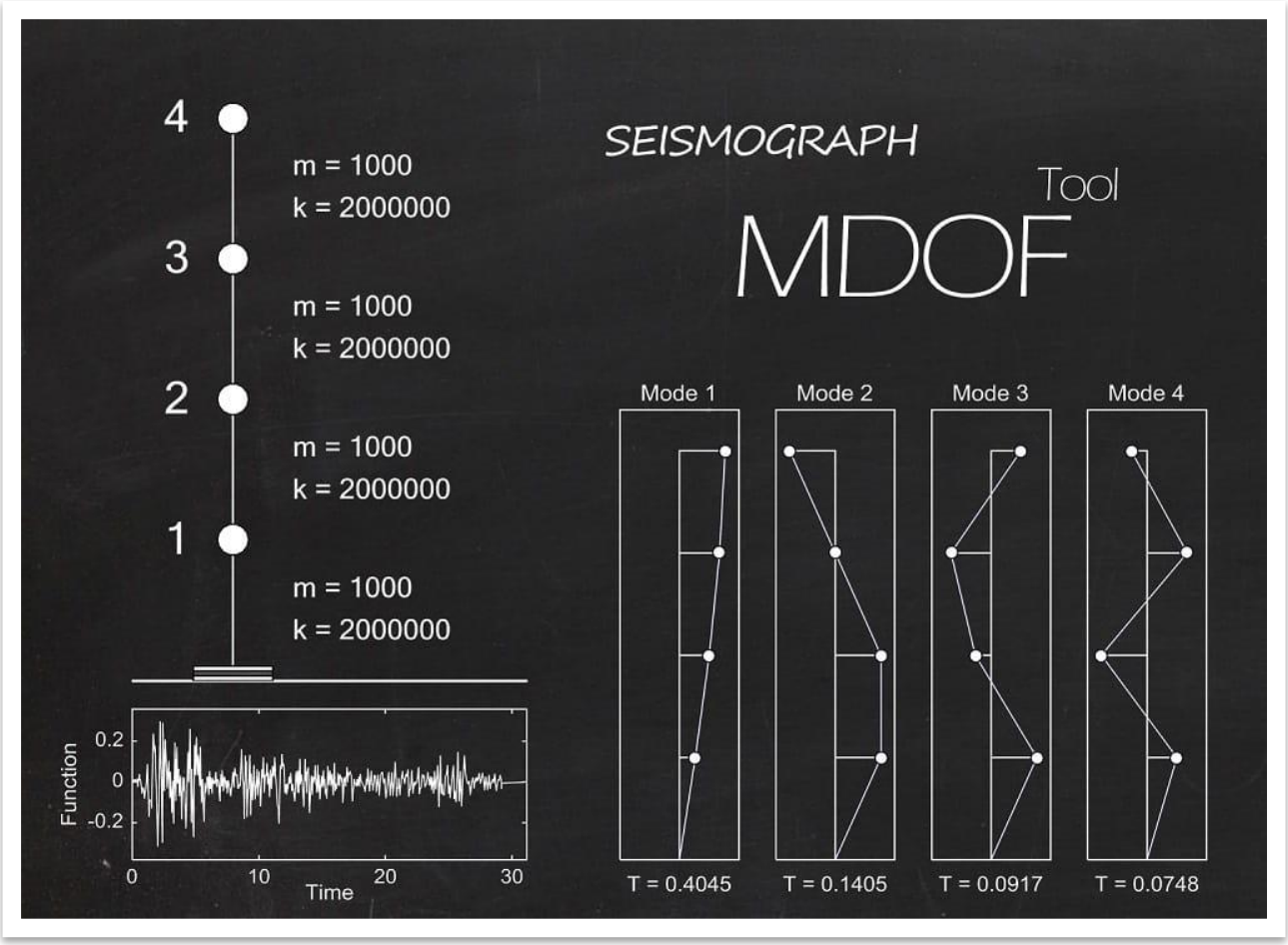
SEISMOGRAPH 2022

https://SEISMOGRAPH.me

Contents

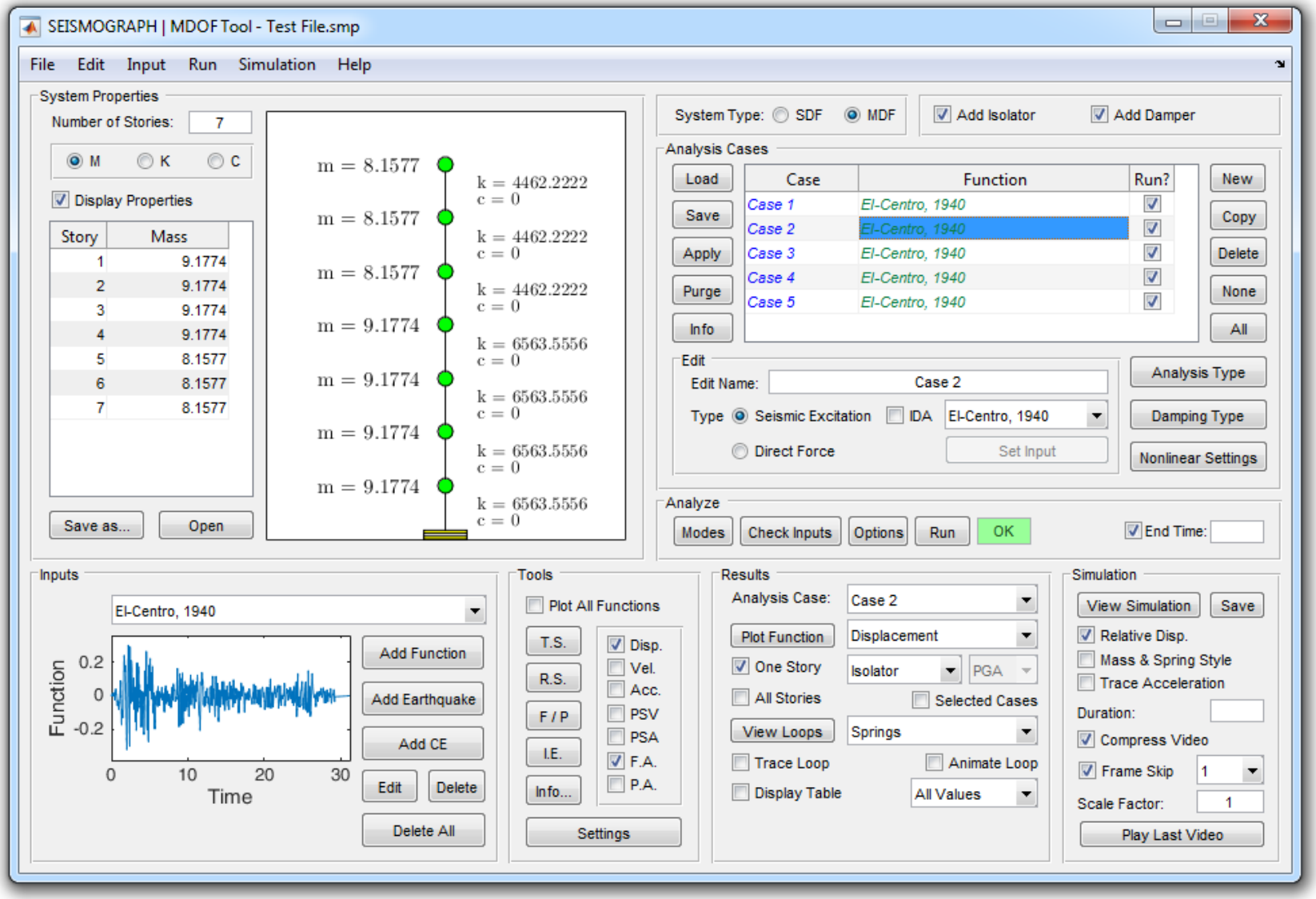
Dynamic Analysis of MDOF Systems



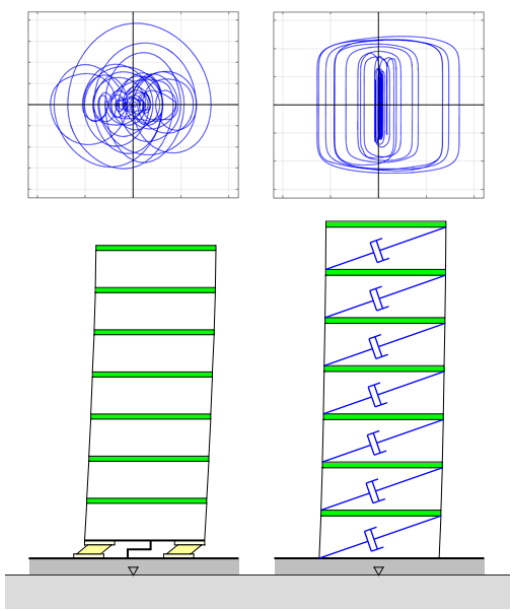
MDOF Analyzer: All In One!

- Linear / Nonlinear Analysis | Seismic Excitation / Direct Force
- Seismic Isolator (LRB - FPS - PF - HDR) / Viscous Damper/ General Bilinear Model
- Live Simulation
- Critical Excitation (Synthetic Earthquake)
- Built-in Scale Tool

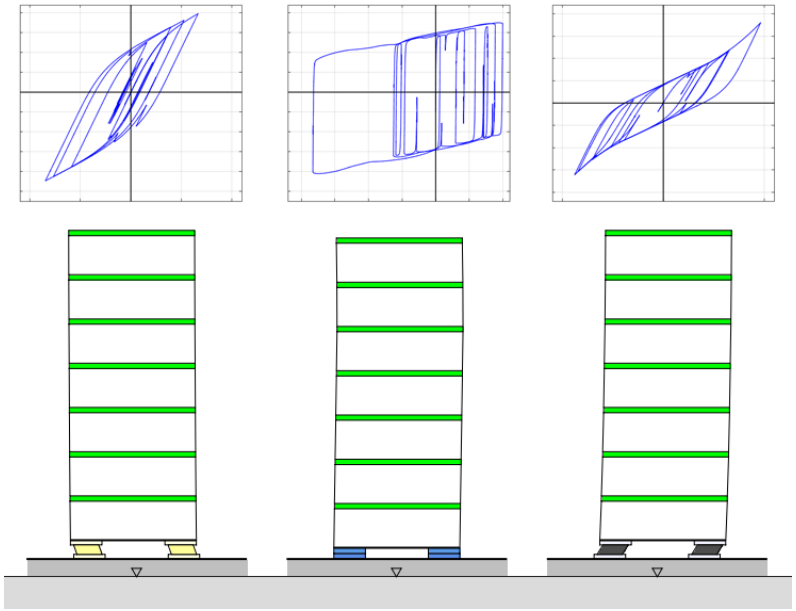
Seismograph MDOF Tool



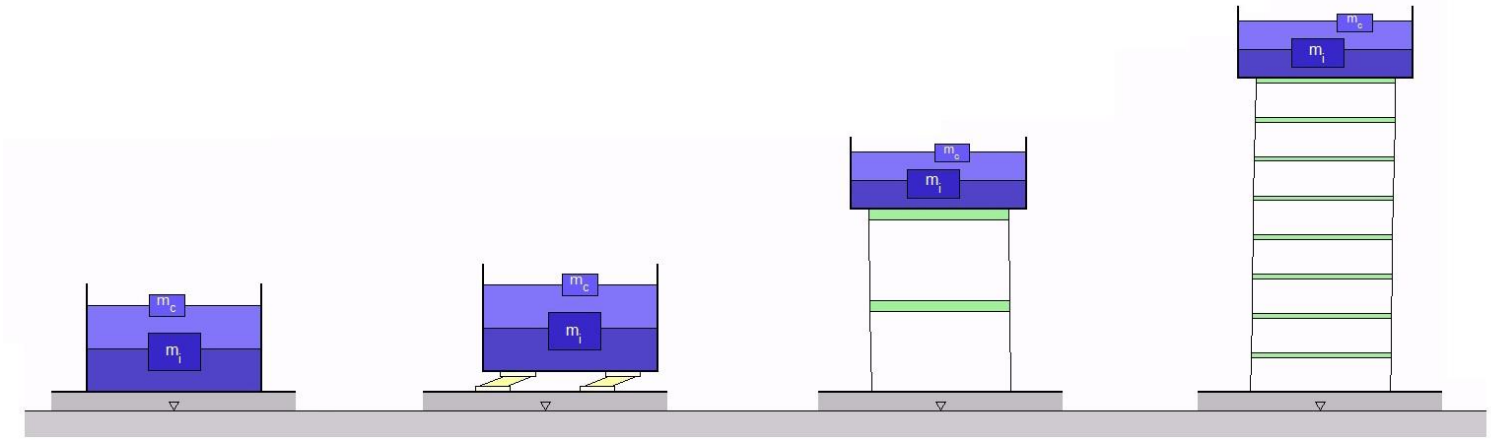
Modeling Tools



Viscous Damper

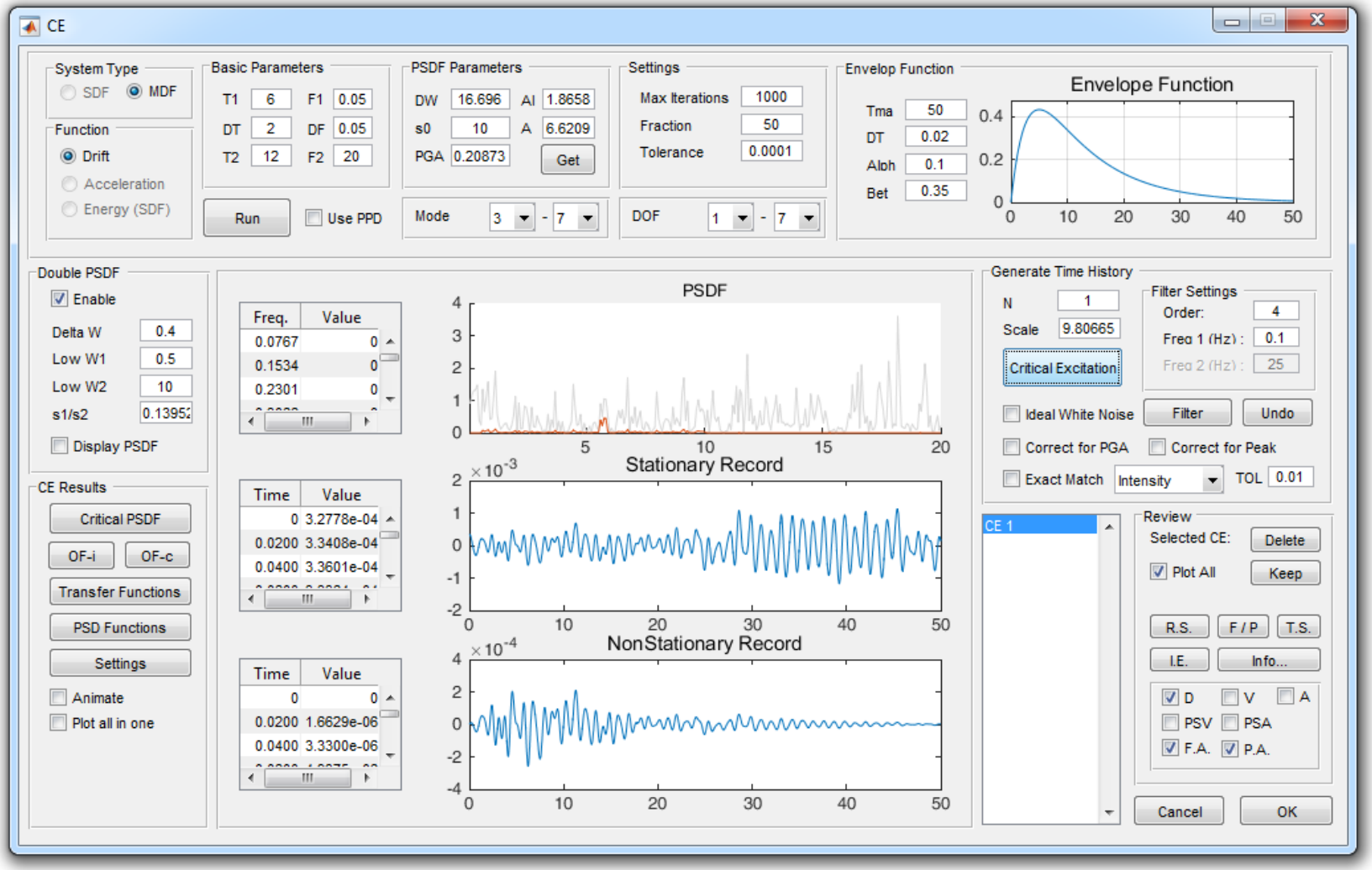


Base Isolator



Liquid Storage Tanks (Available in Seismograph LST Tool)

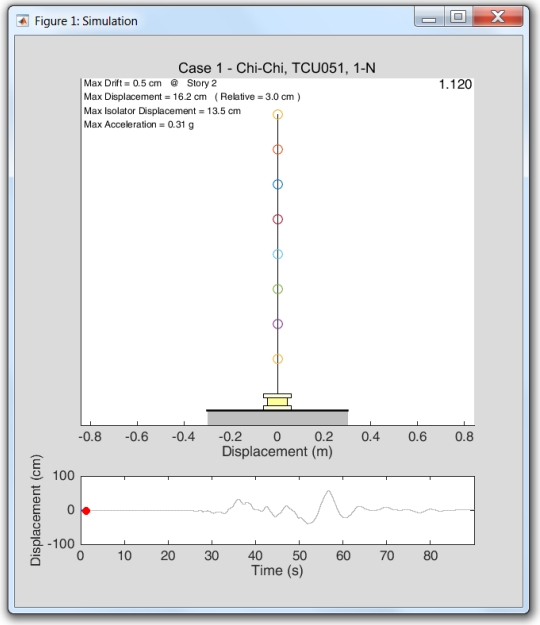
Critical Excitation (Synthetic Earthquake)



* Critical Excitation Tool

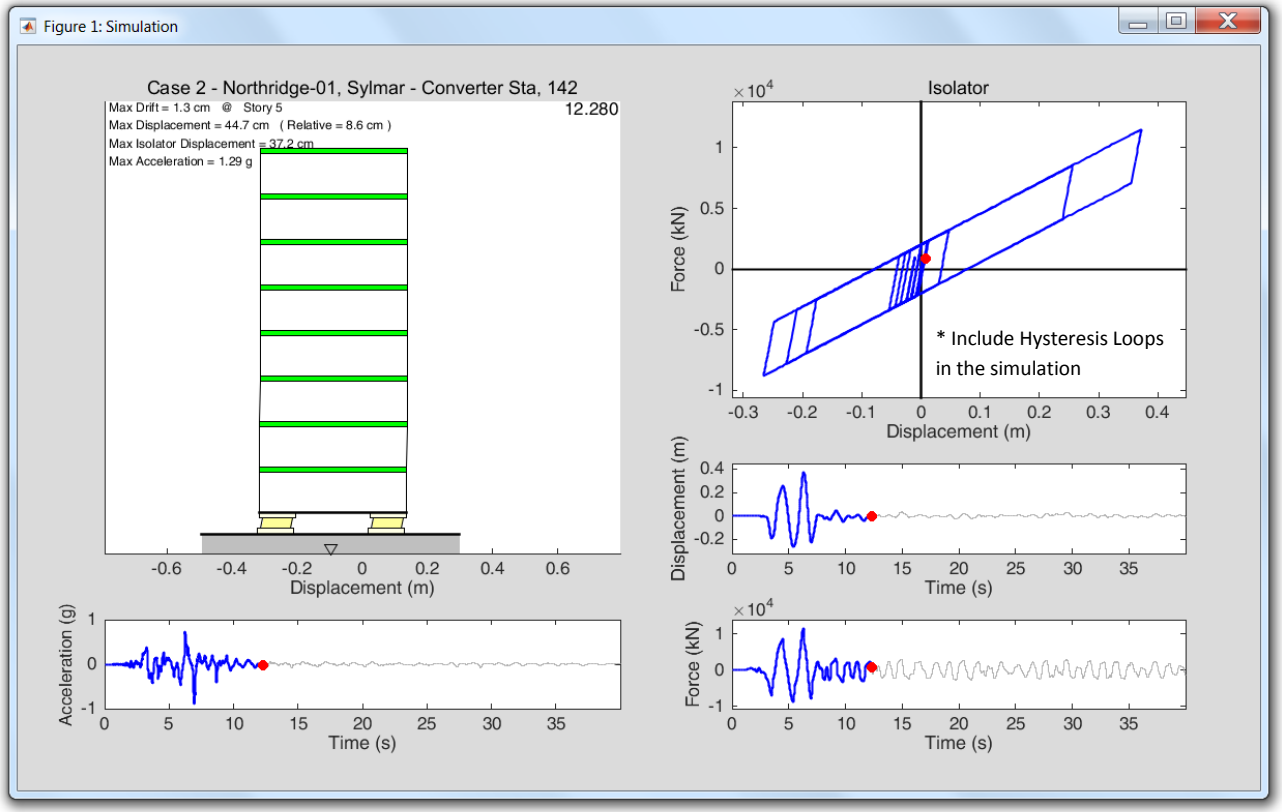
Live Simulation

* Basic ***Mass-Spring*** Style



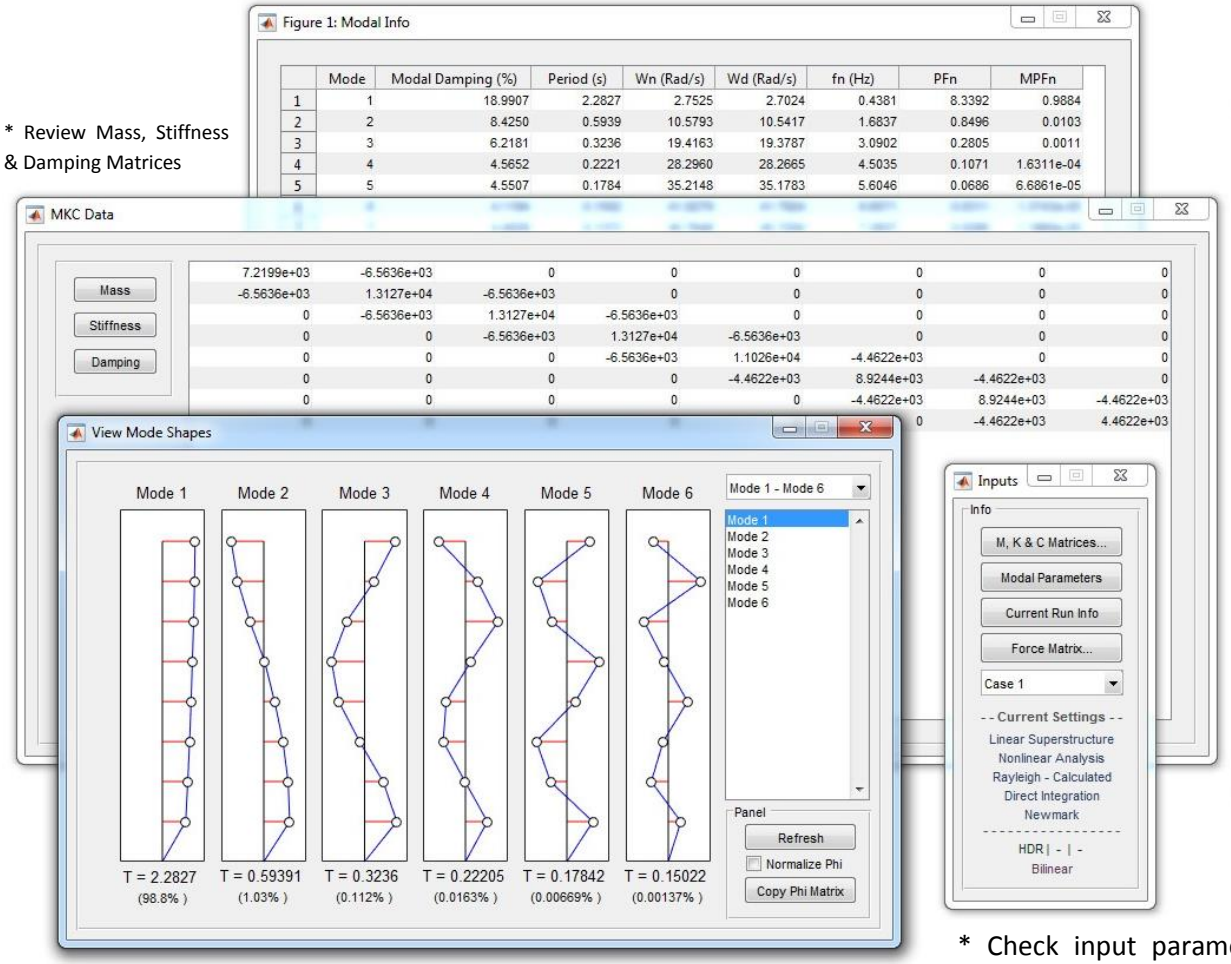
* Add ground motion displacement (or Acceleration) **Trace** to the simulation

* More detailed ***Frame-Like*** Style



Display & Edit Model Data

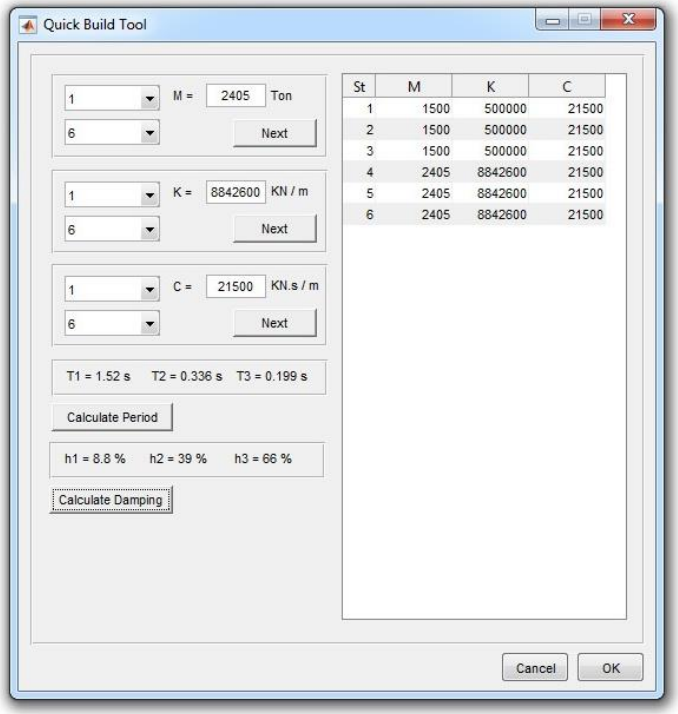
* Display **Modal Information** (*Period, Frequency, PFn, MPFn*, …)



* Review Mass, Stiffness & Damping Matrices

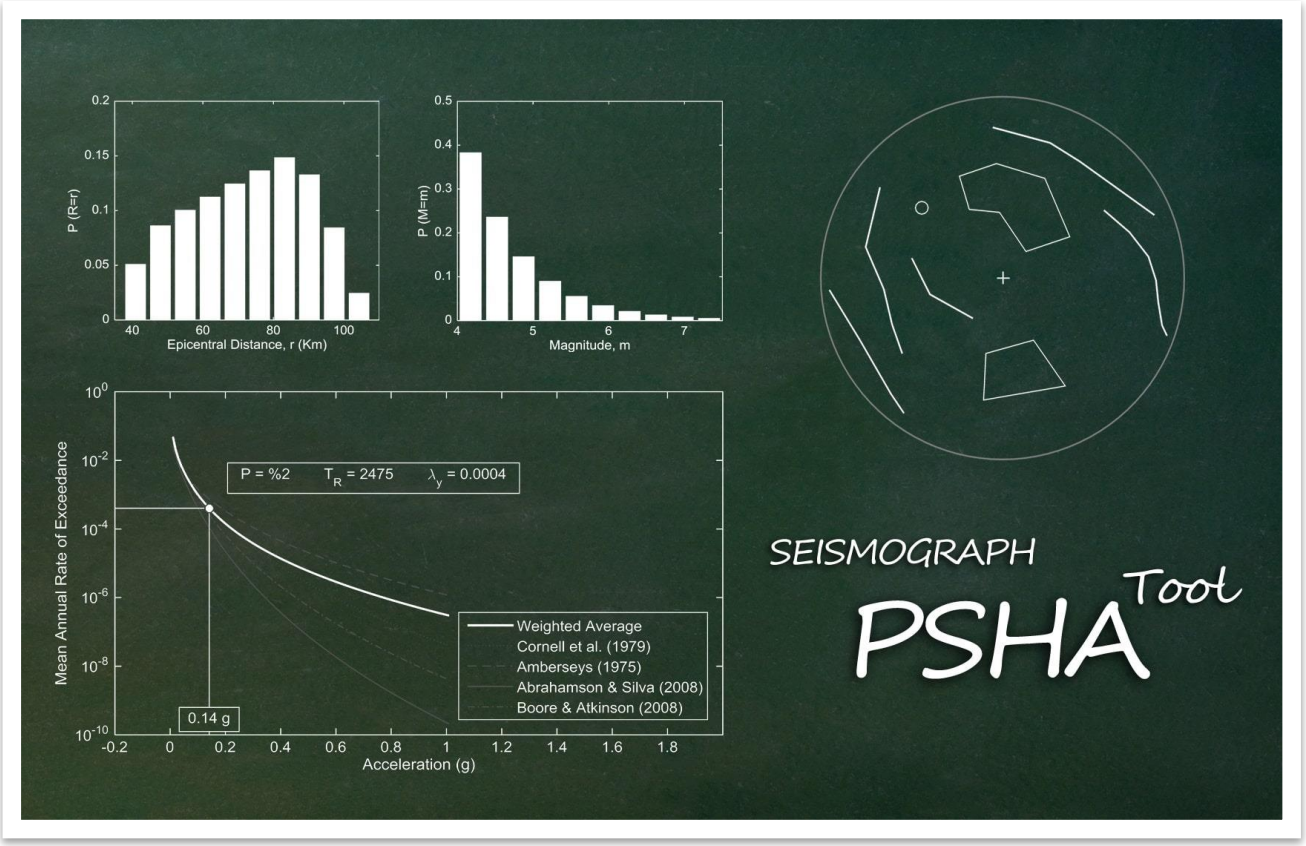
* Display **Mode Shapes**

* Quickly build model using the **Quick Build** Tool



* Check input parameters, force matrix and other settings before running the analysis.

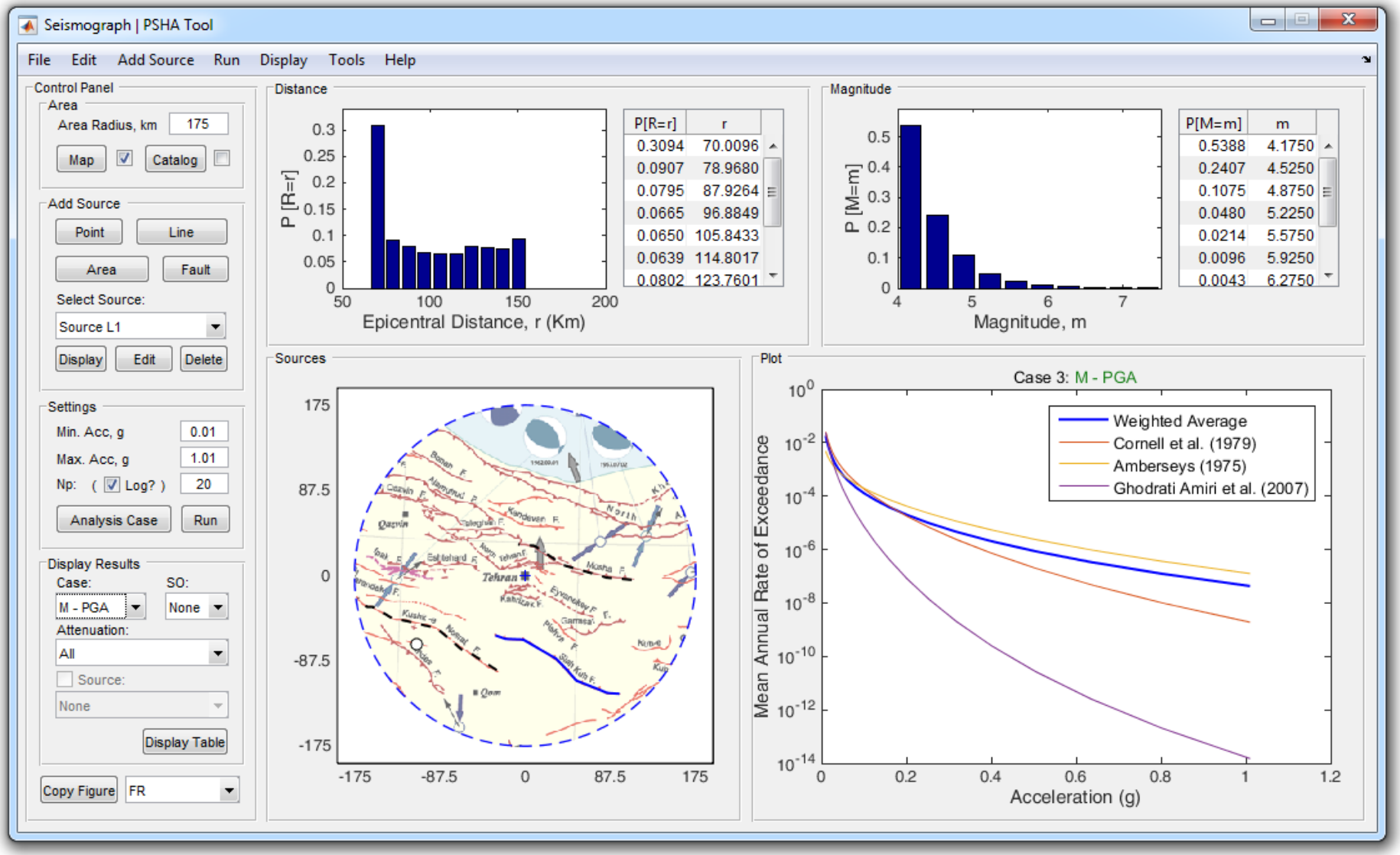
Probabilistic Seismic Hazard Analysis



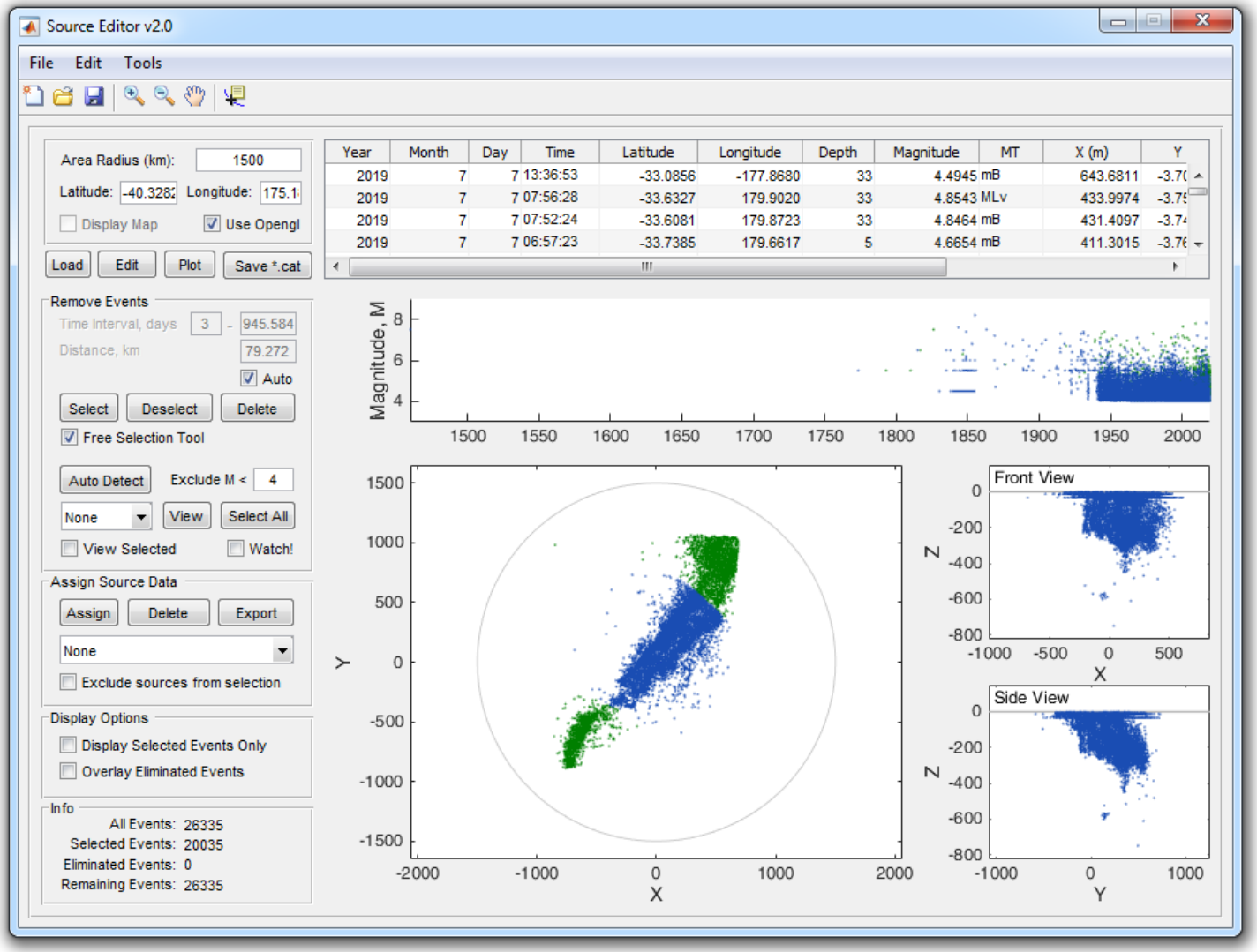
PSHA Tool: Site-Specific Probabilistic Seismic Hazard Analysis Package

- Site-Specific Probabilistic Seismic Hazard Analysis
- **22** Attenuation Models (Including **4 NGA Models**) / **Attenuation Plotter**
- 4 Source Types: Point / Line / Area / **3D Fault**
- Auto-Compute Magnitude and Distance Distributions
- 3 Analysis Cases: Single / Multiple / **Logic Tree**
- Hazard Curves / Uniform Hazard Spectrum / Deaggregation Tool
- Advanced **Source Editor** Tool: Magnitude Conversion / Declustering (Remove Foreshocks & Aftershocks)

Seismograph PSHA Tool

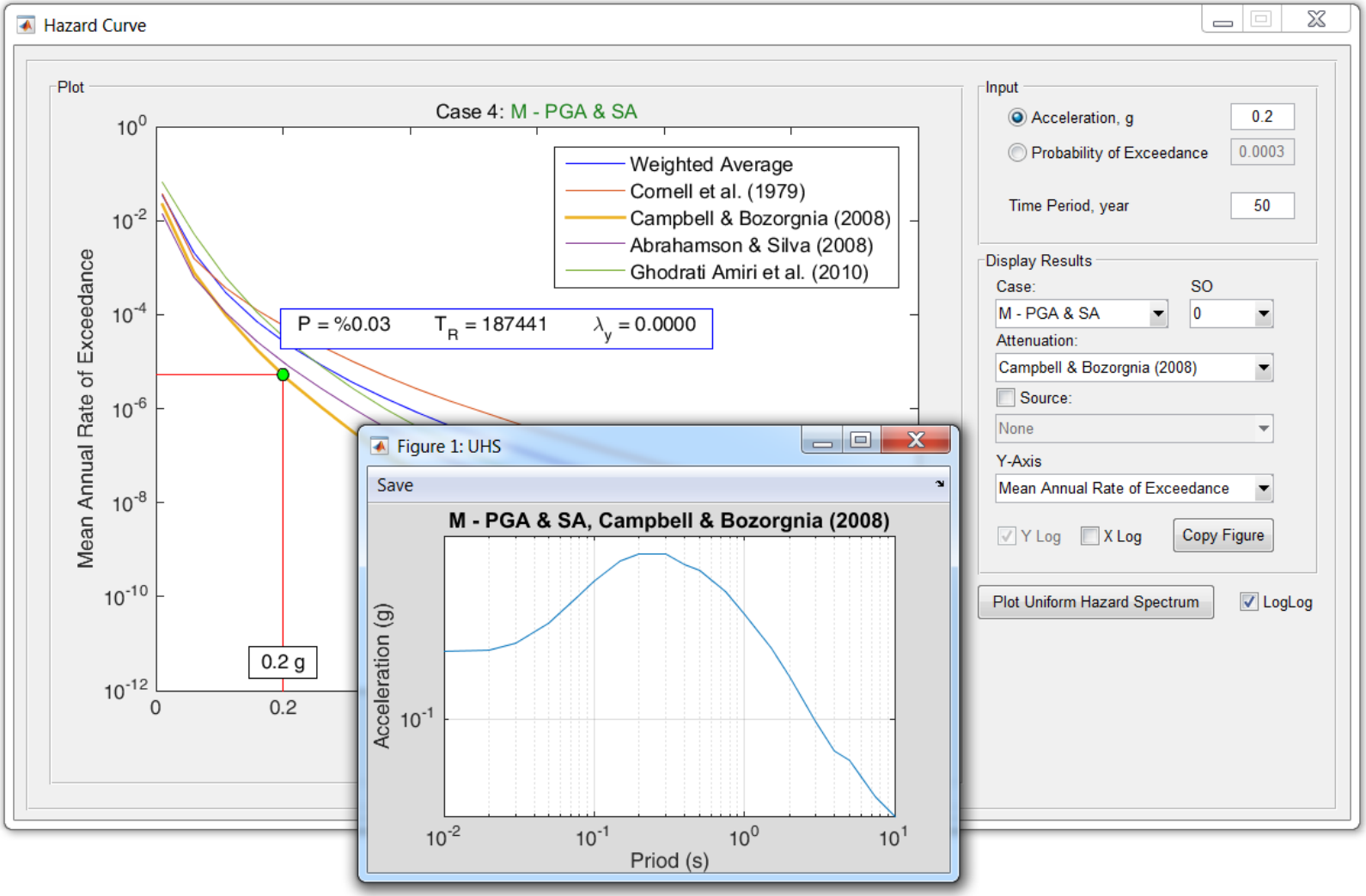


Advanced Source Editor (v2.0)



- Remove Foreshocks & Aftershocks
- Build sources by assigning events
- Export Sources Data into PSHA Tool
- Convert different Magnitude scales:
  - ML -> Mw (Shoja & Taheri, 2007)
  - MS -> Mw (EMME, 2011 – Scordilis, 2006)
  - mb -> Mw (Scordilis, 2006)
  - ML -> Ms (Gutenberg & Richter, 1956)
  - Mb -> Ms (Mirzaei, 2011 – Ambraseys & Melville, 1982)
  - mB -> Ms (Gutenberg & Richter, 1956)

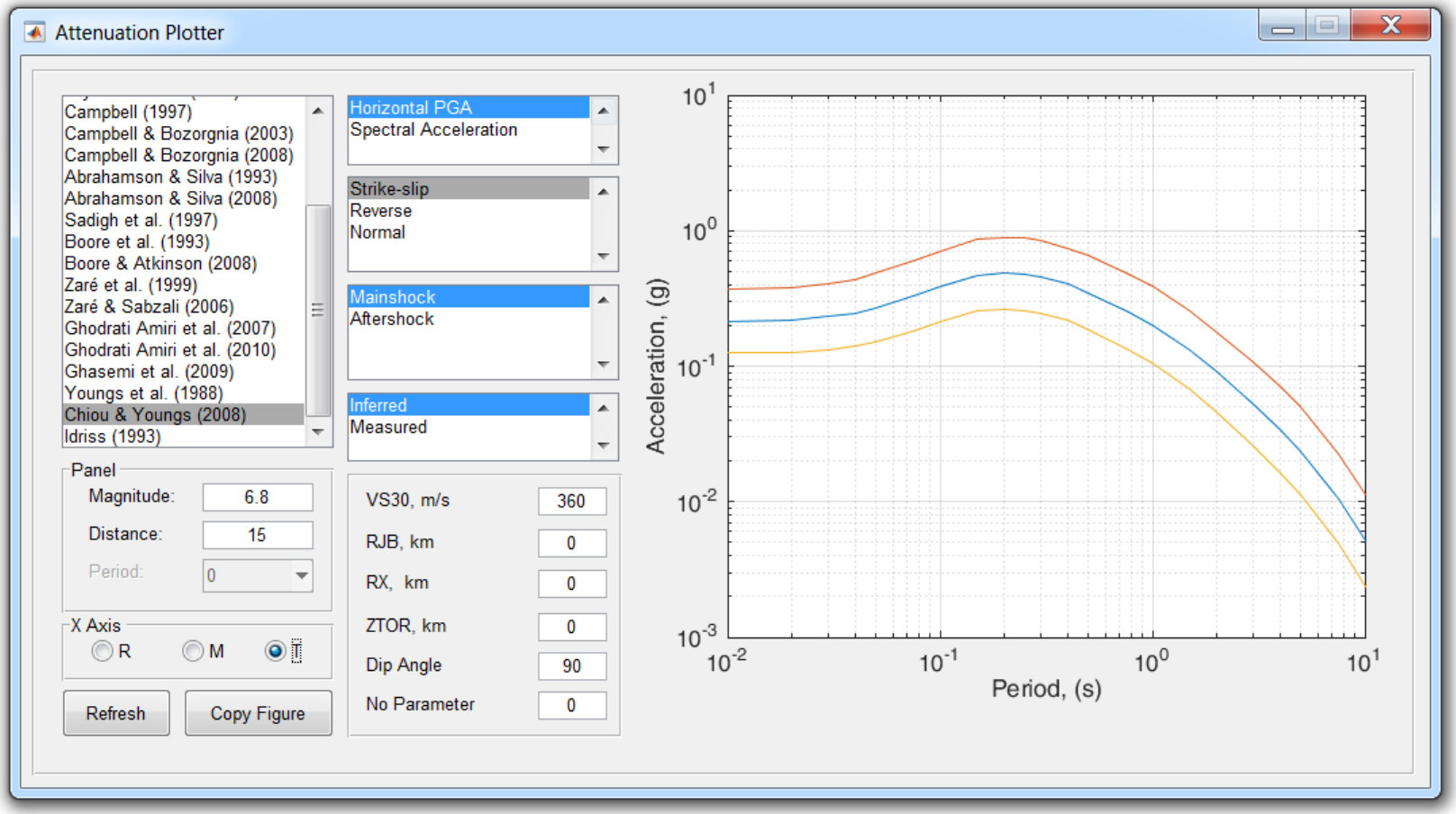
Hazard Curve & UHS



* Plot Uniform Hazard Spectrum for appropriate Attenuation Models.

* Review and compare Hazard Curves for different Attenuation Models and Seismic Sources.

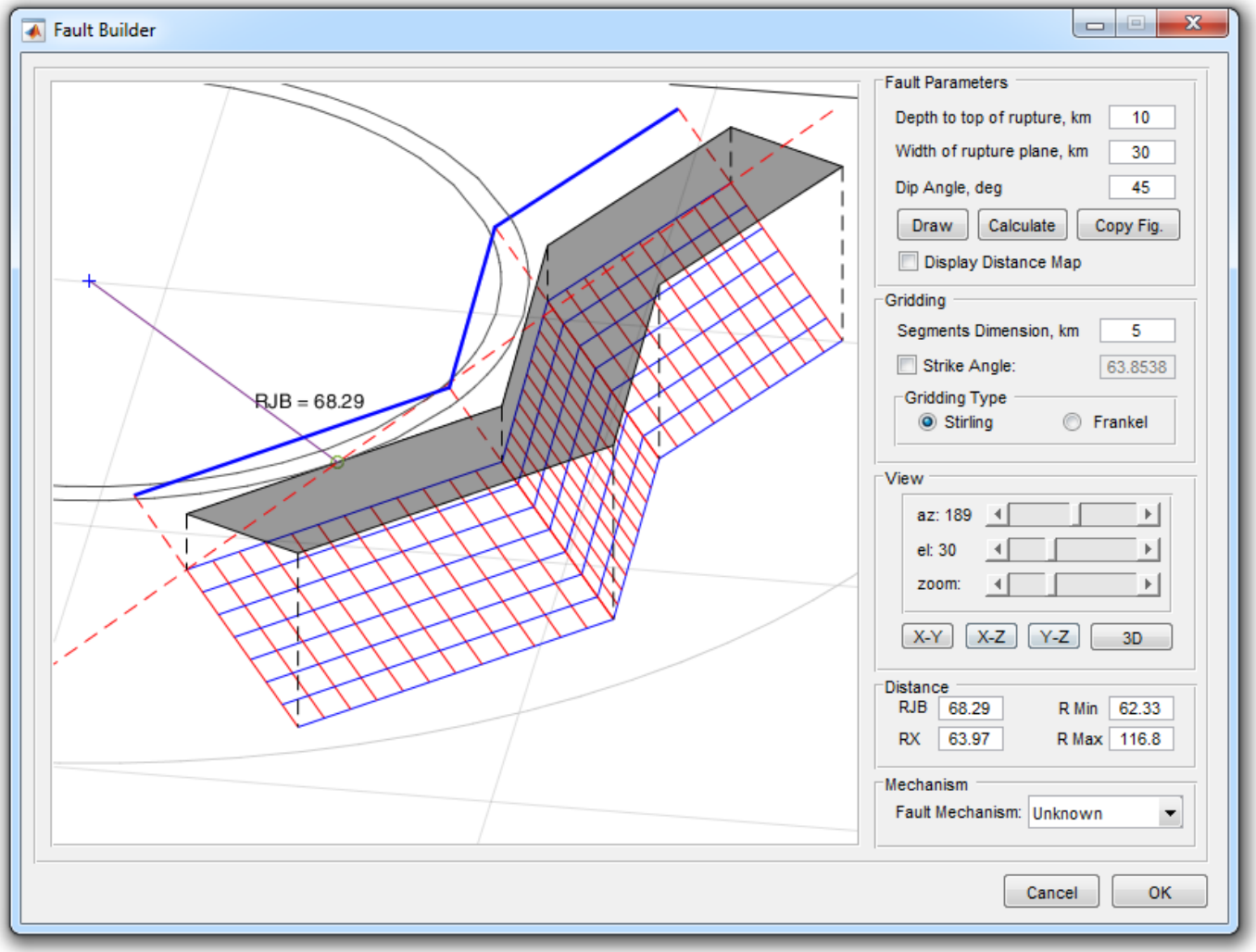
22 Attenuation Relationships



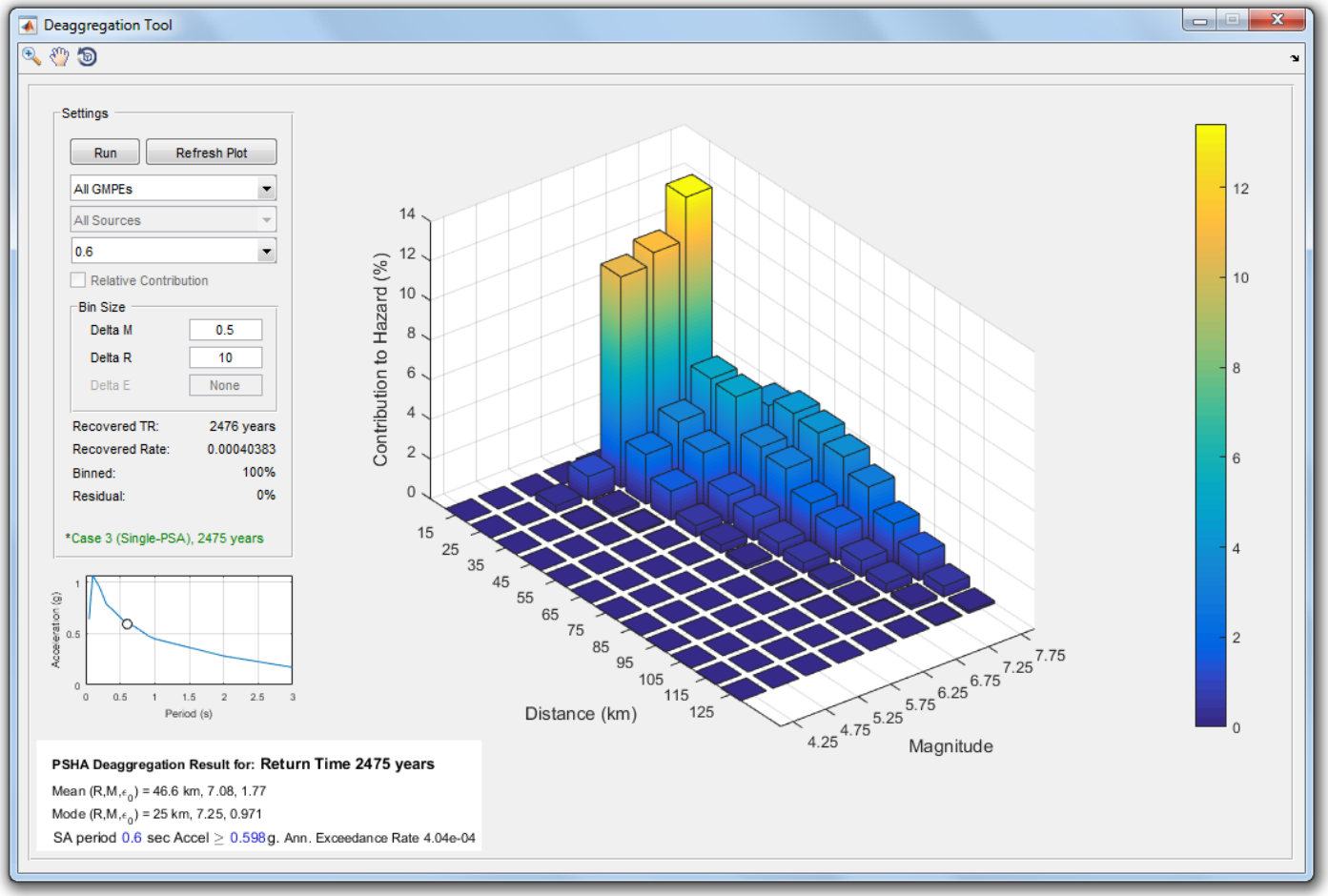
* Cornell et al. (1979), Amberseys (1975), Amberseys (1990), Campbell (1989), Joyner & Boore (1981, 1988), Campbell (1997), **Campbell & Bozorgnia** (2003, 2008), **Abrahamson & Silva** (1993, 2008), Sadigh et al. (1997), Boore et al. (1993), **Boore & Atkinson** (2008), Zaré et al. (1999), Zaré & Sabzali (2006), Ghodrati Amiri et al. (2007, 2010), Ghasemi et al. (2009), Youngs et al. (1988), **Chiou & Youngs** (2008), Idriss (1993)

Advanced 3D Fault Model

- Easily build 3D geometry: Draw fault trace / set Depth, Width and Dip Angle / Use Stirling or Frankel method for gridding.
- Assign Fault Mechanism
- Compute Magnitude and Distance Distributions
- Calculate various distances: R_{JB}, R_X, R_{min} and R_{max}

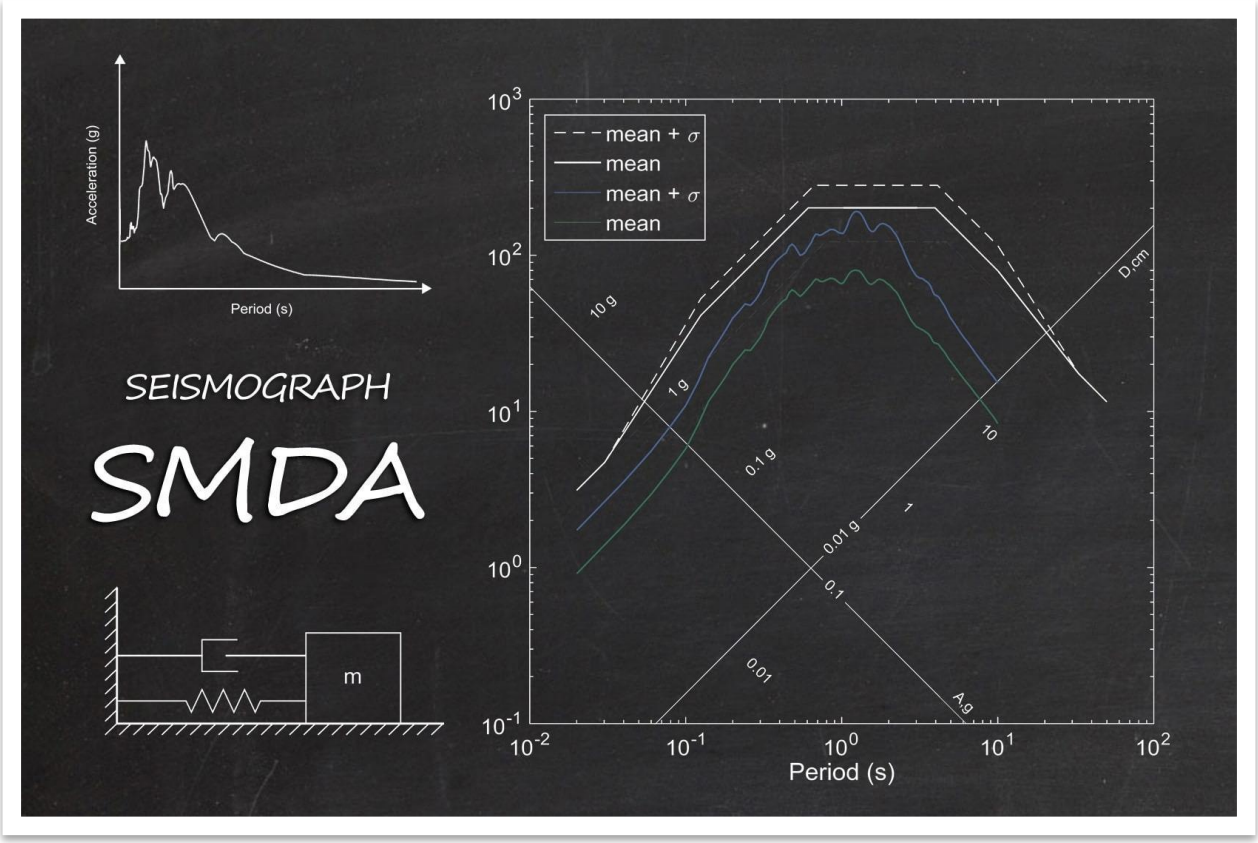


Deaggregation Tool



- Identify the magnitude and distance combination with the largest contribution to seismic hazard
- Compute Mean and Modal Values (for M, R and ε)
- Break down the deaggregation result to individual sources, GMPEs and Magnitude sets
- Perform UHS deaggregation for desired spectral period
- User-friendly design and workflow

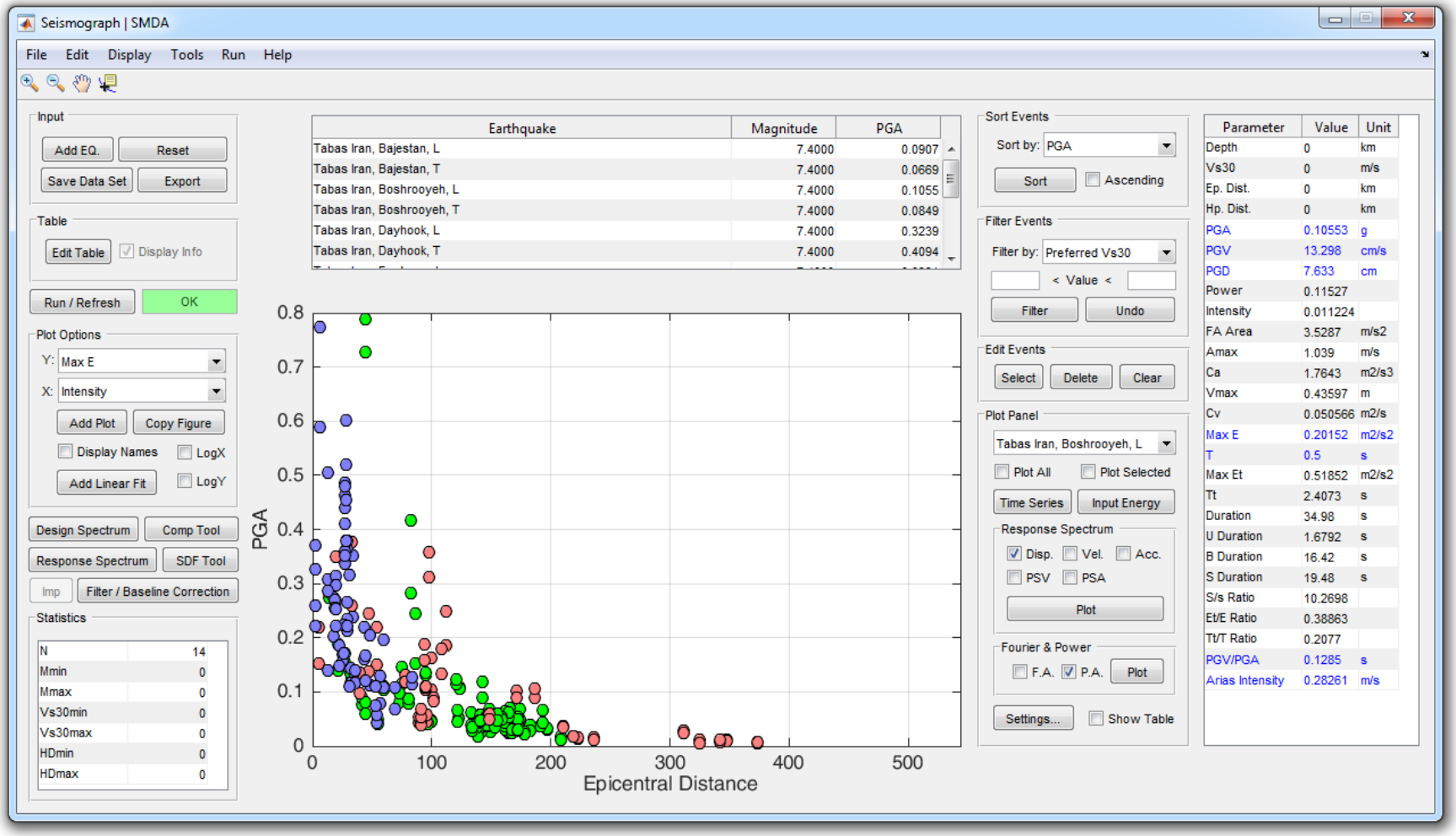
Strong-Motion Data Processing



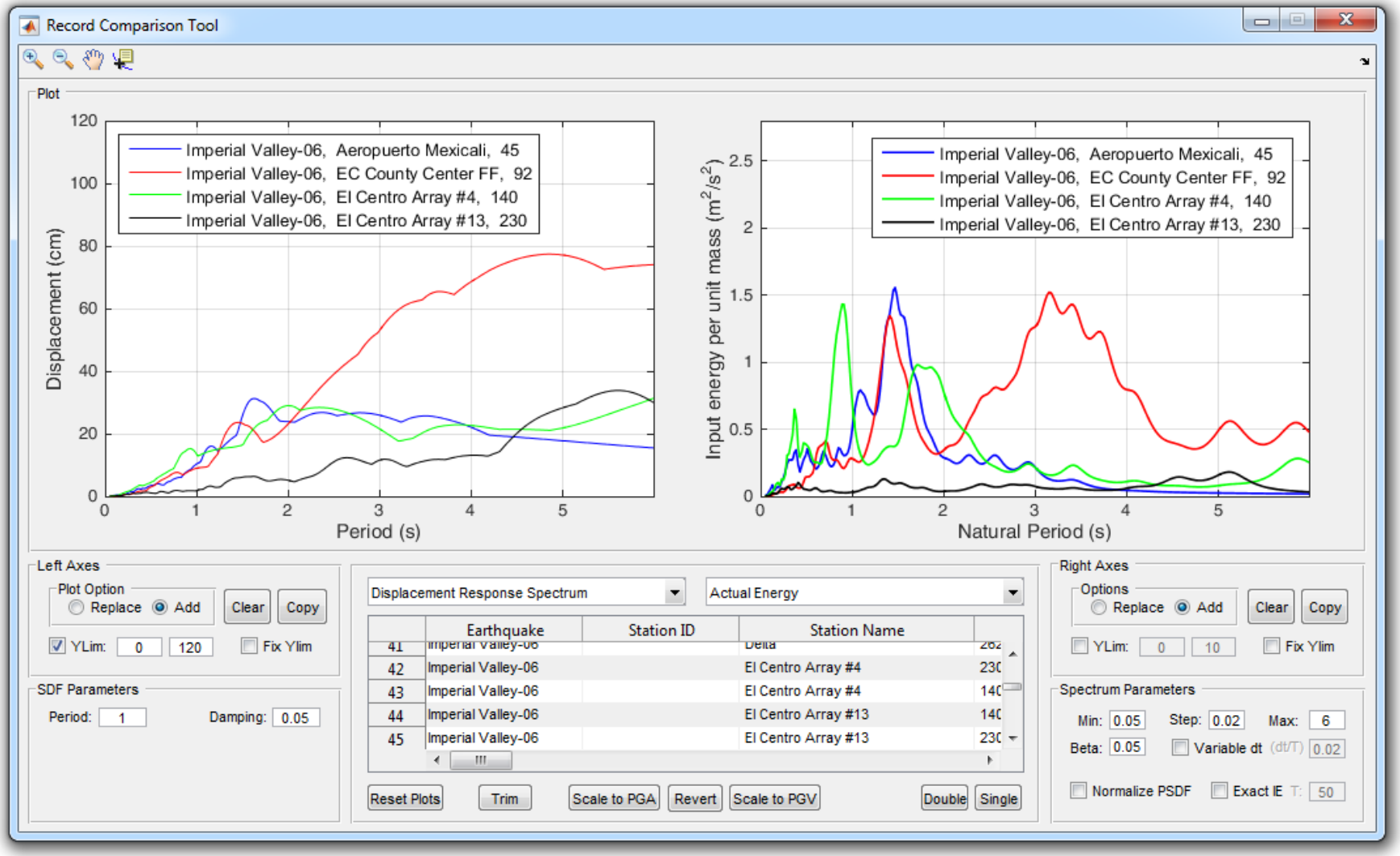
SMDA: Strong-Motion Data Analyzer

- Manage **Multiple** Records (Edit, Sort, Search & Filter, Add/Delete Event, Build Database, etc.)
- Compute **Ground Motion Parameters** (Durations / Arias Intensity / Power & Intensity / Peak Values)
- Elastic / Inelastic Response Spectra | Fourier / Power Spectra
- **Design Spectrum**: Elastic & Inelastic Spectra / Response Spectrum Compatible Design Spectra
- **Spectral Matching / Artificial Accelerogram** Generation / Filtering & Baseline Correction
- **SDF Analyzer** Tool: Nonlinear Analysis / Damping Calculation / Live Simulation / Nonlinear Parameters Calculation (Ductility Ratio / Normalized Yield Strength)

Seismograph SMDA

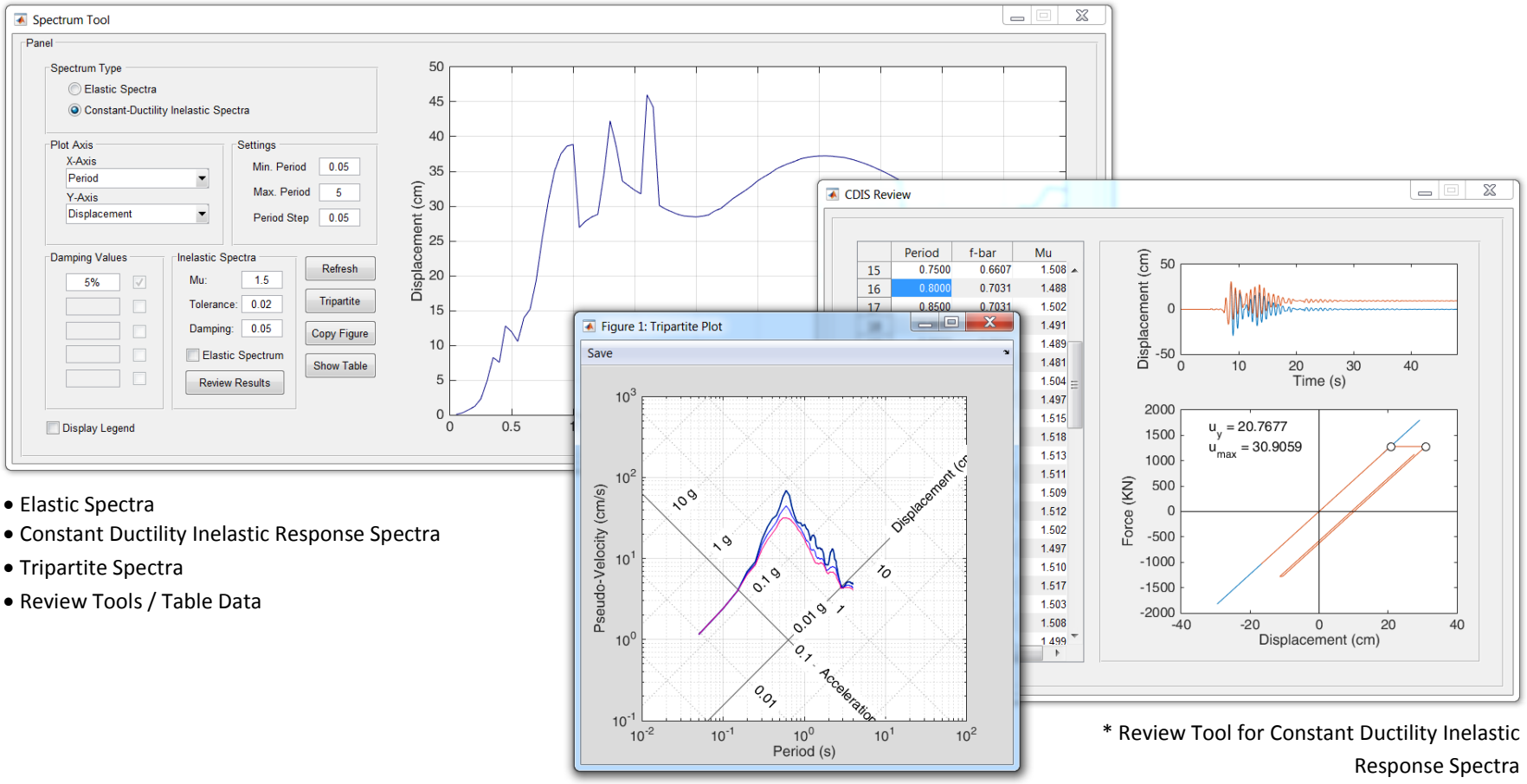


Record Comparison Tool



* Plot and compare various earthquake parameters (Time Series, Response Spectra, Fourier / Power Spectra, Input Energy, Input Energy Rate, etc.)
* Scale Records by PGA & PGV
* Trim Records

Response Spectrum Tool

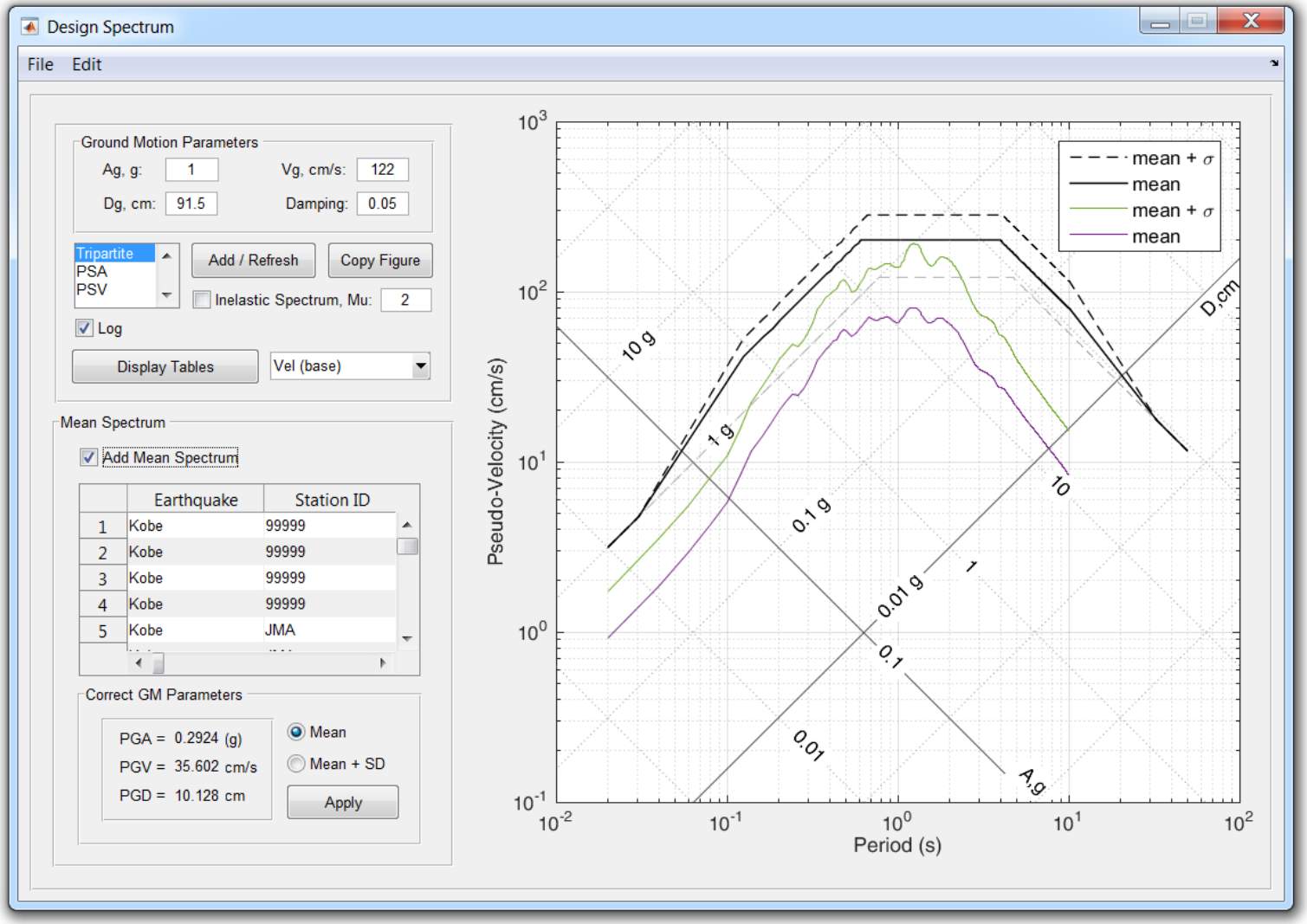


- Elastic Spectra
- Constant Ductility Inelastic Response Spectra
- Tripartite Spectra
- Review Tools / Table Data

* Sample Tripartite Spectra

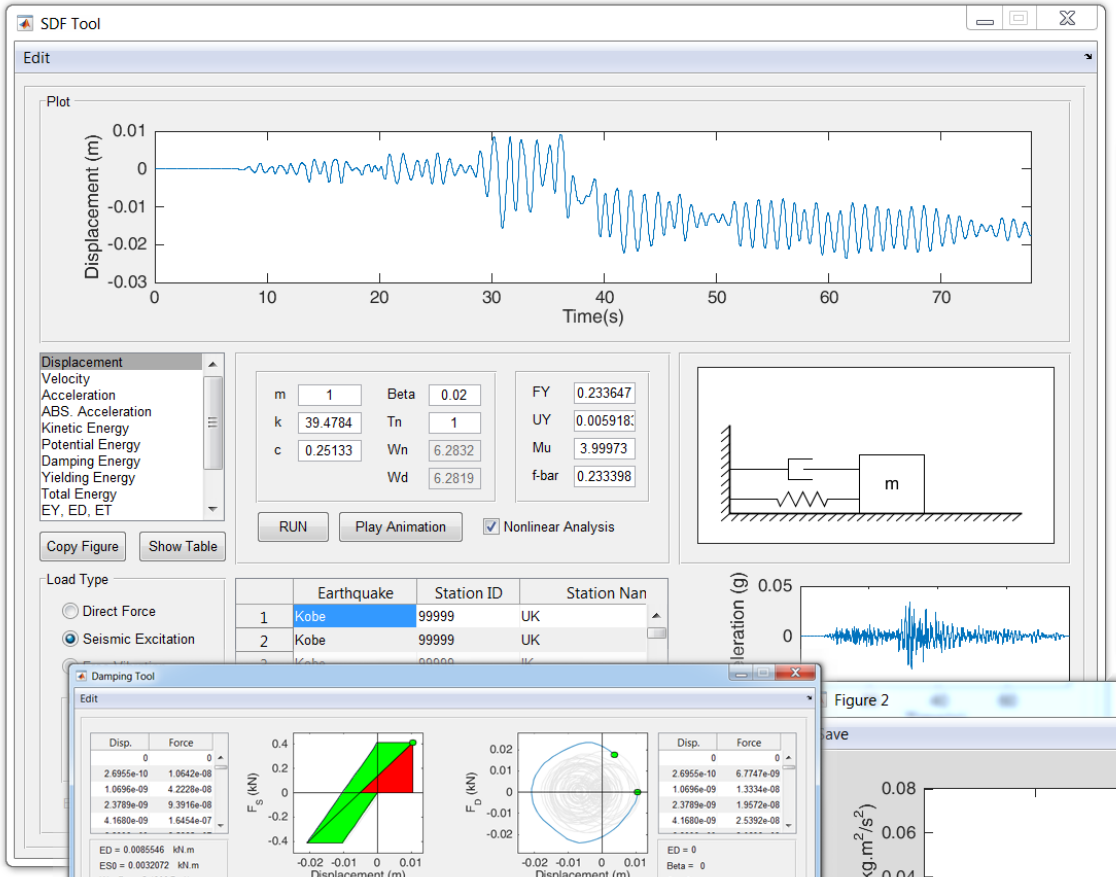
* Review Tool for Constant Ductility Inelastic Response Spectra

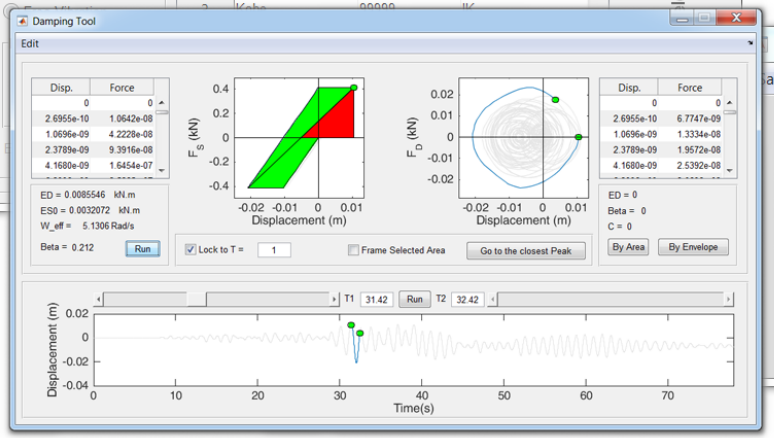
Design Spectrum Tool



- Elastic / Inelastic Spectra
- Response Spectrum Compatible Design Spectra

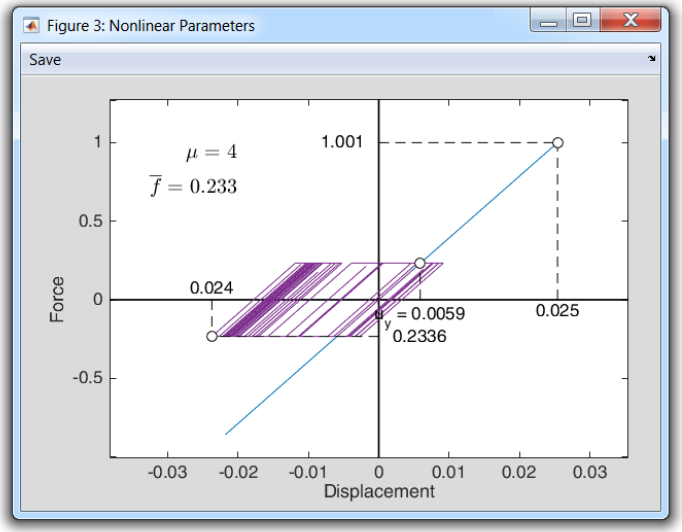
SDOF Analyzer Tool

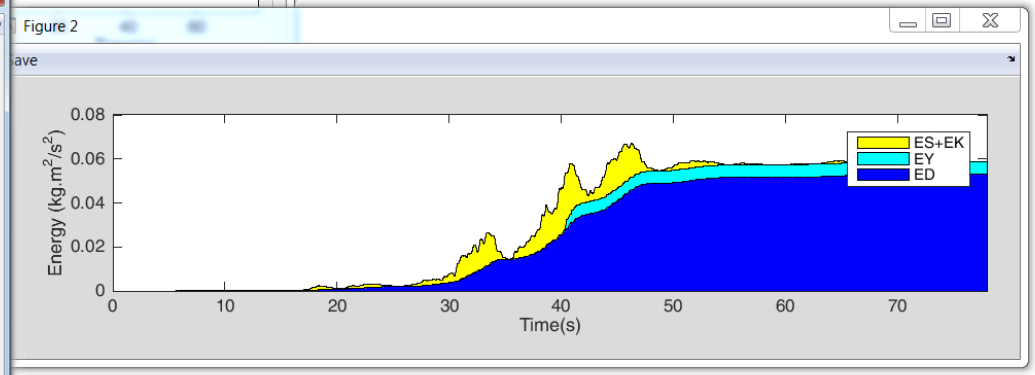




* Damping Calculation Tool

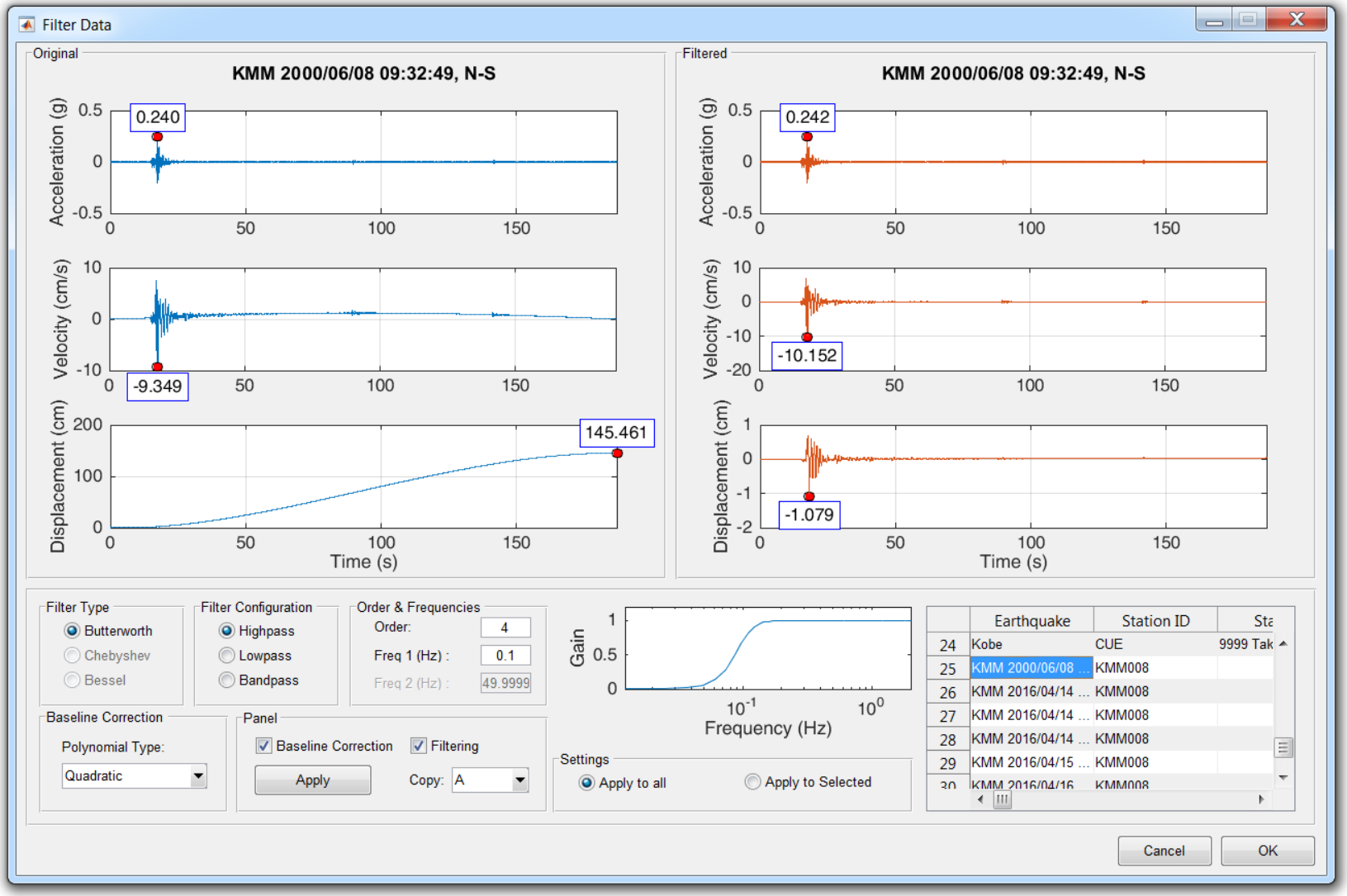
- Linear / Nonlinear Analysis
- Seismic Input / Direct Force / Free Vibration
- Damping Calculation Tool
- Live Simulation





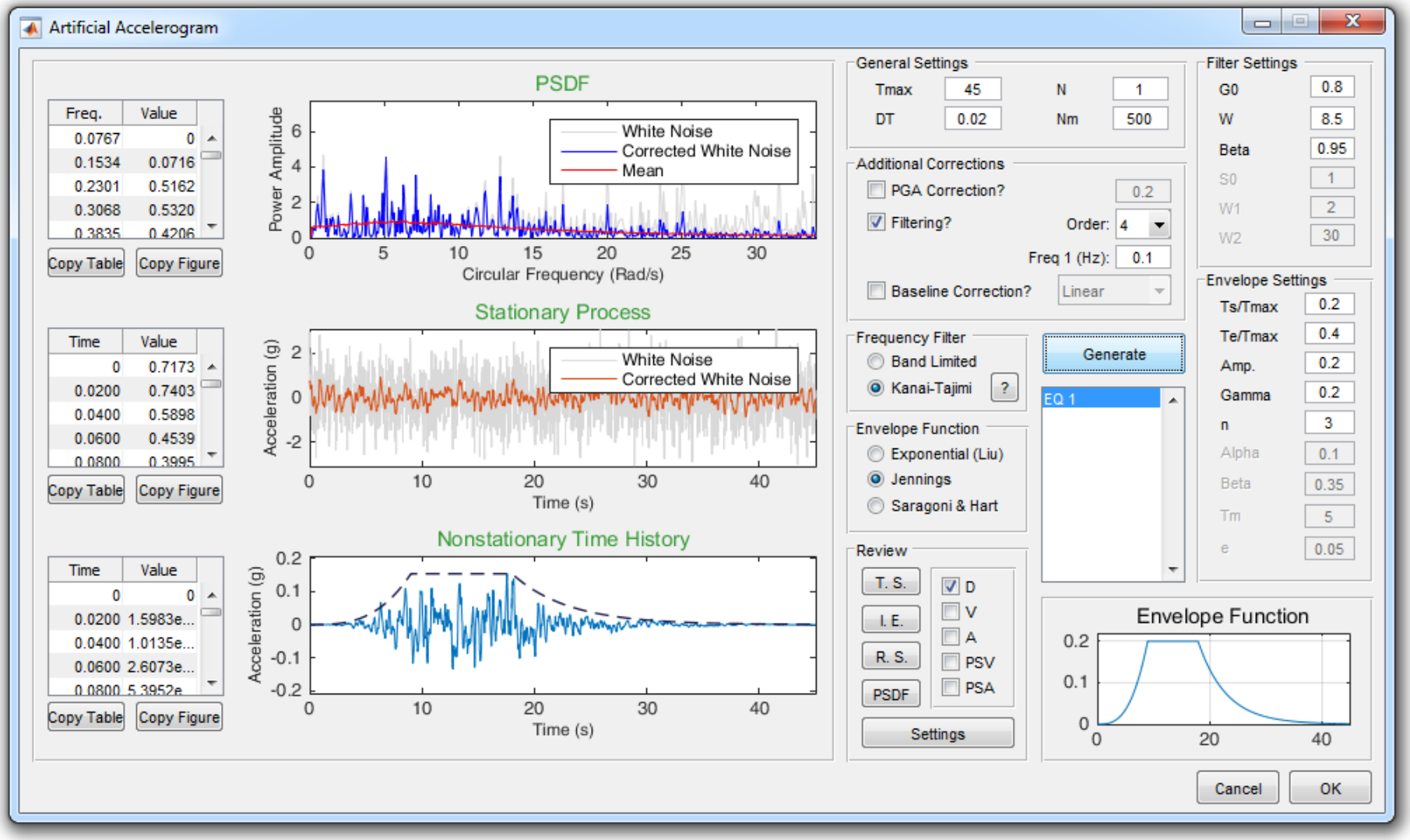
* Potential, Kinetic, Yielding and Damping Energy Plots

Filtering & Baseline Correction



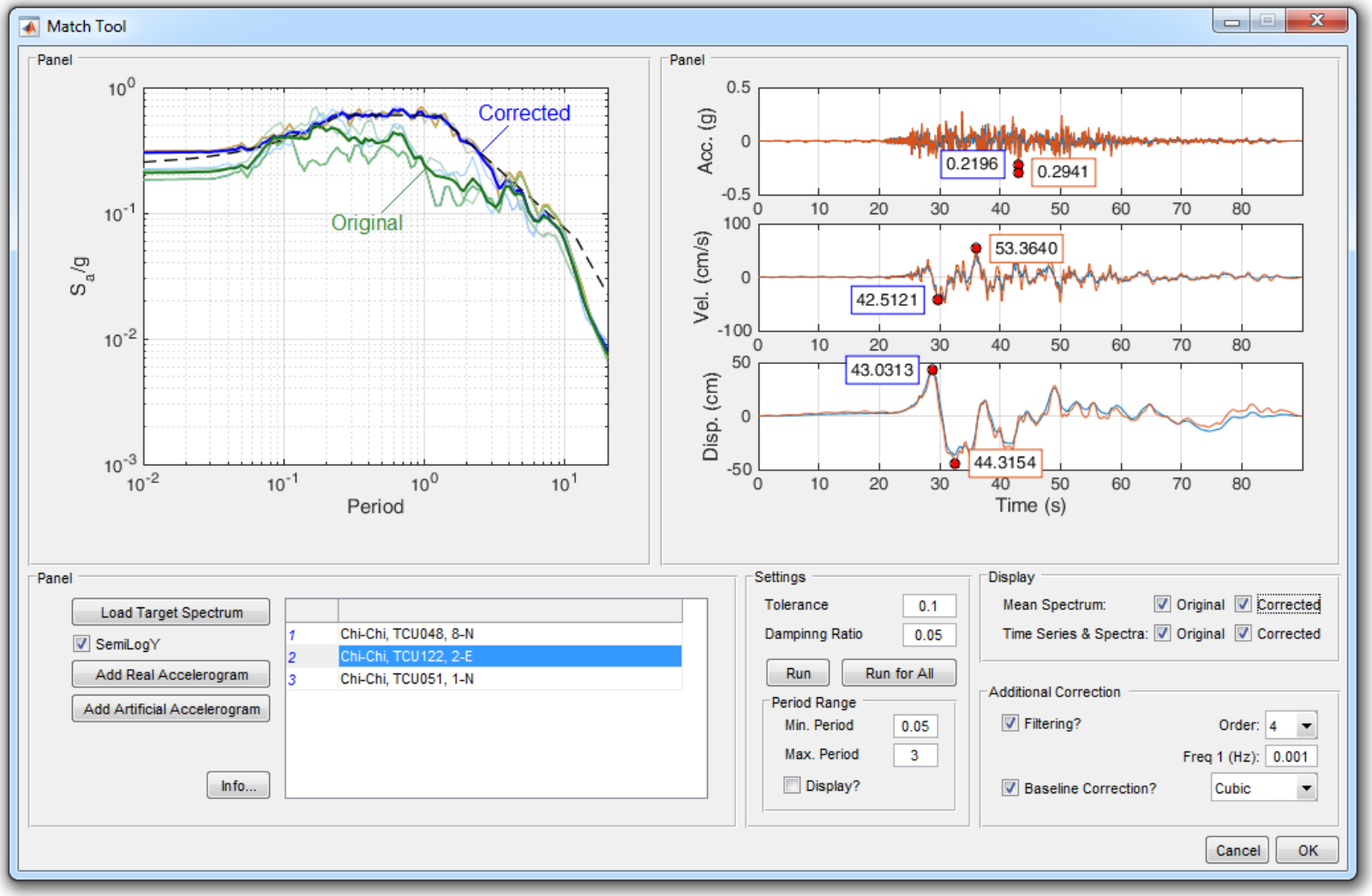
* Apply Filtering & Baseline Correction to multiple records.

Artificial Accelerogram Generator



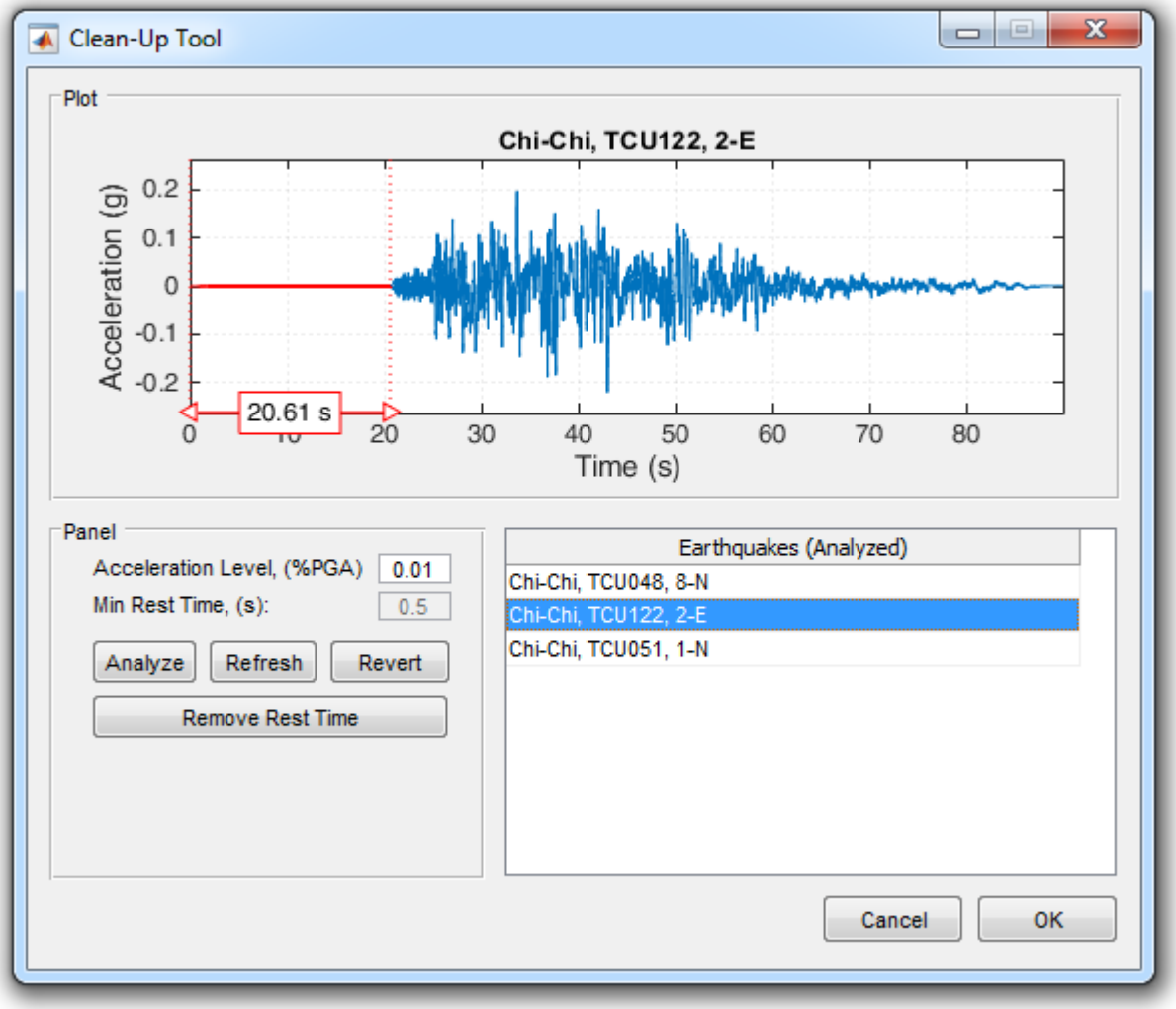
- 2 Frequency Filters (Band Limited / Kanai-Tajimi)
- 3 Envelope Functions (Liu / Jennings / Saragoni & Hart)

Spectral Matching Tool



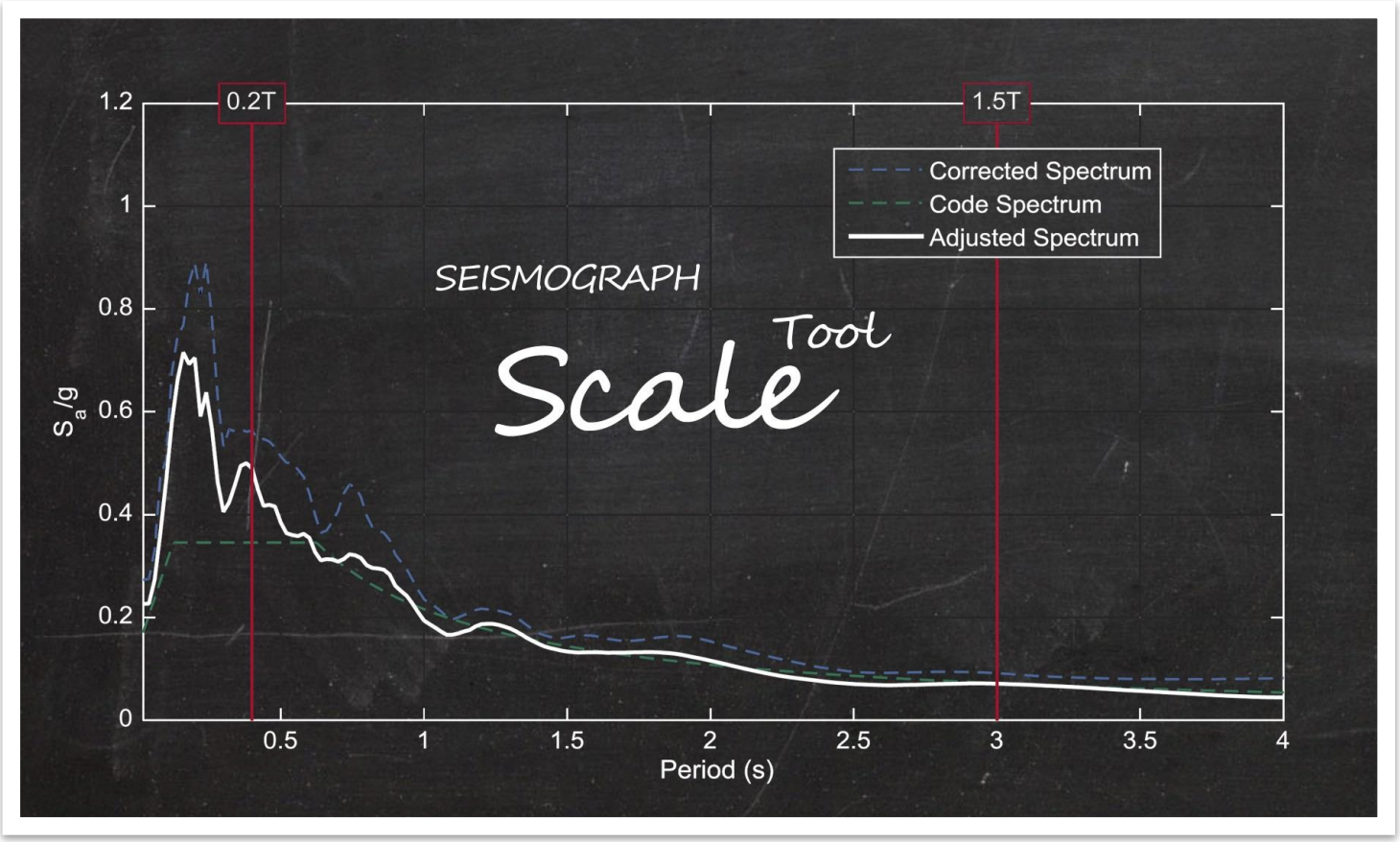
* Modify Real (or Artificial) Accelerograms to match with any target spectrum.

Clean-Up Tool



* Remove Initial Rest time from all records

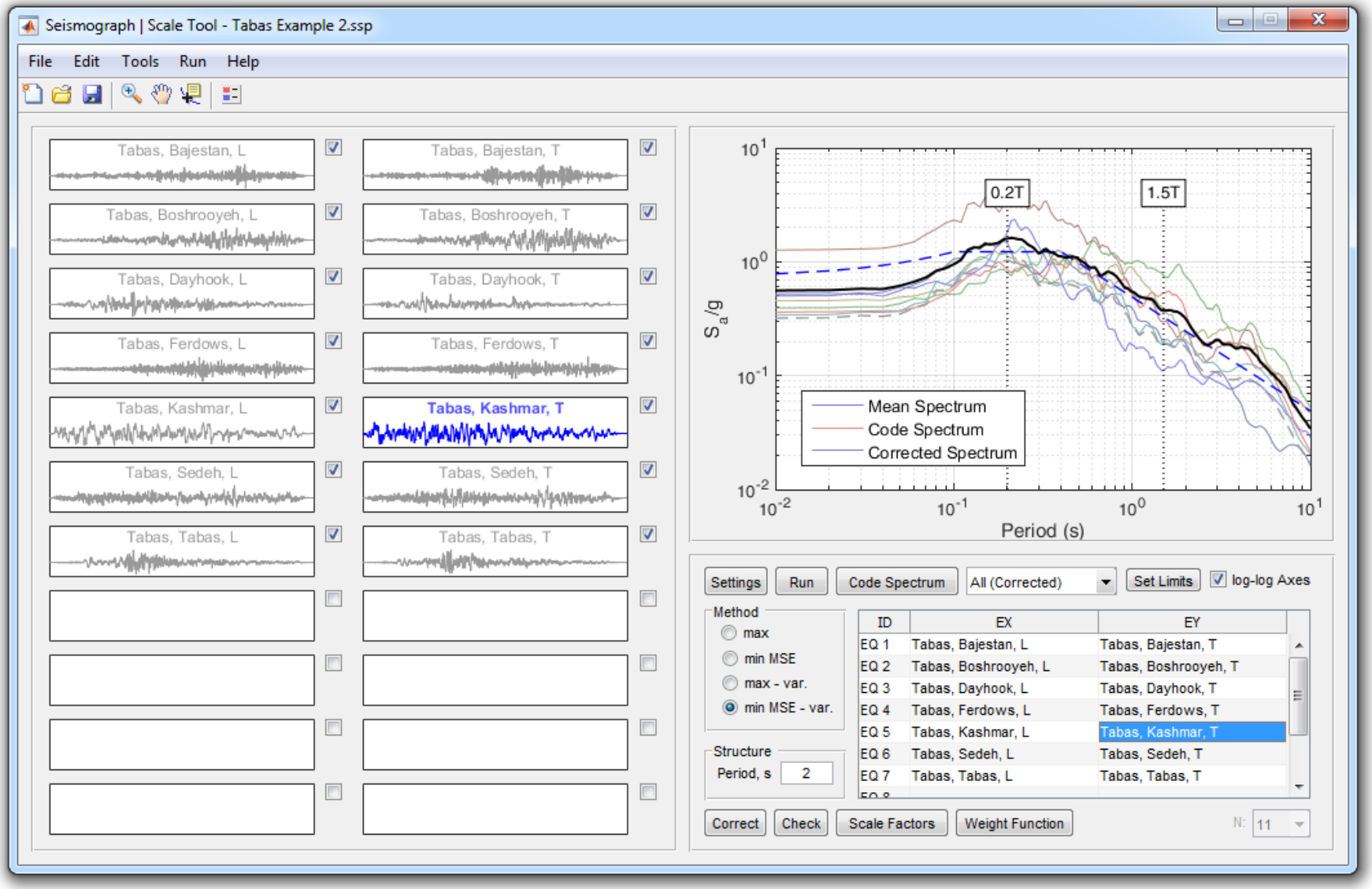
Accelerogram-Scaling



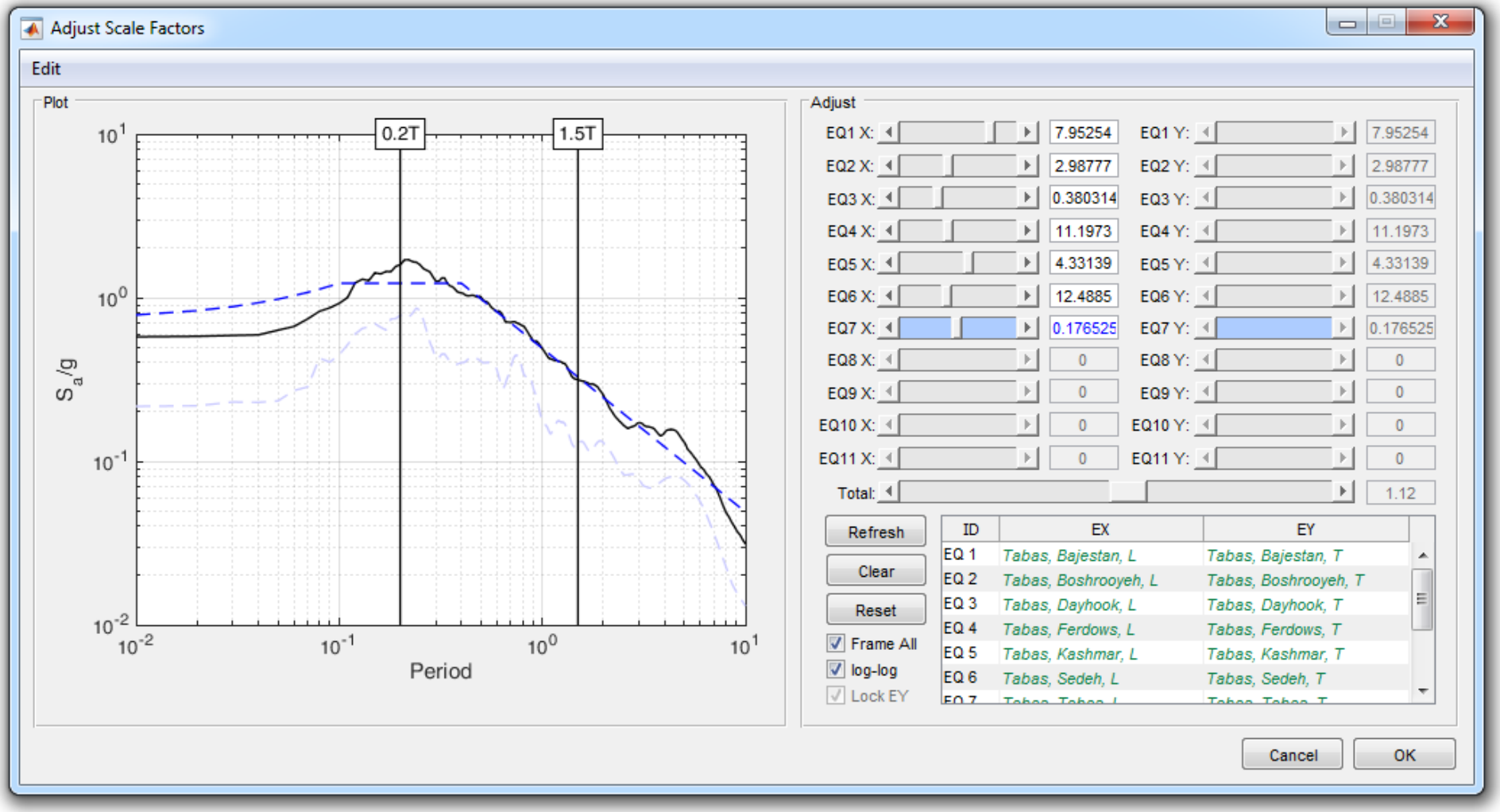
A Comprehensive Tool for Scaling Ground Motions

- Up to **11 pairs** of horizontal records
- Min MSE / Direct Scale Method + **Free Adjustment** Tool
- Single Period Scale / Scale to Peak Values (PGA/PGV)
- Built-in Code Spectrum: 2800 v4 / ASCE 7 (2010 & 2016) / Eurocode 8
- User-Friendly Design & Workflow

Seismograph SCALE Tool

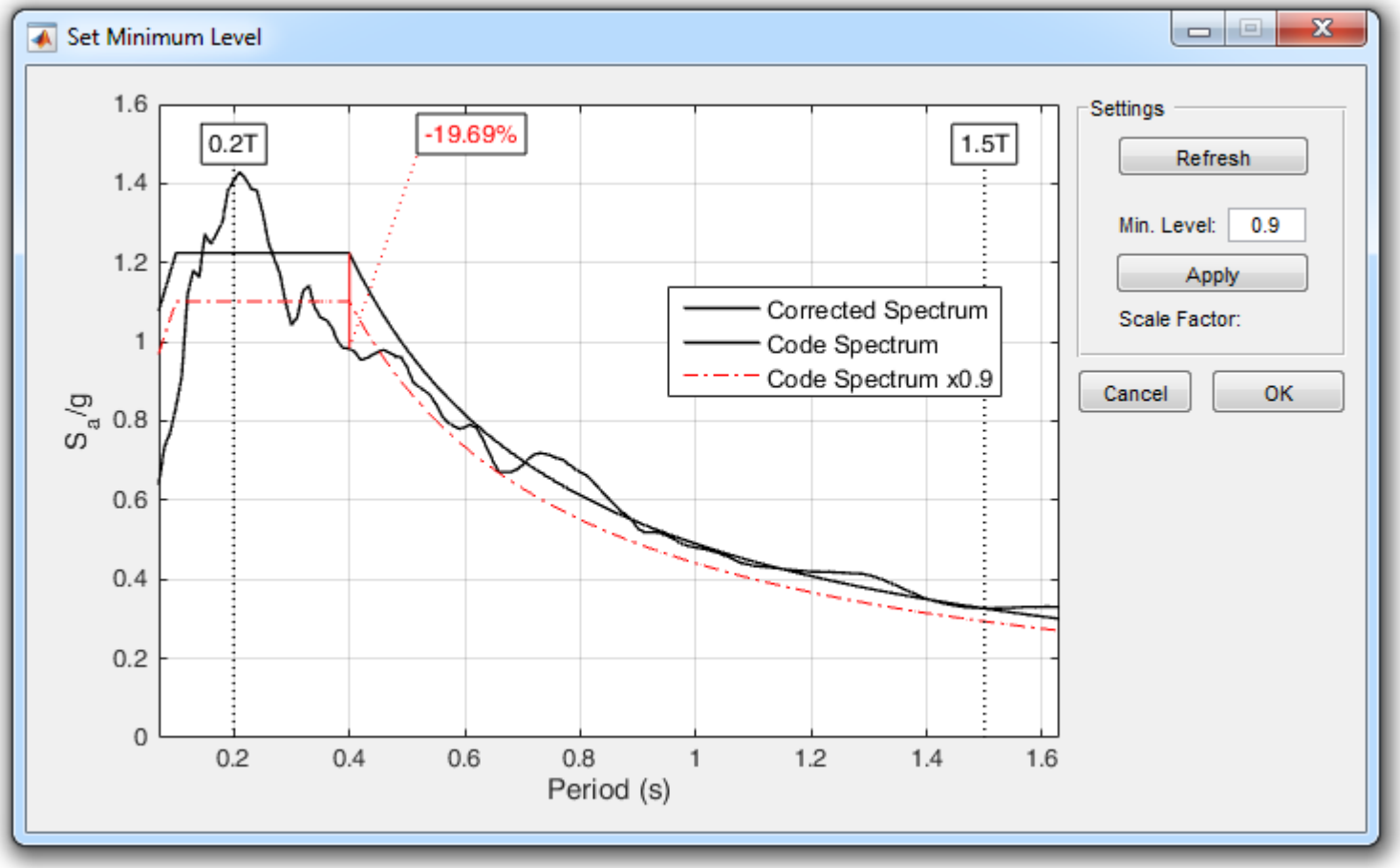


Free Adjustment Tool



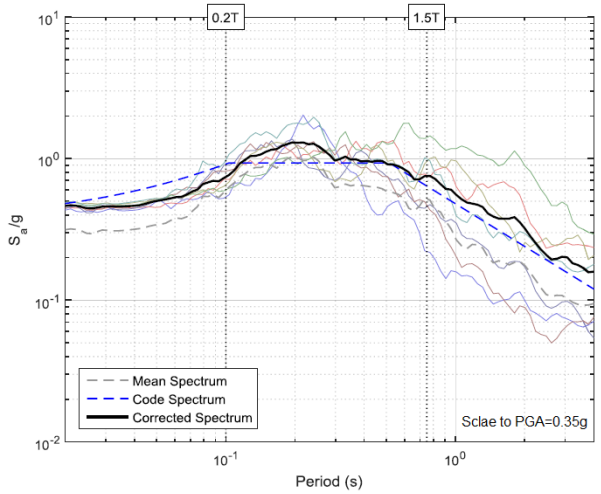
* Adjust scale factors to achieve best match

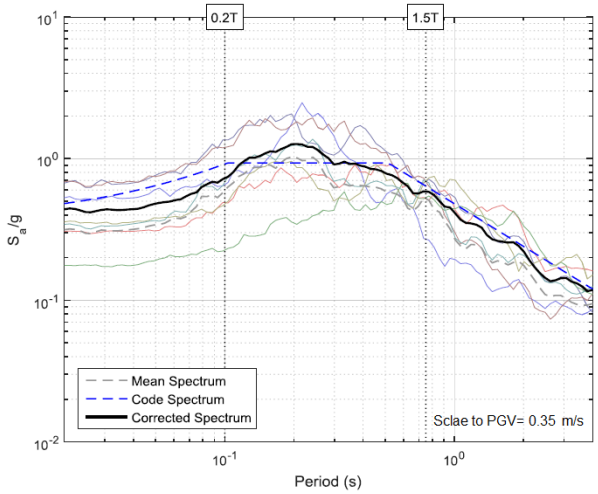
Set Minimum Level



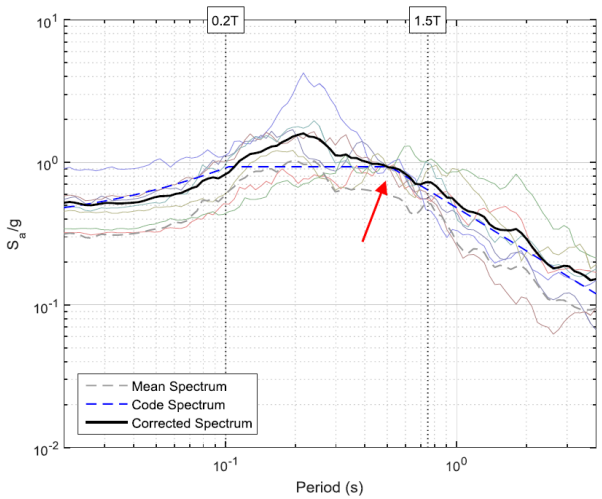
* Specify the minimum value for the ratio of the corrected spectrum to the target spectrum.

Scale to PGA, PGV / Single Period Scale

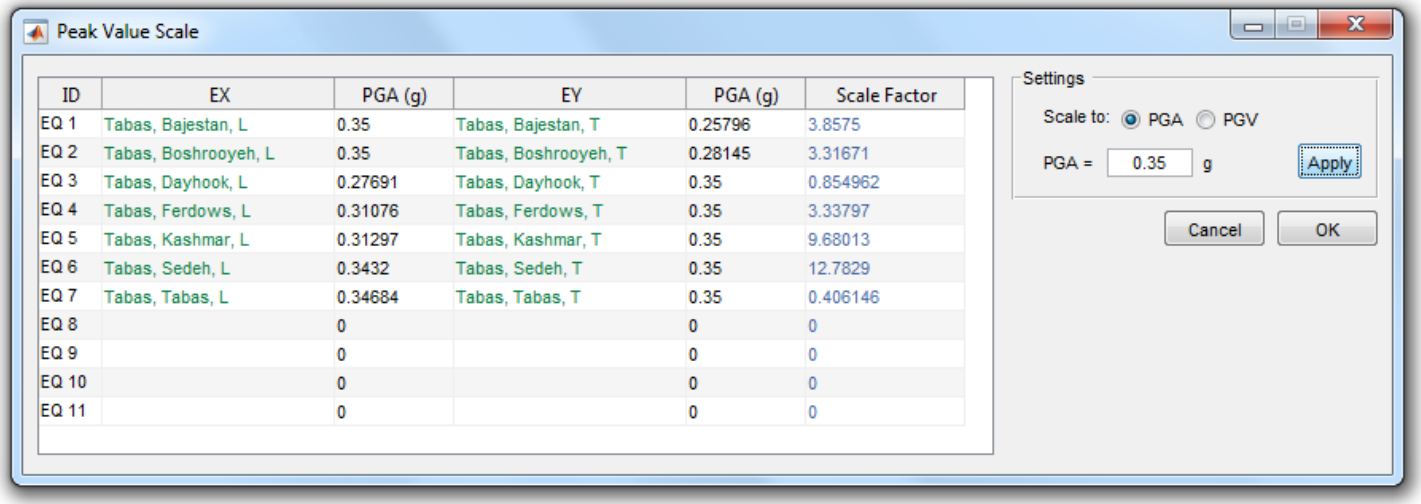




Scale to specific Peak Value (PGA/PGV): Scale to the specific level of PGA (or PGV) as required by some building codes.

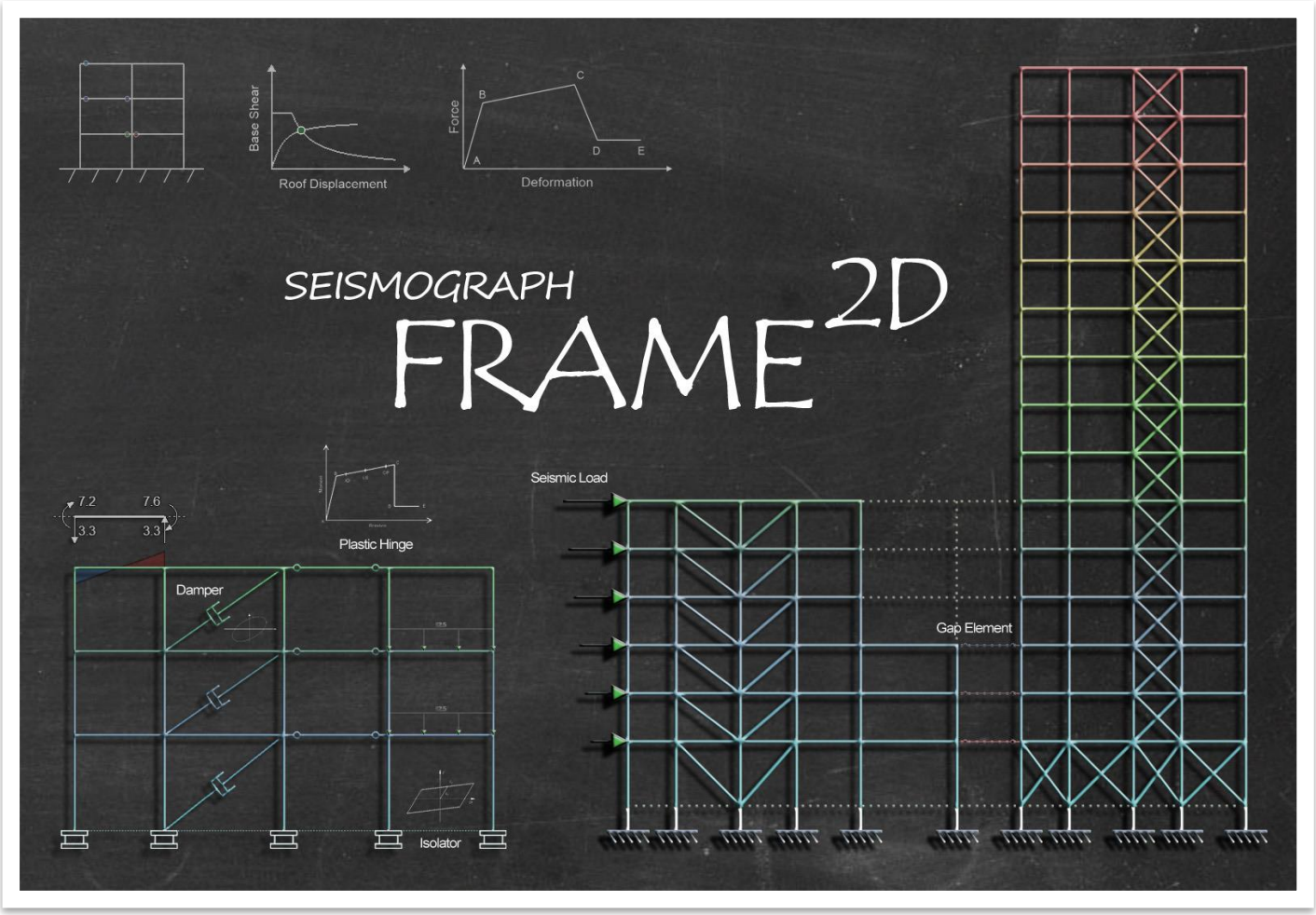


Single Period Scale: Easily control the period of interest at which the mean spectrum crosses the target spectrum.



* Scale to the specific level of PGA (or PGV) as required by some building codes.

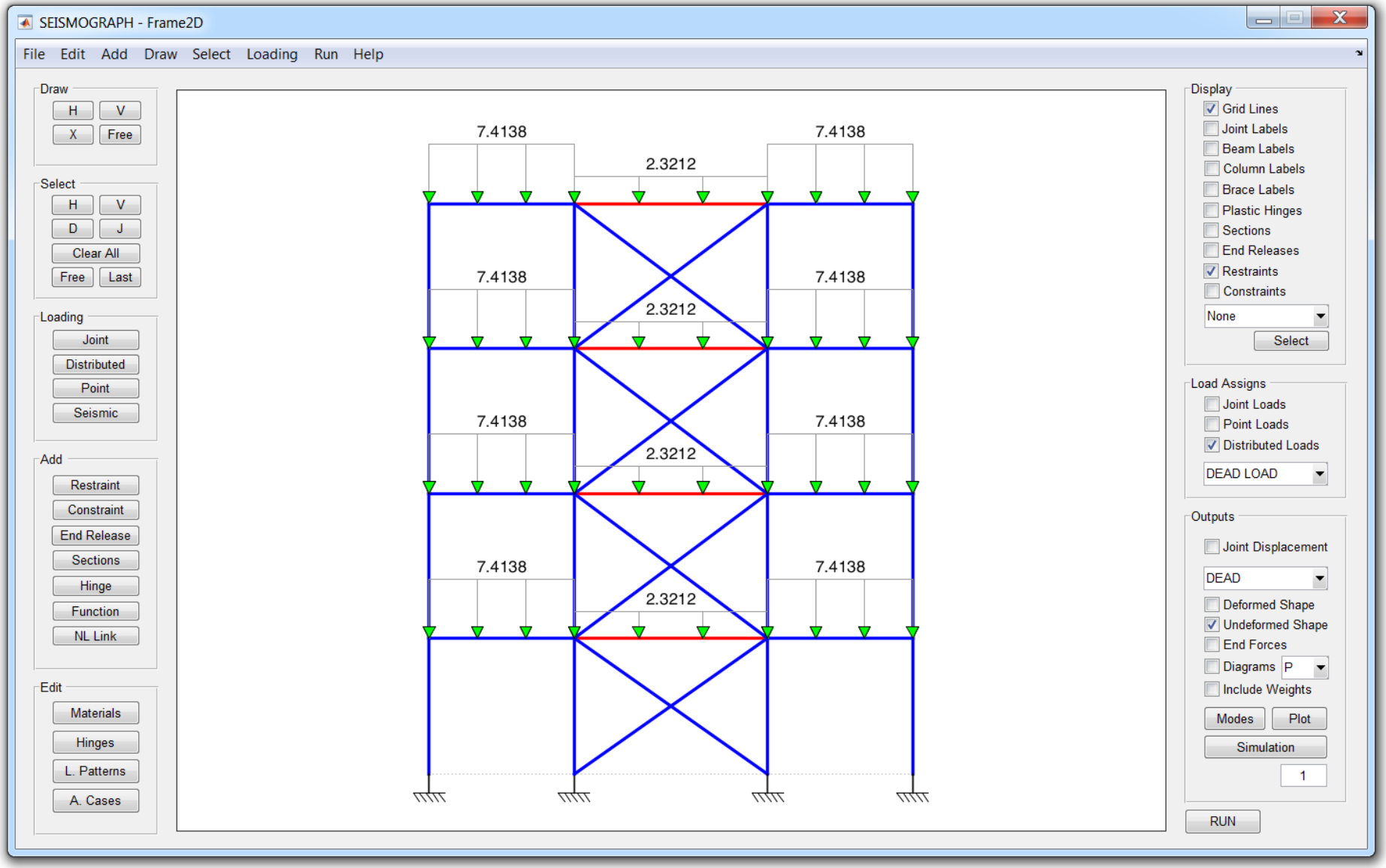
2D Structural Analysis



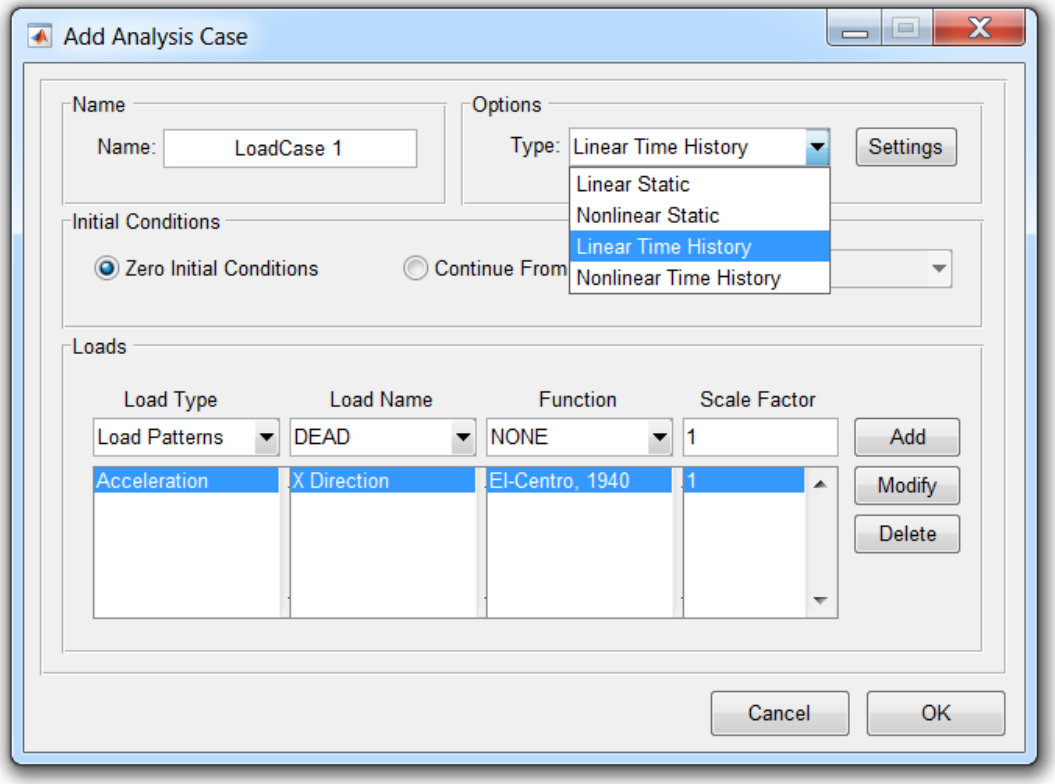
FRAME2D: 2D Frames Analysis Package

- Linear & Nonlinear Static Analysis (Pushover)
- P-Delta Analysis
- Linear & Nonlinear Dynamic Analysis (Gap - Isolator - Damper)

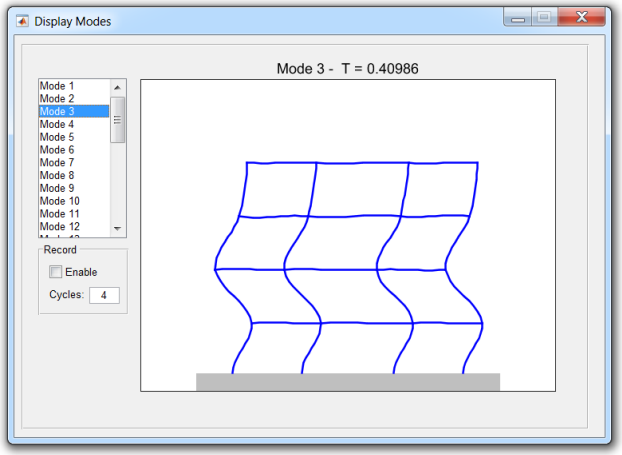
Seismograph Frame2D



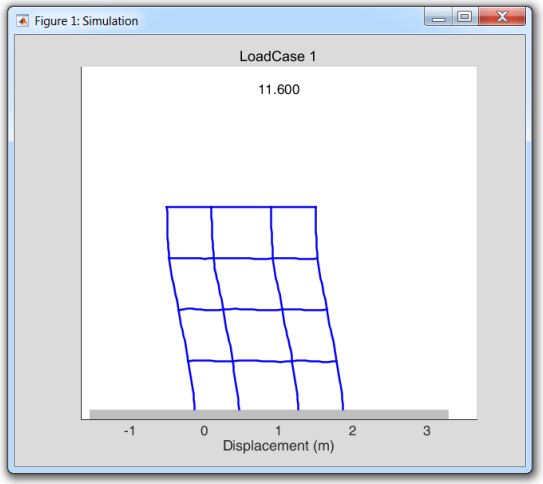
Dynamic Analysis



* Define Analysis Cases window

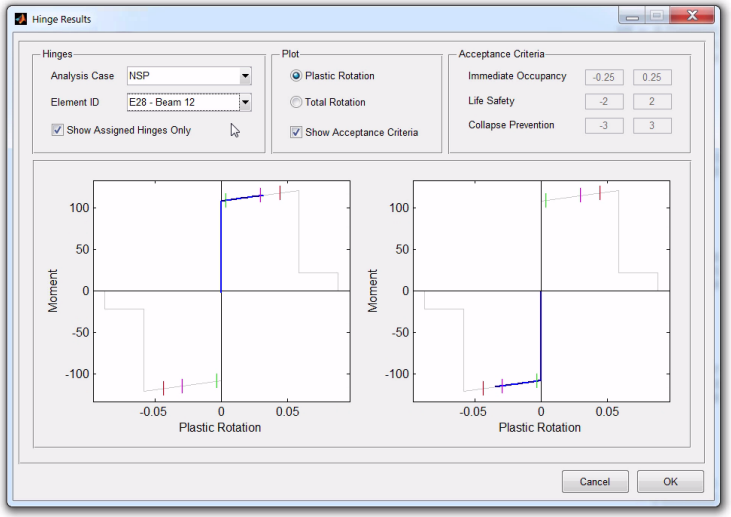


Display Mode Shapes

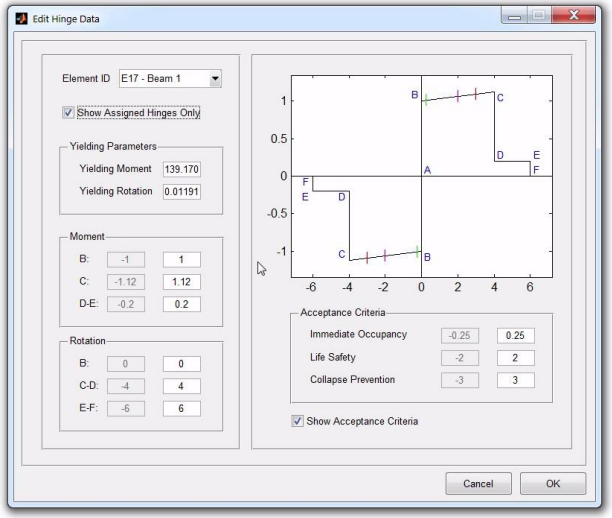


Play Live Simulation

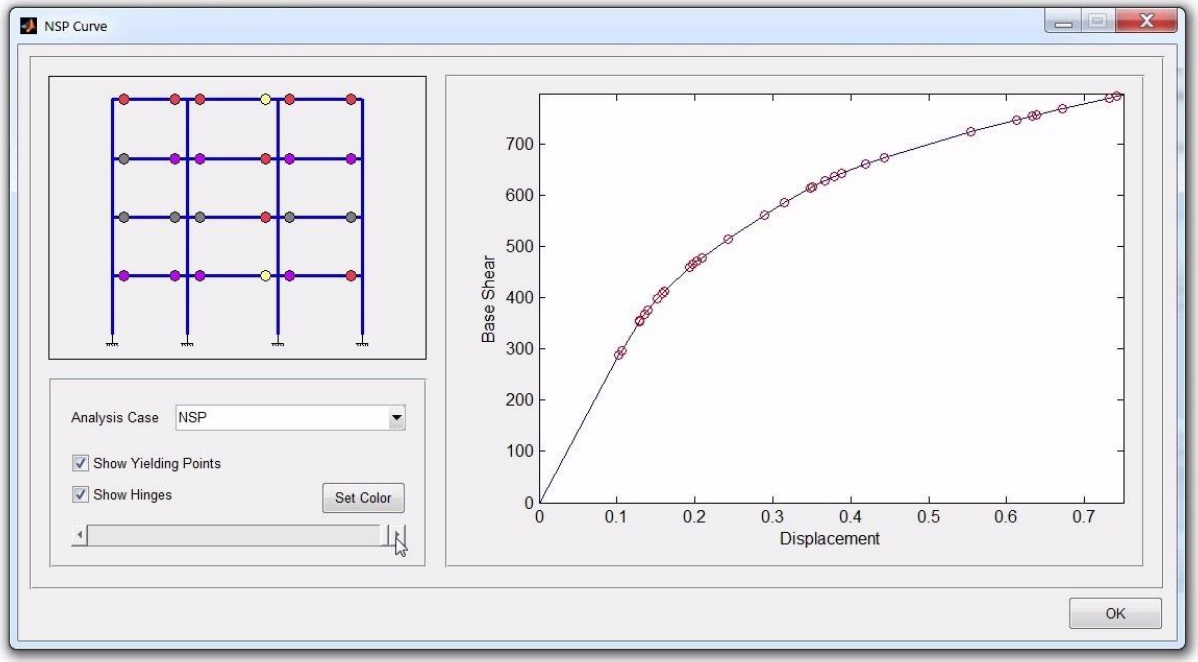
Pushover Analysis



* Review hinges results

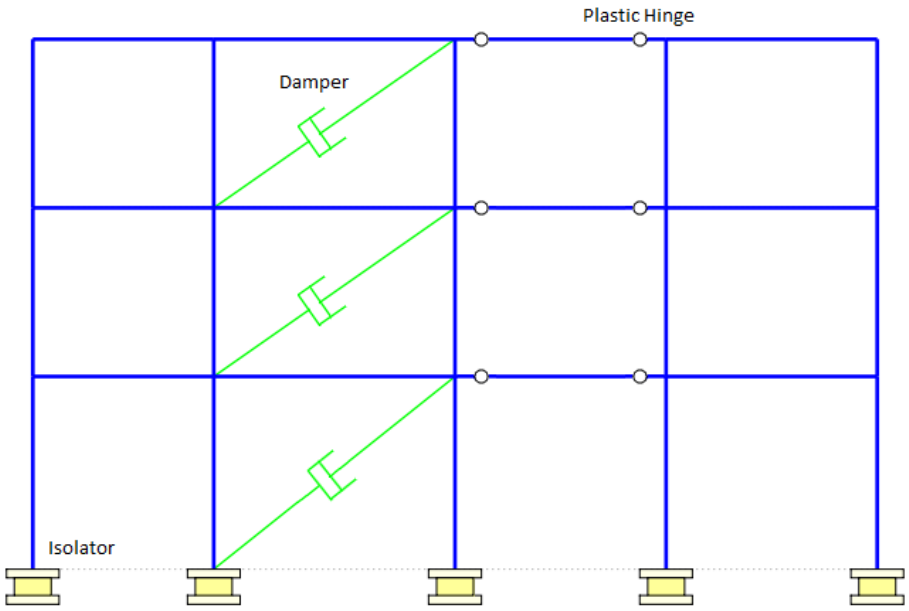


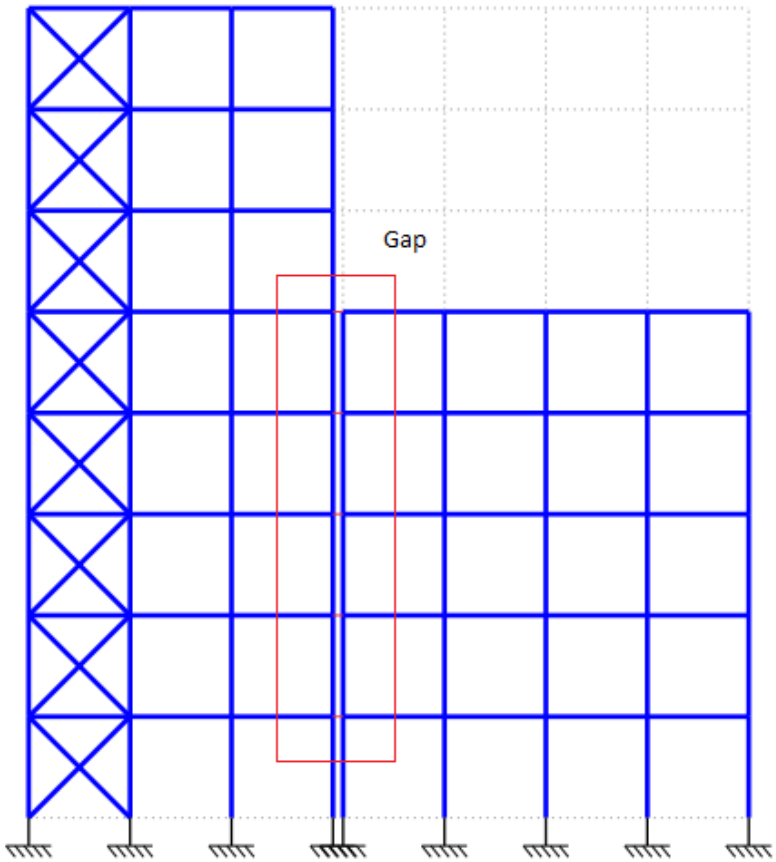
* Assign concentrated plastic hinges to frame elements



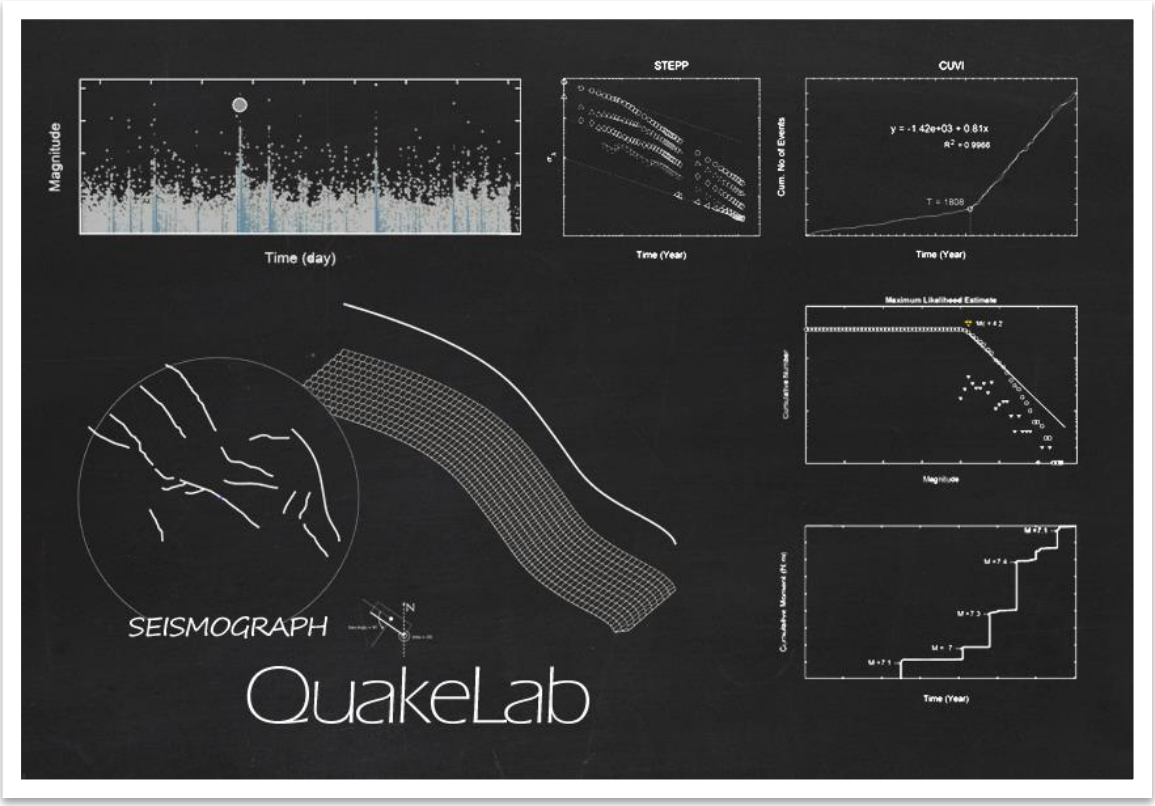
* Display NSP Curve & hinges state for different stage of loading.

Nonlinear Elements





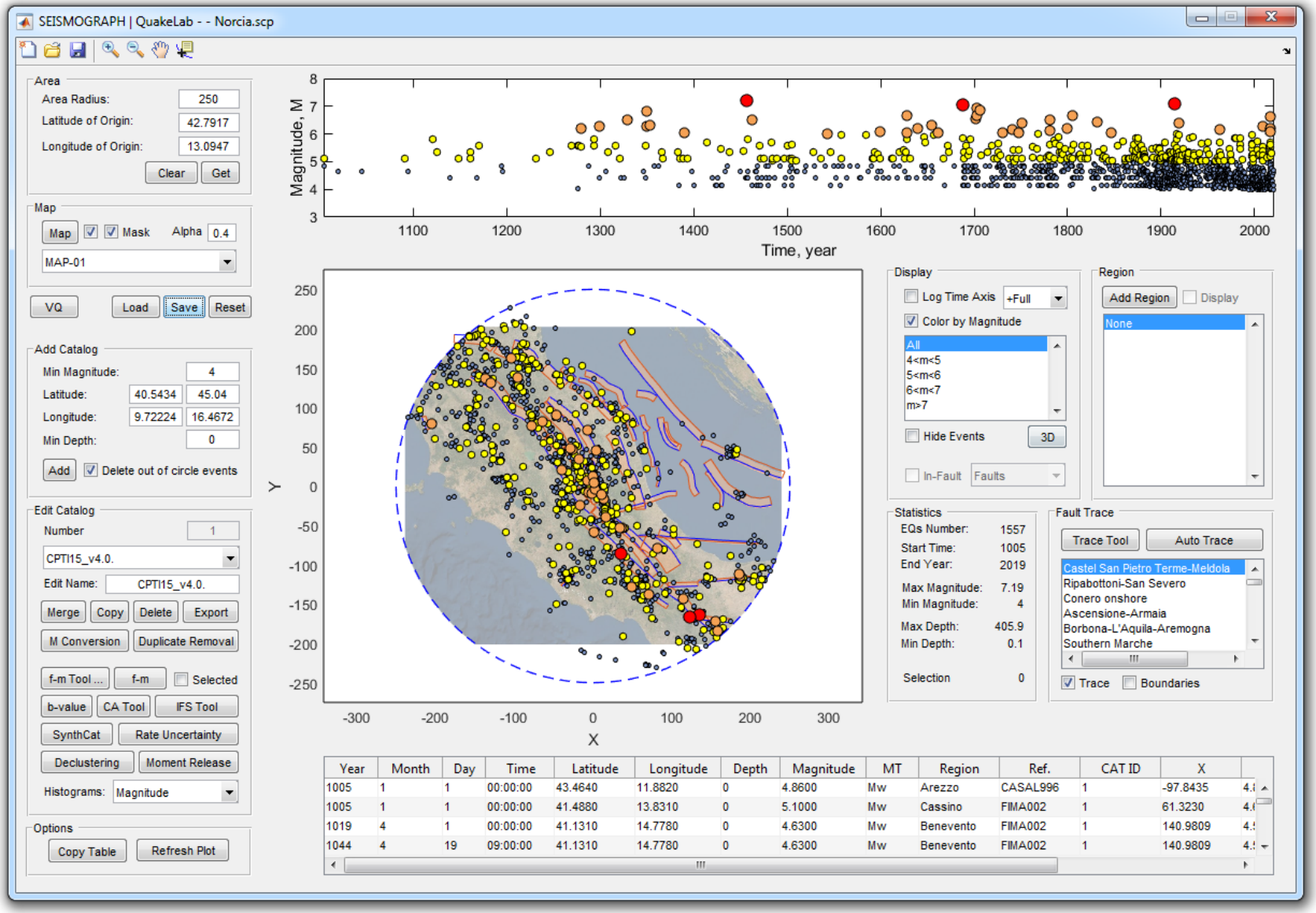
Seismicity Analysis & Catalog Management



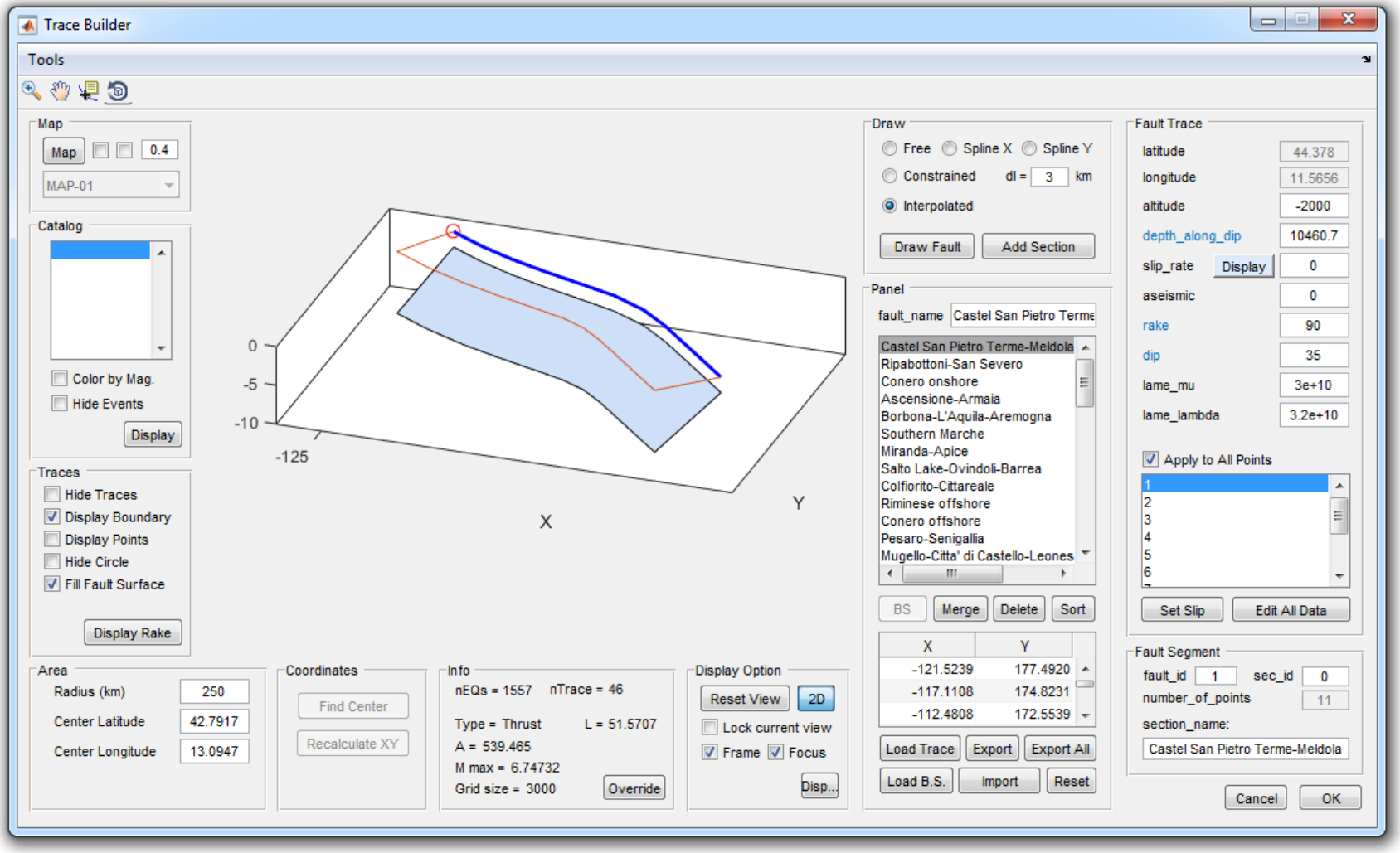
QuakeLab: Powerful Seismicity Analysis Tool

- Create, Merge, Filter, Delete Catalogs / Statistic Reports / Catalog Visualization
- Duplicate Removal / Declustering Tool / Manual Event Removal
- Fault Trace Builder / Background Fault Generator
- Completeness Analysis / b-value Estimation / Frequency-Magnitude Analyzer Tool
- Synthetic Catalog Generation / Aftershock Generation (BASS/ETAS)
- Background Seismicity Editor (IFS Tool)

Seismograph QuakeLab

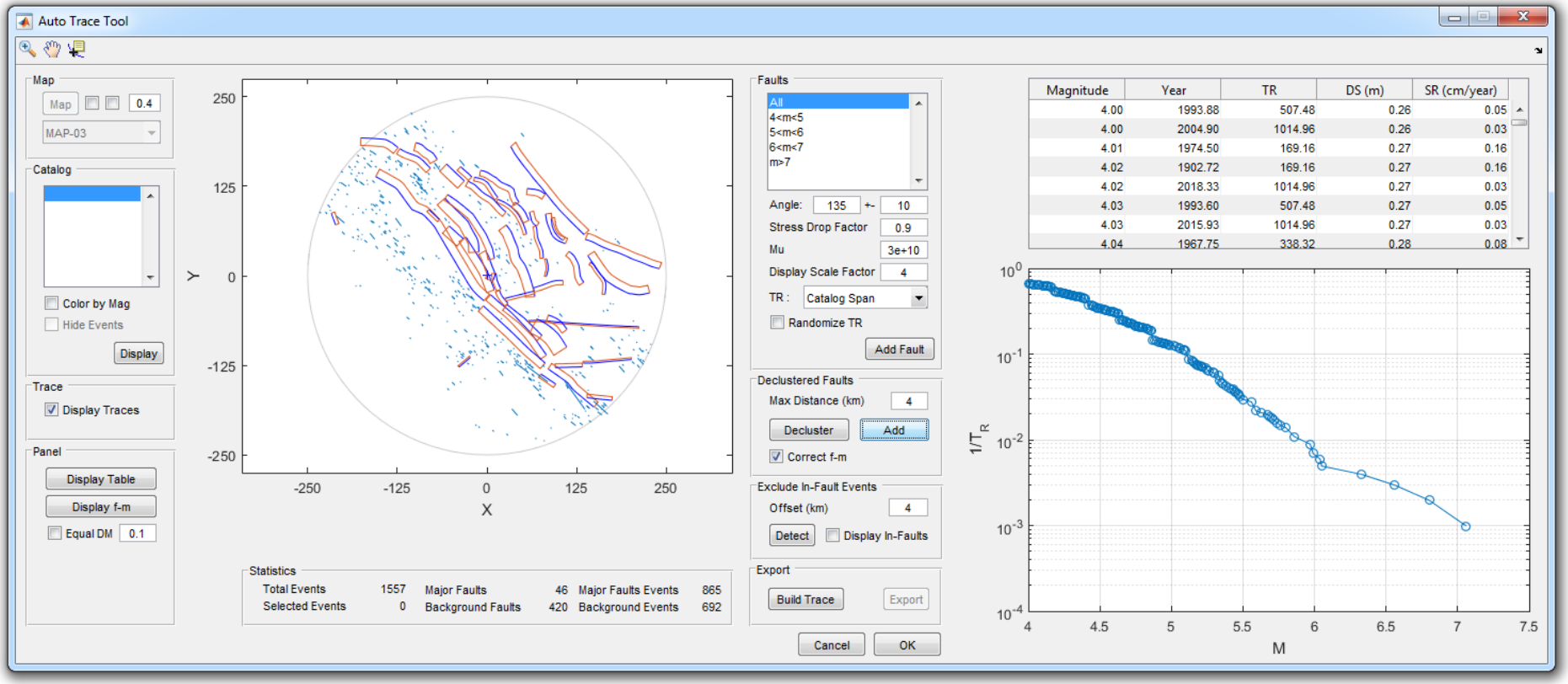


Fault Trace Builder Tool



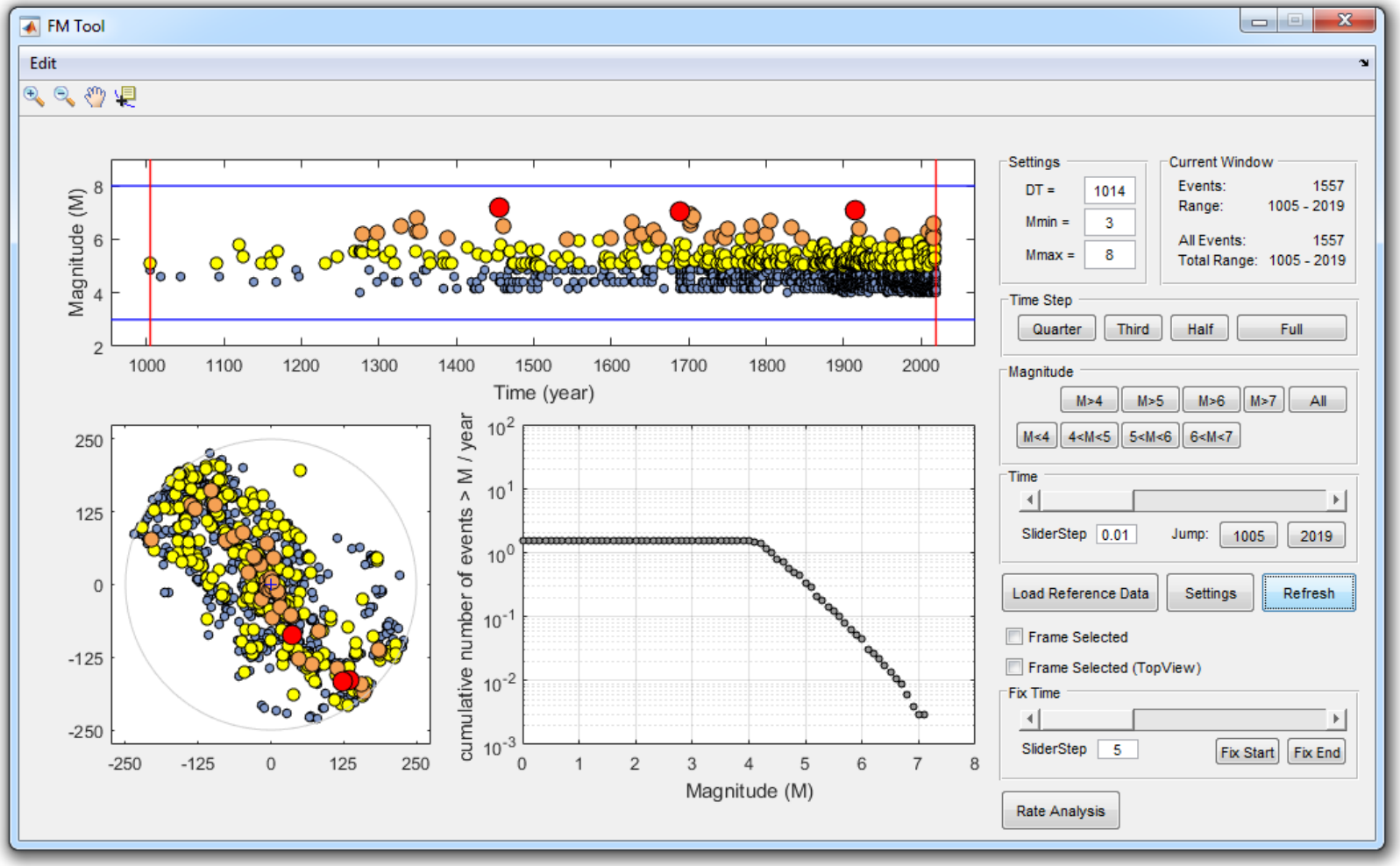
* Advanced Trace Builder Tool

Background Fault Generator



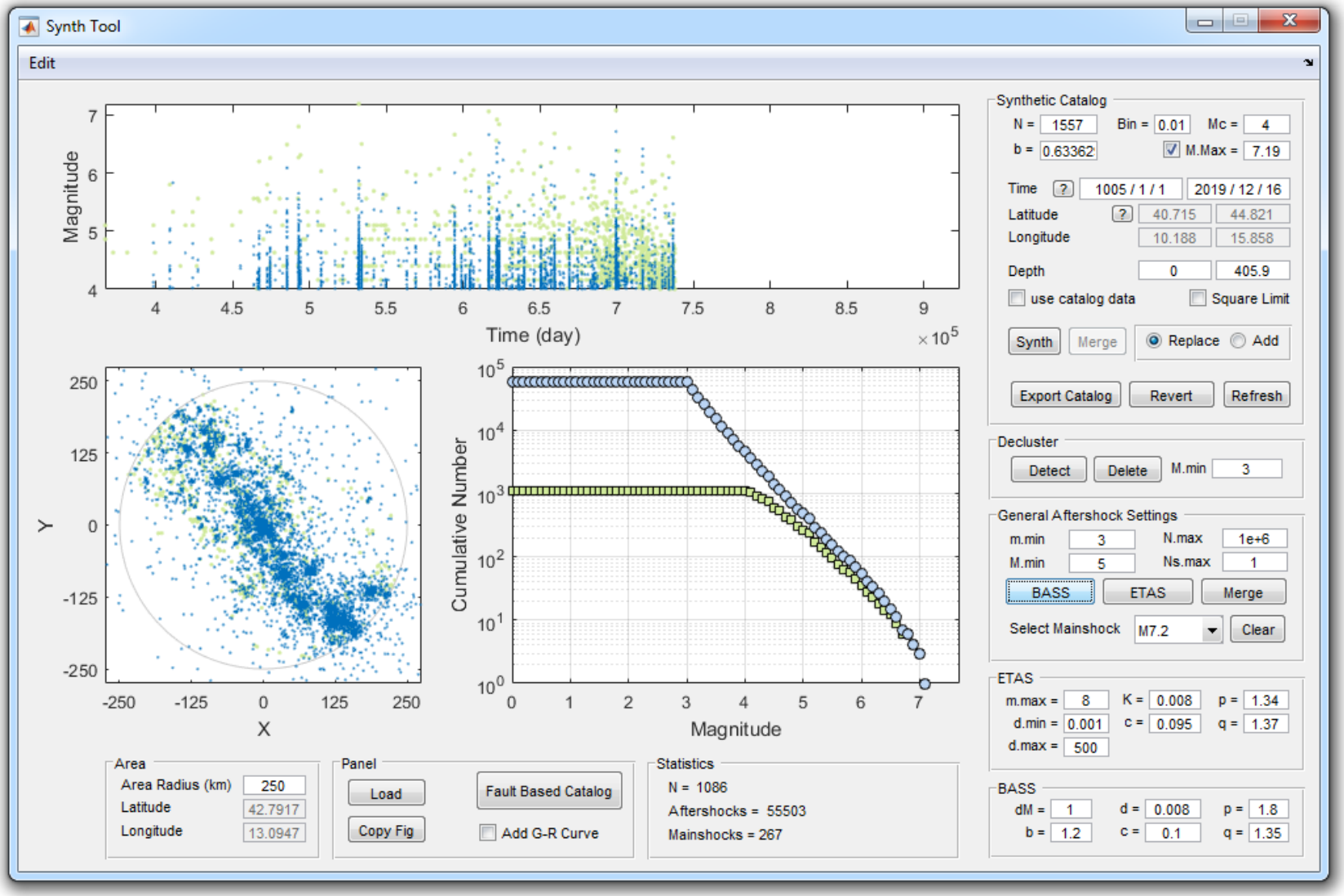
* Background Fault Generator

Frequency-Magnitude Analyzer Tool



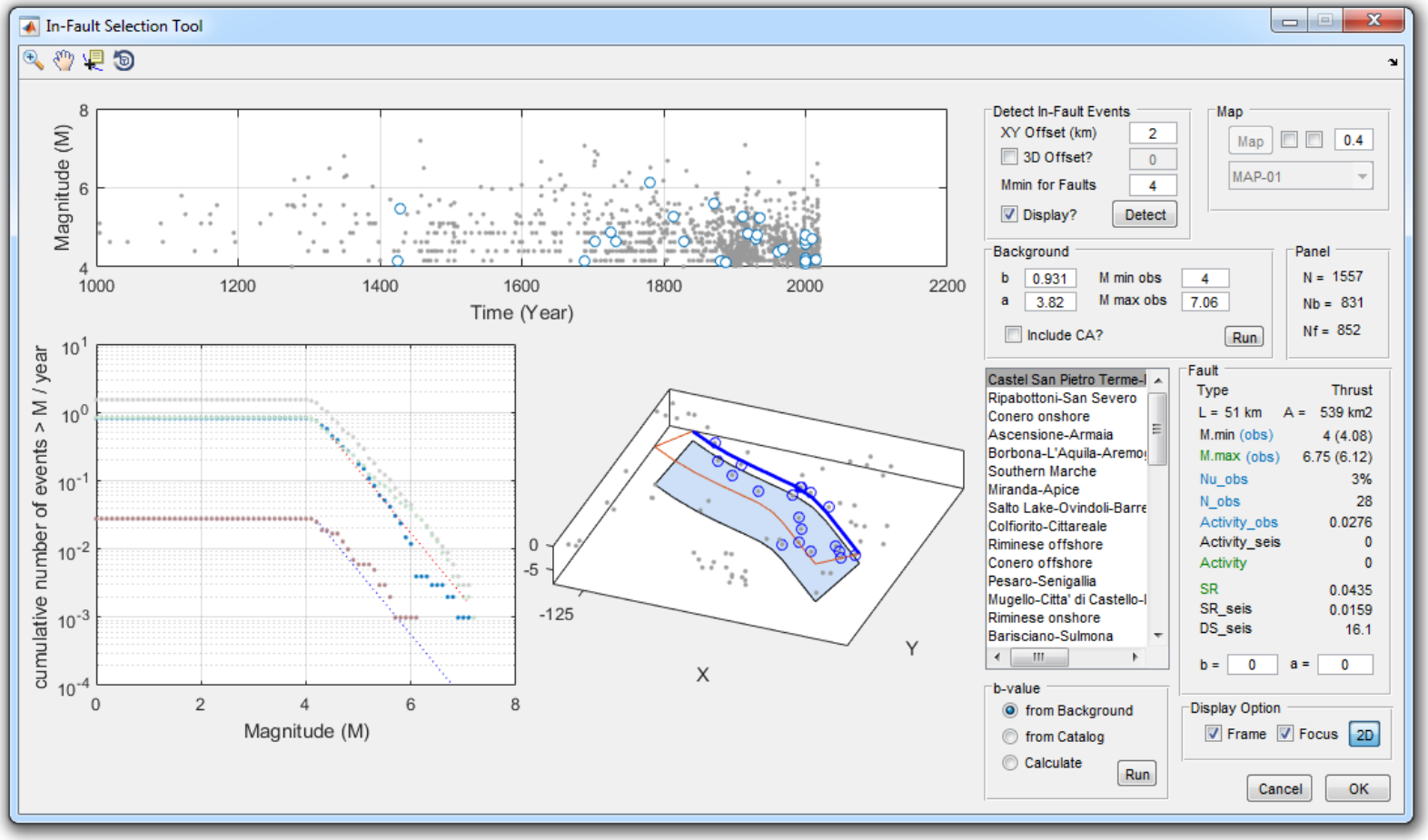
* Frequency-Magnitude Analyzer

Synthetic Catalog Generation



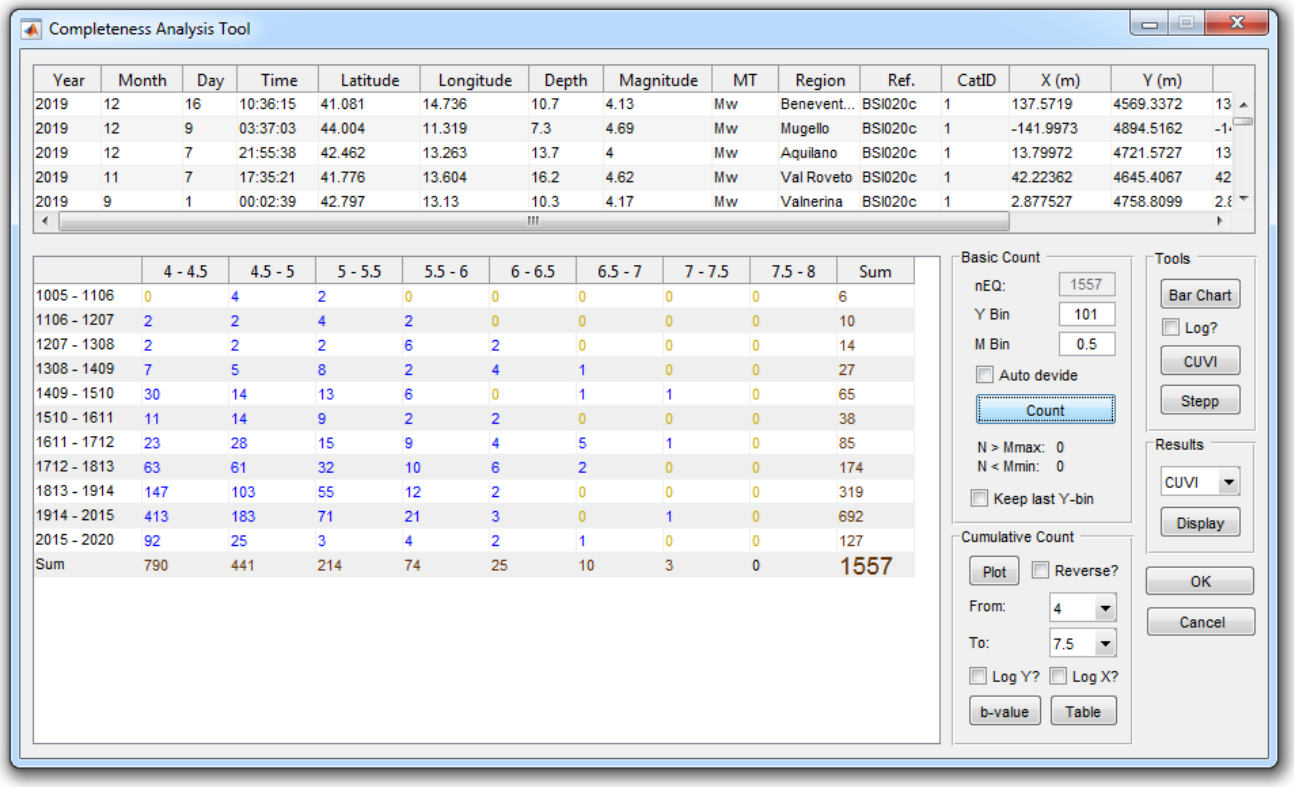
* Synthetic Catalog + Aftershock Generator: BASS / ETAS

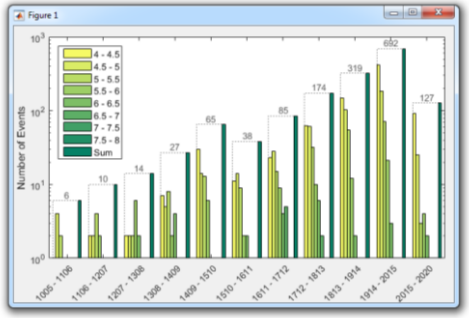
Background Seismicity Editor (IFS Tool)

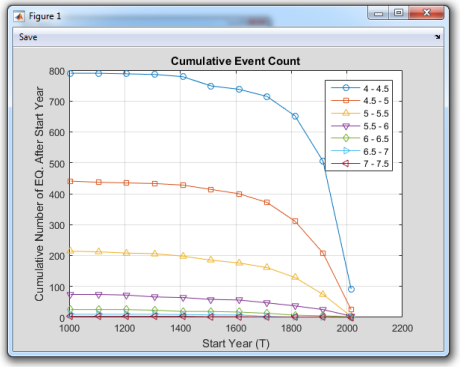


* Fault Event Detector + Background Seismicity Editor

Completeness Analysis Tool

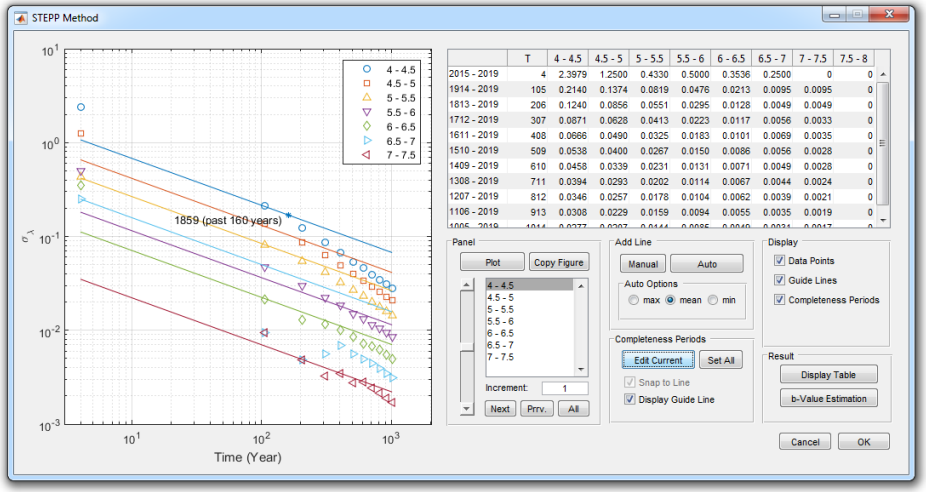




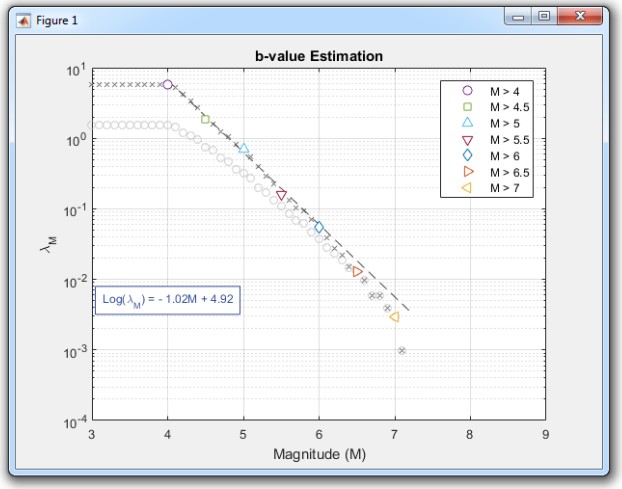


* Completeness Analysis Tool

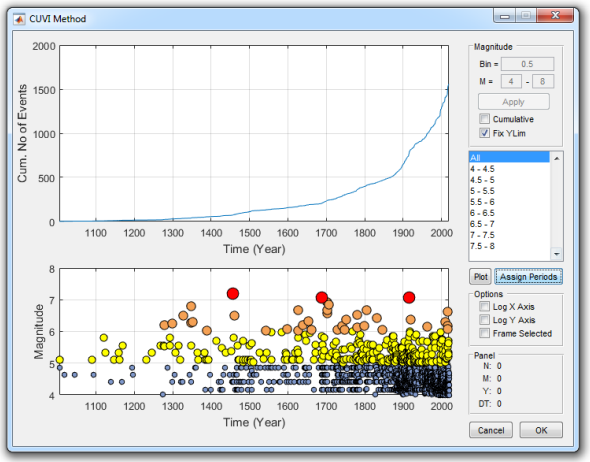
CA Tool: CUVI / STEPP Method



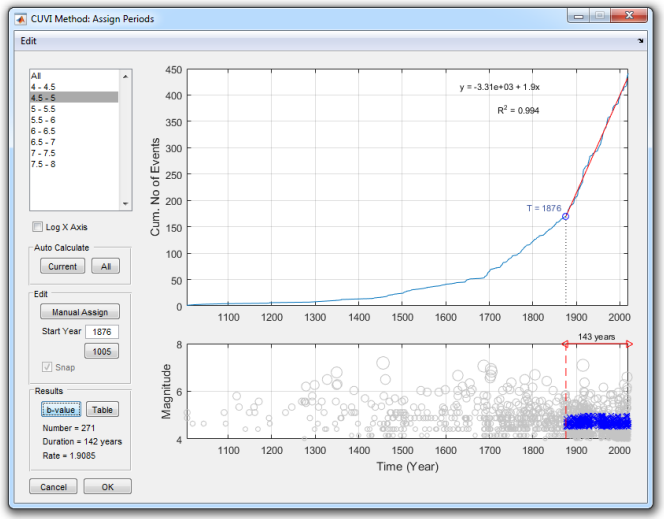
* Stepp Method



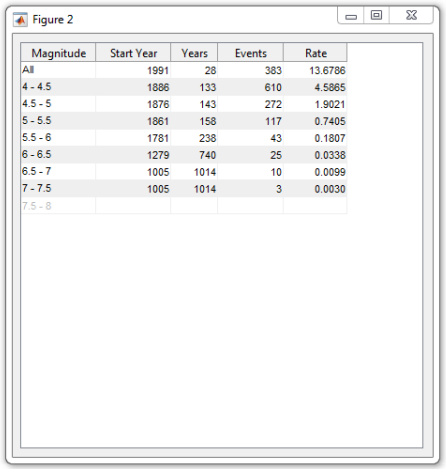
* CA Analysis result: Reconstructed f-m curve



* Visual Cumulative Method



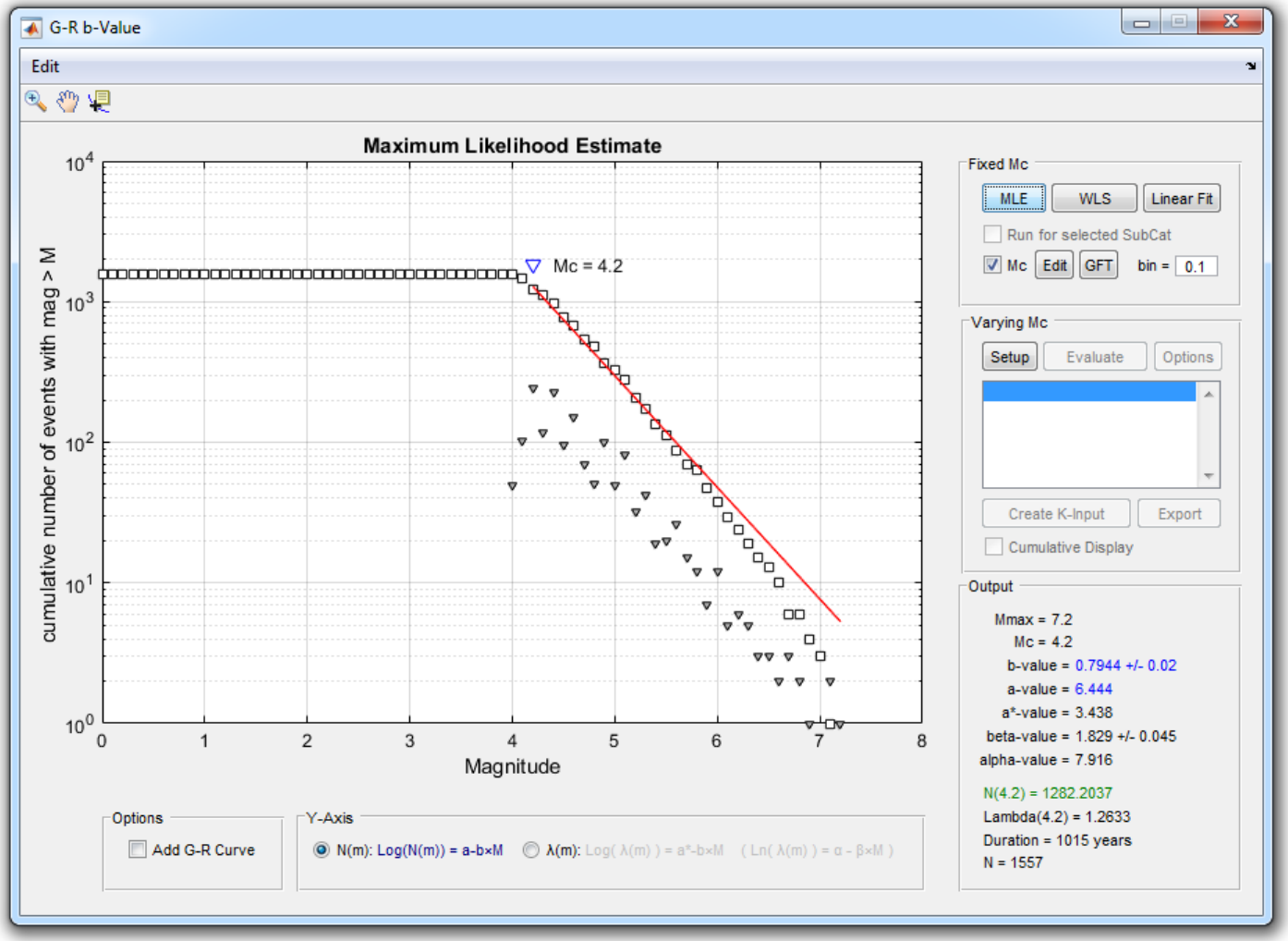
* CUVI Method: Assign Periods Tool



Magnitude	Start Year	Years	Events	Rate
All	1991	28	383	13.6786
4 - 4.5	1886	133	610	4.5865
4.5 - 5	1876	143	272	1.9021
5 - 5.5	1861	158	117	0.7405
5.5 - 6	1781	238	43	0.1807
6 - 6.5	1279	740	25	0.0338
6.5 - 7	1005	1014	10	0.0099
7 - 7.5	1005	1014	3	0.0030
7.5 - 8				

* CA Analysis result: Table Data

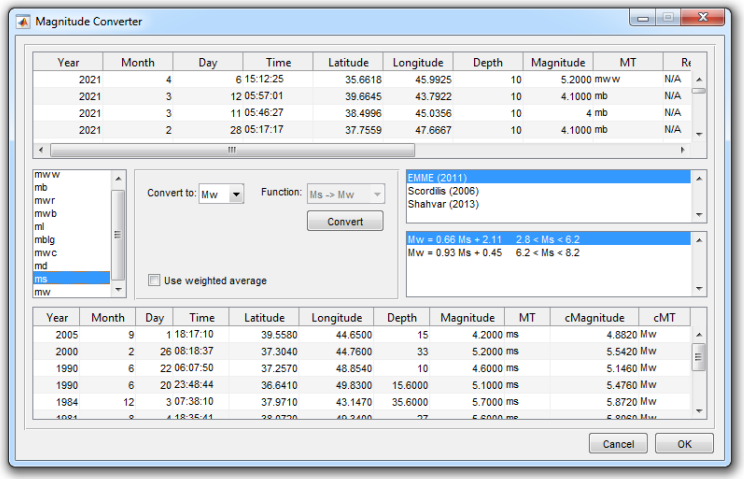
b-value Estimation

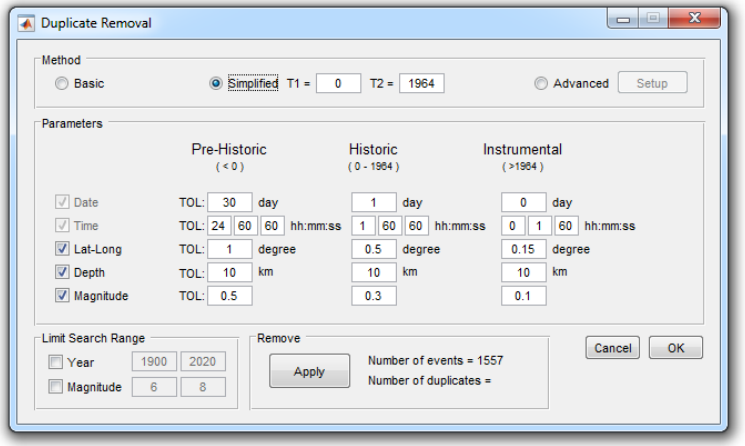


* Maximum Likelihood Estimate / Weighted least squares / Linear regression

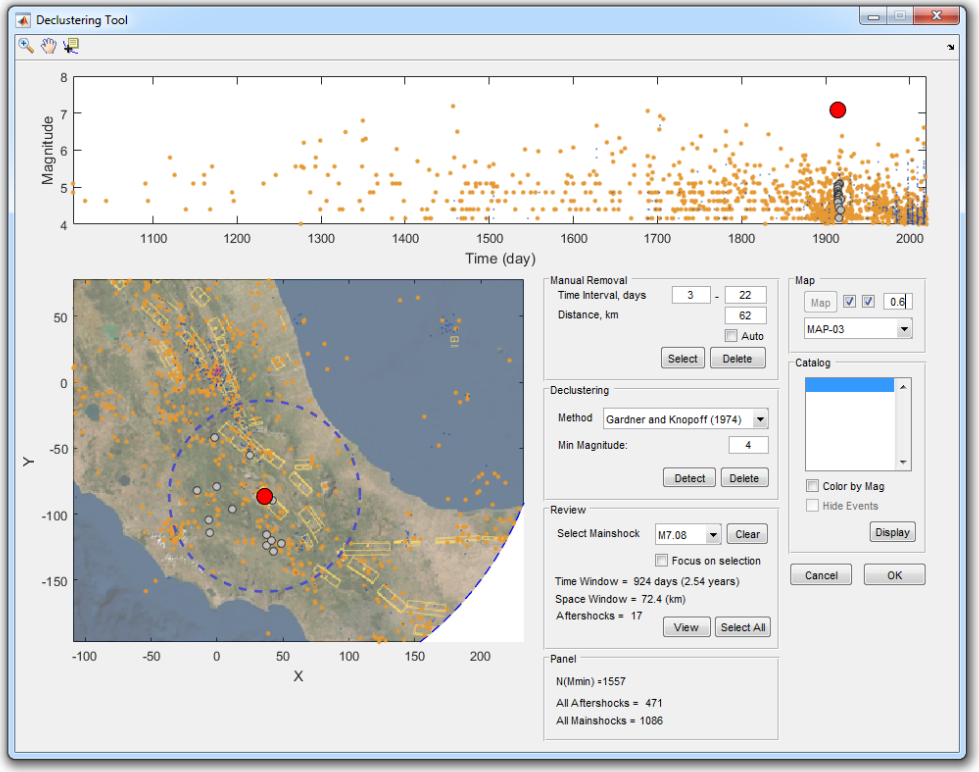
Magnitude Conversion, Duplicate Removal & Declustering Tools

* Magnitude Conversion Tool



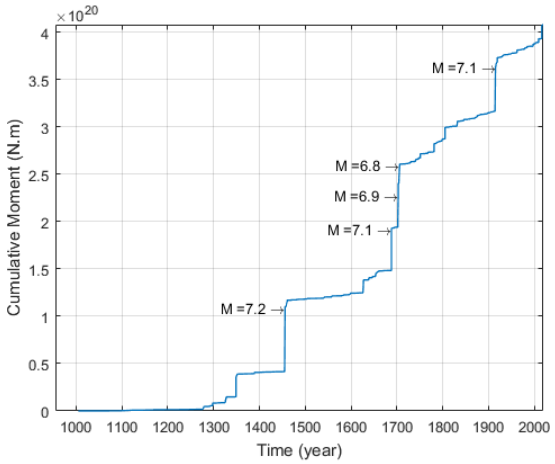


* Duplicate Removal Tool

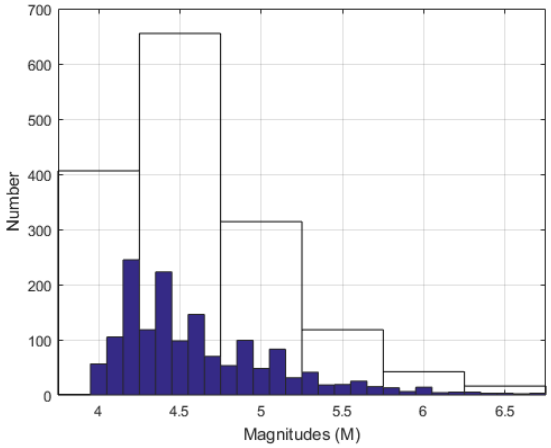


* Declustering Tool: Manual Removal / Gardner Knopoff

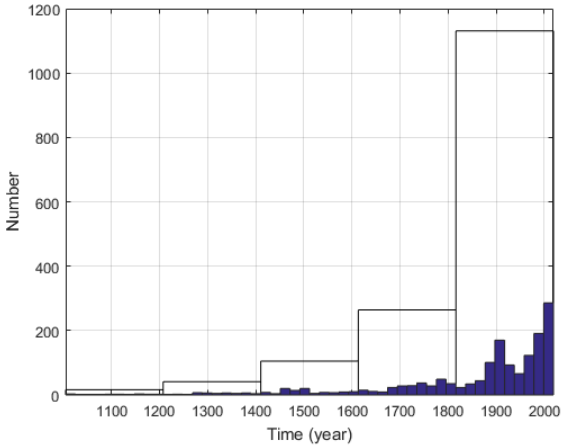
Statistic Reports



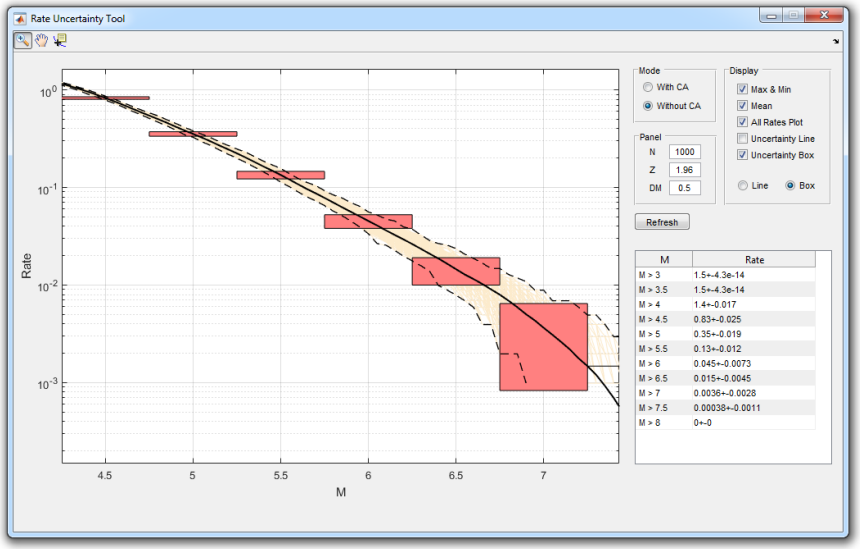
Moment Release Diagram



Magnitude Histogram



Time Histogram

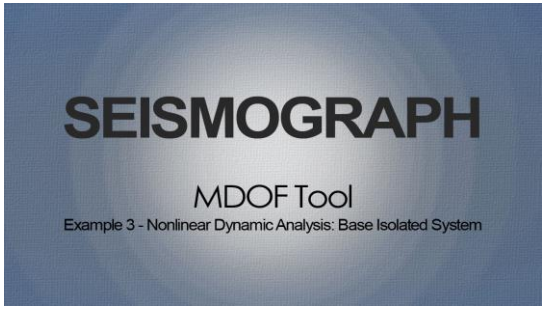


* Rate Uncertainty Calculator

Website:		https://seismograph.me/
YouTube:		https://www.youtube.com/seismograph
Aparat:		http://www.aparat.com/seismograph
Linkedin:		https://www.linkedin.com/company/seismo-graph
Telegram:		https://t.me/SGees
Twitter:		https://twitter.com/seismograph_me
Facebook:		https://www.facebook.com/Seismograph.me/

Contact: info@seismograph.me

Tutorial Videos



MDOF Tool

- Seismic Isolation
- Pulse Load
- Nonlinear Elements
- Nonlinear Dynamic Analysis: Base Isolated System
- Nonlinear Dynamic Analysis: MDOF System
- Nonlinear Dynamic Analysis: SDOF System

PSHA Tool

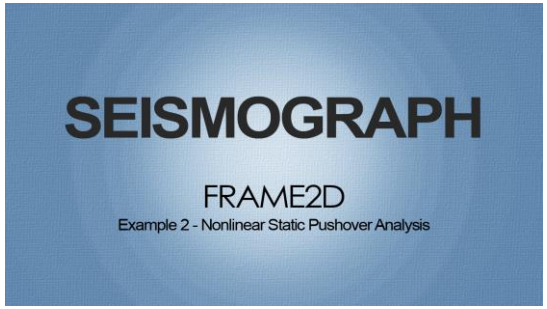
- PSHA Tool v8.8: New Features (2021)
- PSHA Tool v8.5: New Features
- PSHA Tool: Tutorial (2019)
- PSHA Tool: What's New (2019)
- PSHA Tool: What's New (2016)
- PSHA - Advanced Source Editor
- Probabilistic Seismic Hazard Analysis

SCALE Tool

- Scale Tool v5.5: New Features (2021)
- Scale Tool v5.0: New Features
- Scale Tool: Tutorial (2019)
- Scale Tool: What's New (2016)
- Scale Tool

SMDA

- SMDA: What's New (2019)
- SMDA: What's New (2016)
- SMDA Tool

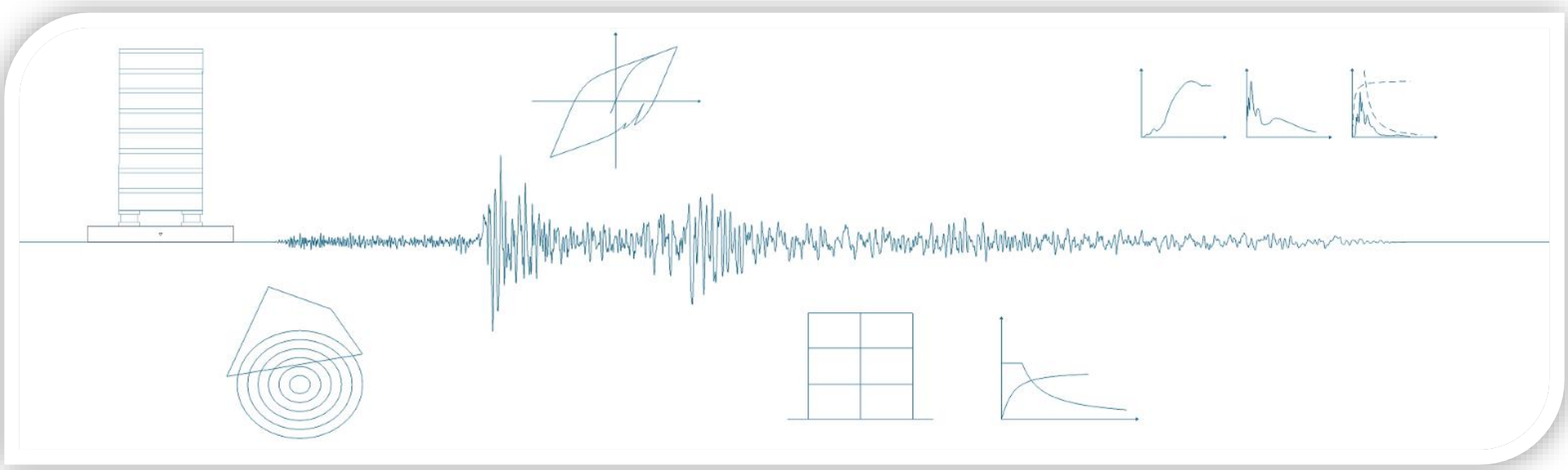


Frame2D

- Linear Static Analysis
- Nonlinear Static Pushover Analysis

LST Tool

- Liquid Storage Tanks



SEISMOGRAPH

earthquake engineering software

https://seismograph.me