NGA-West 2 Database

Ancheta, T. D., Darragh, R. B., Stewart, J. P., Seyhan, E., Silva, W. J., Chiou, B. S. J., ... & Donahue, J. L. (2014). *Earthquake Spectra*, *30*(3), 989-1005.

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Date: 2024/12/13

Outline

1 Introduction and Objective
- What is the NGA-West2

2 Metadata Table
- Four main tables

3 Summary of Database

Introduction

- The NGA-West2 project is an **expansion of the NGA-West1 project** initiated in 2003 by the Pacific Earthquake Engineering Research Center (PEER).

- Primary goal is to improve ground motion prediction equations (GMPEs) for shallow crustal earthquakes in active tectonic regions. Providing **high-quality, processed ground motion data** for seismic research and engineering applications.

- This database is a strong ground motion database that **describe earthquake events** in active tectonic regions post-2000.

Objective

Improve some important research topics and ground motion issues remained unaddressed in NGA-West1 due to time constraints:

① Expanding the database scope

② Improving GMPE models for small-magnitude earthquakes

③ Improving uniformity in the metadata and increasing transparency in its development

Support updates to the U.S. National Seismic Hazard Maps and revise the building codes.

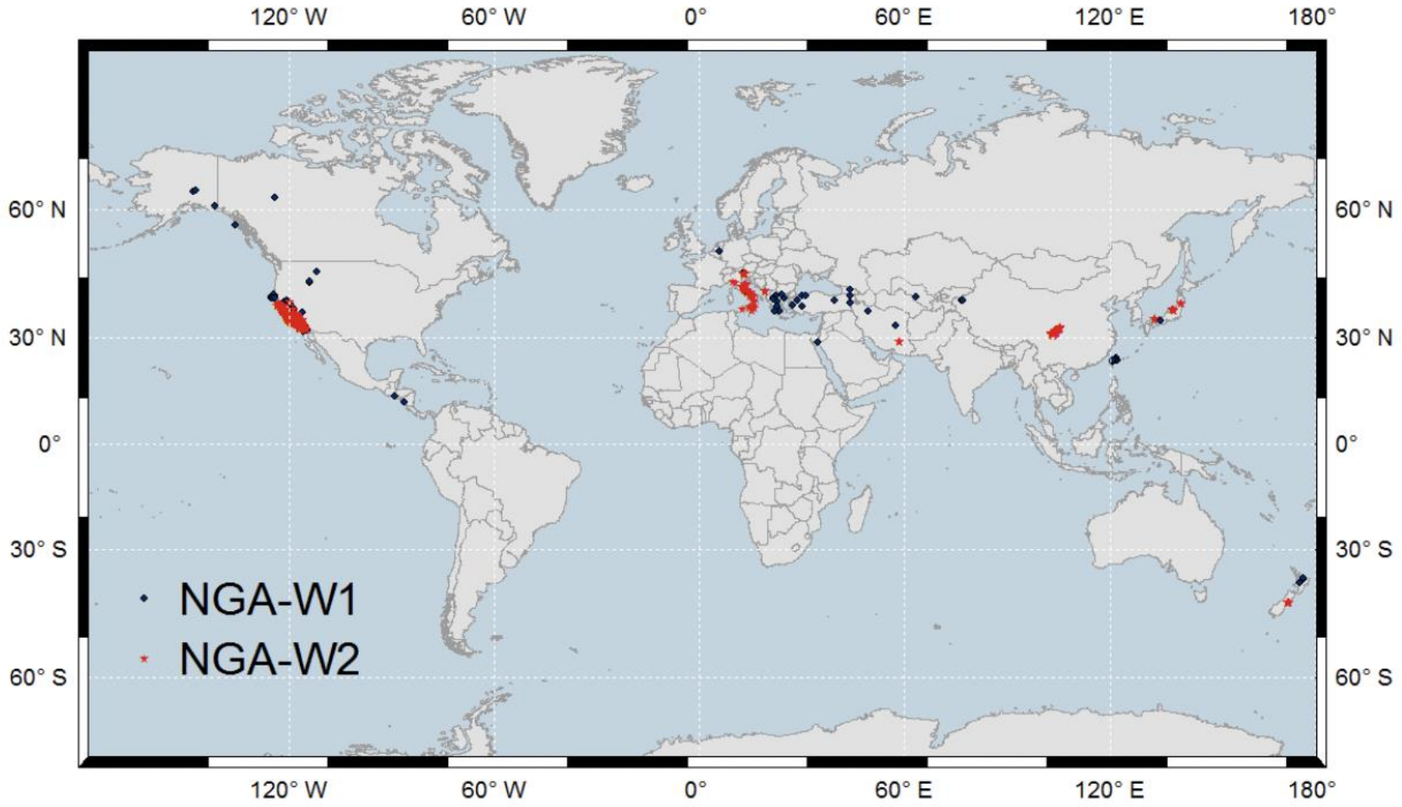
*Motivation

The lack of strong ground motion database for Taiwan in recent years.

Overview of Database

Combination of two datasets:

- Global and concentrates on relatively large **magnitude > 5** events
- **Small-to-moderate** (M3~5) magnitude events from California



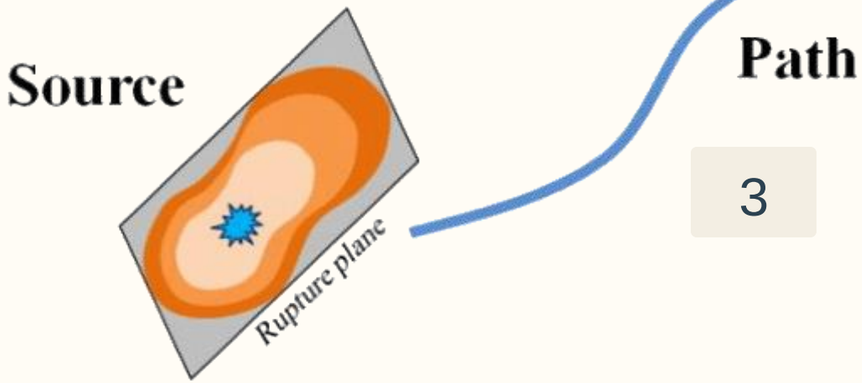
21336 three-component records from 599 events :

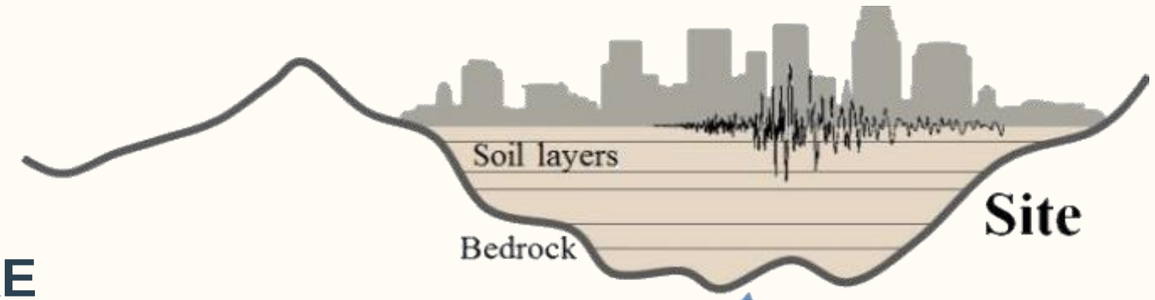
① 173 in NGA-West 1

② 160 added events in NGA-West 2

③ 266 small-to-moderate magnitude events from California

Metadata Tables





Path

1

EARTHQUAKE SOURCE

Basic Information of the earthquake.

2

SITE CONDITION

Environmental effects on seismic wave propagation at station.

3

PROPAGATION PATH

The propagation path of seismic wave from the source to the station.

4

RECORD CATALOG

The seismic wave recording received by the station during an earthquake.

(Schultz, Ryan & Nanometrics. 2019)

Earthquake Source Table

The earthquake source table provides crucial information on 599 seismic events. It includes details such as **moment magnitude**, **hypocenter location**, **fault rupture dimensions**, and **focal mechanisms**.

1

Event Identification

Unique EQID assigned to each earthquake for easy reference and tracking.

2

Event Classification

Class 1 earthquakes are mainshocks, triggered events, or foreshocks.
Class 2 earthquakes are aftershocks.

3

Mechanism Distribution

54% strike-slip, 19% normal-slip, 25% reverse-slip, and 2% unknown mechanisms.

Earthquake Source Table - Finite Fault Model

Finite fault model describes the earthquake source geometry in terms of plane within the Earth's crust. Defined by :

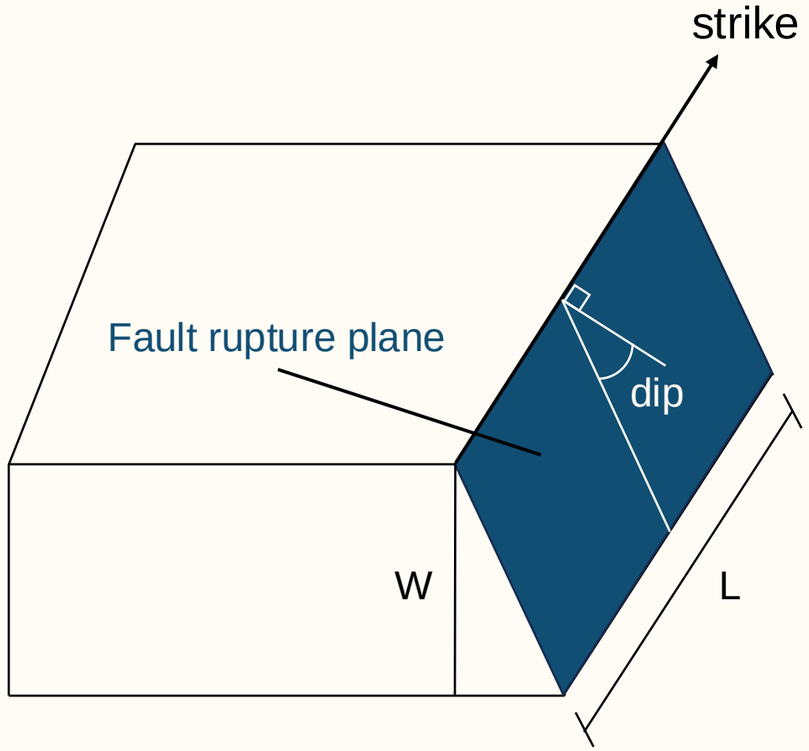
① **end points of the top edge of rupture(L)**

② **depth to the bottom edge of rupture(W)**

③ **fault dip angle**

④ **strike direction**

Help to realize the rupture situation of the event



Finite Fault Model

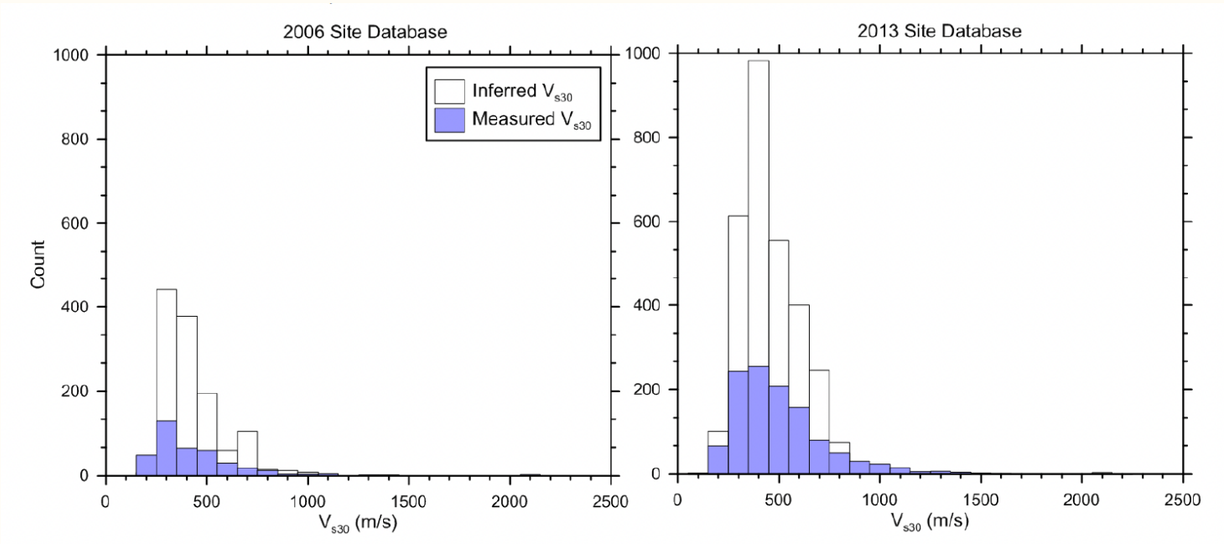
Site Condition Table

The Site Condition table includes **station coordinates**, **time-averaged shear wave velocity in the upper 30 m** (Vs30), and **basin depth parameters**(Z1.0, Z1.5, Z2.5).

Significant improvements from NGA-West 1 include:

1 **Increased Vs30 Measurements**

49% of sites now have Vs30 based on measurements, up from 24% in NGA-West 1.



2 **Updated Basin Depth Parameters**

Re-evaluated from updated 3D velocity models and shear wave velocity profiles.

*Z1.0: the depth in meters to shear-wave velocities of 1.0 km/sec

3 **Expanded VS30 Proxy Methods**

Utilizing geological and slope-based methods for estimation.

Propagation Path Table

Seismic waves attenuate with distance during propagation and are influenced by geological structures, such as the direction and depth of faults.

Six source-to-site distance:

① epicentral distance(R_{EPI})

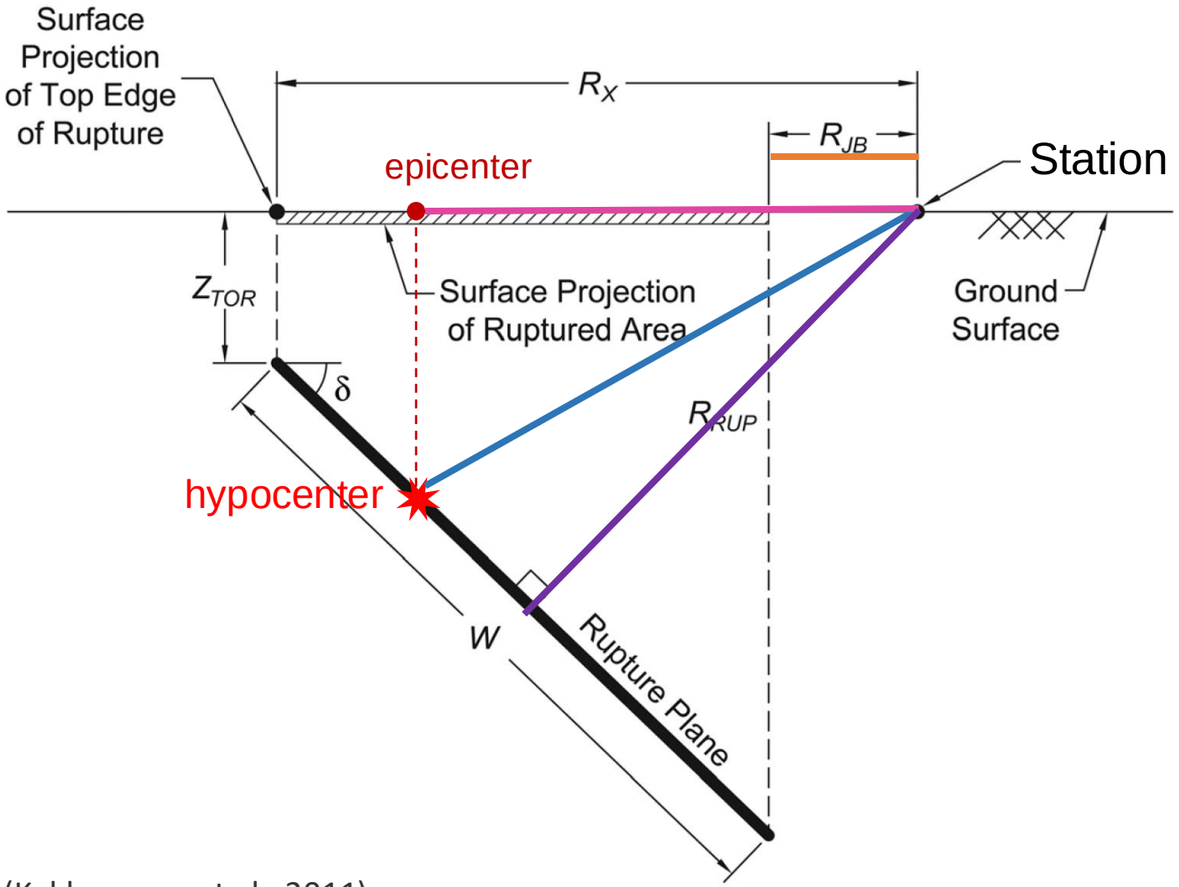
② hypocentral distance(R_{HYP})

③ shortest distance to rupture plane (R_{RUP})

④ Joyner-Boore distance (R_{JB})

⑤ distance perpendicular to fault strike (R_X)

⑥ distance parallel to fault strike (R_Y)



(Kaklamanos et al., 2011)

Record Catalog Table

The record catalog contains computed **ground motion intensity measures** (IMs) and **filter corner information** for each recording.

IMs:

① Peak ground acceleration (PGA)

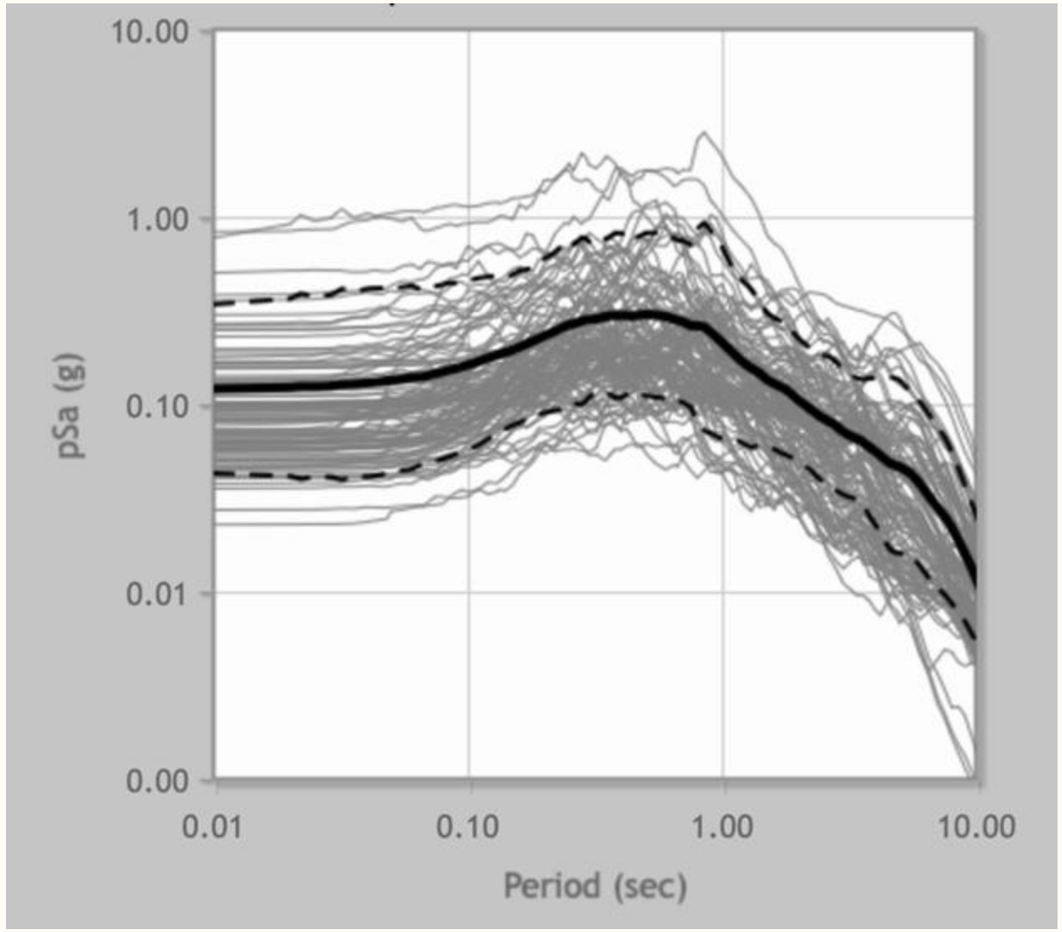
② Peak ground velocity (PGV)

③ Peak ground displacement (PGD)

④ Arias Intensities

⑤ Pseudo-spectrum accelerations (pSa)

(111 periods ranging from 0.01 to 20 sec)



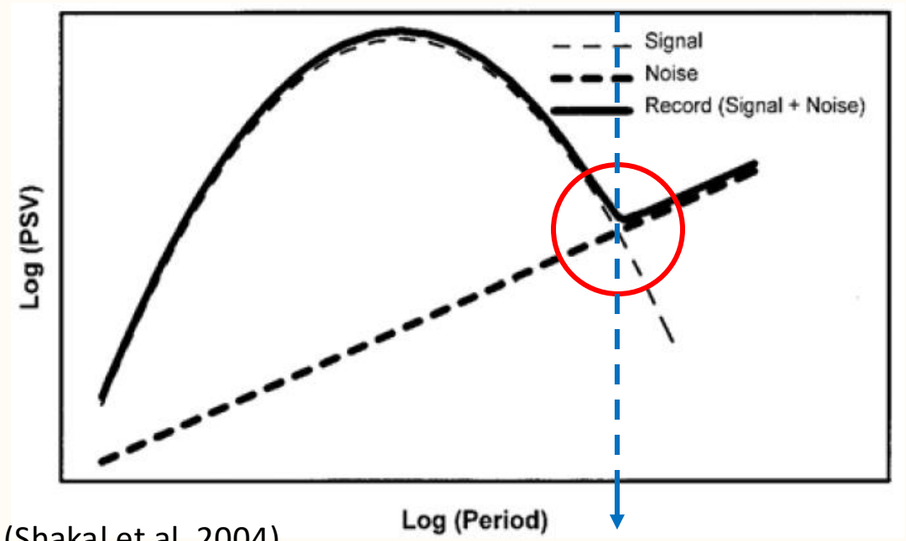
Record Catalog Table

The two major objectives in record processing are:

① Correction for the instrument response

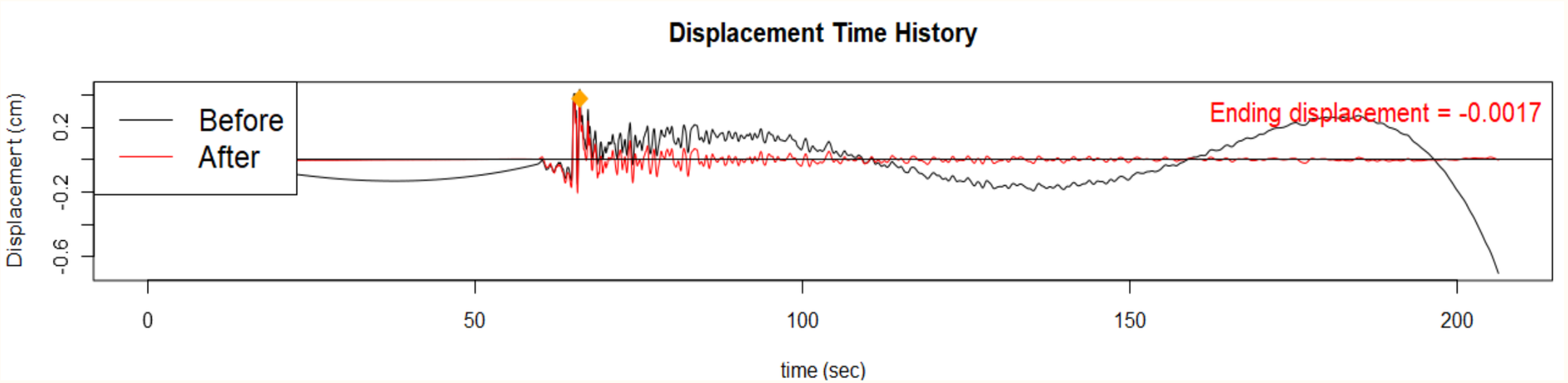
② Reduction of low- and high-frequency noise in the recorded time series

An acausal Butterworth filter was applied to the processing procedure.



(Shakal et al.,2004)

Cut the time series here



Summary of NGA-West2 Database

Over 21,000 ground motion recordings, covering earthquake events from **pre-1970 to post-2011**.

Magnitude Range : Moment magnitude (Mw) **3.0 to 8.0**

Depth Range : Focuses on shallow crustal events with depths up to **30 km**

Recording Stations : Data from over **1,800 strong-motion stations around the world**

Record Catalog : Ground motion data processed with consistent filtering and rotation techniques, including **PGA**, **PGV**, **PGD**, **Intensity**, and **pSa** spectrum.

Thanks for your attention