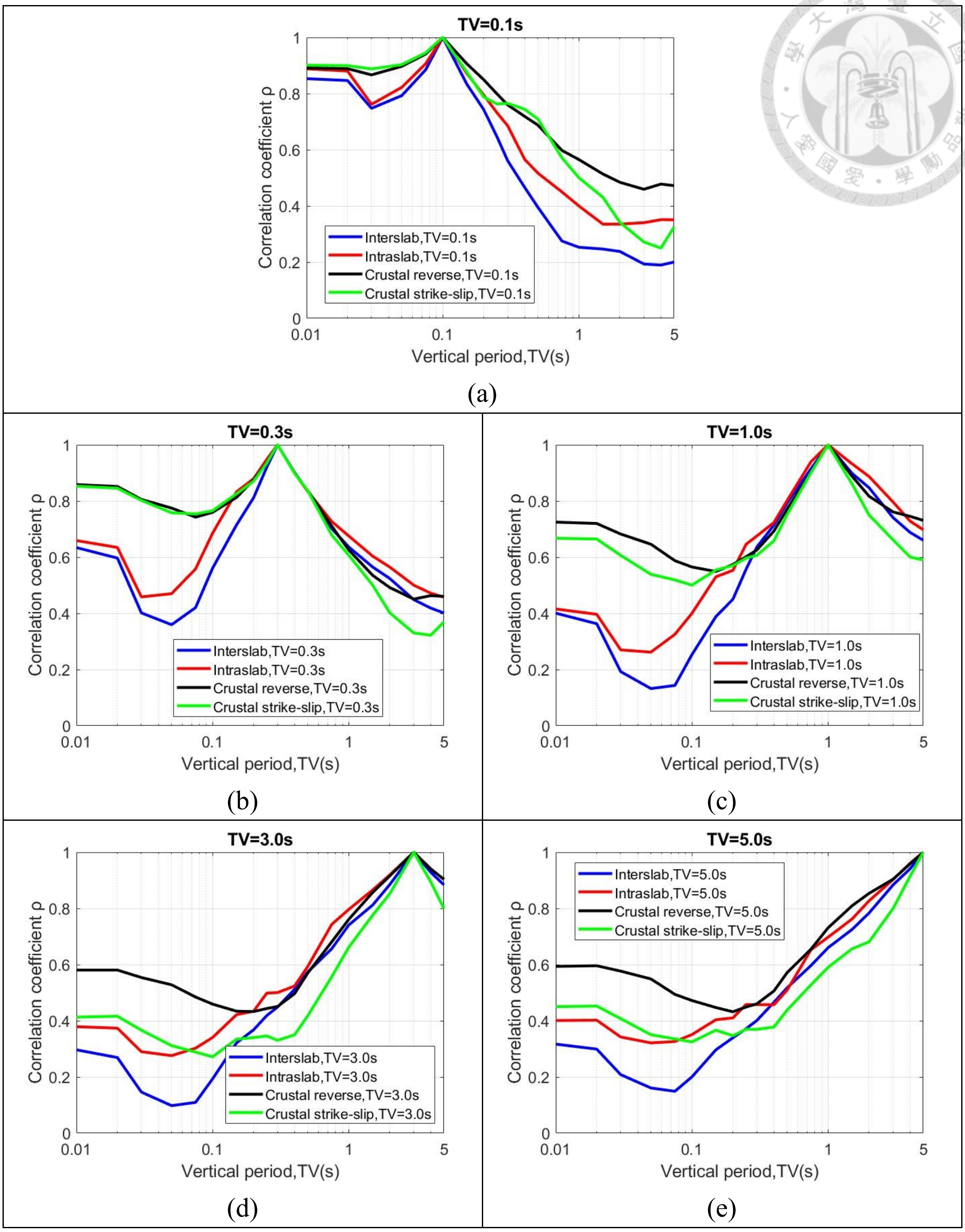


Figure 4.18 Total correlation coefficients for $SA_V$-$SA_V$ in four different earthquake types: (a) Interslab, (b) Intraslab, (c) Crustal Reverse, (d) Crustal Strike-slip



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## 4.3 Parametric Predictive Correlation model

### 4.3.1 Correlation models

The correlation models and their corresponding statistical verification results, obtained from nonlinear regression, are presented in this section. Firstly, we introduce the correlation model for horizontal-vertical spectral accelerations ($SA_H$-$SA_V$). The formula for the $SA_H$-$SA_V$ correlation coefficients at the same period ($T=T_H=T_V$) is as follows:

$$\rho_0(T) = \begin{cases} b_7 + b_9 \cos\left(\dfrac{\pi}{2} + \pi \dfrac{ln\left(\dfrac{max(T, 0.036)}{0.14}\right)}{2.76}, T \leq 2.23\right) \\ b_8 + b_{10} \cos\left(-0.62\pi \ln\left(\dfrac{T}{2.23}\right)\right), T > 2.23 \end{cases} \tag{4.1}$$

For different periods ($T_H \neq T_V$), the formula for the $SA_H$-$SA_V$ correlation coefficients is presented below:

$$\rho_0(T_V, T_H) = \rho_0(T_{max}) * \tag{4.2}$$
$$\begin{cases} \left[1 - b_3 c + b_3 \cdot c \cdot cos\left(\dfrac{\pi \ln\left(\frac{T_{min}}{T_{max}}\right)}{\ln\left(\frac{T_{max}}{0.10}\right)}\right)\right], T_{min} > 0.10 \\ \left[1 - b_4 c + b_5 \cdot c \cdot cos\left(\dfrac{\pi \ln\left(\max\left(\frac{T_{min}}{0.10}, b_6\right)\right)}{\ln\left(\max\left(\frac{T_{min}}{0.10}, 7.14\right)\right)}\right)\right], T_{min} \leq 0.10 \end{cases}$$

In which $T_{min} = \min(T_V, T_H), T_{max} = \max(T_V, T_H)$, and the coefficient c is as follows:



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$$c = 1 - cos\left(\pi/b_1 \cdot \min\left(b_2, \ln\left(\max\left(\frac{T_{min}}{0.10}, 1.0\right)\right)\right)\right) \quad (4.3)$$

The overall model fit shows an R-squared value of 0.958, and a p-value less than 0.001. The results estimated using the nonlinear least squares method are presented in Table 4.1.

Table 4.1 Nonlinear Least-Square Estimated Results for $SA_H$-$SA_V$.

| Coefficients | Estimates | Standard Error | 95% Confidence Interval | | t (390) | P-value |
|---|---|---|---|---|---|---|
| $b_1$ | 1.6146 | 0.1452 | 1.3292 | 1.9000 | 11.11983 | < .0001 |
| $b_2$ | 1.6150 | 129.2 | -252.4 | 255.7 | 0.0125 | 0.990033094 |
| $b_3$ | 0.0992 | 0.00986 | 0.0798 | 0.1185 | 10.06085 | < .0001 |
| $b_4$ | 0.1683 | 0.0151 | 0.1387 | 0.1979 | 11.1457 | < .0001 |
| $b_5$ | -0.0492 | 0.0107 | -0.0703 | -0.0281 | -4.59813 | <.0001 |
| $b_6$ | 0.1665 | 0.0658 | 0.0370 | 0.2959 | 2.530395 | 0.011785992 |
| $b_7$ | 0.8394 | 0.00640 | 0.8268 | 0.8520 | 131.1563 | < .0001 |
| $b_8$ | 0.9098 | 0.0124 | 0.8854 | 0.9343 | 73.37097 | < .0001 |
| $b_9$ | -0.0765 | 0.00865 | -0.0935 | -0.0595 | -8.84393 | < .0001 |
| $b_{10}$ | -0.00656 | 0.0240 | -0.0537 | 0.0406 | -0.27333 | 0.784741681 |

Figure 4.19 and Figure 4.20 present the residual plots against the fitted values and periods. In both plots, the mean of the residuals is approximately zero, with the distribution appearing quite uniform and no obvious trends, we can also employ the quantile-quantile plot to check if the data follows a normal distribution, thereby evaluating the appropriateness of this statistical model. Figure 4.20 represents the Residual quantile-quantile Plot for $SA_H$-$SA_V$, with the results indicating a normal



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distribution for the data.

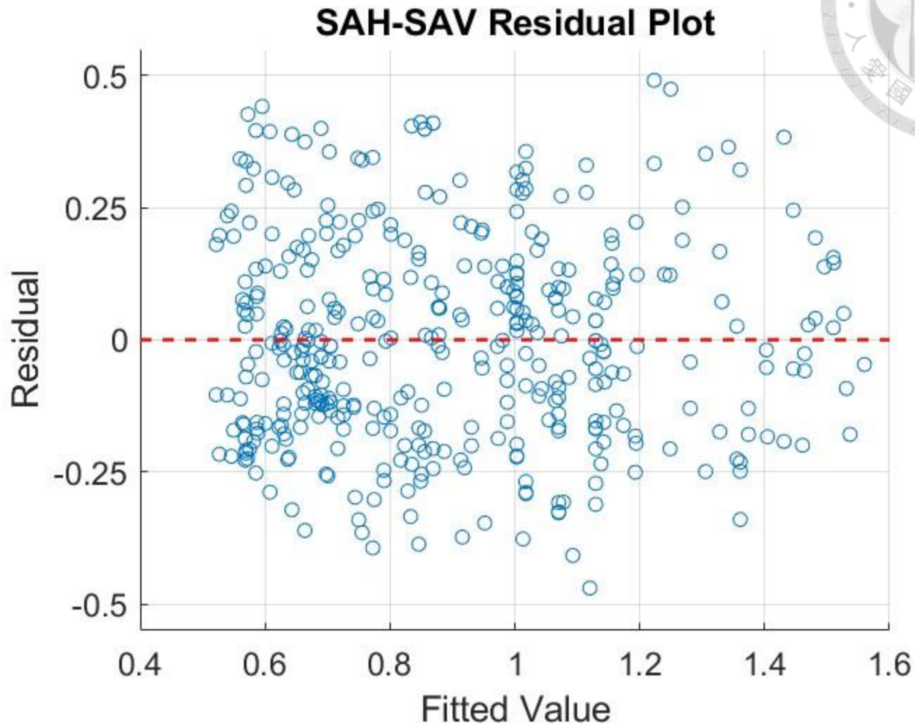


Figure 4.19 $SA_H$-$SA_V$ Residual Plot against Fitted Values

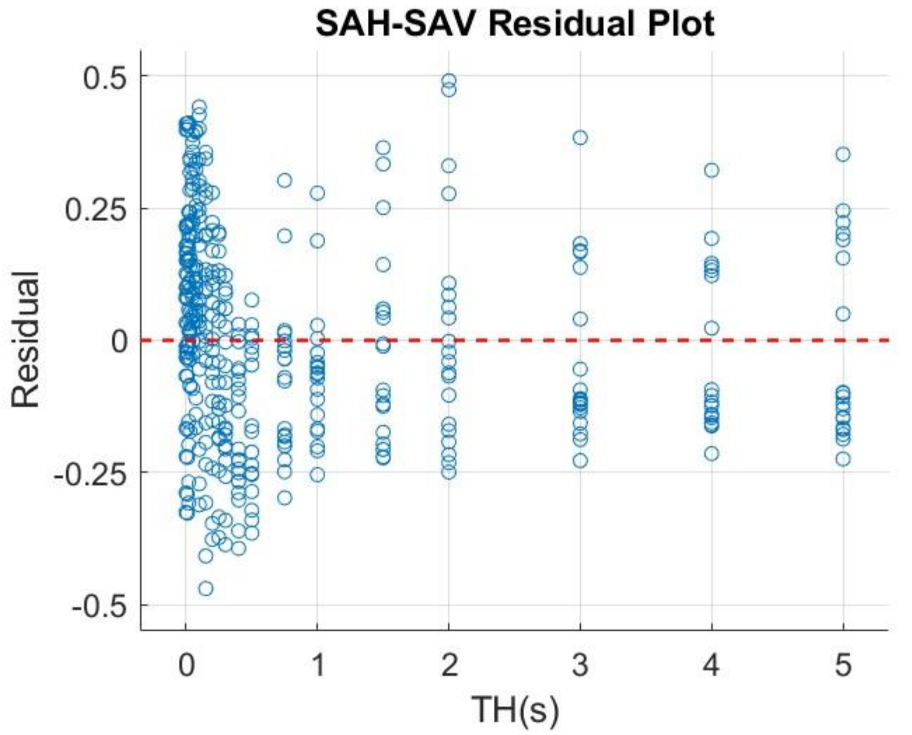


Figure 4.20 $SA_H$-$SA_V$ Residual Plot against $T_H$(s)



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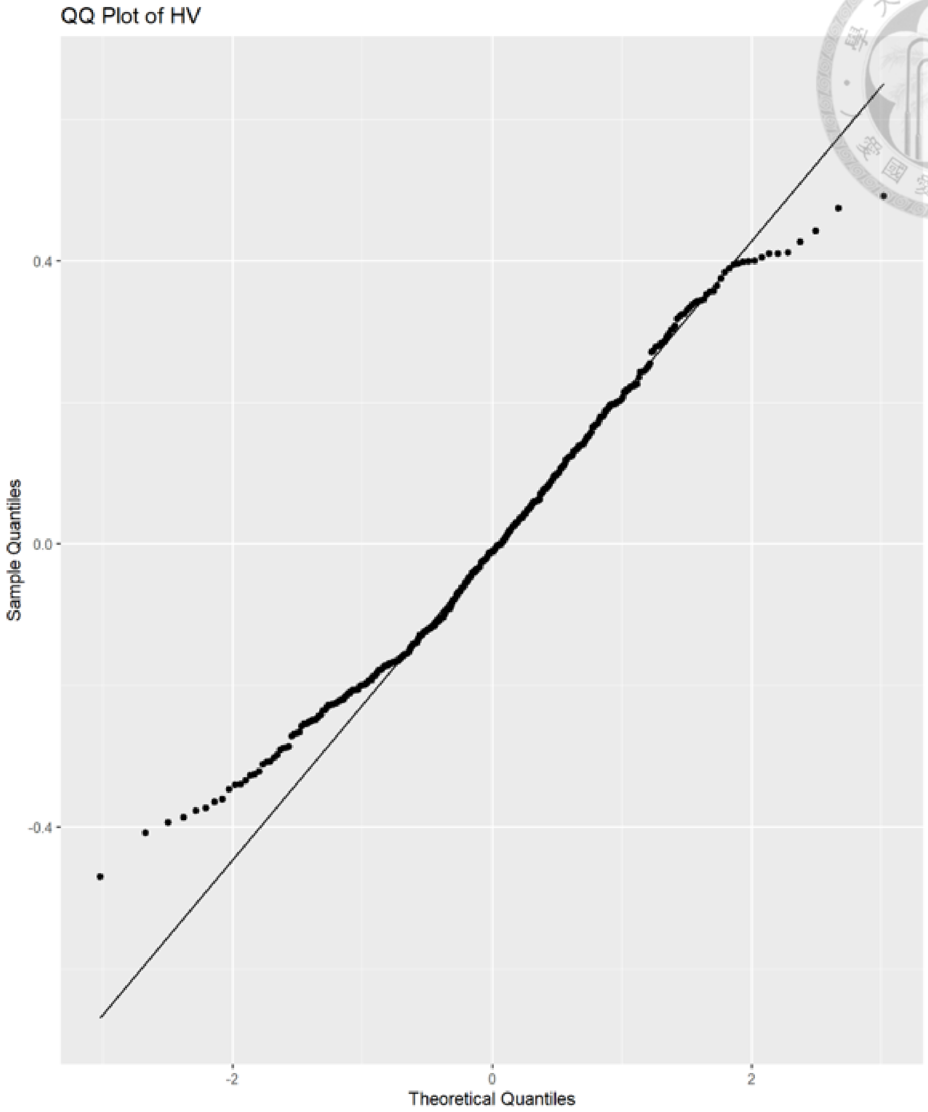


Figure 4.21 $SA_H$-$SA_V$ Residual Quantile-Quantile Plot

Next, the correlation model for horizontal-horizontal spectral accelerations ($SA_H$-$SA_H$).

The formula for the $SA_H$-$SA_H$ correlation coefficients at two different periods ($T_{H1}$, $T_{H2}$) is as follows:

$$\rho_0(T_{H1}, T_{H2}) = 1 - \cos\left(\frac{\pi}{2} - \left(b_1 + \frac{b_2 \mathbb{1}_{\{T_{min} < b_3\}}}{b_3}\right) \ln\left(\frac{T_{max}}{T_{min}}\right)\right) \tag{4.4}$$



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In which $T_{min} = \min(T_{H1}, T_{H2})$, $T_{max} = \max(T_{H1}, T_{H2})$, and $\mathbb{1}$ is an indicator function equal to 1 if $T_{min} < b_3$ and equal to 0 otherwise, The overall model fit shows an R-squared value of 0.982, and a p-value less than 0.0001. The results estimated using the nonlinear least squares method are presented in Table 4.2.

Table 4.2 Nonlinear Least-Square Estimated Results for $SA_H\_SA_H$.

| Coefficients | Estimates | Standard Error | 95% Confidence Interval | | t(390) | P-value |
|---|---|---|---|---|---|---|
| $b_1$ | 0.1353 | 0.00384 | 0.1278 | 0.1429 | 35.23438 | < .0001 |
| $b_2$ | 0.0386 | 0.00175 | 0.0352 | 0.0421 | 22.05714 | < .0001 |
| $b_3$ | 0.1501 | 0.0216 | 0.1076 | 0.1927 | 6.949074 | < .0001 |

Figure 4.22 and Figure 4.23 display the mean of the residuals distribution as appearing quite uniform and showing no obvious trends. However, there are some extreme outliers that deviate considerably from the mean, with the overall average of the residuals slightly above zero.

Figure 4.24 presents the Residual Quantile-Quantile Plot for $SA_H$-$SA_H$. The results roughly correspond to a normal distribution for the data, but with slight deviations at both ends of the plot. This suggests the presence of some outliers in the data that are significantly larger than the mean or median, which aligns with the findings from the residuals plot.



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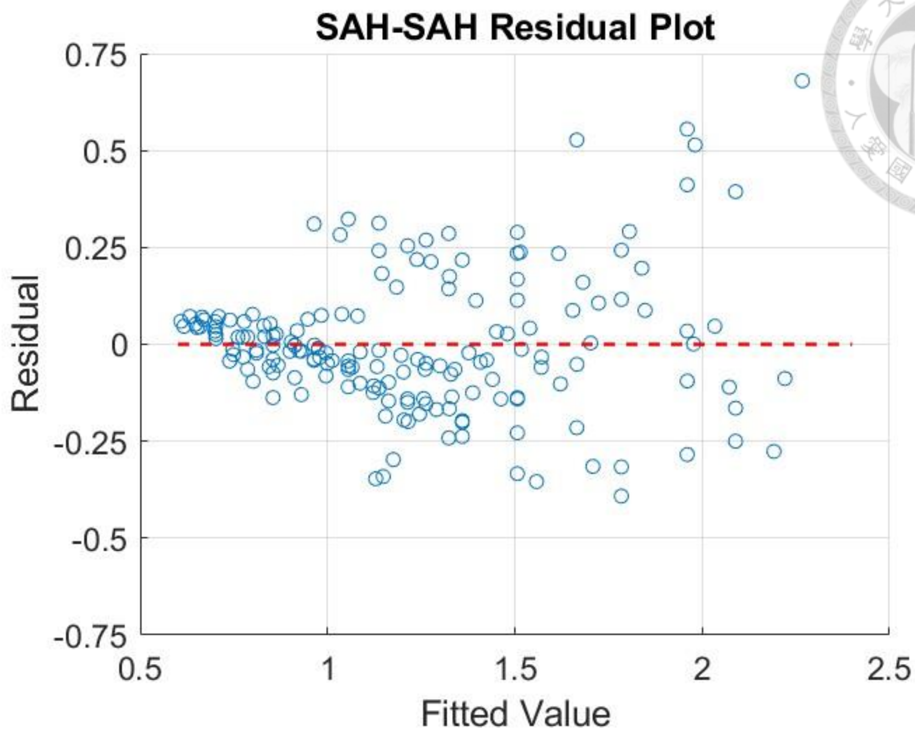


Figure 4.22 $SA_H$-$SA_H$ Residual Plot against Fitted Values

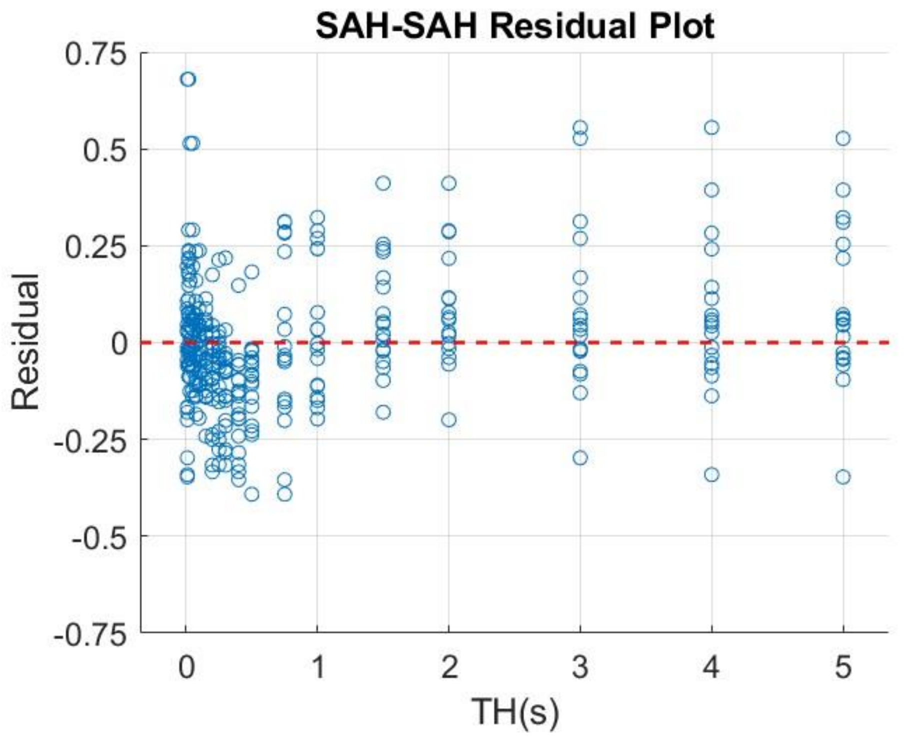


Figure 4.23 $SA_H$-$SA_H$ Residual Plot against $T_H$(s)



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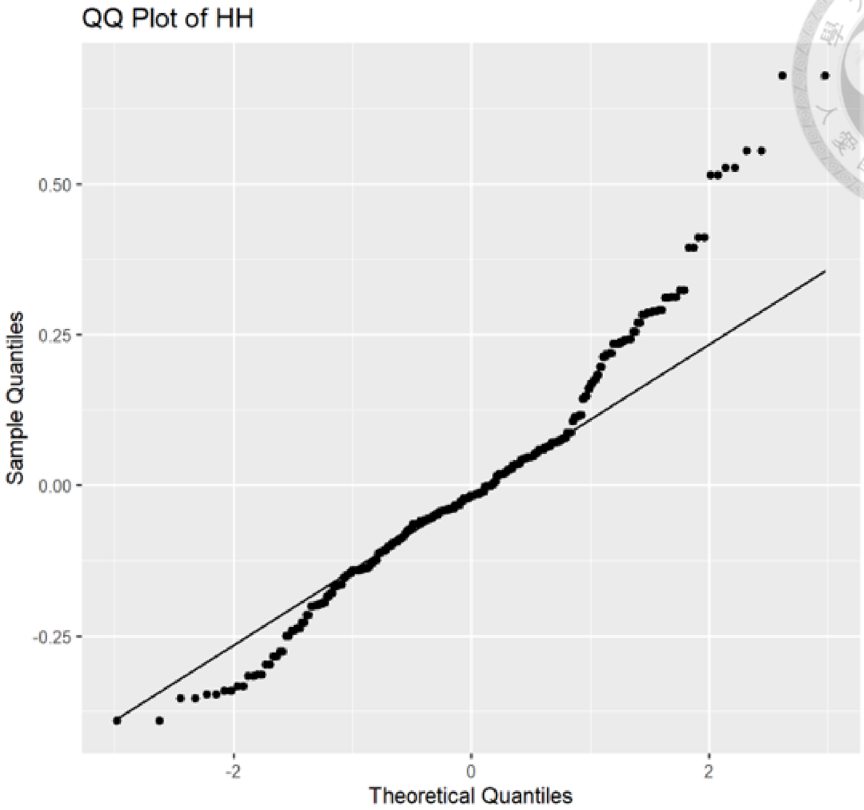


Figure 4.24 $SA_H$-$SA_H$ Residual Quantile-Quantile Plot

Lastly, we introduce the correlation model for vertical-vertical spectral accelerations ($SA_V$-$SA_V$). The formula for the $SA_V$-$SA_V$ correlation coefficients at different periods ($T_{V1}$, $T_{V2}$) is as follows:

$$\rho_0(T_{V1}, T_{V2}) = \begin{cases} c_2, T_{max} < 0.072 \\ c_1, T_{max} \geq 0.072 \; and \; T_{min} > 0.072 \\ \min(c_2, c_3), 0.072 \leq T_{max} < 0.2 \; and \; T_{min} \leq 0.072 \\ c_3, otherwise \end{cases} \tag{4.5}$$

In which $T_{min} = \min(T_{V1}, T_{V2})$, $T_{max} = \max(T_{V1}, T_{V2})$, and the coefficient $c_1$, $c_2$, $c_3$ are as follows:



doi:10.6342/NTU202303258

$$c_1 = 1 - \cos\left(\frac{\pi}{2} - b_1\, ln\left(\frac{T_{max}}{\max(T_{min}, b_2)}\right)\right) \tag{4.6}$$

$$c_2 = \begin{cases} 1 - b_3\left(1 - \frac{1}{1 + e^{100T_{max} - b_4}}\right)\left(\frac{T_{max} - T_{min}}{T_{max} - b_5}\right), T_{max} < 0.2 \\ 0.0\,, T_{max} \geq 0.2 \end{cases} \tag{4.7}$$

$$c_3 = c_1 + 0.5(\sqrt{c_1} - c_1)\left(1 + \cos\left(\frac{\pi T_{min}}{b_6}\right)\right) \tag{4.8}$$

The overall model fit indicates an R-squared value of 0.956, and a p-value less than 0.0001. The results estimated using the nonlinear least squares method are presented in Table 4.3.

Table 4.3 Nonlinear Least-Square Estimated Results for $SA_V\_SA_V$.

| Coefficients | Estimates | Standard Error | 95% Confidence Interval | | t(390) | P-value |
|---|---|---|---|---|---|---|
| b1 | 0.2050 | 0.00514 | 0.1948 | 0.2151 | 39.8832 | < .0001 |
| b2 | 0.0376 | 0.00374 | 0.0302 | 0.0449 | 10.053 | < .0001 |
| b3 | 0.1088 | 0.0185 | 0.0724 | 0.1452 | 5.8810 | < .0001 |
| b4 | 3.5965 | 0.4275 | 2.7558 | 4.4371 | 8.4128 | < .0001 |
| b5 | 0.00659 | 0.00151 | 0.00362 | 0.00956 | 4.3642 | < .0001 |
| b6 | 0.0603 | 0.00976 | 0.0411 | 0.0795 | 6.1782 | < .0001 |

Figure 4.25 and Figure 4.26 show that the mean of the residuals is approximately zero, with the distribution appearing quite uniform and showing no obvious trends. In addition, the Residual Quantile-Quantile Plot for $SA_V$-$SA_V$, as shown in Figure 4.27, indicates a normal distribution for the data.



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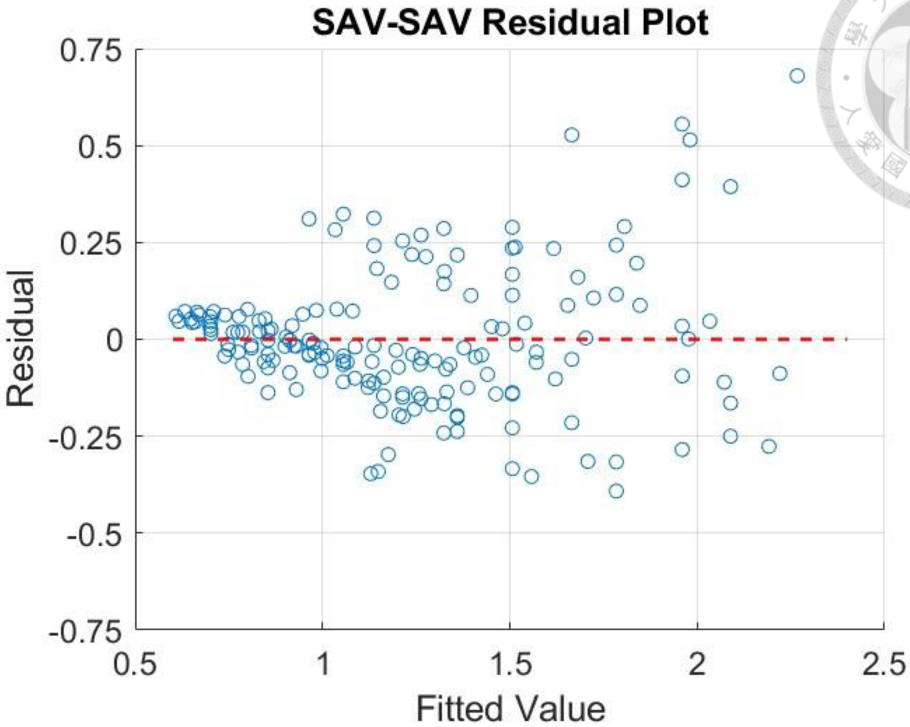


Figure 4.25 SA$_V$-SA$_V$ Residual Plot against Fitted Values

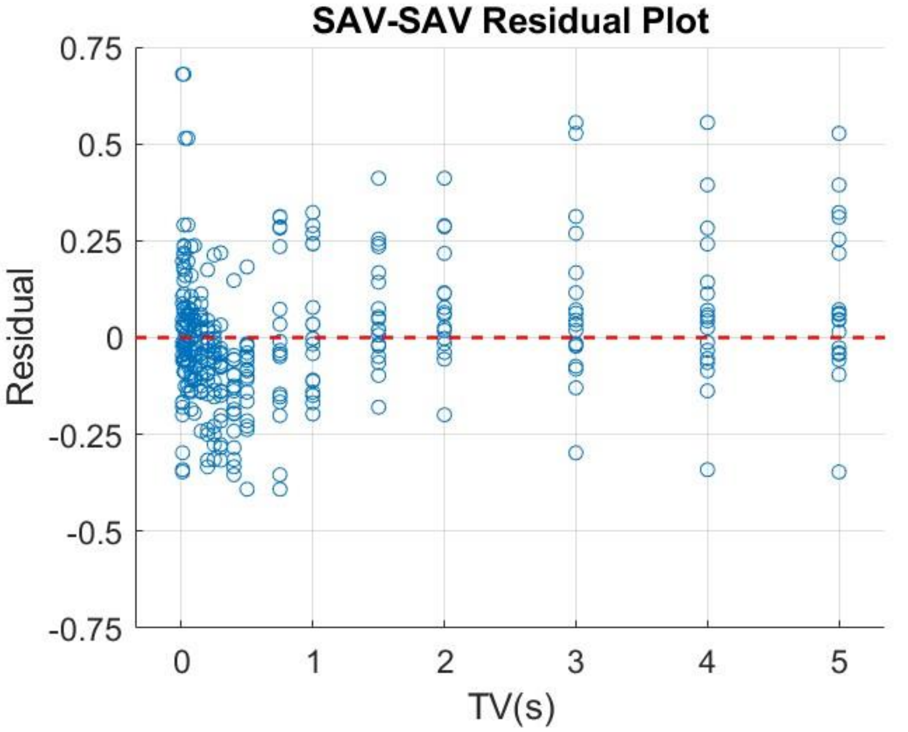


Figure 4.26 SA$_V$-SA$_V$ Residual Plot against Fitted Values



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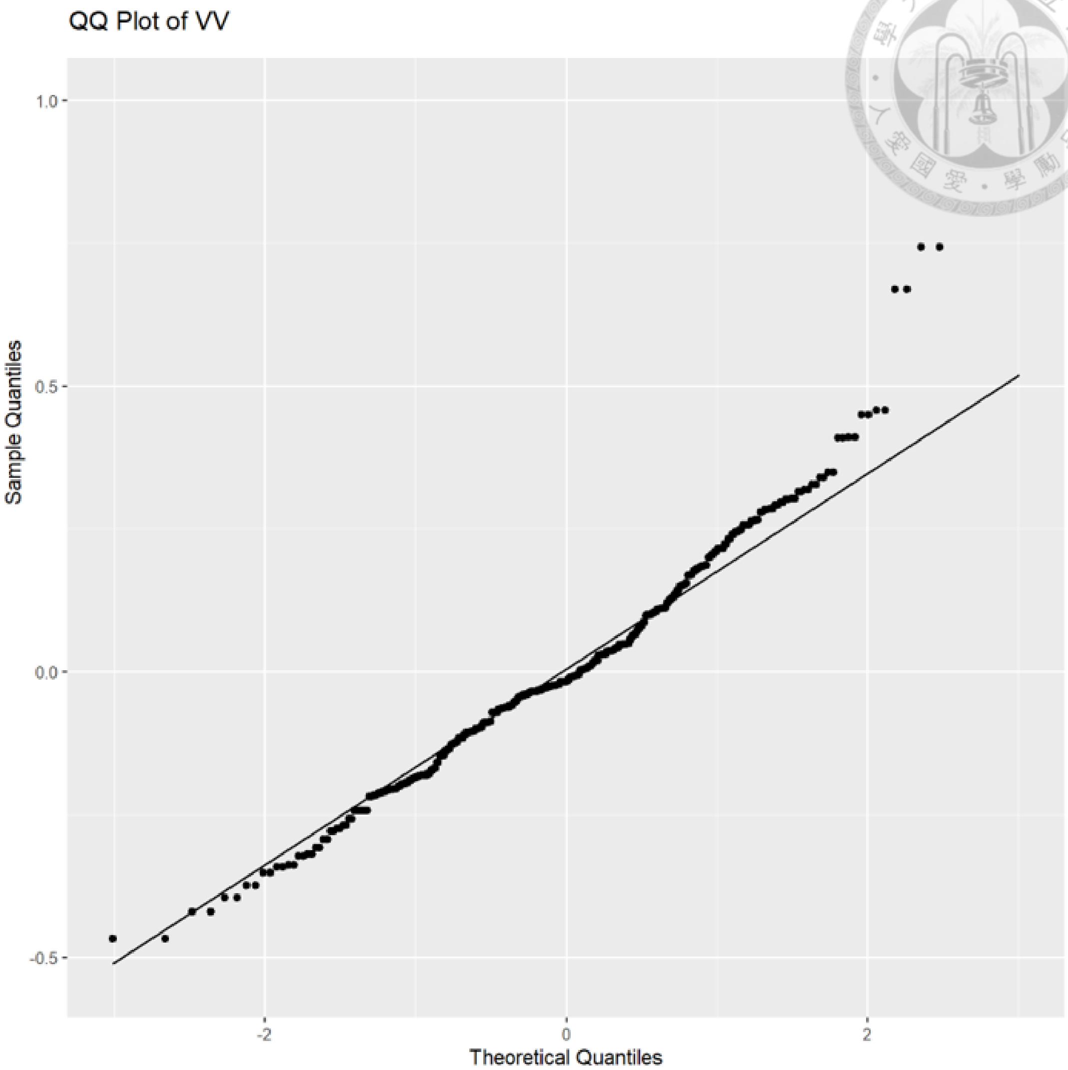

Figure 4.27 $SA_V$-$SA_V$ Residual Quantile-Quantile Plot

Figure 4.28 through Figure 4.30 display the contour plots of the total correlation coefficients, using both empirical data and coefficients derived from the correlation model for three scenarios. The comparison, clearly illustrated in the figures, the black dotted lines represent the actual data, and the red lines represent the values calculated using the model. In the scenarios of $SA_H$-$SA_H$ and $SA_V$-$SA_V$, the model fits closely with the actual data. However, in the $SA_H$-$SA_V$ scenario, a slight difference can be seen in the bottom-right corner, with the model structure more closely resembling the shape of the actual data in the upper-left.



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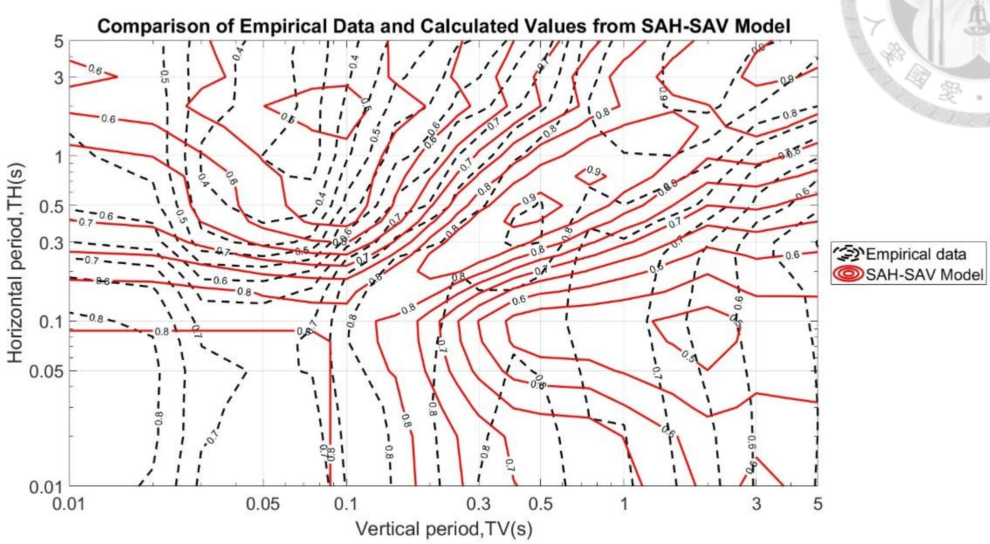


Figure 4.28 Contour plots illustrating the comparison of $SA_H$-$SA_V$ total correlation coefficients derived from empirical data and correlation model.

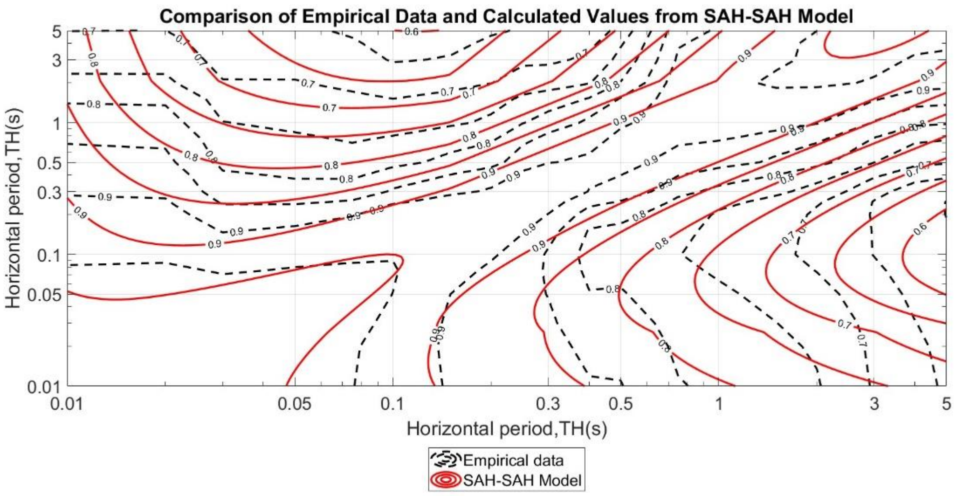


Figure 4.29 Contour plots illustrating the comparison of $SA_H$-$SA_H$ total correlation coefficients derived from empirical data and correlation model.



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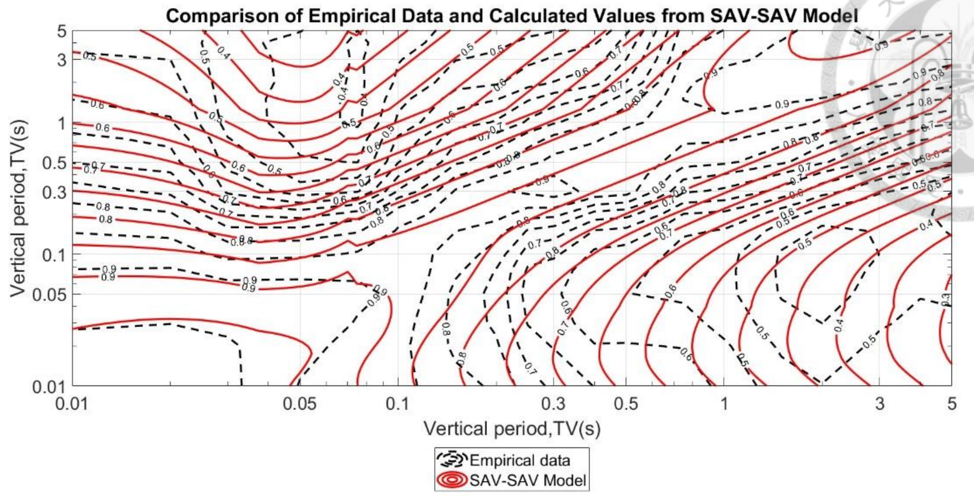


Figure 4.30 Contour plots illustrating the comparison of $SA_V$-$SA_V$ total correlation coefficients derived from empirical data and correlation model.

### 4.3.2 Compared to Previous Studies

The comparison between the $SA_H$-$SA_V$ correlation model from this study and (a) Baker and Jayaram (2008) and (b) Kohrangi et al. (2020) is illustrated in Figure 4.31. In the contour plot, the models by Baker and Jayaram exhibit smaller levels intervals and primarily differ from the model in this study in the upper-left and lower-right corners. Baker's model characterizes parallel lines and smaller levels, with values lower than those of this study's model. Conversely, the model by Kohrangi et al. aligns more closely with the findings of this study, potentially due to their adoption of a similar regression equation. The structural discrepancies may be attributed to the different types of earthquake databases used.



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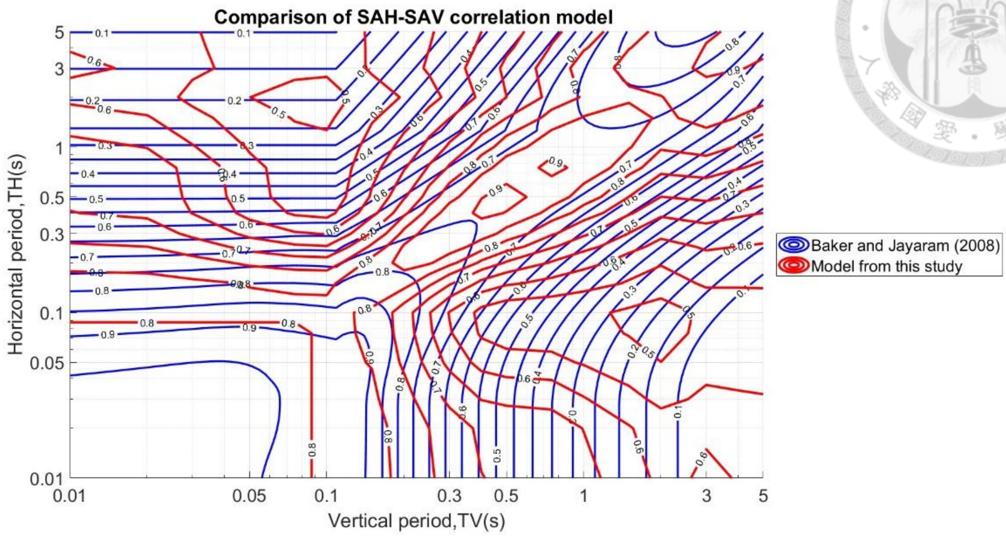
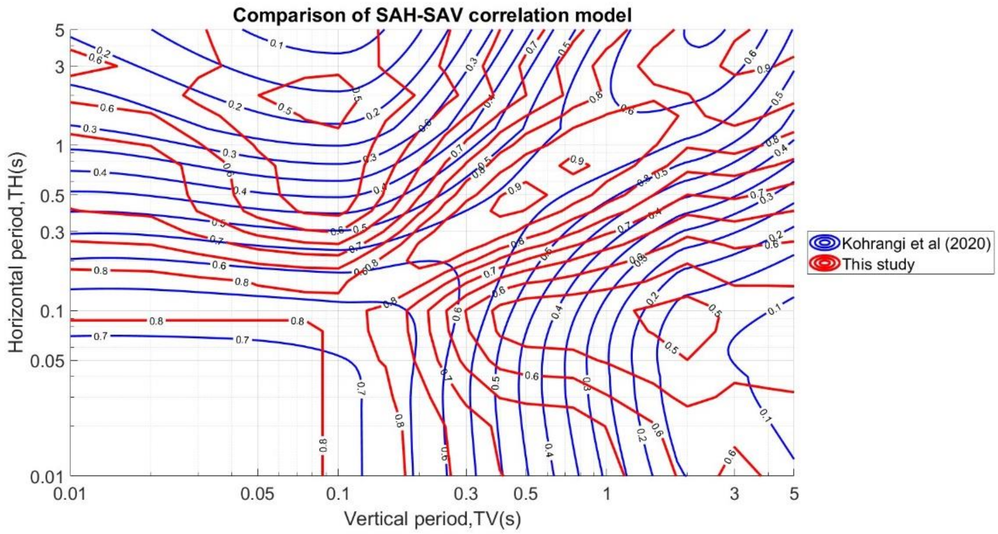



(a)




(b)

Figure 4.31. Comparison of the $SA_H$-$SA_V$ Correlation Model from This Study with (a) Baker and Jayaram (2008) and (b)

Sources: Kohrangi et al. (2020)



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# Chapter 5 Conclusions and Recommendations

## 5.1 Conclusions

1. Because the correlation coefficients of the response spectral value are derived from the normalized residuals, the choice of GMPEs and the factors influencing the residual terms would affect the results. This study demonstrates that the distribution of residuals varies with earthquake types, depth, and Rrup. However, there are no significant effects from the site parameters such as Vs30 and Z1.0.
2. The total, intra-event, and inter-event residuals all display a similar correlation structure. Moreover, they indicate a certain degree of dependence between the total correlation coefficient, moment magnitude, Vs30, and earthquake types. These findings suggest that we can develop correlation coefficient models that are dependent on these three parameters. For instance, a magnitude-dependent correlation coefficient model could be used to establish the conditional mean spectrum (CMS) for seismic design.
3. A parametric predictive correlation model for 5% damped spectral accelerations is proposed in this study. This model performed well in statistical tests and can be applied to crustal and subduction zone earthquakes with Richter magnitudes greater than 5.6 in the Taiwan region for practical applications.

## 5.2 Recommendations for Future Research

1. The earthquakes included in this study all had Richter magnitudes greater than 5.6, mostly occurring in the subduction zone earthquakes off the eastern coast



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and the crustal earthquakes within the Huadong Rift Valley. Almost no crustal earthquakes from the densely populated western region were included. As the data provided by the GDMS platform becomes increasingly comprehensive, it is recommended that future studies on spectral response correlation could expand the amount of data collected, including more earthquakes from across Taiwan, and consider focusing on shallow earthquakes with magnitudes between 3-5.

2. This study calculated the correlation coefficients using only one pair of Ground Motion Prediction Equations model. It is recommended that future studies adopt multiple models to achieve more accurate regression simulation results. The combined model form can also better handle variations in situations and enhance the stability of the results.
3. On the algorithmic level, deep learning neural networks could be considered to replace the regression methods used in this study that rely on pre-set equations. Using neural networks as regression functions might eliminate the need to pre-design regression equations, potentially producing results with a higher degree of fit.



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# Appendix

## Total Correlation Coefficient Matrix

### $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.810966 | 0.795537 | 0.776449 | 0.65473 | 0.62234 | 0.632014 | 0.745414 | 0.807859 | 0.815928 | 0.796285 | 0.816047 | 0.856132 | 0.849316 | 0.766186 | 0.769335 | 0.718492 | 0.678365 | 0.600176 | 0.576613 | 0.546238 |
| 0.01 | 0.810038 | 0.794574 | 0.775394 | 0.6534 | 0.620901 | 0.630855 | 0.744702 | 0.807386 | 0.815471 | 0.796099 | 0.816108 | 0.856291 | 0.849508 | 0.766018 | 0.769269 | 0.718544 | 0.678308 | 0.599792 | 0.576124 | 0.545694 |
| 0.02 | 0.818472 | 0.804011 | 0.786213 | 0.667158 | 0.634789 | 0.642337 | 0.751238 | 0.810821 | 0.817295 | 0.794557 | 0.812616 | 0.851305 | 0.845265 | 0.76652 | 0.768089 | 0.716205 | 0.678262 | 0.603918 | 0.582935 | 0.553012 |
| 0.03 | 0.866918 | 0.858459 | 0.847121 | 0.769934 | 0.730878 | 0.715289 | 0.779775 | 0.795117 | 0.787643 | 0.74154 | 0.761018 | 0.80669 | 0.798828 | 0.735749 | 0.727561 | 0.661742 | 0.629054 | 0.574563 | 0.564037 | 0.541661 |
| 0.05 | 0.879605 | 0.872159 | 0.862678 | 0.783227 | 0.758017 | 0.752608 | 0.81035 | 0.813215 | 0.796944 | 0.740292 | 0.751278 | 0.777204 | 0.774707 | 0.731995 | 0.725167 | 0.661951 | 0.632504 | 0.589371 | 0.584228 | 0.561883 |
| 0.075 | 0.835028 | 0.824103 | 0.809636 | 0.718547 | 0.730628 | 0.74464 | 0.823005 | 0.825596 | 0.785434 | 0.71849 | 0.741994 | 0.762346 | 0.753671 | 0.718872 | 0.719662 | 0.65811 | 0.619686 | 0.590186 | 0.564746 | 0.550536 |
| 0.1 | 0.82278 | 0.810128 | 0.791194 | 0.67406 | 0.695179 | 0.727335 | 0.835812 | 0.87322 | 0.837827 | 0.77297 | 0.796703 | 0.776637 | 0.761178 | 0.697151 | 0.717702 | 0.649466 | 0.605752 | 0.564846 | 0.552739 | 0.532649 |
| 0.15 | 0.755717 | 0.739414 | 0.717813 | 0.572009 | 0.594616 | 0.647246 | 0.793847 | 0.877204 | 0.849593 | 0.797092 | 0.817881 | 0.797783 | 0.785174 | 0.699793 | 0.730658 | 0.670483 | 0.616529 | 0.574795 | 0.551642 | 0.531563 |
| 0.2 | 0.755484 | 0.739597 | 0.717727 | 0.562377 | 0.540746 | 0.589836 | 0.743966 | 0.851836 | 0.886113 | 0.845081 | 0.838064 | 0.819583 | 0.813022 | 0.709918 | 0.736449 | 0.681054 | 0.637694 | 0.582692 | 0.564326 | 0.533412 |
| 0.25 | 0.701154 | 0.682156 | 0.656493 | 0.495023 | 0.461135 | 0.495498 | 0.673059 | 0.785568 | 0.818179 | 0.839984 | 0.846684 | 0.857714 | 0.843207 | 0.734954 | 0.762129 | 0.709156 | 0.66396 | 0.579828 | 0.545952 | 0.514801 |
| 0.3 | 0.64398 | 0.62303 | 0.59531 | 0.429569 | 0.388048 | 0.416232 | 0.595412 | 0.735156 | 0.787131 | 0.832135 | 0.85139 | 0.881229 | 0.866499 | 0.734938 | 0.749867 | 0.701022 | 0.647604 | 0.550168 | 0.505456 | 0.470431 |
| 0.4 | 0.580549 | 0.554828 | 0.523981 | 0.361687 | 0.294179 | 0.308951 | 0.477644 | 0.652156 | 0.713451 | 0.773431 | 0.810956 | 0.893498 | 0.886492 | 0.736242 | 0.731611 | 0.710453 | 0.658858 | 0.529601 | 0.480894 | 0.440224 |
| 0.5 | 0.593453 | 0.567325 | 0.536546 | 0.371931 | 0.310952 | 0.321589 | 0.482292 | 0.652283 | 0.699171 | 0.784628 | 0.828389 | 0.89321 | 0.907467 | 0.77031 | 0.766547 | 0.744078 | 0.701372 | 0.588663 | 0.534594 | 0.494992 |
| 0.75 | 0.590971 | 0.569547 | 0.553641 | 0.418772 | 0.388521 | 0.370768 | 0.461468 | 0.59676 | 0.62444 | 0.699269 | 0.721449 | 0.7661 | 0.80489 | 0.875873 | 0.881783 | 0.874513 | 0.865502 | 0.781596 | 0.752699 | 0.721792 |
| 1 | 0.578364 | 0.557303 | 0.540665 | 0.416658 | 0.388357 | 0.345594 | 0.420791 | 0.55261 | 0.590057 | 0.666786 | 0.696081 | 0.757289 | 0.803932 | 0.874176 | 0.904797 | 0.897013 | 0.883867 | 0.798436 | 0.767971 | 0.739836 |
| 1.5 | 0.559171 | 0.537674 | 0.521098 | 0.393315 | 0.352406 | 0.314587 | 0.409554 | 0.540394 | 0.571693 | 0.646963 | 0.672635 | 0.734298 | 0.774645 | 0.861095 | 0.908621 | 0.936231 | 0.914871 | 0.819113 | 0.778744 | 0.760886 |
| 2 | 0.561047 | 0.542003 | 0.529475 | 0.415085 | 0.361656 | 0.300848 | 0.395273 | 0.510457 | 0.552921 | 0.623423 | 0.637291 | 0.706155 | 0.750727 | 0.859111 | 0.894672 | 0.937166 | 0.938321 | 0.845108 | 0.810843 | 0.784228 |
| 3 | 0.527748 | 0.51559 | 0.513757 | 0.418252 | 0.389451 | 0.327986 | 0.386002 | 0.468684 | 0.496033 | 0.531368 | 0.54724 | 0.608995 | 0.660288 | 0.835304 | 0.871283 | 0.904255 | 0.948289 | 0.926538 | 0.908967 | 0.883424 |
| 4 | 0.526553 | 0.517622 | 0.519054 | 0.433422 | 0.405784 | 0.341107 | 0.384952 | 0.453292 | 0.477111 | 0.514262 | 0.525491 | 0.567832 | 0.621094 | 0.807462 | 0.839271 | 0.878872 | 0.933218 | 0.932091 | 0.929733 | 0.910938 |
| 5 | 0.518003 | 0.508232 | 0.508484 | 0.427283 | 0.395126 | 0.333601 | 0.363785 | 0.424032 | 0.455028 | 0.493806 | 0.514711 | 0.56841 | 0.623204 | 0.817069 | 0.843453 | 0.888937 | 0.92986 | 0.934269 | 0.930982 | 0.918036 |



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# Total Correlation Coefficient Matrix

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.995259 | 0.995237 | 0.994556 | 0.969602 | 0.966804 | 0.950079 | 0.94065 | 0.907064 | 0.90601 | 0.9062 | 0.901899 | 0.876456 | 0.87474 | 0.820511 | 0.808174 | 0.787478 | 0.768069 | 0.705561 | 0.668498 | 0.65392 |
| 0.01 | 0.995237 | 0.995223 | 0.994503 | 0.969288 | 0.966432 | 0.949823 | 0.940463 | 0.90709 | 0.906044 | 0.906447 | 0.902176 | 0.876924 | 0.875305 | 0.820638 | 0.808364 | 0.78779 | 0.76825 | 0.705477 | 0.668341 | 0.653873 |
| 0.02 | 0.994556 | 0.994503 | 0.994484 | 0.972279 | 0.970253 | 0.951851 | 0.94159 | 0.906817 | 0.905242 | 0.903188 | 0.897128 | 0.869684 | 0.868685 | 0.818832 | 0.8062 | 0.784961 | 0.766577 | 0.707349 | 0.671711 | 0.656632 |
| 0.03 | 0.969602 | 0.969288 | 0.972279 | 0.993869 | 0.986496 | 0.950941 | 0.918837 | 0.851718 | 0.846762 | 0.834103 | 0.823605 | 0.79122 | 0.788435 | 0.749002 | 0.745531 | 0.720988 | 0.710832 | 0.660946 | 0.630443 | 0.618533 |
| 0.05 | 0.966804 | 0.966432 | 0.970253 | 0.986496 | 0.993677 | 0.962415 | 0.936111 | 0.86722 | 0.855166 | 0.832342 | 0.81131 | 0.760343 | 0.764429 | 0.746727 | 0.741664 | 0.716364 | 0.705167 | 0.665359 | 0.640143 | 0.625318 |
| 0.075 | 0.950079 | 0.949823 | 0.951851 | 0.950941 | 0.962415 | 0.994882 | 0.961222 | 0.908573 | 0.874031 | 0.832507 | 0.806393 | 0.748537 | 0.755662 | 0.737963 | 0.721153 | 0.705633 | 0.683648 | 0.653412 | 0.626374 | 0.607235 |
| 0.1 | 0.94065 | 0.940463 | 0.94159 | 0.918837 | 0.936111 | 0.961222 | 0.996127 | 0.959145 | 0.911776 | 0.881872 | 0.848801 | 0.765346 | 0.768152 | 0.739772 | 0.720023 | 0.692253 | 0.659764 | 0.625375 | 0.601138 | 0.580669 |
| 0.15 | 0.907064 | 0.90709 | 0.906817 | 0.851718 | 0.86722 | 0.908573 | 0.959145 | 0.997649 | 0.953181 | 0.923703 | 0.878508 | 0.794002 | 0.790624 | 0.766939 | 0.727293 | 0.704717 | 0.667173 | 0.633533 | 0.604284 | 0.583802 |
| 0.2 | 0.90601 | 0.906044 | 0.905242 | 0.846762 | 0.855166 | 0.874031 | 0.911776 | 0.953181 | 0.997717 | 0.950715 | 0.899194 | 0.825225 | 0.808298 | 0.768726 | 0.737885 | 0.722454 | 0.692335 | 0.652347 | 0.621279 | 0.607181 |
| 0.25 | 0.9062 | 0.906447 | 0.903188 | 0.834103 | 0.832342 | 0.832507 | 0.881872 | 0.923703 | 0.950715 | 0.99729 | 0.957509 | 0.883896 | 0.85601 | 0.803944 | 0.771706 | 0.750509 | 0.721216 | 0.657524 | 0.626057 | 0.614885 |
| 0.3 | 0.901899 | 0.902176 | 0.897128 | 0.823605 | 0.81131 | 0.806393 | 0.848801 | 0.878508 | 0.899194 | 0.957509 | 0.996745 | 0.932277 | 0.895733 | 0.820547 | 0.787256 | 0.757688 | 0.728485 | 0.653008 | 0.618263 | 0.601586 |
| 0.4 | 0.876456 | 0.876924 | 0.869684 | 0.79122 | 0.760343 | 0.748537 | 0.765346 | 0.794002 | 0.825225 | 0.883896 | 0.932277 | 0.995785 | 0.958277 | 0.834721 | 0.821871 | 0.787795 | 0.761431 | 0.664323 | 0.615026 | 0.608106 |
| 0.5 | 0.87474 | 0.875305 | 0.868685 | 0.788435 | 0.764429 | 0.755662 | 0.768152 | 0.790624 | 0.808298 | 0.85601 | 0.895733 | 0.958277 | 0.995701 | 0.883795 | 0.877685 | 0.83784 | 0.8081 | 0.723232 | 0.678514 | 0.672564 |
| 0.75 | 0.820511 | 0.820638 | 0.818832 | 0.749002 | 0.746727 | 0.737963 | 0.739772 | 0.766939 | 0.768726 | 0.803944 | 0.820547 | 0.834721 | 0.883795 | 0.997063 | 0.963603 | 0.940417 | 0.92309 | 0.89569 | 0.865893 | 0.855081 |
| 1 | 0.808174 | 0.808364 | 0.8062 | 0.745531 | 0.741664 | 0.721153 | 0.720023 | 0.727293 | 0.737885 | 0.771706 | 0.787256 | 0.821871 | 0.877685 | 0.963603 | 0.997819 | 0.965902 | 0.946351 | 0.910742 | 0.88072 | 0.880614 |
| 1.5 | 0.787478 | 0.78779 | 0.784961 | 0.720988 | 0.716364 | 0.705633 | 0.692253 | 0.704717 | 0.722454 | 0.750509 | 0.757688 | 0.787795 | 0.83784 | 0.940417 | 0.965902 | 0.998384 | 0.982718 | 0.932106 | 0.89892 | 0.899194 |
| 2 | 0.768069 | 0.76825 | 0.766577 | 0.710832 | 0.705167 | 0.683648 | 0.659764 | 0.667173 | 0.692335 | 0.721216 | 0.728485 | 0.761431 | 0.8081 | 0.92309 | 0.946351 | 0.982718 | 0.998709 | 0.956251 | 0.924663 | 0.91815 |
| 3 | 0.705561 | 0.705477 | 0.707349 | 0.660946 | 0.665359 | 0.653412 | 0.625375 | 0.633533 | 0.652347 | 0.657524 | 0.653008 | 0.664323 | 0.723232 | 0.89569 | 0.910742 | 0.932106 | 0.956251 | 0.999422 | 0.987011 | 0.975381 |
| 4 | 0.668498 | 0.668341 | 0.671711 | 0.630443 | 0.640143 | 0.626374 | 0.601138 | 0.604284 | 0.621279 | 0.626057 | 0.618263 | 0.615026 | 0.678514 | 0.865893 | 0.88072 | 0.89892 | 0.924663 | 0.987011 | 0.999233 | 0.986159 |
| 5 | 0.65392 | 0.653873 | 0.656632 | 0.618533 | 0.625318 | 0.607235 | 0.580669 | 0.583802 | 0.607181 | 0.614885 | 0.601586 | 0.608106 | 0.672564 | 0.855081 | 0.880614 | 0.899194 | 0.91815 | 0.975381 | 0.986159 | 0.998614 |



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# Total Correlation Coefficient Matrix

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.991749 | 0.990211 | 0.985348 | 0.93517 | 0.872566 | 0.851146 | 0.885393 | 0.861879 | 0.848886 | 0.785 | 0.7636 | 0.71938 | 0.720966 | 0.67802 | 0.636108 | 0.570941 | 0.543572 | 0.548226 | 0.554741 | 0.54151 |
| 0.01 | 0.990211 | 0.990973 | 0.988492 | 0.94541 | 0.88333 | 0.858228 | 0.883828 | 0.851466 | 0.837395 | 0.767821 | 0.743133 | 0.696232 | 0.698908 | 0.660653 | 0.617122 | 0.55051 | 0.528085 | 0.540765 | 0.55298 | 0.540326 |
| 0.02 | 0.985348 | 0.988492 | 0.990748 | 0.958495 | 0.897856 | 0.865129 | 0.874768 | 0.831035 | 0.814627 | 0.738922 | 0.70939 | 0.663215 | 0.6669 | 0.644079 | 0.59852 | 0.53381 | 0.518324 | 0.541214 | 0.55981 | 0.547211 |
| 0.03 | 0.93517 | 0.94541 | 0.958495 | 0.991276 | 0.935351 | 0.872359 | 0.816854 | 0.704015 | 0.672361 | 0.578259 | 0.546171 | 0.513954 | 0.511502 | 0.535578 | 0.483138 | 0.420032 | 0.414591 | 0.468135 | 0.498804 | 0.494614 |
| 0.05 | 0.872566 | 0.88333 | 0.897856 | 0.935351 | 0.993276 | 0.938003 | 0.851896 | 0.697159 | 0.610898 | 0.498894 | 0.470321 | 0.421023 | 0.420798 | 0.469666 | 0.448486 | 0.377658 | 0.373825 | 0.454393 | 0.489975 | 0.491278 |
| 0.075 | 0.851146 | 0.858228 | 0.865129 | 0.872359 | 0.938003 | 0.995515 | 0.921678 | 0.746612 | 0.653254 | 0.512213 | 0.504698 | 0.428321 | 0.420161 | 0.415571 | 0.408941 | 0.347107 | 0.320442 | 0.41046 | 0.432172 | 0.438385 |
| 0.1 | 0.885393 | 0.883828 | 0.874768 | 0.816854 | 0.851896 | 0.921678 | 0.996853 | 0.882854 | 0.796888 | 0.679944 | 0.681166 | 0.600683 | 0.588271 | 0.513755 | 0.520331 | 0.441044 | 0.39936 | 0.439986 | 0.443866 | 0.437197 |
| 0.15 | 0.861879 | 0.851466 | 0.831035 | 0.704015 | 0.697159 | 0.746612 | 0.882854 | 0.997289 | 0.932337 | 0.847998 | 0.849799 | 0.761697 | 0.742935 | 0.625804 | 0.614682 | 0.525431 | 0.481169 | 0.461764 | 0.458786 | 0.448004 |
| 0.2 | 0.848886 | 0.837395 | 0.814627 | 0.672361 | 0.610898 | 0.653254 | 0.796888 | 0.932337 | 0.996332 | 0.931683 | 0.906413 | 0.810651 | 0.795153 | 0.636708 | 0.618414 | 0.559492 | 0.507006 | 0.466986 | 0.468931 | 0.439286 |
| 0.25 | 0.785 | 0.767821 | 0.738922 | 0.578259 | 0.498894 | 0.512213 | 0.679944 | 0.847998 | 0.931683 | 0.995147 | 0.953056 | 0.863304 | 0.854766 | 0.681632 | 0.664806 | 0.620185 | 0.559992 | 0.485989 | 0.46376 | 0.42793 |
| 0.3 | 0.7636 | 0.743133 | 0.70939 | 0.546171 | 0.470321 | 0.504698 | 0.681166 | 0.849799 | 0.906413 | 0.953056 | 0.993646 | 0.915784 | 0.902356 | 0.71333 | 0.701096 | 0.651822 | 0.57538 | 0.499762 | 0.46851 | 0.440828 |
| 0.4 | 0.71938 | 0.696232 | 0.663215 | 0.513954 | 0.421023 | 0.428321 | 0.600683 | 0.761697 | 0.810651 | 0.863304 | 0.915784 | 0.992192 | 0.954756 | 0.761877 | 0.746187 | 0.68382 | 0.61128 | 0.52596 | 0.467998 | 0.436216 |
| 0.5 | 0.720966 | 0.698908 | 0.6669 | 0.511502 | 0.420798 | 0.420161 | 0.588271 | 0.742935 | 0.795153 | 0.854766 | 0.902356 | 0.954756 | 0.992643 | 0.825839 | 0.799311 | 0.749366 | 0.683207 | 0.60106 | 0.546162 | 0.518039 |
| 0.75 | 0.67802 | 0.660653 | 0.644079 | 0.535578 | 0.469666 | 0.415571 | 0.513755 | 0.625804 | 0.636708 | 0.681632 | 0.71333 | 0.761877 | 0.825839 | 0.993995 | 0.952344 | 0.90567 | 0.889228 | 0.830787 | 0.792642 | 0.773845 |
| 1 | 0.636108 | 0.617122 | 0.59852 | 0.483138 | 0.448486 | 0.408941 | 0.520331 | 0.614682 | 0.618414 | 0.664806 | 0.701096 | 0.746187 | 0.799311 | 0.952344 | 0.994341 | 0.945215 | 0.920033 | 0.860281 | 0.816755 | 0.805411 |
| 1.5 | 0.570941 | 0.55051 | 0.53381 | 0.420032 | 0.377658 | 0.347107 | 0.441044 | 0.525431 | 0.559492 | 0.620185 | 0.651822 | 0.68382 | 0.749366 | 0.90567 | 0.945215 | 0.994779 | 0.95764 | 0.891477 | 0.842073 | 0.829375 |
| 2 | 0.543572 | 0.528085 | 0.518324 | 0.414591 | 0.373825 | 0.320442 | 0.39936 | 0.481169 | 0.507006 | 0.559992 | 0.57538 | 0.61128 | 0.683207 | 0.889228 | 0.920033 | 0.95764 | 0.995626 | 0.938386 | 0.910748 | 0.889847 |
| 3 | 0.548226 | 0.540765 | 0.541214 | 0.468135 | 0.454393 | 0.41046 | 0.439986 | 0.461764 | 0.466986 | 0.485989 | 0.499762 | 0.52596 | 0.60106 | 0.830787 | 0.860281 | 0.891477 | 0.938386 | 0.997982 | 0.964977 | 0.956158 |
| 4 | 0.554741 | 0.55298 | 0.55981 | 0.498804 | 0.489975 | 0.432172 | 0.443866 | 0.458786 | 0.468931 | 0.46376 | 0.46851 | 0.467998 | 0.546162 | 0.792642 | 0.816755 | 0.842073 | 0.910748 | 0.964977 | 0.998163 | 0.981449 |
| 5 | 0.54151 | 0.540326 | 0.547211 | 0.494614 | 0.491278 | 0.438385 | 0.437197 | 0.448004 | 0.439286 | 0.42793 | 0.440828 | 0.436216 | 0.518039 | 0.773845 | 0.805411 | 0.829375 | 0.889847 | 0.956158 | 0.981449 | 0.998076 |



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# Inter-event Correlation Coefficient Matrix

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.858238163 | 0.839793629 | 0.815669 | 0.648235 | 0.622011 | 0.718627 | 0.82284 | 0.893797 | 0.894084 | 0.91401 | 0.926114 | 0.915003 | 0.92022 | 0.896832 | 0.874448 | 0.859924 | 0.856258 | 0.835683 | 0.827093 | 0.817066 |
| 0.01 | 0.857353152 | 0.838914046 | 0.814733 | 0.647046 | 0.620743 | 0.717577 | 0.822041 | 0.893379 | 0.893774 | 0.91384 | 0.926056 | 0.915132 | 0.920339 | 0.896736 | 0.874383 | 0.859966 | 0.856334 | 0.835684 | 0.827102 | 0.816943 |
| 0.02 | 0.865730769 | 0.848090729 | 0.82508 | 0.661409 | 0.635148 | 0.729441 | 0.829119 | 0.894865 | 0.892579 | 0.910465 | 0.921438 | 0.909095 | 0.915347 | 0.893978 | 0.871482 | 0.856769 | 0.853539 | 0.834367 | 0.82616 | 0.817371 |
| 0.03 | 0.924829908 | 0.915083853 | 0.901783 | 0.795223 | 0.758575 | 0.815106 | 0.859676 | 0.857105 | 0.83221 | 0.835212 | 0.847251 | 0.829985 | 0.850303 | 0.860517 | 0.840583 | 0.828576 | 0.829067 | 0.826892 | 0.827011 | 0.833082 |
| 0.05 | 0.943942393 | 0.934894887 | 0.92205 | 0.807659 | 0.783237 | 0.845531 | 0.891111 | 0.884899 | 0.856031 | 0.854982 | 0.854437 | 0.821726 | 0.84003 | 0.849234 | 0.829264 | 0.81736 | 0.820948 | 0.820469 | 0.821708 | 0.826966 |
| 0.075 | 0.927034778 | 0.914843863 | 0.897127 | 0.754985 | 0.742831 | 0.830215 | 0.903443 | 0.928349 | 0.903659 | 0.902166 | 0.893436 | 0.855762 | 0.863512 | 0.849849 | 0.825798 | 0.810798 | 0.811488 | 0.805349 | 0.803366 | 0.804168 |
| 0.1 | 0.880982695 | 0.864788699 | 0.841044 | 0.668129 | 0.666541 | 0.780335 | 0.8942 | 0.955336 | 0.943822 | 0.93825 | 0.923139 | 0.881913 | 0.874976 | 0.827922 | 0.798757 | 0.781923 | 0.781546 | 0.771426 | 0.768124 | 0.760469 |
| 0.15 | 0.796161353 | 0.775043322 | 0.745968 | 0.543591 | 0.547305 | 0.684677 | 0.83066 | 0.952391 | 0.959936 | 0.961764 | 0.949145 | 0.91531 | 0.894515 | 0.816038 | 0.781099 | 0.759911 | 0.75151 | 0.730566 | 0.719685 | 0.703473 |
| 0.2 | 0.767292878 | 0.744194285 | 0.713451 | 0.502272 | 0.504374 | 0.645641 | 0.803335 | 0.940343 | 0.961472 | 0.966472 | 0.956144 | 0.924533 | 0.900018 | 0.81613 | 0.783236 | 0.766262 | 0.759533 | 0.73822 | 0.726903 | 0.705948 |
| 0.25 | 0.729841764 | 0.70393952 | 0.669898 | 0.449282 | 0.442271 | 0.584569 | 0.74912 | 0.906502 | 0.933669 | 0.963575 | 0.97023 | 0.953148 | 0.933176 | 0.857447 | 0.824139 | 0.804215 | 0.793721 | 0.760859 | 0.746254 | 0.72234 |
| 0.3 | 0.681735142 | 0.654075455 | 0.61867 | 0.399571 | 0.383735 | 0.524103 | 0.688379 | 0.856731 | 0.889596 | 0.934512 | 0.963207 | 0.965618 | 0.942288 | 0.867143 | 0.836047 | 0.813407 | 0.798497 | 0.756302 | 0.739463 | 0.716879 |
| 0.4 | 0.603013734 | 0.573527078 | 0.536762 | 0.323518 | 0.290192 | 0.424517 | 0.589852 | 0.774931 | 0.815459 | 0.872881 | 0.919202 | 0.970584 | 0.956022 | 0.878517 | 0.848129 | 0.827011 | 0.806736 | 0.759897 | 0.734919 | 0.708594 |
| 0.5 | 0.629115689 | 0.600951792 | 0.566574 | 0.362181 | 0.321053 | 0.444623 | 0.600163 | 0.768138 | 0.802473 | 0.861504 | 0.905132 | 0.963042 | 0.970836 | 0.914526 | 0.884572 | 0.864472 | 0.845589 | 0.802547 | 0.776944 | 0.748643 |
| 0.75 | 0.678743071 | 0.652380777 | 0.624797 | 0.445955 | 0.400039 | 0.494759 | 0.609676 | 0.73746 | 0.758554 | 0.831263 | 0.872784 | 0.914333 | 0.945788 | 0.969164 | 0.953712 | 0.933798 | 0.915396 | 0.869823 | 0.841117 | 0.817051 |
| 1 | 0.683376054 | 0.658134159 | 0.633189 | 0.466563 | 0.419462 | 0.501638 | 0.59956 | 0.712102 | 0.730534 | 0.80644 | 0.84844 | 0.884531 | 0.918275 | 0.964319 | 0.973794 | 0.964538 | 0.949574 | 0.905961 | 0.87574 | 0.854157 |
| 1.5 | 0.703049297 | 0.680199024 | 0.658788 | 0.505187 | 0.455052 | 0.527115 | 0.613044 | 0.707263 | 0.721858 | 0.791718 | 0.828617 | 0.859143 | 0.894253 | 0.947932 | 0.968816 | 0.980087 | 0.974185 | 0.941321 | 0.915387 | 0.894002 |
| 2 | 0.706069716 | 0.685048998 | 0.665014 | 0.515897 | 0.464861 | 0.53163 | 0.615556 | 0.697527 | 0.711566 | 0.777439 | 0.809999 | 0.836501 | 0.872841 | 0.927486 | 0.95455 | 0.978119 | 0.983618 | 0.96093 | 0.937569 | 0.913405 |
| 3 | 0.715723774 | 0.698345877 | 0.681801 | 0.5447 | 0.490357 | 0.550052 | 0.628318 | 0.691592 | 0.70639 | 0.759352 | 0.784971 | 0.803922 | 0.843253 | 0.896012 | 0.922672 | 0.957707 | 0.974507 | 0.981698 | 0.966104 | 0.938994 |
| 4 | 0.720837185 | 0.7051411 | 0.688776 | 0.557083 | 0.501647 | 0.556743 | 0.632589 | 0.686218 | 0.701428 | 0.751782 | 0.776194 | 0.786676 | 0.826837 | 0.87823 | 0.904728 | 0.944333 | 0.964219 | 0.980656 | 0.980651 | 0.958404 |
| 5 | 0.710982274 | 0.695455577 | 0.680242 | 0.557893 | 0.49892 | 0.545497 | 0.612422 | 0.658262 | 0.67337 | 0.727476 | 0.759068 | 0.772362 | 0.813115 | 0.868113 | 0.896394 | 0.936367 | 0.954215 | 0.969982 | 0.97633 | 0.964715 |



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# Inter-event Correlation Coefficient Matrix

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999995903 | 0.999764 | 0.969221 | 0.969849 | 0.979729 | 0.975023 | 0.952602 | 0.946662 | 0.950774 | 0.941206 | 0.911673 | 0.922014 | 0.923602 | 0.909697 | 0.903685 | 0.893587 | 0.874234 | 0.862789 | 0.848504 |
| 0.01 | 0.999995903 | 1 | 0.999744 | 0.968968 | 0.969566 | 0.979505 | 0.974874 | 0.952582 | 0.946694 | 0.950949 | 0.941491 | 0.912106 | 0.922445 | 0.923855 | 0.909914 | 0.903877 | 0.893782 | 0.8744 | 0.862988 | 0.848685 |
| 0.02 | 0.999764129 | 0.999743962 | 1 | 0.973051 | 0.974064 | 0.982803 | 0.976002 | 0.951246 | 0.943988 | 0.946663 | 0.936098 | 0.90555 | 0.916607 | 0.919856 | 0.90648 | 0.901293 | 0.891536 | 0.872941 | 0.861525 | 0.84738 |
| 0.03 | 0.9692214 | 0.968968248 | 0.973051 | 1 | 0.994856 | 0.977681 | 0.938874 | 0.881062 | 0.863913 | 0.857508 | 0.843479 | 0.810762 | 0.832806 | 0.860016 | 0.855497 | 0.863156 | 0.858438 | 0.851391 | 0.845106 | 0.836224 |
| 0.05 | 0.969848672 | 0.969565903 | 0.974064 | 0.994856 | 1 | 0.98956 | 0.954729 | 0.896489 | 0.878126 | 0.865799 | 0.842545 | 0.796908 | 0.817866 | 0.847262 | 0.843211 | 0.851458 | 0.848375 | 0.842244 | 0.837175 | 0.826197 |
| 0.075 | 0.979729467 | 0.979504644 | 0.982803 | 0.977681 | 0.98956 | 1 | 0.985594 | 0.944803 | 0.926146 | 0.911494 | 0.883784 | 0.832849 | 0.845175 | 0.857182 | 0.846344 | 0.848045 | 0.841566 | 0.830085 | 0.822188 | 0.807212 |
| 0.1 | 0.975023177 | 0.974874356 | 0.976002 | 0.938874 | 0.954729 | 0.985594 | 1 | 0.981067 | 0.966918 | 0.950272 | 0.920712 | 0.865354 | 0.866576 | 0.852571 | 0.832302 | 0.825741 | 0.817051 | 0.802449 | 0.792891 | 0.773026 |
| 0.15 | 0.952601505 | 0.952581845 | 0.951246 | 0.881062 | 0.896489 | 0.944803 | 0.981067 | 1 | 0.994864 | 0.982903 | 0.957091 | 0.906339 | 0.89531 | 0.854602 | 0.825638 | 0.809317 | 0.793506 | 0.770586 | 0.754894 | 0.731007 |
| 0.2 | 0.946661729 | 0.946693663 | 0.943988 | 0.863913 | 0.878126 | 0.926146 | 0.966918 | 0.994864 | 1 | 0.990133 | 0.966899 | 0.918177 | 0.904935 | 0.859568 | 0.830938 | 0.814902 | 0.800069 | 0.778874 | 0.764074 | 0.740439 |
| 0.25 | 0.950774062 | 0.950948701 | 0.946663 | 0.857508 | 0.865799 | 0.911494 | 0.950272 | 0.982903 | 0.990133 | 1 | 0.990038 | 0.954097 | 0.943358 | 0.904022 | 0.873772 | 0.852094 | 0.833999 | 0.805881 | 0.790236 | 0.769418 |
| 0.3 | 0.941205923 | 0.94149125 | 0.936098 | 0.843479 | 0.842545 | 0.883784 | 0.920712 | 0.957091 | 0.966899 | 0.990038 | 1 | 0.97952 | 0.965136 | 0.922837 | 0.893616 | 0.867029 | 0.845011 | 0.810668 | 0.793283 | 0.777756 |
| 0.4 | 0.911672528 | 0.912106259 | 0.90555 | 0.810762 | 0.796908 | 0.832849 | 0.865354 | 0.906339 | 0.918177 | 0.954097 | 0.97952 | 1 | 0.991262 | 0.941975 | 0.91241 | 0.883804 | 0.859242 | 0.821537 | 0.79873 | 0.785401 |
| 0.5 | 0.922014005 | 0.922445052 | 0.916607 | 0.832806 | 0.817866 | 0.845175 | 0.866576 | 0.89531 | 0.904935 | 0.943358 | 0.965136 | 0.991262 | 1 | 0.968876 | 0.942206 | 0.916172 | 0.893861 | 0.86086 | 0.83919 | 0.825949 |
| 0.75 | 0.923602423 | 0.923855373 | 0.919856 | 0.860016 | 0.847262 | 0.857182 | 0.852571 | 0.854602 | 0.859568 | 0.904022 | 0.922837 | 0.941975 | 0.968876 | 1 | 0.98938 | 0.970324 | 0.950033 | 0.916884 | 0.896205 | 0.885834 |
| 1 | 0.90969711 | 0.909913836 | 0.90648 | 0.855497 | 0.843211 | 0.846344 | 0.832302 | 0.825638 | 0.830938 | 0.873772 | 0.893616 | 0.91241 | 0.942206 | 0.98938 | 1 | 0.991235 | 0.976636 | 0.944889 | 0.924822 | 0.916575 |
| 1.5 | 0.903684784 | 0.903876676 | 0.901293 | 0.863156 | 0.851458 | 0.848045 | 0.825741 | 0.809317 | 0.814902 | 0.852094 | 0.867029 | 0.883804 | 0.916172 | 0.970324 | 0.991235 | 1 | 0.994693 | 0.972759 | 0.956108 | 0.948113 |
| 2 | 0.893586684 | 0.893781869 | 0.891536 | 0.858438 | 0.848375 | 0.841566 | 0.817051 | 0.793506 | 0.800069 | 0.833999 | 0.845011 | 0.859242 | 0.893861 | 0.950033 | 0.976636 | 0.994693 | 1 | 0.987101 | 0.972776 | 0.963083 |
| 3 | 0.874233603 | 0.87440021 | 0.872941 | 0.851391 | 0.842244 | 0.830085 | 0.802449 | 0.770586 | 0.778874 | 0.805881 | 0.810668 | 0.821537 | 0.86086 | 0.916884 | 0.944889 | 0.972759 | 0.987101 | 1 | 0.99322 | 0.982848 |
| 4 | 0.86278857 | 0.86298802 | 0.861525 | 0.845106 | 0.837175 | 0.822188 | 0.792891 | 0.754894 | 0.764074 | 0.790236 | 0.793283 | 0.79873 | 0.83919 | 0.896205 | 0.924822 | 0.956108 | 0.972776 | 0.99322 | 1 | 0.995151 |
| 5 | 0.848504235 | 0.848685235 | 0.84738 | 0.836224 | 0.826197 | 0.807212 | 0.773026 | 0.731007 | 0.740439 | 0.769418 | 0.777756 | 0.785401 | 0.825949 | 0.885834 | 0.916575 | 0.948113 | 0.963083 | 0.982848 | 0.995151 | 1 |



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# Inter-event Correlation Coefficient Matrix

## $SA_V$-$SA_V$

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.998831309 | 0.994168 | 0.926585 | 0.924541 | 0.960018 | 0.959826 | 0.87656 | 0.823023 | 0.790659 | 0.760069 | 0.681237 | 0.705141 | 0.736539 | 0.717288 | 0.701239 | 0.709886 | 0.73274 | 0.748904 | 0.772539 |
| 0.01 | 0.998831309 | 1 | 0.997509 | 0.939676 | 0.937846 | 0.967678 | 0.957939 | 0.862659 | 0.804663 | 0.767581 | 0.734801 | 0.653253 | 0.678749 | 0.712134 | 0.692902 | 0.678034 | 0.689005 | 0.717055 | 0.735704 | 0.760917 |
| 0.02 | 0.994167768 | 0.997508829 | 1 | 0.957251 | 0.954194 | 0.973313 | 0.948619 | 0.837017 | 0.773444 | 0.731052 | 0.69561 | 0.61181 | 0.640935 | 0.683293 | 0.665439 | 0.652383 | 0.665165 | 0.697713 | 0.717244 | 0.743357 |
| 0.03 | 0.926584738 | 0.939676389 | 0.957251 | 1 | 0.988019 | 0.951825 | 0.854567 | 0.66238 | 0.577982 | 0.517537 | 0.48378 | 0.401302 | 0.442894 | 0.524587 | 0.51424 | 0.506494 | 0.521471 | 0.571766 | 0.599512 | 0.642522 |
| 0.05 | 0.924541408 | 0.937845767 | 0.954194 | 0.988019 | 1 | 0.975594 | 0.880064 | 0.686619 | 0.599418 | 0.53133 | 0.483552 | 0.379902 | 0.410556 | 0.48368 | 0.472831 | 0.460785 | 0.475725 | 0.522351 | 0.548673 | 0.592006 |
| 0.075 | 0.960018284 | 0.967678057 | 0.973313 | 0.951825 | 0.975594 | 1 | 0.955956 | 0.814534 | 0.736459 | 0.671623 | 0.620386 | 0.514375 | 0.531183 | 0.564192 | 0.5447 | 0.527377 | 0.538886 | 0.576006 | 0.597568 | 0.62878 |
| 0.1 | 0.959825763 | 0.957939105 | 0.948619 | 0.854567 | 0.880064 | 0.955956 | 1 | 0.934083 | 0.881306 | 0.823168 | 0.770804 | 0.671555 | 0.67435 | 0.650783 | 0.620064 | 0.603681 | 0.616059 | 0.643391 | 0.661377 | 0.672897 |
| 0.15 | 0.876559952 | 0.862659313 | 0.837017 | 0.66238 | 0.686619 | 0.814534 | 0.934083 | 1 | 0.985049 | 0.958187 | 0.917622 | 0.840406 | 0.823424 | 0.750681 | 0.712217 | 0.689904 | 0.688377 | 0.690385 | 0.693383 | 0.68683 |
| 0.2 | 0.823023303 | 0.804663116 | 0.773444 | 0.577982 | 0.599418 | 0.736459 | 0.881306 | 0.985049 | 1 | 0.980542 | 0.945497 | 0.874754 | 0.845955 | 0.7602 | 0.723298 | 0.705072 | 0.702742 | 0.703229 | 0.703873 | 0.691274 |
| 0.25 | 0.790659006 | 0.767580773 | 0.731052 | 0.517537 | 0.53133 | 0.671623 | 0.823168 | 0.958187 | 0.980542 | 1 | 0.985003 | 0.928157 | 0.902904 | 0.83434 | 0.803252 | 0.781941 | 0.774121 | 0.755988 | 0.749463 | 0.734656 |
| 0.3 | 0.760068774 | 0.734800621 | 0.69561 | 0.48378 | 0.483552 | 0.620386 | 0.770804 | 0.917622 | 0.945497 | 0.985003 | 1 | 0.96671 | 0.939125 | 0.87133 | 0.841206 | 0.816223 | 0.802566 | 0.774341 | 0.766685 | 0.756367 |
| 0.4 | 0.681237168 | 0.653252782 | 0.61181 | 0.401302 | 0.379902 | 0.514375 | 0.671555 | 0.840406 | 0.874754 | 0.928157 | 0.96671 | 1 | 0.983865 | 0.90141 | 0.86476 | 0.837375 | 0.817379 | 0.779902 | 0.761762 | 0.74777 |
| 0.5 | 0.705140872 | 0.678749486 | 0.640935 | 0.442894 | 0.410556 | 0.531183 | 0.67435 | 0.823424 | 0.845955 | 0.902904 | 0.939125 | 0.983865 | 1 | 0.945448 | 0.906986 | 0.877548 | 0.857174 | 0.820679 | 0.801806 | 0.785693 |
| 0.75 | 0.736539073 | 0.712134001 | 0.683293 | 0.524587 | 0.48368 | 0.564192 | 0.650783 | 0.750681 | 0.7602 | 0.83434 | 0.87133 | 0.90141 | 0.945448 | 1 | 0.982825 | 0.951867 | 0.929199 | 0.887438 | 0.860842 | 0.850833 |
| 1 | 0.717287712 | 0.692901794 | 0.665439 | 0.51424 | 0.472831 | 0.5447 | 0.620064 | 0.712217 | 0.723298 | 0.803252 | 0.841206 | 0.86476 | 0.906986 | 0.982825 | 1 | 0.984078 | 0.964226 | 0.921261 | 0.891073 | 0.880858 |
| 1.5 | 0.701239343 | 0.678034481 | 0.652383 | 0.506494 | 0.460785 | 0.527377 | 0.603681 | 0.689904 | 0.705072 | 0.781941 | 0.816223 | 0.837375 | 0.877548 | 0.951867 | 0.984078 | 1 | 0.992491 | 0.960102 | 0.935017 | 0.920359 |
| 2 | 0.709886098 | 0.689004907 | 0.665165 | 0.521471 | 0.475725 | 0.538886 | 0.616059 | 0.688377 | 0.702742 | 0.774121 | 0.802566 | 0.817379 | 0.857174 | 0.929199 | 0.964226 | 0.992491 | 1 | 0.980116 | 0.958647 | 0.939973 |
| 3 | 0.732739654 | 0.717055425 | 0.697713 | 0.571766 | 0.522351 | 0.576006 | 0.643391 | 0.690385 | 0.703229 | 0.755988 | 0.774341 | 0.779902 | 0.820679 | 0.887438 | 0.921261 | 0.960102 | 0.980116 | 1 | 0.989354 | 0.970575 |
| 4 | 0.748904131 | 0.73570352 | 0.717244 | 0.599512 | 0.548673 | 0.597568 | 0.661377 | 0.693383 | 0.703873 | 0.749463 | 0.766685 | 0.761762 | 0.801806 | 0.860842 | 0.891073 | 0.935017 | 0.958647 | 0.989354 | 1 | 0.98865 |
| 5 | 0.77253855 | 0.7609167 | 0.743357 | 0.642522 | 0.592006 | 0.62878 | 0.672897 | 0.68683 | 0.691274 | 0.734656 | 0.756367 | 0.74777 | 0.785693 | 0.850833 | 0.880858 | 0.920359 | 0.939973 | 0.970575 | 0.98865 | 1 |



doi:10.6342/NTU202303258

# Intra-event Correlation Coefficient Matrix

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.797481552 | 0.783719 | 0.766879 | 0.664559 | 0.627934 | 0.59755 | 0.715498 | 0.775285 | 0.787859 | 0.751961 | 0.775004 | 0.837549 | 0.824454 | 0.708751 | 0.726471 | 0.653839 | 0.59065 | 0.478211 | 0.449271 | 0.4089 |
| 0.01 | 0.796560507 | 0.782742 | 0.765792 | 0.663171 | 0.626424 | 0.596371 | 0.714857 | 0.774822 | 0.787371 | 0.751806 | 0.775156 | 0.837762 | 0.824734 | 0.708616 | 0.726482 | 0.653989 | 0.590608 | 0.477701 | 0.448601 | 0.408219 |
| 0.02 | 0.805187553 | 0.792474 | 0.777038 | 0.677086 | 0.640468 | 0.607616 | 0.721179 | 0.779187 | 0.790651 | 0.750988 | 0.772068 | 0.833261 | 0.820618 | 0.709981 | 0.725294 | 0.650762 | 0.590662 | 0.483287 | 0.458095 | 0.417631 |
| 0.03 | 0.849543115 | 0.842006 | 0.831591 | 0.766898 | 0.725204 | 0.675582 | 0.749279 | 0.773278 | 0.774255 | 0.707358 | 0.730176 | 0.804426 | 0.782998 | 0.680318 | 0.678479 | 0.579146 | 0.525507 | 0.440873 | 0.428103 | 0.391482 |
| 0.05 | 0.860174679 | 0.853818 | 0.845911 | 0.781206 | 0.754164 | 0.717192 | 0.780411 | 0.787817 | 0.77779 | 0.697856 | 0.713714 | 0.765416 | 0.752833 | 0.682483 | 0.683262 | 0.588908 | 0.53885 | 0.471077 | 0.465336 | 0.429125 |
| 0.075 | 0.802892376 | 0.792761 | 0.779716 | 0.710258 | 0.732091 | 0.712755 | 0.793438 | 0.787158 | 0.741542 | 0.647652 | 0.684241 | 0.728634 | 0.711109 | 0.663554 | 0.678335 | 0.589174 | 0.526696 | 0.483812 | 0.447849 | 0.426671 |
| 0.1 | 0.805393382 | 0.794665 | 0.7778 | 0.6838 | 0.71379 | 0.709343 | 0.815517 | 0.843374 | 0.799071 | 0.710225 | 0.749913 | 0.737821 | 0.717098 | 0.642257 | 0.690873 | 0.593054 | 0.522891 | 0.46404 | 0.44918 | 0.423252 |
| 0.15 | 0.745065341 | 0.731228 | 0.712831 | 0.590031 | 0.619804 | 0.635055 | 0.781973 | 0.84971 | 0.808724 | 0.734634 | 0.769012 | 0.753663 | 0.743445 | 0.65286 | 0.721157 | 0.639881 | 0.557969 | 0.50267 | 0.473516 | 0.451661 |
| 0.2 | 0.757103818 | 0.74486 | 0.726853 | 0.594252 | 0.560764 | 0.569106 | 0.721988 | 0.818381 | 0.859198 | 0.799895 | 0.794258 | 0.780544 | 0.781208 | 0.667365 | 0.728231 | 0.652091 | 0.585946 | 0.50968 | 0.488124 | 0.452134 |
| 0.25 | 0.694573356 | 0.678971 | 0.65696 | 0.520207 | 0.473015 | 0.459227 | 0.643166 | 0.737792 | 0.774097 | 0.793271 | 0.799961 | 0.822424 | 0.80935 | 0.682696 | 0.744641 | 0.6734 | 0.606225 | 0.490546 | 0.44757 | 0.41306 |
| 0.3 | 0.632533536 | 0.614821 | 0.59047 | 0.447341 | 0.392984 | 0.370418 | 0.557223 | 0.686227 | 0.747866 | 0.793758 | 0.809071 | 0.850415 | 0.838666 | 0.675599 | 0.716745 | 0.652629 | 0.574615 | 0.443617 | 0.385838 | 0.34497 |
| 0.4 | 0.575258883 | 0.551388 | 0.523164 | 0.383412 | 0.298446 | 0.257021 | 0.428634 | 0.600812 | 0.673088 | 0.735138 | 0.768739 | 0.864937 | 0.86012 | 0.666898 | 0.676011 | 0.654454 | 0.582012 | 0.402125 | 0.343326 | 0.295834 |
| 0.5 | 0.581420832 | 0.556241 | 0.527031 | 0.380457 | 0.30861 | 0.264014 | 0.428747 | 0.602529 | 0.657103 | 0.755887 | 0.799826 | 0.86695 | 0.882644 | 0.69545 | 0.705548 | 0.680718 | 0.621551 | 0.464791 | 0.397339 | 0.35248 |
| 0.75 | 0.550270113 | 0.531119 | 0.52137 | 0.408642 | 0.386025 | 0.309097 | 0.388753 | 0.531558 | 0.564747 | 0.641805 | 0.653268 | 0.695175 | 0.732929 | 0.824897 | 0.843326 | 0.844704 | 0.841218 | 0.729098 | 0.700921 | 0.666165 |
| 1 | 0.526678523 | 0.507397 | 0.495261 | 0.393769 | 0.375387 | 0.263991 | 0.328782 | 0.475391 | 0.525323 | 0.603828 | 0.62526 | 0.69548 | 0.744428 | 0.821585 | 0.864429 | 0.857028 | 0.844406 | 0.728547 | 0.700033 | 0.668479 |
| 1.5 | 0.48354503 | 0.461959 | 0.447996 | 0.333894 | 0.298126 | 0.197924 | 0.300709 | 0.457204 | 0.500401 | 0.580103 | 0.59818 | 0.672273 | 0.709953 | 0.807892 | 0.871373 | 0.910376 | 0.876661 | 0.73475 | 0.687767 | 0.673627 |
| 2 | 0.484287866 | 0.465531 | 0.457261 | 0.362033 | 0.306821 | 0.172728 | 0.276042 | 0.415337 | 0.47643 | 0.550905 | 0.552695 | 0.640216 | 0.683794 | 0.817862 | 0.85686 | 0.912737 | 0.909934 | 0.764396 | 0.725842 | 0.698848 |
| 3 | 0.425187734 | 0.415118 | 0.421915 | 0.350028 | 0.336093 | 0.204996 | 0.254044 | 0.353126 | 0.390523 | 0.417125 | 0.425081 | 0.503879 | 0.554756 | 0.798637 | 0.838943 | 0.869587 | 0.933682 | 0.889093 | 0.871572 | 0.847758 |
| 4 | 0.420519561 | 0.414596 | 0.426495 | 0.367174 | 0.355651 | 0.222176 | 0.250245 | 0.332275 | 0.364 | 0.394819 | 0.396094 | 0.448531 | 0.501491 | 0.76397 | 0.796798 | 0.83526 | 0.915191 | 0.899634 | 0.896863 | 0.881017 |
| 5 | 0.412205205 | 0.404842 | 0.414257 | 0.356708 | 0.34022 | 0.216025 | 0.227462 | 0.301323 | 0.344362 | 0.375656 | 0.388105 | 0.457349 | 0.512879 | 0.787288 | 0.810085 | 0.85892 | 0.916914 | 0.911229 | 0.902224 | 0.888984 |



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# Intra-event Correlation Coefficient Matrix

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999996 | 0.999665 | 0.977411 | 0.973189 | 0.944339 | 0.932249 | 0.893109 | 0.893806 | 0.892223 | 0.890134 | 0.86655 | 0.859334 | 0.776594 | 0.764434 | 0.735543 | 0.710592 | 0.622991 | 0.571471 | 0.556431 |
| 0.01 | 0.99999557 | 1 | 0.999625 | 0.977094 | 0.972799 | 0.944094 | 0.932071 | 0.89318 | 0.893867 | 0.892532 | 0.890438 | 0.86707 | 0.860008 | 0.776721 | 0.76468 | 0.736 | 0.710846 | 0.622853 | 0.571205 | 0.556347 |
| 0.02 | 0.999665169 | 0.999625 | 1 | 0.980153 | 0.976917 | 0.946077 | 0.93369 | 0.893787 | 0.894297 | 0.89006 | 0.885842 | 0.859682 | 0.852989 | 0.775482 | 0.762489 | 0.73209 | 0.708477 | 0.625365 | 0.575924 | 0.560014 |
| 0.03 | 0.977411197 | 0.977094 | 0.980153 | 1 | 0.991767 | 0.94738 | 0.917259 | 0.845031 | 0.844942 | 0.829511 | 0.820536 | 0.788402 | 0.774071 | 0.700103 | 0.696154 | 0.653055 | 0.639408 | 0.564515 | 0.52028 | 0.506223 |
| 0.05 | 0.973189146 | 0.972799 | 0.976917 | 0.991767 | 1 | 0.958924 | 0.935303 | 0.860743 | 0.851024 | 0.823645 | 0.803474 | 0.750011 | 0.746335 | 0.704586 | 0.698382 | 0.654416 | 0.638349 | 0.579037 | 0.542551 | 0.525236 |
| 0.075 | 0.944338915 | 0.944094 | 0.946077 | 0.94738 | 0.958924 | 1 | 0.957421 | 0.898814 | 0.857446 | 0.804497 | 0.778684 | 0.717031 | 0.721228 | 0.687643 | 0.666833 | 0.641543 | 0.610627 | 0.569425 | 0.531816 | 0.510014 |
| 0.1 | 0.932249247 | 0.932071 | 0.93369 | 0.917259 | 0.935303 | 0.957421 | 1 | 0.954613 | 0.893572 | 0.858063 | 0.823307 | 0.72705 | 0.729839 | 0.693018 | 0.672839 | 0.633499 | 0.587645 | 0.541801 | 0.509519 | 0.488304 |
| 0.15 | 0.893108797 | 0.89318 | 0.893787 | 0.845031 | 0.860743 | 0.898814 | 0.954613 | 1 | 0.939717 | 0.903152 | 0.849879 | 0.750377 | 0.749573 | 0.732697 | 0.687494 | 0.66179 | 0.612176 | 0.571977 | 0.53523 | 0.516362 |
| 0.2 | 0.893806216 | 0.893867 | 0.894297 | 0.844942 | 0.851024 | 0.857446 | 0.893572 | 0.939717 | 1 | 0.938042 | 0.874786 | 0.789587 | 0.770351 | 0.732222 | 0.700021 | 0.685217 | 0.646545 | 0.595584 | 0.555513 | 0.546483 |
| 0.25 | 0.892223178 | 0.892532 | 0.89006 | 0.829511 | 0.823645 | 0.804497 | 0.858063 | 0.903152 | 0.938042 | 1 | 0.947903 | 0.857919 | 0.821744 | 0.762039 | 0.728217 | 0.707233 | 0.671435 | 0.587239 | 0.546925 | 0.540888 |
| 0.3 | 0.890133937 | 0.890438 | 0.885842 | 0.820536 | 0.803474 | 0.778684 | 0.823307 | 0.849879 | 0.874786 | 0.947903 | 1 | 0.916405 | 0.86927 | 0.776326 | 0.740085 | 0.708468 | 0.674803 | 0.575309 | 0.530723 | 0.513128 |
| 0.4 | 0.866549551 | 0.86707 | 0.859682 | 0.788402 | 0.750011 | 0.717031 | 0.72705 | 0.750377 | 0.789587 | 0.857919 | 0.916405 | 1 | 0.948561 | 0.785014 | 0.780002 | 0.742278 | 0.714426 | 0.581781 | 0.516959 | 0.513449 |
| 0.5 | 0.859334181 | 0.860008 | 0.852989 | 0.774071 | 0.746335 | 0.721228 | 0.729839 | 0.749573 | 0.770351 | 0.821744 | 0.86927 | 0.948561 | 1 | 0.843219 | 0.847536 | 0.79913 | 0.764517 | 0.647505 | 0.588849 | 0.587094 |
| 0.75 | 0.776594018 | 0.776721 | 0.775482 | 0.700103 | 0.704586 | 0.687643 | 0.693018 | 0.732697 | 0.732222 | 0.762039 | 0.776326 | 0.785014 | 0.843219 | 1 | 0.952226 | 0.926243 | 0.910596 | 0.886205 | 0.850553 | 0.839972 |
| 1 | 0.764433505 | 0.76468 | 0.762489 | 0.696154 | 0.698382 | 0.666833 | 0.672839 | 0.687494 | 0.700021 | 0.728217 | 0.740085 | 0.780002 | 0.847536 | 0.952226 | 1 | 0.952495 | 0.929323 | 0.890472 | 0.853883 | 0.859614 |
| 1.5 | 0.735542638 | 0.736 | 0.73209 | 0.653055 | 0.654416 | 0.641543 | 0.633499 | 0.66179 | 0.685217 | 0.707233 | 0.708468 | 0.742278 | 0.79913 | 0.926243 | 0.952495 | 1 | 0.976831 | 0.905588 | 0.861058 | 0.867278 |
| 2 | 0.710591534 | 0.710846 | 0.708477 | 0.639408 | 0.638349 | 0.610627 | 0.587645 | 0.612176 | 0.646545 | 0.671435 | 0.674803 | 0.714426 | 0.764517 | 0.910596 | 0.929323 | 0.976831 | 1 | 0.936147 | 0.89262 | 0.888535 |
| 3 | 0.622990829 | 0.622853 | 0.625365 | 0.564515 | 0.579037 | 0.569425 | 0.541801 | 0.571977 | 0.595584 | 0.587239 | 0.575309 | 0.581781 | 0.647505 | 0.886205 | 0.890472 | 0.905588 | 0.936147 | 1 | 0.983797 | 0.971755 |
| 4 | 0.571470739 | 0.571205 | 0.575924 | 0.52028 | 0.542551 | 0.531816 | 0.509519 | 0.53523 | 0.555513 | 0.546925 | 0.530723 | 0.516959 | 0.588849 | 0.850553 | 0.853883 | 0.861058 | 0.89262 | 0.983797 | 1 | 0.981652 |
| 5 | 0.556431174 | 0.556347 | 0.560014 | 0.506223 | 0.525236 | 0.510014 | 0.488304 | 0.516362 | 0.546483 | 0.540888 | 0.513128 | 0.513449 | 0.587094 | 0.839972 | 0.859614 | 0.867278 | 0.888535 | 0.971755 | 0.981652 | 1 |



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# Intra-event Correlation Coefficient Matrix

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.998856 | 0.994001 | 0.95124 | 0.857351 | 0.807544 | 0.858165 | 0.862675 | 0.868678 | 0.790711 | 0.773807 | 0.746435 | 0.737887 | 0.655506 | 0.600031 | 0.502832 | 0.452107 | 0.446988 | 0.450838 | 0.417713 |
| 0.01 | 0.998856085 | 1 | 0.99766 | 0.960839 | 0.867377 | 0.814574 | 0.857077 | 0.854374 | 0.860949 | 0.77662 | 0.755908 | 0.725959 | 0.718204 | 0.64177 | 0.583583 | 0.482969 | 0.4388 | 0.443505 | 0.45486 | 0.421521 |
| 0.02 | 0.994000732 | 0.99766 | 1 | 0.972067 | 0.881331 | 0.82227 | 0.848189 | 0.836291 | 0.841921 | 0.750984 | 0.724406 | 0.696758 | 0.688887 | 0.632031 | 0.570044 | 0.471558 | 0.437679 | 0.455898 | 0.476392 | 0.442407 |
| 0.03 | 0.951239809 | 0.960839 | 0.972067 | 1 | 0.920794 | 0.843166 | 0.806504 | 0.729383 | 0.721495 | 0.611869 | 0.58116 | 0.574841 | 0.552994 | 0.550427 | 0.474222 | 0.37578 | 0.357209 | 0.413873 | 0.447647 | 0.417092 |
| 0.05 | 0.857350898 | 0.867377 | 0.881331 | 0.920794 | 1 | 0.928107 | 0.845103 | 0.707033 | 0.62107 | 0.489046 | 0.468994 | 0.445257 | 0.430702 | 0.468851 | 0.442762 | 0.334837 | 0.319111 | 0.421372 | 0.462716 | 0.440566 |
| 0.075 | 0.807543826 | 0.814574 | 0.82227 | 0.843166 | 0.928107 | 1 | 0.911134 | 0.720471 | 0.620969 | 0.445914 | 0.456922 | 0.391541 | 0.368856 | 0.338716 | 0.336425 | 0.244089 | 0.193795 | 0.319693 | 0.344303 | 0.337644 |
| 0.1 | 0.858165021 | 0.857077 | 0.848189 | 0.806504 | 0.845103 | 0.911134 | 1 | 0.864203 | 0.764541 | 0.622027 | 0.646287 | 0.572577 | 0.551247 | 0.445676 | 0.47205 | 0.352563 | 0.277422 | 0.329192 | 0.328558 | 0.313131 |
| 0.15 | 0.862675059 | 0.854374 | 0.836291 | 0.729383 | 0.707033 | 0.720471 | 0.864203 | 1 | 0.914478 | 0.806256 | 0.826221 | 0.732336 | 0.711591 | 0.568893 | 0.572459 | 0.442074 | 0.371569 | 0.341543 | 0.338723 | 0.326799 |
| 0.2 | 0.868677756 | 0.860949 | 0.841921 | 0.721495 | 0.62107 | 0.620969 | 0.764541 | 0.914478 | 1 | 0.917095 | 0.896459 | 0.789564 | 0.779883 | 0.582923 | 0.57442 | 0.490886 | 0.407776 | 0.34568 | 0.351695 | 0.313917 |
| 0.25 | 0.790711054 | 0.77662 | 0.750984 | 0.611869 | 0.489046 | 0.445914 | 0.622027 | 0.806256 | 0.917095 | 1 | 0.947239 | 0.843038 | 0.842056 | 0.613711 | 0.603596 | 0.544232 | 0.4518 | 0.346549 | 0.319738 | 0.27395 |
| 0.3 | 0.773806699 | 0.755908 | 0.724406 | 0.58116 | 0.468994 | 0.456922 | 0.646287 | 0.826221 | 0.896459 | 0.947239 | 1 | 0.902493 | 0.895591 | 0.641289 | 0.637734 | 0.572636 | 0.456826 | 0.354601 | 0.314524 | 0.278904 |
| 0.4 | 0.746435042 | 0.725959 | 0.696758 | 0.574841 | 0.445257 | 0.391541 | 0.572577 | 0.732336 | 0.789564 | 0.843038 | 0.902493 | 1 | 0.951448 | 0.69492 | 0.690047 | 0.604225 | 0.497056 | 0.383462 | 0.306609 | 0.266355 |
| 0.5 | 0.73788747 | 0.718204 | 0.688887 | 0.552994 | 0.430702 | 0.368856 | 0.551247 | 0.711591 | 0.779883 | 0.842056 | 0.895591 | 0.951448 | 1 | 0.765187 | 0.744086 | 0.679218 | 0.58144 | 0.470741 | 0.397884 | 0.364182 |
| 0.75 | 0.655506226 | 0.64177 | 0.632031 | 0.550427 | 0.468851 | 0.338716 | 0.445676 | 0.568893 | 0.582923 | 0.613711 | 0.641289 | 0.69492 | 0.765187 | 1 | 0.941079 | 0.882553 | 0.869742 | 0.797295 | 0.752173 | 0.728095 |
| 1 | 0.600030535 | 0.583583 | 0.570044 | 0.474222 | 0.442762 | 0.336425 | 0.47205 | 0.572459 | 0.57442 | 0.603596 | 0.637734 | 0.690047 | 0.744086 | 0.941079 | 1 | 0.924411 | 0.89422 | 0.820757 | 0.769593 | 0.758403 |
| 1.5 | 0.502832366 | 0.482969 | 0.471558 | 0.37578 | 0.334837 | 0.244089 | 0.352563 | 0.442074 | 0.490886 | 0.544232 | 0.572636 | 0.604225 | 0.679218 | 0.882553 | 0.924411 | 1 | 0.93782 | 0.844564 | 0.779907 | 0.769996 |
| 2 | 0.452106732 | 0.4388 | 0.437679 | 0.357209 | 0.319111 | 0.193795 | 0.277422 | 0.371569 | 0.407776 | 0.4518 | 0.456826 | 0.497056 | 0.58144 | 0.869742 | 0.89422 | 0.93782 | 1 | 0.912001 | 0.88185 | 0.860181 |
| 3 | 0.446988416 | 0.443505 | 0.455898 | 0.413873 | 0.421372 | 0.319693 | 0.329192 | 0.341543 | 0.34568 | 0.346549 | 0.354601 | 0.383462 | 0.470741 | 0.797295 | 0.820757 | 0.844564 | 0.912001 | 1 | 0.951337 | 0.949972 |
| 4 | 0.450838484 | 0.45486 | 0.476392 | 0.447647 | 0.462716 | 0.344303 | 0.328558 | 0.338723 | 0.351695 | 0.319738 | 0.314524 | 0.306609 | 0.397884 | 0.752173 | 0.769593 | 0.779907 | 0.88185 | 0.951337 | 1 | 0.979771 |
| 5 | 0.417713123 | 0.421521 | 0.442407 | 0.417092 | 0.440566 | 0.337644 | 0.313131 | 0.326799 | 0.313917 | 0.27395 | 0.278904 | 0.266355 | 0.364182 | 0.728095 | 0.758403 | 0.769996 | 0.860181 | 0.949972 | 0.979771 | 1 |



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# Total Correlation Coefficient Matrix (Mw>6)

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.879416366 | 0.873432334 | 0.869911 | 0.821843 | 0.792044 | 0.792562 | 0.81255 | 0.823362 | 0.829012 | 0.847914 | 0.837505 | 0.818346 | 0.825769 | 0.817216 | 0.807748 | 0.770957 | 0.754723 | 0.7132 | 0.704 | 0.690775678 |
| 0.01 | 0.879358463 | 0.873364967 | 0.869832 | 0.821733 | 0.79192 | 0.792472 | 0.812492 | 0.823315 | 0.828966 | 0.847913 | 0.837534 | 0.818417 | 0.825861 | 0.817312 | 0.807849 | 0.771064 | 0.754827 | 0.7133 | 0.704 | 0.690886567 |
| 0.02 | 0.880502132 | 0.874748971 | 0.871718 | 0.824213 | 0.794453 | 0.794036 | 0.813225 | 0.823348 | 0.828807 | 0.847158 | 0.836208 | 0.81659 | 0.824009 | 0.8156 | 0.806396 | 0.770033 | 0.754282 | 0.7129 | 0.704 | 0.690913061 |
| 0.03 | 0.88279814 | 0.880037534 | 0.878268 | 0.854035 | 0.820041 | 0.803715 | 0.807334 | 0.80254 | 0.804894 | 0.814708 | 0.804 | 0.784743 | 0.785728 | 0.763887 | 0.754755 | 0.717837 | 0.703891 | 0.6654 | 0.661 | 0.649772124 |
| 0.05 | 0.893878046 | 0.891077861 | 0.890513 | 0.861181 | 0.846027 | 0.829654 | 0.82775 | 0.815649 | 0.813567 | 0.819334 | 0.805696 | 0.779052 | 0.779925 | 0.760273 | 0.750544 | 0.71454 | 0.701433 | 0.6634 | 0.658 | 0.647262948 |
| 0.075 | 0.891624798 | 0.886829358 | 0.886012 | 0.844017 | 0.836824 | 0.845815 | 0.85267 | 0.843149 | 0.837139 | 0.841356 | 0.821353 | 0.789216 | 0.788722 | 0.774887 | 0.766364 | 0.728967 | 0.714071 | 0.6775 | 0.669 | 0.660159743 |
| 0.1 | 0.872039025 | 0.865166658 | 0.863352 | 0.811615 | 0.807892 | 0.831849 | 0.859742 | 0.860982 | 0.852563 | 0.854924 | 0.831297 | 0.793979 | 0.791942 | 0.781344 | 0.771297 | 0.736004 | 0.719385 | 0.6783 | 0.668 | 0.65959731 |
| 0.15 | 0.842008032 | 0.833422745 | 0.829892 | 0.770544 | 0.762629 | 0.799145 | 0.842428 | 0.869514 | 0.858732 | 0.862411 | 0.83867 | 0.802411 | 0.796192 | 0.786731 | 0.774089 | 0.738956 | 0.721097 | 0.676 | 0.665 | 0.65587474 |
| 0.2 | 0.823285949 | 0.81467324 | 0.809647 | 0.746694 | 0.730455 | 0.768079 | 0.817952 | 0.857039 | 0.864306 | 0.865256 | 0.843322 | 0.809419 | 0.804154 | 0.788234 | 0.769772 | 0.731649 | 0.71513 | 0.6718 | 0.662 | 0.651049174 |
| 0.25 | 0.797725861 | 0.787184977 | 0.780481 | 0.709609 | 0.684922 | 0.722929 | 0.778249 | 0.829133 | 0.842128 | 0.868189 | 0.849118 | 0.818492 | 0.816535 | 0.806132 | 0.786581 | 0.749322 | 0.731798 | 0.6893 | 0.677 | 0.66350122 |
| 0.3 | 0.791291494 | 0.780461392 | 0.772555 | 0.69716 | 0.669617 | 0.705768 | 0.761445 | 0.815085 | 0.836766 | 0.867427 | 0.863971 | 0.835677 | 0.832582 | 0.81969 | 0.800258 | 0.758677 | 0.74097 | 0.7001 | 0.687 | 0.673975263 |
| 0.4 | 0.774828074 | 0.764246473 | 0.755505 | 0.677155 | 0.644829 | 0.674317 | 0.726168 | 0.783495 | 0.813804 | 0.849637 | 0.84942 | 0.853002 | 0.85156 | 0.836721 | 0.811111 | 0.769953 | 0.755068 | 0.7141 | 0.703 | 0.686420552 |
| 0.5 | 0.754803995 | 0.742872226 | 0.734682 | 0.653329 | 0.613227 | 0.638828 | 0.693131 | 0.752086 | 0.781887 | 0.82539 | 0.827877 | 0.836816 | 0.870993 | 0.864866 | 0.838405 | 0.800181 | 0.784202 | 0.7456 | 0.736 | 0.719408367 |
| 0.75 | 0.724161981 | 0.710014602 | 0.70334 | 0.618704 | 0.575497 | 0.596676 | 0.65024 | 0.70524 | 0.72857 | 0.780797 | 0.784707 | 0.800066 | 0.848598 | 0.904262 | 0.886044 | 0.854917 | 0.837537 | 0.7968 | 0.783 | 0.764221007 |
| 1 | 0.722911072 | 0.708910675 | 0.703956 | 0.621789 | 0.581163 | 0.596503 | 0.64105 | 0.685791 | 0.705331 | 0.758589 | 0.763466 | 0.773773 | 0.830323 | 0.901915 | 0.914478 | 0.890569 | 0.868743 | 0.8291 | 0.808 | 0.787869184 |
| 1.5 | 0.709133029 | 0.695155473 | 0.692066 | 0.613025 | 0.572573 | 0.587869 | 0.63114 | 0.664777 | 0.674587 | 0.727397 | 0.730015 | 0.740166 | 0.801128 | 0.883434 | 0.911045 | 0.920904 | 0.903873 | 0.8669 | 0.843 | 0.820176176 |
| 2 | 0.690923738 | 0.677486447 | 0.675247 | 0.59771 | 0.557106 | 0.570374 | 0.612246 | 0.645691 | 0.652016 | 0.701418 | 0.700713 | 0.708816 | 0.767459 | 0.860023 | 0.894958 | 0.918068 | 0.926335 | 0.8937 | 0.867 | 0.83951738 |
| 3 | 0.657493033 | 0.644477424 | 0.64271 | 0.566514 | 0.52408 | 0.536722 | 0.578127 | 0.608012 | 0.61468 | 0.663304 | 0.665033 | 0.671701 | 0.733147 | 0.826169 | 0.866718 | 0.900156 | 0.920742 | 0.9265 | 0.904 | 0.870650811 |
| 4 | 0.646712689 | 0.634509963 | 0.63319 | 0.55933 | 0.514998 | 0.525108 | 0.568053 | 0.600286 | 0.607522 | 0.652893 | 0.651565 | 0.659164 | 0.722641 | 0.811462 | 0.849079 | 0.885314 | 0.911541 | 0.9277 | 0.924 | 0.895201811 |
| 5 | 0.638588788 | 0.626097976 | 0.625012 | 0.550194 | 0.50532 | 0.517211 | 0.565013 | 0.598336 | 0.605114 | 0.651224 | 0.647152 | 0.656457 | 0.719294 | 0.806395 | 0.842189 | 0.876713 | 0.904931 | 0.9212 | 0.922 | 0.903755613 |



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# Total Correlation Coefficient Matrix (Mw>6)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999999549 | 0.999909 | 0.984041 | 0.977906 | 0.974266 | 0.962077 | 0.943096 | 0.936057 | 0.930067 | 0.926515 | 0.919954 | 0.908051 | 0.876319 | 0.862052 | 0.832395 | 0.811939 | 0.7767 | 0.764 | 0.75707091 |
| 0.01 | 0.999999549 | 1 | 0.999906 | 0.984021 | 0.977882 | 0.974244 | 0.962056 | 0.943082 | 0.936044 | 0.930089 | 0.926556 | 0.92001 | 0.908146 | 0.876441 | 0.862183 | 0.832532 | 0.812065 | 0.7768 | 0.764 | 0.757222725 |
| 0.02 | 0.999909052 | 0.999906092 | 1 | 0.984713 | 0.978859 | 0.974896 | 0.962148 | 0.942554 | 0.935099 | 0.928414 | 0.92465 | 0.918074 | 0.906018 | 0.874545 | 0.860631 | 0.831474 | 0.811363 | 0.776 | 0.763 | 0.756491293 |
| 0.03 | 0.984040618 | 0.984021198 | 0.984713 | 1 | 0.985163 | 0.964159 | 0.937411 | 0.907487 | 0.897074 | 0.883104 | 0.876977 | 0.868884 | 0.851993 | 0.812813 | 0.800252 | 0.771683 | 0.753339 | 0.72 | 0.709 | 0.70079118 |
| 0.05 | 0.977906249 | 0.977882079 | 0.978859 | 0.985163 | 1 | 0.980894 | 0.951945 | 0.914528 | 0.897713 | 0.879499 | 0.871193 | 0.859499 | 0.842007 | 0.803587 | 0.793299 | 0.766976 | 0.749268 | 0.7165 | 0.706 | 0.697741094 |
| 0.075 | 0.974265632 | 0.974244317 | 0.974896 | 0.964159 | 0.980894 | 1 | 0.982551 | 0.949445 | 0.927236 | 0.906466 | 0.894933 | 0.87555 | 0.855758 | 0.819735 | 0.807918 | 0.781806 | 0.762352 | 0.7286 | 0.717 | 0.712688871 |
| 0.1 | 0.962076562 | 0.962055577 | 0.962148 | 0.937411 | 0.951945 | 0.982551 | 1 | 0.97483 | 0.951573 | 0.930376 | 0.915007 | 0.88876 | 0.865592 | 0.831355 | 0.817345 | 0.791779 | 0.770701 | 0.7322 | 0.72 | 0.717349558 |
| 0.15 | 0.9430959 | 0.94308246 | 0.942554 | 0.907487 | 0.914528 | 0.949445 | 0.97483 | 1 | 0.977334 | 0.954514 | 0.936738 | 0.906115 | 0.878502 | 0.841116 | 0.821128 | 0.792466 | 0.77176 | 0.7312 | 0.717 | 0.716024225 |
| 0.2 | 0.936056937 | 0.936043981 | 0.935099 | 0.897074 | 0.897713 | 0.927236 | 0.951573 | 0.977334 | 1 | 0.972983 | 0.954243 | 0.924173 | 0.895144 | 0.848768 | 0.823124 | 0.788905 | 0.767443 | 0.7279 | 0.715 | 0.713033013 |
| 0.25 | 0.930067198 | 0.930089329 | 0.928414 | 0.883104 | 0.879499 | 0.906466 | 0.930376 | 0.954514 | 0.972983 | 1 | 0.97903 | 0.946428 | 0.920873 | 0.880258 | 0.852513 | 0.817741 | 0.794885 | 0.7559 | 0.742 | 0.739276086 |
| 0.3 | 0.926514942 | 0.926555821 | 0.92465 | 0.876977 | 0.871193 | 0.894933 | 0.915007 | 0.936738 | 0.954243 | 0.97903 | 1 | 0.963614 | 0.936665 | 0.892596 | 0.86456 | 0.82709 | 0.803752 | 0.7682 | 0.755 | 0.75153092 |
| 0.4 | 0.919953687 | 0.920010419 | 0.918074 | 0.868884 | 0.859499 | 0.87555 | 0.88876 | 0.906115 | 0.924173 | 0.946428 | 0.963614 | 1 | 0.968693 | 0.917445 | 0.885602 | 0.844201 | 0.820599 | 0.7881 | 0.774 | 0.769020113 |
| 0.5 | 0.908050774 | 0.908145669 | 0.906018 | 0.851993 | 0.842007 | 0.855758 | 0.865592 | 0.878502 | 0.895144 | 0.920873 | 0.936665 | 0.968693 | 1 | 0.952001 | 0.920864 | 0.879655 | 0.852768 | 0.8225 | 0.81 | 0.804998197 |
| 0.75 | 0.876319274 | 0.87644092 | 0.874545 | 0.812813 | 0.803587 | 0.819735 | 0.831355 | 0.841116 | 0.848768 | 0.880258 | 0.892596 | 0.917445 | 0.952001 | 1 | 0.973256 | 0.936722 | 0.911747 | 0.8798 | 0.865 | 0.859856261 |
| 1 | 0.862051776 | 0.862182919 | 0.860631 | 0.800252 | 0.793299 | 0.807918 | 0.817345 | 0.821128 | 0.823124 | 0.852513 | 0.86456 | 0.885602 | 0.920864 | 0.973256 | 1 | 0.968621 | 0.944629 | 0.9117 | 0.893 | 0.885925286 |
| 1.5 | 0.83239457 | 0.832532194 | 0.831474 | 0.771683 | 0.766976 | 0.781806 | 0.791779 | 0.792466 | 0.788905 | 0.817741 | 0.82709 | 0.844201 | 0.879655 | 0.936722 | 0.968621 | 1 | 0.978655 | 0.946 | 0.927 | 0.917661986 |
| 2 | 0.811939429 | 0.812064809 | 0.811363 | 0.753339 | 0.749268 | 0.762352 | 0.770701 | 0.77176 | 0.767443 | 0.794885 | 0.803752 | 0.820599 | 0.852768 | 0.911747 | 0.944629 | 0.978655 | 1 | 0.9687 | 0.95 | 0.939481426 |
| 3 | 0.776673178 | 0.776809415 | 0.775955 | 0.720022 | 0.716536 | 0.728592 | 0.73216 | 0.731171 | 0.727875 | 0.75589 | 0.768205 | 0.788105 | 0.822469 | 0.879772 | 0.911685 | 0.945995 | 0.968686 | 1 | 0.981 | 0.966020163 |
| 4 | 0.763821854 | 0.763962553 | 0.763244 | 0.709156 | 0.705505 | 0.717492 | 0.719785 | 0.717375 | 0.714969 | 0.742397 | 0.754899 | 0.774021 | 0.809502 | 0.865335 | 0.893016 | 0.927413 | 0.950236 | 0.9812 | 1 | 0.98573151 |
| 5 | 0.75707091 | 0.757222725 | 0.756491 | 0.700791 | 0.697741 | 0.712689 | 0.71735 | 0.716024 | 0.713033 | 0.739276 | 0.751531 | 0.76902 | 0.804998 | 0.859856 | 0.885925 | 0.917662 | 0.939481 | 0.966 | 0.986 | 1 |



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# Total Correlation Coefficient Matrix (Mw>6)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999427498 | 0.997829 | 0.9707 | 0.946062 | 0.927136 | 0.922954 | 0.901013 | 0.890359 | 0.880082 | 0.868431 | 0.834925 | 0.822117 | 0.783347 | 0.765905 | 0.72066 | 0.695551 | 0.6571 | 0.649 | 0.644037722 |
| 0.01 | 0.999427498 | 1 | 0.998842 | 0.974496 | 0.949724 | 0.928038 | 0.921122 | 0.896787 | 0.885718 | 0.872952 | 0.861031 | 0.827477 | 0.813009 | 0.771392 | 0.754156 | 0.708535 | 0.684222 | 0.6464 | 0.639 | 0.634693226 |
| 0.02 | 0.997829265 | 0.998841883 | 1 | 0.978045 | 0.953441 | 0.929143 | 0.920242 | 0.892939 | 0.879951 | 0.865158 | 0.85138 | 0.81581 | 0.80291 | 0.762211 | 0.746864 | 0.703762 | 0.680652 | 0.6445 | 0.639 | 0.633720965 |
| 0.03 | 0.970699553 | 0.974495516 | 0.978045 | 1 | 0.964961 | 0.920206 | 0.892086 | 0.845898 | 0.826129 | 0.803125 | 0.787207 | 0.747561 | 0.729406 | 0.681834 | 0.66914 | 0.628721 | 0.607082 | 0.5764 | 0.576 | 0.574189967 |
| 0.05 | 0.94606222 | 0.949723948 | 0.953441 | 0.964961 | 1 | 0.958148 | 0.911527 | 0.844806 | 0.811238 | 0.775494 | 0.752082 | 0.703173 | 0.681084 | 0.635236 | 0.625818 | 0.585137 | 0.56565 | 0.5352 | 0.531 | 0.528421163 |
| 0.075 | 0.927136315 | 0.928037501 | 0.929143 | 0.920206 | 0.958148 | 1 | 0.951093 | 0.878781 | 0.838575 | 0.798547 | 0.766815 | 0.713031 | 0.689589 | 0.644443 | 0.634401 | 0.597198 | 0.574464 | 0.546 | 0.536 | 0.531561834 |
| 0.1 | 0.922953513 | 0.921121693 | 0.920242 | 0.892086 | 0.911527 | 0.951093 | 1 | 0.933456 | 0.886895 | 0.843824 | 0.811142 | 0.759086 | 0.736031 | 0.6877 | 0.671324 | 0.632003 | 0.611863 | 0.5824 | 0.574 | 0.57189731 |
| 0.15 | 0.901012624 | 0.896787165 | 0.892939 | 0.845898 | 0.844806 | 0.878781 | 0.933456 | 1 | 0.94326 | 0.900903 | 0.868212 | 0.812851 | 0.7831 | 0.735807 | 0.706969 | 0.661766 | 0.640575 | 0.6062 | 0.604 | 0.600390141 |
| 0.2 | 0.890358705 | 0.885718223 | 0.879951 | 0.826129 | 0.811238 | 0.838575 | 0.886895 | 0.94326 | 1 | 0.942599 | 0.906203 | 0.847017 | 0.815683 | 0.75785 | 0.726113 | 0.667914 | 0.643218 | 0.6075 | 0.604 | 0.600089142 |
| 0.25 | 0.88008204 | 0.872951916 | 0.865158 | 0.803125 | 0.775494 | 0.798547 | 0.843824 | 0.900903 | 0.942599 | 1 | 0.953099 | 0.8905 | 0.859796 | 0.807022 | 0.772883 | 0.714052 | 0.684483 | 0.642 | 0.638 | 0.636137225 |
| 0.3 | 0.868431249 | 0.861030608 | 0.85138 | 0.787207 | 0.752082 | 0.766815 | 0.811142 | 0.868212 | 0.906203 | 0.953099 | 1 | 0.925983 | 0.887971 | 0.820871 | 0.780179 | 0.717466 | 0.681428 | 0.6393 | 0.635 | 0.632657283 |
| 0.4 | 0.834924661 | 0.827476905 | 0.81581 | 0.747561 | 0.703173 | 0.713031 | 0.759086 | 0.812851 | 0.847017 | 0.8905 | 0.925983 | 1 | 0.932628 | 0.848379 | 0.796594 | 0.728691 | 0.692818 | 0.6468 | 0.642 | 0.639219935 |
| 0.5 | 0.822117014 | 0.813008846 | 0.80291 | 0.729406 | 0.681084 | 0.689589 | 0.736031 | 0.7831 | 0.815683 | 0.859796 | 0.887971 | 0.932628 | 1 | 0.907273 | 0.851451 | 0.787351 | 0.750675 | 0.7096 | 0.704 | 0.698446072 |
| 0.75 | 0.783347186 | 0.771392078 | 0.762211 | 0.681834 | 0.635236 | 0.644443 | 0.6877 | 0.735807 | 0.75785 | 0.807022 | 0.820871 | 0.848379 | 0.907273 | 1 | 0.944237 | 0.88716 | 0.851844 | 0.8048 | 0.787 | 0.773945297 |
| 1 | 0.765904802 | 0.754155935 | 0.746864 | 0.66914 | 0.625818 | 0.634401 | 0.671324 | 0.706969 | 0.726113 | 0.772883 | 0.780179 | 0.796594 | 0.851451 | 0.944237 | 1 | 0.93677 | 0.898814 | 0.8514 | 0.824 | 0.808153353 |
| 1.5 | 0.720659924 | 0.708535157 | 0.703762 | 0.628721 | 0.585137 | 0.597198 | 0.632003 | 0.661766 | 0.667914 | 0.714052 | 0.717466 | 0.728691 | 0.787351 | 0.88716 | 0.93677 | 1 | 0.950032 | 0.8971 | 0.864 | 0.847234611 |
| 2 | 0.695551483 | 0.684222373 | 0.680652 | 0.607082 | 0.56565 | 0.574464 | 0.611863 | 0.640575 | 0.643218 | 0.684483 | 0.681428 | 0.692818 | 0.750675 | 0.851844 | 0.898814 | 0.950032 | 1 | 0.9374 | 0.903 | 0.882032457 |
| 3 | 0.657086675 | 0.646364708 | 0.644516 | 0.576443 | 0.53524 | 0.545994 | 0.582446 | 0.60618 | 0.60748 | 0.641983 | 0.63928 | 0.64684 | 0.709554 | 0.804783 | 0.8514 | 0.897148 | 0.937438 | 1 | 0.959 | 0.930336267 |
| 4 | 0.64894018 | 0.639230515 | 0.638682 | 0.57604 | 0.530642 | 0.536427 | 0.573738 | 0.603527 | 0.603753 | 0.638392 | 0.634629 | 0.642103 | 0.704008 | 0.787126 | 0.823693 | 0.864364 | 0.902546 | 0.9589 | 1 | 0.968068957 |
| 5 | 0.644037722 | 0.634693226 | 0.633721 | 0.57419 | 0.528421 | 0.531562 | 0.571897 | 0.60039 | 0.600089 | 0.636137 | 0.632657 | 0.63922 | 0.698446 | 0.773945 | 0.808153 | 0.847235 | 0.882032 | 0.9303 | 0.968 | 1 |



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# Total Correlation Coefficient Matrix (6>Mw>5.4)

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.766257689 | 0.755133426 | 0.74496 | 0.644627 | 0.615481 | 0.631294 | 0.679783 | 0.717645 | 0.734878 | 0.745122 | 0.743095 | 0.742638 | 0.724434 | 0.651634 | 0.602944 | 0.565197 | 0.539673 | 0.4965 | 0.481 | 0.474816353 |
| 0.01 | 0.765790244 | 0.754636461 | 0.744416 | 0.643945 | 0.614773 | 0.630703 | 0.679335 | 0.717413 | 0.734701 | 0.745029 | 0.743042 | 0.74276 | 0.724681 | 0.651961 | 0.603357 | 0.565718 | 0.540224 | 0.4969 | 0.482 | 0.475129756 |
| 0.02 | 0.771533371 | 0.761083937 | 0.752064 | 0.653791 | 0.624313 | 0.63816 | 0.683472 | 0.718312 | 0.734182 | 0.743174 | 0.740082 | 0.73801 | 0.720126 | 0.64821 | 0.599494 | 0.56211 | 0.537387 | 0.4955 | 0.481 | 0.475757033 |
| 0.03 | 0.817937186 | 0.813056833 | 0.81033 | 0.770052 | 0.71994 | 0.69838 | 0.700516 | 0.678071 | 0.677225 | 0.675602 | 0.670138 | 0.653059 | 0.632554 | 0.574071 | 0.520751 | 0.480066 | 0.458277 | 0.4271 | 0.42 | 0.429361869 |
| 0.05 | 0.828613566 | 0.823864361 | 0.82171 | 0.759977 | 0.759325 | 0.751341 | 0.743976 | 0.706881 | 0.696201 | 0.688458 | 0.672296 | 0.645755 | 0.621945 | 0.55929 | 0.505877 | 0.468091 | 0.450065 | 0.4192 | 0.413 | 0.421835433 |
| 0.075 | 0.80593006 | 0.799312916 | 0.794486 | 0.706314 | 0.72576 | 0.76249 | 0.779517 | 0.749411 | 0.731768 | 0.714259 | 0.690657 | 0.659388 | 0.62744 | 0.544248 | 0.492617 | 0.456984 | 0.438201 | 0.4061 | 0.398 | 0.402986158 |
| 0.1 | 0.75503665 | 0.745493127 | 0.736638 | 0.627341 | 0.649246 | 0.707541 | 0.778334 | 0.783556 | 0.76928 | 0.741208 | 0.714457 | 0.685955 | 0.64657 | 0.537254 | 0.486523 | 0.453383 | 0.432384 | 0.3997 | 0.392 | 0.390289142 |
| 0.15 | 0.663214932 | 0.650635403 | 0.638671 | 0.509236 | 0.523511 | 0.593901 | 0.697111 | 0.794367 | 0.788902 | 0.765801 | 0.738518 | 0.713126 | 0.673672 | 0.552063 | 0.505642 | 0.478422 | 0.454846 | 0.4165 | 0.404 | 0.392618844 |
| 0.2 | 0.620764466 | 0.606683197 | 0.59227 | 0.454476 | 0.458726 | 0.526821 | 0.640025 | 0.764458 | 0.799822 | 0.779417 | 0.756488 | 0.736628 | 0.695644 | 0.571877 | 0.524384 | 0.495109 | 0.471143 | 0.4318 | 0.417 | 0.399648842 |
| 0.25 | 0.58557249 | 0.569668889 | 0.553167 | 0.4107 | 0.401878 | 0.465401 | 0.577827 | 0.718124 | 0.766898 | 0.795105 | 0.784908 | 0.768936 | 0.732531 | 0.619722 | 0.569627 | 0.535864 | 0.510283 | 0.4621 | 0.443 | 0.420948237 |
| 0.3 | 0.550235834 | 0.532675517 | 0.514631 | 0.372449 | 0.355374 | 0.414228 | 0.525245 | 0.670174 | 0.731654 | 0.775684 | 0.798036 | 0.796957 | 0.758971 | 0.649113 | 0.600652 | 0.563795 | 0.532628 | 0.4751 | 0.456 | 0.434063718 |
| 0.4 | 0.495661387 | 0.475277984 | 0.455521 | 0.316503 | 0.29136 | 0.343042 | 0.449162 | 0.59665 | 0.668724 | 0.723147 | 0.757194 | 0.825078 | 0.803737 | 0.701045 | 0.659735 | 0.622494 | 0.587202 | 0.524 | 0.497 | 0.471664739 |
| 0.5 | 0.471330568 | 0.450816023 | 0.431325 | 0.295672 | 0.261555 | 0.301886 | 0.405007 | 0.549797 | 0.622649 | 0.685171 | 0.721299 | 0.809735 | 0.835611 | 0.758063 | 0.716264 | 0.677409 | 0.640734 | 0.5767 | 0.545 | 0.515266793 |
| 0.75 | 0.436400276 | 0.417332282 | 0.400909 | 0.278719 | 0.234341 | 0.255909 | 0.330111 | 0.45787 | 0.521308 | 0.602835 | 0.646981 | 0.745026 | 0.808345 | 0.845639 | 0.815872 | 0.772409 | 0.73101 | 0.6677 | 0.629 | 0.595214734 |
| 1 | 0.400482968 | 0.382077255 | 0.367169 | 0.251079 | 0.206771 | 0.224319 | 0.286698 | 0.40832 | 0.465986 | 0.547957 | 0.592225 | 0.696682 | 0.769734 | 0.842179 | 0.861943 | 0.836572 | 0.798992 | 0.7301 | 0.688 | 0.653039085 |
| 1.5 | 0.368175569 | 0.351293659 | 0.339715 | 0.231848 | 0.189954 | 0.204931 | 0.258321 | 0.369231 | 0.419639 | 0.49218 | 0.529993 | 0.631571 | 0.711293 | 0.801281 | 0.849346 | 0.884305 | 0.86283 | 0.7987 | 0.755 | 0.713892942 |
| 2 | 0.34450325 | 0.32895644 | 0.319624 | 0.216513 | 0.175197 | 0.188934 | 0.234936 | 0.338736 | 0.387112 | 0.45323 | 0.48454 | 0.581994 | 0.661669 | 0.756614 | 0.818714 | 0.881735 | 0.892632 | 0.8393 | 0.792 | 0.744989065 |
| 3 | 0.327299169 | 0.314157719 | 0.307701 | 0.211168 | 0.169603 | 0.180006 | 0.220404 | 0.321153 | 0.366068 | 0.419917 | 0.44212 | 0.531931 | 0.612724 | 0.710523 | 0.773955 | 0.855789 | 0.884094 | 0.8843 | 0.846 | 0.794603589 |
| 4 | 0.323776433 | 0.311661115 | 0.307026 | 0.214583 | 0.173248 | 0.180565 | 0.219212 | 0.317305 | 0.361704 | 0.412281 | 0.430024 | 0.511519 | 0.589408 | 0.680025 | 0.747562 | 0.835833 | 0.869845 | 0.8826 | 0.874 | 0.830203916 |
| 5 | 0.314487598 | 0.302358625 | 0.299409 | 0.213671 | 0.172838 | 0.177345 | 0.212028 | 0.304189 | 0.345472 | 0.395733 | 0.414252 | 0.495428 | 0.567252 | 0.651899 | 0.717981 | 0.808388 | 0.844544 | 0.8602 | 0.868 | 0.842217905 |



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# Total Correlation Coefficient Matrix (6>Mw>5.4)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999997763 | 0.999734 | 0.955096 | 0.947381 | 0.936882 | 0.924245 | 0.890048 | 0.878863 | 0.87478 | 0.861108 | 0.830986 | 0.808012 | 0.750447 | 0.704532 | 0.653178 | 0.624714 | 0.5891 | 0.573 | 0.559249198 |
| 0.01 | 0.999997763 | 1 | 0.999717 | 0.954881 | 0.947163 | 0.936723 | 0.924157 | 0.890068 | 0.87892 | 0.874932 | 0.861326 | 0.831355 | 0.808503 | 0.750999 | 0.70513 | 0.653824 | 0.625377 | 0.5897 | 0.574 | 0.559873133 |
| 0.02 | 0.999734067 | 0.999716572 | 1 | 0.95829 | 0.950776 | 0.939145 | 0.92452 | 0.888416 | 0.875928 | 0.870709 | 0.856135 | 0.825004 | 0.802177 | 0.745609 | 0.700296 | 0.650164 | 0.622417 | 0.5876 | 0.572 | 0.558219367 |
| 0.03 | 0.955096431 | 0.954881074 | 0.95829 | 1 | 0.963009 | 0.917688 | 0.869389 | 0.796456 | 0.769311 | 0.755441 | 0.735622 | 0.698004 | 0.67529 | 0.629402 | 0.588352 | 0.544707 | 0.521903 | 0.4944 | 0.481 | 0.471259473 |
| 0.05 | 0.947381451 | 0.947163259 | 0.950776 | 0.963009 | 1 | 0.965797 | 0.910129 | 0.824171 | 0.78701 | 0.765219 | 0.737741 | 0.689582 | 0.663623 | 0.614621 | 0.573855 | 0.533015 | 0.512173 | 0.4871 | 0.477 | 0.467115181 |
| 0.075 | 0.936881787 | 0.936722667 | 0.939145 | 0.917688 | 0.965797 | 1 | 0.96209 | 0.879981 | 0.834058 | 0.802152 | 0.767048 | 0.711383 | 0.677971 | 0.613837 | 0.568453 | 0.526862 | 0.50572 | 0.4793 | 0.469 | 0.457711633 |
| 0.1 | 0.924244914 | 0.924156649 | 0.92452 | 0.869389 | 0.910129 | 0.96209 | 1 | 0.939258 | 0.894613 | 0.853704 | 0.813682 | 0.754344 | 0.713286 | 0.626075 | 0.577281 | 0.53195 | 0.508612 | 0.4802 | 0.47 | 0.458266999 |
| 0.15 | 0.89004819 | 0.89006766 | 0.888416 | 0.796456 | 0.824171 | 0.879981 | 0.939258 | 1 | 0.957502 | 0.917577 | 0.875737 | 0.812609 | 0.766596 | 0.664639 | 0.613237 | 0.565612 | 0.540144 | 0.5084 | 0.495 | 0.479980105 |
| 0.2 | 0.878863154 | 0.878919987 | 0.875928 | 0.769311 | 0.78701 | 0.834058 | 0.894613 | 0.957502 | 1 | 0.957245 | 0.917529 | 0.853952 | 0.803956 | 0.697586 | 0.643604 | 0.589875 | 0.560017 | 0.5268 | 0.514 | 0.500069794 |
| 0.25 | 0.874779586 | 0.874931934 | 0.870709 | 0.755441 | 0.765219 | 0.802152 | 0.853704 | 0.917577 | 0.957245 | 1 | 0.966086 | 0.9032 | 0.856543 | 0.758595 | 0.701241 | 0.641076 | 0.606632 | 0.5664 | 0.553 | 0.540123326 |
| 0.3 | 0.861107919 | 0.861326332 | 0.856135 | 0.735622 | 0.737741 | 0.767048 | 0.813682 | 0.875737 | 0.917529 | 0.966086 | 1 | 0.943667 | 0.894476 | 0.796121 | 0.741591 | 0.676584 | 0.637859 | 0.5903 | 0.575 | 0.565557231 |
| 0.4 | 0.830986268 | 0.831354612 | 0.825004 | 0.698004 | 0.689582 | 0.711383 | 0.754344 | 0.812609 | 0.853952 | 0.9032 | 0.943667 | 1 | 0.959223 | 0.862039 | 0.809906 | 0.743348 | 0.70146 | 0.652 | 0.632 | 0.621787181 |
| 0.5 | 0.808011501 | 0.808502952 | 0.802177 | 0.67529 | 0.663623 | 0.677971 | 0.713286 | 0.766596 | 0.803956 | 0.856543 | 0.894476 | 0.959223 | 1 | 0.920239 | 0.869216 | 0.803749 | 0.760647 | 0.7133 | 0.69 | 0.674575451 |
| 0.75 | 0.750446672 | 0.750999292 | 0.745609 | 0.629402 | 0.614621 | 0.613837 | 0.626075 | 0.664639 | 0.697586 | 0.758595 | 0.796121 | 0.862039 | 0.920239 | 1 | 0.956177 | 0.891468 | 0.846973 | 0.7987 | 0.77 | 0.747625231 |
| 1 | 0.704531884 | 0.705129616 | 0.700296 | 0.588352 | 0.573855 | 0.568453 | 0.577281 | 0.613237 | 0.643604 | 0.701241 | 0.741591 | 0.809906 | 0.869216 | 0.956177 | 1 | 0.948478 | 0.910827 | 0.8585 | 0.828 | 0.804601453 |
| 1.5 | 0.653178078 | 0.653824028 | 0.650164 | 0.544707 | 0.533015 | 0.526862 | 0.53195 | 0.565612 | 0.589875 | 0.641076 | 0.676584 | 0.743348 | 0.803749 | 0.891468 | 0.948478 | 1 | 0.96857 | 0.9223 | 0.893 | 0.867717312 |
| 2 | 0.624714457 | 0.625376599 | 0.622417 | 0.521903 | 0.512173 | 0.50572 | 0.508612 | 0.540144 | 0.560017 | 0.606632 | 0.637859 | 0.70146 | 0.760647 | 0.846973 | 0.910827 | 0.96857 | 1 | 0.9578 | 0.929 | 0.902288171 |
| 3 | 0.589092621 | 0.589737155 | 0.587649 | 0.494352 | 0.48715 | 0.4793 | 0.480211 | 0.508406 | 0.526839 | 0.566389 | 0.59028 | 0.652005 | 0.713336 | 0.798664 | 0.858492 | 0.92233 | 0.957847 | 1 | 0.971 | 0.940776848 |
| 4 | 0.573079882 | 0.573720176 | 0.571891 | 0.481402 | 0.47657 | 0.468775 | 0.470301 | 0.495303 | 0.513546 | 0.553081 | 0.575082 | 0.632161 | 0.690243 | 0.769546 | 0.827875 | 0.892876 | 0.928886 | 0.9707 | 1 | 0.977080655 |
| 5 | 0.559249198 | 0.559873133 | 0.558219 | 0.471259 | 0.467115 | 0.457712 | 0.458267 | 0.47998 | 0.50007 | 0.540123 | 0.565557 | 0.621787 | 0.674575 | 0.747625 | 0.804601 | 0.867717 | 0.902288 | 0.9408 | 0.977 | 1 |



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# Total Correlation Coefficient Matrix (6>Mw>5.4)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999154011 | 0.995942 | 0.940363 | 0.9172 | 0.898292 | 0.883354 | 0.813074 | 0.775013 | 0.751154 | 0.723456 | 0.654724 | 0.618786 | 0.537532 | 0.464658 | 0.391886 | 0.360961 | 0.3467 | 0.356 | 0.388829099 |
| 0.01 | 0.999154011 | 1 | 0.997969 | 0.946575 | 0.923104 | 0.90135 | 0.881586 | 0.806055 | 0.765779 | 0.739517 | 0.710393 | 0.637941 | 0.602251 | 0.523073 | 0.450201 | 0.377233 | 0.347537 | 0.3364 | 0.348 | 0.382201366 |
| 0.02 | 0.995942257 | 0.997968822 | 1 | 0.955584 | 0.931519 | 0.904408 | 0.876836 | 0.793838 | 0.750512 | 0.721722 | 0.690871 | 0.616125 | 0.581198 | 0.50507 | 0.432942 | 0.363363 | 0.33681 | 0.3302 | 0.344 | 0.381049683 |
| 0.03 | 0.940362779 | 0.946574892 | 0.955584 | 1 | 0.946725 | 0.878125 | 0.806519 | 0.677117 | 0.624455 | 0.588503 | 0.559563 | 0.481947 | 0.447614 | 0.391925 | 0.323847 | 0.260021 | 0.241282 | 0.2472 | 0.268 | 0.316203157 |
| 0.05 | 0.917200421 | 0.923104421 | 0.931519 | 0.946725 | 1 | 0.938543 | 0.845833 | 0.685761 | 0.618305 | 0.572702 | 0.535126 | 0.449563 | 0.408124 | 0.344862 | 0.278134 | 0.219382 | 0.201263 | 0.2054 | 0.226 | 0.274050803 |
| 0.075 | 0.898292418 | 0.901350089 | 0.904408 | 0.878125 | 0.938543 | 1 | 0.91595 | 0.750514 | 0.672011 | 0.6173 | 0.57262 | 0.484082 | 0.431913 | 0.347508 | 0.285497 | 0.228188 | 0.208802 | 0.2066 | 0.222 | 0.261601644 |
| 0.1 | 0.88335432 | 0.881585662 | 0.876836 | 0.806519 | 0.845833 | 0.91595 | 1 | 0.861536 | 0.775501 | 0.706879 | 0.660234 | 0.574069 | 0.515211 | 0.394145 | 0.329957 | 0.270422 | 0.244971 | 0.2395 | 0.254 | 0.28105252 |
| 0.15 | 0.81307399 | 0.806055398 | 0.793838 | 0.677117 | 0.685761 | 0.750514 | 0.861536 | 1 | 0.908659 | 0.840528 | 0.783502 | 0.693579 | 0.635378 | 0.493304 | 0.428955 | 0.369691 | 0.33761 | 0.3252 | 0.33 | 0.339794645 |
| 0.2 | 0.775013316 | 0.765778603 | 0.750512 | 0.624455 | 0.618305 | 0.672011 | 0.775501 | 0.908659 | 1 | 0.915243 | 0.853244 | 0.762607 | 0.69643 | 0.54235 | 0.476062 | 0.411013 | 0.375418 | 0.3565 | 0.356 | 0.354154518 |
| 0.25 | 0.751154393 | 0.739517017 | 0.721722 | 0.588503 | 0.572702 | 0.6173 | 0.706879 | 0.840528 | 0.915243 | 1 | 0.93477 | 0.837146 | 0.772394 | 0.626851 | 0.554209 | 0.480264 | 0.440132 | 0.4047 | 0.397 | 0.392592083 |
| 0.3 | 0.723455745 | 0.710392857 | 0.690871 | 0.559563 | 0.535126 | 0.57262 | 0.660234 | 0.783502 | 0.853244 | 0.93477 | 1 | 0.894576 | 0.821579 | 0.67727 | 0.599567 | 0.513781 | 0.464619 | 0.4166 | 0.407 | 0.406144423 |
| 0.4 | 0.654723756 | 0.637940586 | 0.616125 | 0.481947 | 0.449563 | 0.484082 | 0.574069 | 0.693579 | 0.762607 | 0.837146 | 0.894576 | 1 | 0.925058 | 0.775432 | 0.696417 | 0.606276 | 0.549783 | 0.4912 | 0.47 | 0.464351198 |
| 0.5 | 0.618786436 | 0.602251425 | 0.581198 | 0.447614 | 0.408124 | 0.431913 | 0.515211 | 0.635378 | 0.69643 | 0.772394 | 0.821579 | 0.925058 | 1 | 0.865534 | 0.785577 | 0.69275 | 0.630109 | 0.5703 | 0.541 | 0.52805801 |
| 0.75 | 0.537531894 | 0.523073115 | 0.50507 | 0.391925 | 0.344862 | 0.347508 | 0.394145 | 0.493304 | 0.54235 | 0.626851 | 0.67727 | 0.775432 | 0.865534 | 1 | 0.917069 | 0.818021 | 0.748588 | 0.6801 | 0.64 | 0.620696835 |
| 1 | 0.464657662 | 0.450200905 | 0.432942 | 0.323847 | 0.278134 | 0.285497 | 0.329957 | 0.428955 | 0.476062 | 0.554209 | 0.599567 | 0.696417 | 0.785577 | 0.917069 | 1 | 0.900239 | 0.833864 | 0.7566 | 0.711 | 0.685686903 |
| 1.5 | 0.391886273 | 0.377232958 | 0.363363 | 0.260021 | 0.219382 | 0.228188 | 0.270422 | 0.369691 | 0.411013 | 0.480264 | 0.513781 | 0.606276 | 0.69275 | 0.818021 | 0.900239 | 1 | 0.931545 | 0.8544 | 0.806 | 0.768039881 |
| 2 | 0.360961015 | 0.347536852 | 0.33681 | 0.241282 | 0.201263 | 0.208802 | 0.244971 | 0.33761 | 0.375418 | 0.440132 | 0.464619 | 0.549783 | 0.630109 | 0.748588 | 0.833864 | 0.931545 | 1 | 0.9134 | 0.861 | 0.81707029 |
| 3 | 0.346749697 | 0.336424498 | 0.330176 | 0.247195 | 0.205412 | 0.206605 | 0.239529 | 0.325195 | 0.356456 | 0.404672 | 0.41659 | 0.491175 | 0.570285 | 0.680136 | 0.756552 | 0.854448 | 0.913363 | 1 | 0.939 | 0.890132428 |
| 4 | 0.356447978 | 0.347892732 | 0.344355 | 0.267953 | 0.226304 | 0.222047 | 0.253729 | 0.330076 | 0.356072 | 0.396989 | 0.406501 | 0.470202 | 0.541311 | 0.640173 | 0.711407 | 0.805845 | 0.861438 | 0.9395 | 1 | 0.951237939 |
| 5 | 0.388829099 | 0.382201366 | 0.38105 | 0.316203 | 0.274051 | 0.261602 | 0.281053 | 0.339795 | 0.354155 | 0.392592 | 0.406144 | 0.464351 | 0.528058 | 0.620697 | 0.685687 | 0.76804 | 0.81707 | 0.8901 | 0.951 | 1 |



doi:10.6342/NTU202303258

# Total Correlation Coefficient Matrix (Site Class B)

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.875305952 | 0.868092787 | 0.859158 | 0.763259 | 0.782094 | 0.815057 | 0.836693 | 0.85208 | 0.858693 | 0.863653 | 0.859797 | 0.857224 | 0.837316 | 0.774531 | 0.759452 | 0.714272 | 0.675221 | 0.612 | 0.569 | 0.545429683 |
| 0.01 | 0.875161375 | 0.867934518 | 0.858949 | 0.762949 | 0.781851 | 0.814957 | 0.836617 | 0.852016 | 0.858621 | 0.863675 | 0.859816 | 0.857335 | 0.837426 | 0.774634 | 0.759568 | 0.714426 | 0.675351 | 0.6121 | 0.569 | 0.545428264 |
| 0.02 | 0.878385867 | 0.871700297 | 0.863643 | 0.769331 | 0.78679 | 0.817604 | 0.837778 | 0.852318 | 0.858635 | 0.862738 | 0.858173 | 0.855098 | 0.835191 | 0.772989 | 0.757887 | 0.712752 | 0.674236 | 0.6123 | 0.57 | 0.54704046 |
| 0.03 | 0.883136589 | 0.881961779 | 0.879518 | 0.824271 | 0.818593 | 0.81806 | 0.816259 | 0.818152 | 0.826009 | 0.814221 | 0.807813 | 0.800502 | 0.777342 | 0.724806 | 0.710866 | 0.660185 | 0.630458 | 0.5742 | 0.531 | 0.520056791 |
| 0.05 | 0.886145032 | 0.883819518 | 0.880662 | 0.818941 | 0.833126 | 0.843443 | 0.839054 | 0.824121 | 0.819884 | 0.811347 | 0.800398 | 0.790606 | 0.768024 | 0.71204 | 0.705595 | 0.658298 | 0.627411 | 0.5729 | 0.531 | 0.521254321 |
| 0.075 | 0.872216923 | 0.865685199 | 0.856626 | 0.773304 | 0.817632 | 0.85689 | 0.864572 | 0.846447 | 0.838645 | 0.834975 | 0.823267 | 0.808494 | 0.781946 | 0.723869 | 0.716264 | 0.677544 | 0.645596 | 0.5874 | 0.539 | 0.525425764 |
| 0.1 | 0.836903456 | 0.828233495 | 0.815724 | 0.722667 | 0.777274 | 0.840106 | 0.872657 | 0.860618 | 0.84834 | 0.840543 | 0.822078 | 0.801972 | 0.771527 | 0.696599 | 0.686999 | 0.653766 | 0.625684 | 0.5721 | 0.528 | 0.507616445 |
| 0.15 | 0.819440278 | 0.810244234 | 0.797393 | 0.693627 | 0.738804 | 0.806783 | 0.855853 | 0.880505 | 0.869899 | 0.863868 | 0.84393 | 0.811342 | 0.779274 | 0.693927 | 0.677944 | 0.648268 | 0.61672 | 0.5678 | 0.533 | 0.507390371 |
| 0.2 | 0.810056816 | 0.800006573 | 0.787268 | 0.668769 | 0.712355 | 0.774849 | 0.827367 | 0.88042 | 0.889892 | 0.890806 | 0.87379 | 0.845663 | 0.813766 | 0.718606 | 0.690198 | 0.654405 | 0.618521 | 0.5747 | 0.546 | 0.513250035 |
| 0.25 | 0.78423472 | 0.772047183 | 0.758483 | 0.63437 | 0.669941 | 0.72528 | 0.781403 | 0.841446 | 0.860548 | 0.89349 | 0.890219 | 0.861773 | 0.834139 | 0.749681 | 0.726535 | 0.687352 | 0.647099 | 0.5903 | 0.559 | 0.52095573 |
| 0.3 | 0.753319455 | 0.739524102 | 0.725207 | 0.591139 | 0.621136 | 0.675741 | 0.737285 | 0.802445 | 0.834168 | 0.882773 | 0.901201 | 0.874592 | 0.849549 | 0.767262 | 0.743368 | 0.704069 | 0.657358 | 0.5901 | 0.552 | 0.513410229 |
| 0.4 | 0.718345388 | 0.703014283 | 0.688368 | 0.547394 | 0.569041 | 0.621795 | 0.687214 | 0.752153 | 0.787397 | 0.839857 | 0.862425 | 0.889816 | 0.872505 | 0.794705 | 0.768228 | 0.720933 | 0.669392 | 0.5886 | 0.549 | 0.505727843 |
| 0.5 | 0.72037915 | 0.704931537 | 0.692568 | 0.549943 | 0.572393 | 0.617951 | 0.676338 | 0.731782 | 0.761604 | 0.817257 | 0.833879 | 0.871254 | 0.885708 | 0.820639 | 0.789091 | 0.740769 | 0.688046 | 0.5984 | 0.552 | 0.502527226 |
| 0.75 | 0.719911589 | 0.704328916 | 0.693821 | 0.560278 | 0.580437 | 0.618812 | 0.665006 | 0.703018 | 0.721546 | 0.777598 | 0.798822 | 0.827195 | 0.865438 | 0.880365 | 0.852092 | 0.808794 | 0.757202 | 0.6633 | 0.607 | 0.557746915 |
| 1 | 0.714874884 | 0.699451111 | 0.690432 | 0.566052 | 0.581496 | 0.61241 | 0.650243 | 0.675765 | 0.687571 | 0.742969 | 0.771124 | 0.802345 | 0.838081 | 0.865251 | 0.873339 | 0.833473 | 0.781593 | 0.6838 | 0.621 | 0.575241274 |
| 1.5 | 0.725888623 | 0.711824442 | 0.703424 | 0.584161 | 0.599468 | 0.630949 | 0.66186 | 0.67866 | 0.682453 | 0.733913 | 0.757055 | 0.780916 | 0.817471 | 0.846689 | 0.867363 | 0.866976 | 0.825411 | 0.7309 | 0.67 | 0.628012912 |
| 2 | 0.712501219 | 0.699242019 | 0.691445 | 0.578365 | 0.590808 | 0.619415 | 0.649652 | 0.667606 | 0.672063 | 0.716607 | 0.740252 | 0.760528 | 0.797226 | 0.828537 | 0.854581 | 0.86215 | 0.845601 | 0.7649 | 0.705 | 0.658704942 |
| 3 | 0.676779967 | 0.666220281 | 0.659666 | 0.552454 | 0.558849 | 0.58157 | 0.609945 | 0.628999 | 0.634741 | 0.66993 | 0.693458 | 0.707829 | 0.747736 | 0.798407 | 0.820576 | 0.844107 | 0.847722 | 0.8219 | 0.775 | 0.720762005 |
| 4 | 0.670344727 | 0.660929139 | 0.656587 | 0.555157 | 0.563394 | 0.578659 | 0.608345 | 0.620377 | 0.622078 | 0.654329 | 0.674977 | 0.682926 | 0.715833 | 0.773109 | 0.799908 | 0.834833 | 0.846877 | 0.8387 | 0.818 | 0.772524249 |
| 5 | 0.642599658 | 0.632973941 | 0.630298 | 0.535746 | 0.540342 | 0.551348 | 0.581182 | 0.589893 | 0.585594 | 0.617105 | 0.634862 | 0.642661 | 0.67548 | 0.742986 | 0.771675 | 0.814086 | 0.829403 | 0.8274 | 0.82 | 0.792135591 |



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# Total Correlation Coefficient Matrix (Site Class B)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999998357 | 0.999828 | 0.970788 | 0.969134 | 0.969903 | 0.949545 | 0.939678 | 0.938622 | 0.934715 | 0.915529 | 0.891901 | 0.885339 | 0.851326 | 0.826225 | 0.810044 | 0.794385 | 0.7438 | 0.725 | 0.696965643 |
| 0.01 | 0.999998357 | 1 | 0.999818 | 0.970633 | 0.969022 | 0.969895 | 0.949599 | 0.939713 | 0.938657 | 0.934825 | 0.915659 | 0.892099 | 0.885588 | 0.851566 | 0.826482 | 0.810301 | 0.794632 | 0.7441 | 0.725 | 0.697172082 |
| 0.02 | 0.999828428 | 0.999818337 | 1 | 0.973225 | 0.971133 | 0.969854 | 0.948202 | 0.938088 | 0.936849 | 0.932345 | 0.912525 | 0.888463 | 0.882597 | 0.848851 | 0.824069 | 0.808428 | 0.792877 | 0.7429 | 0.724 | 0.696361526 |
| 0.03 | 0.970788239 | 0.970632867 | 0.973225 | 1 | 0.98299 | 0.948466 | 0.905766 | 0.885264 | 0.87518 | 0.863684 | 0.836659 | 0.804764 | 0.8016 | 0.772852 | 0.754727 | 0.74107 | 0.728571 | 0.6859 | 0.669 | 0.64437573 |
| 0.05 | 0.969133532 | 0.969022143 | 0.971133 | 0.98299 | 1 | 0.969352 | 0.930537 | 0.897713 | 0.879841 | 0.863825 | 0.835214 | 0.797607 | 0.798791 | 0.770365 | 0.755825 | 0.744519 | 0.730905 | 0.6861 | 0.672 | 0.648268484 |
| 0.075 | 0.969902593 | 0.969895096 | 0.969854 | 0.948466 | 0.969352 | 1 | 0.974697 | 0.942595 | 0.91761 | 0.898473 | 0.86722 | 0.822871 | 0.819186 | 0.79092 | 0.771722 | 0.764651 | 0.752927 | 0.701 | 0.686 | 0.662743249 |
| 0.1 | 0.949544522 | 0.949599101 | 0.948202 | 0.905766 | 0.930537 | 0.974697 | 1 | 0.969868 | 0.93899 | 0.914679 | 0.877005 | 0.829568 | 0.814481 | 0.775501 | 0.748911 | 0.745631 | 0.73481 | 0.6825 | 0.668 | 0.645176926 |
| 0.15 | 0.939678274 | 0.939712508 | 0.938088 | 0.885264 | 0.897713 | 0.942595 | 0.969868 | 1 | 0.967024 | 0.938416 | 0.900015 | 0.849409 | 0.823892 | 0.774865 | 0.738693 | 0.732224 | 0.721853 | 0.6769 | 0.662 | 0.63739163 |
| 0.2 | 0.938622266 | 0.938657472 | 0.936849 | 0.87518 | 0.879841 | 0.91761 | 0.93899 | 0.967024 | 1 | 0.969893 | 0.936107 | 0.887186 | 0.861144 | 0.803324 | 0.76142 | 0.746544 | 0.734294 | 0.6898 | 0.677 | 0.648795324 |
| 0.25 | 0.934715394 | 0.93482459 | 0.932345 | 0.863684 | 0.863825 | 0.898473 | 0.914679 | 0.938416 | 0.969893 | 1 | 0.976645 | 0.932566 | 0.908533 | 0.856225 | 0.817806 | 0.795474 | 0.77717 | 0.726 | 0.711 | 0.681111269 |
| 0.3 | 0.915529224 | 0.915659289 | 0.912525 | 0.836659 | 0.835214 | 0.86722 | 0.877005 | 0.900015 | 0.936107 | 0.976645 | 1 | 0.960634 | 0.933586 | 0.882733 | 0.847122 | 0.818722 | 0.794492 | 0.7399 | 0.721 | 0.691680892 |
| 0.4 | 0.891901374 | 0.89209948 | 0.888463 | 0.804764 | 0.797607 | 0.822871 | 0.829568 | 0.849409 | 0.887186 | 0.932566 | 0.960634 | 1 | 0.97084 | 0.913704 | 0.877009 | 0.843705 | 0.817611 | 0.7647 | 0.737 | 0.708426819 |
| 0.5 | 0.885338695 | 0.885587776 | 0.882597 | 0.8016 | 0.798791 | 0.819186 | 0.814481 | 0.823892 | 0.861144 | 0.908533 | 0.933586 | 0.97084 | 1 | 0.945351 | 0.910683 | 0.875863 | 0.850491 | 0.7981 | 0.762 | 0.731357993 |
| 0.75 | 0.851325964 | 0.851566477 | 0.848851 | 0.772852 | 0.770365 | 0.79092 | 0.775501 | 0.774865 | 0.803324 | 0.856225 | 0.882733 | 0.913704 | 0.945351 | 1 | 0.969617 | 0.933795 | 0.910256 | 0.8617 | 0.826 | 0.797845827 |
| 1 | 0.826225372 | 0.82648183 | 0.824069 | 0.754727 | 0.755825 | 0.771722 | 0.748911 | 0.738693 | 0.76142 | 0.817806 | 0.847122 | 0.877009 | 0.910683 | 0.969617 | 1 | 0.960637 | 0.937284 | 0.8842 | 0.849 | 0.821716235 |
| 1.5 | 0.810044451 | 0.810301041 | 0.808428 | 0.74107 | 0.744519 | 0.764651 | 0.745631 | 0.732224 | 0.746544 | 0.795474 | 0.818722 | 0.843705 | 0.875863 | 0.933795 | 0.960637 | 1 | 0.975373 | 0.9232 | 0.889 | 0.859968185 |
| 2 | 0.794384787 | 0.794631674 | 0.792877 | 0.728571 | 0.730905 | 0.752927 | 0.73481 | 0.721853 | 0.734294 | 0.77717 | 0.794492 | 0.817611 | 0.850491 | 0.910256 | 0.937284 | 0.975373 | 1 | 0.9511 | 0.919 | 0.888674095 |
| 3 | 0.743840661 | 0.744071859 | 0.742891 | 0.685898 | 0.686111 | 0.700998 | 0.68246 | 0.676939 | 0.689794 | 0.725985 | 0.7399 | 0.764747 | 0.798113 | 0.861661 | 0.884206 | 0.92316 | 0.951052 | 1 | 0.971 | 0.944005159 |
| 4 | 0.724946554 | 0.725165417 | 0.724379 | 0.669409 | 0.672386 | 0.686463 | 0.668028 | 0.661799 | 0.676916 | 0.71145 | 0.720849 | 0.73663 | 0.762036 | 0.826286 | 0.848969 | 0.889232 | 0.918533 | 0.9712 | 1 | 0.979935919 |
| 5 | 0.696965643 | 0.697172082 | 0.696362 | 0.644376 | 0.648268 | 0.662743 | 0.645177 | 0.637392 | 0.648795 | 0.681111 | 0.691681 | 0.708427 | 0.731358 | 0.797846 | 0.821716 | 0.859968 | 0.888674 | 0.944 | 0.98 | 1 |



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# Total Correlation Coefficient Matrix (Site Class B)

### SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999178834 | 0.996493 | 0.954555 | 0.957076 | 0.939433 | 0.930798 | 0.910305 | 0.890847 | 0.869969 | 0.850704 | 0.83324 | 0.8238 | 0.797121 | 0.784257 | 0.74451 | 0.724727 | 0.6859 | 0.645 | 0.641403162 |
| 0.01 | 0.999178834 | 1 | 0.998104 | 0.960334 | 0.959537 | 0.937996 | 0.92664 | 0.904912 | 0.885449 | 0.862336 | 0.841701 | 0.822936 | 0.812947 | 0.787085 | 0.774674 | 0.73487 | 0.717035 | 0.6809 | 0.642 | 0.639489711 |
| 0.02 | 0.996493388 | 0.998103912 | 1 | 0.967326 | 0.962732 | 0.934354 | 0.918821 | 0.894552 | 0.873718 | 0.84832 | 0.826178 | 0.805711 | 0.796734 | 0.773929 | 0.761476 | 0.723044 | 0.707244 | 0.6755 | 0.64 | 0.638937305 |
| 0.03 | 0.954554907 | 0.960333885 | 0.967326 | 1 | 0.967912 | 0.905484 | 0.865492 | 0.825137 | 0.791409 | 0.747734 | 0.723156 | 0.693841 | 0.682331 | 0.674816 | 0.667542 | 0.631865 | 0.631551 | 0.6137 | 0.583 | 0.596909528 |
| 0.05 | 0.95707632 | 0.959536709 | 0.962732 | 0.967912 | 1 | 0.953266 | 0.913671 | 0.853919 | 0.808348 | 0.767523 | 0.73653 | 0.703179 | 0.691996 | 0.675265 | 0.665013 | 0.634376 | 0.625823 | 0.6099 | 0.573 | 0.583127016 |
| 0.075 | 0.939432652 | 0.937995769 | 0.934354 | 0.905484 | 0.953266 | 1 | 0.960069 | 0.889994 | 0.838515 | 0.801344 | 0.767485 | 0.735357 | 0.711216 | 0.67823 | 0.673613 | 0.641527 | 0.626676 | 0.6073 | 0.564 | 0.564405777 |
| 0.1 | 0.930798468 | 0.926639982 | 0.918821 | 0.865492 | 0.913671 | 0.960069 | 1 | 0.937441 | 0.889608 | 0.851413 | 0.819793 | 0.785412 | 0.761808 | 0.707976 | 0.700454 | 0.664274 | 0.648385 | 0.6254 | 0.585 | 0.577156358 |
| 0.15 | 0.910305144 | 0.904912329 | 0.894552 | 0.825137 | 0.853919 | 0.889994 | 0.937441 | 1 | 0.946099 | 0.910321 | 0.878822 | 0.839041 | 0.813925 | 0.737135 | 0.716226 | 0.675626 | 0.654834 | 0.6236 | 0.59 | 0.57246048 |
| 0.2 | 0.890847165 | 0.885448981 | 0.873718 | 0.791409 | 0.808348 | 0.838515 | 0.889608 | 0.946099 | 1 | 0.947854 | 0.917821 | 0.88031 | 0.852047 | 0.758297 | 0.738761 | 0.683074 | 0.656792 | 0.6267 | 0.592 | 0.571355263 |
| 0.25 | 0.869968982 | 0.8623361 | 0.84832 | 0.747734 | 0.767523 | 0.801344 | 0.851413 | 0.910321 | 0.947854 | 1 | 0.96188 | 0.918737 | 0.887101 | 0.797093 | 0.774328 | 0.726042 | 0.691965 | 0.6501 | 0.61 | 0.582289393 |
| 0.3 | 0.850704281 | 0.841700552 | 0.826178 | 0.723156 | 0.73653 | 0.767485 | 0.819793 | 0.878822 | 0.917821 | 0.96188 | 1 | 0.933832 | 0.89273 | 0.808512 | 0.789704 | 0.73133 | 0.701152 | 0.6498 | 0.609 | 0.581050914 |
| 0.4 | 0.833240199 | 0.822936381 | 0.805711 | 0.693841 | 0.703179 | 0.735357 | 0.785412 | 0.839041 | 0.88031 | 0.918737 | 0.933832 | 1 | 0.948279 | 0.853971 | 0.833588 | 0.773897 | 0.727899 | 0.663 | 0.614 | 0.585743071 |
| 0.5 | 0.823800298 | 0.812947384 | 0.796734 | 0.682331 | 0.691996 | 0.711216 | 0.761808 | 0.813925 | 0.852047 | 0.887101 | 0.89273 | 0.948279 | 1 | 0.907125 | 0.872968 | 0.822945 | 0.771926 | 0.6907 | 0.641 | 0.606878313 |
| 0.75 | 0.797121422 | 0.787084787 | 0.773929 | 0.674816 | 0.675265 | 0.67823 | 0.707976 | 0.737135 | 0.758297 | 0.797093 | 0.808512 | 0.853971 | 0.907125 | 1 | 0.940292 | 0.884651 | 0.848317 | 0.7768 | 0.721 | 0.688621031 |
| 1 | 0.784257272 | 0.774674123 | 0.761476 | 0.667542 | 0.665013 | 0.673613 | 0.700454 | 0.716226 | 0.738761 | 0.774328 | 0.789704 | 0.833588 | 0.872968 | 0.940292 | 1 | 0.934915 | 0.897466 | 0.8141 | 0.752 | 0.732501971 |
| 1.5 | 0.744509578 | 0.73486982 | 0.723044 | 0.631865 | 0.634376 | 0.641527 | 0.664274 | 0.675626 | 0.683074 | 0.726042 | 0.73133 | 0.773897 | 0.822945 | 0.884651 | 0.934915 | 1 | 0.951946 | 0.8733 | 0.819 | 0.795199928 |
| 2 | 0.72472743 | 0.717035359 | 0.707244 | 0.631551 | 0.625823 | 0.626676 | 0.648385 | 0.654834 | 0.656792 | 0.691965 | 0.701152 | 0.727899 | 0.771926 | 0.848317 | 0.897466 | 0.951946 | 1 | 0.9249 | 0.875 | 0.854301085 |
| 3 | 0.685889227 | 0.68086603 | 0.675459 | 0.613658 | 0.609944 | 0.607332 | 0.625352 | 0.623568 | 0.626685 | 0.650103 | 0.64983 | 0.662953 | 0.690709 | 0.77682 | 0.814122 | 0.873253 | 0.924886 | 1 | 0.955 | 0.925354015 |
| 4 | 0.645423779 | 0.642071013 | 0.639562 | 0.582826 | 0.573028 | 0.564414 | 0.585345 | 0.589946 | 0.591694 | 0.609899 | 0.609492 | 0.614364 | 0.641318 | 0.720723 | 0.752404 | 0.818571 | 0.875463 | 0.9552 | 1 | 0.967880132 |
| 5 | 0.641403162 | 0.639489711 | 0.638937 | 0.59691 | 0.583127 | 0.564406 | 0.577156 | 0.57246 | 0.571355 | 0.582289 | 0.581051 | 0.585743 | 0.606878 | 0.688621 | 0.732502 | 0.7952 | 0.854301 | 0.9254 | 0.968 | 1 |



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# Total Correlation Coefficient Matrix (Site Class C)

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.839029765 | 0.830039659 | 0.820003 | 0.733682 | 0.717991 | 0.72508 | 0.748047 | 0.763719 | 0.792477 | 0.819289 | 0.821721 | 0.801364 | 0.783099 | 0.730228 | 0.692411 | 0.660306 | 0.64917 | 0.5997 | 0.578 | 0.563440258 |
| 0.01 | 0.838778244 | 0.829780636 | 0.8197 | 0.733239 | 0.717559 | 0.724773 | 0.74786 | 0.763683 | 0.792442 | 0.819292 | 0.82176 | 0.801547 | 0.783371 | 0.730467 | 0.692699 | 0.660657 | 0.649525 | 0.6 | 0.578 | 0.563728817 |
| 0.02 | 0.842705713 | 0.834190507 | 0.825187 | 0.74057 | 0.724231 | 0.729552 | 0.750492 | 0.764241 | 0.791778 | 0.817515 | 0.819373 | 0.798071 | 0.780233 | 0.727771 | 0.689928 | 0.658599 | 0.648383 | 0.6002 | 0.579 | 0.564940626 |
| 0.03 | 0.858239943 | 0.854266517 | 0.850615 | 0.82186 | 0.780971 | 0.746545 | 0.733419 | 0.712234 | 0.731043 | 0.748002 | 0.745975 | 0.718329 | 0.699534 | 0.65662 | 0.615696 | 0.584227 | 0.577069 | 0.5359 | 0.519 | 0.513643659 |
| 0.05 | 0.87161629 | 0.866949581 | 0.863042 | 0.810392 | 0.819976 | 0.802176 | 0.783694 | 0.754024 | 0.767449 | 0.77542 | 0.762588 | 0.71948 | 0.698098 | 0.649249 | 0.608417 | 0.577922 | 0.574734 | 0.5362 | 0.518 | 0.507988577 |
| 0.075 | 0.849964354 | 0.843421675 | 0.836916 | 0.755664 | 0.791706 | 0.820977 | 0.819384 | 0.791873 | 0.802001 | 0.804743 | 0.784242 | 0.733638 | 0.705313 | 0.644661 | 0.607412 | 0.576041 | 0.574824 | 0.5354 | 0.513 | 0.499050923 |
| 0.1 | 0.811635323 | 0.803025167 | 0.793892 | 0.693822 | 0.738519 | 0.790235 | 0.827257 | 0.81674 | 0.827499 | 0.822301 | 0.800135 | 0.751004 | 0.714895 | 0.637157 | 0.597525 | 0.566169 | 0.562266 | 0.5219 | 0.499 | 0.48233451 |
| 0.15 | 0.748992126 | 0.738078626 | 0.726325 | 0.607193 | 0.645113 | 0.713456 | 0.77489 | 0.821576 | 0.833154 | 0.835077 | 0.818026 | 0.777404 | 0.740988 | 0.653188 | 0.615523 | 0.587052 | 0.578786 | 0.5319 | 0.504 | 0.485478792 |
| 0.2 | 0.728242187 | 0.716548711 | 0.703086 | 0.577398 | 0.602039 | 0.666287 | 0.741237 | 0.804742 | 0.848316 | 0.847952 | 0.836837 | 0.798292 | 0.7579 | 0.668913 | 0.629694 | 0.599647 | 0.587743 | 0.5403 | 0.515 | 0.498593307 |
| 0.25 | 0.702167326 | 0.688935736 | 0.673921 | 0.545731 | 0.552465 | 0.612565 | 0.688092 | 0.766588 | 0.818897 | 0.860176 | 0.860046 | 0.824152 | 0.786025 | 0.705164 | 0.664402 | 0.633482 | 0.616856 | 0.5682 | 0.542 | 0.520674361 |
| 0.3 | 0.674750417 | 0.660215347 | 0.643519 | 0.514512 | 0.51237 | 0.5662 | 0.644012 | 0.728609 | 0.790146 | 0.842823 | 0.86894 | 0.848658 | 0.808907 | 0.729689 | 0.690682 | 0.653594 | 0.630828 | 0.5771 | 0.553 | 0.531333836 |
| 0.4 | 0.630904401 | 0.614923767 | 0.596051 | 0.468085 | 0.456647 | 0.505452 | 0.578563 | 0.670103 | 0.734841 | 0.795737 | 0.834536 | 0.87636 | 0.850157 | 0.771627 | 0.732804 | 0.693841 | 0.668649 | 0.6082 | 0.581 | 0.556370358 |
| 0.5 | 0.609409928 | 0.593697673 | 0.574594 | 0.446986 | 0.426711 | 0.468497 | 0.542161 | 0.63351 | 0.689896 | 0.753778 | 0.795673 | 0.859621 | 0.879663 | 0.81923 | 0.78208 | 0.746044 | 0.719143 | 0.6617 | 0.634 | 0.609550779 |
| 0.75 | 0.590851625 | 0.575209646 | 0.558995 | 0.438743 | 0.40634 | 0.436154 | 0.491628 | 0.569651 | 0.609934 | 0.688559 | 0.737321 | 0.813535 | 0.868087 | 0.902297 | 0.873199 | 0.835955 | 0.806615 | 0.749 | 0.717 | 0.691558017 |
| 1 | 0.562061351 | 0.546626536 | 0.532314 | 0.417321 | 0.380784 | 0.406145 | 0.452548 | 0.529212 | 0.561882 | 0.641002 | 0.690999 | 0.766953 | 0.833171 | 0.896785 | 0.913767 | 0.891991 | 0.862979 | 0.8067 | 0.771 | 0.745239295 |
| 1.5 | 0.538895457 | 0.524586925 | 0.513609 | 0.406233 | 0.372008 | 0.393788 | 0.430721 | 0.498211 | 0.520386 | 0.596958 | 0.642982 | 0.718469 | 0.791531 | 0.868281 | 0.901442 | 0.925019 | 0.907128 | 0.8569 | 0.82 | 0.791821679 |
| 2 | 0.532947045 | 0.519638617 | 0.510964 | 0.405967 | 0.374442 | 0.394313 | 0.423832 | 0.485691 | 0.504157 | 0.576086 | 0.617163 | 0.689231 | 0.762412 | 0.842303 | 0.88365 | 0.92089 | 0.925734 | 0.8853 | 0.845 | 0.814535695 |
| 3 | 0.517532397 | 0.505547415 | 0.499859 | 0.401003 | 0.370368 | 0.388076 | 0.411952 | 0.469809 | 0.483319 | 0.54971 | 0.584541 | 0.648409 | 0.721721 | 0.80311 | 0.847819 | 0.896657 | 0.914451 | 0.9157 | 0.884 | 0.849686198 |
| 4 | 0.511376685 | 0.50038729 | 0.496005 | 0.398481 | 0.368343 | 0.383813 | 0.406771 | 0.465562 | 0.481008 | 0.545014 | 0.574343 | 0.629046 | 0.70138 | 0.777504 | 0.824016 | 0.875877 | 0.897733 | 0.9098 | 0.903 | 0.874706284 |
| 5 | 0.498621808 | 0.487052354 | 0.483913 | 0.389749 | 0.359013 | 0.371252 | 0.394822 | 0.453491 | 0.467082 | 0.53051 | 0.559086 | 0.614446 | 0.684075 | 0.758681 | 0.803727 | 0.855423 | 0.874037 | 0.8907 | 0.896 | 0.880297745 |



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# Total Correlation Coefficient Matrix (Site Class C)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999997938 | 0.999808 | 0.963877 | 0.959017 | 0.943755 | 0.92621 | 0.905518 | 0.901512 | 0.90105 | 0.891204 | 0.862193 | 0.838544 | 0.789196 | 0.750098 | 0.706757 | 0.688985 | 0.6595 | 0.646 | 0.633007333 |
| 0.01 | 0.999997938 | 1 | 0.9998 | 0.963726 | 0.958887 | 0.943683 | 0.926165 | 0.905563 | 0.901562 | 0.901185 | 0.891405 | 0.862509 | 0.838964 | 0.789613 | 0.750553 | 0.707243 | 0.689458 | 0.66 | 0.646 | 0.633412469 |
| 0.02 | 0.999808174 | 0.999800064 | 1 | 0.966105 | 0.961 | 0.944883 | 0.926284 | 0.904464 | 0.899664 | 0.898459 | 0.887914 | 0.858233 | 0.834592 | 0.785824 | 0.747154 | 0.704755 | 0.687665 | 0.6588 | 0.645 | 0.632440968 |
| 0.03 | 0.963877373 | 0.963726039 | 0.966105 | 1 | 0.963039 | 0.91464 | 0.871814 | 0.826181 | 0.814695 | 0.809586 | 0.795557 | 0.761578 | 0.736639 | 0.691556 | 0.655797 | 0.617878 | 0.603648 | 0.5788 | 0.567 | 0.555035781 |
| 0.05 | 0.959017065 | 0.958887157 | 0.961 | 0.963039 | 1 | 0.966792 | 0.920664 | 0.863419 | 0.839555 | 0.82477 | 0.802221 | 0.756388 | 0.72902 | 0.680744 | 0.642751 | 0.608282 | 0.597454 | 0.5753 | 0.566 | 0.55398623 |
| 0.075 | 0.943755167 | 0.943682608 | 0.944883 | 0.91464 | 0.966792 | 1 | 0.967881 | 0.910725 | 0.876518 | 0.851383 | 0.822726 | 0.770949 | 0.737515 | 0.682419 | 0.641281 | 0.607189 | 0.595834 | 0.5739 | 0.566 | 0.553343297 |
| 0.1 | 0.926209714 | 0.926164928 | 0.926284 | 0.871814 | 0.920664 | 0.967881 | 1 | 0.948749 | 0.913236 | 0.879199 | 0.846273 | 0.790124 | 0.748656 | 0.682227 | 0.638789 | 0.602199 | 0.588778 | 0.565 | 0.557 | 0.545146375 |
| 0.15 | 0.905517889 | 0.90556337 | 0.904464 | 0.826181 | 0.863419 | 0.910725 | 0.948749 | 1 | 0.960725 | 0.924298 | 0.889197 | 0.831711 | 0.78876 | 0.71295 | 0.667679 | 0.627416 | 0.610366 | 0.5827 | 0.573 | 0.559795399 |
| 0.2 | 0.901512128 | 0.901562306 | 0.899664 | 0.814695 | 0.839555 | 0.876518 | 0.913236 | 0.960725 | 1 | 0.955748 | 0.921709 | 0.863764 | 0.817806 | 0.736307 | 0.690095 | 0.644346 | 0.623974 | 0.5948 | 0.585 | 0.571795468 |
| 0.25 | 0.90105035 | 0.901184719 | 0.898459 | 0.809586 | 0.82477 | 0.851383 | 0.879199 | 0.924298 | 0.955748 | 1 | 0.966617 | 0.907755 | 0.866141 | 0.789627 | 0.739627 | 0.690794 | 0.668485 | 0.6355 | 0.625 | 0.610813374 |
| 0.3 | 0.891204448 | 0.891404821 | 0.887914 | 0.795557 | 0.802221 | 0.822726 | 0.846273 | 0.889197 | 0.921709 | 0.966617 | 1 | 0.945736 | 0.903692 | 0.8237 | 0.773745 | 0.719383 | 0.692702 | 0.6551 | 0.643 | 0.631913255 |
| 0.4 | 0.862192538 | 0.862508779 | 0.858233 | 0.761578 | 0.756388 | 0.770949 | 0.790124 | 0.831711 | 0.863764 | 0.907755 | 0.945736 | 1 | 0.961063 | 0.8802 | 0.827895 | 0.770902 | 0.742522 | 0.7022 | 0.683 | 0.672722192 |
| 0.5 | 0.838544287 | 0.838963799 | 0.834592 | 0.736639 | 0.72902 | 0.737515 | 0.748656 | 0.78876 | 0.817806 | 0.866141 | 0.903692 | 0.961063 | 1 | 0.929832 | 0.881826 | 0.827527 | 0.798762 | 0.7614 | 0.741 | 0.729992274 |
| 0.75 | 0.789196271 | 0.789613169 | 0.785824 | 0.691556 | 0.680744 | 0.682419 | 0.682227 | 0.71295 | 0.736307 | 0.789627 | 0.8237 | 0.8802 | 0.929832 | 1 | 0.960871 | 0.912756 | 0.882554 | 0.8458 | 0.823 | 0.808980432 |
| 1 | 0.75009758 | 0.750552667 | 0.747154 | 0.655797 | 0.642751 | 0.641281 | 0.638789 | 0.667679 | 0.690095 | 0.739627 | 0.773745 | 0.827895 | 0.881826 | 0.960871 | 1 | 0.960495 | 0.936413 | 0.8983 | 0.873 | 0.856646698 |
| 1.5 | 0.706756556 | 0.707243088 | 0.704755 | 0.617878 | 0.608282 | 0.607189 | 0.602199 | 0.627416 | 0.644346 | 0.690794 | 0.719383 | 0.770902 | 0.827527 | 0.912756 | 0.960495 | 1 | 0.976019 | 0.9419 | 0.917 | 0.896858101 |
| 2 | 0.688985366 | 0.689458243 | 0.687665 | 0.603648 | 0.597454 | 0.595834 | 0.588778 | 0.610366 | 0.623974 | 0.668485 | 0.692702 | 0.742522 | 0.798762 | 0.882554 | 0.936413 | 0.976019 | 1 | 0.9666 | 0.942 | 0.918545094 |
| 3 | 0.659519475 | 0.659958432 | 0.658756 | 0.578846 | 0.575259 | 0.57386 | 0.564995 | 0.582699 | 0.594827 | 0.6355 | 0.655103 | 0.702237 | 0.761449 | 0.845794 | 0.898264 | 0.941941 | 0.966608 | 1 | 0.976 | 0.95055628 |
| 4 | 0.645963264 | 0.646406587 | 0.645436 | 0.56667 | 0.566251 | 0.566046 | 0.557499 | 0.573443 | 0.584767 | 0.624501 | 0.642638 | 0.683491 | 0.741208 | 0.822976 | 0.873023 | 0.91732 | 0.941924 | 0.9756 | 1 | 0.980780961 |
| 5 | 0.633007333 | 0.633412469 | 0.632441 | 0.555036 | 0.553986 | 0.553343 | 0.545146 | 0.559795 | 0.571795 | 0.610813 | 0.631913 | 0.672722 | 0.729992 | 0.80898 | 0.856647 | 0.896858 | 0.918545 | 0.9506 | 0.981 | 1 |



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# Total Correlation Coefficient Matrix (Site Class C)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999223268 | 0.99629 | 0.941979 | 0.923271 | 0.899077 | 0.876947 | 0.832082 | 0.813808 | 0.800983 | 0.776833 | 0.712575 | 0.692093 | 0.643827 | 0.598045 | 0.557641 | 0.552319 | 0.5243 | 0.514 | 0.509822604 |
| 0.01 | 0.999223268 | 1 | 0.997807 | 0.947214 | 0.927149 | 0.899872 | 0.874852 | 0.826741 | 0.807201 | 0.791942 | 0.766473 | 0.699984 | 0.679923 | 0.631529 | 0.58562 | 0.545306 | 0.541073 | 0.5155 | 0.507 | 0.503543611 |
| 0.02 | 0.996290168 | 0.997807149 | 1 | 0.955926 | 0.934515 | 0.901293 | 0.86974 | 0.815473 | 0.792478 | 0.774947 | 0.748223 | 0.679229 | 0.66014 | 0.614988 | 0.569988 | 0.533792 | 0.532893 | 0.5126 | 0.505 | 0.5028966 |
| 0.03 | 0.941978753 | 0.947214065 | 0.955926 | 1 | 0.944362 | 0.864766 | 0.795438 | 0.70194 | 0.670392 | 0.645657 | 0.616266 | 0.546449 | 0.527807 | 0.503545 | 0.460943 | 0.428558 | 0.432236 | 0.4222 | 0.418 | 0.423087421 |
| 0.05 | 0.923271432 | 0.927148623 | 0.934515 | 0.944362 | 1 | 0.935036 | 0.84835 | 0.732885 | 0.691021 | 0.655197 | 0.612742 | 0.529317 | 0.50609 | 0.470343 | 0.43095 | 0.40214 | 0.408586 | 0.3964 | 0.388 | 0.390464438 |
| 0.075 | 0.899076608 | 0.899871627 | 0.901293 | 0.864766 | 0.935036 | 1 | 0.917721 | 0.795988 | 0.746122 | 0.706279 | 0.653795 | 0.564142 | 0.534726 | 0.485034 | 0.451708 | 0.421214 | 0.425378 | 0.409 | 0.395 | 0.38960344 |
| 0.1 | 0.876947181 | 0.874852095 | 0.86974 | 0.795438 | 0.84835 | 0.917721 | 1 | 0.886478 | 0.82236 | 0.770204 | 0.72062 | 0.629503 | 0.591016 | 0.5167 | 0.47977 | 0.441348 | 0.436968 | 0.4191 | 0.41 | 0.399283759 |
| 0.15 | 0.832082375 | 0.826741332 | 0.815473 | 0.70194 | 0.732885 | 0.795988 | 0.886478 | 1 | 0.911038 | 0.860387 | 0.810495 | 0.722141 | 0.679352 | 0.581543 | 0.541358 | 0.499944 | 0.490974 | 0.4699 | 0.462 | 0.449790849 |
| 0.2 | 0.813807935 | 0.807201388 | 0.792478 | 0.670392 | 0.691021 | 0.746122 | 0.82236 | 0.911038 | 1 | 0.92635 | 0.877977 | 0.791517 | 0.73342 | 0.615473 | 0.566311 | 0.515955 | 0.502776 | 0.4739 | 0.462 | 0.445888682 |
| 0.25 | 0.800982933 | 0.791941518 | 0.774947 | 0.645657 | 0.655197 | 0.706279 | 0.770204 | 0.860387 | 0.92635 | 1 | 0.94342 | 0.852962 | 0.794702 | 0.686818 | 0.638188 | 0.590375 | 0.571337 | 0.5269 | 0.51 | 0.490971751 |
| 0.3 | 0.776832554 | 0.766473482 | 0.748223 | 0.616266 | 0.612742 | 0.653795 | 0.72062 | 0.810495 | 0.877977 | 0.94342 | 1 | 0.903444 | 0.84262 | 0.738014 | 0.684227 | 0.629321 | 0.600997 | 0.5481 | 0.525 | 0.50593202 |
| 0.4 | 0.712574682 | 0.699983991 | 0.679229 | 0.546449 | 0.529317 | 0.564142 | 0.629503 | 0.722141 | 0.791517 | 0.852962 | 0.903444 | 1 | 0.927668 | 0.808698 | 0.746267 | 0.688319 | 0.658576 | 0.5956 | 0.564 | 0.541729241 |
| 0.5 | 0.692092624 | 0.67992295 | 0.66014 | 0.527807 | 0.50609 | 0.534726 | 0.591016 | 0.679352 | 0.73342 | 0.794702 | 0.84262 | 0.927668 | 1 | 0.886325 | 0.825949 | 0.768245 | 0.733585 | 0.6703 | 0.638 | 0.612346082 |
| 0.75 | 0.64382717 | 0.631528838 | 0.614988 | 0.503545 | 0.470343 | 0.485034 | 0.5167 | 0.581543 | 0.615473 | 0.686818 | 0.738014 | 0.808698 | 0.886325 | 1 | 0.929862 | 0.866819 | 0.826455 | 0.7585 | 0.721 | 0.695509961 |
| 1 | 0.598044692 | 0.585619659 | 0.569988 | 0.460943 | 0.43095 | 0.451708 | 0.47977 | 0.541358 | 0.566311 | 0.638188 | 0.684227 | 0.746267 | 0.825949 | 0.929862 | 1 | 0.924714 | 0.88379 | 0.8193 | 0.779 | 0.75382742 |
| 1.5 | 0.557641227 | 0.545305756 | 0.533792 | 0.428558 | 0.40214 | 0.421214 | 0.441348 | 0.499944 | 0.515955 | 0.590375 | 0.629321 | 0.688319 | 0.768245 | 0.866819 | 0.924714 | 1 | 0.948046 | 0.8863 | 0.847 | 0.820237839 |
| 2 | 0.552319419 | 0.541073403 | 0.532893 | 0.432236 | 0.408586 | 0.425378 | 0.436968 | 0.490974 | 0.502776 | 0.571337 | 0.600997 | 0.658576 | 0.733585 | 0.826455 | 0.88379 | 0.948046 | 1 | 0.9296 | 0.889 | 0.859385563 |
| 3 | 0.524338376 | 0.515534448 | 0.512598 | 0.42222 | 0.396362 | 0.408988 | 0.419055 | 0.469894 | 0.473852 | 0.526914 | 0.548124 | 0.595558 | 0.670298 | 0.758468 | 0.819288 | 0.886345 | 0.92959 | 1 | 0.948 | 0.913874582 |
| 4 | 0.514260087 | 0.50695657 | 0.504922 | 0.417696 | 0.388326 | 0.394585 | 0.410125 | 0.461615 | 0.462198 | 0.509781 | 0.525091 | 0.564395 | 0.63779 | 0.720632 | 0.77921 | 0.846737 | 0.888941 | 0.9483 | 1 | 0.961043916 |
| 5 | 0.509822604 | 0.503543611 | 0.502897 | 0.423087 | 0.390464 | 0.389603 | 0.399284 | 0.449791 | 0.445889 | 0.490972 | 0.505932 | 0.541729 | 0.612346 | 0.69551 | 0.753827 | 0.820238 | 0.859386 | 0.9139 | 0.961 | 1 |



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## Total Correlation Coefficient Matrix (Site Class D)

### $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.712965484 | 0.701502635 | 0.694329 | 0.589299 | 0.534427 | 0.562644 | 0.631456 | 0.681185 | 0.686684 | 0.694183 | 0.687903 | 0.693957 | 0.69707 | 0.662844 | 0.637258 | 0.601904 | 0.568473 | 0.5306 | 0.535 | 0.533852635 |
| 0.01 | 0.712452333 | 0.700968542 | 0.693743 | 0.588562 | 0.533629 | 0.561954 | 0.630952 | 0.680935 | 0.686506 | 0.694117 | 0.687896 | 0.694084 | 0.697298 | 0.663129 | 0.637644 | 0.602411 | 0.569055 | 0.5311 | 0.535 | 0.534160929 |
| 0.02 | 0.71711521 | 0.706251336 | 0.6998 | 0.596327 | 0.541653 | 0.568757 | 0.635106 | 0.682007 | 0.685986 | 0.692353 | 0.685474 | 0.690536 | 0.693369 | 0.65914 | 0.633405 | 0.598321 | 0.565541 | 0.5287 | 0.534 | 0.53398962 |
| 0.03 | 0.779914804 | 0.774145539 | 0.772201 | 0.717628 | 0.655771 | 0.659715 | 0.68026 | 0.663625 | 0.648135 | 0.643718 | 0.639434 | 0.626637 | 0.619761 | 0.585399 | 0.553285 | 0.514421 | 0.482134 | 0.4566 | 0.47 | 0.483644053 |
| 0.05 | 0.795029539 | 0.790232934 | 0.789704 | 0.718756 | 0.695777 | 0.701864 | 0.712933 | 0.678952 | 0.653531 | 0.645932 | 0.634672 | 0.617648 | 0.608243 | 0.572878 | 0.537888 | 0.502499 | 0.475055 | 0.4489 | 0.465 | 0.482913463 |
| 0.075 | 0.782586807 | 0.776018476 | 0.773896 | 0.681509 | 0.662939 | 0.705003 | 0.744332 | 0.722788 | 0.693908 | 0.679282 | 0.660902 | 0.642465 | 0.628729 | 0.580468 | 0.545979 | 0.512677 | 0.48146 | 0.4523 | 0.469 | 0.485862907 |
| 0.1 | 0.737265678 | 0.727322854 | 0.721878 | 0.608795 | 0.58667 | 0.644481 | 0.737472 | 0.765097 | 0.744916 | 0.720534 | 0.695057 | 0.676649 | 0.658726 | 0.594786 | 0.562761 | 0.529907 | 0.494532 | 0.4594 | 0.475 | 0.484744683 |
| 0.15 | 0.637059915 | 0.623669423 | 0.614586 | 0.483134 | 0.45714 | 0.525792 | 0.649287 | 0.77553 | 0.769434 | 0.745746 | 0.713644 | 0.696986 | 0.679056 | 0.607073 | 0.579403 | 0.548647 | 0.513725 | 0.4682 | 0.477 | 0.474762548 |
| 0.2 | 0.583448763 | 0.568534257 | 0.557847 | 0.423454 | 0.390809 | 0.457969 | 0.588855 | 0.735004 | 0.763622 | 0.742027 | 0.711002 | 0.700203 | 0.685002 | 0.609531 | 0.580028 | 0.548324 | 0.517283 | 0.472 | 0.477 | 0.462740846 |
| 0.25 | 0.547307049 | 0.53041685 | 0.518435 | 0.380549 | 0.337995 | 0.403633 | 0.532017 | 0.692286 | 0.732178 | 0.756598 | 0.730079 | 0.722502 | 0.714344 | 0.653707 | 0.622353 | 0.586771 | 0.556884 | 0.503 | 0.503 | 0.484986032 |
| 0.3 | 0.512615834 | 0.49472228 | 0.481426 | 0.343343 | 0.293906 | 0.358145 | 0.484004 | 0.649227 | 0.700004 | 0.736971 | 0.73771 | 0.74036 | 0.730035 | 0.668067 | 0.6389 | 0.602033 | 0.570357 | 0.5104 | 0.508 | 0.491242839 |
| 0.4 | 0.447754886 | 0.427370288 | 0.41255 | 0.276224 | 0.219842 | 0.279094 | 0.405113 | 0.575267 | 0.642351 | 0.686365 | 0.693901 | 0.753537 | 0.75786 | 0.701076 | 0.678746 | 0.644403 | 0.611935 | 0.5545 | 0.544 | 0.523700585 |
| 0.5 | 0.425792094 | 0.404002955 | 0.389335 | 0.257036 | 0.192664 | 0.240773 | 0.367087 | 0.533215 | 0.605332 | 0.662007 | 0.671285 | 0.737507 | 0.785789 | 0.753495 | 0.728528 | 0.69173 | 0.65556 | 0.6001 | 0.586 | 0.563061548 |
| 0.75 | 0.379134114 | 0.356851459 | 0.345622 | 0.225624 | 0.157845 | 0.190804 | 0.29728 | 0.446586 | 0.504763 | 0.576235 | 0.58591 | 0.654462 | 0.73737 | 0.82191 | 0.81204 | 0.77522 | 0.734793 | 0.6825 | 0.663 | 0.639079504 |
| 1 | 0.351473969 | 0.329710938 | 0.319467 | 0.201113 | 0.139296 | 0.170869 | 0.265535 | 0.406455 | 0.459686 | 0.530376 | 0.542415 | 0.618126 | 0.706934 | 0.814772 | 0.843757 | 0.822759 | 0.784316 | 0.7263 | 0.701 | 0.676539588 |
| 1.5 | 0.327908847 | 0.306955175 | 0.298515 | 0.184344 | 0.126029 | 0.160367 | 0.253741 | 0.381163 | 0.424037 | 0.481931 | 0.491066 | 0.569112 | 0.659203 | 0.777895 | 0.836088 | 0.868611 | 0.8438 | 0.7882 | 0.76 | 0.72750143 |
| 2 | 0.292522176 | 0.272890267 | 0.265269 | 0.155347 | 0.097556 | 0.131497 | 0.2202 | 0.345412 | 0.382247 | 0.434207 | 0.438467 | 0.513452 | 0.599764 | 0.728977 | 0.802599 | 0.871448 | 0.885624 | 0.8362 | 0.801 | 0.761490649 |
| 3 | 0.269713813 | 0.252149951 | 0.246187 | 0.142052 | 0.083348 | 0.113422 | 0.196208 | 0.316212 | 0.353395 | 0.395923 | 0.391476 | 0.459908 | 0.54785 | 0.682041 | 0.760921 | 0.853838 | 0.887183 | 0.8888 | 0.857 | 0.810618224 |
| 4 | 0.278814447 | 0.26234812 | 0.257857 | 0.159158 | 0.101435 | 0.126143 | 0.204362 | 0.320073 | 0.355952 | 0.397786 | 0.389551 | 0.450249 | 0.536402 | 0.664055 | 0.74324 | 0.838468 | 0.878332 | 0.8914 | 0.886 | 0.846044327 |
| 5 | 0.280449127 | 0.2637863 | 0.260989 | 0.168979 | 0.113204 | 0.136318 | 0.2097 | 0.317664 | 0.349503 | 0.393147 | 0.386385 | 0.444217 | 0.525753 | 0.649796 | 0.724169 | 0.815606 | 0.861079 | 0.8731 | 0.88 | 0.856042898 |



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# Total Correlation Coefficient Matrix (Site Class D)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999997594 | 0.999834 | 0.960534 | 0.951148 | 0.950904 | 0.942995 | 0.902057 | 0.883499 | 0.878529 | 0.868975 | 0.845884 | 0.828288 | 0.778545 | 0.748598 | 0.710567 | 0.680739 | 0.6443 | 0.633 | 0.623227589 |
| 0.01 | 0.999997594 | 1 | 0.99982 | 0.960358 | 0.950949 | 0.950737 | 0.942884 | 0.902033 | 0.883493 | 0.878595 | 0.869102 | 0.846157 | 0.828652 | 0.77893 | 0.749037 | 0.711061 | 0.681287 | 0.6448 | 0.634 | 0.623706044 |
| 0.02 | 0.999834157 | 0.999820183 | 1 | 0.962737 | 0.953925 | 0.953119 | 0.943794 | 0.901116 | 0.881501 | 0.875645 | 0.865437 | 0.841343 | 0.823471 | 0.774111 | 0.744475 | 0.707121 | 0.677716 | 0.6418 | 0.631 | 0.621460372 |
| 0.03 | 0.960534439 | 0.960357966 | 0.962737 | 1 | 0.972286 | 0.944731 | 0.900202 | 0.817747 | 0.785415 | 0.77014 | 0.755858 | 0.722247 | 0.702078 | 0.657589 | 0.629042 | 0.595534 | 0.570477 | 0.5419 | 0.536 | 0.529960214 |
| 0.05 | 0.951148362 | 0.950948525 | 0.953925 | 0.972286 | 1 | 0.974724 | 0.921128 | 0.829675 | 0.791749 | 0.771693 | 0.751514 | 0.711619 | 0.688762 | 0.642769 | 0.618033 | 0.58688 | 0.561773 | 0.5352 | 0.532 | 0.526737973 |
| 0.075 | 0.95090392 | 0.950737411 | 0.953119 | 0.944731 | 0.974724 | 1 | 0.966129 | 0.884298 | 0.843504 | 0.818695 | 0.792014 | 0.747361 | 0.719997 | 0.663979 | 0.636613 | 0.60525 | 0.577516 | 0.5475 | 0.543 | 0.538091049 |
| 0.1 | 0.942995036 | 0.942884384 | 0.943794 | 0.900202 | 0.921128 | 0.966129 | 1 | 0.947755 | 0.910042 | 0.878996 | 0.84832 | 0.80151 | 0.769777 | 0.697665 | 0.666893 | 0.632786 | 0.602551 | 0.5673 | 0.56 | 0.554837892 |
| 0.15 | 0.902057035 | 0.902033415 | 0.901116 | 0.817747 | 0.829675 | 0.884298 | 0.947755 | 1 | 0.969862 | 0.9422 | 0.910285 | 0.859354 | 0.820325 | 0.735602 | 0.699666 | 0.662142 | 0.63299 | 0.5925 | 0.579 | 0.571020142 |
| 0.2 | 0.883498775 | 0.883493493 | 0.881501 | 0.785415 | 0.791749 | 0.843504 | 0.910042 | 0.969862 | 1 | 0.967256 | 0.937116 | 0.886386 | 0.843754 | 0.754794 | 0.71489 | 0.672354 | 0.642301 | 0.6013 | 0.587 | 0.580476845 |
| 0.25 | 0.878529215 | 0.878594605 | 0.875645 | 0.77014 | 0.771693 | 0.818695 | 0.878996 | 0.9422 | 0.967256 | 1 | 0.972522 | 0.920262 | 0.882524 | 0.805841 | 0.765259 | 0.719988 | 0.68642 | 0.6414 | 0.628 | 0.622717359 |
| 0.3 | 0.868974752 | 0.869102204 | 0.865437 | 0.755858 | 0.751514 | 0.792014 | 0.84832 | 0.910285 | 0.937116 | 0.972522 | 1 | 0.950853 | 0.907888 | 0.824344 | 0.786594 | 0.738561 | 0.704146 | 0.6555 | 0.642 | 0.637806751 |
| 0.4 | 0.845883967 | 0.846156903 | 0.841343 | 0.722247 | 0.711619 | 0.747361 | 0.80151 | 0.859354 | 0.886386 | 0.920262 | 0.950853 | 1 | 0.961872 | 0.871435 | 0.83458 | 0.783171 | 0.745323 | 0.699 | 0.684 | 0.675736708 |
| 0.5 | 0.828288413 | 0.828651601 | 0.823471 | 0.702078 | 0.688762 | 0.719997 | 0.769777 | 0.820325 | 0.843754 | 0.882524 | 0.907888 | 0.961872 | 1 | 0.925329 | 0.885257 | 0.830711 | 0.788288 | 0.7442 | 0.729 | 0.71527697 |
| 0.75 | 0.778545388 | 0.778929883 | 0.774111 | 0.657589 | 0.642769 | 0.663979 | 0.697665 | 0.735602 | 0.754794 | 0.805841 | 0.824344 | 0.871435 | 0.925329 | 1 | 0.964416 | 0.909964 | 0.869227 | 0.8245 | 0.806 | 0.791956174 |
| 1 | 0.748598052 | 0.749036882 | 0.744475 | 0.629042 | 0.618033 | 0.636613 | 0.666893 | 0.699666 | 0.71489 | 0.765259 | 0.786594 | 0.83458 | 0.885257 | 0.964416 | 1 | 0.954338 | 0.916267 | 0.8681 | 0.846 | 0.831062884 |
| 1.5 | 0.710567457 | 0.711060822 | 0.707121 | 0.595534 | 0.58688 | 0.60525 | 0.632786 | 0.662142 | 0.672354 | 0.719988 | 0.738561 | 0.783171 | 0.830711 | 0.909964 | 0.954338 | 1 | 0.968675 | 0.9227 | 0.899 | 0.884050935 |
| 2 | 0.680738846 | 0.681286662 | 0.677716 | 0.570477 | 0.561773 | 0.577516 | 0.602551 | 0.63299 | 0.642301 | 0.68642 | 0.704146 | 0.745323 | 0.788288 | 0.869227 | 0.916267 | 0.968675 | 1 | 0.9594 | 0.935 | 0.918901967 |
| 3 | 0.644264148 | 0.644806474 | 0.641795 | 0.541928 | 0.535163 | 0.547538 | 0.56733 | 0.592489 | 0.601276 | 0.641373 | 0.655523 | 0.699039 | 0.744248 | 0.824536 | 0.868144 | 0.92271 | 0.959376 | 1 | 0.974 | 0.951943812 |
| 4 | 0.633431183 | 0.633960432 | 0.631428 | 0.53645 | 0.531824 | 0.543039 | 0.560202 | 0.579294 | 0.587272 | 0.627963 | 0.641791 | 0.683737 | 0.728537 | 0.805565 | 0.845503 | 0.899472 | 0.935435 | 0.9744 | 1 | 0.981025459 |
| 5 | 0.623227589 | 0.623706044 | 0.62146 | 0.52996 | 0.526738 | 0.538091 | 0.554838 | 0.57102 | 0.580477 | 0.622717 | 0.637807 | 0.675737 | 0.715277 | 0.791956 | 0.831063 | 0.884051 | 0.918902 | 0.9519 | 0.981 | 1 |



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# Total Correlation Coefficient Matrix (Site Class D)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.99913533 | 0.996605 | 0.94356 | 0.908119 | 0.90091 | 0.895936 | 0.816291 | 0.767743 | 0.737973 | 0.7222 | 0.657678 | 0.610808 | 0.523553 | 0.45163 | 0.364476 | 0.311716 | 0.2958 | 0.33 | 0.38454062 |
| 0.01 | 0.99913533 | 1 | 0.998528 | 0.949496 | 0.915289 | 0.905675 | 0.894931 | 0.808876 | 0.757392 | 0.724851 | 0.70852 | 0.641442 | 0.592872 | 0.504551 | 0.432652 | 0.345852 | 0.294804 | 0.2819 | 0.318 | 0.374023152 |
| 0.02 | 0.996605074 | 0.998528207 | 1 | 0.957388 | 0.924246 | 0.910806 | 0.892694 | 0.798858 | 0.744618 | 0.709417 | 0.691337 | 0.622476 | 0.575069 | 0.489731 | 0.418019 | 0.333286 | 0.284128 | 0.274 | 0.312 | 0.370355813 |
| 0.03 | 0.943559511 | 0.949496468 | 0.957388 | 1 | 0.950906 | 0.901553 | 0.834257 | 0.690269 | 0.628024 | 0.587885 | 0.573824 | 0.495928 | 0.445457 | 0.370436 | 0.300313 | 0.221237 | 0.180089 | 0.1827 | 0.227 | 0.29550795 |
| 0.05 | 0.908118695 | 0.915289424 | 0.924246 | 0.950906 | 1 | 0.944421 | 0.849602 | 0.667719 | 0.585969 | 0.531585 | 0.512051 | 0.429548 | 0.370762 | 0.29898 | 0.231414 | 0.160288 | 0.122329 | 0.1264 | 0.173 | 0.243981763 |
| 0.075 | 0.900909696 | 0.905674628 | 0.910806 | 0.901553 | 0.944421 | 1 | 0.918746 | 0.733128 | 0.640739 | 0.576403 | 0.551325 | 0.470969 | 0.405356 | 0.314217 | 0.252552 | 0.187632 | 0.150088 | 0.1469 | 0.19 | 0.254028487 |
| 0.1 | 0.895936443 | 0.894930594 | 0.892694 | 0.834257 | 0.849602 | 0.918746 | 1 | 0.85356 | 0.759987 | 0.684645 | 0.651445 | 0.579531 | 0.516581 | 0.395839 | 0.332913 | 0.268942 | 0.230331 | 0.2189 | 0.258 | 0.306887079 |
| 0.15 | 0.816290927 | 0.808876256 | 0.798858 | 0.690269 | 0.667719 | 0.733128 | 0.85356 | 1 | 0.91732 | 0.840456 | 0.790035 | 0.70933 | 0.647652 | 0.518165 | 0.456977 | 0.390163 | 0.344127 | 0.3198 | 0.351 | 0.376226953 |
| 0.2 | 0.76774309 | 0.757392173 | 0.744618 | 0.628024 | 0.585969 | 0.640739 | 0.759987 | 0.91732 | 1 | 0.911948 | 0.849677 | 0.766137 | 0.702584 | 0.559767 | 0.499557 | 0.423703 | 0.368673 | 0.3451 | 0.372 | 0.3859126 |
| 0.25 | 0.737973267 | 0.724850578 | 0.709417 | 0.587885 | 0.531585 | 0.576403 | 0.684645 | 0.840456 | 0.911948 | 1 | 0.934095 | 0.838824 | 0.779917 | 0.645489 | 0.568817 | 0.476237 | 0.419021 | 0.3821 | 0.404 | 0.420615165 |
| 0.3 | 0.722200242 | 0.708520386 | 0.691337 | 0.573824 | 0.512051 | 0.551325 | 0.651445 | 0.790035 | 0.849677 | 0.934095 | 1 | 0.895358 | 0.823798 | 0.680295 | 0.597335 | 0.492492 | 0.422021 | 0.3741 | 0.397 | 0.419670625 |
| 0.4 | 0.657677676 | 0.641441504 | 0.622476 | 0.495928 | 0.429548 | 0.470969 | 0.579531 | 0.70933 | 0.766137 | 0.838824 | 0.895358 | 1 | 0.920962 | 0.767868 | 0.67998 | 0.567165 | 0.489089 | 0.4354 | 0.448 | 0.465672095 |
| 0.5 | 0.610807921 | 0.592871916 | 0.575069 | 0.445457 | 0.370762 | 0.405356 | 0.516581 | 0.647652 | 0.702584 | 0.779917 | 0.823798 | 0.920962 | 1 | 0.861209 | 0.769553 | 0.653282 | 0.571615 | 0.5223 | 0.524 | 0.534432863 |
| 0.75 | 0.52355298 | 0.504551411 | 0.489731 | 0.370436 | 0.29898 | 0.314217 | 0.395839 | 0.518165 | 0.559767 | 0.645489 | 0.680295 | 0.767868 | 0.861209 | 1 | 0.917992 | 0.801899 | 0.715389 | 0.6558 | 0.643 | 0.643595272 |
| 1 | 0.451629696 | 0.432652166 | 0.418019 | 0.300313 | 0.231414 | 0.252552 | 0.332913 | 0.456977 | 0.499557 | 0.568817 | 0.597335 | 0.67998 | 0.769553 | 0.917992 | 1 | 0.893975 | 0.812291 | 0.7408 | 0.715 | 0.705638704 |
| 1.5 | 0.364475976 | 0.345852093 | 0.333286 | 0.221237 | 0.160288 | 0.187632 | 0.268942 | 0.390163 | 0.423703 | 0.476237 | 0.492492 | 0.567165 | 0.653282 | 0.801899 | 0.893975 | 1 | 0.923308 | 0.8499 | 0.81 | 0.781471225 |
| 2 | 0.311715536 | 0.294803805 | 0.284128 | 0.180089 | 0.122329 | 0.150088 | 0.230331 | 0.344127 | 0.368673 | 0.419021 | 0.422021 | 0.489089 | 0.571615 | 0.715389 | 0.812291 | 0.923308 | 1 | 0.9153 | 0.867 | 0.828509858 |
| 3 | 0.295785695 | 0.281862781 | 0.273965 | 0.182743 | 0.126351 | 0.14689 | 0.218935 | 0.319773 | 0.345137 | 0.382079 | 0.374117 | 0.435373 | 0.522333 | 0.655814 | 0.740774 | 0.84994 | 0.91531 | 1 | 0.944 | 0.895130866 |
| 4 | 0.329993902 | 0.317817275 | 0.312247 | 0.227104 | 0.17289 | 0.189691 | 0.257504 | 0.351034 | 0.371721 | 0.404214 | 0.396618 | 0.448169 | 0.524289 | 0.643183 | 0.715494 | 0.810198 | 0.867198 | 0.9436 | 1 | 0.953098807 |
| 5 | 0.38454062 | 0.374023152 | 0.370356 | 0.295508 | 0.243982 | 0.254028 | 0.306887 | 0.376227 | 0.385913 | 0.420615 | 0.419671 | 0.465672 | 0.534433 | 0.643595 | 0.705639 | 0.781471 | 0.82851 | 0.8951 | 0.953 | 1 |



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# Total Correlation Coefficient Matrix (Site Class E)

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.765704697 | 0.749711175 | 0.740934 | 0.656153 | 0.595136 | 0.614128 | 0.727654 | 0.751781 | 0.746993 | 0.770154 | 0.739589 | 0.748163 | 0.754259 | 0.713801 | 0.662318 | 0.618055 | 0.634269 | 0.6123 | 0.623 | 0.607367196 |
| 0.01 | 0.765233988 | 0.749219883 | 0.740393 | 0.655464 | 0.594387 | 0.613446 | 0.727141 | 0.751398 | 0.746693 | 0.769962 | 0.739358 | 0.74819 | 0.754449 | 0.713999 | 0.662627 | 0.618586 | 0.634833 | 0.6129 | 0.623 | 0.607697172 |
| 0.02 | 0.770589562 | 0.755187472 | 0.746921 | 0.663286 | 0.602644 | 0.620586 | 0.731789 | 0.753554 | 0.746891 | 0.770175 | 0.739319 | 0.746531 | 0.751543 | 0.710479 | 0.658187 | 0.613337 | 0.629838 | 0.6094 | 0.621 | 0.606129808 |
| 0.03 | 0.818214056 | 0.809041435 | 0.805208 | 0.757986 | 0.698701 | 0.696344 | 0.768765 | 0.73871 | 0.711481 | 0.720682 | 0.693106 | 0.681747 | 0.67464 | 0.627398 | 0.571946 | 0.51617 | 0.54266 | 0.5412 | 0.571 | 0.571451936 |
| 0.05 | 0.848830497 | 0.842201111 | 0.840393 | 0.789659 | 0.754652 | 0.748302 | 0.800602 | 0.752987 | 0.721919 | 0.734693 | 0.708499 | 0.688099 | 0.677402 | 0.610982 | 0.549854 | 0.481945 | 0.502268 | 0.5031 | 0.534 | 0.539065197 |
| 0.075 | 0.843220695 | 0.835717249 | 0.833047 | 0.768344 | 0.726917 | 0.747286 | 0.816404 | 0.790762 | 0.756526 | 0.765677 | 0.738191 | 0.71342 | 0.691595 | 0.623622 | 0.557356 | 0.492647 | 0.507883 | 0.5076 | 0.535 | 0.53715585 |
| 0.1 | 0.807543271 | 0.795312004 | 0.788658 | 0.706196 | 0.653093 | 0.695625 | 0.806619 | 0.824419 | 0.796005 | 0.796545 | 0.762607 | 0.734169 | 0.711353 | 0.643067 | 0.576479 | 0.519584 | 0.530149 | 0.523 | 0.538 | 0.537616239 |
| 0.15 | 0.769086314 | 0.755154996 | 0.747166 | 0.661 | 0.609264 | 0.663994 | 0.798017 | 0.851278 | 0.826721 | 0.808826 | 0.770504 | 0.728703 | 0.699376 | 0.626321 | 0.561199 | 0.507437 | 0.512342 | 0.5035 | 0.512 | 0.506971823 |
| 0.2 | 0.717429293 | 0.701539849 | 0.691657 | 0.603715 | 0.550337 | 0.606423 | 0.751081 | 0.827452 | 0.845466 | 0.813136 | 0.764037 | 0.734075 | 0.702005 | 0.620752 | 0.552167 | 0.500765 | 0.508679 | 0.4973 | 0.504 | 0.497779382 |
| 0.25 | 0.672669434 | 0.654192391 | 0.644126 | 0.549758 | 0.49806 | 0.550625 | 0.696908 | 0.775632 | 0.790287 | 0.809303 | 0.76183 | 0.72385 | 0.713312 | 0.660561 | 0.604299 | 0.564062 | 0.575846 | 0.5522 | 0.564 | 0.548697866 |
| 0.3 | 0.623697336 | 0.60325834 | 0.592567 | 0.495055 | 0.446625 | 0.484834 | 0.629454 | 0.710273 | 0.737533 | 0.783941 | 0.765331 | 0.748524 | 0.720859 | 0.676734 | 0.63227 | 0.603476 | 0.617081 | 0.588 | 0.604 | 0.594140835 |
| 0.4 | 0.620066198 | 0.59534442 | 0.579802 | 0.480568 | 0.421224 | 0.452611 | 0.611972 | 0.698983 | 0.734736 | 0.789191 | 0.763467 | 0.803644 | 0.781054 | 0.72228 | 0.686349 | 0.673357 | 0.689344 | 0.6543 | 0.658 | 0.631314363 |
| 0.5 | 0.537654518 | 0.51075622 | 0.496521 | 0.392127 | 0.316082 | 0.346124 | 0.495187 | 0.582666 | 0.627193 | 0.702289 | 0.666006 | 0.743063 | 0.803642 | 0.788397 | 0.75909 | 0.745171 | 0.766803 | 0.7221 | 0.719 | 0.667137762 |
| 0.75 | 0.435084742 | 0.40731651 | 0.395844 | 0.293365 | 0.220182 | 0.235272 | 0.371046 | 0.448015 | 0.479454 | 0.588689 | 0.573958 | 0.640936 | 0.755024 | 0.852836 | 0.853949 | 0.83258 | 0.835286 | 0.7969 | 0.772 | 0.714172106 |
| 1 | 0.416661703 | 0.388919451 | 0.378351 | 0.283342 | 0.19795 | 0.20388 | 0.334482 | 0.405528 | 0.437679 | 0.556398 | 0.542788 | 0.60719 | 0.727222 | 0.846471 | 0.883513 | 0.869126 | 0.883667 | 0.8336 | 0.797 | 0.738241076 |
| 1.5 | 0.383602875 | 0.355961869 | 0.347503 | 0.259771 | 0.16446 | 0.166157 | 0.298617 | 0.374497 | 0.405883 | 0.520987 | 0.494379 | 0.557631 | 0.684435 | 0.812282 | 0.859042 | 0.89023 | 0.91399 | 0.8774 | 0.827 | 0.766171556 |
| 2 | 0.342168673 | 0.315821371 | 0.308129 | 0.226386 | 0.125965 | 0.121324 | 0.255823 | 0.328944 | 0.373314 | 0.485095 | 0.446203 | 0.52024 | 0.636921 | 0.77224 | 0.817483 | 0.86977 | 0.925475 | 0.8993 | 0.854 | 0.794984801 |
| 3 | 0.326282747 | 0.301452717 | 0.294899 | 0.220035 | 0.120109 | 0.113286 | 0.243244 | 0.310917 | 0.357723 | 0.482109 | 0.443865 | 0.512274 | 0.620852 | 0.753739 | 0.799995 | 0.838928 | 0.905587 | 0.9287 | 0.907 | 0.853558704 |
| 4 | 0.319974785 | 0.295616857 | 0.289578 | 0.217845 | 0.115872 | 0.105236 | 0.232187 | 0.297939 | 0.344117 | 0.471871 | 0.43565 | 0.508439 | 0.615942 | 0.731515 | 0.783549 | 0.824943 | 0.897504 | 0.9132 | 0.91 | 0.860667089 |
| 5 | 0.340825362 | 0.316565655 | 0.311814 | 0.245774 | 0.146186 | 0.130943 | 0.25712 | 0.308682 | 0.358309 | 0.478251 | 0.436503 | 0.512573 | 0.601311 | 0.701282 | 0.753751 | 0.795225 | 0.882612 | 0.8969 | 0.901 | 0.871011281 |



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# Total Correlation Coefficient Matrix (Site Class E)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999997794 | 0.999864 | 0.966657 | 0.953101 | 0.961904 | 0.968857 | 0.941002 | 0.920982 | 0.929722 | 0.916266 | 0.908907 | 0.889759 | 0.805391 | 0.776251 | 0.730728 | 0.684718 | 0.6512 | 0.646 | 0.665865747 |
| 0.01 | 0.999997794 | 1 | 0.999853 | 0.966465 | 0.952902 | 0.961717 | 0.96876 | 0.940793 | 0.920772 | 0.929581 | 0.916211 | 0.909058 | 0.890073 | 0.805751 | 0.77667 | 0.73121 | 0.685283 | 0.6518 | 0.647 | 0.666412741 |
| 0.02 | 0.999864456 | 0.999853071 | 1 | 0.968974 | 0.956239 | 0.964833 | 0.970012 | 0.941181 | 0.920048 | 0.927982 | 0.913818 | 0.904978 | 0.885506 | 0.801052 | 0.771836 | 0.726648 | 0.681039 | 0.648 | 0.643 | 0.663142481 |
| 0.03 | 0.966657204 | 0.966464742 | 0.968974 | 1 | 0.978621 | 0.966183 | 0.943451 | 0.902393 | 0.869216 | 0.863432 | 0.834749 | 0.821274 | 0.790365 | 0.700674 | 0.678875 | 0.634734 | 0.597979 | 0.5692 | 0.567 | 0.59187269 |
| 0.05 | 0.953100595 | 0.952901604 | 0.956239 | 0.978621 | 1 | 0.981593 | 0.943641 | 0.89071 | 0.851729 | 0.842113 | 0.814933 | 0.794552 | 0.757139 | 0.66314 | 0.633477 | 0.588293 | 0.546068 | 0.5203 | 0.517 | 0.545475315 |
| 0.075 | 0.961904429 | 0.961717348 | 0.964833 | 0.966183 | 0.981593 | 1 | 0.977553 | 0.933008 | 0.892062 | 0.880035 | 0.851427 | 0.818222 | 0.774748 | 0.678812 | 0.645081 | 0.600849 | 0.550577 | 0.5244 | 0.521 | 0.549588351 |
| 0.1 | 0.968856878 | 0.968760133 | 0.970012 | 0.943451 | 0.943641 | 0.977553 | 1 | 0.973372 | 0.941107 | 0.929634 | 0.896671 | 0.867064 | 0.815879 | 0.713159 | 0.674602 | 0.627386 | 0.575277 | 0.5471 | 0.541 | 0.567919625 |
| 0.15 | 0.94100228 | 0.940793216 | 0.941181 | 0.902393 | 0.89071 | 0.933008 | 0.973372 | 1 | 0.972902 | 0.9547 | 0.912646 | 0.868623 | 0.809831 | 0.701161 | 0.66007 | 0.618573 | 0.561271 | 0.528 | 0.517 | 0.541437758 |
| 0.2 | 0.920981843 | 0.920772477 | 0.920048 | 0.869216 | 0.851729 | 0.892062 | 0.941107 | 0.972902 | 1 | 0.966368 | 0.918815 | 0.879857 | 0.820052 | 0.69784 | 0.649432 | 0.61001 | 0.563375 | 0.532 | 0.523 | 0.54858448 |
| 0.25 | 0.929722183 | 0.929581298 | 0.927982 | 0.863432 | 0.842113 | 0.880035 | 0.929634 | 0.9547 | 0.966368 | 1 | 0.962127 | 0.921478 | 0.872518 | 0.768306 | 0.721131 | 0.679808 | 0.63026 | 0.5962 | 0.588 | 0.614223448 |
| 0.3 | 0.916266032 | 0.916210748 | 0.913818 | 0.834749 | 0.814933 | 0.851427 | 0.896671 | 0.912646 | 0.918815 | 0.962127 | 1 | 0.947797 | 0.898422 | 0.807527 | 0.760007 | 0.717503 | 0.66385 | 0.6357 | 0.634 | 0.664667714 |
| 0.4 | 0.908906845 | 0.909058441 | 0.904978 | 0.821274 | 0.794552 | 0.818222 | 0.867064 | 0.868623 | 0.879857 | 0.921478 | 0.947797 | 1 | 0.94117 | 0.832827 | 0.795973 | 0.750024 | 0.712848 | 0.6893 | 0.687 | 0.711959026 |
| 0.5 | 0.889759054 | 0.890073196 | 0.885506 | 0.790365 | 0.757139 | 0.774748 | 0.815879 | 0.809831 | 0.820052 | 0.872518 | 0.898422 | 0.94117 | 1 | 0.922969 | 0.889315 | 0.84755 | 0.809939 | 0.7859 | 0.781 | 0.786637024 |
| 0.75 | 0.805391104 | 0.805751026 | 0.801052 | 0.700674 | 0.66314 | 0.678812 | 0.713159 | 0.701161 | 0.69784 | 0.768306 | 0.807527 | 0.832827 | 0.922969 | 1 | 0.967623 | 0.924596 | 0.876277 | 0.8557 | 0.842 | 0.833068744 |
| 1 | 0.776250551 | 0.776670484 | 0.771836 | 0.678875 | 0.633477 | 0.645081 | 0.674602 | 0.66007 | 0.649432 | 0.721131 | 0.760007 | 0.795973 | 0.889315 | 0.967623 | 1 | 0.964704 | 0.92482 | 0.895 | 0.877 | 0.865457902 |
| 1.5 | 0.73072847 | 0.731209624 | 0.726648 | 0.634734 | 0.588293 | 0.600849 | 0.627386 | 0.618573 | 0.61001 | 0.679808 | 0.717503 | 0.750024 | 0.84755 | 0.924596 | 0.964704 | 1 | 0.969707 | 0.9394 | 0.922 | 0.911975328 |
| 2 | 0.68471824 | 0.685283472 | 0.681039 | 0.597979 | 0.546068 | 0.550577 | 0.575277 | 0.561271 | 0.563375 | 0.63026 | 0.66385 | 0.712848 | 0.809939 | 0.876277 | 0.92482 | 0.969707 | 1 | 0.9629 | 0.946 | 0.938294914 |
| 3 | 0.651171644 | 0.651767596 | 0.648034 | 0.569179 | 0.520256 | 0.524388 | 0.547114 | 0.528005 | 0.531992 | 0.596212 | 0.635725 | 0.689311 | 0.785891 | 0.855703 | 0.894981 | 0.939372 | 0.962942 | 1 | 0.974 | 0.955915403 |
| 4 | 0.646380359 | 0.646998656 | 0.643424 | 0.567126 | 0.51667 | 0.520968 | 0.541358 | 0.517469 | 0.523417 | 0.588274 | 0.634206 | 0.687232 | 0.780833 | 0.84174 | 0.876602 | 0.921701 | 0.945574 | 0.9744 | 1 | 0.975669121 |
| 5 | 0.665865747 | 0.666412741 | 0.663142 | 0.591873 | 0.545475 | 0.549588 | 0.56792 | 0.541438 | 0.548584 | 0.614223 | 0.664668 | 0.711959 | 0.786637 | 0.833069 | 0.865458 | 0.911975 | 0.938295 | 0.9559 | 0.976 | 1 |



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# Total Correlation Coefficient Matrix (Site Class E)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.998990208 | 0.996846 | 0.965069 | 0.922519 | 0.927935 | 0.942136 | 0.872156 | 0.819062 | 0.811422 | 0.808423 | 0.743519 | 0.693478 | 0.576686 | 0.502612 | 0.406781 | 0.380265 | 0.3813 | 0.413 | 0.418294724 |
| 0.01 | 0.998990208 | 1 | 0.9988 | 0.970805 | 0.931542 | 0.934333 | 0.94107 | 0.865126 | 0.807874 | 0.798639 | 0.796542 | 0.728081 | 0.674174 | 0.553877 | 0.477158 | 0.379747 | 0.353568 | 0.3585 | 0.394 | 0.401065831 |
| 0.02 | 0.996845818 | 0.998799956 | 1 | 0.976483 | 0.939146 | 0.937168 | 0.938704 | 0.856505 | 0.795789 | 0.787615 | 0.784655 | 0.711655 | 0.657242 | 0.540942 | 0.465277 | 0.366419 | 0.342293 | 0.3498 | 0.389 | 0.399227364 |
| 0.03 | 0.965069414 | 0.970805031 | 0.976483 | 1 | 0.968688 | 0.936669 | 0.901186 | 0.786533 | 0.717824 | 0.696168 | 0.699962 | 0.617961 | 0.554641 | 0.443937 | 0.370388 | 0.27217 | 0.253081 | 0.2801 | 0.341 | 0.36157761 |
| 0.05 | 0.922518668 | 0.931542425 | 0.939146 | 0.968688 | 1 | 0.957442 | 0.891502 | 0.750352 | 0.673233 | 0.65726 | 0.665448 | 0.561699 | 0.495815 | 0.378738 | 0.295308 | 0.184136 | 0.16254 | 0.1887 | 0.25 | 0.272866003 |
| 0.075 | 0.927935099 | 0.934332793 | 0.937168 | 0.936669 | 0.957442 | 1 | 0.939942 | 0.815033 | 0.744353 | 0.715915 | 0.712768 | 0.599078 | 0.532229 | 0.410204 | 0.314255 | 0.20137 | 0.173406 | 0.184 | 0.224 | 0.242542252 |
| 0.1 | 0.942136139 | 0.941070032 | 0.938704 | 0.901186 | 0.891502 | 0.939942 | 1 | 0.925407 | 0.866058 | 0.83458 | 0.819541 | 0.71285 | 0.63359 | 0.508495 | 0.414145 | 0.318281 | 0.300398 | 0.3102 | 0.331 | 0.340251703 |
| 0.15 | 0.87215581 | 0.865126095 | 0.856505 | 0.786533 | 0.750352 | 0.815033 | 0.925407 | 1 | 0.941016 | 0.891588 | 0.86491 | 0.77786 | 0.702151 | 0.566957 | 0.461839 | 0.376342 | 0.361577 | 0.3659 | 0.375 | 0.365772308 |
| 0.2 | 0.81906221 | 0.807874499 | 0.795789 | 0.717824 | 0.673233 | 0.744353 | 0.866058 | 0.941016 | 1 | 0.925098 | 0.887991 | 0.809635 | 0.73595 | 0.591725 | 0.486068 | 0.398571 | 0.39644 | 0.3951 | 0.402 | 0.39354498 |
| 0.25 | 0.811421757 | 0.798638608 | 0.787615 | 0.696168 | 0.65726 | 0.715915 | 0.83458 | 0.891588 | 0.925098 | 1 | 0.954967 | 0.86967 | 0.823089 | 0.695694 | 0.619173 | 0.53889 | 0.523809 | 0.5138 | 0.516 | 0.498981257 |
| 0.3 | 0.808423134 | 0.796541974 | 0.784655 | 0.699962 | 0.665448 | 0.712768 | 0.819541 | 0.86491 | 0.887991 | 0.954967 | 1 | 0.903027 | 0.842372 | 0.707181 | 0.628727 | 0.536141 | 0.508669 | 0.4916 | 0.498 | 0.481961249 |
| 0.4 | 0.743518572 | 0.728080596 | 0.711655 | 0.617961 | 0.561699 | 0.599078 | 0.71285 | 0.77786 | 0.809635 | 0.86967 | 0.903027 | 1 | 0.910821 | 0.743808 | 0.686126 | 0.606423 | 0.581002 | 0.5451 | 0.548 | 0.534219442 |
| 0.5 | 0.69347824 | 0.674173995 | 0.657242 | 0.554641 | 0.495815 | 0.532229 | 0.63359 | 0.702151 | 0.73595 | 0.823089 | 0.842372 | 0.910821 | 1 | 0.865678 | 0.803874 | 0.731173 | 0.704863 | 0.6583 | 0.643 | 0.602414225 |
| 0.75 | 0.576686381 | 0.553877348 | 0.540942 | 0.443937 | 0.378738 | 0.410204 | 0.508495 | 0.566957 | 0.591725 | 0.695694 | 0.707181 | 0.743808 | 0.865678 | 1 | 0.930848 | 0.850429 | 0.809591 | 0.7608 | 0.72 | 0.655080539 |
| 1 | 0.502611893 | 0.477157587 | 0.465277 | 0.370388 | 0.295308 | 0.314255 | 0.414145 | 0.461839 | 0.486068 | 0.619173 | 0.628727 | 0.686126 | 0.803874 | 0.930848 | 1 | 0.917881 | 0.874845 | 0.8053 | 0.753 | 0.693792779 |
| 1.5 | 0.406781288 | 0.379747073 | 0.366419 | 0.27217 | 0.184136 | 0.20137 | 0.318281 | 0.376342 | 0.398571 | 0.53889 | 0.536141 | 0.606423 | 0.731173 | 0.850429 | 0.917881 | 1 | 0.923477 | 0.8492 | 0.777 | 0.700250982 |
| 2 | 0.380265363 | 0.353568102 | 0.342293 | 0.253081 | 0.16254 | 0.173406 | 0.300398 | 0.361577 | 0.39644 | 0.523809 | 0.508669 | 0.581002 | 0.704863 | 0.809591 | 0.874845 | 0.923477 | 1 | 0.9311 | 0.867 | 0.794601376 |
| 3 | 0.381276566 | 0.358511323 | 0.349762 | 0.280119 | 0.188682 | 0.183983 | 0.310175 | 0.36585 | 0.395074 | 0.513792 | 0.491573 | 0.545091 | 0.658305 | 0.760782 | 0.805323 | 0.849227 | 0.931124 | 1 | 0.936 | 0.873077649 |
| 4 | 0.413465116 | 0.393932681 | 0.388892 | 0.341268 | 0.249972 | 0.224235 | 0.331423 | 0.374831 | 0.401578 | 0.515652 | 0.497955 | 0.547842 | 0.643248 | 0.719824 | 0.753357 | 0.777342 | 0.866705 | 0.9358 | 1 | 0.947774424 |
| 5 | 0.418294724 | 0.401065831 | 0.399227 | 0.361578 | 0.272866 | 0.242542 | 0.340252 | 0.365772 | 0.393545 | 0.498981 | 0.481961 | 0.534219 | 0.602414 | 0.655081 | 0.693793 | 0.700251 | 0.794601 | 0.8731 | 0.948 | 1 |



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## Total Correlation Coefficient Matrix (Interslab)

### SA$_H$-SA$_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.779502885 | 0.764188034 | 0.738858 | 0.568574 | 0.544995 | 0.589168 | 0.679394 | 0.730787 | 0.753921 | 0.772023 | 0.759007 | 0.743168 | 0.720042 | 0.638047 | 0.61156 | 0.568675 | 0.535692 | 0.4481 | 0.423 | 0.422272633 |
| 0.01 | 0.779126158 | 0.763760131 | 0.738306 | 0.567785 | 0.544226 | 0.58864 | 0.679192 | 0.730893 | 0.754005 | 0.772244 | 0.759266 | 0.743423 | 0.720351 | 0.638437 | 0.612026 | 0.569127 | 0.536206 | 0.4485 | 0.424 | 0.422385102 |
| 0.02 | 0.786103262 | 0.771790253 | 0.748028 | 0.581135 | 0.55774 | 0.598877 | 0.685073 | 0.731211 | 0.752999 | 0.768466 | 0.753205 | 0.736031 | 0.712437 | 0.62953 | 0.603288 | 0.561364 | 0.528596 | 0.4416 | 0.418 | 0.418223655 |
| 0.03 | 0.841127354 | 0.836810426 | 0.827015 | 0.74513 | 0.697306 | 0.691437 | 0.709361 | 0.675023 | 0.686943 | 0.672644 | 0.645741 | 0.621165 | 0.5937 | 0.508605 | 0.473577 | 0.439425 | 0.408116 | 0.3437 | 0.337 | 0.353119023 |
| 0.05 | 0.841471597 | 0.836732217 | 0.826551 | 0.716153 | 0.728447 | 0.742144 | 0.75606 | 0.701902 | 0.694589 | 0.675739 | 0.63508 | 0.599687 | 0.567069 | 0.48132 | 0.45214 | 0.419018 | 0.392651 | 0.3211 | 0.312 | 0.326235978 |
| 0.075 | 0.803514541 | 0.79660972 | 0.782429 | 0.640654 | 0.677126 | 0.747805 | 0.796907 | 0.756987 | 0.729181 | 0.689382 | 0.63499 | 0.584521 | 0.538836 | 0.438297 | 0.421427 | 0.395816 | 0.374314 | 0.3033 | 0.288 | 0.291232837 |
| 0.1 | 0.740010035 | 0.729261039 | 0.708892 | 0.539561 | 0.577006 | 0.672442 | 0.788447 | 0.80247 | 0.763569 | 0.720447 | 0.65967 | 0.602698 | 0.551332 | 0.442747 | 0.436593 | 0.421038 | 0.405225 | 0.3308 | 0.304 | 0.301501036 |
| 0.15 | 0.633144537 | 0.616921586 | 0.590205 | 0.403194 | 0.426669 | 0.53352 | 0.697986 | 0.819488 | 0.785374 | 0.743508 | 0.687069 | 0.631506 | 0.57682 | 0.467158 | 0.468032 | 0.459116 | 0.443774 | 0.3662 | 0.333 | 0.321205371 |
| 0.2 | 0.601550844 | 0.582569134 | 0.552405 | 0.355455 | 0.362997 | 0.467022 | 0.637076 | 0.785364 | 0.80295 | 0.776426 | 0.733099 | 0.684485 | 0.637601 | 0.515351 | 0.502762 | 0.487337 | 0.470012 | 0.3963 | 0.361 | 0.342678767 |
| 0.25 | 0.557623179 | 0.534550601 | 0.49973 | 0.291981 | 0.286275 | 0.382103 | 0.557435 | 0.730194 | 0.768518 | 0.801259 | 0.779813 | 0.736594 | 0.694132 | 0.583791 | 0.562578 | 0.53067 | 0.509436 | 0.418 | 0.377 | 0.35644601 |
| 0.3 | 0.535023056 | 0.509152012 | 0.470833 | 0.255861 | 0.242507 | 0.329346 | 0.499811 | 0.682412 | 0.746839 | 0.805168 | 0.821045 | 0.798603 | 0.76136 | 0.65162 | 0.616622 | 0.566597 | 0.536504 | 0.4412 | 0.401 | 0.382833911 |
| 0.4 | 0.516683007 | 0.490043832 | 0.451691 | 0.245935 | 0.220606 | 0.286376 | 0.428276 | 0.609428 | 0.696811 | 0.778165 | 0.816885 | 0.853948 | 0.820961 | 0.717085 | 0.676107 | 0.617032 | 0.581156 | 0.4965 | 0.458 | 0.443240087 |
| 0.5 | 0.477268408 | 0.448806283 | 0.407316 | 0.207379 | 0.166155 | 0.218616 | 0.354056 | 0.53964 | 0.641289 | 0.739422 | 0.798328 | 0.845191 | 0.861856 | 0.786873 | 0.744092 | 0.671321 | 0.630742 | 0.5496 | 0.513 | 0.494956279 |
| 0.75 | 0.426439694 | 0.396739806 | 0.355156 | 0.16628 | 0.113834 | 0.147292 | 0.26387 | 0.432176 | 0.517356 | 0.639761 | 0.722618 | 0.785157 | 0.841358 | 0.886623 | 0.854074 | 0.773902 | 0.72039 | 0.6242 | 0.586 | 0.560214953 |
| 1 | 0.39583039 | 0.366827535 | 0.32736 | 0.146629 | 0.098736 | 0.12639 | 0.236556 | 0.397021 | 0.467324 | 0.583803 | 0.658111 | 0.727643 | 0.793151 | 0.876665 | 0.901174 | 0.841123 | 0.795163 | 0.6841 | 0.634 | 0.609417946 |
| 1.5 | 0.37779507 | 0.350217386 | 0.31502 | 0.147942 | 0.100428 | 0.122036 | 0.230317 | 0.386829 | 0.445418 | 0.54289 | 0.598201 | 0.659157 | 0.72664 | 0.83307 | 0.889436 | 0.895533 | 0.857325 | 0.7537 | 0.715 | 0.684252662 |
| 2 | 0.360709862 | 0.334643737 | 0.300465 | 0.138644 | 0.09544 | 0.124629 | 0.226707 | 0.374268 | 0.427023 | 0.516768 | 0.561064 | 0.616227 | 0.680597 | 0.784101 | 0.856718 | 0.882532 | 0.889159 | 0.8074 | 0.761 | 0.722564834 |
| 3 | 0.320460375 | 0.297436146 | 0.267032 | 0.12428 | 0.077866 | 0.102054 | 0.184107 | 0.331079 | 0.388171 | 0.454375 | 0.493601 | 0.561435 | 0.627976 | 0.719946 | 0.793611 | 0.836743 | 0.860954 | 0.8615 | 0.833 | 0.796590482 |
| 4 | 0.320819985 | 0.299457003 | 0.273499 | 0.14615 | 0.102507 | 0.116787 | 0.187846 | 0.327122 | 0.379627 | 0.428576 | 0.461897 | 0.521754 | 0.58909 | 0.679667 | 0.746787 | 0.813892 | 0.837144 | 0.8548 | 0.855 | 0.818520918 |
| 5 | 0.343488949 | 0.324129563 | 0.303982 | 0.189387 | 0.150122 | 0.156224 | 0.206253 | 0.32686 | 0.378202 | 0.421577 | 0.449919 | 0.513873 | 0.570289 | 0.652889 | 0.71667 | 0.786374 | 0.8052 | 0.8271 | 0.837 | 0.823814045 |



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# Total Correlation Coefficient Matrix (Interslab)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999997917 | 0.999697 | 0.936981 | 0.934184 | 0.918125 | 0.907362 | 0.868364 | 0.872962 | 0.869957 | 0.860119 | 0.835865 | 0.801563 | 0.720244 | 0.686241 | 0.637415 | 0.61036 | 0.5444 | 0.517 | 0.521249474 |
| 0.01 | 0.999997917 | 1 | 0.999665 | 0.936673 | 0.93391 | 0.917989 | 0.907406 | 0.868554 | 0.873156 | 0.870237 | 0.860407 | 0.836089 | 0.801892 | 0.72066 | 0.686689 | 0.637848 | 0.61085 | 0.5448 | 0.518 | 0.521357269 |
| 0.02 | 0.999696626 | 0.999664709 | 1 | 0.941995 | 0.939136 | 0.921687 | 0.908781 | 0.866545 | 0.869469 | 0.864363 | 0.852796 | 0.828027 | 0.792505 | 0.7105 | 0.677092 | 0.629446 | 0.603046 | 0.5379 | 0.512 | 0.516868865 |
| 0.03 | 0.936980877 | 0.936673441 | 0.941995 | 1 | 0.956494 | 0.896929 | 0.842304 | 0.759027 | 0.748836 | 0.723484 | 0.699951 | 0.678826 | 0.640427 | 0.558263 | 0.524894 | 0.482337 | 0.459951 | 0.4156 | 0.399 | 0.417605219 |
| 0.05 | 0.934183526 | 0.933909527 | 0.939136 | 0.956494 | 1 | 0.958265 | 0.897799 | 0.79763 | 0.771611 | 0.74049 | 0.71093 | 0.676649 | 0.628006 | 0.539963 | 0.512026 | 0.471673 | 0.452667 | 0.4024 | 0.39 | 0.409234393 |
| 0.075 | 0.918124945 | 0.917989253 | 0.921687 | 0.896929 | 0.958265 | 1 | 0.959977 | 0.865648 | 0.824145 | 0.777113 | 0.732537 | 0.674354 | 0.61147 | 0.511148 | 0.485013 | 0.448189 | 0.438301 | 0.3857 | 0.374 | 0.388000404 |
| 0.1 | 0.907361762 | 0.90740609 | 0.908781 | 0.842304 | 0.897799 | 0.959977 | 1 | 0.934465 | 0.887825 | 0.836746 | 0.780878 | 0.706092 | 0.636256 | 0.527806 | 0.51005 | 0.479014 | 0.474044 | 0.4149 | 0.401 | 0.406216842 |
| 0.15 | 0.868363994 | 0.868553816 | 0.866545 | 0.759027 | 0.79763 | 0.865648 | 0.934465 | 1 | 0.952512 | 0.901048 | 0.841964 | 0.755996 | 0.684359 | 0.565219 | 0.541244 | 0.513173 | 0.508402 | 0.4506 | 0.433 | 0.428980443 |
| 0.2 | 0.872962341 | 0.873156012 | 0.869469 | 0.748836 | 0.771611 | 0.824145 | 0.887825 | 0.952512 | 1 | 0.951066 | 0.901071 | 0.818329 | 0.751866 | 0.625238 | 0.587767 | 0.553409 | 0.54193 | 0.4851 | 0.461 | 0.455754941 |
| 0.25 | 0.869956979 | 0.870237363 | 0.864363 | 0.723484 | 0.74049 | 0.777113 | 0.836746 | 0.901048 | 0.951066 | 1 | 0.959488 | 0.881738 | 0.822738 | 0.704291 | 0.659535 | 0.612176 | 0.590729 | 0.5177 | 0.488 | 0.478106164 |
| 0.3 | 0.860119444 | 0.860407261 | 0.852796 | 0.699951 | 0.71093 | 0.732537 | 0.780878 | 0.841964 | 0.901071 | 0.959488 | 1 | 0.93905 | 0.888077 | 0.768317 | 0.716082 | 0.65606 | 0.62278 | 0.5526 | 0.52 | 0.513651305 |
| 0.4 | 0.835864706 | 0.83608877 | 0.828027 | 0.678826 | 0.676649 | 0.674354 | 0.706092 | 0.755996 | 0.818329 | 0.881738 | 0.93905 | 1 | 0.950017 | 0.829898 | 0.775763 | 0.707 | 0.670025 | 0.6141 | 0.579 | 0.572221 |
| 0.5 | 0.801563461 | 0.801891546 | 0.792505 | 0.640427 | 0.628006 | 0.61147 | 0.636256 | 0.684359 | 0.751866 | 0.822738 | 0.888077 | 0.950017 | 1 | 0.900657 | 0.841373 | 0.765735 | 0.725093 | 0.6694 | 0.632 | 0.618939292 |
| 0.75 | 0.720244381 | 0.720659884 | 0.7105 | 0.558263 | 0.539963 | 0.511148 | 0.527806 | 0.565219 | 0.625238 | 0.704291 | 0.768317 | 0.829898 | 0.900657 | 1 | 0.944534 | 0.871812 | 0.822426 | 0.7472 | 0.703 | 0.679016606 |
| 1 | 0.686241021 | 0.686689414 | 0.677092 | 0.524894 | 0.512026 | 0.485013 | 0.51005 | 0.541244 | 0.587767 | 0.659535 | 0.716082 | 0.775763 | 0.841373 | 0.944534 | 1 | 0.937601 | 0.897607 | 0.8161 | 0.762 | 0.736298457 |
| 1.5 | 0.637414983 | 0.637848291 | 0.629446 | 0.482337 | 0.471673 | 0.448189 | 0.479014 | 0.513173 | 0.553409 | 0.612176 | 0.65606 | 0.707 | 0.765735 | 0.871812 | 0.937601 | 1 | 0.955019 | 0.8852 | 0.849 | 0.823978573 |
| 2 | 0.61035968 | 0.61085042 | 0.603046 | 0.459951 | 0.452667 | 0.438301 | 0.474044 | 0.508402 | 0.54193 | 0.590729 | 0.62278 | 0.670025 | 0.725093 | 0.822426 | 0.897607 | 0.955019 | 1 | 0.9344 | 0.895 | 0.866872446 |
| 3 | 0.5444264 | 0.544834738 | 0.53789 | 0.415641 | 0.402443 | 0.385717 | 0.414888 | 0.450569 | 0.485103 | 0.517651 | 0.552572 | 0.614112 | 0.669407 | 0.747193 | 0.816083 | 0.885171 | 0.934421 | 1 | 0.959 | 0.925901412 |
| 4 | 0.517481744 | 0.517802103 | 0.511884 | 0.399341 | 0.389681 | 0.373709 | 0.400681 | 0.433378 | 0.461145 | 0.488078 | 0.519558 | 0.579396 | 0.632325 | 0.702663 | 0.762369 | 0.848703 | 0.894547 | 0.959 | 1 | 0.963274414 |
| 5 | 0.521249474 | 0.521357269 | 0.516869 | 0.417605 | 0.409234 | 0.388 | 0.406217 | 0.42898 | 0.455755 | 0.478106 | 0.513651 | 0.572221 | 0.618939 | 0.679017 | 0.736298 | 0.823979 | 0.866872 | 0.9259 | 0.963 | 1 |



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# Total Correlation Coefficient Matrix (Interslab)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.998934081 | 0.993037 | 0.904977 | 0.874839 | 0.858759 | 0.853569 | 0.751797 | 0.739061 | 0.706976 | 0.655956 | 0.602317 | 0.565995 | 0.473842 | 0.427477 | 0.392764 | 0.37003 | 0.3176 | 0.315 | 0.333264747 |
| 0.01 | 0.998934081 | 1 | 0.997016 | 0.917644 | 0.888147 | 0.866729 | 0.853069 | 0.740633 | 0.725854 | 0.688455 | 0.63421 | 0.578529 | 0.541076 | 0.447016 | 0.400744 | 0.367433 | 0.345695 | 0.2967 | 0.297 | 0.316978595 |
| 0.02 | 0.993036763 | 0.997015722 | 1 | 0.93525 | 0.906433 | 0.874471 | 0.846544 | 0.71893 | 0.700441 | 0.655684 | 0.596909 | 0.53936 | 0.501415 | 0.408212 | 0.363203 | 0.334747 | 0.31335 | 0.2691 | 0.275 | 0.299235539 |
| 0.03 | 0.904977297 | 0.917643963 | 0.93525 | 1 | 0.937204 | 0.848582 | 0.747624 | 0.562824 | 0.533797 | 0.465118 | 0.401703 | 0.347355 | 0.310748 | 0.236191 | 0.192654 | 0.177209 | 0.159637 | 0.1463 | 0.171 | 0.20830606 |
| 0.05 | 0.874839473 | 0.888146929 | 0.906433 | 0.937204 | 1 | 0.92463 | 0.79276 | 0.570178 | 0.515873 | 0.434593 | 0.359659 | 0.294658 | 0.250596 | 0.168237 | 0.132275 | 0.125715 | 0.111884 | 0.0979 | 0.126 | 0.160831379 |
| 0.075 | 0.858758555 | 0.866728911 | 0.874471 | 0.848582 | 0.92463 | 1 | 0.884927 | 0.666885 | 0.595401 | 0.502214 | 0.420628 | 0.337323 | 0.277509 | 0.174833 | 0.143455 | 0.142561 | 0.132451 | 0.1095 | 0.125 | 0.149031844 |
| 0.1 | 0.853568687 | 0.85306904 | 0.846544 | 0.747624 | 0.79276 | 0.884927 | 1 | 0.834436 | 0.742918 | 0.646705 | 0.560857 | 0.465911 | 0.395156 | 0.275181 | 0.25289 | 0.246593 | 0.237991 | 0.1933 | 0.19 | 0.200287965 |
| 0.15 | 0.751797075 | 0.740633464 | 0.71893 | 0.562824 | 0.570178 | 0.666885 | 0.834436 | 1 | 0.892582 | 0.807425 | 0.715052 | 0.623791 | 0.542176 | 0.413825 | 0.38854 | 0.383186 | 0.370817 | 0.3214 | 0.304 | 0.296712235 |
| 0.2 | 0.739061245 | 0.725854239 | 0.700441 | 0.533797 | 0.515873 | 0.595401 | 0.742918 | 0.892582 | 1 | 0.902536 | 0.811647 | 0.7199 | 0.643657 | 0.494187 | 0.450222 | 0.432302 | 0.41104 | 0.3678 | 0.349 | 0.339551324 |
| 0.25 | 0.706976331 | 0.688455124 | 0.655684 | 0.465118 | 0.434593 | 0.502214 | 0.646705 | 0.807425 | 0.902536 | 1 | 0.920301 | 0.827592 | 0.752296 | 0.609636 | 0.557283 | 0.51605 | 0.491805 | 0.4187 | 0.39 | 0.37187798 |
| 0.3 | 0.655956468 | 0.634210227 | 0.596909 | 0.401703 | 0.359659 | 0.420628 | 0.560857 | 0.715052 | 0.811647 | 0.920301 | 1 | 0.901394 | 0.835623 | 0.701659 | 0.636392 | 0.564779 | 0.524126 | 0.4489 | 0.419 | 0.401285709 |
| 0.4 | 0.602316969 | 0.578529395 | 0.53936 | 0.347355 | 0.294658 | 0.337323 | 0.465911 | 0.623791 | 0.7199 | 0.827592 | 0.901394 | 1 | 0.922411 | 0.790454 | 0.714087 | 0.620163 | 0.58065 | 0.5121 | 0.477 | 0.465731585 |
| 0.5 | 0.565994994 | 0.541076366 | 0.501415 | 0.310748 | 0.250596 | 0.277509 | 0.395156 | 0.542176 | 0.643657 | 0.752296 | 0.835623 | 0.922411 | 1 | 0.872154 | 0.792723 | 0.687934 | 0.640446 | 0.5735 | 0.535 | 0.517395906 |
| 0.75 | 0.473842341 | 0.447016176 | 0.408212 | 0.236191 | 0.168237 | 0.174833 | 0.275181 | 0.413825 | 0.494187 | 0.609636 | 0.701659 | 0.790454 | 0.872154 | 1 | 0.915293 | 0.81288 | 0.750224 | 0.6566 | 0.618 | 0.59711045 |
| 1 | 0.427476993 | 0.400744328 | 0.363203 | 0.192654 | 0.132275 | 0.143455 | 0.25289 | 0.38854 | 0.450222 | 0.557283 | 0.636392 | 0.714087 | 0.792723 | 0.915293 | 1 | 0.898411 | 0.847151 | 0.7409 | 0.688 | 0.660201438 |
| 1.5 | 0.392763662 | 0.367432918 | 0.334747 | 0.177209 | 0.125715 | 0.142561 | 0.246593 | 0.383186 | 0.432302 | 0.51605 | 0.564779 | 0.620163 | 0.687934 | 0.81288 | 0.898411 | 1 | 0.916576 | 0.8123 | 0.763 | 0.725132743 |
| 2 | 0.370030176 | 0.345694593 | 0.31335 | 0.159637 | 0.111884 | 0.132451 | 0.237991 | 0.370817 | 0.41104 | 0.491805 | 0.524126 | 0.58065 | 0.640446 | 0.750224 | 0.847151 | 0.916576 | 1 | 0.8848 | 0.82 | 0.783855957 |
| 3 | 0.317639861 | 0.296741132 | 0.269121 | 0.146252 | 0.097928 | 0.109529 | 0.193301 | 0.321389 | 0.367818 | 0.418662 | 0.448921 | 0.512109 | 0.57348 | 0.656563 | 0.740897 | 0.812296 | 0.8848 | 1 | 0.929 | 0.883738168 |
| 4 | 0.315469211 | 0.297193556 | 0.275283 | 0.170607 | 0.126376 | 0.124961 | 0.18954 | 0.303555 | 0.34947 | 0.390387 | 0.418896 | 0.477016 | 0.535168 | 0.617648 | 0.688278 | 0.762509 | 0.820333 | 0.9287 | 1 | 0.941193699 |
| 5 | 0.333264747 | 0.316978595 | 0.299236 | 0.208306 | 0.160831 | 0.149032 | 0.200288 | 0.296712 | 0.339551 | 0.371878 | 0.401286 | 0.465732 | 0.517396 | 0.59711 | 0.660201 | 0.725133 | 0.783856 | 0.8837 | 0.941 | 1 |



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# Total Correlation Coefficient Matrix (Intraslab)

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.766245338 | 0.7508881 | 0.732697 | 0.621148 | 0.61148 | 0.650811 | 0.722886 | 0.754725 | 0.752935 | 0.751747 | 0.742461 | 0.701724 | 0.664724 | 0.596446 | 0.559622 | 0.513088 | 0.49577 | 0.4616 | 0.442 | 0.438047008 |
| 0.01 | 0.765649261 | 0.75024693 | 0.731929 | 0.620213 | 0.610583 | 0.650108 | 0.722379 | 0.754501 | 0.75283 | 0.751727 | 0.742564 | 0.702155 | 0.665098 | 0.596548 | 0.559678 | 0.513188 | 0.495754 | 0.4613 | 0.442 | 0.4376133 |
| 0.02 | 0.771079278 | 0.756526215 | 0.739373 | 0.630009 | 0.619505 | 0.656432 | 0.725284 | 0.754705 | 0.751804 | 0.749932 | 0.740184 | 0.698032 | 0.661316 | 0.594189 | 0.557312 | 0.510758 | 0.494701 | 0.4624 | 0.444 | 0.440857808 |
| 0.03 | 0.798062235 | 0.792780152 | 0.78526 | 0.763439 | 0.707203 | 0.684372 | 0.693456 | 0.6519 | 0.623886 | 0.613394 | 0.603726 | 0.546142 | 0.512997 | 0.47176 | 0.433512 | 0.383445 | 0.379289 | 0.372 | 0.37 | 0.379474385 |
| 0.05 | 0.82573941 | 0.820446867 | 0.813036 | 0.748687 | 0.776614 | 0.772318 | 0.764792 | 0.707609 | 0.669343 | 0.652129 | 0.629493 | 0.554427 | 0.517681 | 0.475181 | 0.434583 | 0.388486 | 0.3908 | 0.3824 | 0.383 | 0.39003529 |
| 0.075 | 0.800204646 | 0.789845275 | 0.777708 | 0.661649 | 0.717338 | 0.786055 | 0.813909 | 0.775623 | 0.740898 | 0.726278 | 0.697249 | 0.62356 | 0.581992 | 0.528814 | 0.492832 | 0.44856 | 0.445732 | 0.4235 | 0.413 | 0.413976151 |
| 0.1 | 0.733135212 | 0.717132726 | 0.699722 | 0.551057 | 0.606554 | 0.700119 | 0.80957 | 0.821137 | 0.805096 | 0.781656 | 0.7546 | 0.69243 | 0.645205 | 0.565443 | 0.528565 | 0.486239 | 0.47212 | 0.4383 | 0.423 | 0.418013685 |
| 0.15 | 0.630139308 | 0.609448901 | 0.588354 | 0.416793 | 0.464178 | 0.569535 | 0.710247 | 0.828565 | 0.829251 | 0.817265 | 0.798251 | 0.753352 | 0.713133 | 0.621204 | 0.585441 | 0.547706 | 0.522436 | 0.4732 | 0.444 | 0.43346233 |
| 0.2 | 0.585089536 | 0.563082738 | 0.540933 | 0.364822 | 0.404583 | 0.510234 | 0.661567 | 0.798587 | 0.837227 | 0.82055 | 0.803292 | 0.768772 | 0.724472 | 0.62168 | 0.584143 | 0.544989 | 0.517555 | 0.4685 | 0.441 | 0.42875577 |
| 0.25 | 0.549213228 | 0.524993987 | 0.500491 | 0.323712 | 0.349587 | 0.455127 | 0.604671 | 0.75793 | 0.79938 | 0.832163 | 0.821464 | 0.789289 | 0.751477 | 0.674722 | 0.636531 | 0.593683 | 0.560321 | 0.4956 | 0.459 | 0.443502686 |
| 0.3 | 0.509524166 | 0.483681242 | 0.457536 | 0.283774 | 0.301118 | 0.407228 | 0.557862 | 0.716571 | 0.764434 | 0.806087 | 0.829327 | 0.812409 | 0.76901 | 0.688937 | 0.658214 | 0.613115 | 0.573298 | 0.4941 | 0.451 | 0.438819459 |
| 0.4 | 0.42653735 | 0.397608868 | 0.367255 | 0.19769 | 0.206034 | 0.312251 | 0.466443 | 0.637357 | 0.697696 | 0.739453 | 0.772732 | 0.836779 | 0.804598 | 0.703141 | 0.674362 | 0.635429 | 0.590383 | 0.4967 | 0.444 | 0.430202513 |
| 0.5 | 0.404341566 | 0.37409575 | 0.343826 | 0.179173 | 0.179251 | 0.277103 | 0.432826 | 0.606887 | 0.666031 | 0.714726 | 0.742372 | 0.824222 | 0.841127 | 0.765101 | 0.730117 | 0.688525 | 0.641732 | 0.5428 | 0.481 | 0.463966884 |
| 0.75 | 0.405410303 | 0.375155125 | 0.350839 | 0.20878 | 0.19982 | 0.279542 | 0.395095 | 0.547734 | 0.59092 | 0.673677 | 0.69636 | 0.752584 | 0.807427 | 0.866678 | 0.847214 | 0.807711 | 0.768064 | 0.6698 | 0.605 | 0.585543977 |
| 1 | 0.374155979 | 0.344083259 | 0.322561 | 0.192997 | 0.184967 | 0.255233 | 0.352014 | 0.495209 | 0.537993 | 0.626825 | 0.656717 | 0.713378 | 0.772077 | 0.862264 | 0.877147 | 0.852267 | 0.812178 | 0.713 | 0.643 | 0.622029714 |
| 1.5 | 0.343066639 | 0.314086946 | 0.295069 | 0.1748 | 0.16782 | 0.232533 | 0.317561 | 0.451793 | 0.488177 | 0.575073 | 0.606118 | 0.667007 | 0.732737 | 0.843707 | 0.879823 | 0.890687 | 0.859971 | 0.7676 | 0.695 | 0.66880159 |
| 2 | 0.337016892 | 0.309974618 | 0.29401 | 0.180457 | 0.174302 | 0.230966 | 0.3067 | 0.430572 | 0.463992 | 0.545858 | 0.571675 | 0.631345 | 0.697295 | 0.818352 | 0.862318 | 0.892895 | 0.882794 | 0.8059 | 0.735 | 0.708182083 |
| 3 | 0.365460493 | 0.342078106 | 0.331581 | 0.230077 | 0.222483 | 0.266362 | 0.326289 | 0.425141 | 0.457166 | 0.527703 | 0.541712 | 0.583159 | 0.646446 | 0.780944 | 0.826487 | 0.86836 | 0.878589 | 0.8558 | 0.798 | 0.766195458 |
| 4 | 0.37469371 | 0.354416876 | 0.347974 | 0.255285 | 0.24718 | 0.284565 | 0.335176 | 0.417549 | 0.447297 | 0.515426 | 0.517475 | 0.542803 | 0.605288 | 0.747314 | 0.793364 | 0.838658 | 0.862513 | 0.8609 | 0.831 | 0.808612386 |
| 5 | 0.379055768 | 0.359709765 | 0.355984 | 0.27366 | 0.263254 | 0.293821 | 0.338784 | 0.406742 | 0.430867 | 0.495783 | 0.498451 | 0.51793 | 0.57267 | 0.720418 | 0.767346 | 0.809282 | 0.838157 | 0.8415 | 0.828 | 0.824876123 |



doi:10.6342/NTU202303258

# Total Correlation Coefficient Matrix (Intraslab)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.99999682 | 0.999787 | 0.930187 | 0.918114 | 0.91773 | 0.911431 | 0.873678 | 0.852293 | 0.842165 | 0.823608 | 0.772797 | 0.739305 | 0.679344 | 0.628502 | 0.574648 | 0.557781 | 0.5502 | 0.54 | 0.532922576 |
| 0.01 | 0.99999682 | 1 | 0.999757 | 0.929971 | 0.917835 | 0.917515 | 0.911316 | 0.873691 | 0.852338 | 0.842305 | 0.82385 | 0.773275 | 0.739777 | 0.679565 | 0.628658 | 0.57476 | 0.557812 | 0.55 | 0.54 | 0.532481874 |
| 0.02 | 0.999786682 | 0.999756635 | 1 | 0.933534 | 0.921357 | 0.919225 | 0.910533 | 0.871167 | 0.848973 | 0.838118 | 0.819277 | 0.767708 | 0.734149 | 0.675204 | 0.625024 | 0.5718 | 0.555762 | 0.5492 | 0.54 | 0.533151169 |
| 0.03 | 0.930187385 | 0.929970944 | 0.933534 | 1 | 0.932553 | 0.864319 | 0.799955 | 0.712514 | 0.675421 | 0.659608 | 0.637275 | 0.578657 | 0.547165 | 0.511184 | 0.470329 | 0.4245 | 0.415596 | 0.4242 | 0.425 | 0.429316302 |
| 0.05 | 0.918114156 | 0.917834856 | 0.921357 | 0.932553 | 1 | 0.942158 | 0.86007 | 0.754767 | 0.708762 | 0.682829 | 0.650175 | 0.57614 | 0.542716 | 0.50494 | 0.463735 | 0.419766 | 0.41295 | 0.429 | 0.434 | 0.43829208 |
| 0.075 | 0.917730247 | 0.91751545 | 0.919225 | 0.864319 | 0.942158 | 1 | 0.944325 | 0.849315 | 0.798052 | 0.767585 | 0.731907 | 0.655481 | 0.619215 | 0.572244 | 0.52705 | 0.483434 | 0.473018 | 0.4802 | 0.481 | 0.480770111 |
| 0.1 | 0.911430744 | 0.911315502 | 0.910533 | 0.799955 | 0.86007 | 0.944325 | 1 | 0.932886 | 0.891095 | 0.854515 | 0.818714 | 0.747663 | 0.709468 | 0.63769 | 0.5857 | 0.53585 | 0.520799 | 0.5175 | 0.513 | 0.508904153 |
| 0.15 | 0.873677508 | 0.873690619 | 0.871167 | 0.712514 | 0.754767 | 0.849315 | 0.932886 | 1 | 0.963282 | 0.931745 | 0.898385 | 0.834126 | 0.796843 | 0.711946 | 0.656735 | 0.605473 | 0.586246 | 0.569 | 0.552 | 0.539849293 |
| 0.2 | 0.852293484 | 0.852338418 | 0.848973 | 0.675421 | 0.708762 | 0.798052 | 0.891095 | 0.963282 | 1 | 0.959511 | 0.925924 | 0.86519 | 0.823856 | 0.729243 | 0.671898 | 0.61571 | 0.591045 | 0.5699 | 0.555 | 0.543693115 |
| 0.25 | 0.842164547 | 0.842304869 | 0.838118 | 0.659608 | 0.682829 | 0.767585 | 0.854515 | 0.931745 | 0.959511 | 1 | 0.970069 | 0.90731 | 0.871789 | 0.799245 | 0.739892 | 0.679424 | 0.649153 | 0.6167 | 0.597 | 0.582666617 |
| 0.3 | 0.823607764 | 0.823849994 | 0.819277 | 0.637275 | 0.650175 | 0.731907 | 0.818714 | 0.898385 | 0.925924 | 0.970069 | 1 | 0.946457 | 0.903814 | 0.824567 | 0.77346 | 0.710641 | 0.676072 | 0.6307 | 0.602 | 0.587003266 |
| 0.4 | 0.772796773 | 0.773274504 | 0.767708 | 0.578657 | 0.57614 | 0.655481 | 0.747663 | 0.834126 | 0.86519 | 0.90731 | 0.946457 | 1 | 0.963452 | 0.858465 | 0.808822 | 0.746499 | 0.710484 | 0.6529 | 0.612 | 0.592056121 |
| 0.5 | 0.739305294 | 0.739776685 | 0.734149 | 0.547165 | 0.542716 | 0.619215 | 0.709468 | 0.796843 | 0.823856 | 0.871789 | 0.903814 | 0.963452 | 1 | 0.916701 | 0.866585 | 0.806864 | 0.769606 | 0.7105 | 0.667 | 0.639771545 |
| 0.75 | 0.679344403 | 0.679565007 | 0.675204 | 0.511184 | 0.50494 | 0.572244 | 0.63769 | 0.711946 | 0.729243 | 0.799245 | 0.824567 | 0.858465 | 0.916701 | 1 | 0.967711 | 0.920063 | 0.885497 | 0.834 | 0.797 | 0.771144537 |
| 1 | 0.628501751 | 0.628657597 | 0.625024 | 0.470329 | 0.463735 | 0.52705 | 0.5857 | 0.656735 | 0.671898 | 0.739892 | 0.77346 | 0.808822 | 0.866585 | 0.967711 | 1 | 0.963059 | 0.932589 | 0.8811 | 0.84 | 0.812652314 |
| 1.5 | 0.574648114 | 0.574760314 | 0.5718 | 0.4245 | 0.419766 | 0.483434 | 0.53585 | 0.605473 | 0.61571 | 0.679424 | 0.710641 | 0.746499 | 0.806864 | 0.920063 | 0.963059 | 1 | 0.975274 | 0.928 | 0.886 | 0.855592425 |
| 2 | 0.557780742 | 0.55781203 | 0.555762 | 0.415596 | 0.41295 | 0.473018 | 0.520799 | 0.586246 | 0.591045 | 0.649153 | 0.676072 | 0.710484 | 0.769606 | 0.885497 | 0.932589 | 0.975274 | 1 | 0.9587 | 0.922 | 0.89115473 |
| 3 | 0.550210176 | 0.550011195 | 0.549221 | 0.424242 | 0.429019 | 0.480249 | 0.517465 | 0.568969 | 0.569884 | 0.616692 | 0.630679 | 0.652944 | 0.710516 | 0.833954 | 0.881081 | 0.927955 | 0.958696 | 1 | 0.971 | 0.941005636 |
| 4 | 0.540176968 | 0.539850308 | 0.539939 | 0.425251 | 0.434243 | 0.481352 | 0.513236 | 0.552036 | 0.554639 | 0.597267 | 0.60205 | 0.612429 | 0.666642 | 0.797407 | 0.83976 | 0.885698 | 0.922066 | 0.9713 | 1 | 0.977851044 |
| 5 | 0.532922576 | 0.532481874 | 0.533151 | 0.429316 | 0.438292 | 0.48077 | 0.508904 | 0.539849 | 0.543693 | 0.582667 | 0.587003 | 0.592056 | 0.639772 | 0.771145 | 0.812652 | 0.855592 | 0.891155 | 0.941 | 0.978 | 1 |



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# Total Correlation Coefficient Matrix (Intraslab)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.998772882 | 0.994368 | 0.921651 | 0.912152 | 0.904893 | 0.893215 | 0.806031 | 0.746424 | 0.716829 | 0.67876 | 0.559801 | 0.528237 | 0.495587 | 0.441564 | 0.376237 | 0.380089 | 0.3948 | 0.408 | 0.411031858 |
| 0.01 | 0.998772882 | 1 | 0.997947 | 0.932167 | 0.921162 | 0.907921 | 0.888196 | 0.793465 | 0.731428 | 0.698865 | 0.659188 | 0.535604 | 0.503372 | 0.470583 | 0.415705 | 0.350791 | 0.358033 | 0.379 | 0.397 | 0.401018231 |
| 0.02 | 0.994368 | 0.997946812 | 1 | 0.943721 | 0.930217 | 0.909117 | 0.880156 | 0.777053 | 0.711695 | 0.676458 | 0.634672 | 0.505007 | 0.474718 | 0.449524 | 0.396699 | 0.333124 | 0.344974 | 0.3737 | 0.396 | 0.402164593 |
| 0.03 | 0.921651352 | 0.932166721 | 0.943721 | 1 | 0.928126 | 0.84424 | 0.761755 | 0.608217 | 0.533682 | 0.494893 | 0.458625 | 0.330563 | 0.304002 | 0.311593 | 0.26995 | 0.214083 | 0.238526 | 0.29 | 0.325 | 0.342313618 |
| 0.05 | 0.912151845 | 0.921161707 | 0.930217 | 0.928126 | 1 | 0.927624 | 0.822138 | 0.649298 | 0.563284 | 0.517036 | 0.470076 | 0.331768 | 0.298365 | 0.302626 | 0.261992 | 0.208004 | 0.233115 | 0.276 | 0.308 | 0.321299063 |
| 0.075 | 0.904892521 | 0.907920619 | 0.909117 | 0.84424 | 0.927624 | 1 | 0.906377 | 0.739858 | 0.653944 | 0.607834 | 0.558245 | 0.426128 | 0.382423 | 0.364892 | 0.325368 | 0.268025 | 0.28372 | 0.3025 | 0.32 | 0.326252351 |
| 0.1 | 0.893215181 | 0.888195728 | 0.880156 | 0.761755 | 0.822138 | 0.906377 | 1 | 0.872249 | 0.794665 | 0.732142 | 0.685343 | 0.56567 | 0.516826 | 0.450072 | 0.399986 | 0.335264 | 0.335327 | 0.3404 | 0.351 | 0.350765426 |
| 0.15 | 0.806031183 | 0.793464733 | 0.777053 | 0.608217 | 0.649298 | 0.739858 | 0.872249 | 1 | 0.930141 | 0.87717 | 0.832957 | 0.732859 | 0.686909 | 0.585246 | 0.53013 | 0.466974 | 0.450048 | 0.4219 | 0.415 | 0.403801261 |
| 0.2 | 0.746424024 | 0.731427697 | 0.711695 | 0.533682 | 0.563284 | 0.653944 | 0.794665 | 0.930141 | 1 | 0.927944 | 0.879158 | 0.791086 | 0.734913 | 0.609034 | 0.553095 | 0.487905 | 0.464636 | 0.4342 | 0.426 | 0.41027202 |
| 0.25 | 0.71682895 | 0.698864825 | 0.676458 | 0.494893 | 0.517036 | 0.607834 | 0.732142 | 0.87717 | 0.927944 | 1 | 0.948065 | 0.849244 | 0.796265 | 0.698962 | 0.645933 | 0.578591 | 0.546576 | 0.4984 | 0.476 | 0.458047957 |
| 0.3 | 0.678760414 | 0.659188164 | 0.634672 | 0.458625 | 0.470076 | 0.558245 | 0.685343 | 0.832957 | 0.879158 | 0.948065 | 1 | 0.899601 | 0.833982 | 0.72698 | 0.67555 | 0.603565 | 0.564917 | 0.5005 | 0.472 | 0.457480384 |
| 0.4 | 0.559800777 | 0.53560445 | 0.505007 | 0.330563 | 0.331768 | 0.426128 | 0.56567 | 0.732859 | 0.791086 | 0.849244 | 0.899601 | 1 | 0.932537 | 0.782618 | 0.723285 | 0.654714 | 0.604736 | 0.5237 | 0.475 | 0.457093758 |
| 0.5 | 0.52823675 | 0.503371674 | 0.474718 | 0.304002 | 0.298365 | 0.382423 | 0.516826 | 0.686909 | 0.734913 | 0.796265 | 0.833982 | 0.932537 | 1 | 0.870597 | 0.80156 | 0.731738 | 0.677985 | 0.5934 | 0.533 | 0.509061846 |
| 0.75 | 0.495587176 | 0.470583046 | 0.449524 | 0.311593 | 0.302626 | 0.364892 | 0.450072 | 0.585246 | 0.609034 | 0.698962 | 0.72698 | 0.782618 | 0.870597 | 1 | 0.940232 | 0.875337 | 0.830987 | 0.7433 | 0.68 | 0.653171428 |
| 1 | 0.441563889 | 0.415704647 | 0.396699 | 0.26995 | 0.261992 | 0.325368 | 0.399986 | 0.53013 | 0.553095 | 0.645933 | 0.67555 | 0.723285 | 0.80156 | 0.940232 | 1 | 0.932282 | 0.887131 | 0.7965 | 0.728 | 0.697587189 |
| 1.5 | 0.376236619 | 0.350790697 | 0.333124 | 0.214083 | 0.208004 | 0.268025 | 0.335264 | 0.466974 | 0.487905 | 0.578591 | 0.603565 | 0.654714 | 0.731738 | 0.875337 | 0.932282 | 1 | 0.950945 | 0.8659 | 0.797 | 0.762288008 |
| 2 | 0.380089191 | 0.358032933 | 0.344974 | 0.238526 | 0.233115 | 0.28372 | 0.335327 | 0.450048 | 0.464636 | 0.546576 | 0.564917 | 0.604736 | 0.677985 | 0.830987 | 0.887131 | 0.950945 | 1 | 0.9193 | 0.861 | 0.827223554 |
| 3 | 0.394783752 | 0.379008992 | 0.373738 | 0.290026 | 0.275977 | 0.302517 | 0.340419 | 0.421879 | 0.434173 | 0.498433 | 0.50047 | 0.523703 | 0.59341 | 0.743271 | 0.796456 | 0.865927 | 0.919339 | 1 | 0.941 | 0.902922582 |
| 4 | 0.408160125 | 0.39679167 | 0.395549 | 0.32489 | 0.308466 | 0.320289 | 0.351015 | 0.414545 | 0.426097 | 0.476103 | 0.471866 | 0.474652 | 0.532901 | 0.679911 | 0.72841 | 0.797145 | 0.860737 | 0.9411 | 1 | 0.960775519 |
| 5 | 0.411031858 | 0.401018231 | 0.402165 | 0.342314 | 0.321299 | 0.326252 | 0.350765 | 0.403801 | 0.410272 | 0.458048 | 0.45748 | 0.457094 | 0.509062 | 0.653171 | 0.697587 | 0.762288 | 0.827224 | 0.9029 | 0.961 | 1 |



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# Total Correlation Coefficient Matrix (Crustal Reverse)

### $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.855113623 | 0.856267341 | 0.854425 | 0.820569 | 0.800204 | 0.76844 | 0.760231 | 0.755664 | 0.77588 | 0.788411 | 0.786026 | 0.779591 | 0.774691 | 0.731721 | 0.702578 | 0.658083 | 0.633213 | 0.5902 | 0.594 | 0.579467548 |
| 0.01 | 0.855186879 | 0.856357821 | 0.854523 | 0.820673 | 0.800317 | 0.768533 | 0.760273 | 0.75563 | 0.775796 | 0.78831 | 0.785914 | 0.77948 | 0.774631 | 0.73171 | 0.702619 | 0.658155 | 0.633304 | 0.5903 | 0.594 | 0.579566017 |
| 0.02 | 0.855654842 | 0.856878801 | 0.855549 | 0.822129 | 0.801654 | 0.76907 | 0.759656 | 0.754322 | 0.774488 | 0.787073 | 0.784322 | 0.777664 | 0.773277 | 0.731024 | 0.702667 | 0.659404 | 0.635236 | 0.5923 | 0.596 | 0.581630065 |
| 0.03 | 0.864296361 | 0.865207974 | 0.865262 | 0.846364 | 0.823059 | 0.782011 | 0.764362 | 0.751811 | 0.770921 | 0.781231 | 0.776525 | 0.768899 | 0.76546 | 0.724741 | 0.697104 | 0.656098 | 0.633354 | 0.5915 | 0.597 | 0.584786984 |
| 0.05 | 0.865307605 | 0.866389395 | 0.867184 | 0.846722 | 0.837032 | 0.802052 | 0.778362 | 0.75605 | 0.772992 | 0.778461 | 0.768299 | 0.757808 | 0.751676 | 0.708825 | 0.682326 | 0.642638 | 0.621788 | 0.5816 | 0.587 | 0.574167464 |
| 0.075 | 0.856516232 | 0.857372523 | 0.857543 | 0.832254 | 0.835069 | 0.820006 | 0.803414 | 0.774116 | 0.780172 | 0.775129 | 0.759453 | 0.742114 | 0.727961 | 0.673701 | 0.647259 | 0.605836 | 0.585549 | 0.5487 | 0.555 | 0.541087516 |
| 0.1 | 0.837638585 | 0.837907878 | 0.836366 | 0.806434 | 0.816089 | 0.818237 | 0.817151 | 0.792641 | 0.792159 | 0.776385 | 0.754563 | 0.730845 | 0.708022 | 0.640007 | 0.612984 | 0.56814 | 0.547624 | 0.5124 | 0.521 | 0.503332038 |
| 0.15 | 0.80023146 | 0.799772999 | 0.796565 | 0.760106 | 0.767433 | 0.78288 | 0.802663 | 0.810834 | 0.79972 | 0.78183 | 0.754464 | 0.720941 | 0.684724 | 0.6005 | 0.571174 | 0.527256 | 0.503948 | 0.4677 | 0.476 | 0.456385588 |
| 0.2 | 0.782498438 | 0.782174544 | 0.776814 | 0.734772 | 0.730746 | 0.740443 | 0.768978 | 0.796705 | 0.809933 | 0.792775 | 0.771536 | 0.736744 | 0.697492 | 0.612871 | 0.575797 | 0.523498 | 0.499047 | 0.4632 | 0.47 | 0.451316999 |
| 0.25 | 0.775696528 | 0.775652442 | 0.769795 | 0.723737 | 0.707877 | 0.706505 | 0.731592 | 0.767778 | 0.796728 | 0.809365 | 0.796041 | 0.760102 | 0.723953 | 0.634625 | 0.589298 | 0.535566 | 0.511612 | 0.4766 | 0.481 | 0.461497813 |
| 0.3 | 0.765950587 | 0.766306368 | 0.759503 | 0.711205 | 0.68914 | 0.679671 | 0.702358 | 0.741217 | 0.782601 | 0.803353 | 0.811913 | 0.779026 | 0.741688 | 0.655539 | 0.605791 | 0.548054 | 0.521477 | 0.4805 | 0.486 | 0.471691421 |
| 0.4 | 0.761308523 | 0.762273732 | 0.75474 | 0.704761 | 0.679338 | 0.654609 | 0.668257 | 0.704252 | 0.753066 | 0.781206 | 0.7953 | 0.809079 | 0.781435 | 0.711052 | 0.661359 | 0.596908 | 0.565626 | 0.5256 | 0.528 | 0.512408174 |
| 0.5 | 0.764146243 | 0.765874392 | 0.759342 | 0.71158 | 0.67967 | 0.640593 | 0.648586 | 0.674331 | 0.717768 | 0.754608 | 0.775137 | 0.800146 | 0.819854 | 0.75891 | 0.707707 | 0.646002 | 0.61264 | 0.5736 | 0.574 | 0.560618106 |
| 0.75 | 0.730938379 | 0.733270651 | 0.729341 | 0.691795 | 0.652931 | 0.593969 | 0.585061 | 0.589437 | 0.624008 | 0.664965 | 0.696223 | 0.747058 | 0.797178 | 0.837873 | 0.796957 | 0.737775 | 0.69485 | 0.66 | 0.649 | 0.634309776 |
| 1 | 0.71829221 | 0.720732544 | 0.719313 | 0.684585 | 0.650451 | 0.5891 | 0.565551 | 0.555025 | 0.57645 | 0.611651 | 0.639451 | 0.699595 | 0.761264 | 0.837573 | 0.862882 | 0.820445 | 0.775738 | 0.7357 | 0.723 | 0.707532698 |
| 1.5 | 0.678075172 | 0.680766866 | 0.681577 | 0.650233 | 0.621257 | 0.562066 | 0.529937 | 0.501481 | 0.514723 | 0.545639 | 0.571757 | 0.626768 | 0.699298 | 0.791687 | 0.849782 | 0.882586 | 0.853973 | 0.8153 | 0.795 | 0.779169473 |
| 2 | 0.635731248 | 0.638725913 | 0.640173 | 0.609491 | 0.579227 | 0.523016 | 0.48661 | 0.457648 | 0.469098 | 0.496426 | 0.517351 | 0.566992 | 0.638894 | 0.741714 | 0.817637 | 0.883656 | 0.896504 | 0.8587 | 0.831 | 0.810514595 |
| 3 | 0.591087782 | 0.593859821 | 0.59529 | 0.566009 | 0.537342 | 0.486527 | 0.453023 | 0.42901 | 0.433688 | 0.455716 | 0.476056 | 0.521345 | 0.593005 | 0.702649 | 0.778732 | 0.863742 | 0.891428 | 0.9047 | 0.877 | 0.849061083 |
| 4 | 0.596553145 | 0.599396891 | 0.600899 | 0.57336 | 0.54398 | 0.489365 | 0.459353 | 0.438979 | 0.440387 | 0.459614 | 0.479338 | 0.523576 | 0.593526 | 0.688537 | 0.770539 | 0.855016 | 0.884936 | 0.9006 | 0.906 | 0.887424181 |
| 5 | 0.585945648 | 0.588666741 | 0.591125 | 0.569485 | 0.537712 | 0.477677 | 0.446881 | 0.423712 | 0.42311 | 0.442639 | 0.461529 | 0.50687 | 0.576086 | 0.667908 | 0.750181 | 0.831711 | 0.865862 | 0.883 | 0.902 | 0.902322294 |



doi:10.6342/NTU202303258

# Total Correlation Coefficient Matrix (Crustal Reverse)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999999172 | 0.999881 | 0.992563 | 0.986636 | 0.971533 | 0.951099 | 0.918486 | 0.913793 | 0.91515 | 0.911334 | 0.911568 | 0.9061 | 0.858205 | 0.824563 | 0.758371 | 0.714533 | 0.6645 | 0.663 | 0.65074922 |
| 0.01 | 0.999999172 | 1 | 0.999891 | 0.992584 | 0.98669 | 0.971581 | 0.951094 | 0.918406 | 0.913675 | 0.915018 | 0.911197 | 0.911433 | 0.90603 | 0.858196 | 0.824612 | 0.758456 | 0.714626 | 0.6645 | 0.663 | 0.650834351 |
| 0.02 | 0.999881099 | 0.999891434 | 1 | 0.993075 | 0.987453 | 0.971933 | 0.950604 | 0.916894 | 0.911484 | 0.91277 | 0.908852 | 0.909271 | 0.904536 | 0.857833 | 0.825157 | 0.760169 | 0.716837 | 0.6667 | 0.665 | 0.652946809 |
| 0.03 | 0.992562662 | 0.99258412 | 0.993075 | 1 | 0.990471 | 0.970511 | 0.945064 | 0.905655 | 0.895186 | 0.893991 | 0.888719 | 0.888074 | 0.88459 | 0.84098 | 0.811197 | 0.750506 | 0.70937 | 0.6605 | 0.66 | 0.650327436 |
| 0.05 | 0.986635945 | 0.986689873 | 0.987453 | 0.990471 | 1 | 0.986387 | 0.959656 | 0.911581 | 0.892663 | 0.886063 | 0.876599 | 0.872512 | 0.867992 | 0.823029 | 0.795475 | 0.73755 | 0.697894 | 0.6492 | 0.649 | 0.638908247 |
| 0.075 | 0.971532632 | 0.971580708 | 0.971933 | 0.970511 | 0.986387 | 1 | 0.981507 | 0.932306 | 0.902899 | 0.885028 | 0.868712 | 0.853744 | 0.842215 | 0.787891 | 0.757884 | 0.697895 | 0.658342 | 0.6115 | 0.612 | 0.599118589 |
| 0.1 | 0.951099301 | 0.951094364 | 0.950604 | 0.945064 | 0.959656 | 0.981507 | 1 | 0.958085 | 0.923518 | 0.893498 | 0.8701 | 0.843054 | 0.819289 | 0.75141 | 0.719746 | 0.657049 | 0.614786 | 0.5693 | 0.571 | 0.555317808 |
| 0.15 | 0.918485915 | 0.918405924 | 0.916894 | 0.905655 | 0.911581 | 0.932306 | 0.958085 | 1 | 0.957995 | 0.916593 | 0.88531 | 0.842184 | 0.803984 | 0.71565 | 0.677354 | 0.6091 | 0.567323 | 0.5236 | 0.524 | 0.504159368 |
| 0.2 | 0.913793013 | 0.913675096 | 0.911484 | 0.895186 | 0.892663 | 0.902899 | 0.923518 | 0.957995 | 1 | 0.957031 | 0.92429 | 0.876994 | 0.829894 | 0.731267 | 0.683691 | 0.604888 | 0.560818 | 0.5177 | 0.518 | 0.50006803 |
| 0.25 | 0.915149551 | 0.915017871 | 0.91277 | 0.893991 | 0.886063 | 0.885028 | 0.893498 | 0.916593 | 0.957031 | 1 | 0.963641 | 0.909675 | 0.863114 | 0.760724 | 0.704621 | 0.624543 | 0.579903 | 0.5363 | 0.537 | 0.519294045 |
| 0.3 | 0.911333753 | 0.911196805 | 0.908852 | 0.888719 | 0.876599 | 0.868712 | 0.8701 | 0.88531 | 0.92429 | 0.963641 | 1 | 0.93629 | 0.886044 | 0.781798 | 0.722071 | 0.638236 | 0.593148 | 0.5456 | 0.547 | 0.533109979 |
| 0.4 | 0.911567585 | 0.911432665 | 0.909271 | 0.888074 | 0.872512 | 0.853744 | 0.843054 | 0.842184 | 0.876994 | 0.909675 | 0.93629 | 1 | 0.945243 | 0.846823 | 0.786538 | 0.696908 | 0.645784 | 0.5997 | 0.597 | 0.581890434 |
| 0.5 | 0.906100483 | 0.906030113 | 0.904536 | 0.88459 | 0.867992 | 0.842215 | 0.819289 | 0.803984 | 0.829894 | 0.863114 | 0.886044 | 0.945243 | 1 | 0.901995 | 0.839539 | 0.751361 | 0.696398 | 0.6533 | 0.648 | 0.63134865 |
| 0.75 | 0.858204669 | 0.858196283 | 0.857833 | 0.84098 | 0.823029 | 0.787891 | 0.75141 | 0.71565 | 0.731267 | 0.760724 | 0.781798 | 0.846823 | 0.901995 | 1 | 0.935121 | 0.847756 | 0.791274 | 0.7506 | 0.733 | 0.711972567 |
| 1 | 0.824562629 | 0.824612347 | 0.825157 | 0.811197 | 0.795475 | 0.757884 | 0.719746 | 0.677354 | 0.683691 | 0.704621 | 0.722071 | 0.786538 | 0.839539 | 0.935121 | 1 | 0.926826 | 0.877444 | 0.8281 | 0.813 | 0.792089214 |
| 1.5 | 0.758370889 | 0.758455979 | 0.760169 | 0.750506 | 0.73755 | 0.697895 | 0.657049 | 0.6091 | 0.604888 | 0.624543 | 0.638236 | 0.696908 | 0.751361 | 0.847756 | 0.926826 | 1 | 0.957714 | 0.9096 | 0.892 | 0.868670788 |
| 2 | 0.714533083 | 0.714626353 | 0.716837 | 0.70937 | 0.697894 | 0.658342 | 0.614786 | 0.567323 | 0.560818 | 0.579903 | 0.593148 | 0.645784 | 0.696398 | 0.791274 | 0.877444 | 0.957714 | 1 | 0.9513 | 0.929 | 0.905400823 |
| 3 | 0.664458748 | 0.664506167 | 0.666678 | 0.660543 | 0.649164 | 0.611506 | 0.569302 | 0.523635 | 0.517701 | 0.536279 | 0.545576 | 0.599674 | 0.653337 | 0.750576 | 0.828063 | 0.909619 | 0.951254 | 1 | 0.965 | 0.935552666 |
| 4 | 0.663227581 | 0.663293517 | 0.665349 | 0.66038 | 0.649329 | 0.612279 | 0.570991 | 0.524277 | 0.517991 | 0.536796 | 0.547402 | 0.597272 | 0.648094 | 0.732871 | 0.812987 | 0.891614 | 0.928789 | 0.9654 | 1 | 0.974290126 |
| 5 | 0.65074922 | 0.650834351 | 0.652947 | 0.650327 | 0.638908 | 0.599119 | 0.555318 | 0.504159 | 0.500068 | 0.519294 | 0.53311 | 0.58189 | 0.631349 | 0.711973 | 0.792089 | 0.868671 | 0.905401 | 0.9356 | 0.974 | 1 |



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# Total Correlation Coefficient Matrix (Crustal Reverse)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999830396 | 0.999028 | 0.973374 | 0.950354 | 0.908395 | 0.891583 | 0.872933 | 0.871738 | 0.868786 | 0.859041 | 0.841146 | 0.828369 | 0.76395 | 0.72276 | 0.659686 | 0.623524 | 0.578 | 0.592 | 0.5914732 |
| 0.01 | 0.999830396 | 1 | 0.998835 | 0.972429 | 0.94938 | 0.907646 | 0.890915 | 0.871999 | 0.870668 | 0.867934 | 0.858456 | 0.841043 | 0.829105 | 0.765779 | 0.724838 | 0.662052 | 0.626517 | 0.5807 | 0.595 | 0.593739727 |
| 0.02 | 0.999028404 | 0.998834838 | 1 | 0.976416 | 0.953247 | 0.908797 | 0.888658 | 0.867506 | 0.865166 | 0.861991 | 0.851681 | 0.833244 | 0.821562 | 0.758681 | 0.719997 | 0.660453 | 0.625641 | 0.5806 | 0.596 | 0.595991762 |
| 0.03 | 0.973373575 | 0.972428878 | 0.976416 | 1 | 0.965934 | 0.904193 | 0.866629 | 0.832119 | 0.825761 | 0.819514 | 0.805648 | 0.783264 | 0.774601 | 0.718855 | 0.68232 | 0.625396 | 0.593431 | 0.5541 | 0.571 | 0.576777175 |
| 0.05 | 0.950353687 | 0.949380279 | 0.953247 | 0.965934 | 1 | 0.948399 | 0.89687 | 0.836163 | 0.816159 | 0.797612 | 0.774795 | 0.747088 | 0.73359 | 0.677078 | 0.646187 | 0.594258 | 0.564439 | 0.5281 | 0.544 | 0.548966807 |
| 0.075 | 0.90839534 | 0.907645593 | 0.908797 | 0.904193 | 0.948399 | 1 | 0.940837 | 0.855123 | 0.815519 | 0.779033 | 0.742585 | 0.704148 | 0.680149 | 0.611609 | 0.587528 | 0.540721 | 0.512699 | 0.4846 | 0.497 | 0.494108833 |
| 0.1 | 0.891582705 | 0.890914855 | 0.888658 | 0.866629 | 0.89687 | 0.940837 | 1 | 0.906405 | 0.849468 | 0.799156 | 0.759686 | 0.718663 | 0.687588 | 0.597823 | 0.565084 | 0.513766 | 0.484133 | 0.4594 | 0.478 | 0.472170941 |
| 0.15 | 0.872932796 | 0.871998738 | 0.867506 | 0.832119 | 0.836163 | 0.855123 | 0.906405 | 1 | 0.914631 | 0.85536 | 0.813042 | 0.750755 | 0.706595 | 0.597428 | 0.549003 | 0.484237 | 0.452519 | 0.4341 | 0.455 | 0.447166456 |
| 0.2 | 0.871737666 | 0.87066759 | 0.865166 | 0.825761 | 0.816159 | 0.815519 | 0.849468 | 0.914631 | 1 | 0.922284 | 0.874914 | 0.799825 | 0.745446 | 0.630345 | 0.574089 | 0.49374 | 0.458652 | 0.4329 | 0.444 | 0.432163795 |
| 0.25 | 0.868785734 | 0.867934202 | 0.861991 | 0.819514 | 0.797612 | 0.779033 | 0.799156 | 0.85536 | 0.922284 | 1 | 0.936539 | 0.852017 | 0.797404 | 0.674639 | 0.60167 | 0.51424 | 0.478286 | 0.4437 | 0.456 | 0.449160202 |
| 0.3 | 0.859041181 | 0.858456043 | 0.851681 | 0.805648 | 0.774795 | 0.742585 | 0.759686 | 0.813042 | 0.874914 | 0.936539 | 1 | 0.898859 | 0.836911 | 0.710408 | 0.625758 | 0.535121 | 0.49189 | 0.4508 | 0.463 | 0.460486335 |
| 0.4 | 0.841145982 | 0.841042728 | 0.833244 | 0.783264 | 0.747088 | 0.704148 | 0.718663 | 0.750755 | 0.799825 | 0.852017 | 0.898859 | 1 | 0.912216 | 0.779537 | 0.692884 | 0.592249 | 0.544098 | 0.4966 | 0.509 | 0.506027322 |
| 0.5 | 0.828368699 | 0.829104759 | 0.821562 | 0.774601 | 0.73359 | 0.680149 | 0.687588 | 0.706595 | 0.745446 | 0.797404 | 0.836911 | 0.912216 | 1 | 0.859745 | 0.771035 | 0.669907 | 0.613361 | 0.57 | 0.576 | 0.571250424 |
| 0.75 | 0.763950239 | 0.765778969 | 0.758681 | 0.718855 | 0.677078 | 0.611609 | 0.597823 | 0.597428 | 0.630345 | 0.674639 | 0.710408 | 0.779537 | 0.859745 | 1 | 0.902162 | 0.795205 | 0.72662 | 0.6812 | 0.667 | 0.655374301 |
| 1 | 0.722760307 | 0.724837978 | 0.719997 | 0.68232 | 0.646187 | 0.587528 | 0.565084 | 0.549003 | 0.574089 | 0.60167 | 0.625758 | 0.692884 | 0.771035 | 0.902162 | 1 | 0.887992 | 0.817055 | 0.761 | 0.745 | 0.73108239 |
| 1.5 | 0.659686342 | 0.662051813 | 0.660453 | 0.625396 | 0.594258 | 0.540721 | 0.513766 | 0.484237 | 0.49374 | 0.51424 | 0.535121 | 0.592249 | 0.669907 | 0.795205 | 0.887992 | 1 | 0.92283 | 0.8572 | 0.831 | 0.809468856 |
| 2 | 0.623523697 | 0.626517373 | 0.625641 | 0.593431 | 0.564439 | 0.512699 | 0.484133 | 0.452519 | 0.458652 | 0.478286 | 0.49189 | 0.544098 | 0.613361 | 0.72662 | 0.817055 | 0.92283 | 1 | 0.9156 | 0.879 | 0.853744134 |
| 3 | 0.578022349 | 0.580657294 | 0.580648 | 0.554057 | 0.528142 | 0.484628 | 0.459356 | 0.434121 | 0.432889 | 0.443735 | 0.450844 | 0.4966 | 0.570018 | 0.68119 | 0.761037 | 0.857219 | 0.915587 | 1 | 0.94 | 0.903963483 |
| 4 | 0.592182531 | 0.594683198 | 0.59555 | 0.570828 | 0.543978 | 0.497488 | 0.477885 | 0.455476 | 0.444438 | 0.456459 | 0.463119 | 0.509034 | 0.575569 | 0.666814 | 0.745382 | 0.830666 | 0.879204 | 0.9397 | 1 | 0.958962824 |
| 5 | 0.5914732 | 0.593739727 | 0.595992 | 0.576777 | 0.548967 | 0.494109 | 0.472171 | 0.447166 | 0.432164 | 0.44916 | 0.460486 | 0.506027 | 0.57125 | 0.655374 | 0.731082 | 0.809469 | 0.853744 | 0.904 | 0.959 | 1 |



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# Total Correlation Coefficient Matrix (Crustal Strike-Slip)

## $SA_H$-$SA_V$

| H / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.828315755 | 0.829186766 | 0.830864 | 0.790923 | 0.754229 | 0.739875 | 0.723849 | 0.741166 | 0.745021 | 0.750781 | 0.750504 | 0.763842 | 0.771158 | 0.72133 | 0.667988 | 0.620412 | 0.551658 | 0.4442 | 0.401 | 0.426420218 |
| 0.01 | 0.828282239 | 0.829179559 | 0.830844 | 0.790826 | 0.754093 | 0.739745 | 0.723739 | 0.741139 | 0.744993 | 0.750712 | 0.750381 | 0.763649 | 0.771077 | 0.721405 | 0.668226 | 0.620729 | 0.552033 | 0.4448 | 0.402 | 0.426994635 |
| 0.02 | 0.827767543 | 0.828668609 | 0.831056 | 0.79115 | 0.754356 | 0.739327 | 0.722313 | 0.739095 | 0.74327 | 0.748917 | 0.748156 | 0.761137 | 0.769347 | 0.721209 | 0.668856 | 0.622943 | 0.555533 | 0.4486 | 0.406 | 0.429922011 |
| 0.03 | 0.848165252 | 0.848287877 | 0.852275 | 0.831446 | 0.791859 | 0.769791 | 0.74314 | 0.740977 | 0.743022 | 0.747395 | 0.74781 | 0.759066 | 0.762268 | 0.711638 | 0.654372 | 0.610235 | 0.542905 | 0.4341 | 0.392 | 0.419988771 |
| 0.05 | 0.853371523 | 0.853426637 | 0.857867 | 0.833119 | 0.813148 | 0.792215 | 0.760921 | 0.745585 | 0.739778 | 0.742324 | 0.741896 | 0.748238 | 0.751441 | 0.697014 | 0.640585 | 0.600183 | 0.532419 | 0.4259 | 0.383 | 0.412080939 |
| 0.075 | 0.852199004 | 0.852241751 | 0.854657 | 0.826696 | 0.815475 | 0.809089 | 0.785215 | 0.760023 | 0.747735 | 0.743135 | 0.742729 | 0.743527 | 0.74144 | 0.672165 | 0.613996 | 0.569006 | 0.495755 | 0.3923 | 0.354 | 0.392237637 |
| 0.1 | 0.839785133 | 0.839582643 | 0.83965 | 0.809141 | 0.801541 | 0.804612 | 0.796264 | 0.77249 | 0.748948 | 0.73953 | 0.740376 | 0.739531 | 0.730404 | 0.64377 | 0.58115 | 0.536825 | 0.461156 | 0.3549 | 0.319 | 0.364301163 |
| 0.15 | 0.801738731 | 0.80196012 | 0.800516 | 0.760869 | 0.746036 | 0.753145 | 0.75515 | 0.780373 | 0.762713 | 0.749606 | 0.744609 | 0.739825 | 0.725554 | 0.638036 | 0.579739 | 0.539206 | 0.4752 | 0.3583 | 0.321 | 0.354346353 |
| 0.2 | 0.767395764 | 0.768179752 | 0.766119 | 0.72069 | 0.695463 | 0.698264 | 0.7018 | 0.756653 | 0.775392 | 0.753149 | 0.739847 | 0.733115 | 0.716648 | 0.634453 | 0.574924 | 0.534902 | 0.481006 | 0.366 | 0.322 | 0.335766465 |
| 0.25 | 0.746700736 | 0.747342275 | 0.744471 | 0.695663 | 0.66475 | 0.667761 | 0.671825 | 0.734475 | 0.758616 | 0.772063 | 0.763527 | 0.748698 | 0.723402 | 0.634843 | 0.573543 | 0.5202 | 0.464565 | 0.3602 | 0.323 | 0.339806826 |
| 0.3 | 0.736642857 | 0.73688512 | 0.73452 | 0.68549 | 0.651418 | 0.650955 | 0.653506 | 0.715877 | 0.747459 | 0.770308 | 0.782834 | 0.76886 | 0.734574 | 0.636224 | 0.575229 | 0.516107 | 0.45574 | 0.3643 | 0.341 | 0.355686101 |
| 0.4 | 0.735736641 | 0.735238672 | 0.734107 | 0.688764 | 0.651501 | 0.644454 | 0.638114 | 0.692812 | 0.724607 | 0.74964 | 0.763085 | 0.804094 | 0.778273 | 0.673316 | 0.610883 | 0.539153 | 0.478436 | 0.3749 | 0.343 | 0.356266326 |
| 0.5 | 0.726598937 | 0.72713217 | 0.726399 | 0.678609 | 0.633488 | 0.617306 | 0.608351 | 0.656988 | 0.688112 | 0.714516 | 0.724713 | 0.78111 | 0.806251 | 0.734991 | 0.676883 | 0.595902 | 0.525758 | 0.4227 | 0.386 | 0.403610298 |
| 0.75 | 0.663918876 | 0.666073838 | 0.668337 | 0.615817 | 0.559193 | 0.533772 | 0.514854 | 0.561402 | 0.583534 | 0.609871 | 0.6227 | 0.684251 | 0.747044 | 0.813673 | 0.771593 | 0.683056 | 0.607199 | 0.5206 | 0.48 | 0.47914561 |
| 1 | 0.626345615 | 0.629921086 | 0.632542 | 0.575107 | 0.513472 | 0.48876 | 0.466977 | 0.517379 | 0.535619 | 0.564334 | 0.573734 | 0.623806 | 0.706151 | 0.810124 | 0.824152 | 0.763418 | 0.697073 | 0.6125 | 0.556 | 0.543328385 |
| 1.5 | 0.568349693 | 0.572397947 | 0.578065 | 0.525601 | 0.4676 | 0.445953 | 0.422418 | 0.465548 | 0.474901 | 0.491929 | 0.489578 | 0.537014 | 0.615823 | 0.742445 | 0.793493 | 0.824766 | 0.788306 | 0.6932 | 0.613 | 0.573633256 |
| 2 | 0.500811206 | 0.505300161 | 0.512675 | 0.462951 | 0.407345 | 0.385594 | 0.357321 | 0.404801 | 0.417714 | 0.423787 | 0.416533 | 0.458954 | 0.528668 | 0.667354 | 0.737186 | 0.807035 | 0.828425 | 0.7393 | 0.643 | 0.573950816 |
| 3 | 0.415914735 | 0.422602341 | 0.428616 | 0.375094 | 0.319561 | 0.293064 | 0.265178 | 0.320118 | 0.336897 | 0.343068 | 0.333048 | 0.362659 | 0.440795 | 0.595687 | 0.683287 | 0.773319 | 0.818719 | 0.8161 | 0.728 | 0.639715827 |
| 4 | 0.397763133 | 0.405632552 | 0.410435 | 0.351779 | 0.294542 | 0.267253 | 0.24171 | 0.305557 | 0.331961 | 0.339466 | 0.328649 | 0.346495 | 0.414562 | 0.564333 | 0.653286 | 0.734028 | 0.789004 | 0.8247 | 0.794 | 0.722402756 |
| 5 | 0.392977048 | 0.40124585 | 0.406138 | 0.346213 | 0.291313 | 0.269405 | 0.247433 | 0.308504 | 0.319384 | 0.327722 | 0.317915 | 0.331213 | 0.391453 | 0.526346 | 0.603171 | 0.691428 | 0.748047 | 0.796 | 0.806 | 0.761789974 |



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# Total Correlation Coefficient Matrix (Crustal Strike-Slip)

## $SA_H$-$SA_H$

| H / H | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999998993 | 0.999858 | 0.988313 | 0.982619 | 0.972373 | 0.956578 | 0.948367 | 0.934437 | 0.92163 | 0.909209 | 0.908799 | 0.910172 | 0.858658 | 0.817483 | 0.755052 | 0.694219 | 0.5991 | 0.564 | 0.535569821 |
| 0.01 | 0.999998993 | 1 | 0.999867 | 0.988293 | 0.982611 | 0.97236 | 0.956535 | 0.948306 | 0.93437 | 0.921532 | 0.909079 | 0.908632 | 0.910105 | 0.858726 | 0.817674 | 0.755317 | 0.694522 | 0.5996 | 0.565 | 0.536179419 |
| 0.02 | 0.999857557 | 0.999866774 | 1 | 0.988726 | 0.983133 | 0.972156 | 0.955407 | 0.94669 | 0.932788 | 0.919549 | 0.907058 | 0.906778 | 0.908842 | 0.859087 | 0.818933 | 0.758052 | 0.698208 | 0.6037 | 0.569 | 0.54077018 |
| 0.03 | 0.988312653 | 0.988293388 | 0.988726 | 1 | 0.988198 | 0.971056 | 0.948578 | 0.930045 | 0.911547 | 0.895372 | 0.882856 | 0.883863 | 0.884246 | 0.83046 | 0.789932 | 0.732845 | 0.675299 | 0.5783 | 0.542 | 0.514588134 |
| 0.05 | 0.982619202 | 0.982611187 | 0.983133 | 0.988198 | 1 | 0.985715 | 0.96305 | 0.934523 | 0.9073 | 0.886807 | 0.872928 | 0.869103 | 0.866136 | 0.810946 | 0.771837 | 0.719288 | 0.66228 | 0.5671 | 0.531 | 0.506925306 |
| 0.075 | 0.972372631 | 0.972360084 | 0.972156 | 0.971056 | 0.985715 | 1 | 0.984485 | 0.946432 | 0.910456 | 0.885464 | 0.866861 | 0.857617 | 0.849011 | 0.783002 | 0.737702 | 0.682455 | 0.622439 | 0.5278 | 0.494 | 0.47378336 |
| 0.1 | 0.956578467 | 0.956534955 | 0.955407 | 0.948578 | 0.96305 | 0.984485 | 1 | 0.961744 | 0.915983 | 0.887539 | 0.86411 | 0.846884 | 0.829814 | 0.74985 | 0.699513 | 0.643159 | 0.581592 | 0.4826 | 0.452 | 0.436052169 |
| 0.15 | 0.948366697 | 0.948306188 | 0.94669 | 0.930045 | 0.934523 | 0.946432 | 0.961744 | 1 | 0.957105 | 0.929282 | 0.902749 | 0.876909 | 0.848546 | 0.759553 | 0.708633 | 0.651427 | 0.595753 | 0.495 | 0.464 | 0.446894774 |
| 0.2 | 0.934436995 | 0.934369744 | 0.932788 | 0.911547 | 0.9073 | 0.910456 | 0.915983 | 0.957105 | 1 | 0.961188 | 0.930525 | 0.892987 | 0.859649 | 0.769796 | 0.718853 | 0.659697 | 0.606125 | 0.5087 | 0.474 | 0.448886044 |
| 0.25 | 0.921629865 | 0.921531571 | 0.919549 | 0.895372 | 0.886807 | 0.885464 | 0.887539 | 0.929282 | 0.961188 | 1 | 0.966192 | 0.915731 | 0.874531 | 0.777407 | 0.723272 | 0.653299 | 0.594673 | 0.501 | 0.474 | 0.449129341 |
| 0.3 | 0.909208666 | 0.909078823 | 0.907058 | 0.882856 | 0.872928 | 0.866861 | 0.86411 | 0.902749 | 0.930525 | 0.966192 | 1 | 0.939809 | 0.889672 | 0.783937 | 0.728865 | 0.653242 | 0.593472 | 0.5056 | 0.487 | 0.466048405 |
| 0.4 | 0.908799353 | 0.908631575 | 0.906778 | 0.883863 | 0.869103 | 0.857617 | 0.846884 | 0.876909 | 0.892987 | 0.915731 | 0.939809 | 1 | 0.946949 | 0.832573 | 0.764421 | 0.680467 | 0.616822 | 0.5221 | 0.495 | 0.464470378 |
| 0.5 | 0.910172165 | 0.910104932 | 0.908842 | 0.884246 | 0.866136 | 0.849011 | 0.829814 | 0.848546 | 0.859649 | 0.874531 | 0.889672 | 0.946949 | 1 | 0.90107 | 0.840082 | 0.747312 | 0.674391 | 0.5861 | 0.554 | 0.513292581 |
| 0.75 | 0.858658348 | 0.858725898 | 0.859087 | 0.83046 | 0.810946 | 0.783002 | 0.74985 | 0.759553 | 0.769796 | 0.777407 | 0.783937 | 0.832573 | 0.90107 | 1 | 0.942544 | 0.837959 | 0.769025 | 0.6934 | 0.66 | 0.609365027 |
| 1 | 0.817482631 | 0.817674079 | 0.818933 | 0.789932 | 0.771837 | 0.737702 | 0.699513 | 0.708633 | 0.718853 | 0.723272 | 0.728865 | 0.764421 | 0.840082 | 0.942544 | 1 | 0.920686 | 0.85898 | 0.7832 | 0.738 | 0.681584488 |
| 1.5 | 0.755051627 | 0.755316567 | 0.758052 | 0.732845 | 0.719288 | 0.682455 | 0.643159 | 0.651427 | 0.659697 | 0.653299 | 0.653242 | 0.680467 | 0.747312 | 0.837959 | 0.920686 | 1 | 0.948815 | 0.8682 | 0.808 | 0.748388686 |
| 2 | 0.694218832 | 0.694521774 | 0.698208 | 0.675299 | 0.66228 | 0.622439 | 0.581592 | 0.595753 | 0.606125 | 0.594673 | 0.593472 | 0.616822 | 0.674391 | 0.769025 | 0.85898 | 0.948815 | 1 | 0.9211 | 0.858 | 0.798743847 |
| 3 | 0.599117672 | 0.599587131 | 0.603717 | 0.578311 | 0.567148 | 0.527826 | 0.482632 | 0.495023 | 0.508685 | 0.501008 | 0.505565 | 0.52214 | 0.586145 | 0.693404 | 0.783248 | 0.868213 | 0.921094 | 1 | 0.94 | 0.873464095 |
| 4 | 0.564113966 | 0.564665247 | 0.568952 | 0.54177 | 0.531326 | 0.494334 | 0.451583 | 0.463938 | 0.474068 | 0.473825 | 0.486772 | 0.49508 | 0.554481 | 0.660074 | 0.737947 | 0.807642 | 0.858077 | 0.94 | 1 | 0.954813213 |
| 5 | 0.535569821 | 0.536179419 | 0.54077 | 0.514588 | 0.506925 | 0.473783 | 0.436052 | 0.446895 | 0.448886 | 0.449129 | 0.466048 | 0.46447 | 0.513293 | 0.609365 | 0.681584 | 0.748389 | 0.798744 | 0.8735 | 0.955 | 1 |



doi:10.6342/NTU202303258

# Total Correlation Coefficient Matrix (Crustal Strike-Slip)

## SAv-SAv

| V / V | 0 | 0.01 | 0.02 | 0.03 | 0.05 | 0.075 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.999757162 | 0.998742 | 0.973237 | 0.940943 | 0.921969 | 0.902691 | 0.877727 | 0.849883 | 0.85041 | 0.852592 | 0.843186 | 0.832701 | 0.734626 | 0.663011 | 0.583321 | 0.484343 | 0.4062 | 0.382 | 0.443644807 |
| 0.01 | 0.999757162 | 1 | 0.998247 | 0.971215 | 0.938089 | 0.919431 | 0.900999 | 0.878717 | 0.851532 | 0.851525 | 0.852769 | 0.84212 | 0.832782 | 0.736886 | 0.66737 | 0.587999 | 0.489703 | 0.413 | 0.39 | 0.450361513 |
| 0.02 | 0.998742071 | 0.998247026 | 1 | 0.975364 | 0.943093 | 0.922045 | 0.899439 | 0.871254 | 0.843154 | 0.843529 | 0.845561 | 0.836725 | 0.828152 | 0.734753 | 0.664747 | 0.589166 | 0.493566 | 0.4164 | 0.393 | 0.452464955 |
| 0.03 | 0.973236983 | 0.971215191 | 0.975364 | 1 | 0.962468 | 0.925863 | 0.887874 | 0.830539 | 0.796529 | 0.79733 | 0.8023 | 0.790878 | 0.776442 | 0.682335 | 0.60657 | 0.535214 | 0.447747 | 0.3667 | 0.344 | 0.407698105 |
| 0.05 | 0.940943176 | 0.938088567 | 0.943093 | 0.962468 | 1 | 0.958231 | 0.902926 | 0.806378 | 0.758159 | 0.752497 | 0.758099 | 0.745932 | 0.726954 | 0.618304 | 0.539145 | 0.474233 | 0.389467 | 0.3116 | 0.285 | 0.350618604 |
| 0.075 | 0.921968764 | 0.919431017 | 0.922045 | 0.925863 | 0.958231 | 1 | 0.944981 | 0.827951 | 0.763655 | 0.7508 | 0.753895 | 0.739585 | 0.714213 | 0.595096 | 0.51914 | 0.453295 | 0.366493 | 0.2886 | 0.263 | 0.335528553 |
| 0.1 | 0.902691206 | 0.900999077 | 0.899439 | 0.887874 | 0.902926 | 0.944981 | 1 | 0.877285 | 0.787822 | 0.762923 | 0.765364 | 0.744142 | 0.709402 | 0.571694 | 0.500489 | 0.430967 | 0.341604 | 0.2719 | 0.25 | 0.324973578 |
| 0.15 | 0.877727448 | 0.878716509 | 0.871254 | 0.830539 | 0.806378 | 0.827951 | 0.877285 | 1 | 0.899662 | 0.852476 | 0.825656 | 0.776963 | 0.743101 | 0.615985 | 0.554442 | 0.487772 | 0.401563 | 0.3346 | 0.31 | 0.366622372 |
| 0.2 | 0.849883259 | 0.851532386 | 0.843154 | 0.796529 | 0.758159 | 0.763655 | 0.787822 | 0.899662 | 1 | 0.917807 | 0.870532 | 0.807197 | 0.765469 | 0.626442 | 0.570285 | 0.492426 | 0.412489 | 0.3402 | 0.316 | 0.346819473 |
| 0.25 | 0.850409758 | 0.851524896 | 0.843529 | 0.79733 | 0.752497 | 0.7508 | 0.762923 | 0.852476 | 0.917807 | 1 | 0.935205 | 0.853252 | 0.805618 | 0.658701 | 0.59664 | 0.506746 | 0.418077 | 0.3461 | 0.33 | 0.369987608 |
| 0.3 | 0.852592146 | 0.852769252 | 0.845561 | 0.8023 | 0.758099 | 0.753895 | 0.765364 | 0.825656 | 0.870532 | 0.935205 | 1 | 0.89863 | 0.836817 | 0.678875 | 0.606915 | 0.500099 | 0.402056 | 0.3304 | 0.322 | 0.369436467 |
| 0.4 | 0.843185755 | 0.842119783 | 0.836725 | 0.790878 | 0.745932 | 0.739585 | 0.744142 | 0.776963 | 0.807197 | 0.853252 | 0.89863 | 1 | 0.918535 | 0.745609 | 0.65808 | 0.54268 | 0.433884 | 0.3501 | 0.332 | 0.377857067 |
| 0.5 | 0.832700805 | 0.832781637 | 0.828152 | 0.776442 | 0.726954 | 0.714213 | 0.709402 | 0.743101 | 0.765469 | 0.805618 | 0.836817 | 0.918535 | 1 | 0.839147 | 0.751921 | 0.624749 | 0.505989 | 0.4177 | 0.397 | 0.437832788 |
| 0.75 | 0.734625643 | 0.736886354 | 0.734753 | 0.682335 | 0.618304 | 0.595096 | 0.571694 | 0.615985 | 0.626442 | 0.658701 | 0.678875 | 0.745609 | 0.839147 | 1 | 0.901167 | 0.766526 | 0.647493 | 0.5568 | 0.522 | 0.528241312 |
| 1 | 0.663011148 | 0.667370437 | 0.664747 | 0.60657 | 0.539145 | 0.51914 | 0.500489 | 0.554442 | 0.570285 | 0.59664 | 0.606915 | 0.65808 | 0.751921 | 0.901167 | 1 | 0.861052 | 0.750046 | 0.6616 | 0.6 | 0.590174981 |
| 1.5 | 0.58332145 | 0.58799861 | 0.589166 | 0.535214 | 0.474233 | 0.453295 | 0.430967 | 0.487772 | 0.492426 | 0.506746 | 0.500099 | 0.54268 | 0.624749 | 0.766526 | 0.861052 | 1 | 0.881915 | 0.7765 | 0.69 | 0.656189848 |
| 2 | 0.484342637 | 0.489702725 | 0.493566 | 0.447747 | 0.389467 | 0.366493 | 0.341604 | 0.401563 | 0.412489 | 0.418077 | 0.402056 | 0.433884 | 0.505989 | 0.647493 | 0.750046 | 0.881915 | 1 | 0.852 | 0.752 | 0.681129126 |
| 3 | 0.406214231 | 0.413032239 | 0.41635 | 0.366664 | 0.311603 | 0.288621 | 0.271904 | 0.334559 | 0.340154 | 0.346085 | 0.330426 | 0.350058 | 0.417703 | 0.556806 | 0.661634 | 0.77647 | 0.851976 | 1 | 0.895 | 0.799629644 |
| 4 | 0.382325455 | 0.389647709 | 0.392593 | 0.343829 | 0.28472 | 0.262714 | 0.249963 | 0.31048 | 0.316062 | 0.330352 | 0.322137 | 0.332102 | 0.397415 | 0.521871 | 0.600487 | 0.690323 | 0.751712 | 0.8946 | 1 | 0.914424345 |
| 5 | 0.443644807 | 0.450361513 | 0.452465 | 0.407698 | 0.350619 | 0.335529 | 0.324974 | 0.366622 | 0.346819 | 0.369988 | 0.369436 | 0.377857 | 0.437833 | 0.528241 | 0.590175 | 0.65619 | 0.681129 | 0.7996 | 0.914 | 1 |



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