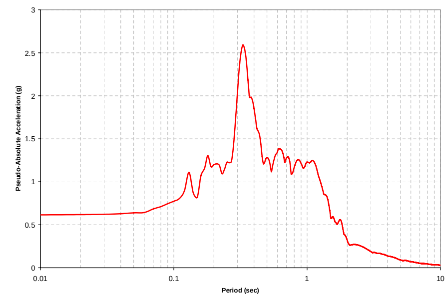
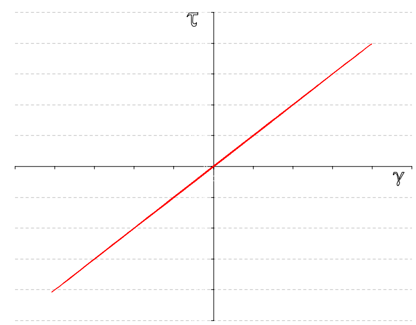
SHAKE2000

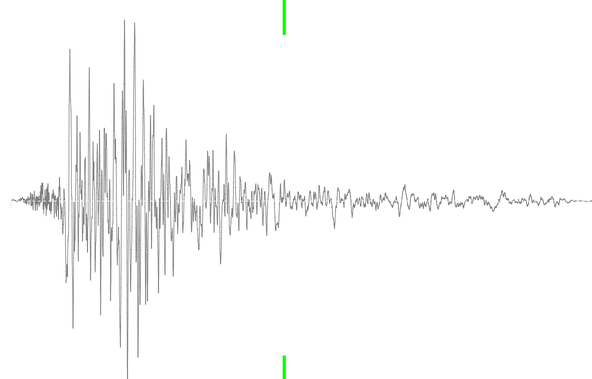
A Computer Program for the 1-D Analysis of Geotechnical Earthquake Engineering Problems

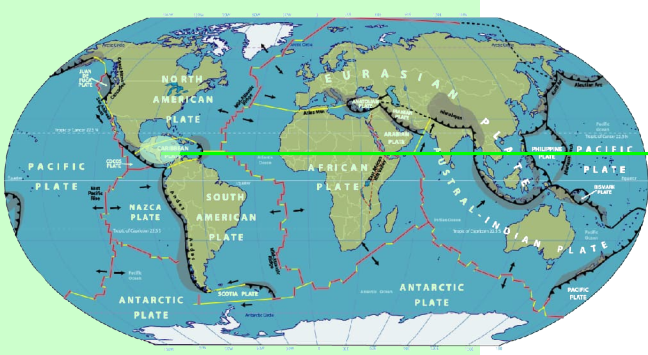
Quick Tutorial

Gustavo A. Ordóñez









SHAKE2000

A Computer Program for the 1-D Analysis of Geotechnical Earthquake Engineering Problems

By

Gustavo A. Ordóñez
GeoMotions

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  - Ordonez, Gustavo A. (2022). SHAKE2000 – A Pre- & Post-Processor for SHAKE. GeoMotions, Lacey, Washington, USA.

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SHAKE2000

A Computer Program for the 1-D Analysis of Geotechnical Earthquake Engineering Problems

A software application that integrates

SHAKE

A Computer Program for Earthquake Response Analysis of Horizontally Layered Sites

Per B. Schnabel, John Lysmer, H. Bolton Seed
University of California, Berkeley

and

SHAKE91

A Modified Version of SHAKE for Conducting Equivalent Linear Seismic Response Analyses of Horizontally Layered Soil Deposits

I.M. Idriss and J.I. Sun
University of California, Davis

With

ShakEdit

A Pre and Postprocessor for SHAKE and SHAKE91

Gustavo A. Ordóñez

March 2025

SHAKE2000 Quick Tutorial

by:

Gustavo A. Ordonez

GeoMotions
Lacey, Washington

March 2025

This tutorial is not a teaching tool for seismic site response analysis.

SHAKE2000 Quick Tutorial

Steps

The steps to be followed when entering the data to create a work file for SHAKE, or to perform the different functions to run an analysis, are indicated with colored and numbered text boxes. Step 1 is shown with a green color text box pointing to the cell where a value is entered or where you should click on a command button to perform a function:

1. Enter “Option 2 – Column 1”

After executing step 1, then move on to Step 2 and so on …

2. Enter “Col 1” in Identification

3. Enter “124” in Surface

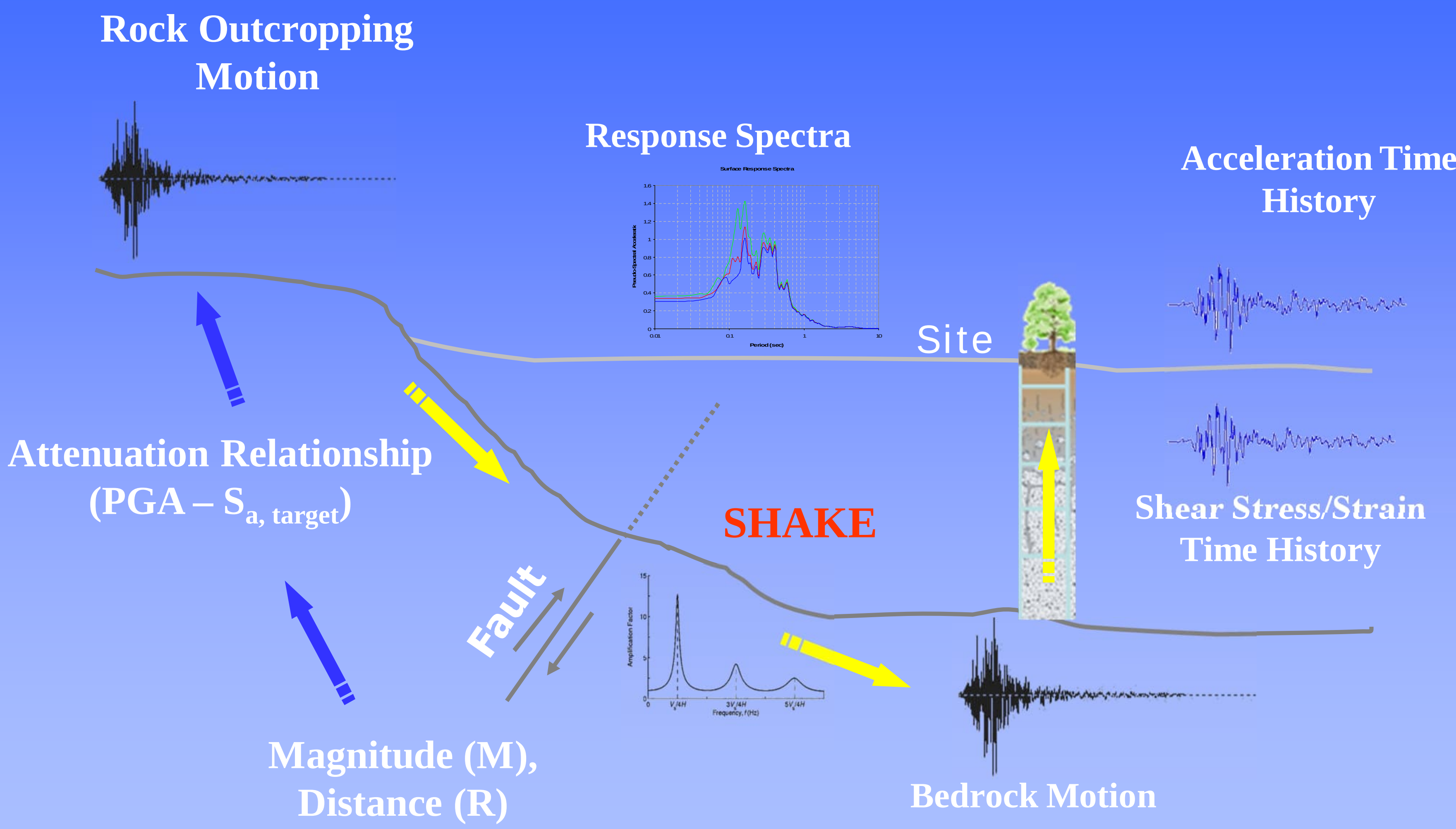
4. Enter “5” in Thickness

5. Enter “0.125” for Unit Weight

6. Enter “573” in Shear Wave

GeoMotions

Site-Specific Seismic Hazard Analysis & Site Response



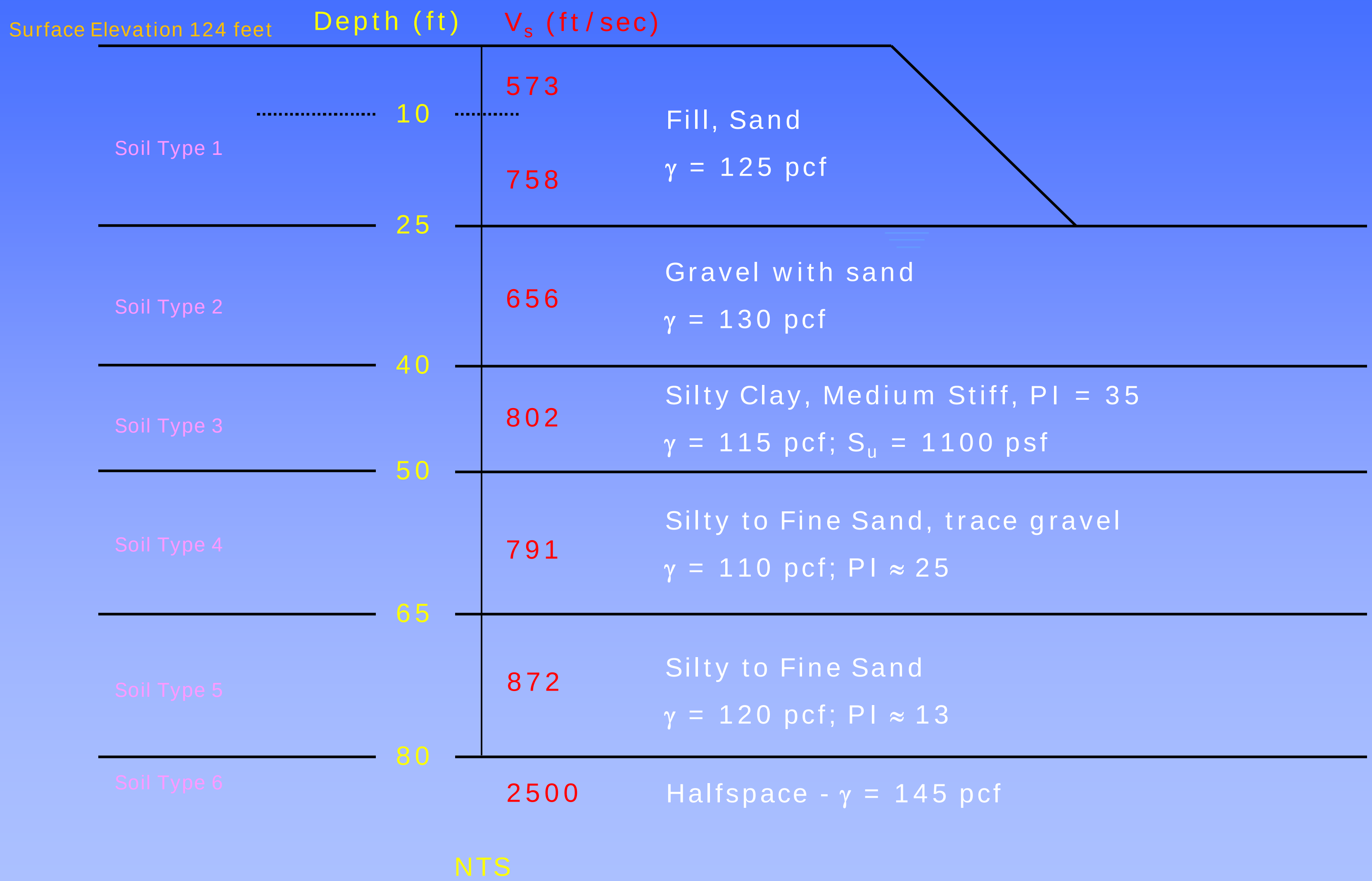
Site-Specific
Seismic Hazard Analysis & Site Response

1. Define the subsurface conditions at the site.
2. Define the significant structures and seismogenic source zones in the region that may affect the site.
3. Determine the peak “rock” accelerations at the site corresponding to the different earthquake sources.
4. Develop a target response spectrum for each source mechanism.
5. Select representative time histories of ground motion from similar tectonic environments that would approximately match the target response spectrum.
6. Conduct the seismic site-response analysis (i.e., evaluate the influence of local site conditions on seismic ground motions).

Site-Specific Analysis - Step 1

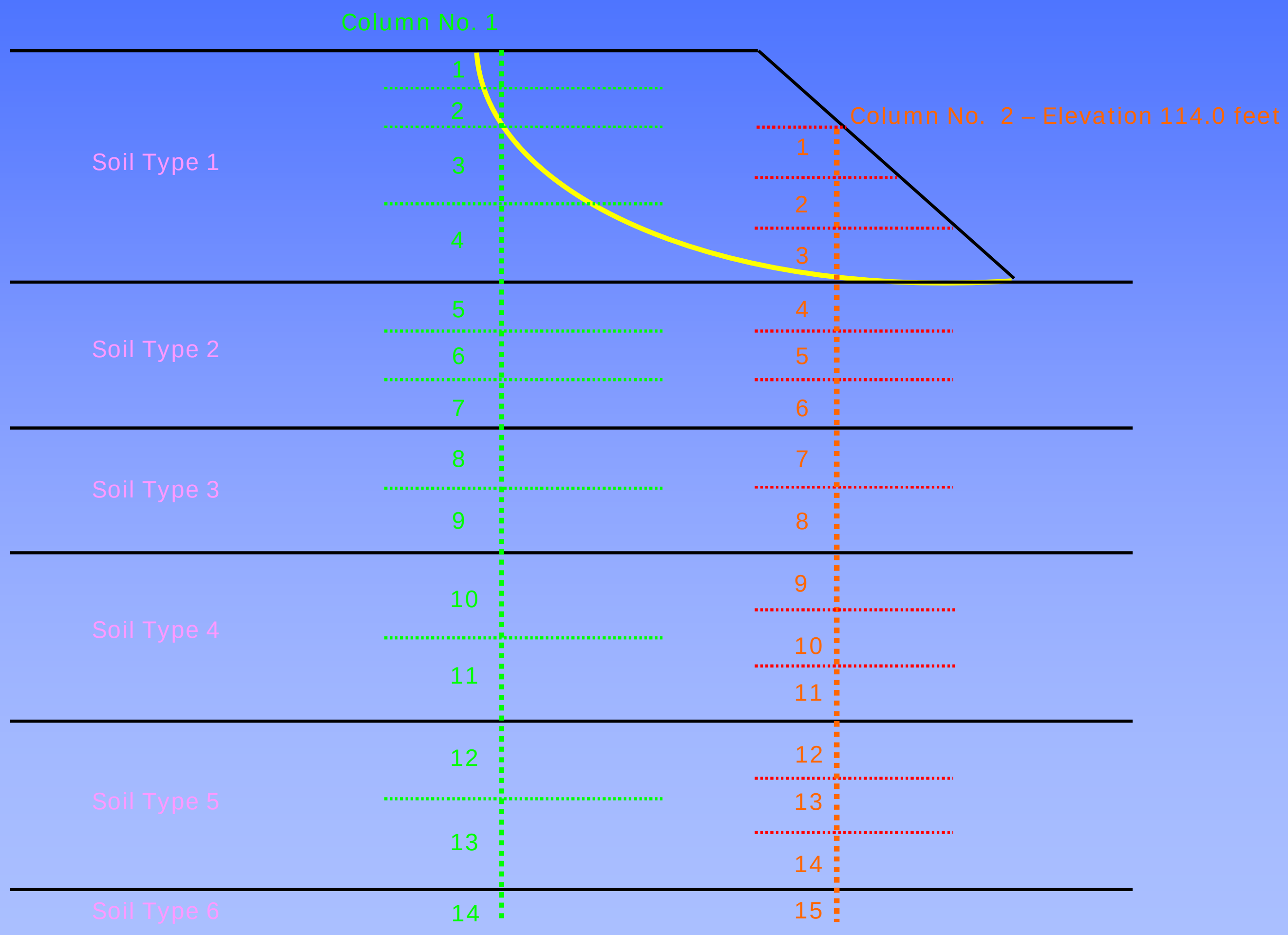
Define the subsurface conditions at the site

Sample Problem



Sample Problem

SHAKE Columns



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Site-Specific Analysis - Step 2

Define the significant structures and seismogenic source zones in the region that may affect the site

For this tutorial assume:

Source	Fault Type	M_W	R_{RUP} (km)
Crustal Event	Normal+Reverse	7.1	25

GeoMotions

Site-Specific Analysis - Step 3

Determine the peak “rock” accelerations at the site corresponding to the different earthquake sources

For this tutorial assume $PGA_{M+1\sigma}$ = 0.46 g’s

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Site Specific Analysis - Step 4

Develop a target response spectrum for each source mechanism

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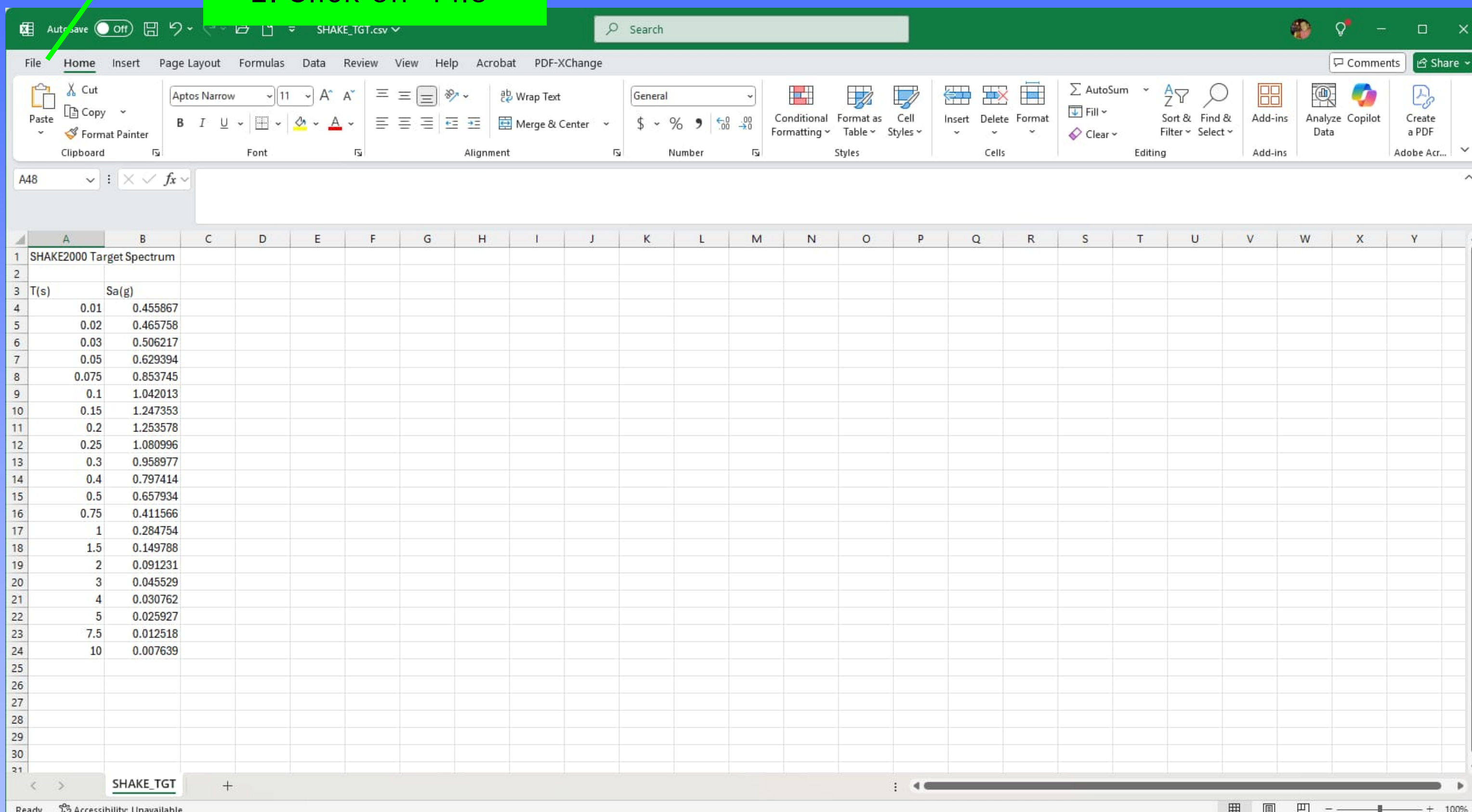
For this tutorial assume Target Response Spectrum

Period (%)	S_a (g's)
0.01	0.455867
0.02	0.465758
0.03	0.506217
0.05	0.629394
0.075	0.853745
0.1	1.042013
0.15	1.247353
0.2	1.253578
0.25	1.080996
0.3	0.958977
0.4	0.797414
0.5	0.657934
0.75	0.411566
1	0.284754
1.5	0.149788
2	0.091231
3	0.045529
4	0.030762
5	0.025927
7.5	0.012518
10	0.007639

Create a new “.csv” Excel file with the target response spectrum values following PEER format

1. Click on “File”



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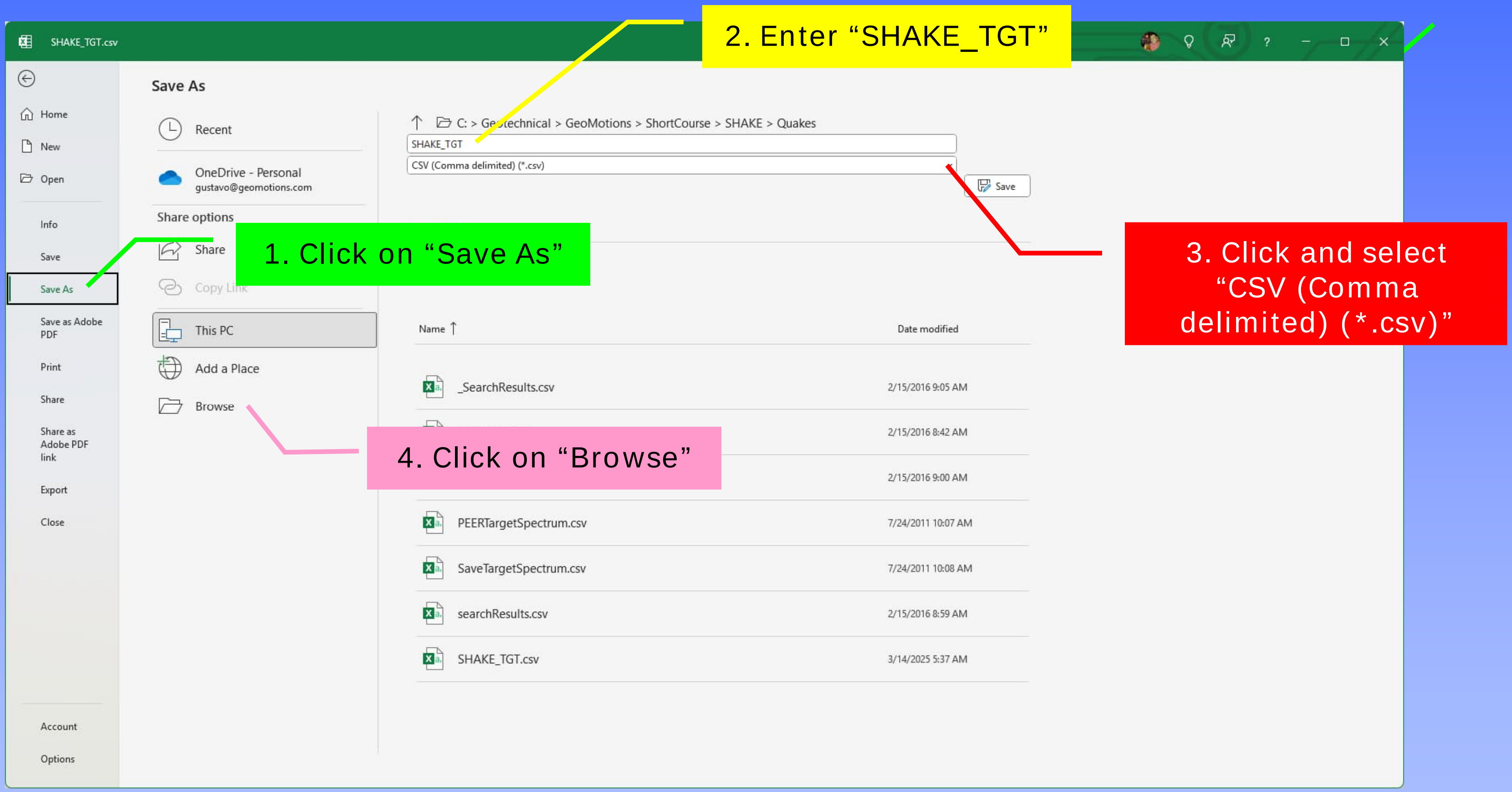
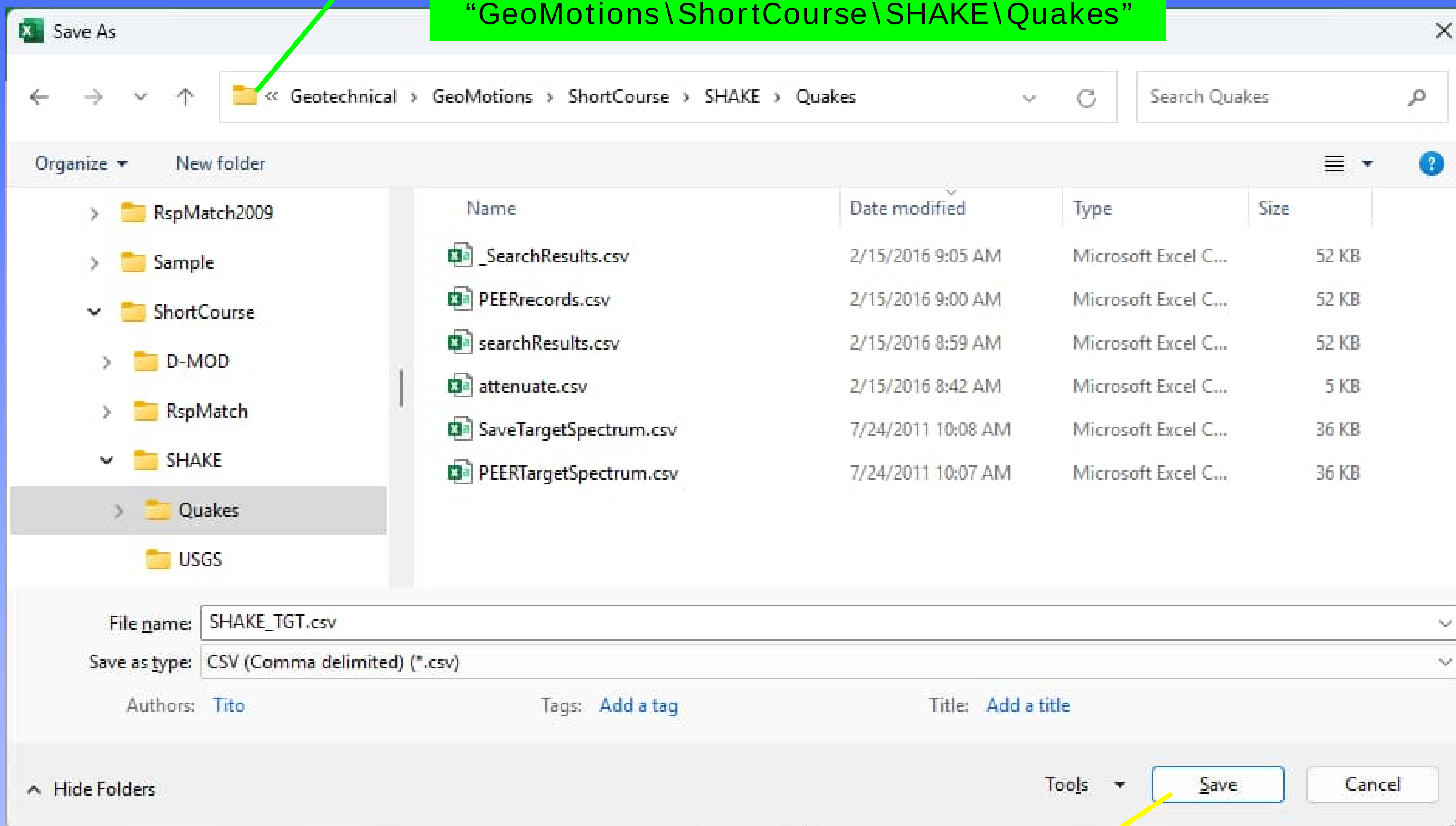
Create a new ".csv" Excel file with the target response spectrum values following PEER format



Save Target Response Spectrum

1. Switch folders until you change to "GeoMotions\ShortCourse\SHAKE\Quakes"



2. Click "Save"

Site-Specific Analysis - Step 5

Select representative time histories of ground motion from similar tectonic environments that would approximately match the target response spectrum

Crustal

PEER Ground Motion Database

https://ngawest2.berkeley.edu/

Subduction

NGA-Subduction Portal

https://www.risksciences.ucla.edu/nhr3/nga-subduction/gmportal

Selection of Acceleration Time Histories

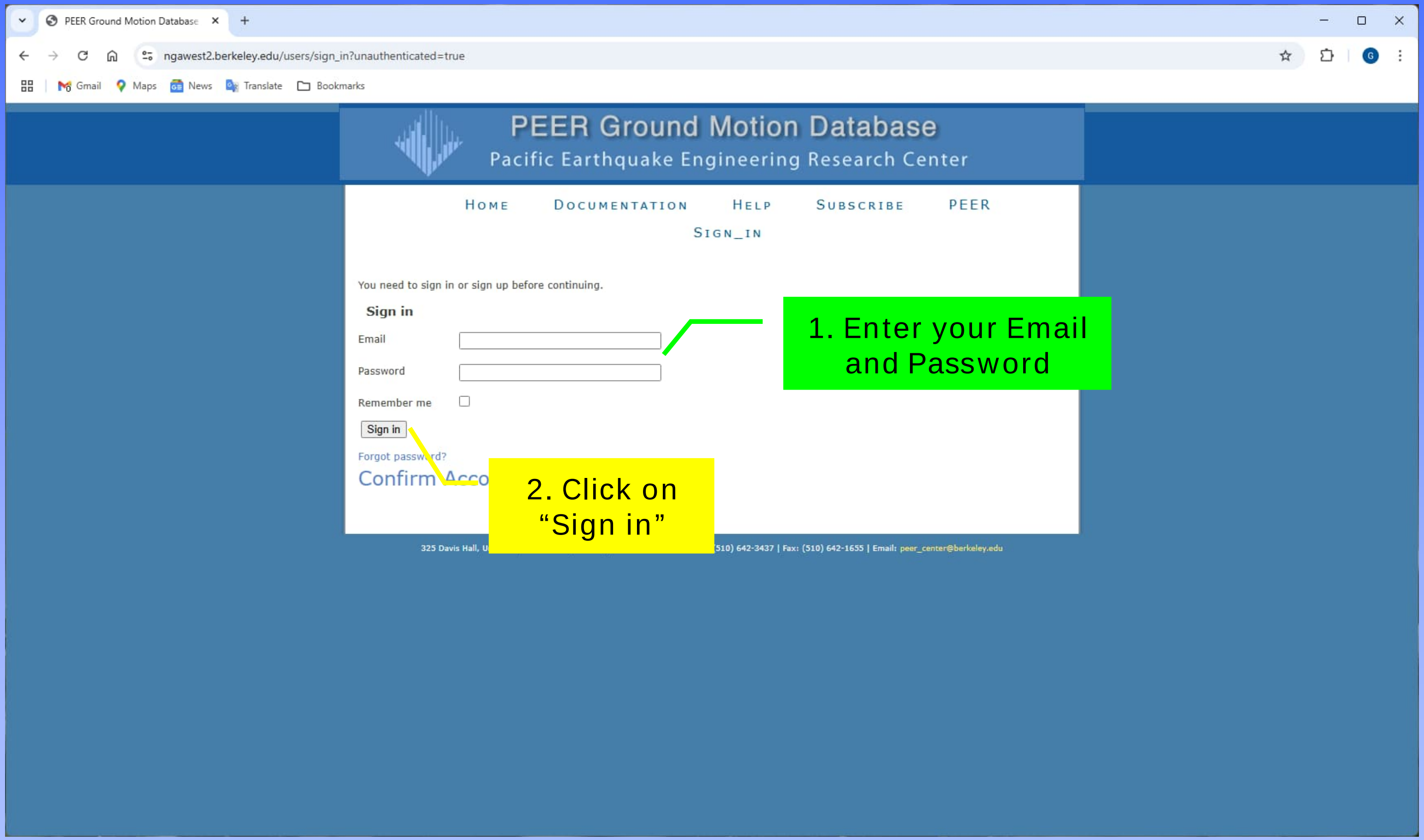
http://ngawest2.berkeley.edu/

1. Click on "NGA West 2"

GeoMotions

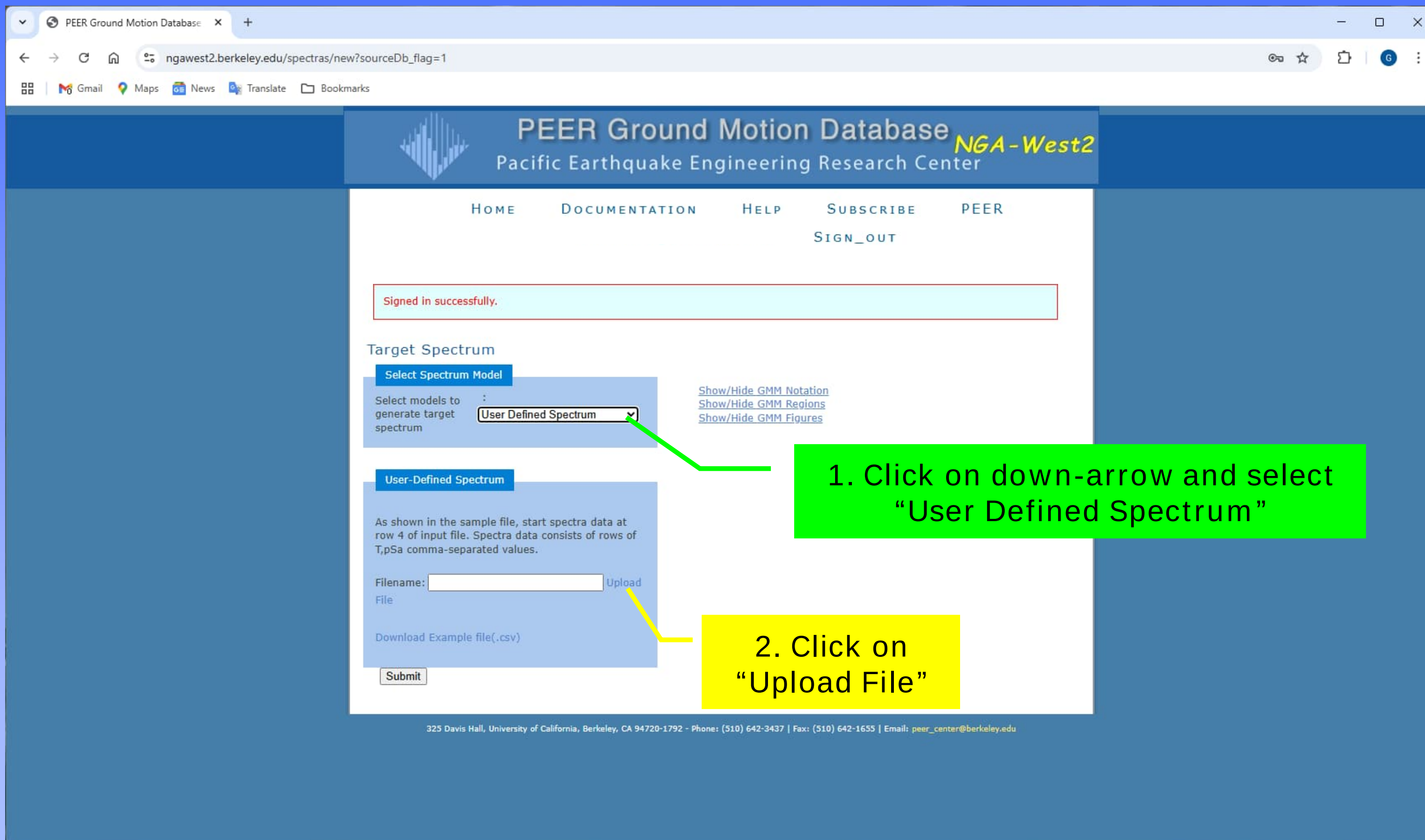
Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/



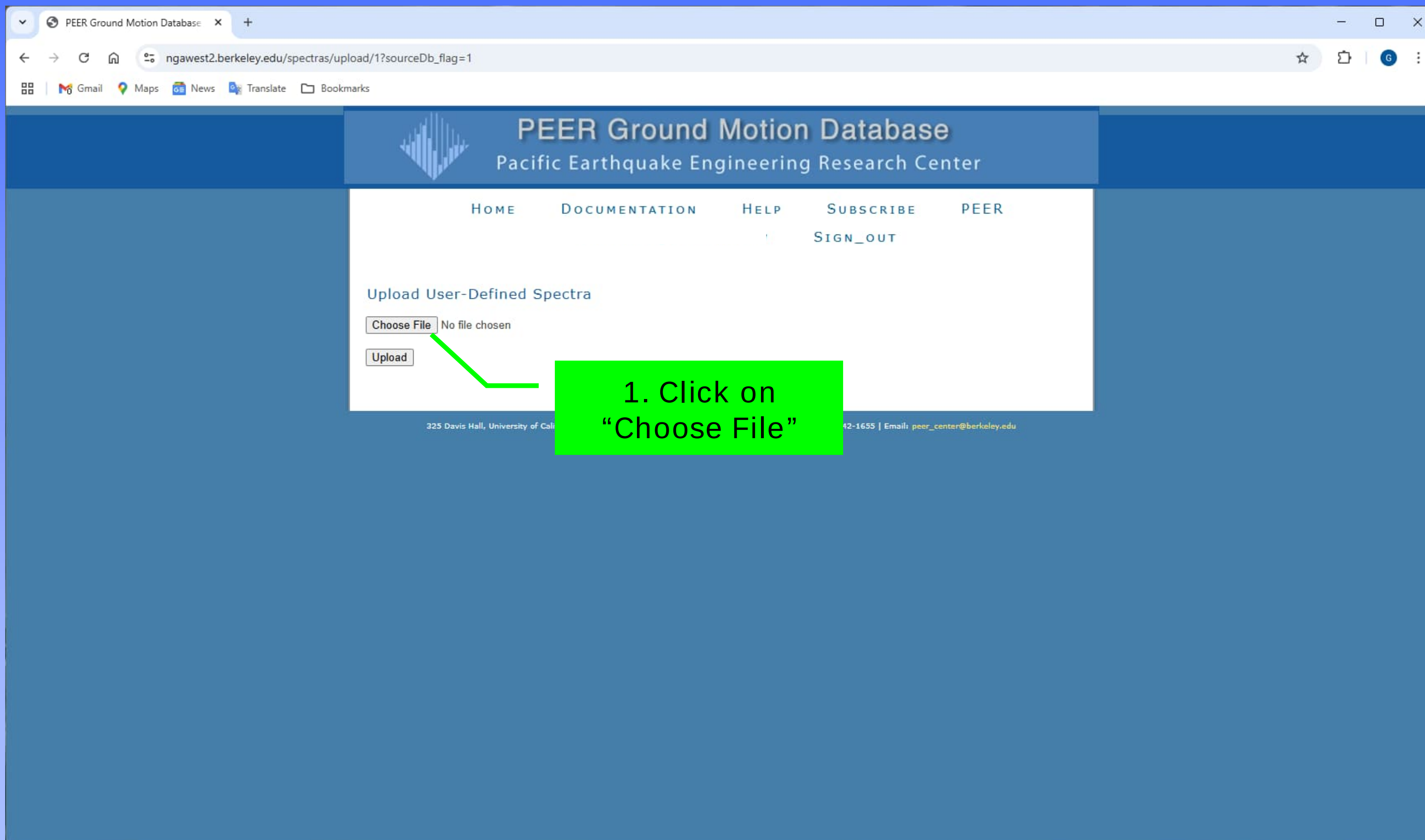
Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/



Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/



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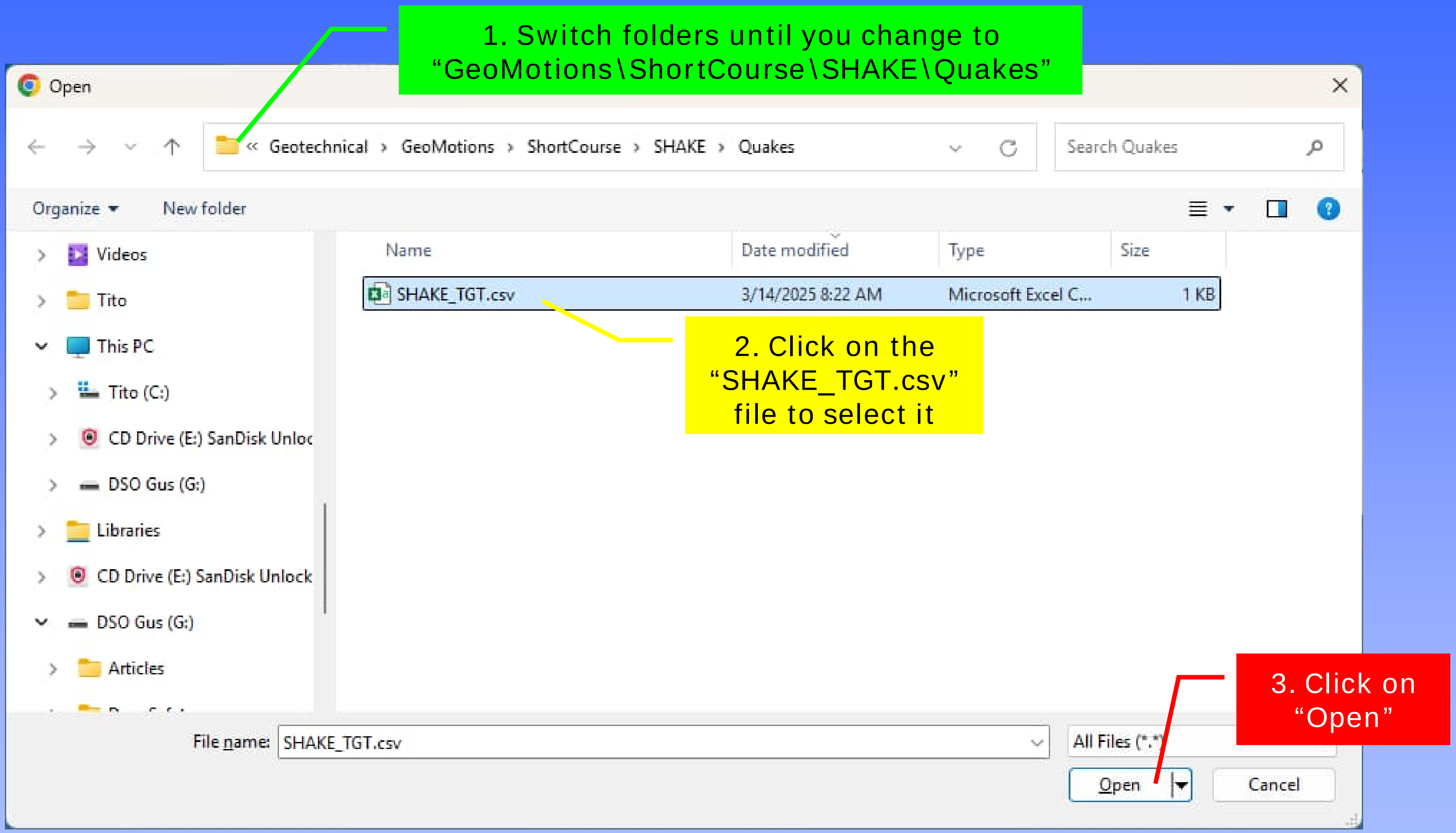
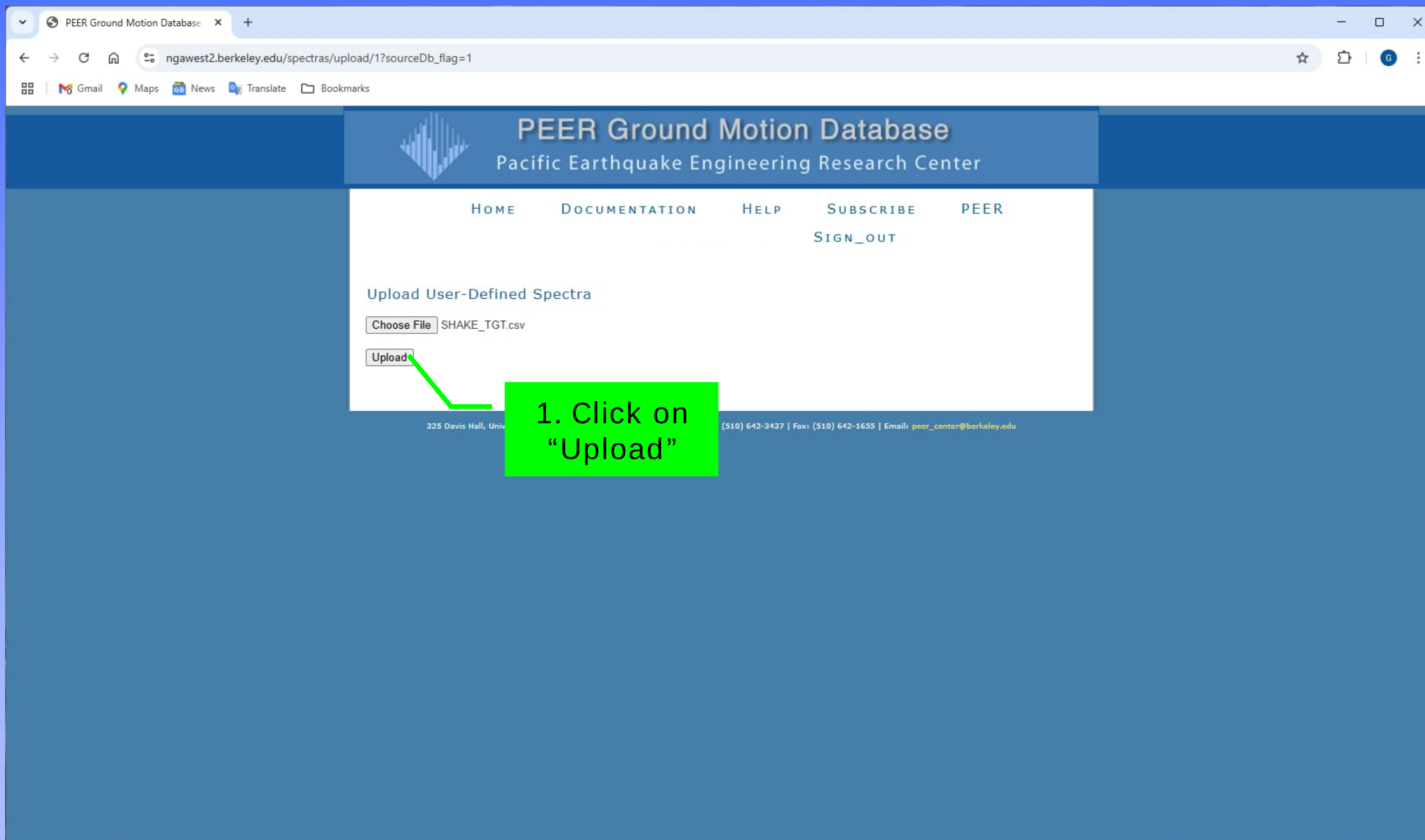
Upload Target Response Spectrum



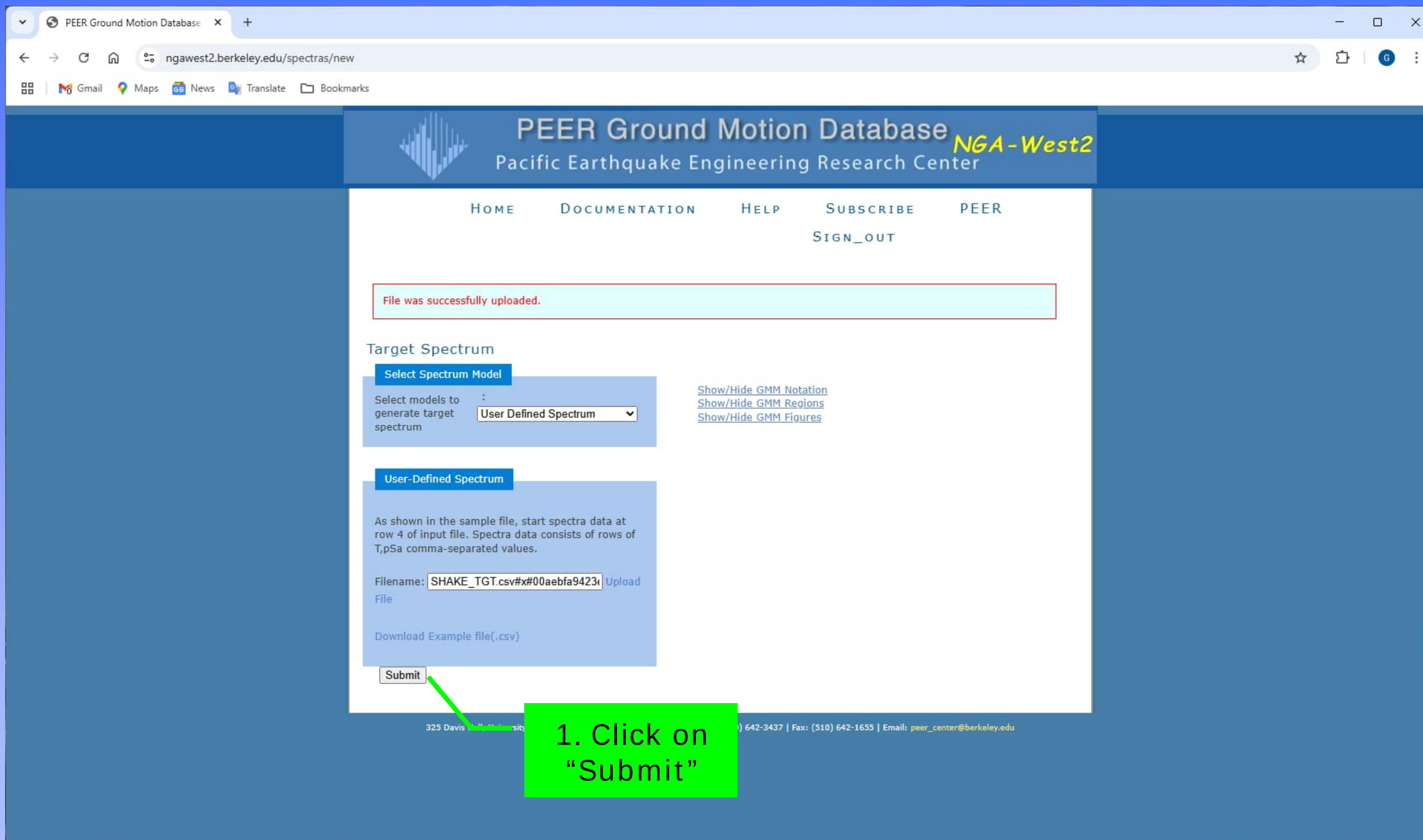
Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/



Selection of Acceleration Time Histories

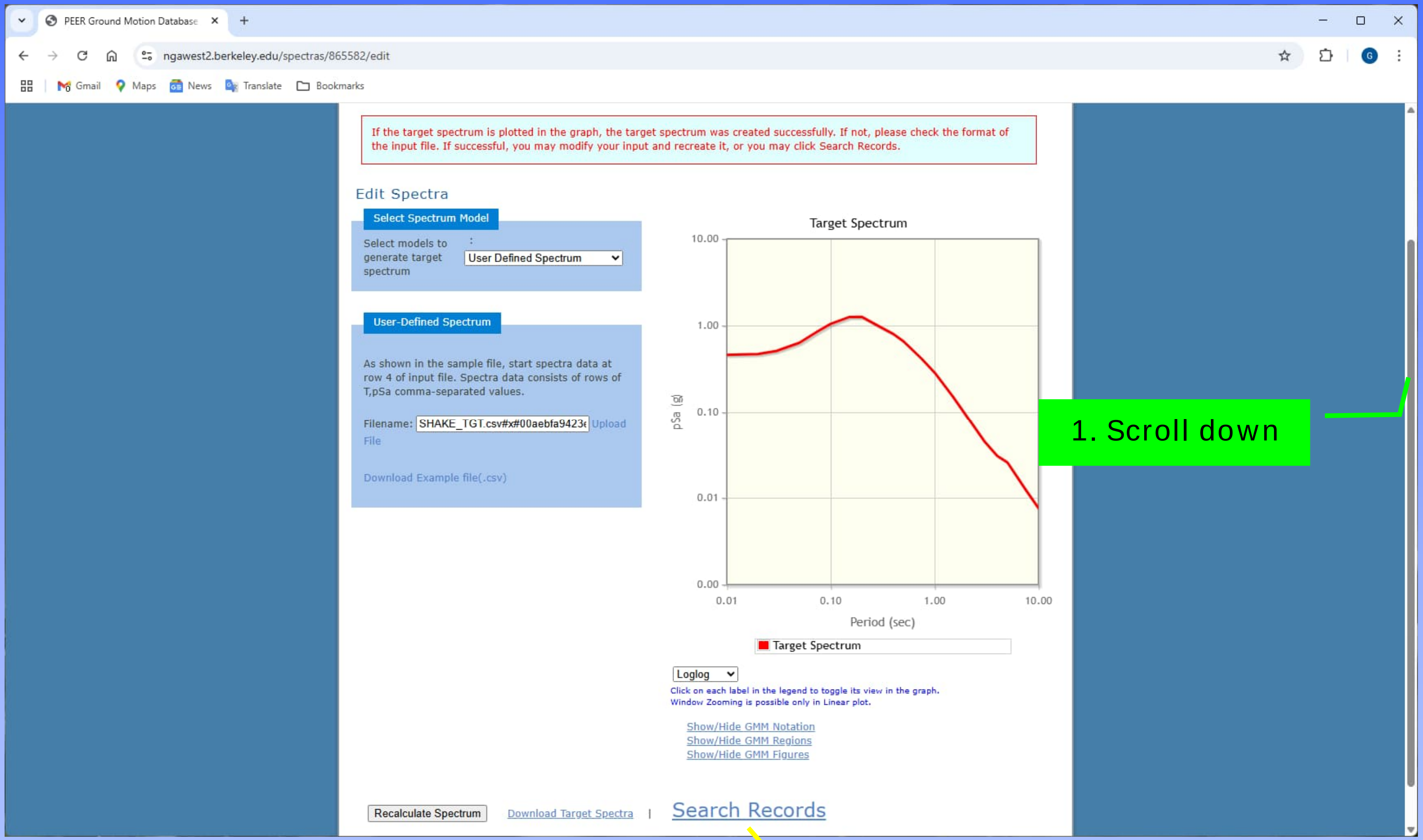
http://ngawest2.berkeley.edu/



GeoMotions

Selection of Acceleration Time Histories

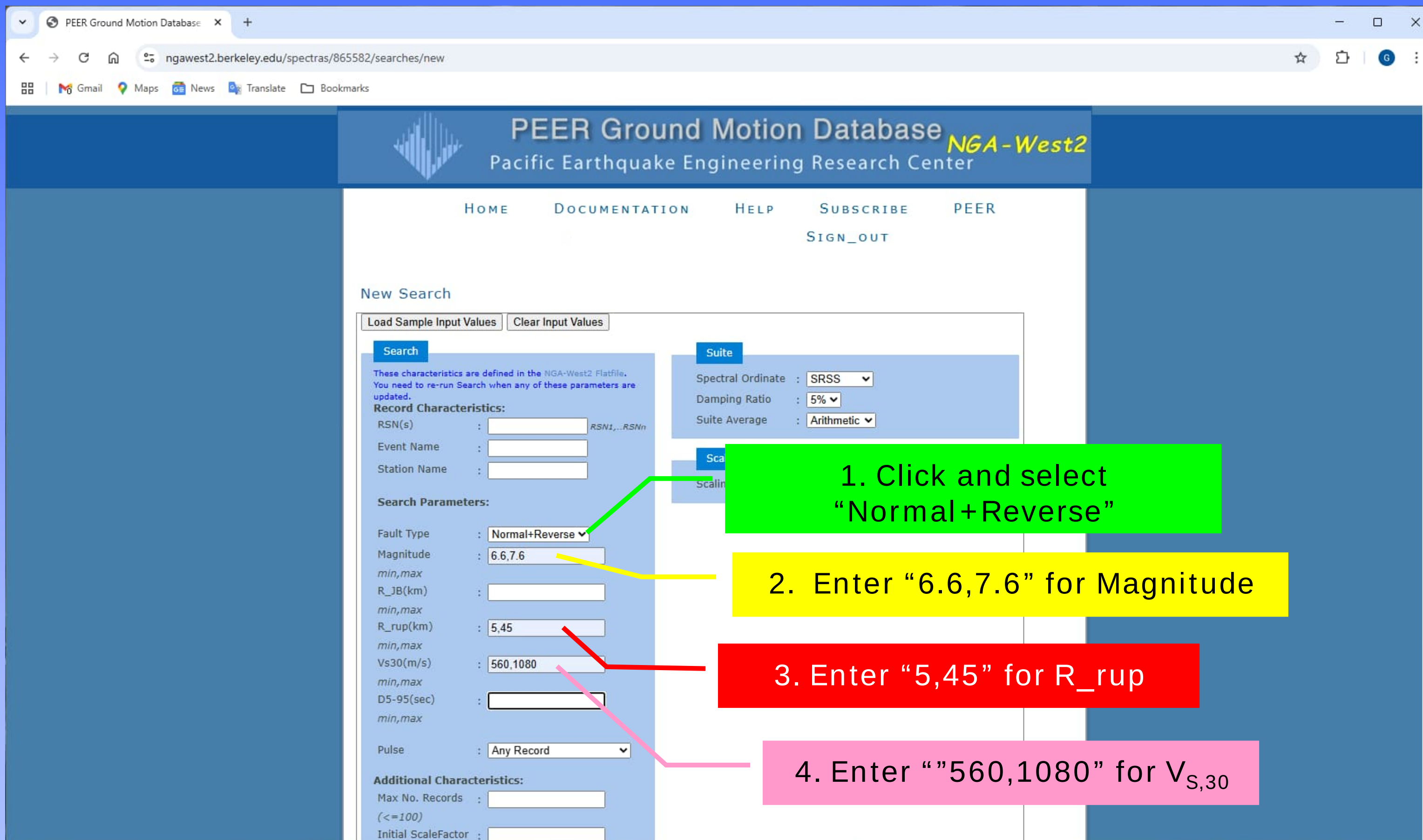
http://ngawest2.berkeley.edu/



1. Click on "Search Records"

Selection of Acceleration Time Histories

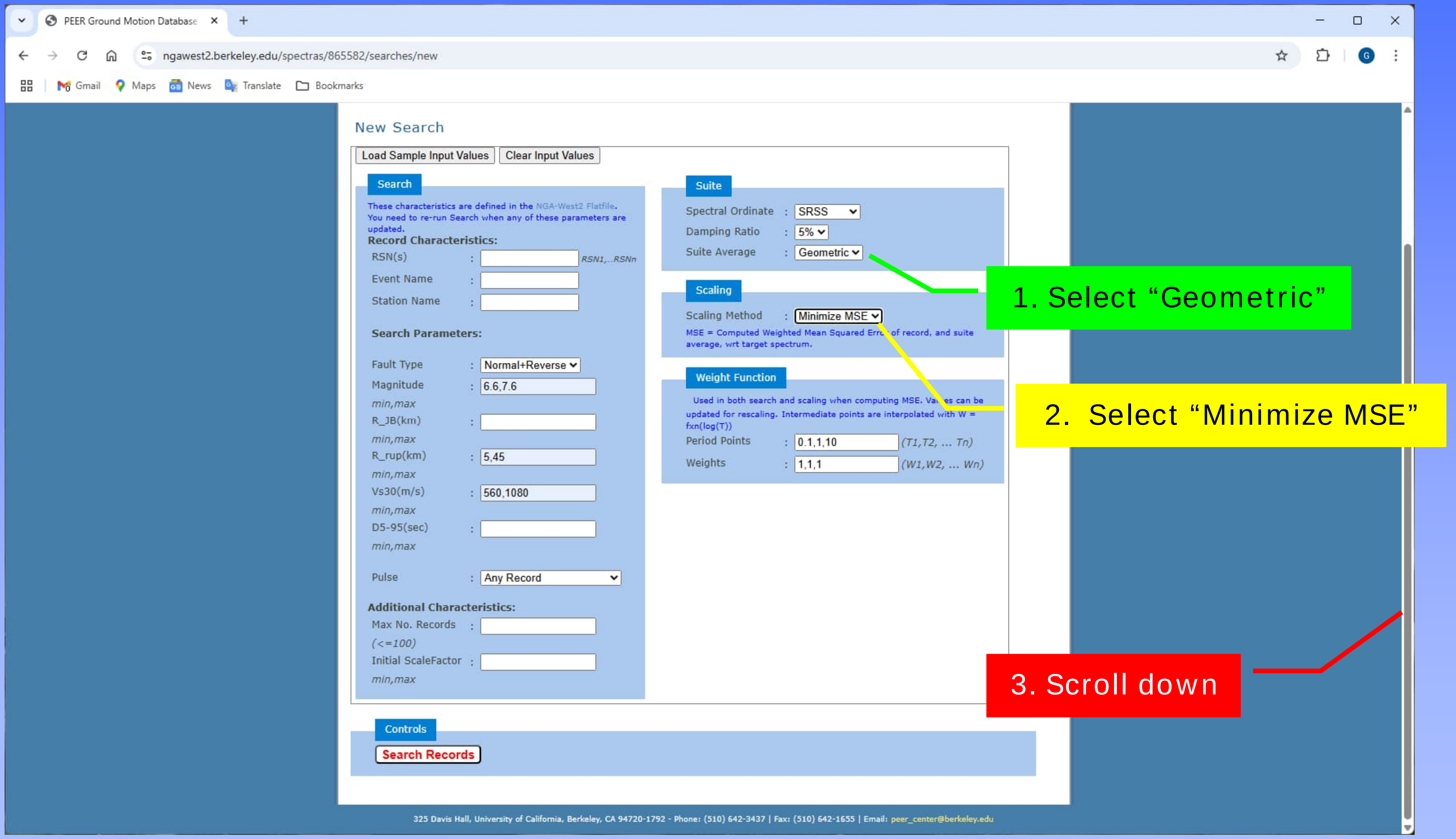
http://ngawest2.berkeley.edu/



GeoMotions

Selection of Acceleration Time Histories

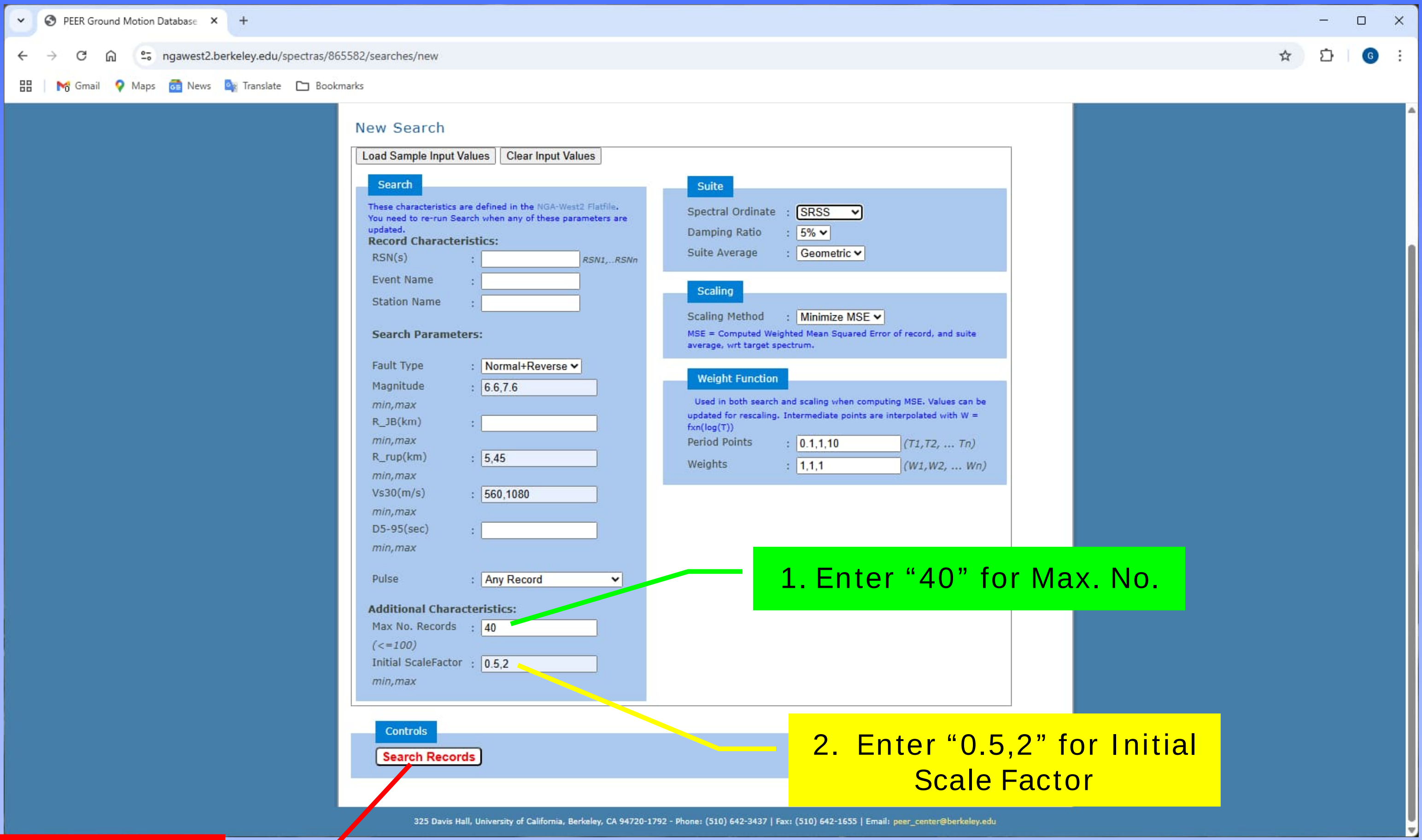
http://ngawest2.berkeley.edu/



GeoMotions

Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/



1. Enter “40” for Max. No.

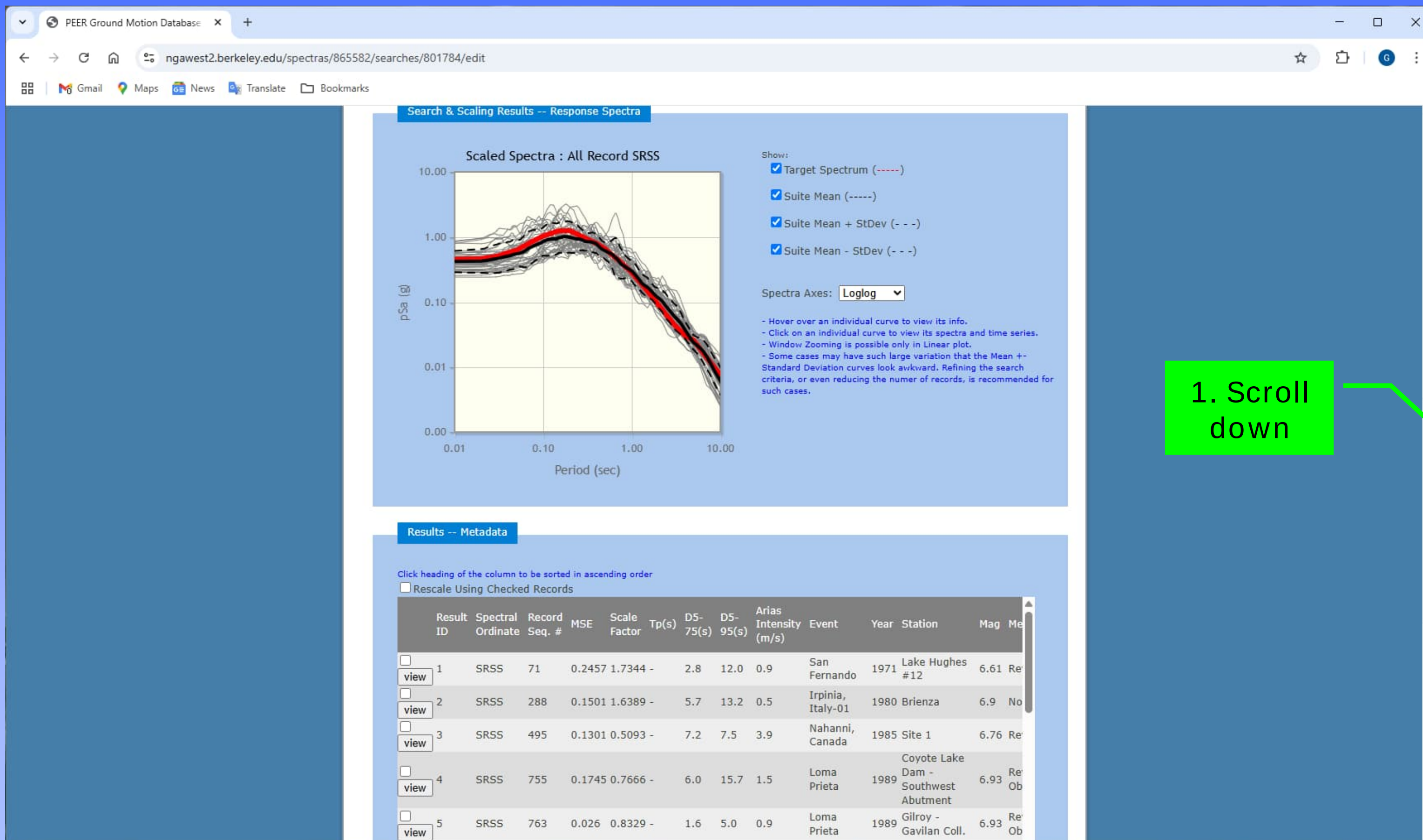
2. Enter “0.5,2” for Initial Scale Factor

3. Click on “Search Records”

GeoMotions

Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/



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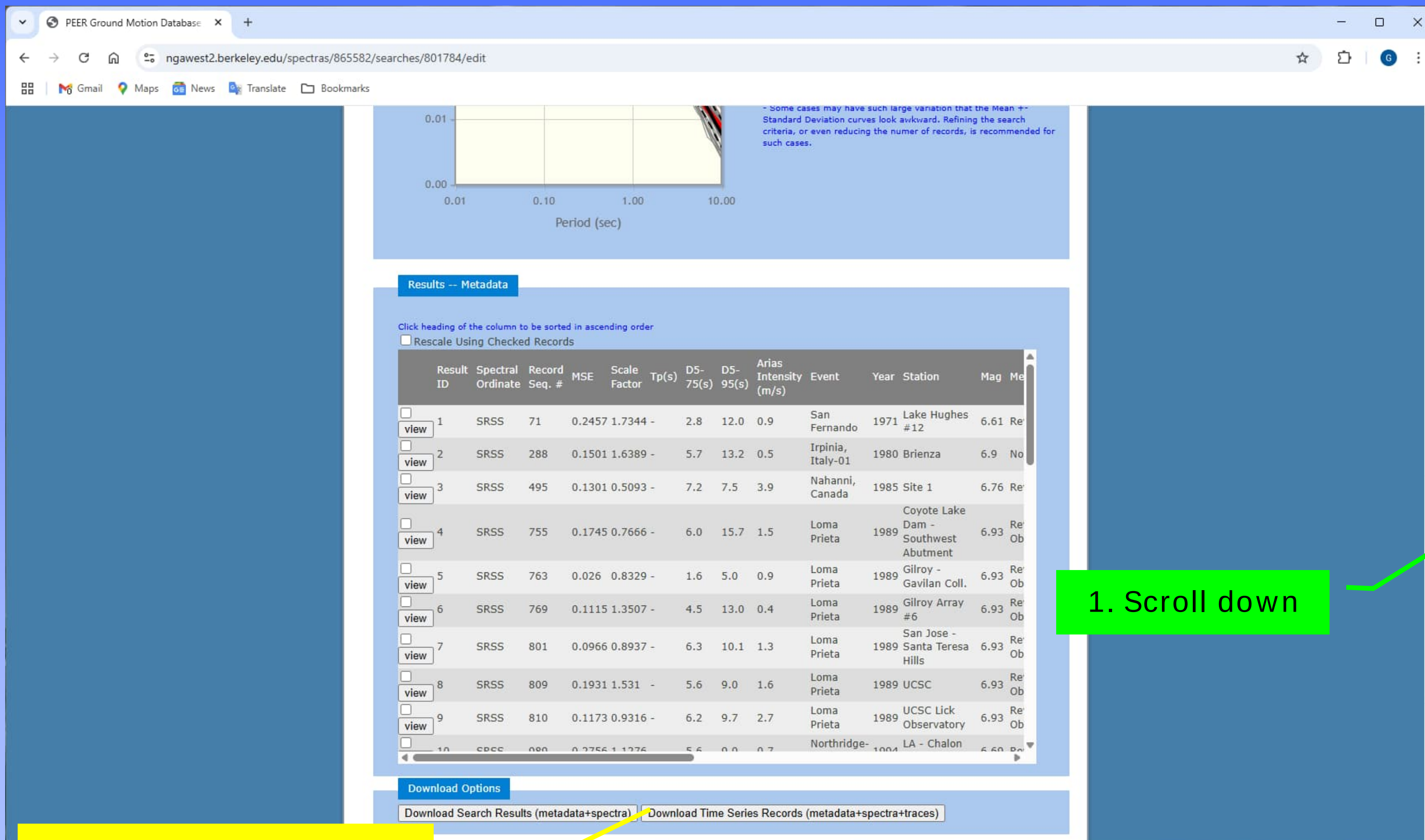
Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/



1. Scroll down

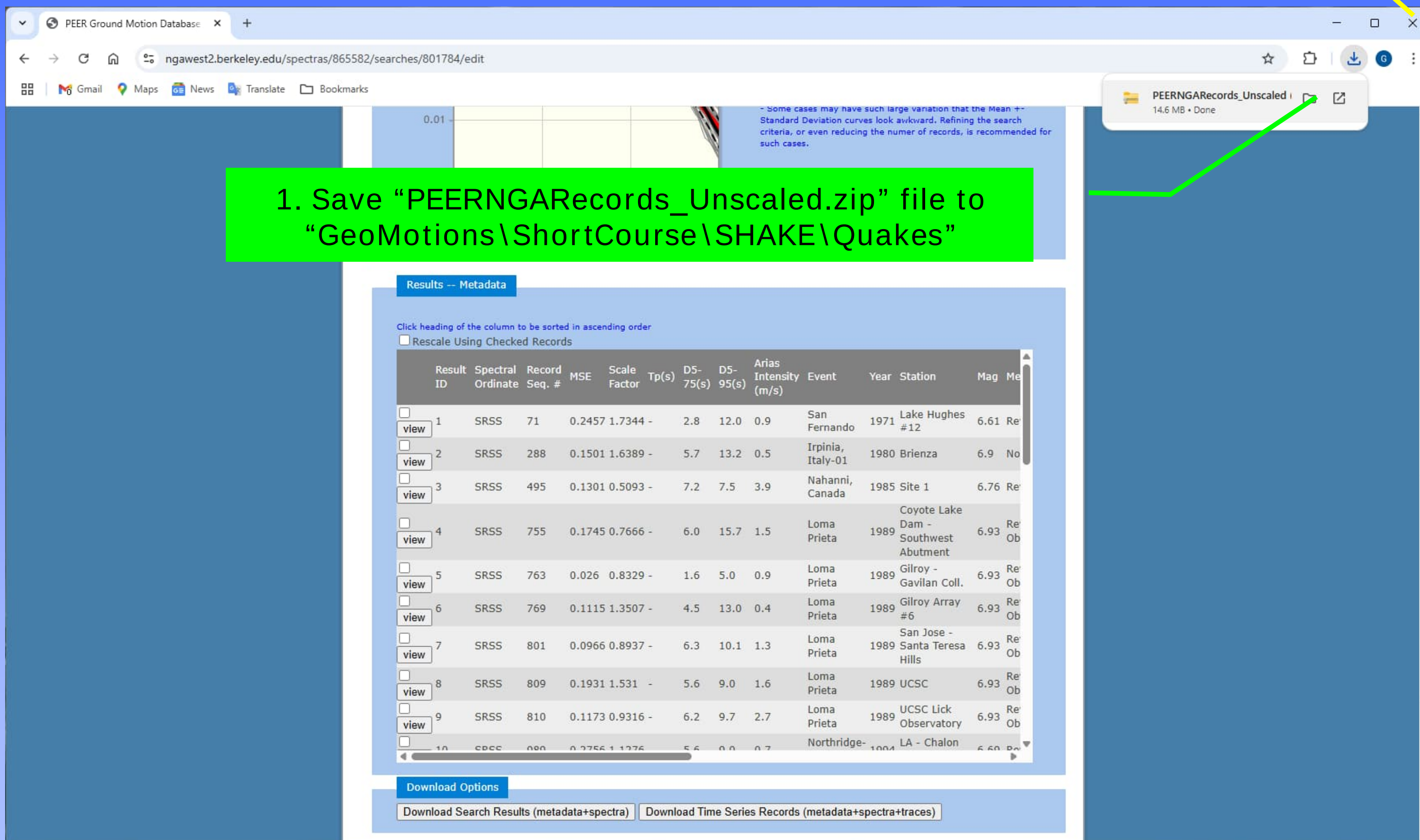
2. Click “Download Time Series Records”

GeoMotions

Selection of Acceleration Time Histories

http://ngawest2.berkeley.edu/

2. Click to close

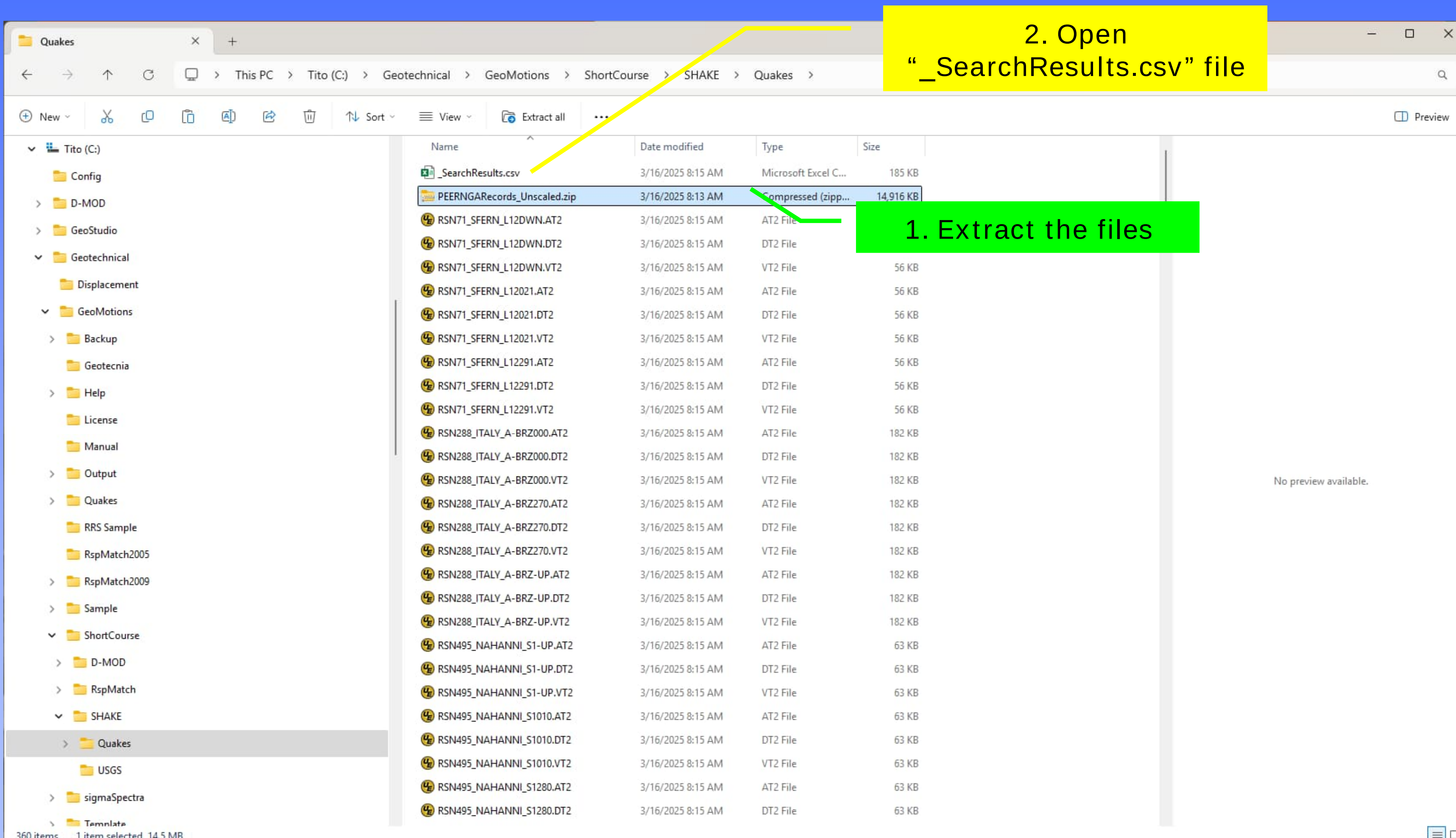


Result ID	Spectral Ordinate	Record Seq. #	MSE	Scale Factor	Tp(s)	D5-75(s)	D5-95(s)	Arias Intensity (m/s)	Event	Year	Station	Mag	Me
1	SRSS	71	0.2457	1.7344	-	2.8	12.0	0.9	San Fernando	1971	Lake Hughes #12	6.61	Re
2	SRSS	288	0.1501	1.6389	-	5.7	13.2	0.5	Irpinia, Italy-01	1980	Brienza	6.9	No
3	SRSS	495	0.1301	0.5093	-	7.2	7.5	3.9	Nahanni, Canada	1985	Site 1	6.76	Re
4	SRSS	755	0.1745	0.7666	-	6.0	15.7	1.5	Loma Prieta	1989	Coyote Lake Dam - Southwest Abutment	6.93	Re Ob
5	SRSS	763	0.026	0.8329	-	1.6	5.0	0.9	Loma Prieta	1989	Gilroy - Gavilan Coll.	6.93	Re Ob
6	SRSS	769	0.1115	1.3507	-	4.5	13.0	0.4	Loma Prieta	1989	Gilroy Array #6	6.93	Re Ob
7	SRSS	801	0.0966	0.8937	-	6.3	10.1	1.3	Loma Prieta	1989	San Jose - Santa Teresa Hills	6.93	Re Ob
8	SRSS	809	0.1931	1.531	-	5.6	9.0	1.6	Loma Prieta	1989	UCSC	6.93	Re Ob
9	SRSS	810	0.1173	0.9316	-	6.2	9.7	2.7	Loma Prieta	1989	UCSC Lick Observatory	6.93	Re Ob

1. Save "PEERNGARecords_Unscaled.zip" file to "GeoMotions\ShortCourse\SHAKE\Quakes"

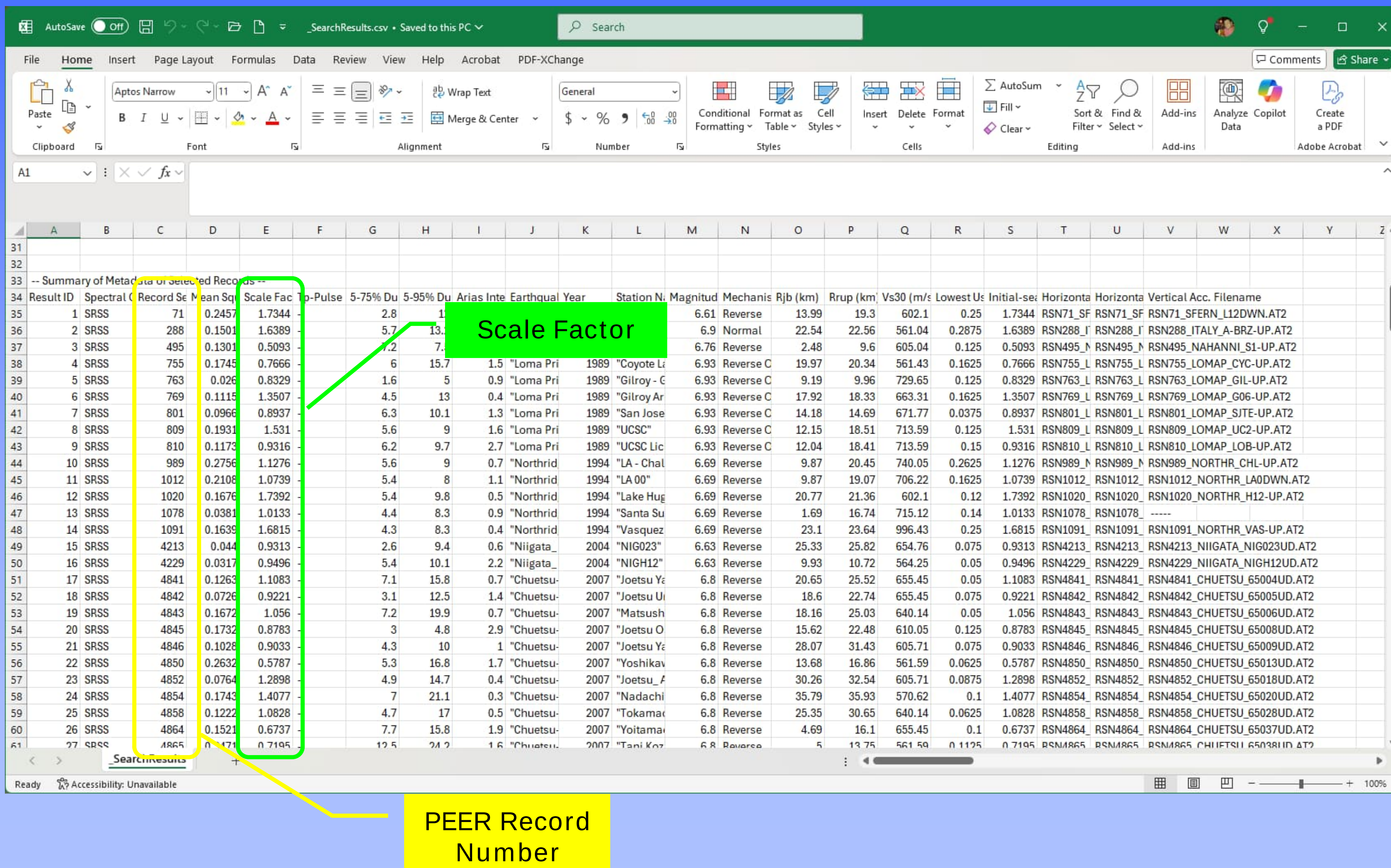
PEER Search Results

Ground Motion Files in PEERNGARecords_Unscaled.zip File



PEER Search Results

(searchResults Excel CSV file)

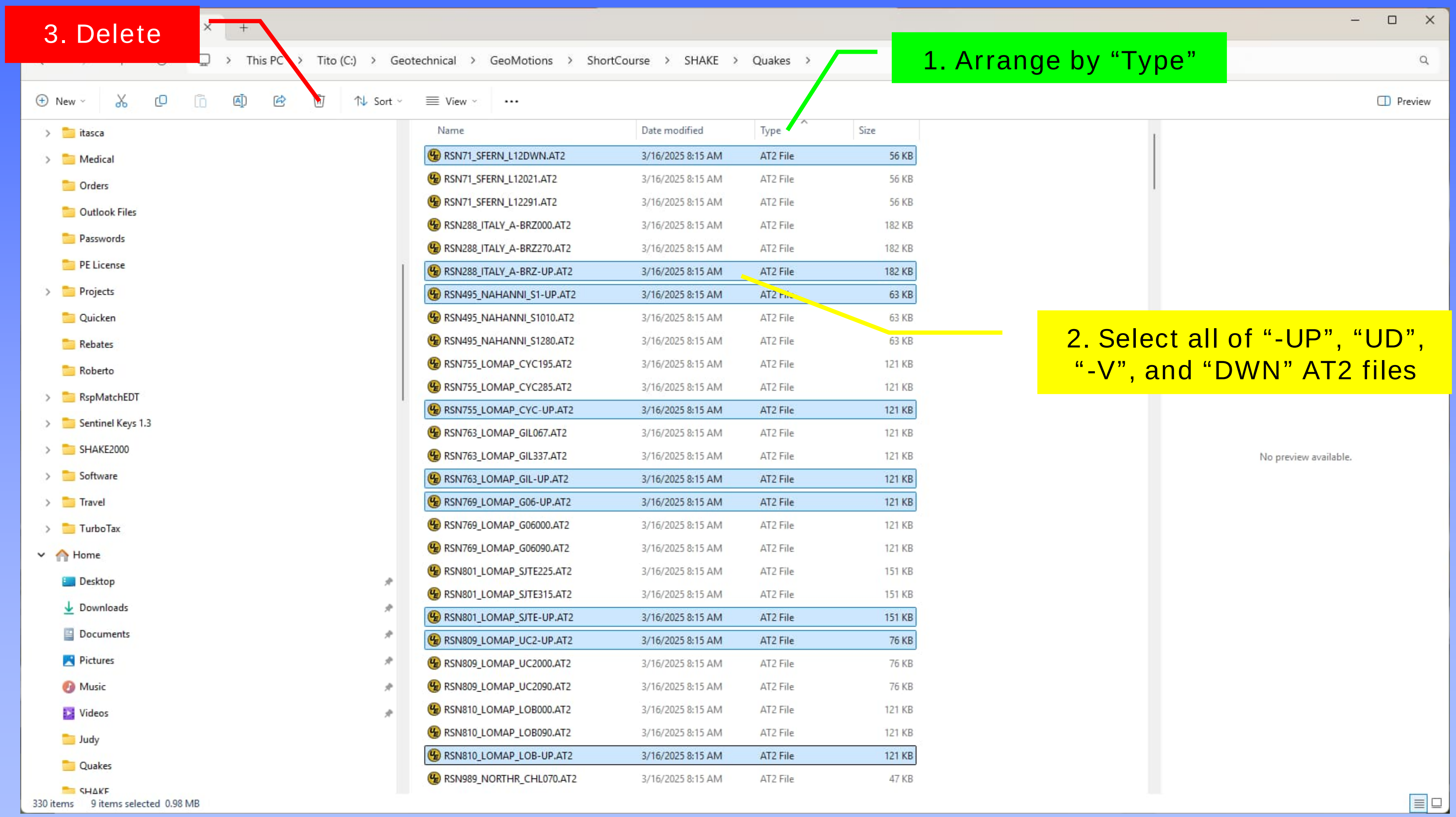


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
31																						
32																						
33	-- Summary of Metadata of Selected Records --																					
34	Result ID	Spectral (	Record Se	Mean Sq	Scale Fac	Tp-Pulse	5-75% Du	5-95% Du	Arias Inte	Earthqual	Year	Station N	Magnitud	Mechanis	Rjb (km)	Rrup (km)	Vs30 (m/s	Lowest Us	Initial-sea	Horizonta	Horizonta	Vertical Acc. Filename
35	1	SRSS	71	0.2457	1.7344	-	2.8	1					6.61	Reverse	13.99	19.3	602.1	0.25	1.7344	RSN71_SF	RSN71_SF	RSN71_SFERN_L12DWN.AT2
36	2	SRSS	288	0.1501	1.6389	-	5.7	13.					6.9	Normal	22.54	22.56	561.04	0.2875	1.6389	RSN288_I	RSN288_I	RSN288_ITALY_A-BRZ-UP.AT2
37	3	SRSS	495	0.1301	0.5093	-	.2	7.					6.76	Reverse	2.48	9.6	605.04	0.125	0.5093	RSN495_N	RSN495_N	RSN495_NAHANNI_S1-UP.AT2
38	4	SRSS	755	0.1745	0.7666	-	6	15.7	1.5	"Loma Pri	1989	"Coyote La	6.93	Reverse C	19.97	20.34	561.43	0.1625	0.7666	RSN755_L	RSN755_L	RSN755_LOMAP_CYC-UP.AT2
39	5	SRSS	763	0.026	0.8329	-	1.6	5	0.9	"Loma Pri	1989	"Gilroy - G	6.93	Reverse C	9.19	9.96	729.65	0.125	0.8329	RSN763_L	RSN763_L	RSN763_LOMAP_GIL-UP.AT2
40	6	SRSS	769	0.1115	1.3507	-	4.5	13	0.4	"Loma Pri	1989	"Gilroy Ar	6.93	Reverse C	17.92	18.33	663.31	0.1625	1.3507	RSN769_L	RSN769_L	RSN769_LOMAP_G06-UP.AT2
41	7	SRSS	801	0.0966	0.8937	-	6.3	10.1	1.3	"Loma Pri	1989	"San Jose	6.93	Reverse C	14.18	14.69	671.77	0.0375	0.8937	RSN801_L	RSN801_L	RSN801_LOMAP_SJTE-UP.AT2
42	8	SRSS	809	0.1931	1.531	-	5.6	9	1.6	"Loma Pri	1989	"UCSC"	6.93	Reverse C	12.15	18.51	713.59	0.125	1.531	RSN809_L	RSN809_L	RSN809_LOMAP_UC2-UP.AT2
43	9	SRSS	810	0.1173	0.9316	-	6.2	9.7	2.7	"Loma Pri	1989	"UCSC Lic	6.93	Reverse C	12.04	18.41	713.59	0.15	0.9316	RSN810_L	RSN810_L	RSN810_LOMAP_LOB-UP.AT2
44	10	SRSS	989	0.2756	1.1276	-	5.6	9	0.7	"Northrid	1994	"LA - Chal	6.69	Reverse	9.87	20.45	740.05	0.2625	1.1276	RSN989_N	RSN989_N	RSN989_NORTHR_CHL-UP.AT2
45	11	SRSS	1012	0.2108	1.0739	-	5.4	8	1.1	"Northrid	1994	"LA 00"	6.69	Reverse	9.87	19.07	706.22	0.1625	1.0739	RSN1012_	RSN1012_	RSN1012_NORTHR_LA0DWN.AT2
46	12	SRSS	1020	0.1676	1.7392	-	5.4	9.8	0.5	"Northrid	1994	"Lake Hug	6.69	Reverse	20.77	21.36	602.1	0.12	1.7392	RSN1020_	RSN1020_	RSN1020_NORTHR_H12-UP.AT2
47	13	SRSS	1078	0.0381	1.0133	-	4.4	8.3	0.9	"Northrid	1994	"Santa Su	6.69	Reverse	1.69	16.74	715.12	0.14	1.0133	RSN1078_	RSN1078_	-----
48	14	SRSS	1091	0.1639	1.6815	-	4.3	8.3	0.4	"Northrid	1994	"Vasquez	6.69	Reverse	23.1	23.64	996.43	0.25	1.6815	RSN1091_	RSN1091_	RSN1091_NORTHR_VAS-UP.AT2
49	15	SRSS	4213	0.044	0.9313	-	2.6	9.4	0.6	"Niigata_	2004	"NIG023"	6.63	Reverse	25.33	25.82	654.76	0.075	0.9313	RSN4213_	RSN4213_	RSN4213_NIIGATA_NIG023UD.AT2
50	16	SRSS	4229	0.0317	0.9496	-	5.4	10.1	2.2	"Niigata_	2004	"NIGH12"	6.63	Reverse	9.93	10.72	564.25	0.05	0.9496	RSN4229_	RSN4229_	RSN4229_NIIGATA_NIGH12UD.AT2
51	17	SRSS	4841	0.1263	1.1083	-	7.1	15.8	0.7	"Chuetsu-	2007	"Joetsu Ya	6.8	Reverse	20.65	25.52	655.45	0.05	1.1083	RSN4841_	RSN4841_	RSN4841_CHUETSU_65004UD.AT2
52	18	SRSS	4842	0.0726	0.9221	-	3.1	12.5	1.4	"Chuetsu-	2007	"Joetsu U	6.8	Reverse	18.6	22.74	655.45	0.075	0.9221	RSN4842_	RSN4842_	RSN4842_CHUETSU_65005UD.AT2
53	19	SRSS	4843	0.1672	1.056	-	7.2	19.9	0.7	"Chuetsu-	2007	"Matsush	6.8	Reverse	18.16	25.03	640.14	0.05	1.056	RSN4843_	RSN4843_	RSN4843_CHUETSU_65006UD.AT2
54	20	SRSS	4845	0.1732	0.8783	-	3	4.8	2.9	"Chuetsu-	2007	"Joetsu O	6.8	Reverse	15.62	22.48	610.05	0.125	0.8783	RSN4845_	RSN4845_	RSN4845_CHUETSU_65008UD.AT2
55	21	SRSS	4846	0.1028	0.9033	-	4.3	10	1	"Chuetsu-	2007	"Joetsu Ya	6.8	Reverse	28.07	31.43	605.71	0.075	0.9033	RSN4846_	RSN4846_	RSN4846_CHUETSU_65009UD.AT2
56	22	SRSS	4850	0.2632	0.5787	-	5.3	16.8	1.7	"Chuetsu-	2007	"Yoshikav	6.8	Reverse	13.68	16.86	561.59	0.0625	0.5787	RSN4850_	RSN4850_	RSN4850_CHUETSU_65013UD.AT2
57	23	SRSS	4852	0.0764	1.2898	-	4.9	14.7	0.4	"Chuetsu-	2007	"Joetsu_A	6.8	Reverse	30.26	32.54	605.71	0.0875	1.2898	RSN4852_	RSN4852_	RSN4852_CHUETSU_65018UD.AT2
58	24	SRSS	4854	0.1743	1.4077	-	7	21.1	0.3	"Chuetsu-	2007	"Nadachi	6.8	Reverse	35.79	35.93	570.62	0.1	1.4077	RSN4854_	RSN4854_	RSN4854_CHUETSU_65020UD.AT2
59	25	SRSS	4858	0.1222	1.0828	-	4.7	17	0.5	"Chuetsu-	2007	"Tokamac	6.8	Reverse	25.35	30.65	640.14	0.0625	1.0828	RSN4858_	RSN4858_	RSN4858_CHUETSU_65028UD.AT2
60	26	SRSS	4864	0.1521	0.6737	-	7.7	15.8	1.9	"Chuetsu-	2007	"Yoitama	6.8	Reverse	4.69	16.1	655.45	0.1	0.6737	RSN4864_	RSN4864_	RSN4864_CHUETSU_65037UD.AT2
61	27	SRSS	4865	[illegible]	0.7195	-	12.5	24.2	1.6	"Chuetsu-	2007	"Tani Koz	6.8	Reverse	5	13.75	561.59	0.1125	0.7195	RSN4865_	RSN4865_	RSN4865_CHUETSU_65038UD.AT2

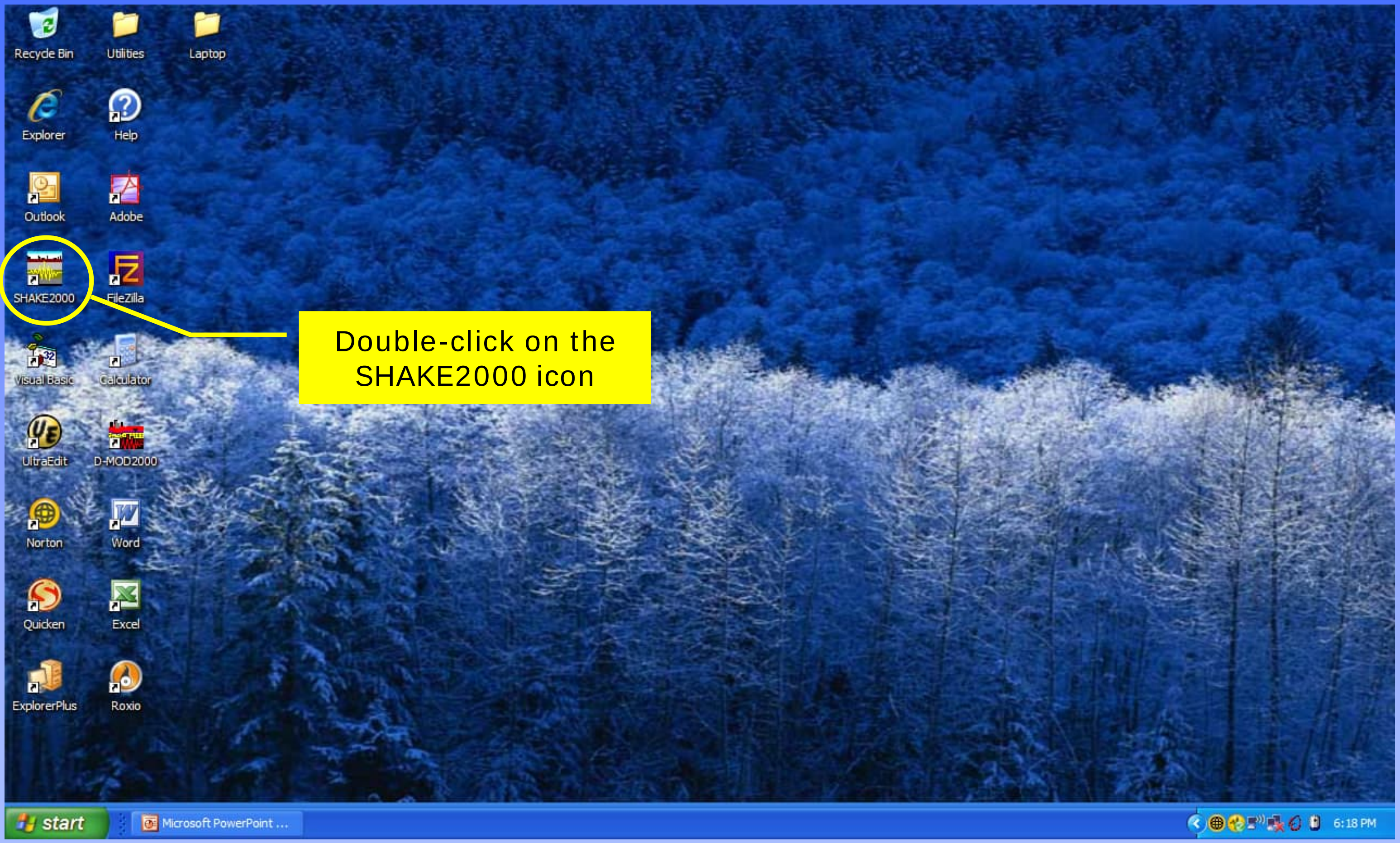
GeoMotions

PEER Search Results

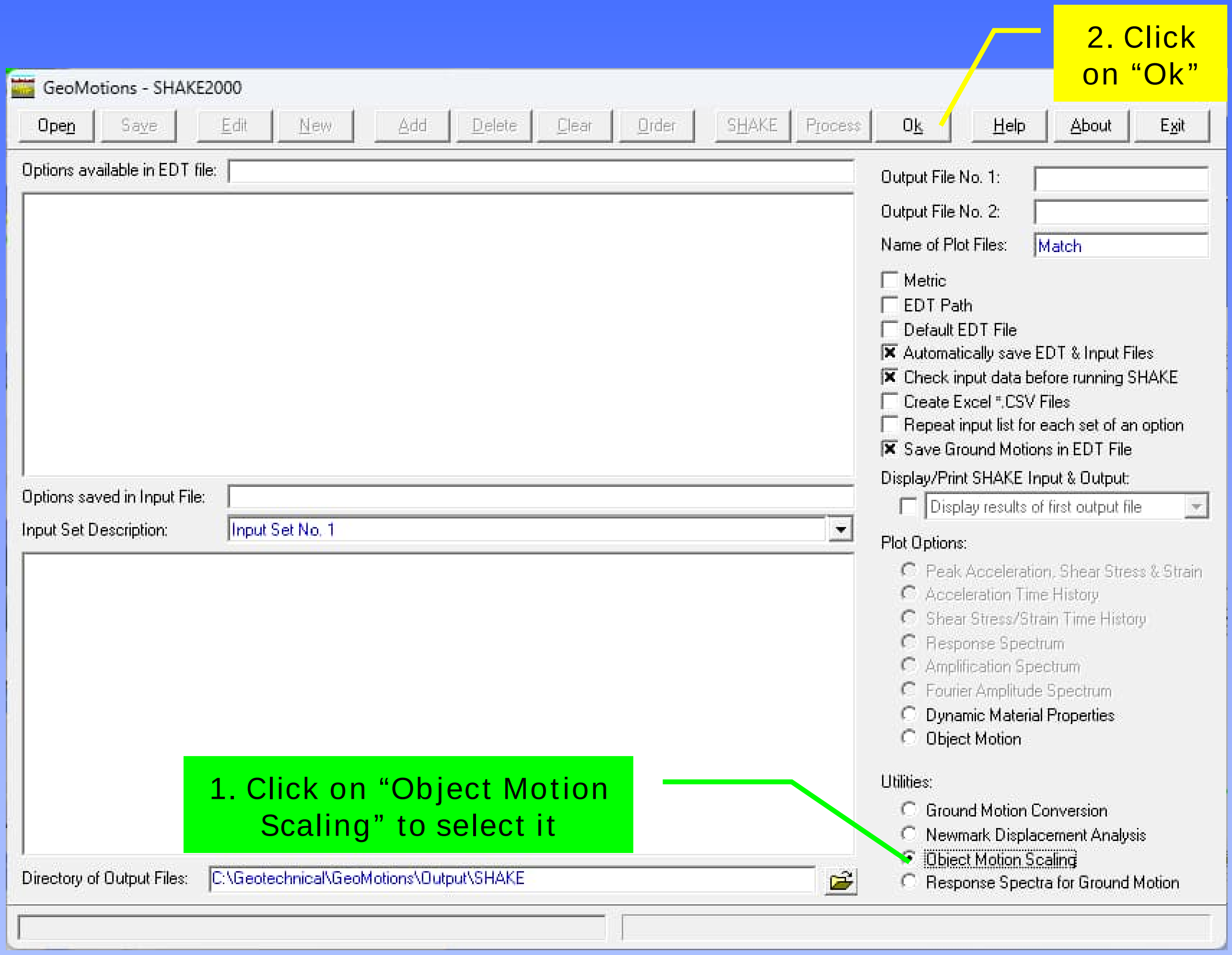
Delete vertical component to avoid loading these files later



SHAKE2000


Recycle Bin
Utilities
Laptop
Explorer
Help
Outlook
Adobe
SHAKE2000
FileZilla
Double-click on the SHAKE2000 icon
Visual Basic
Calculator
UltraEdit
D-MOD2000
Norton
Word
Quicken
Excel
ExplorerPlus
Roxio
start
Microsoft PowerPoint ...
6:18 PM

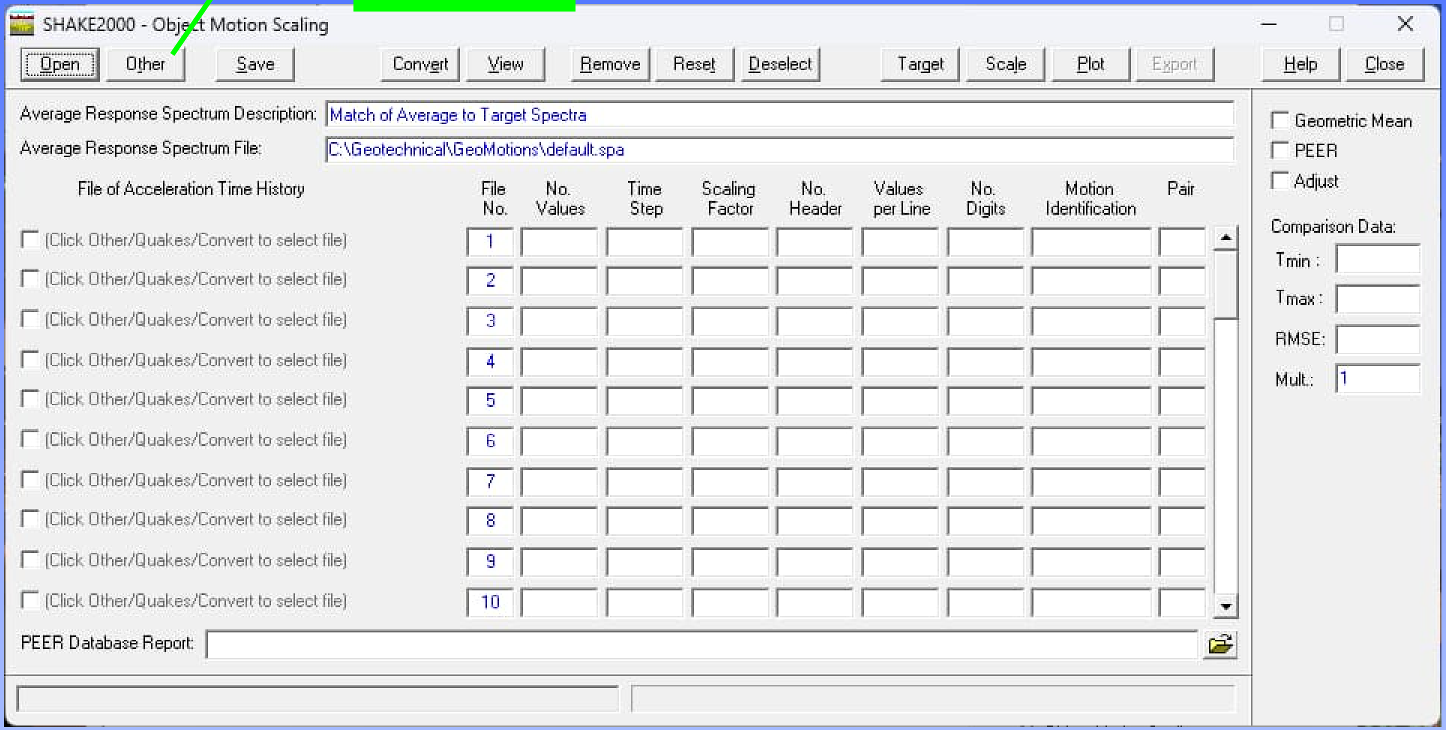
Selection of Acceleration Time Histories



GeoMotions

Selection of Acceleration Time Histories

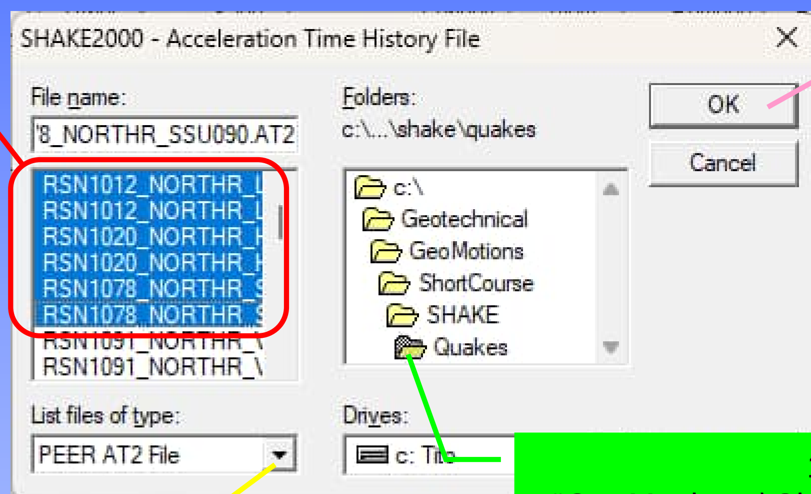
1. Click on “Other”



GeoMotions

Selection of Acceleration Time Histories
Select both horizontal components

3. Select group of 6 AT2 files



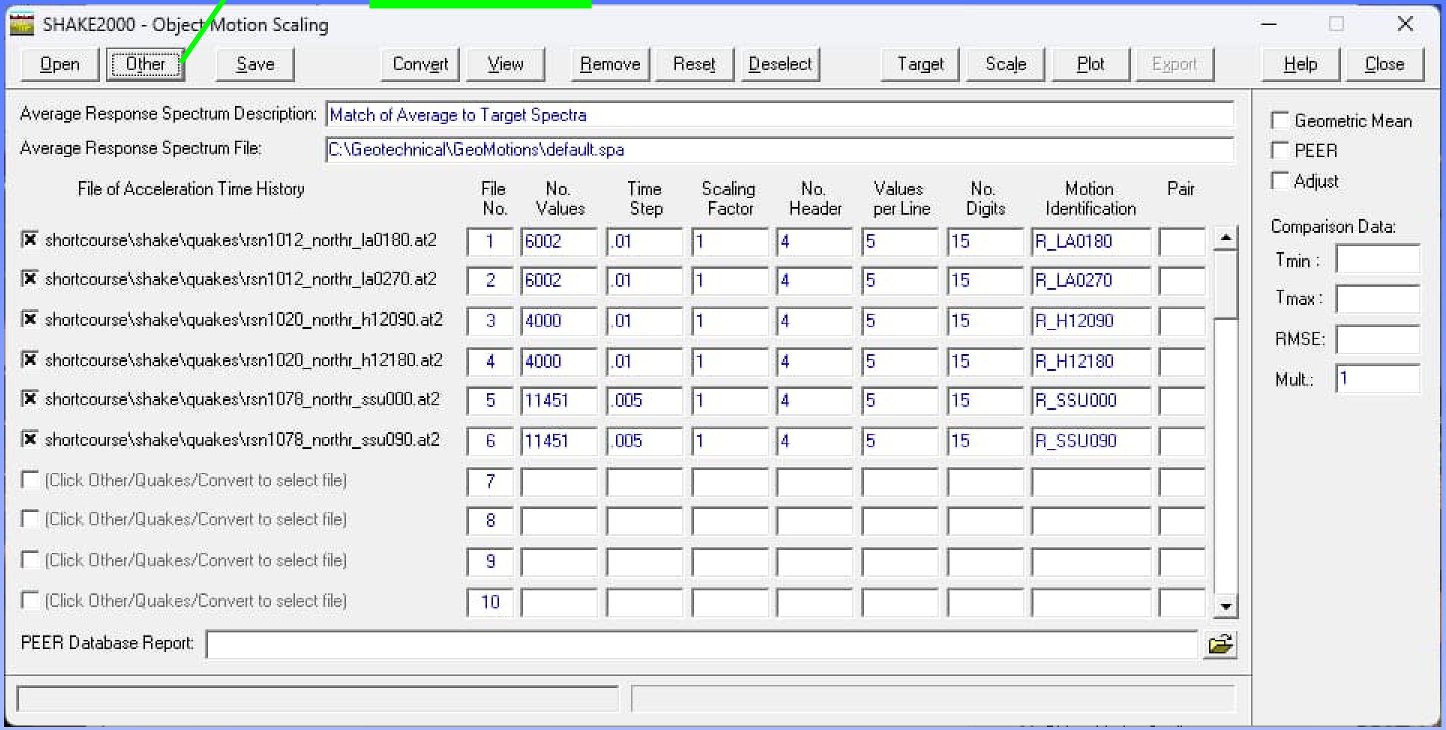
4. Click on "Ok"

1. Switch to "GeoMotions\ShortCourse\SHAKE\Quakes" folder

2. Select "PEER AT2 Files"

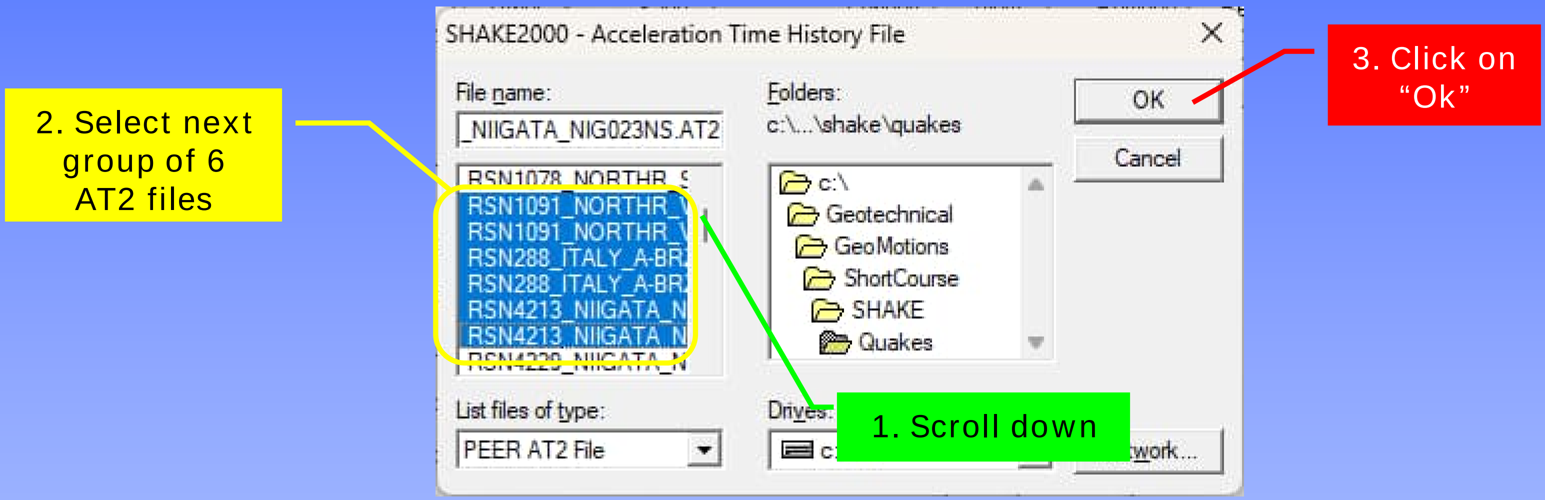
Selection of Acceleration Time Histories

1. Click on "Other"

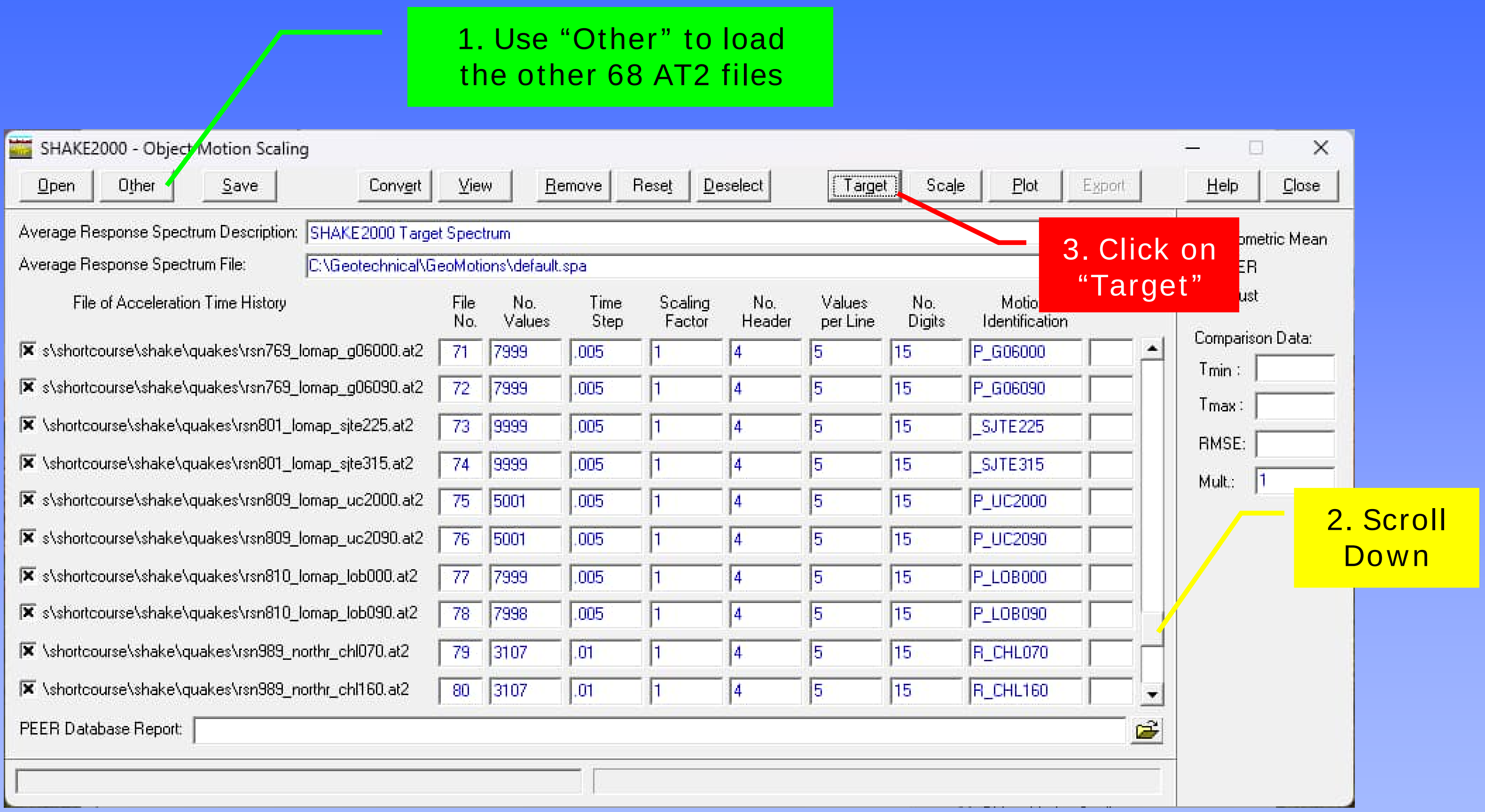


GeoMotions

Selection of Acceleration Time Histories
Select both horizontal components



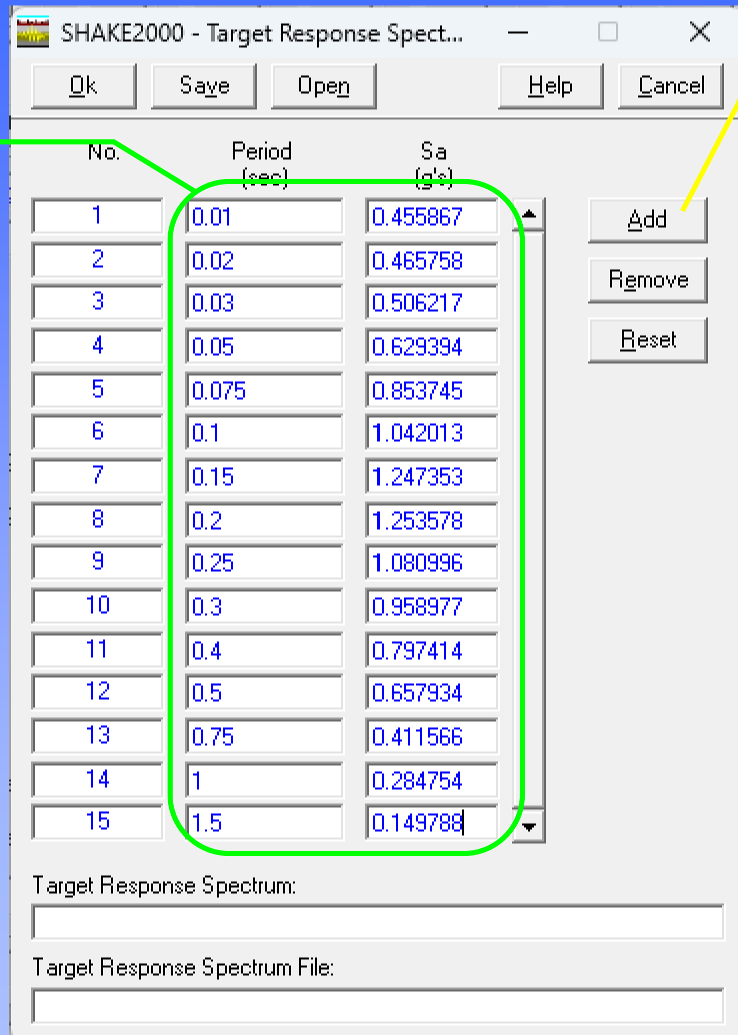
Selection of Acceleration Time Histories



GeoMotions

Enter Target Response Spectrum Values

1. Enter the first 15 values of the target spectrum



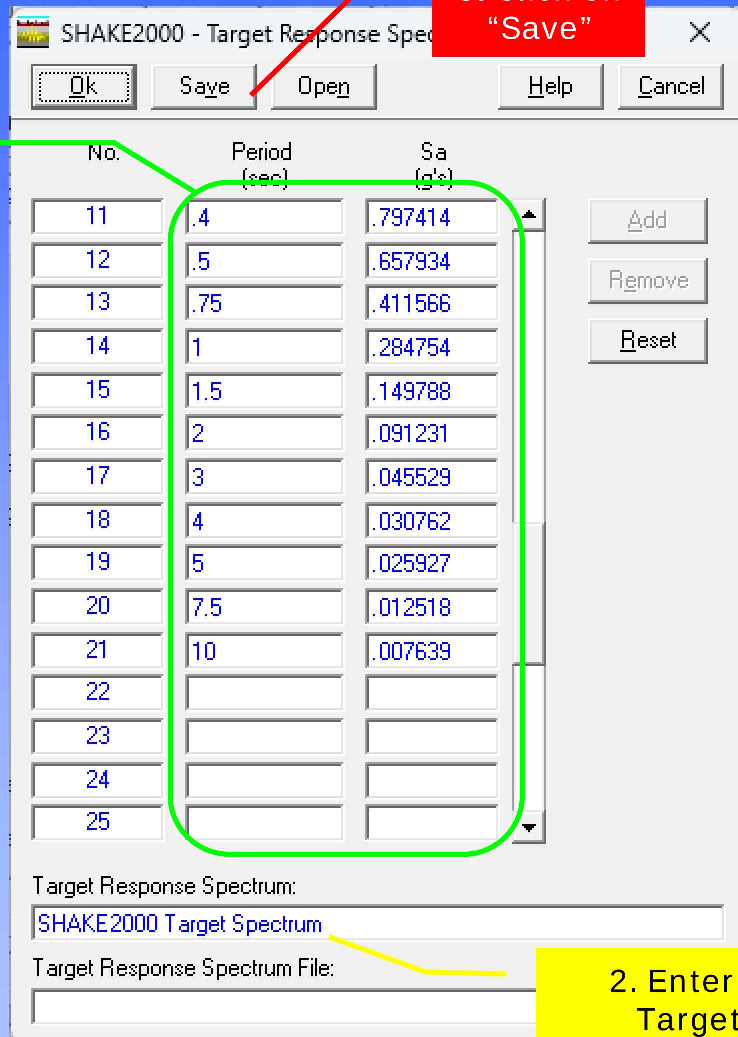
2. Click on “Add” to add more cells

GeoMotions

Enter Target Response Spectrum Values

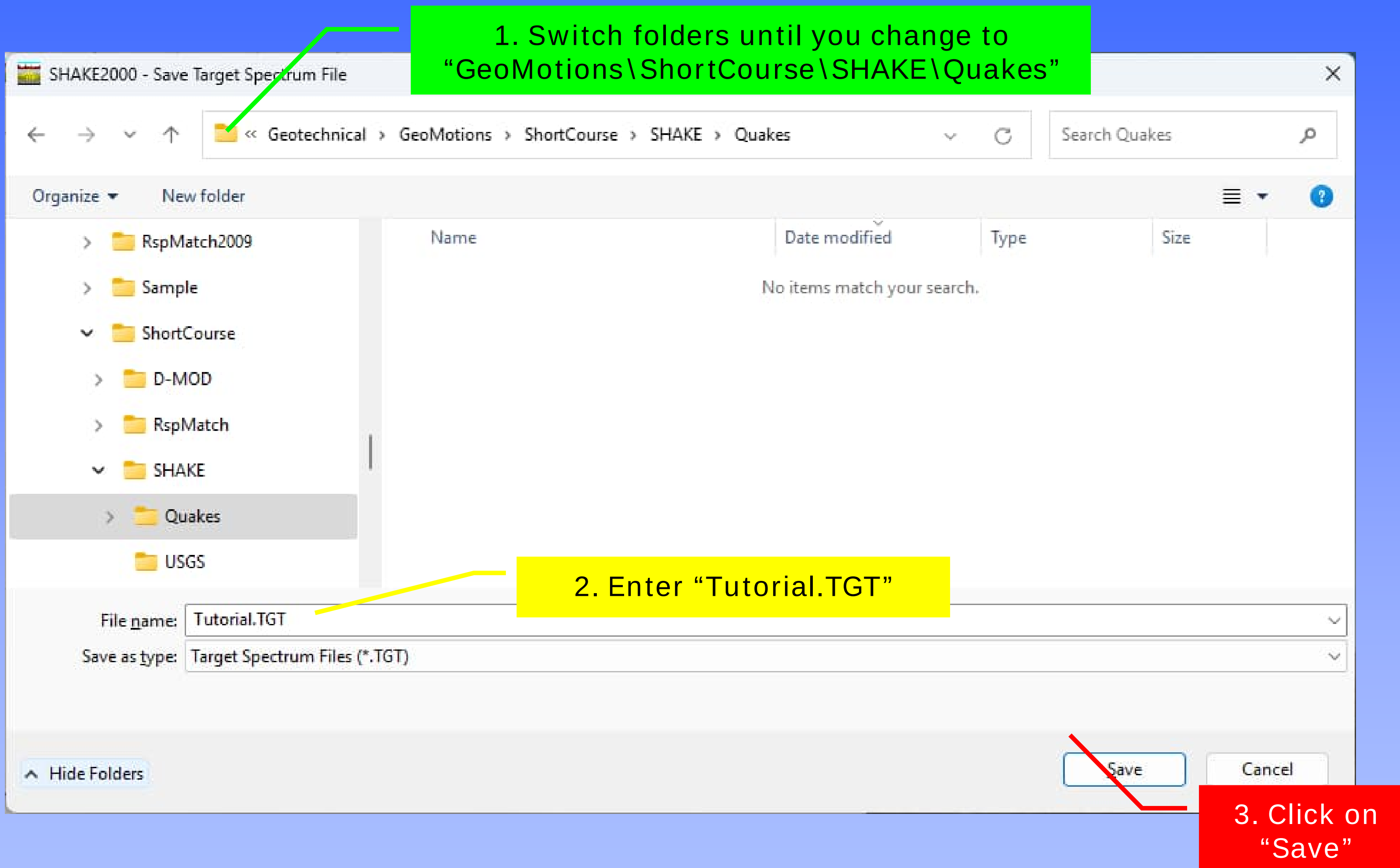
3. Click on “Save”

1. Enter the last 6 values of the USHA Spectrum



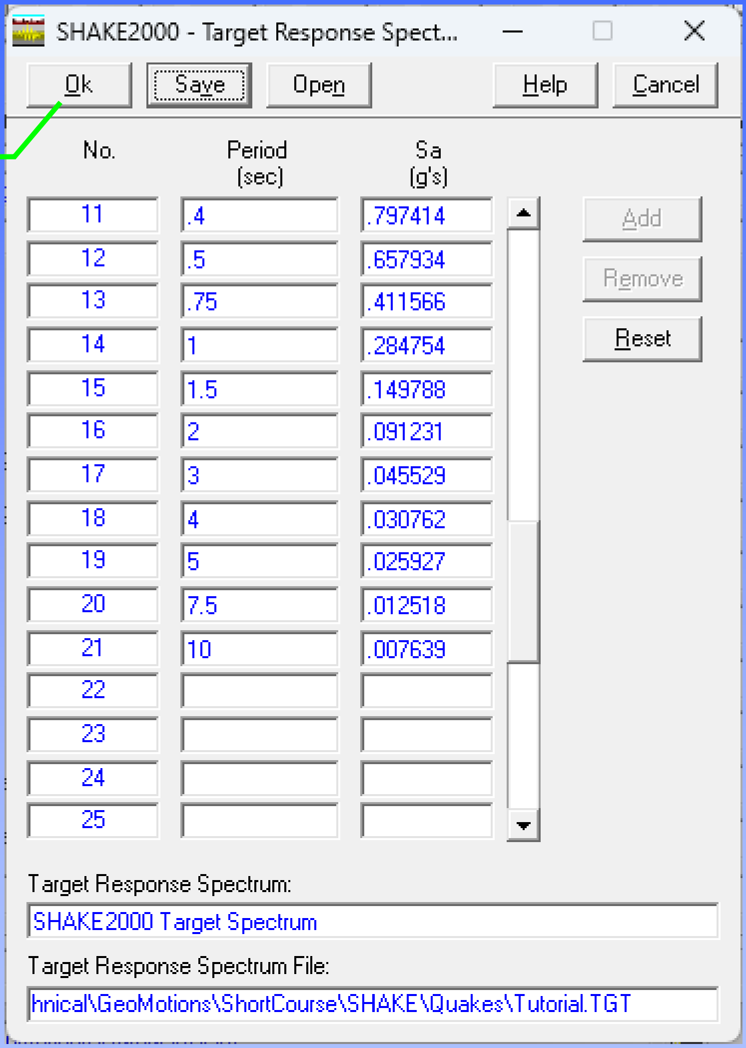
2. Enter “SHAKE2000 Target Spectrum”

Save Target Response Spectrum File



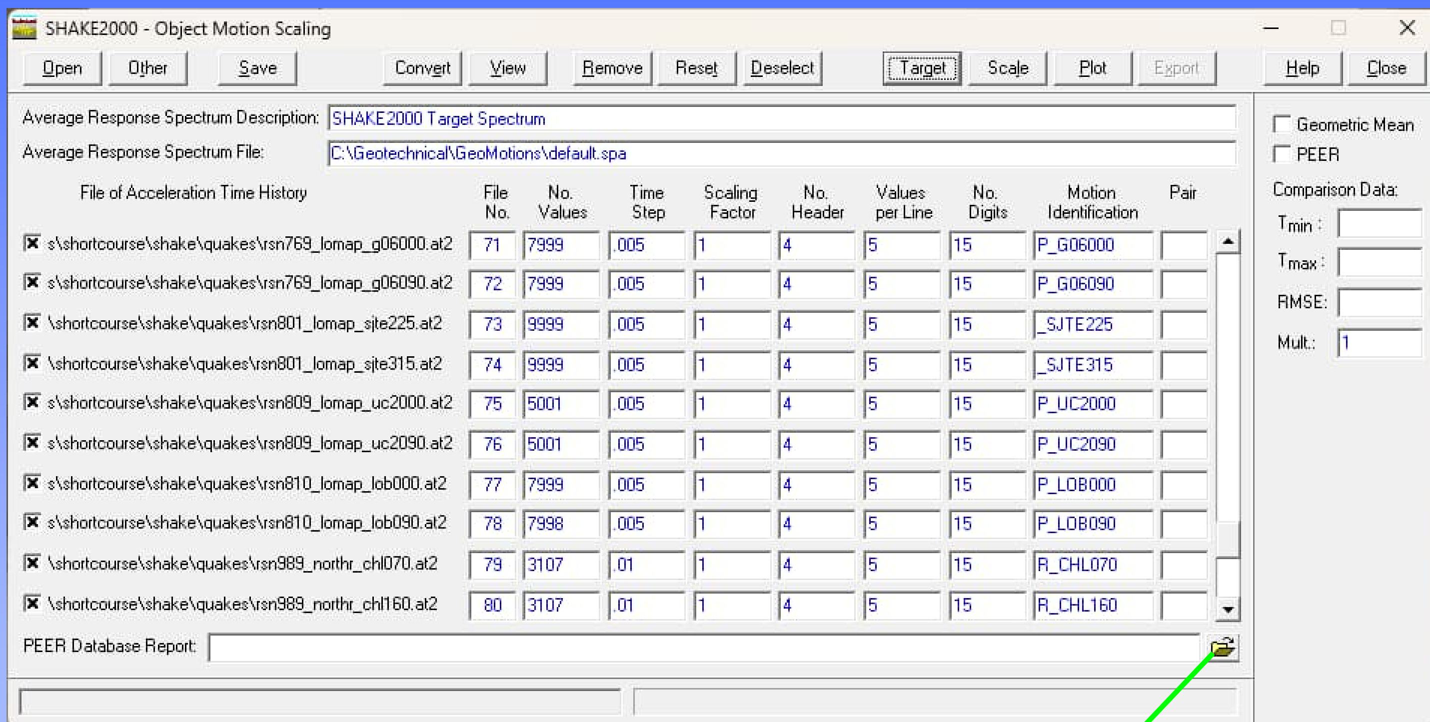
Select Target Response Spectrum

1. Click on “Ok”



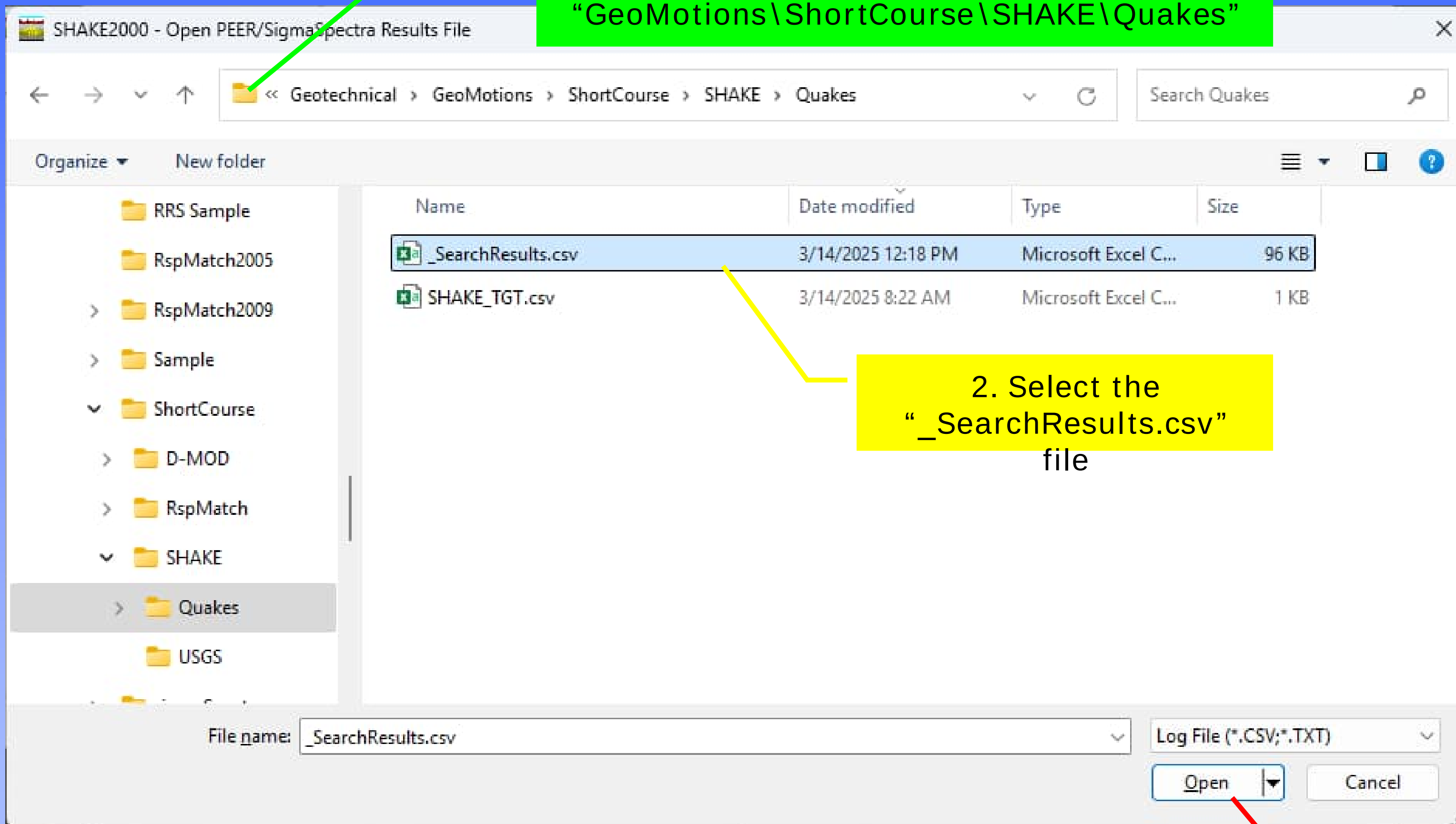
Selection of Acceleration Time Histories

Compare to Target Response Spectrum



1. Click on open folder icon to open log file from PEER search

Open PEER Search Results File



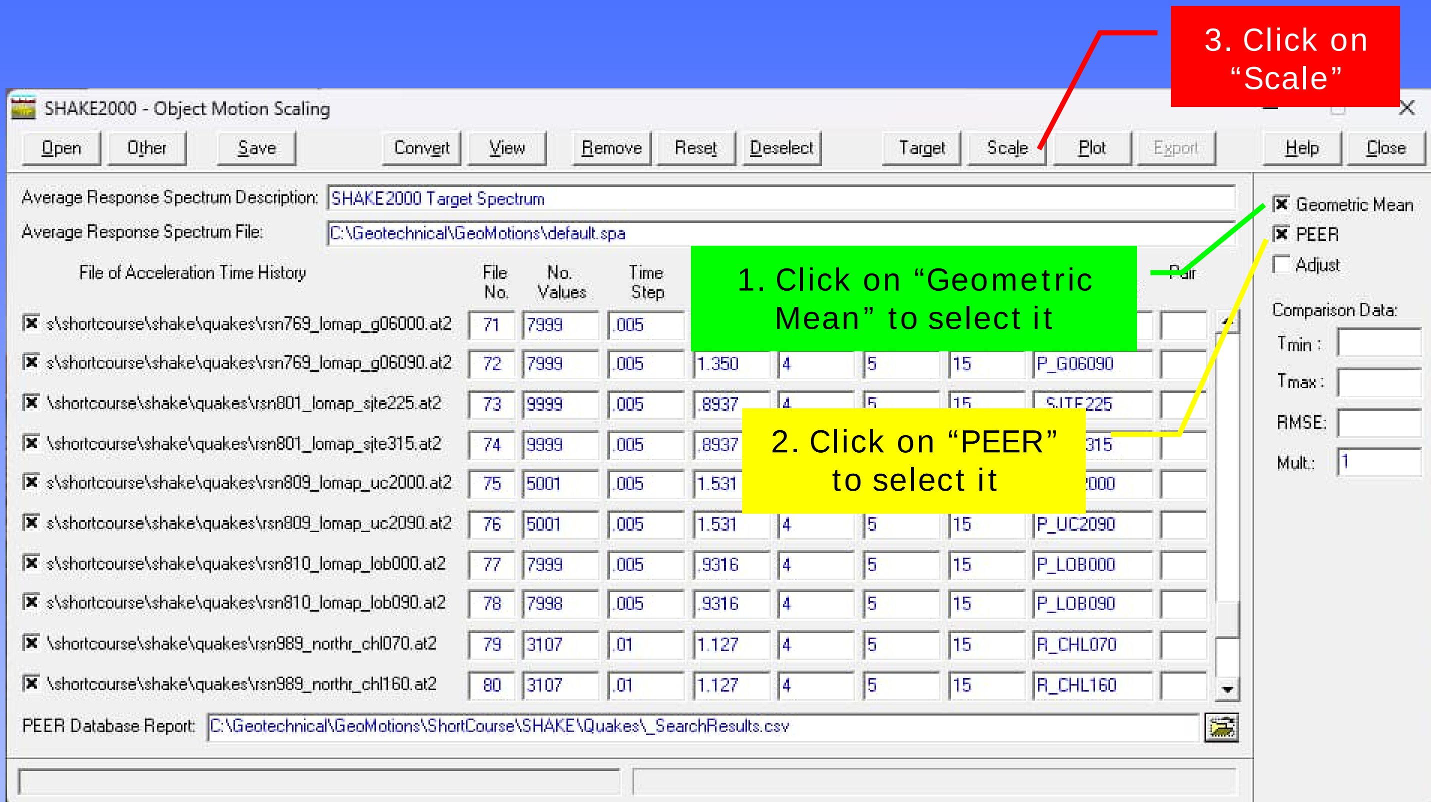
1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE\Quakes”

2. Select the “_SearchResults.csv” file

3. Click on “Open”

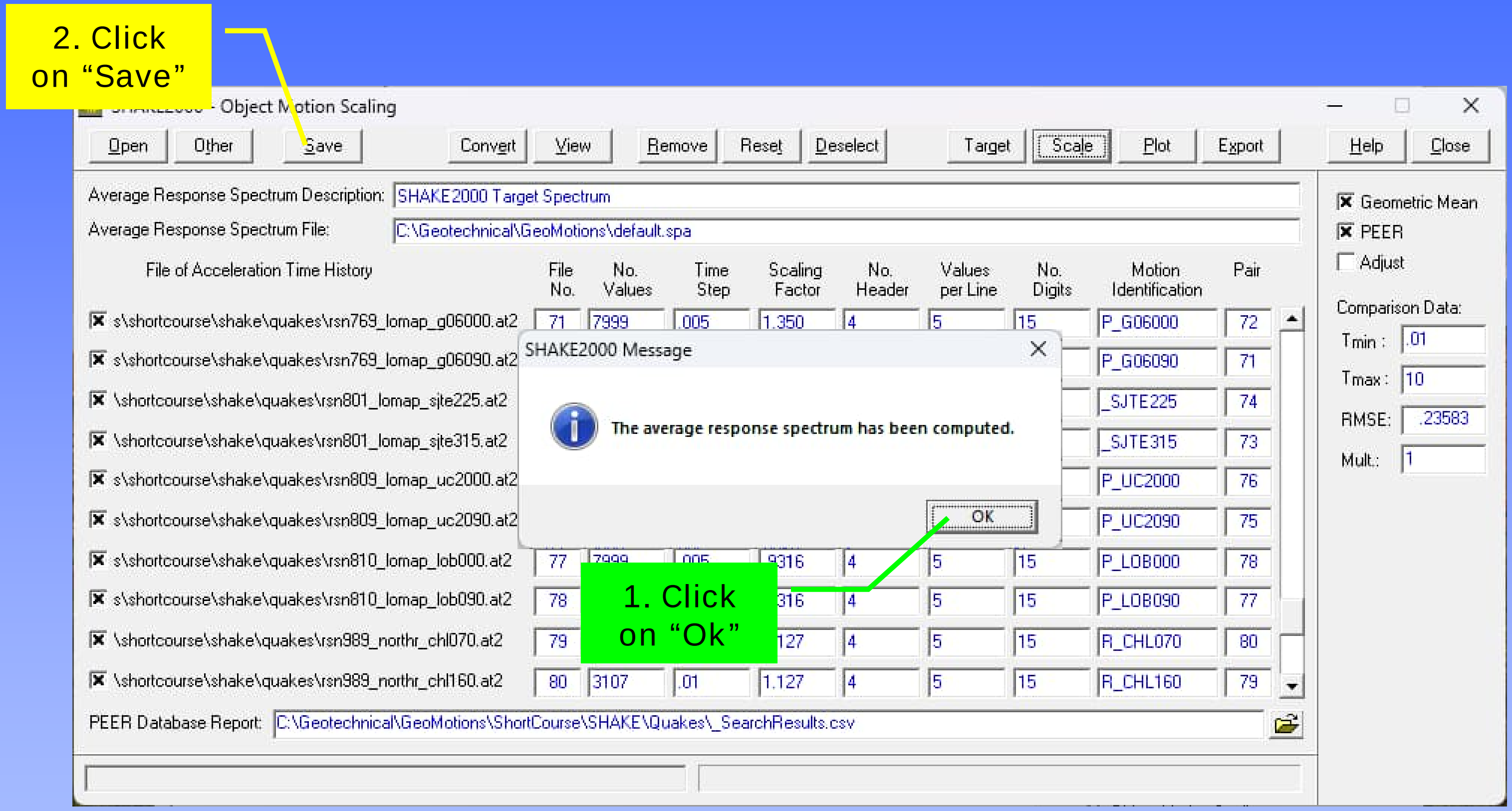
Selection of Acceleration Time Histories

Compare to Target Response Spectrum



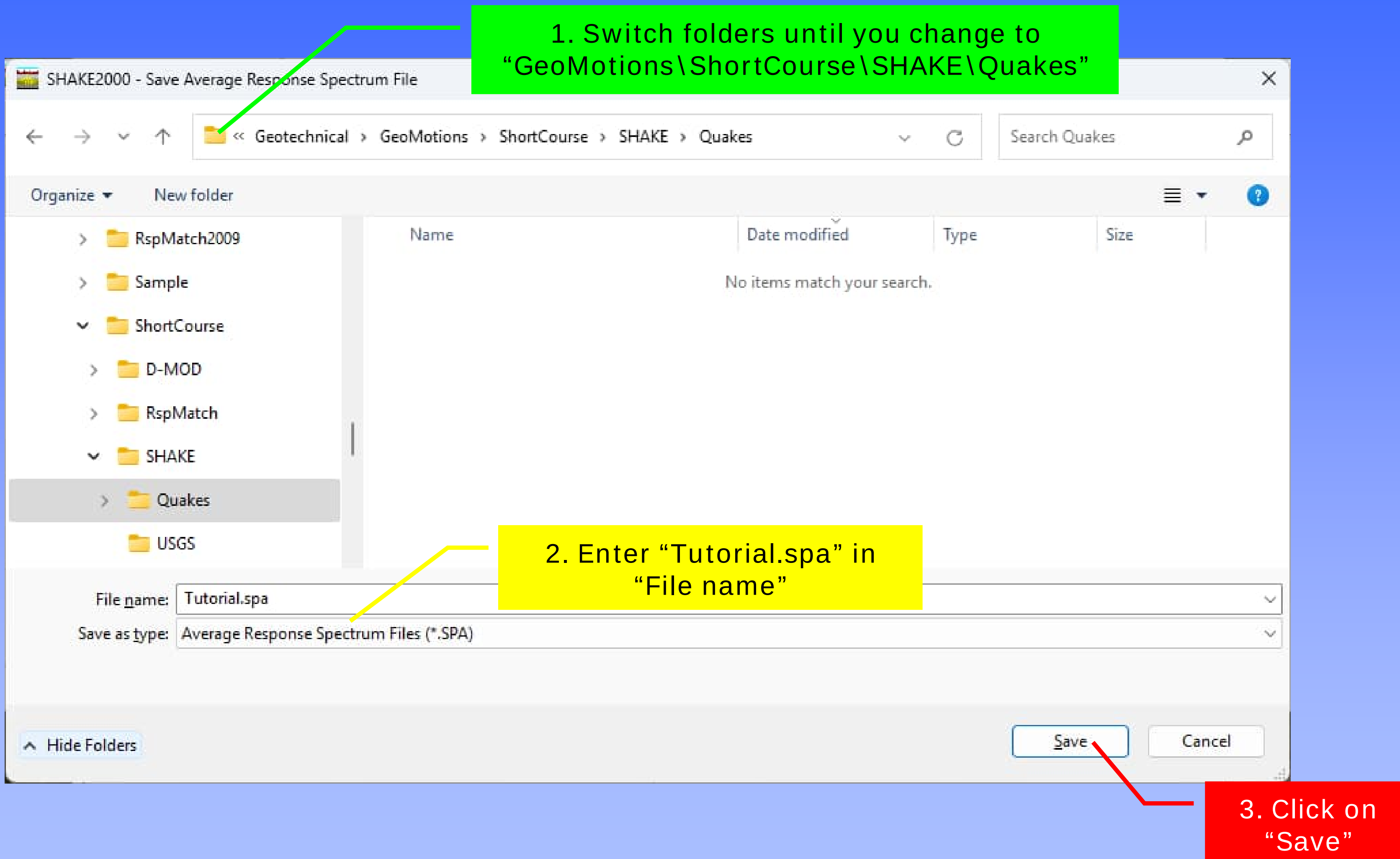
Selection of Acceleration Time Histories

Compare to Target Response Spectrum



GeoMotions

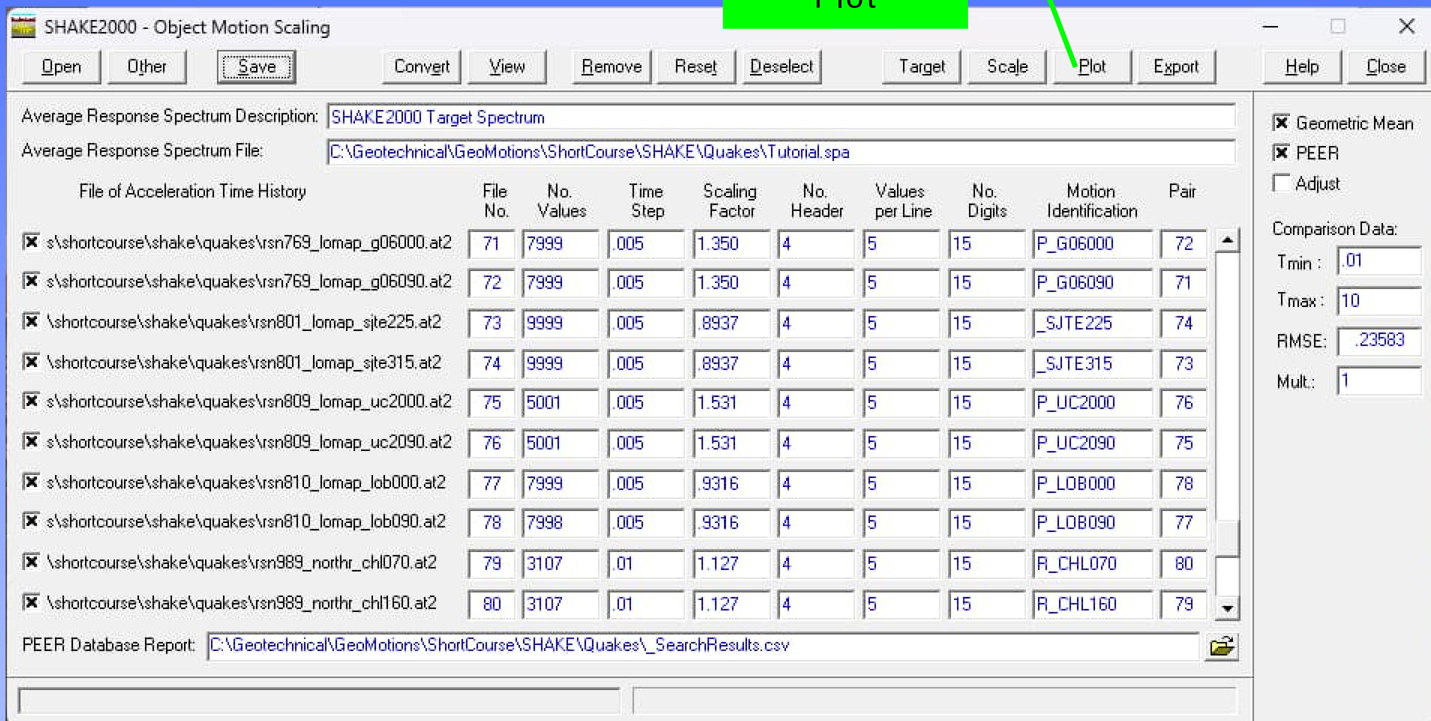
Save Ground Motion Scaling Data



Selection of Acceleration Time Histories

Save Chosen Motions to SHAKE2000 EDT File

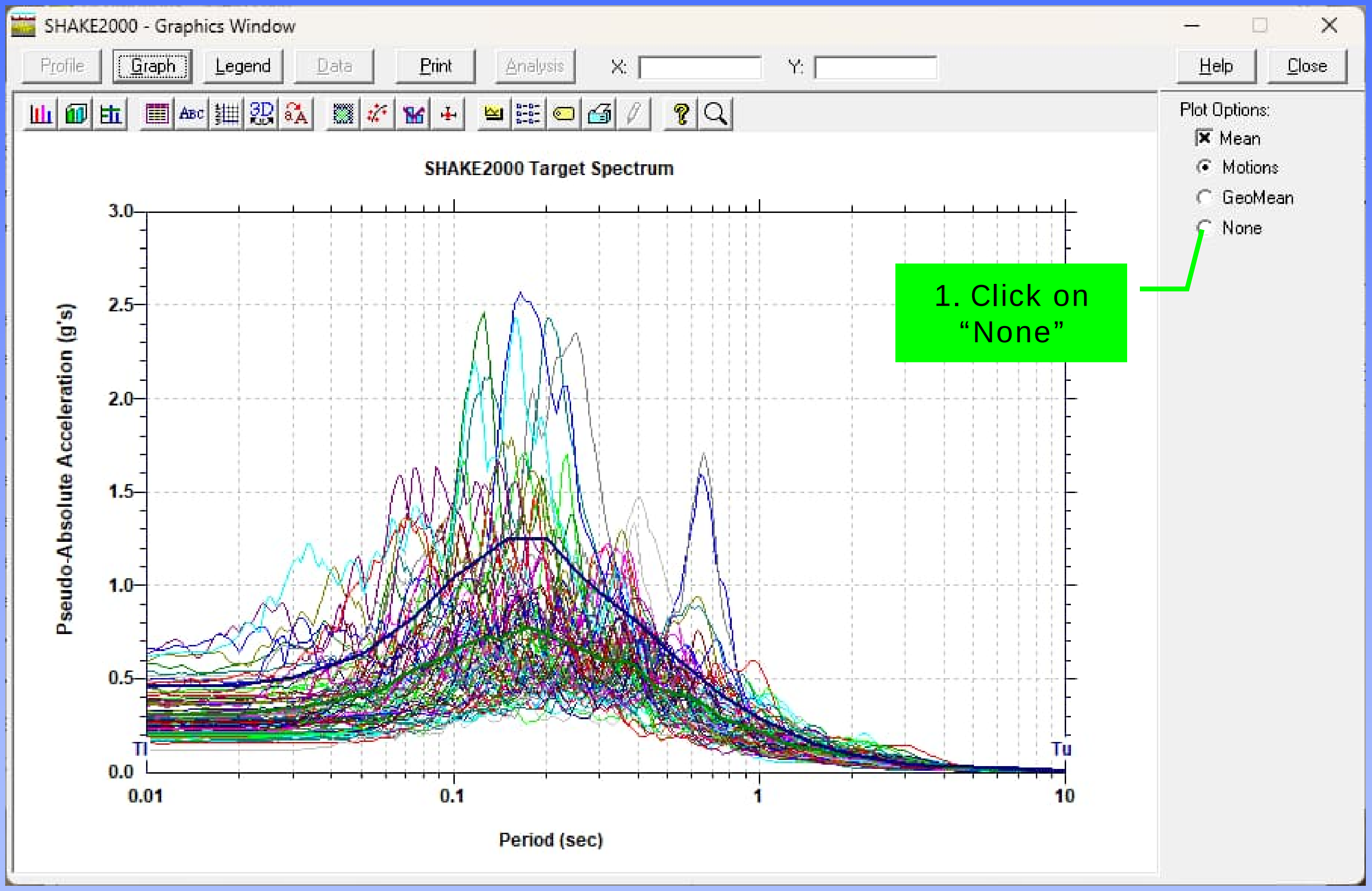
1. Click on "Plot"



GeoMotions

Selection of Acceleration Time Histories

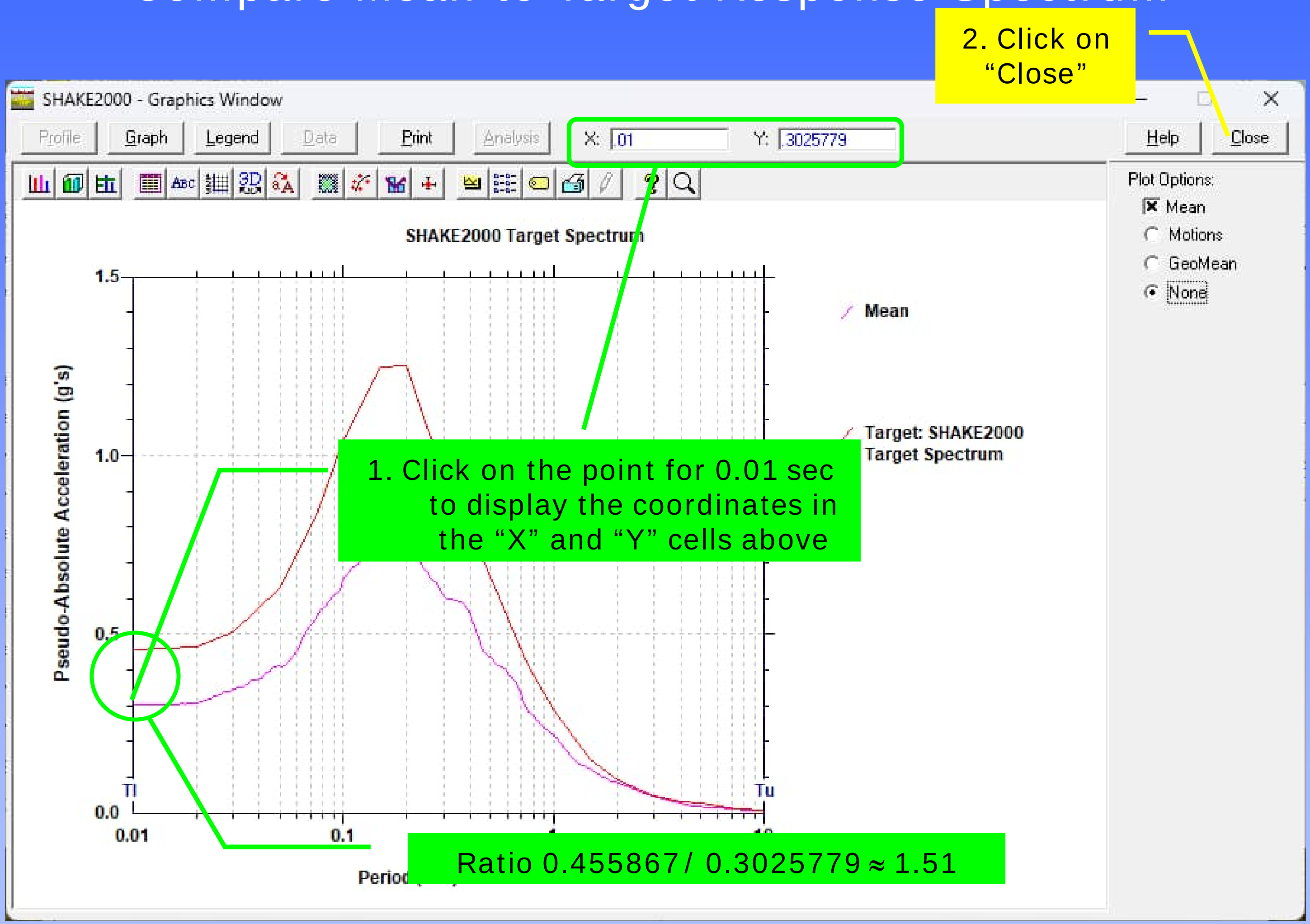
Compare Mean to Target Response Spectrum



GeoMotions

Selection of Acceleration Time Histories

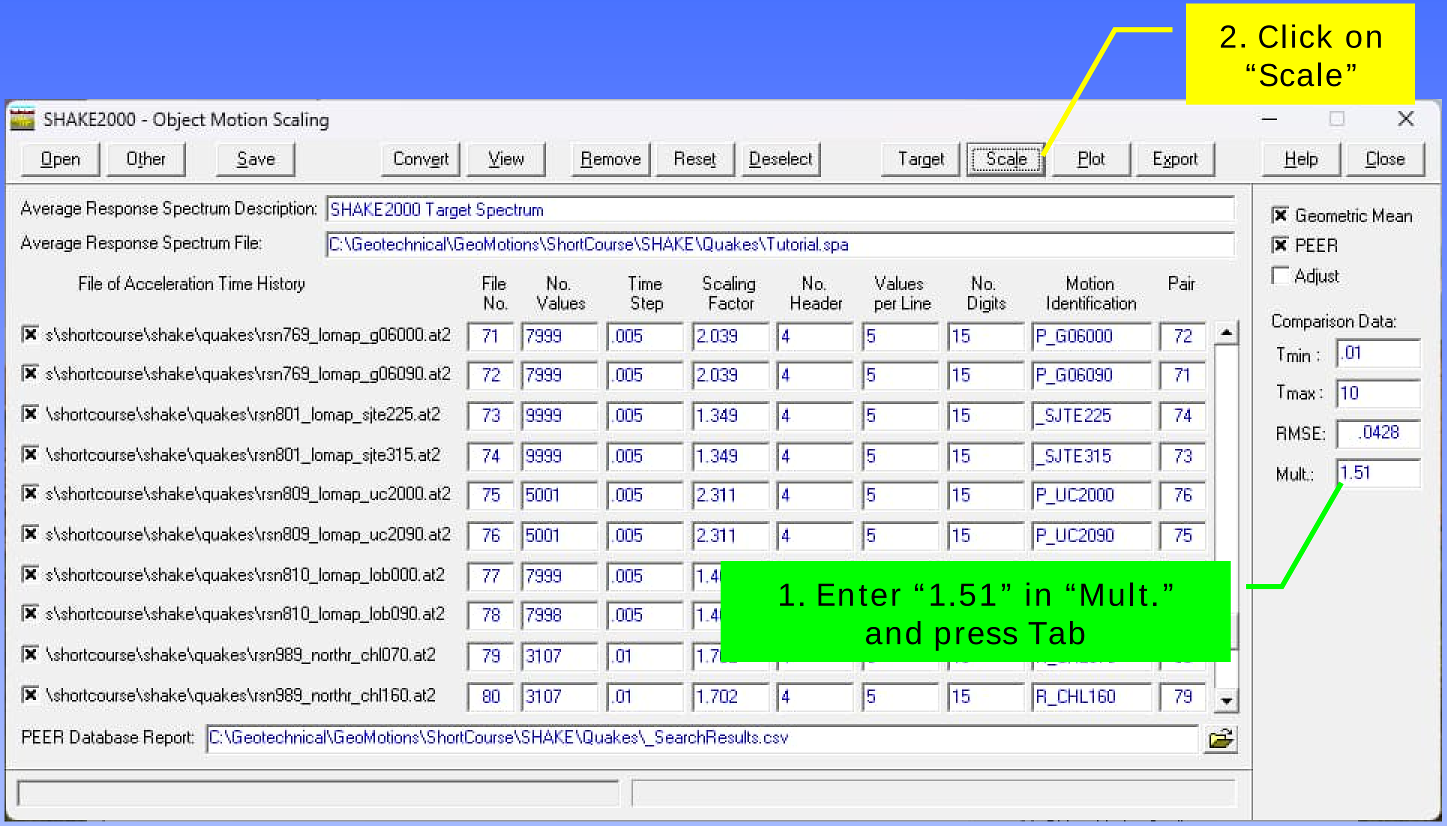
Compare Mean to Target Response Spectrum



Target PGA = 0.455867 g's

Selection of Acceleration Time Histories

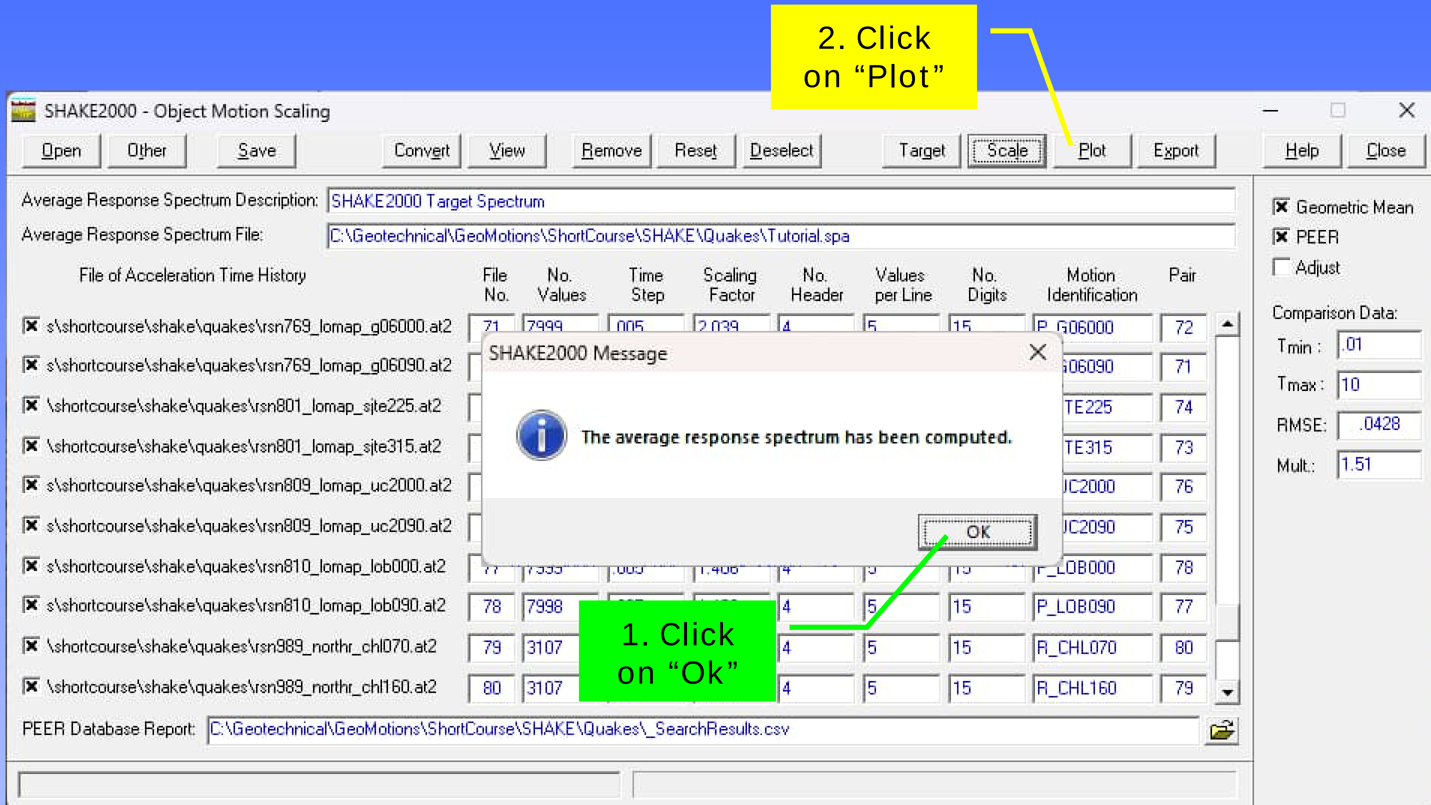
Compare to Target Response Spectrum



GeoMotions

Selection of Acceleration Time Histories

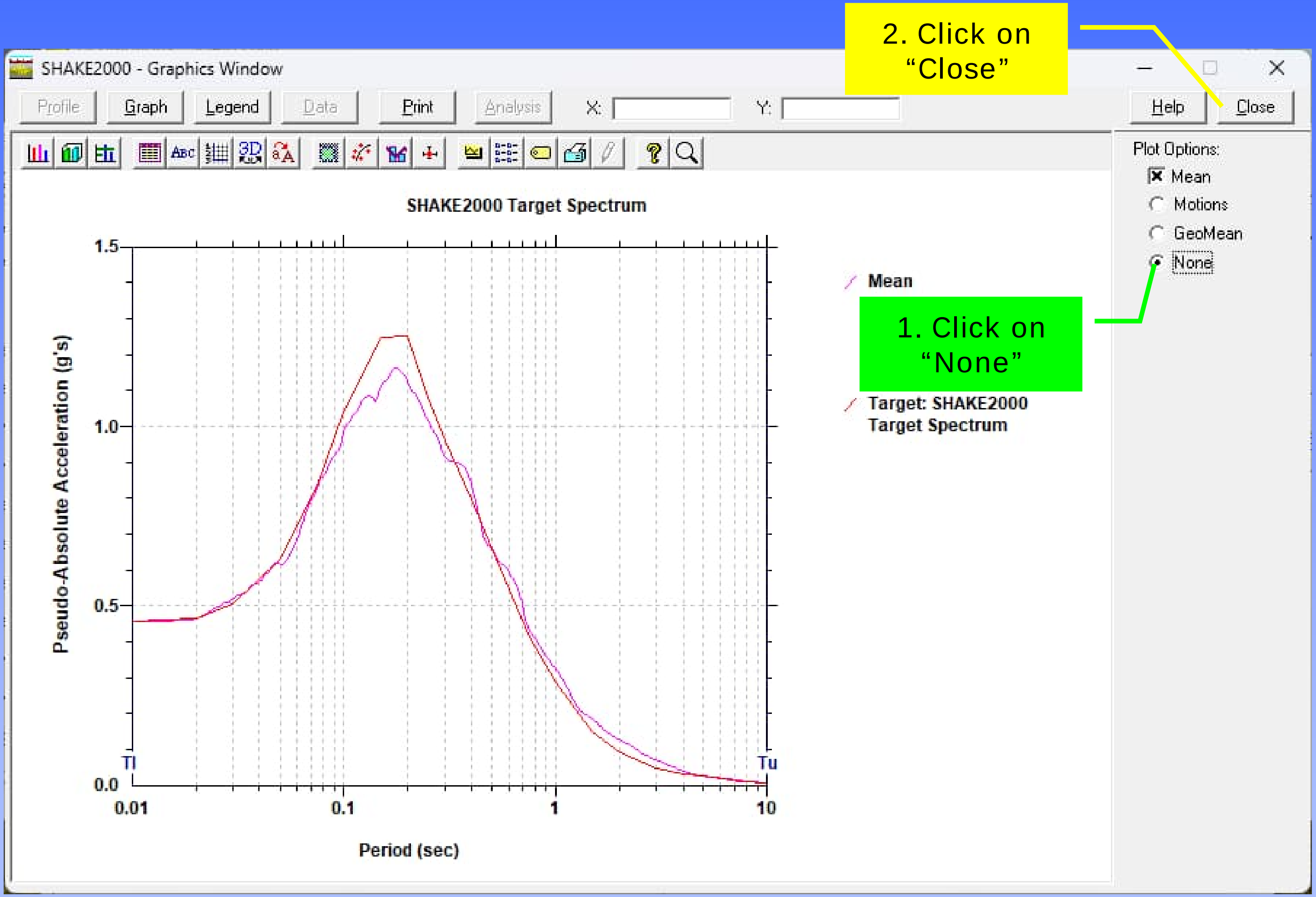
Compare to Target Response Spectrum



GeoMotions

Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Trial and Error

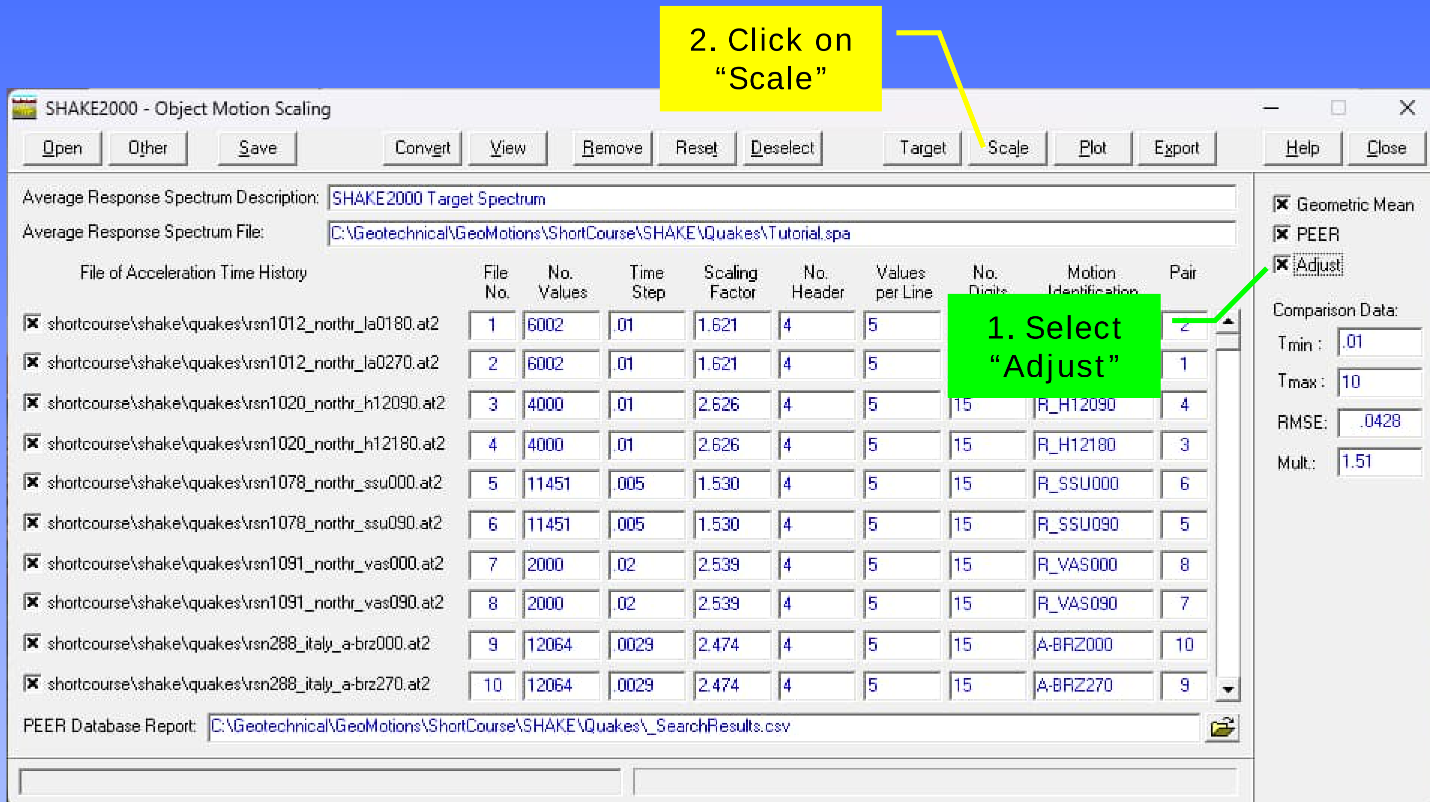
Typically, select a set of seven 2-component motions for the analysis.

To this end, first select the “Adjust” check box and let the program automatically select the factor to match the motion’s PGA to the target PGA.

Then, by trial and error select seven 2-component motions that provide the best match.

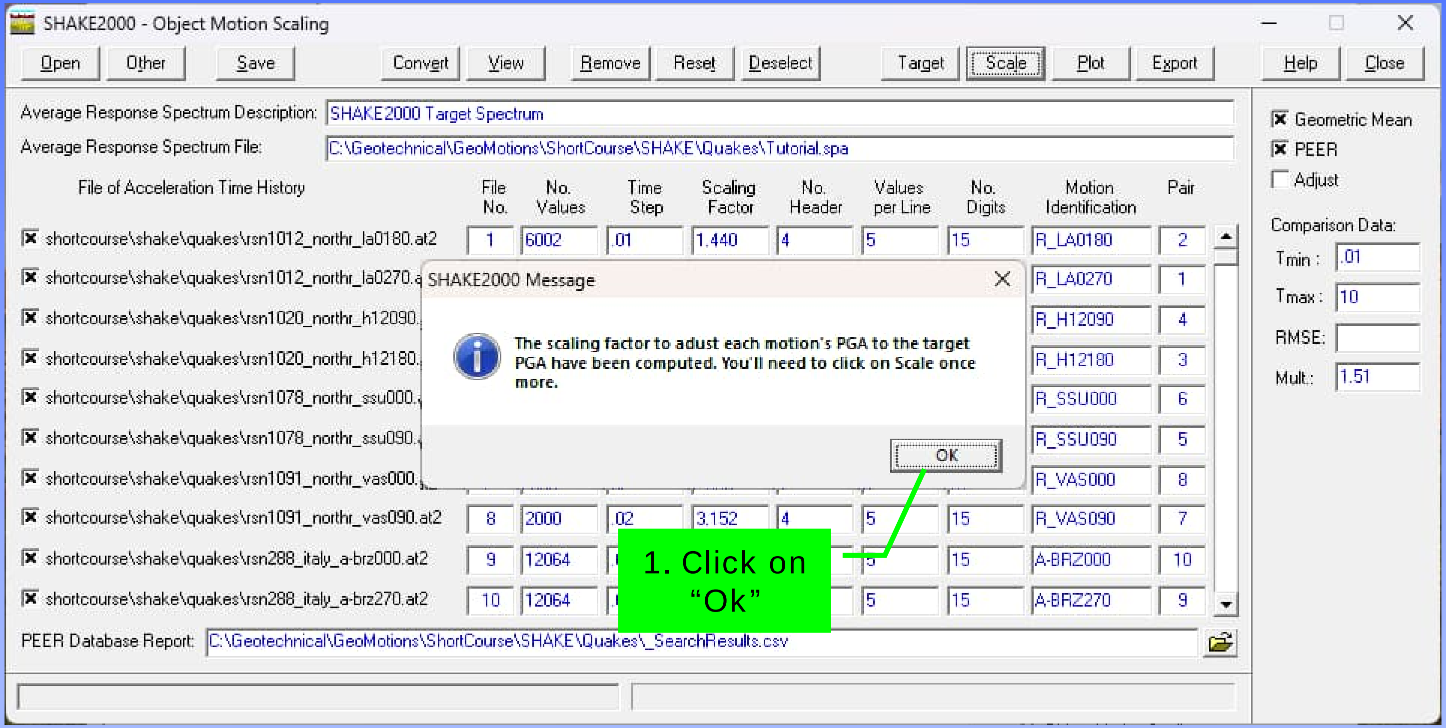
Selection of Acceleration Time Histories

Update Scaling Factor



Selection of Acceleration Time Histories

Update Scaling Factor

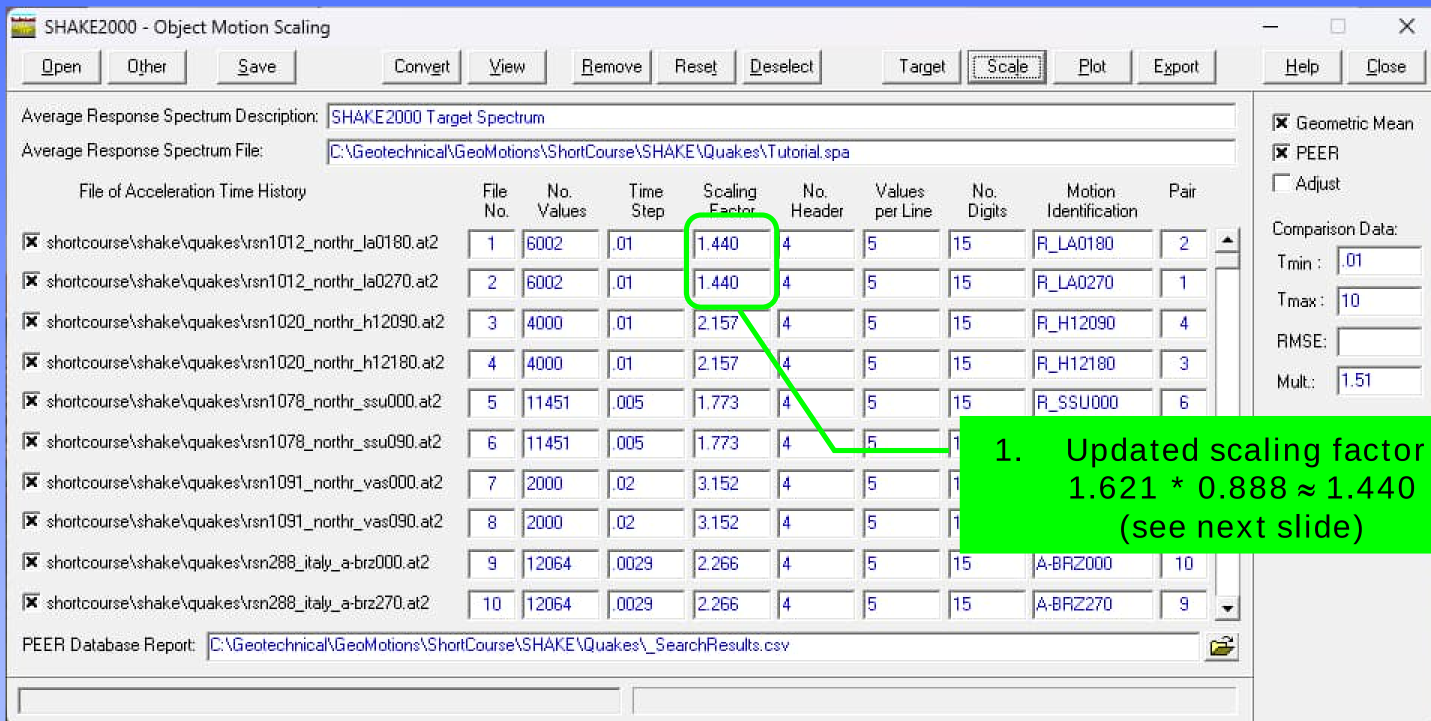


File of Acceleration Time History	File No.	No. Values	Time Step	Scaling Factor	No. Header	Values per Line	No. Digits	Motion Identification	Pair
shortcourse\shake\quakes\rsn1012_northr_la0180.at2	1	6002	.01	1.440	4	5	15	R_LA0180	2
shortcourse\shake\quakes\rsn1012_northr_la0270.a								R_LA0270	1
shortcourse\shake\quakes\rsn1020_northr_h12090.								R_H12090	4
shortcourse\shake\quakes\rsn1020_northr_h12180.								R_H12180	3
shortcourse\shake\quakes\rsn1078_northr_ssu000.								R_SSU000	6
shortcourse\shake\quakes\rsn1078_northr_ssu090.								R_SSU090	5
shortcourse\shake\quakes\rsn1091_northr_vas000.								R_VAS000	8
shortcourse\shake\quakes\rsn1091_northr_vas090.at2	8	2000	.02	3.152	4	5	15	R_VAS090	7
shortcourse\shake\quakes\rsn288_italy_a-brz000.at2	9	12064					15	A-BRZ000	10
shortcourse\shake\quakes\rsn288_italy_a-brz270.at2	10	12064				5	15	A-BRZ270	9

GeoMotions

Selection of Acceleration Time Histories

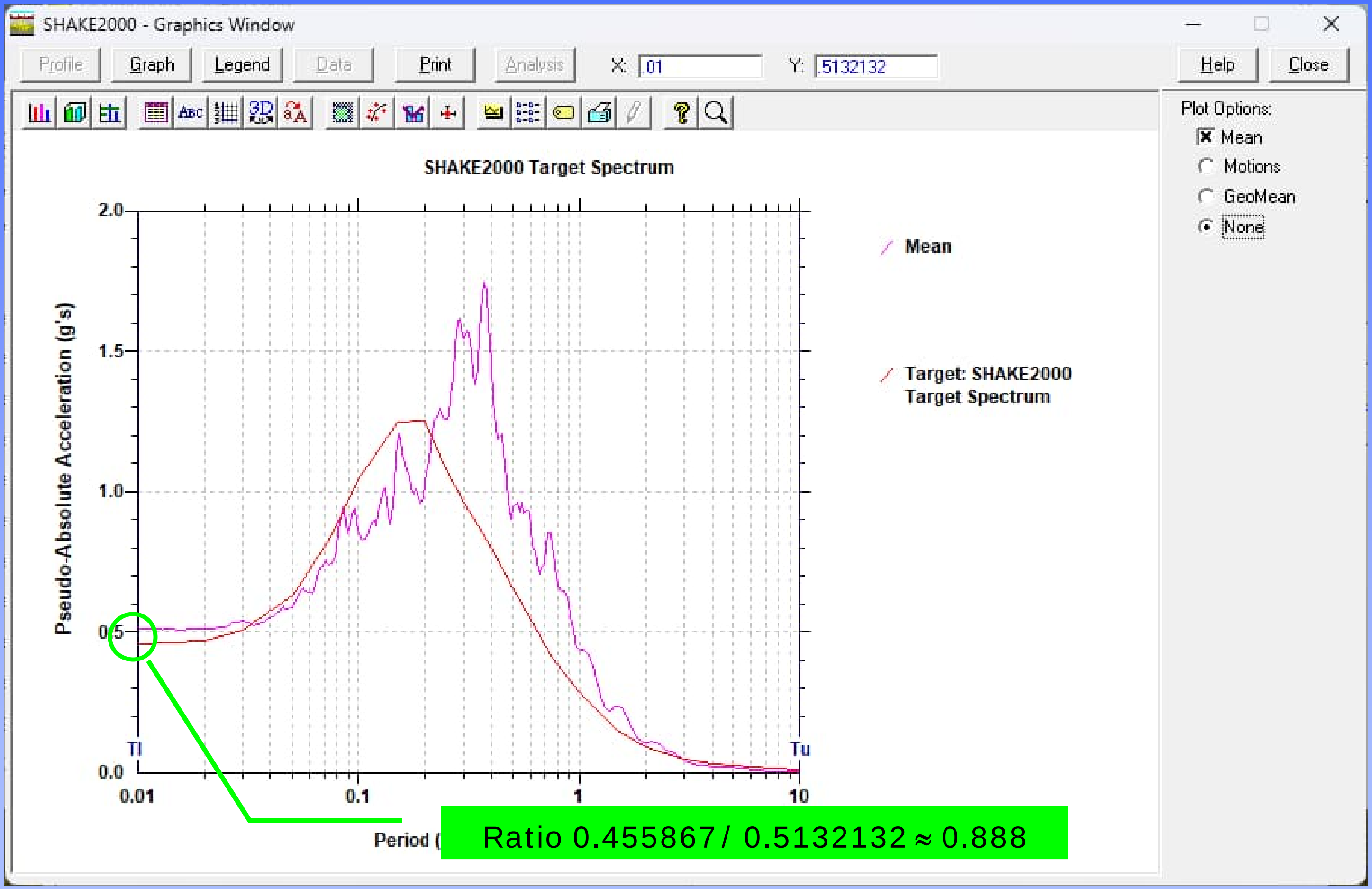
Update Scaling Factor



1. Updated scaling factor to: 1.621 * 0.888 ≈ 1.440 (see next slide)

Selection of Acceleration Time Histories

For Motions Sets 1 & 2



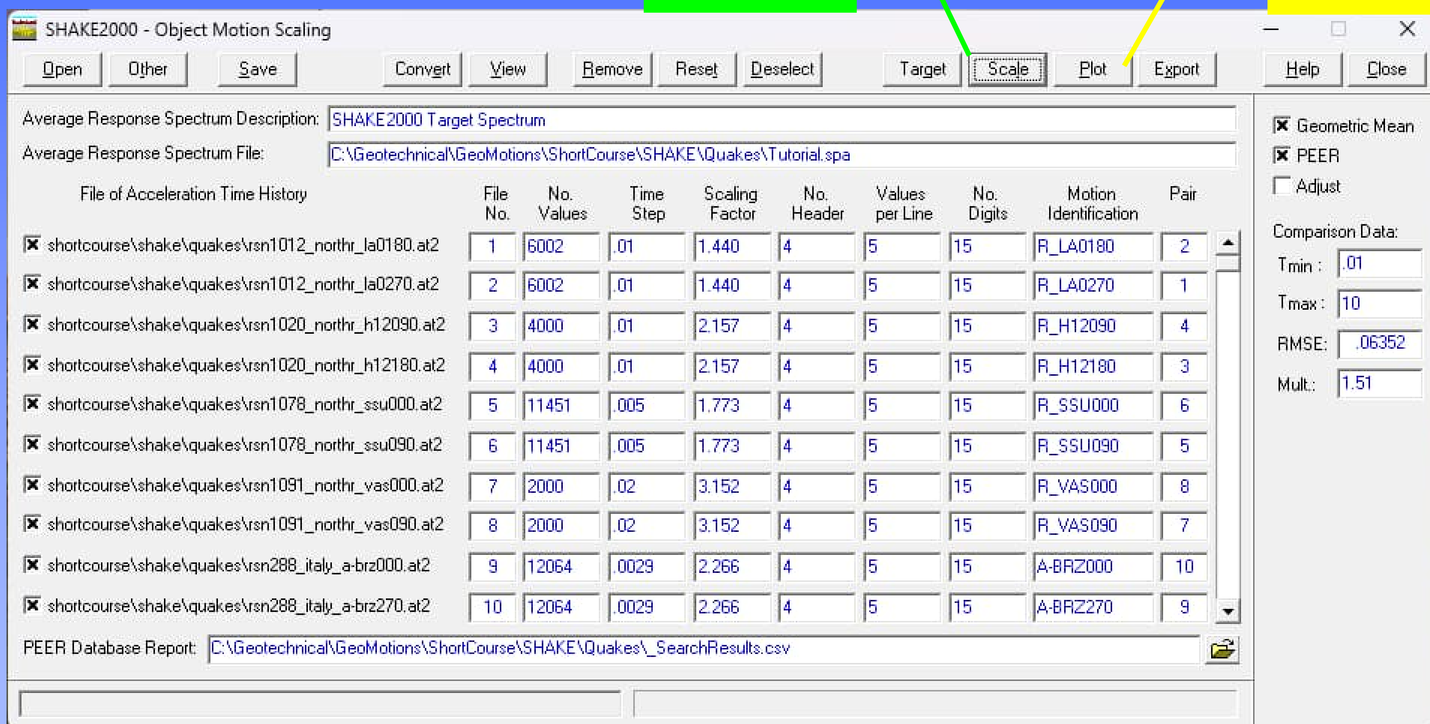
0.455867 g's is the target PGA, and 0.5132132 g's is the GeoMean PGA for Motions 1 & 2 when previously scaled by a factor of 1.621

Selection of Acceleration Time Histories

Update Scaling Factor

1. Click on "Scale"

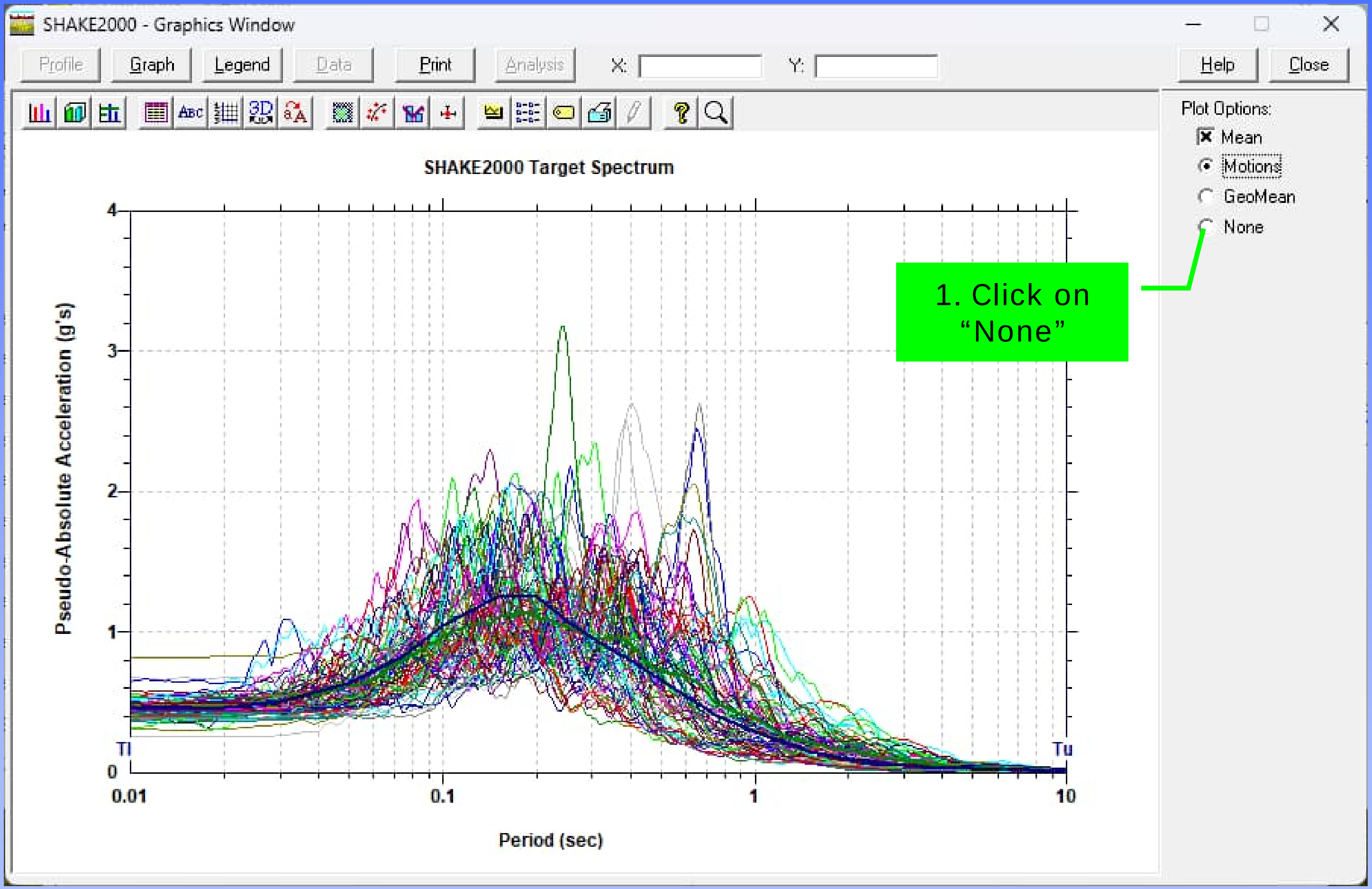
2. Click on "Plot"



GeoMotions

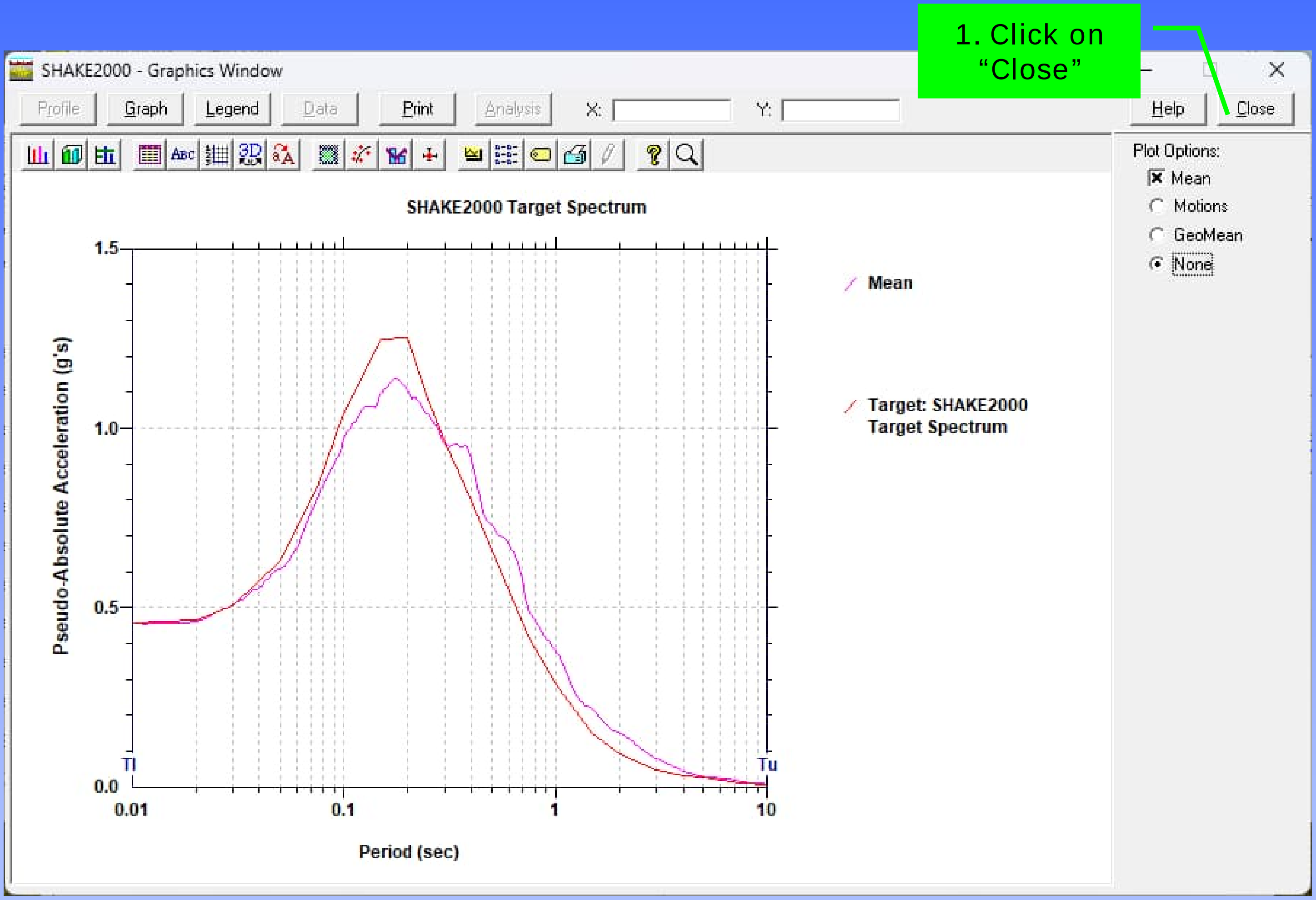
Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



GeoMotions

Selection of Acceleration Time Histories

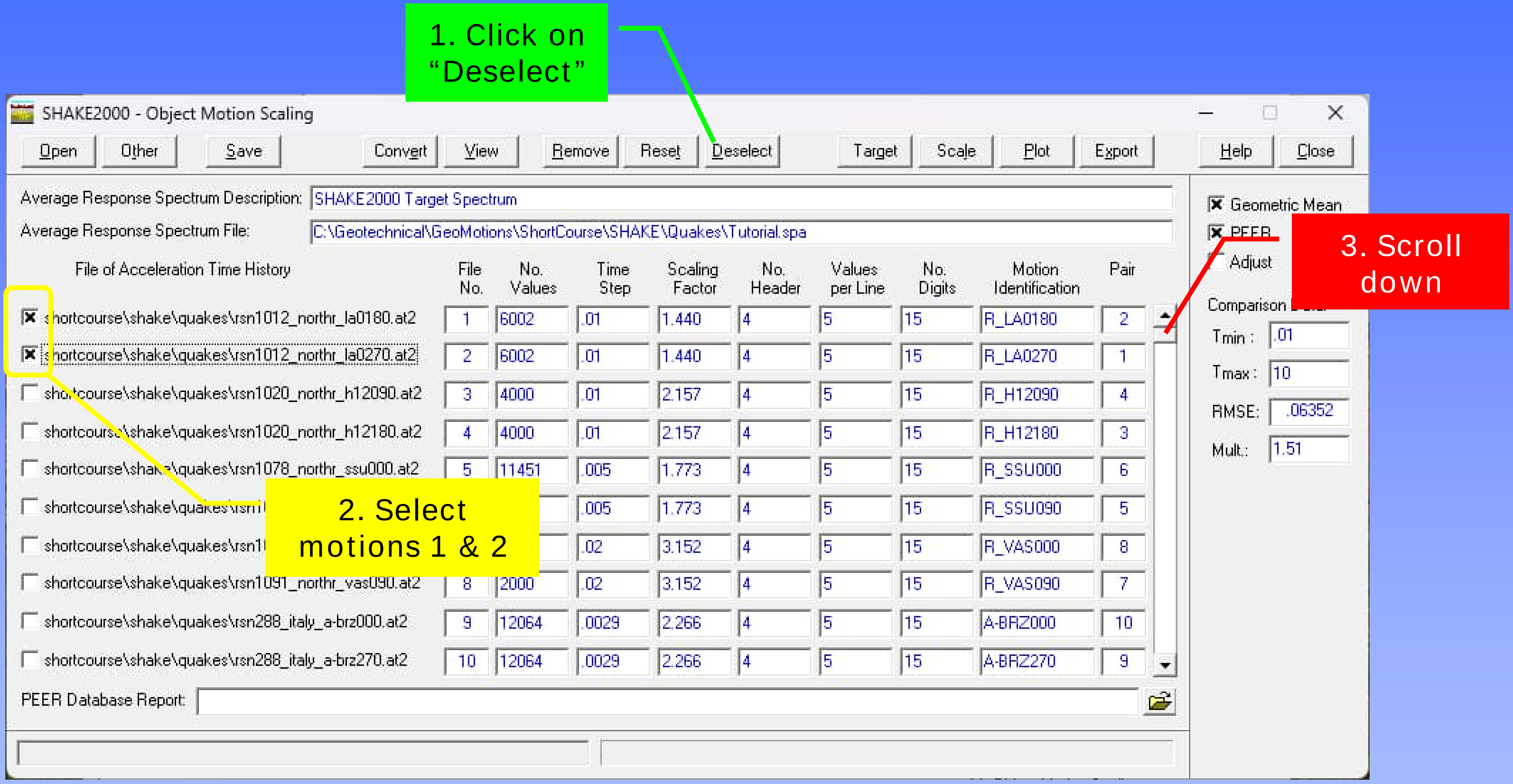
Trial and Error

For first trial, select the first seven 2-component sets from seven different seismic events with scaling factors ≥ 0.5 and ≤ 2

Motion	Sets
Northridge	1 & 2
Niigata	11 & 12
Chuetsu	17 & 18
Nahanni	49 & 50
Iwate	53 & 54
San Fernando	65 & 66
Loma Prieta	67 & 68

Selection of Acceleration Time Histories

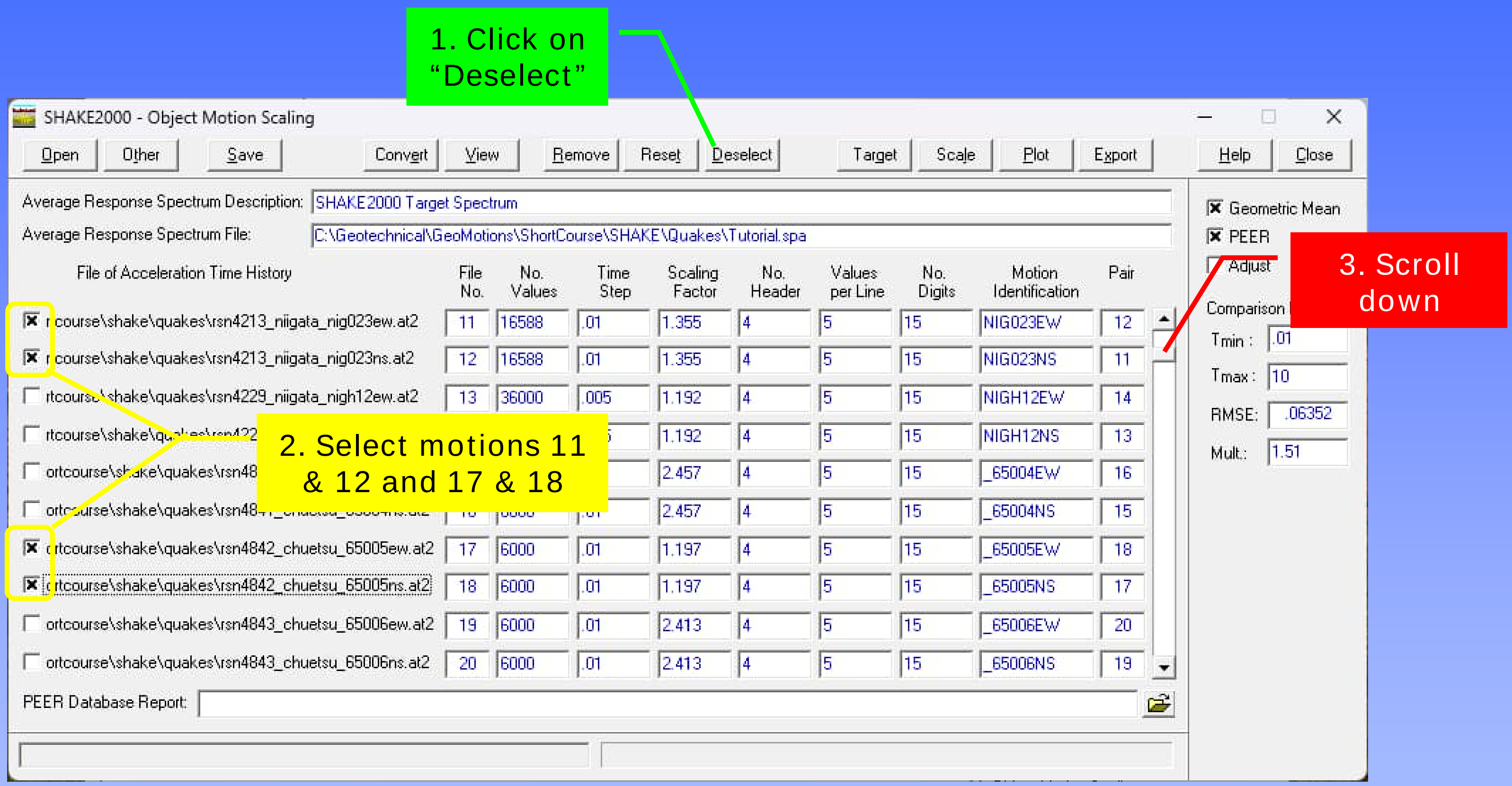
Trial and Error



GeoMotions

Selection of Acceleration Time Histories

Trial and Error



GeoMotions

Selection of Acceleration Time Histories

Trial and Error

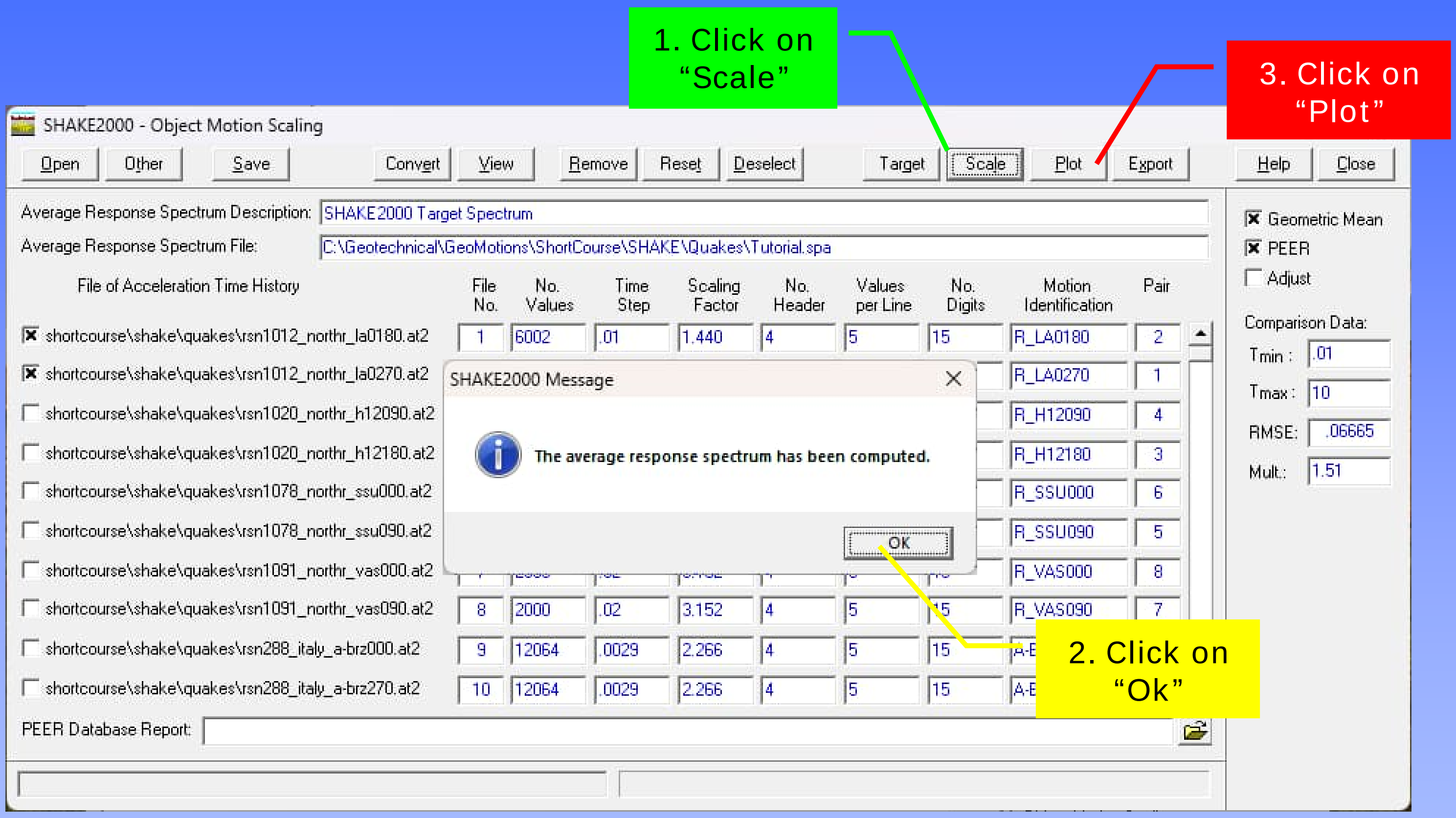
Scroll Down, use “Deselect” on every screen to clear the check boxes, and then select the remaining motions:

Motion	Sets
Nahanni	49 & 50
Iwate	53 & 54
San Fernando	65 & 66
Loma Prieta	67 & 68

After selecting the motions, scroll up to the first screen with motions 1 to 10.

Selection of Acceleration Time Histories

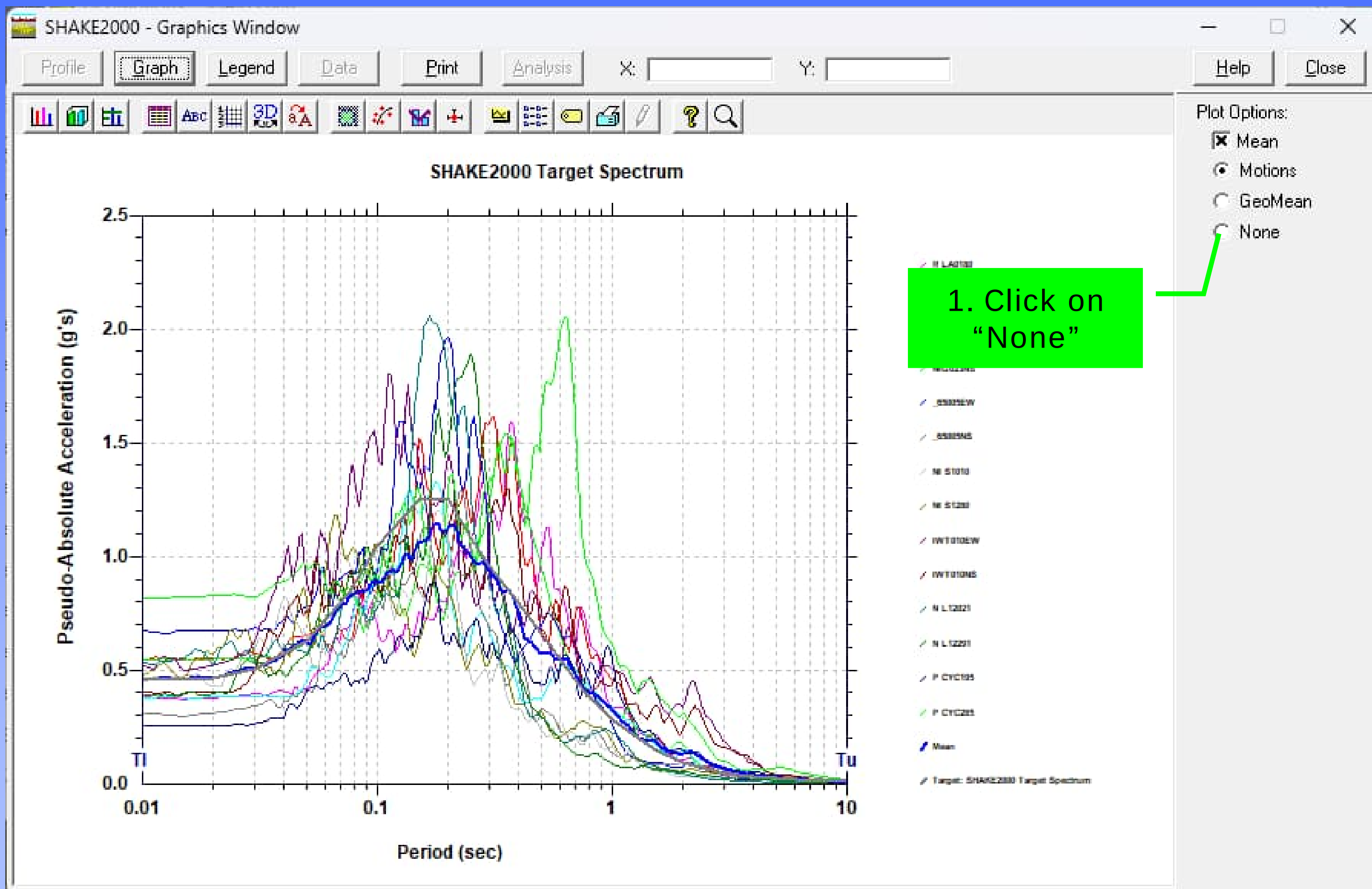
Update Scaling Factor



GeoMotions

Selection of Acceleration Time Histories

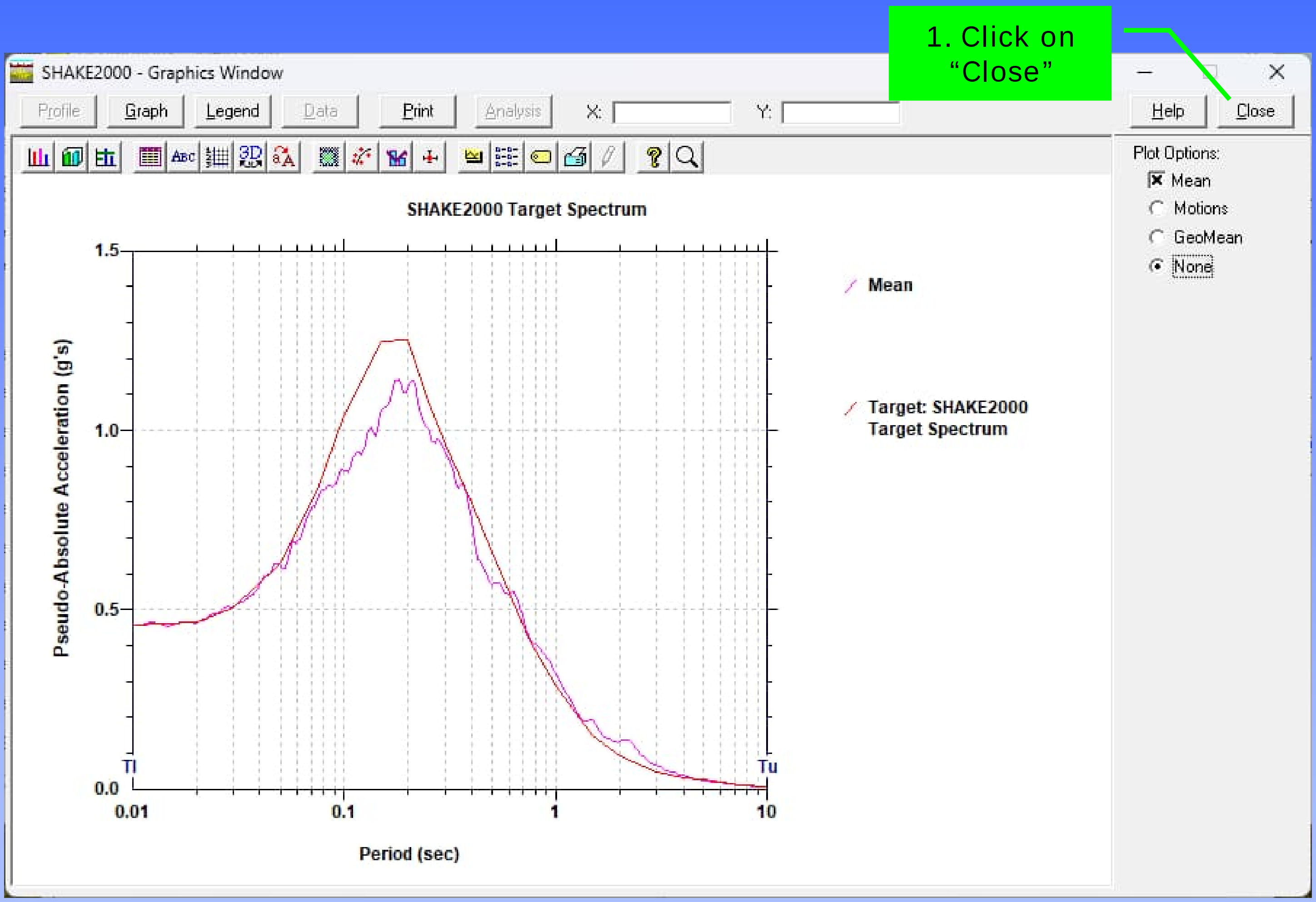
Compare Mean to Target Response Spectrum



GeoMotions

Selection of Acceleration Time Histories

Compare Mean to Target Response Spectrum



GeoMotions

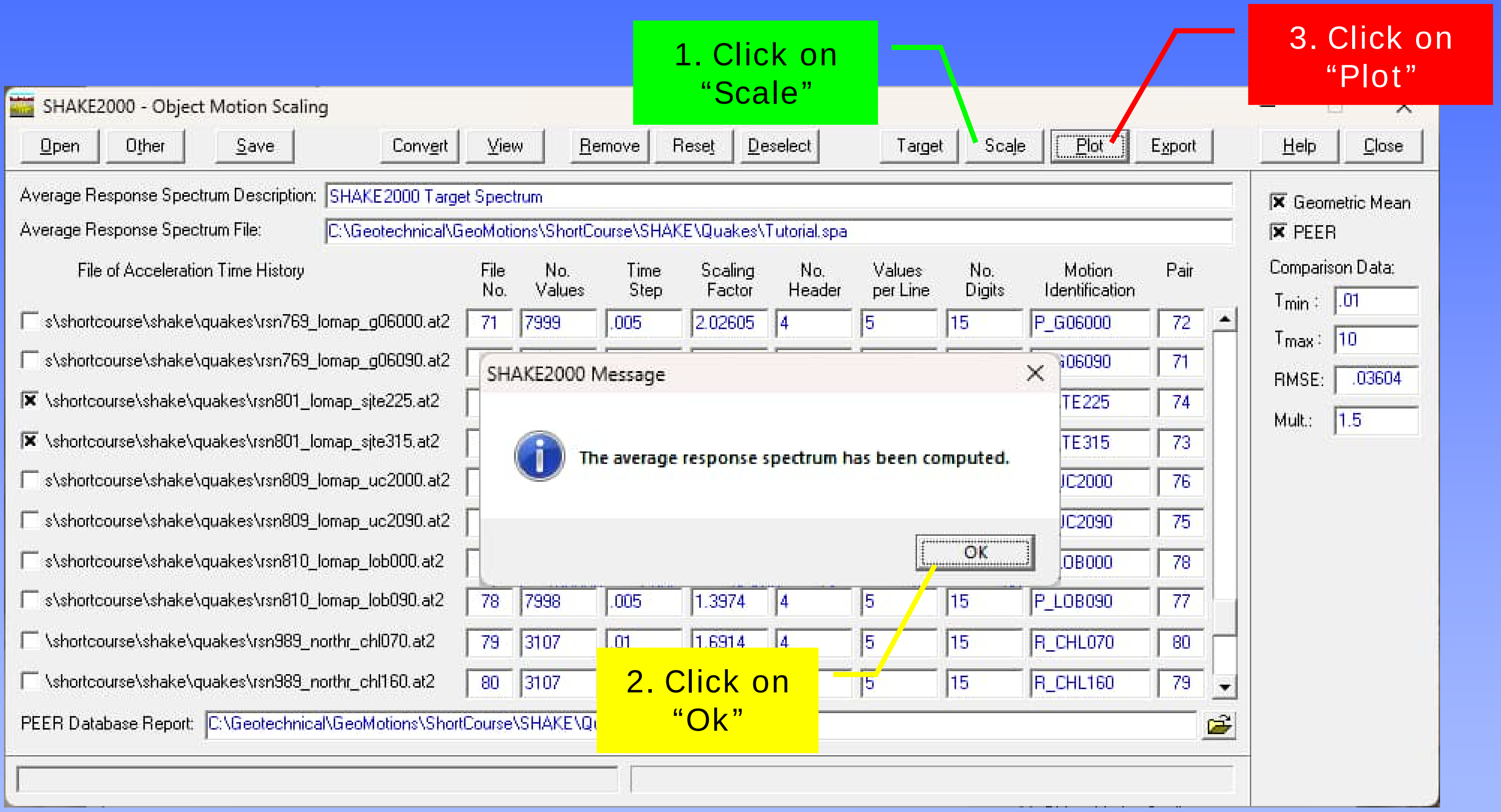
Selection of Acceleration Time Histories

After a few trials

Event	Motion Set	Scaling Factor
Northridge	5 & 6	1.775
Italy	9 & 10	2.0
Niigata	11 & 12	1.45
Chuetsu	17 & 18	1.201
Iwate	53 & 54	1.787
San Fernando	65 & 66	1.392
Loma Prieta	73 & 74	1.703

Selection of Acceleration Time Histories

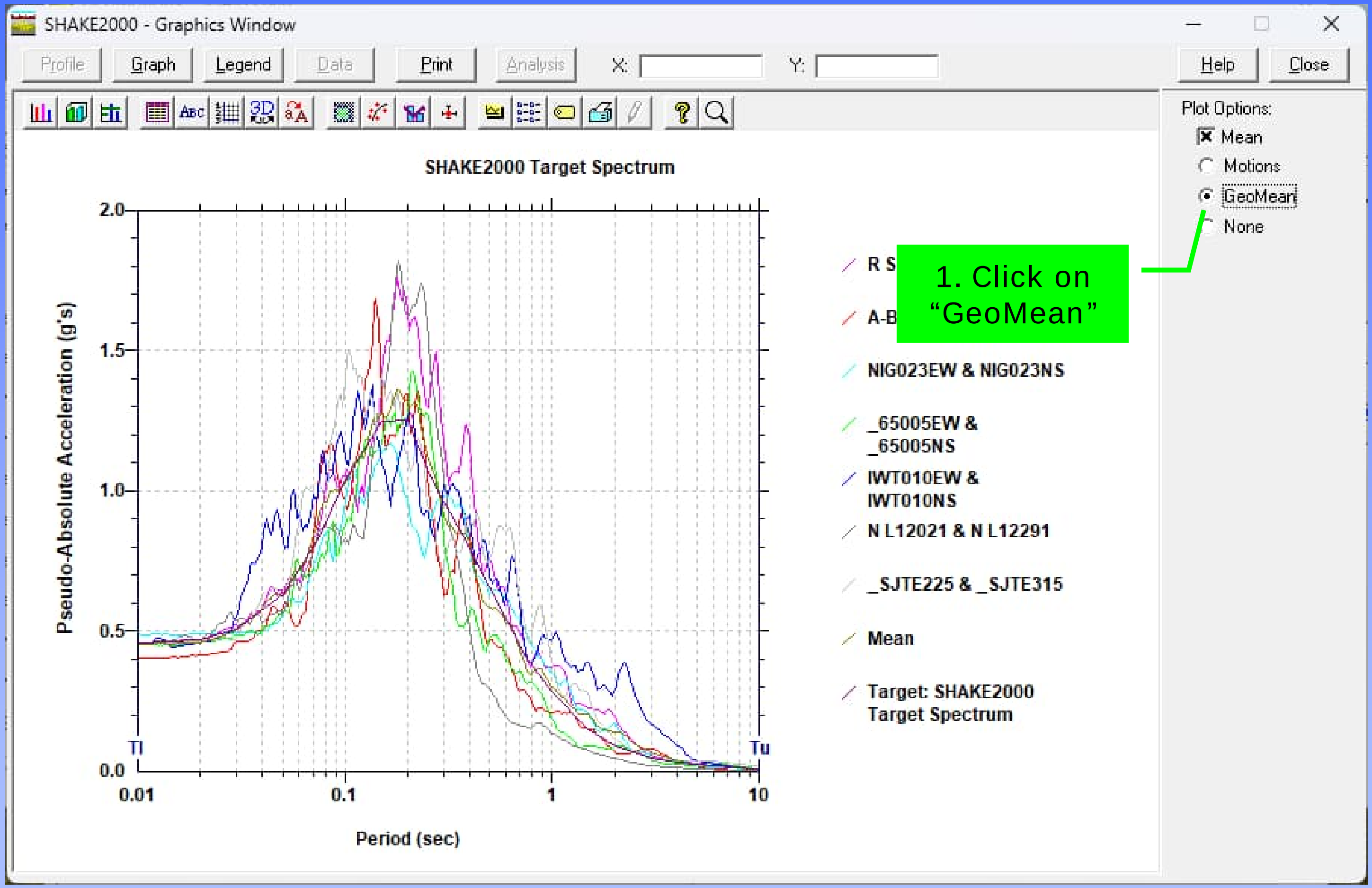
Trial and Error Motion Selection



GeoMotions

Selection of Acceleration Time Histories

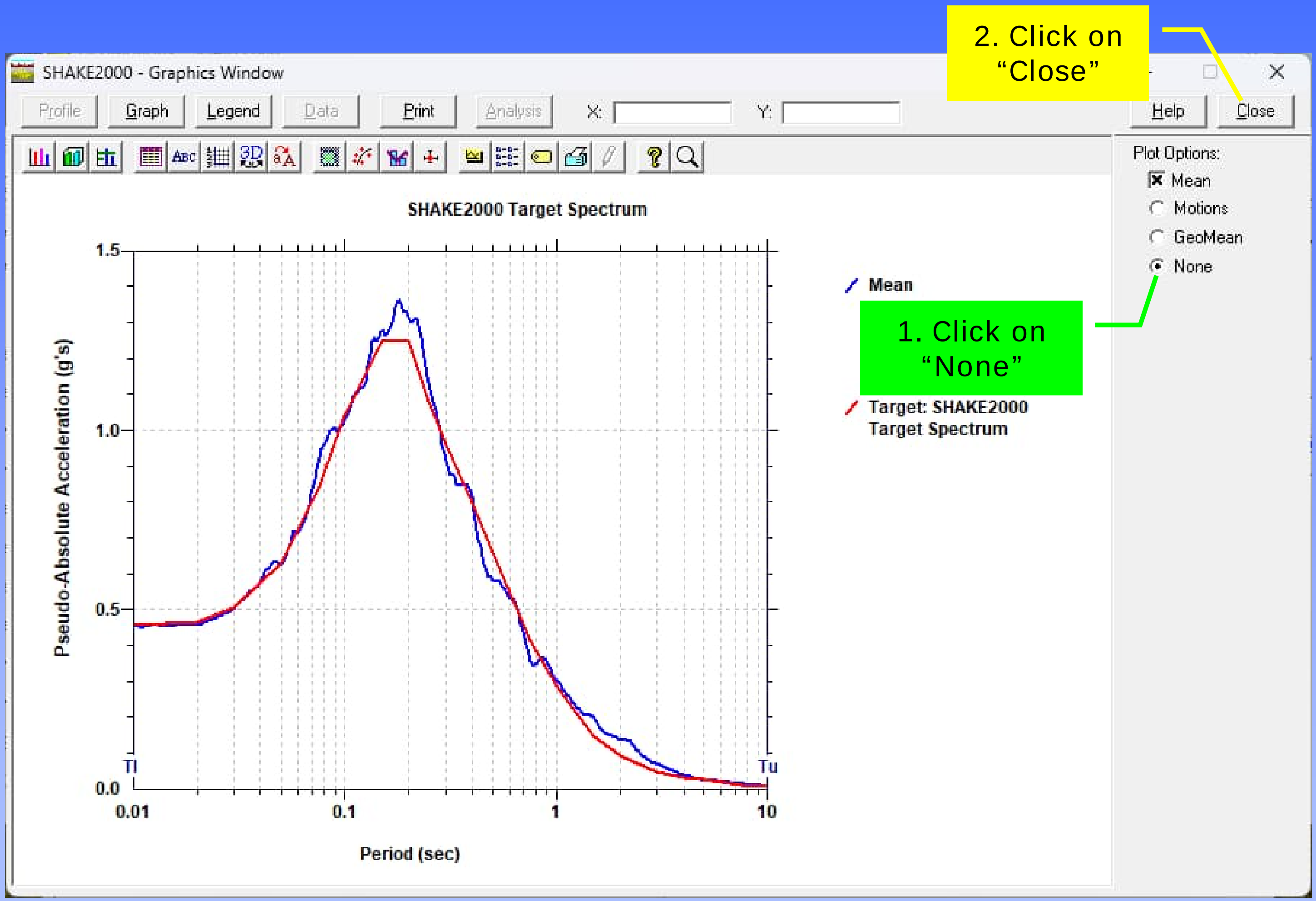
Compare Mean to Target Response Spectrum



GeoMotions

Selection of Acceleration Time Histories

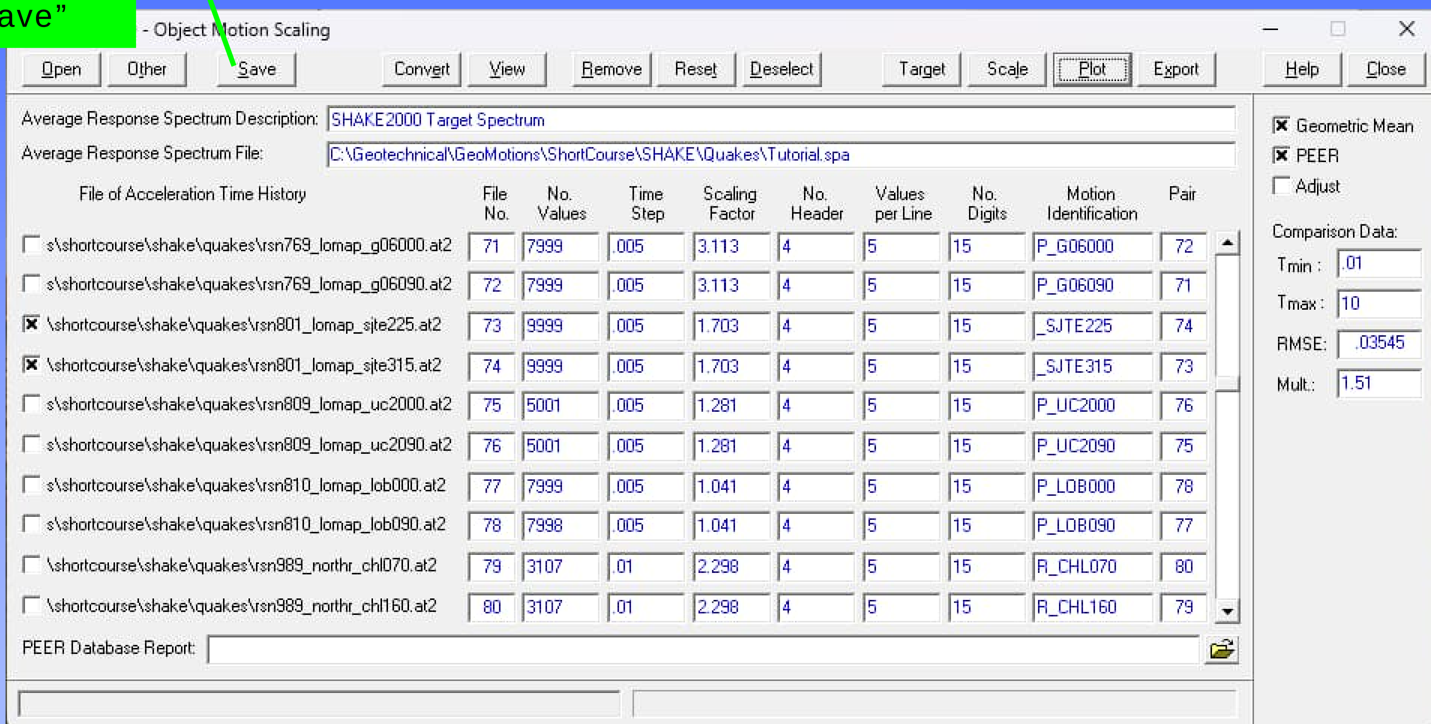
Compare Mean to Target Response Spectrum



Selection of Acceleration Time Histories

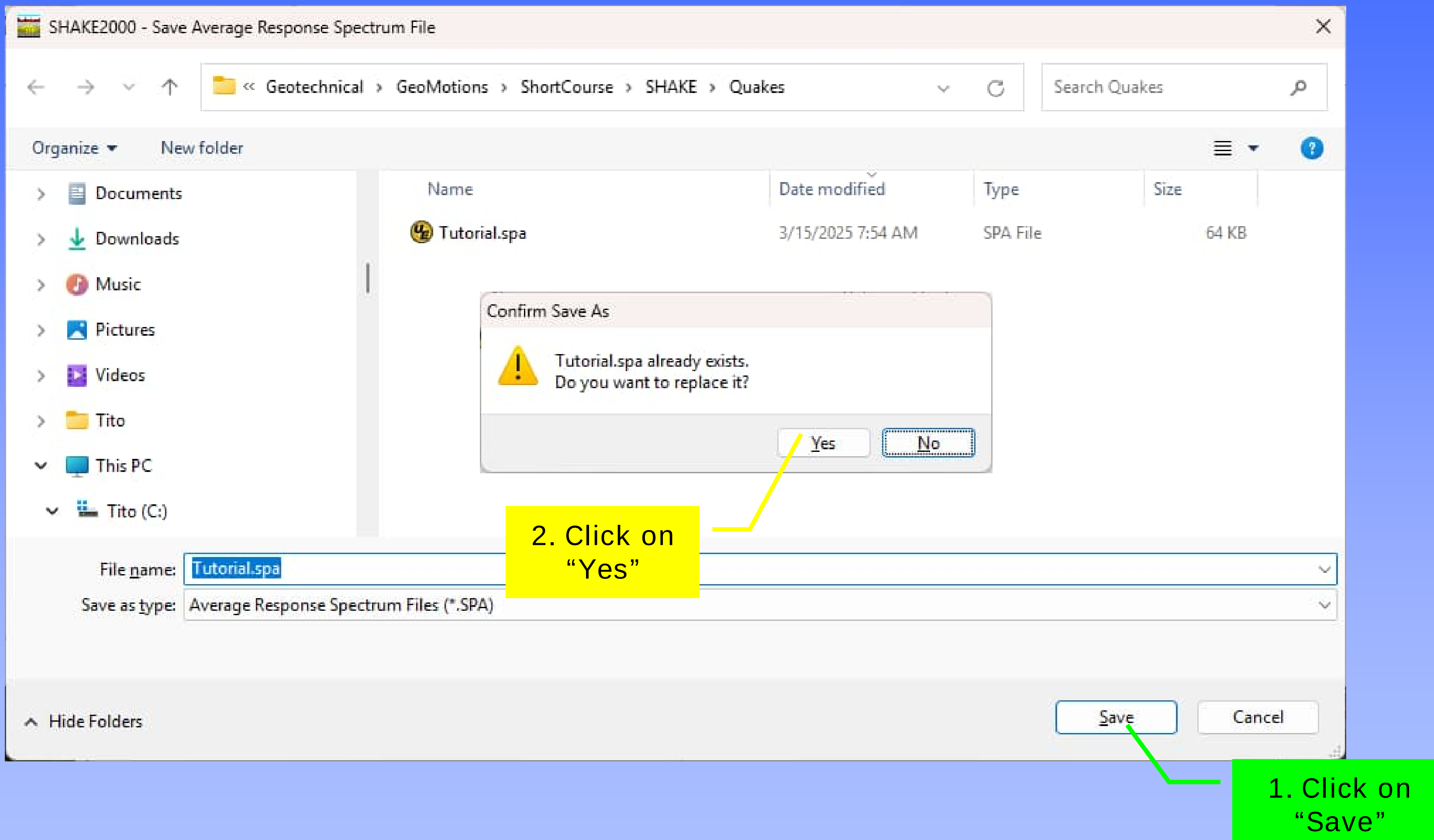
Trial and Error Motion Selection

1. Click on “Save”



GeoMotions

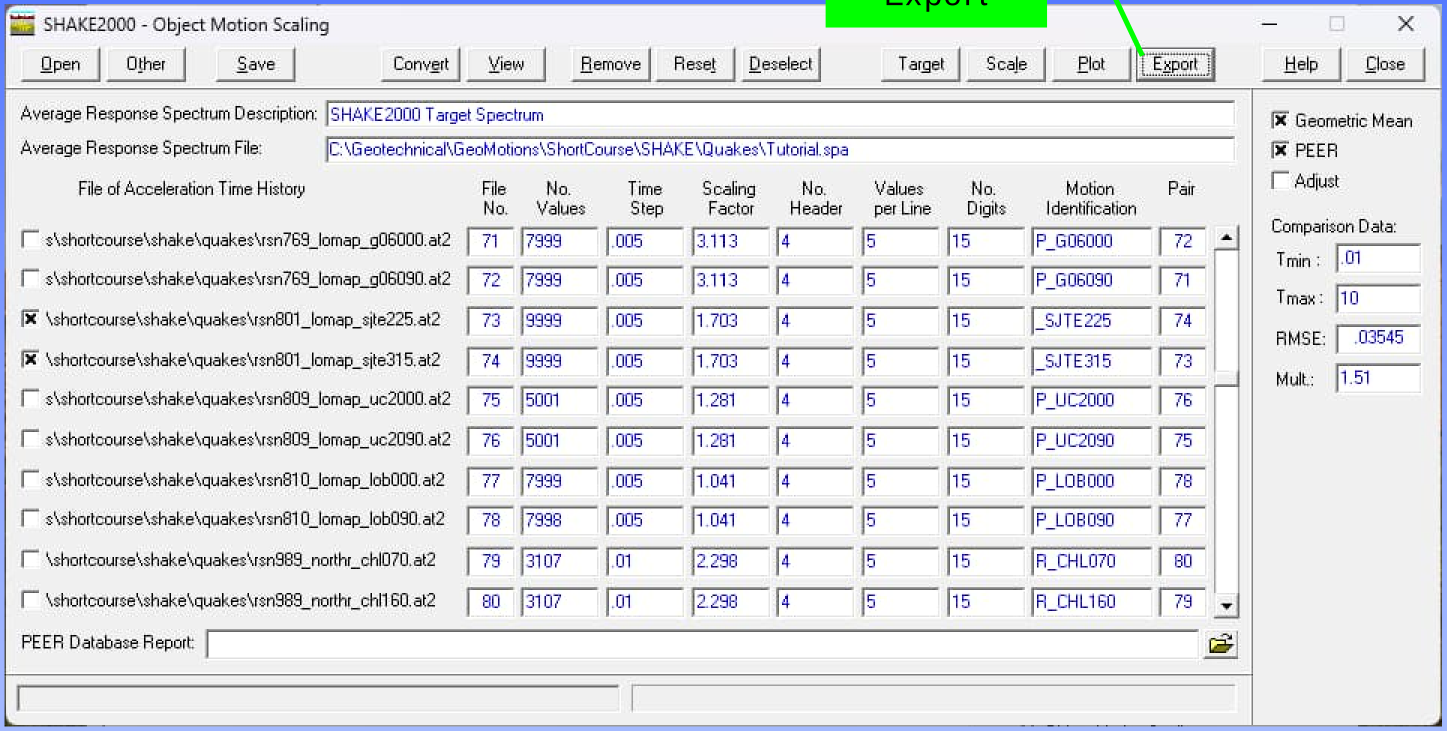
Save Chosen Motions to SHAKE2000 EDT File



Selection of Acceleration Time Histories

Save Chosen Motions to SHAKE2000 EDT File

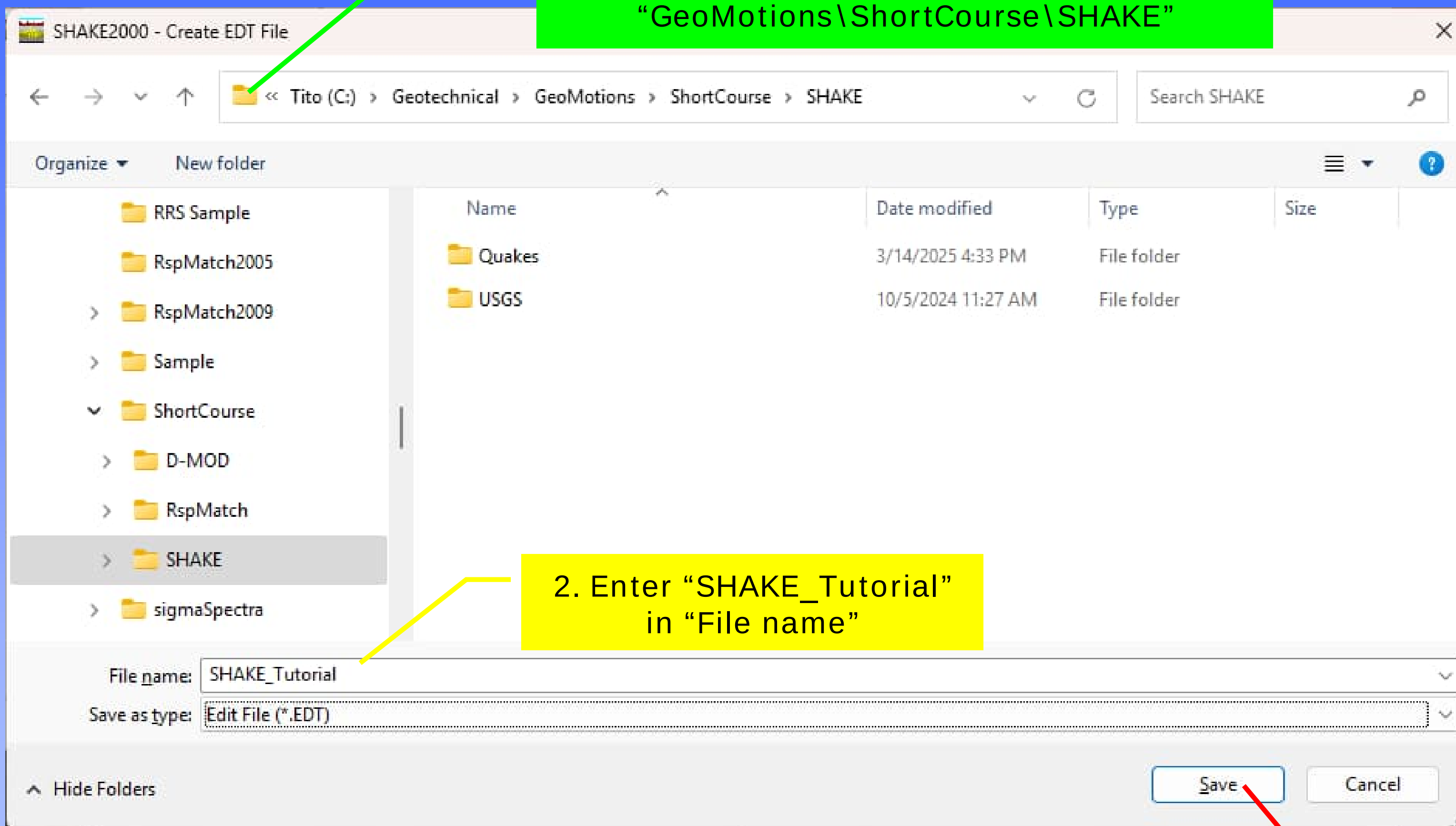
1. Click on “Export”



GeoMotions

Save Ground Motion Scaling Data

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”

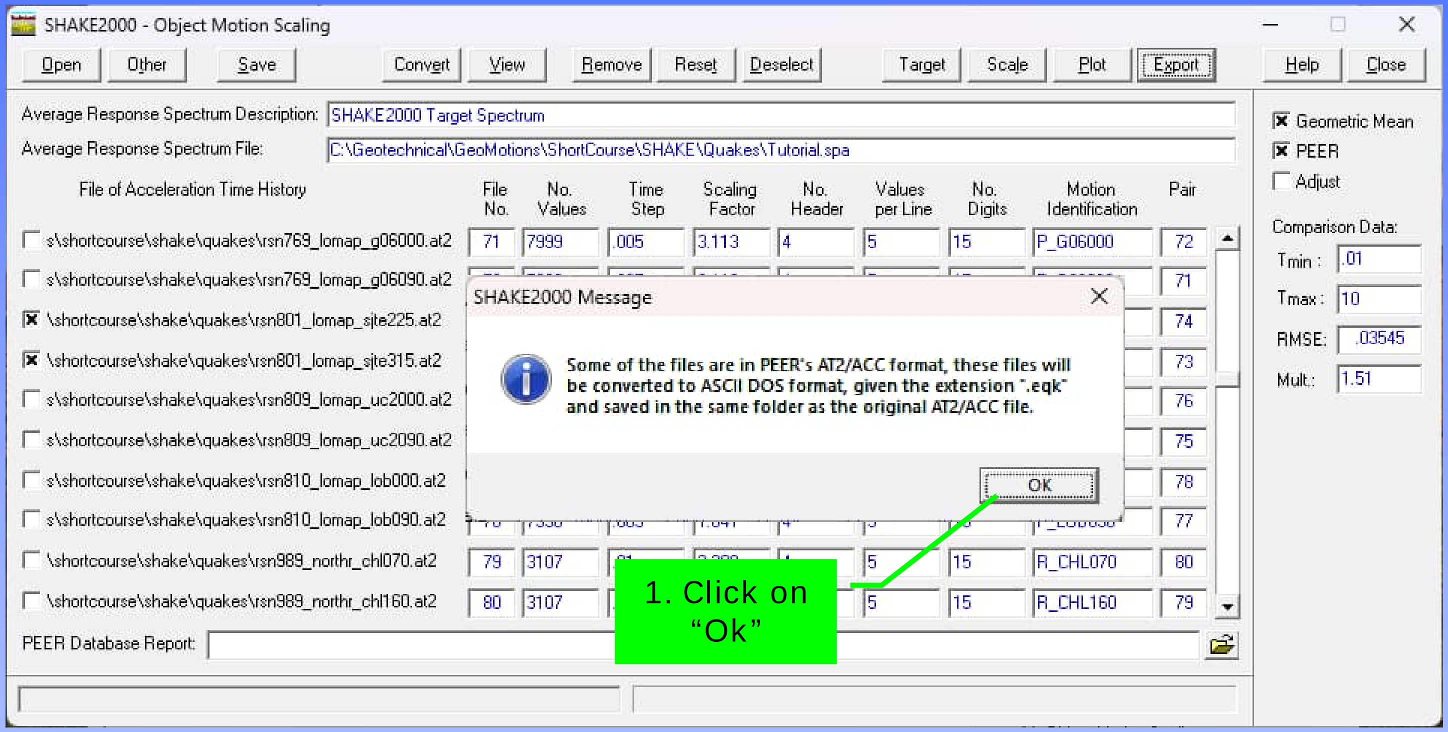


2. Enter “SHAKE_Tutorial” in “File name”

3. Click on “Save”

Selection of Acceleration Time Histories

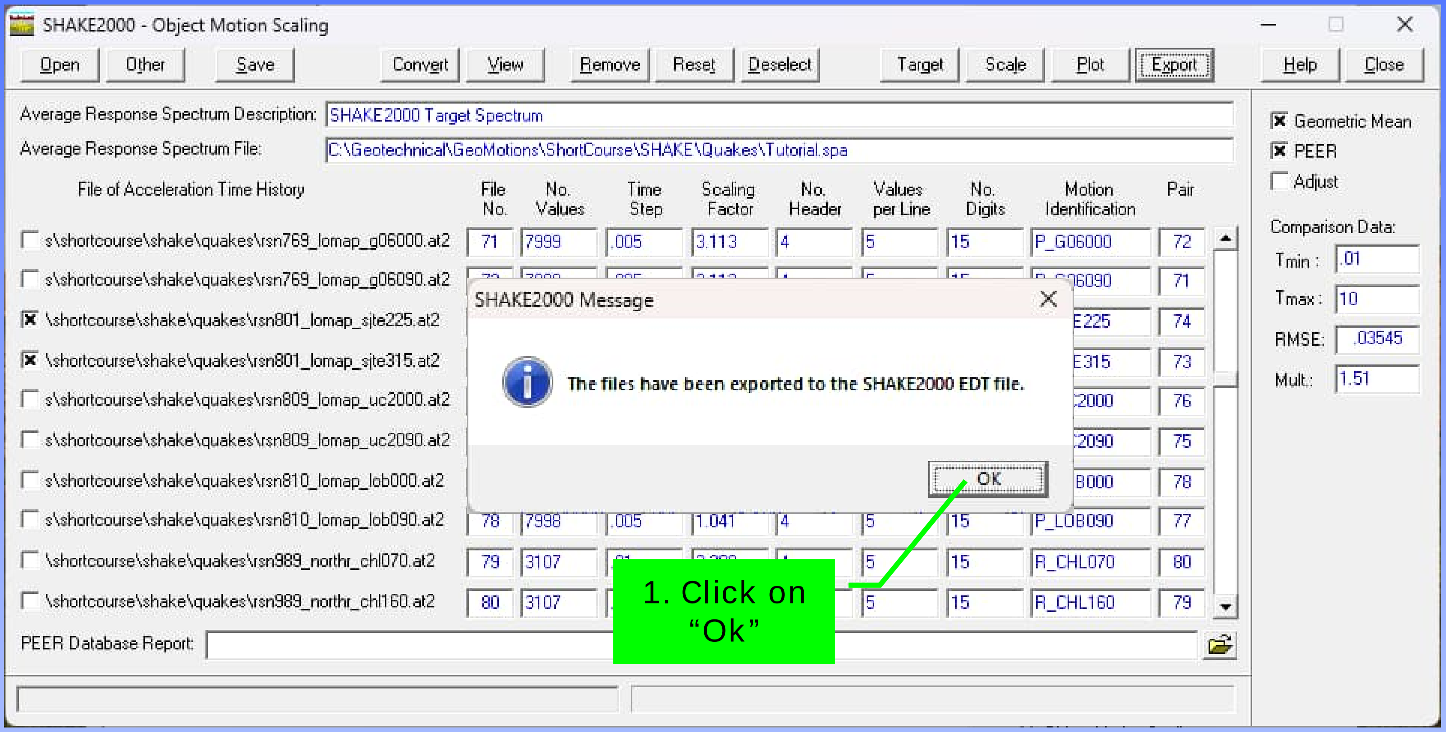
Save Chosen Motions to SHAKE2000 EDT File



GeoMotions

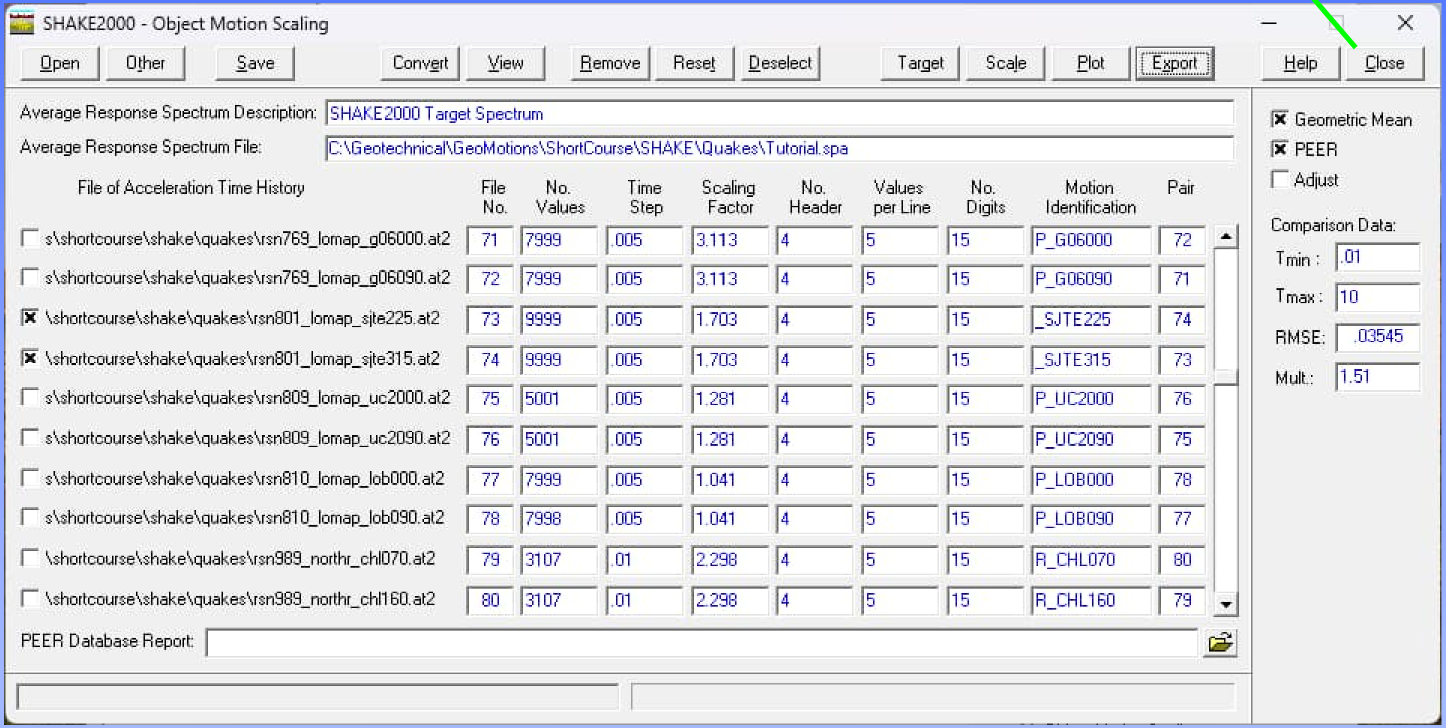
Selection of Acceleration Time Histories

Save Chosen Motions to SHAKE2000 EDT File



Selection of Acceleration Time Histories

1. Click on “Close”



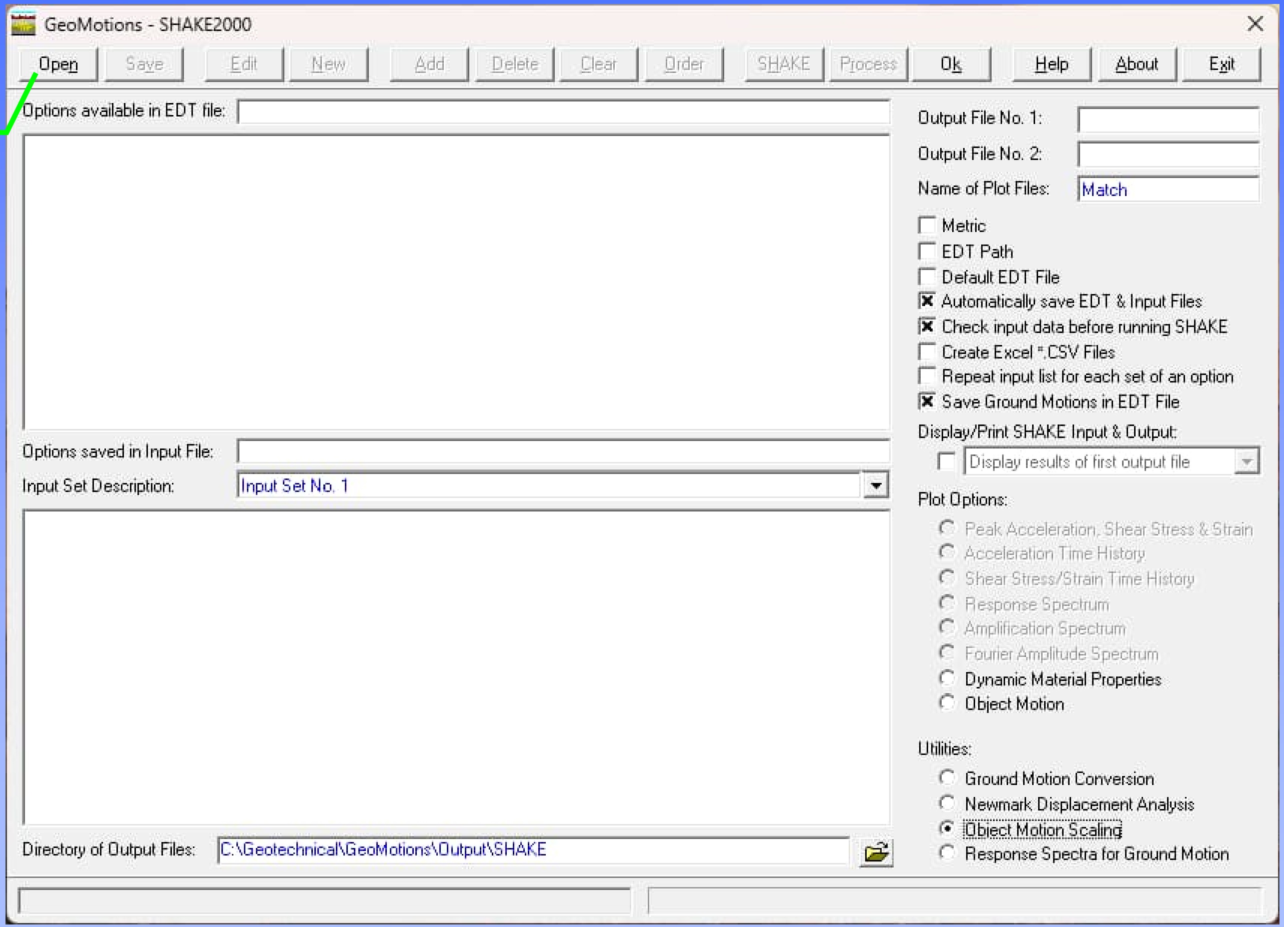
GeoMotions

Site-Specific Analysis - Step 6

Use SHAKE to conduct the site-response analysis

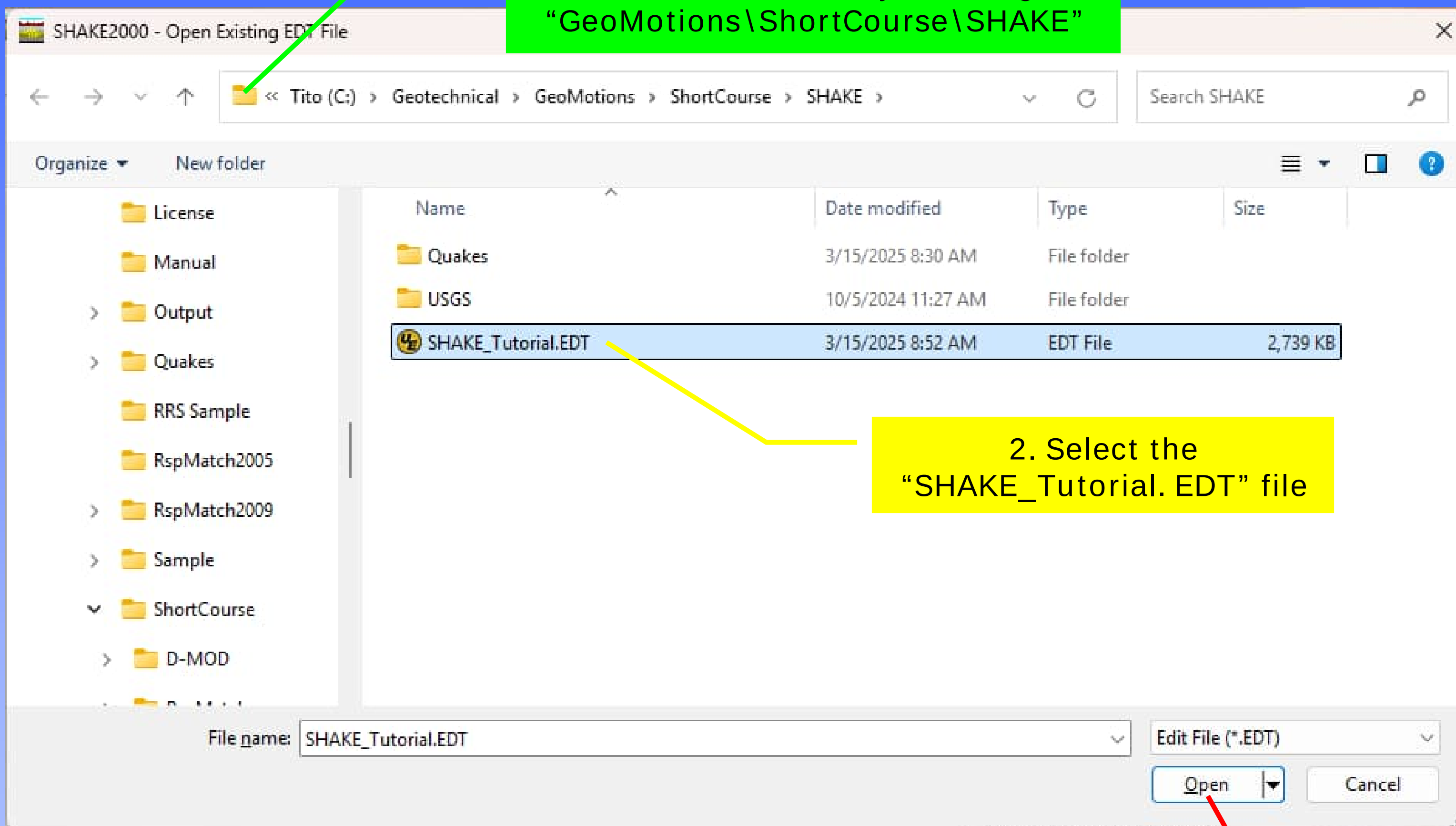
Site Specific Response Analysis

1. Click on "Open"



Open Existing SHAKE2000 EDT File

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”

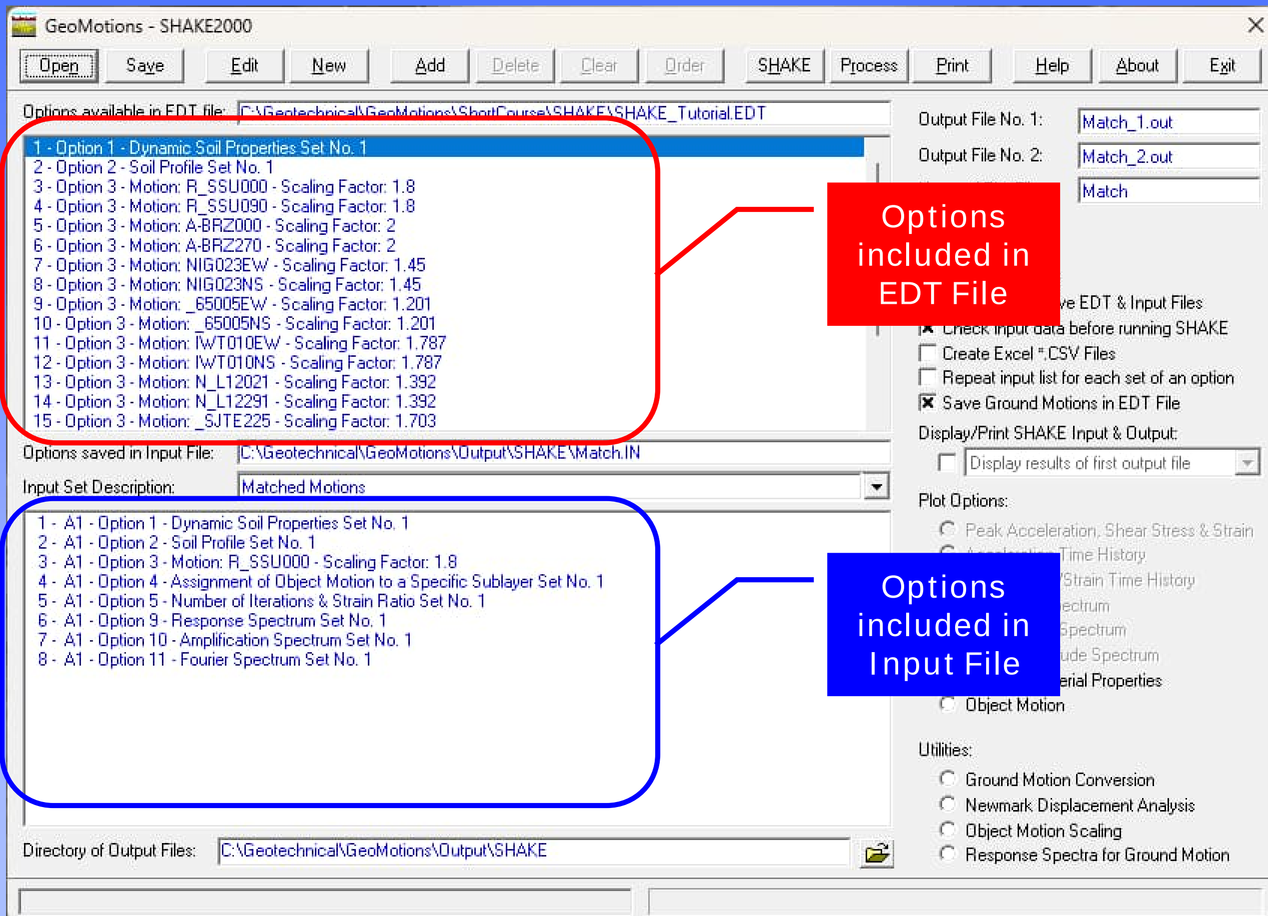


2. Select the “SHAKE_Tutorial. EDT” file

3. Click on “Open”

Site Specific Response Analysis

Create SHAKE Options



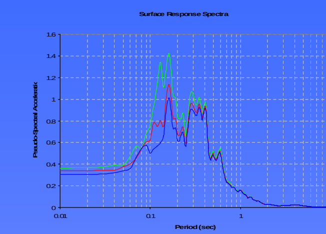
Site Specific Response Analysis

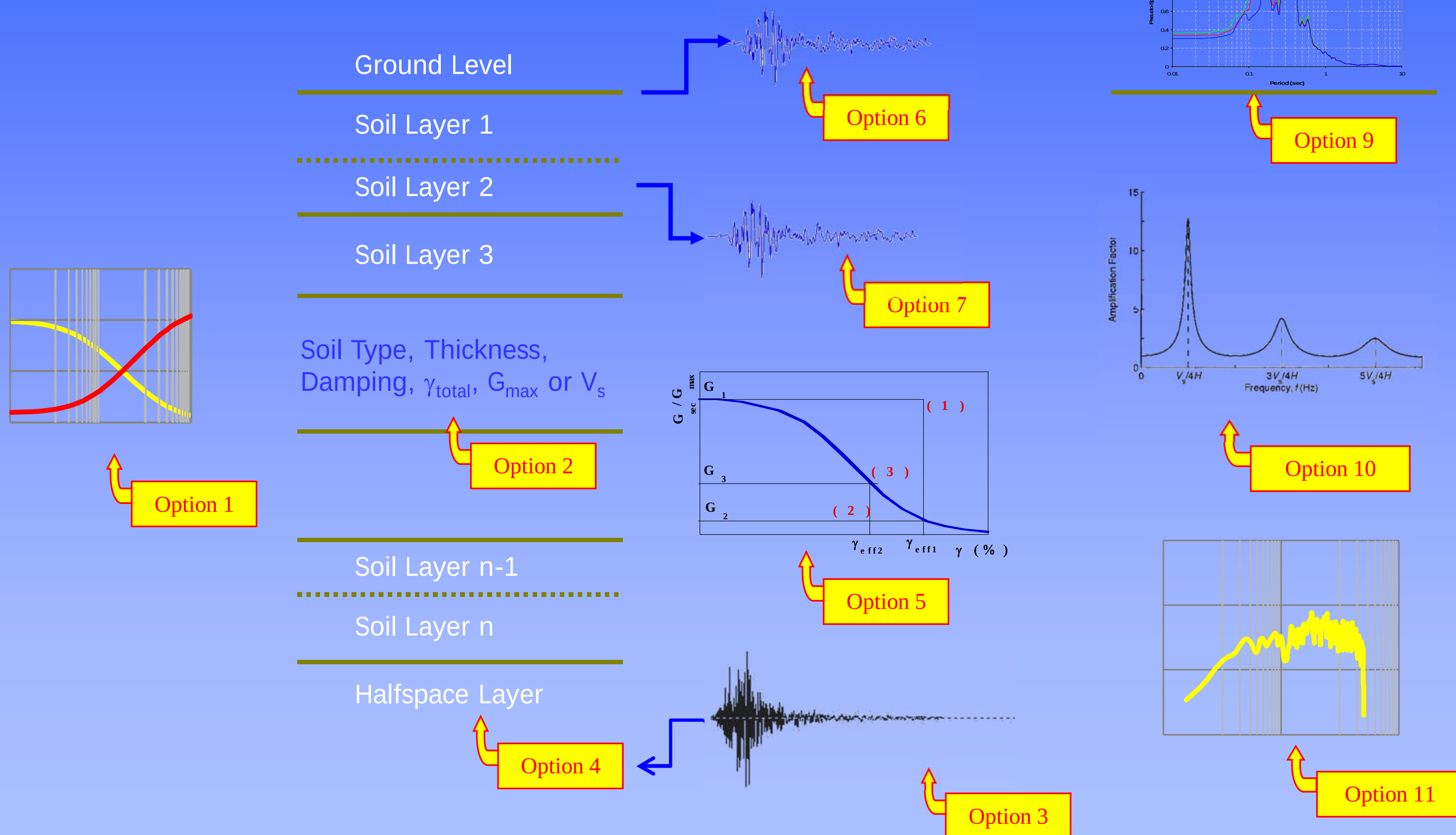
SHAKE Options

Option	Input	Analysis	Description
1	x		Dynamic Soil Properties
2	x		Soil Profile
3	x		Input (Object) Motion
4	x		Assignment of Object Motion
5	x		No. Iterations & Strain Ratio
6		x	PGA & Time Histories
7		x	Stress & Strain Time Histories
9		x	Response Spectra
10		x	Amplification Spectra
11		x	Fourier Spectra

Site Specific Response Analysis

SHAKE Column Options





EDT and Input Data Files

- An EDT file is a database file that stores the data for the different SHAKE options. These options are used by SHAKE2000 to create an input file.
- A maximum of 32,000 options can be saved in the EDT file.
- The options are saved sequentially.
- Files used in SHAKE91 can be read as EDT files.
- Listing of options used in the input file are saved in the EDT file.
- The input file stores the different options that will be executed by SHAKE.

SHAKE2000 EDT & Input Files

EDT File

Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1
Option 2 – Column No. 2
Option 3 – Input Motion: LomaPrieta.eq
Option 3 – Input Motion: ChiChi.eq
Option 4 – Column No. 1 - Layer 21
Option 4 – Column No. 2 – Layer 13
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 6 – Layers 1-13 – Column 3
Option 7 – Layer 4 – Column 1
Option 7 – Layer 3 – Column 3
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 10 – Layers 13-1 – Column 3
Option 11 – Layers 21-1 – Column 1
Option 11 – Layers 13-1 – Column 3

Input File

Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1
Option 3 – Input Motion: LomaPrieta.eq
Option 4 – Column No. 1 - Layer 21
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 7 – Layer 4 – Column 1
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 11 – Layers 21-1 – Column 1

GeoMotions

SHAKE2000 EDT & Input Files

EDT File

Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1
Option 2 – Column No. 2
Option 3 – Input Motion: LomaPrieta.eq
Option 3 – Input Motion: ChiChi.eq
Option 4 – Column No. 1 - Layer 21
Option 4 – Column No. 2 – Layer 13
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 6 – Layers 1-13 – Column 3
Option 7 – Layer 4 – Colu
Option 7 – Layer 3 – Column 3
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 10 – Layers 13-1 – Column 3
Option 11 – Layers 21-1 – Column 1
Option 11 – Layers 13-1 – Column 3

Input File

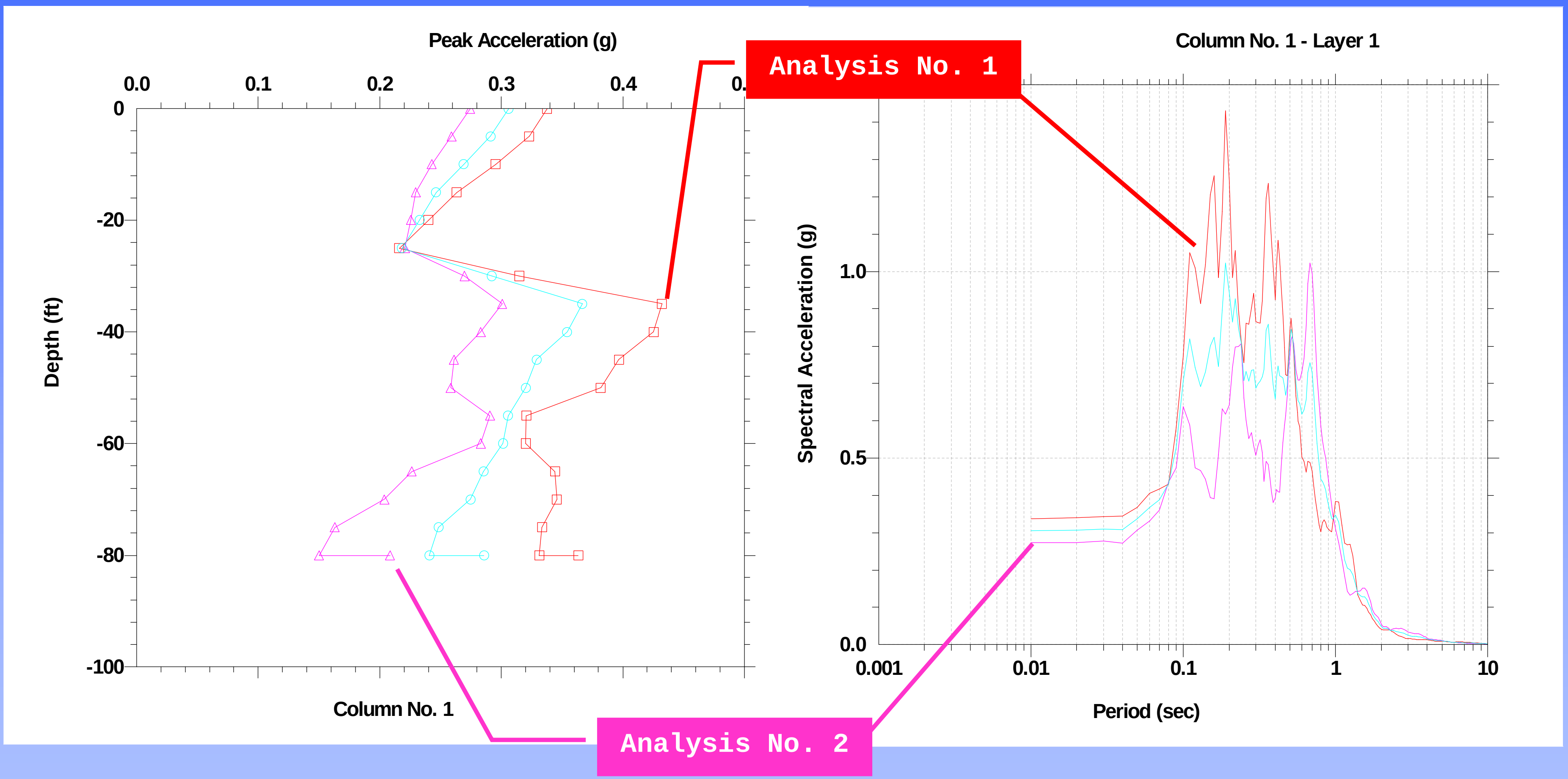
Analysis No. 1

Option 1 – G/Gmax & Damping vs. Strain
Option 2 – Column No. 1
Option 3 – Input Motion: LomaPrieta.eq
Option 4 – Column No. 1 - Layer 21
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 7 – Layer 4 – Column 1
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 11 – Layers 21-1 – Column 1

Analysis No. 2

Option 2 – Column No. 1
Option 3 – Input Motion: ChiChi.eq
Option 4 – Column No. 1 - Layer 21
Option 5 – Iterations: 10 – Ratio: 0.65
Option 6 – Layers 1-15 – Column 1
Option 6 – Layers 16-21 – Column 1
Option 7 – Layer 4 – Column 1
Option 9 – Surface – 5% Damping
Option 10 – Layers 21-1 – Column 1
Option 11 – Layers 21-1 – Column 1

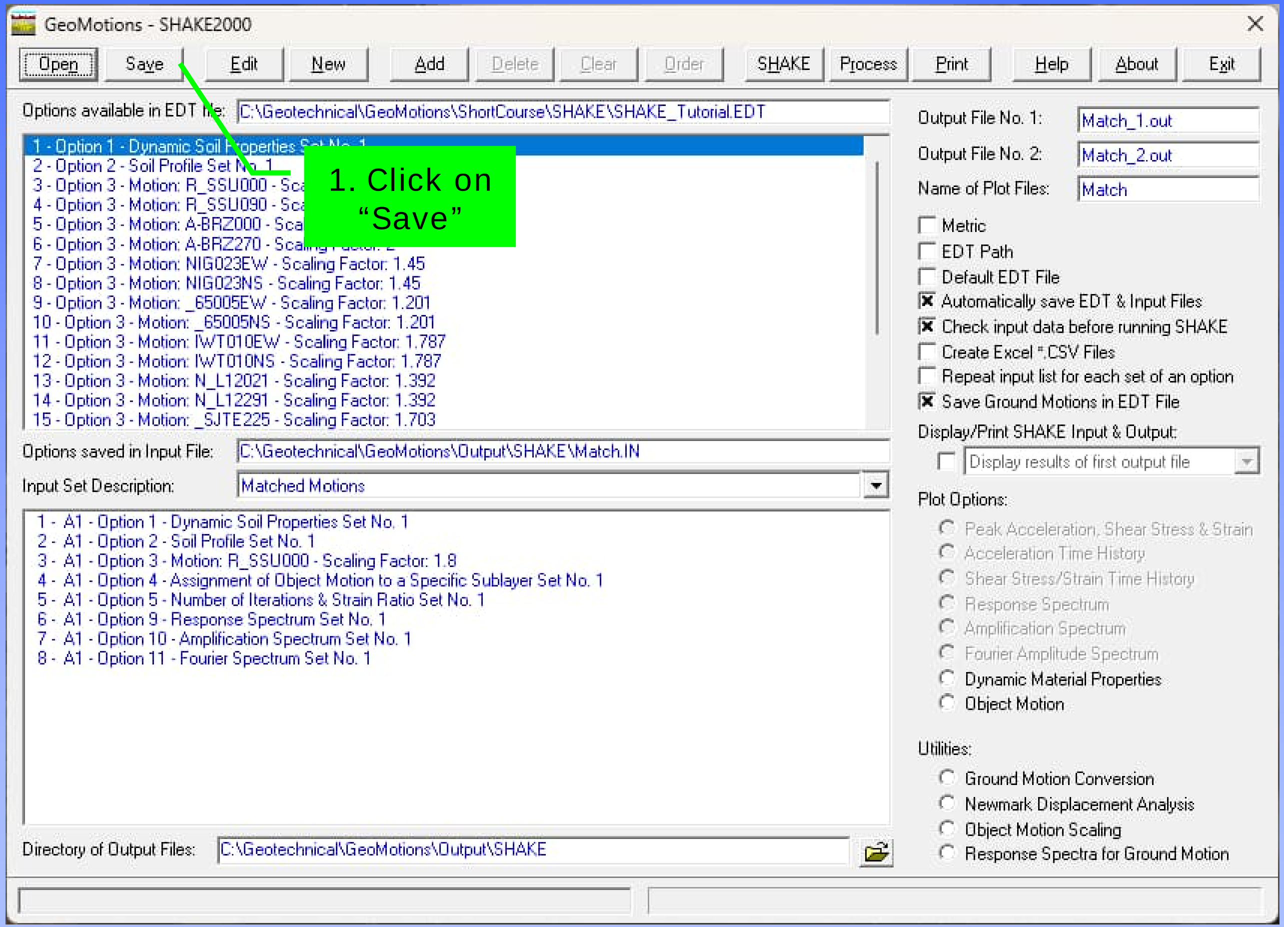
SHAKE Analyses



GeoMotions

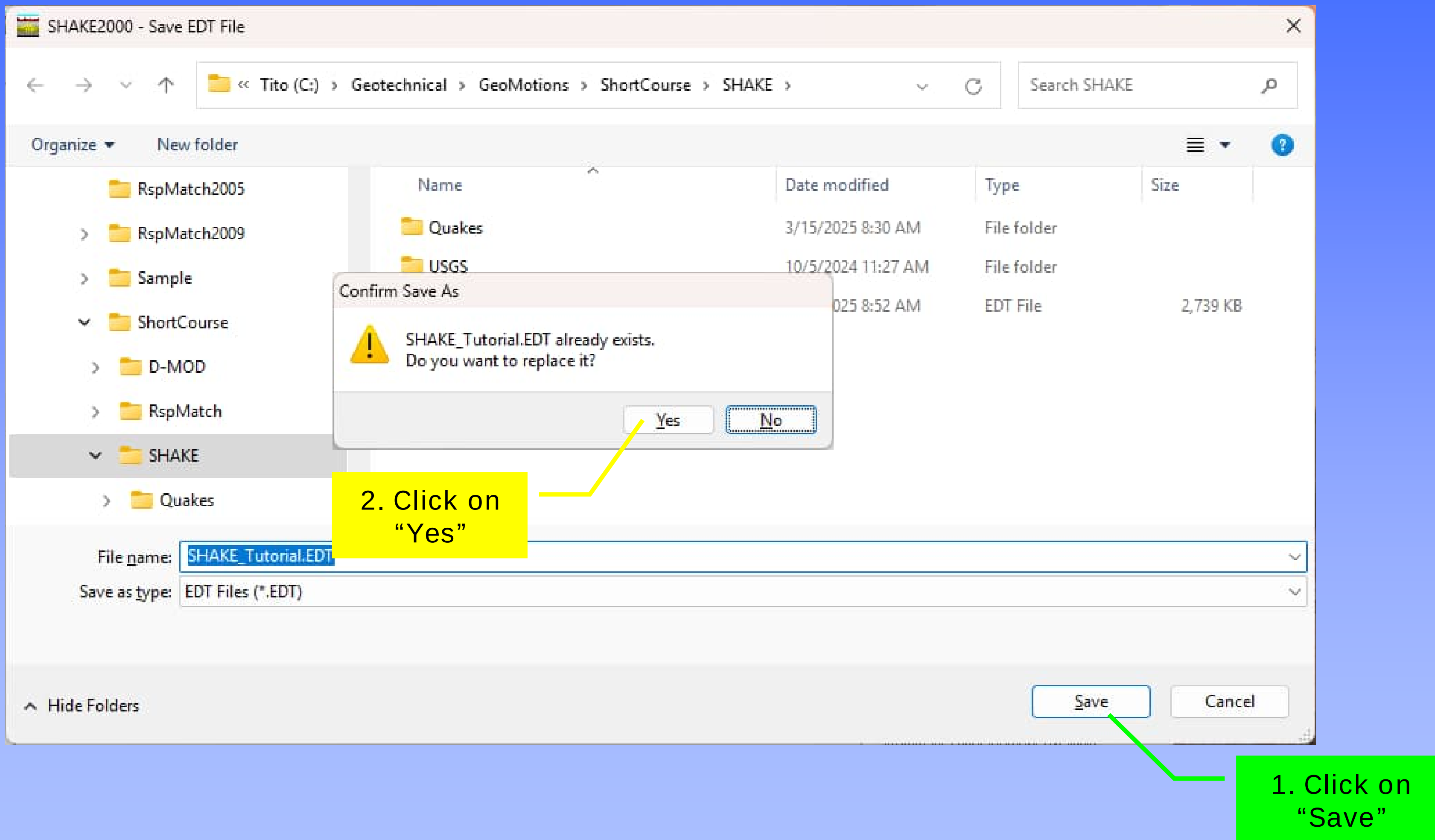
Site Specific Response Analysis

Create Input File



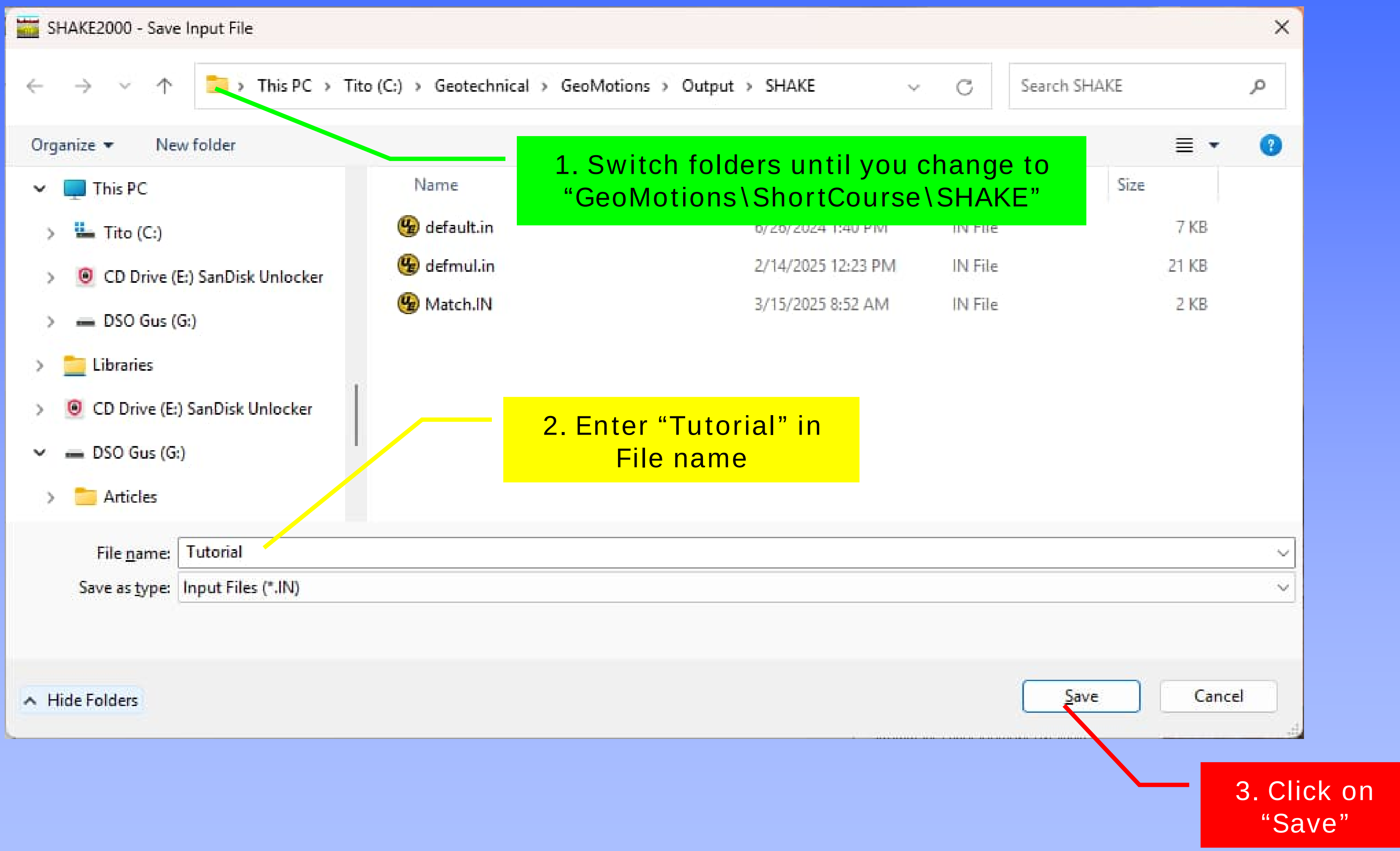
Site Specific Response Analysis

Save EDT File



Site Specific Response Analysis

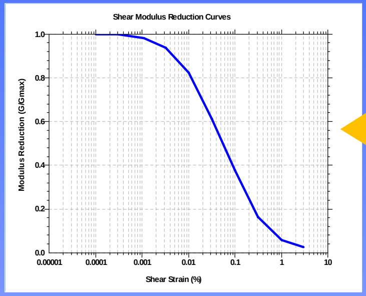
Create Input File



Site Specific Response Analysis

SHAKE Column Option 1 – G/Gmax & Damping vs. Strain

Soil Type 1, e.g., SAND



Ground Level

Layer No. 1

Layer No. 2

Layer No. 3

Soil Stratum j

Layer No. i

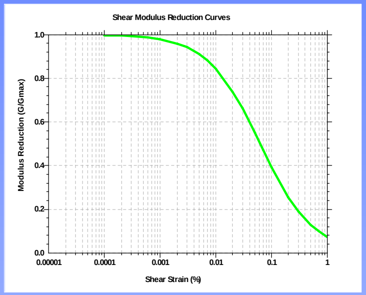
Layer No. i+1

Soil Stratum n

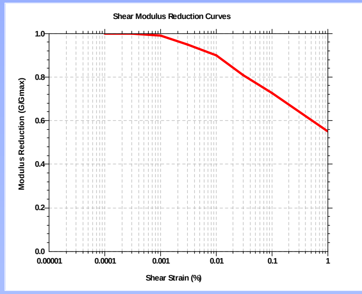
Layer n+1: Halfspace Layer

Option 1 assigns a soil type and corresponding dynamic material properties to each Soil Stratum

Soil Type j, e.g., CLAY



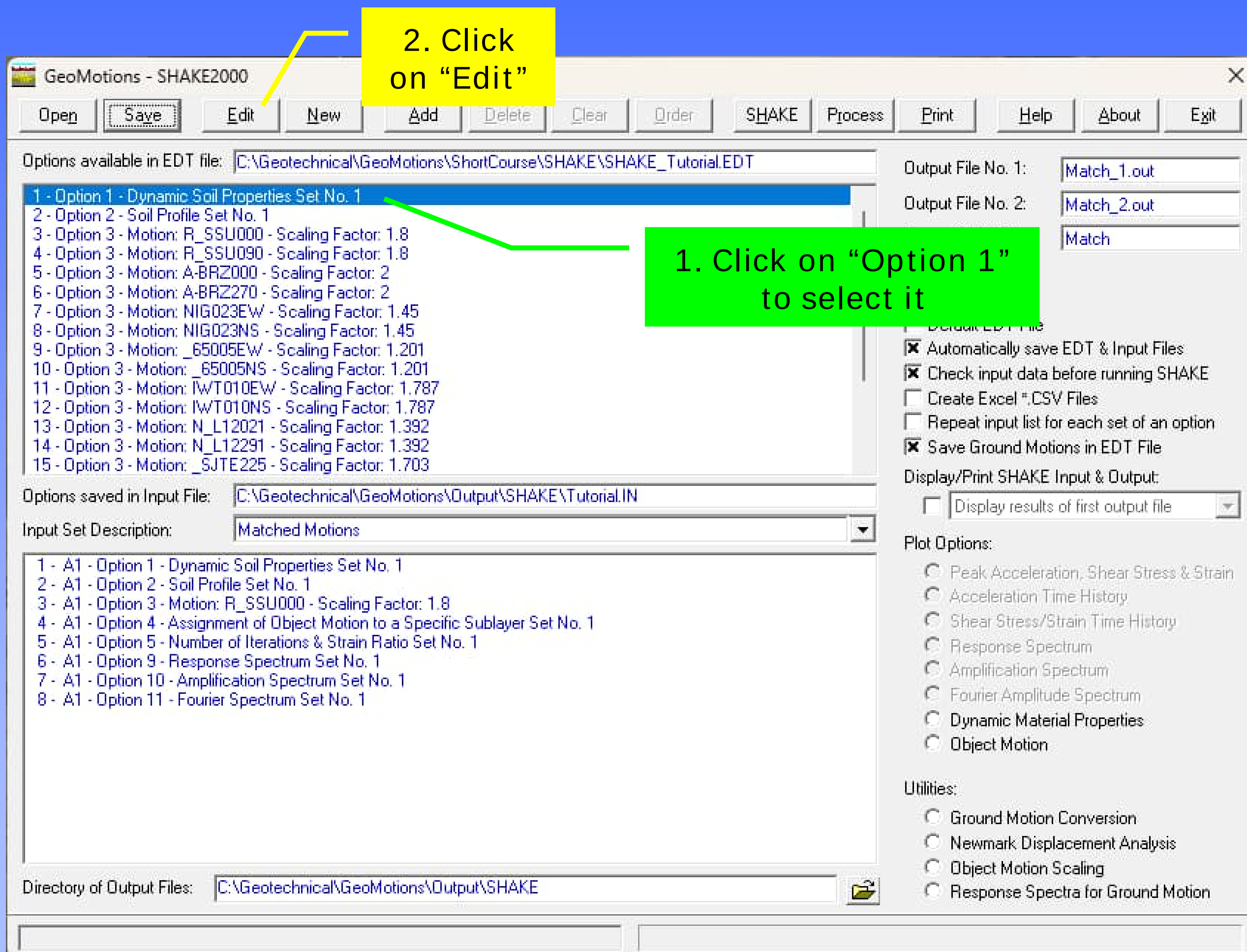
Soil Type n+1: Halfspace



GeoMotions

Site Specific Response Analysis

Edit SHAKE Options – Option 1

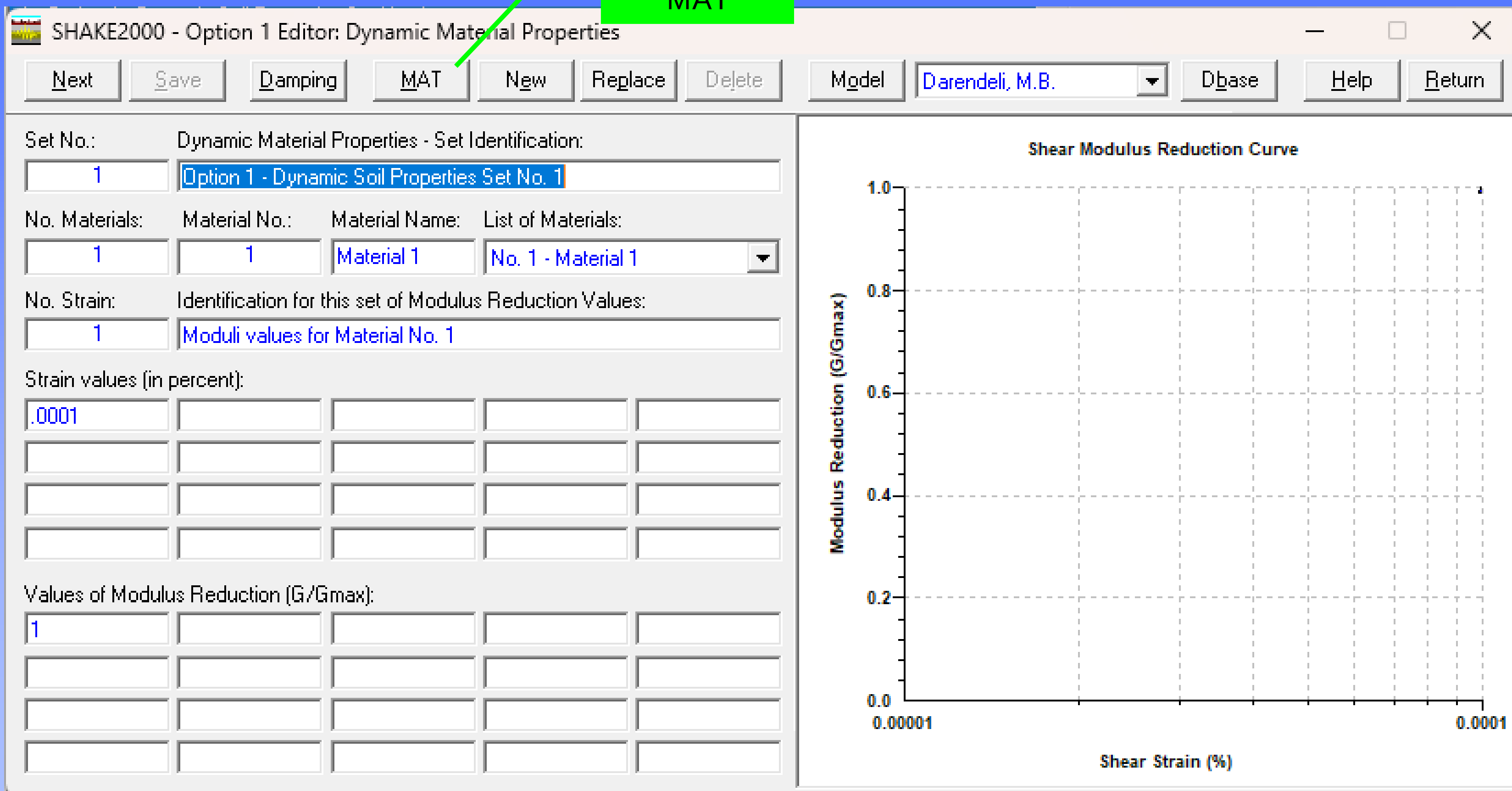


GeoMotions

Site Specific Response Analysis

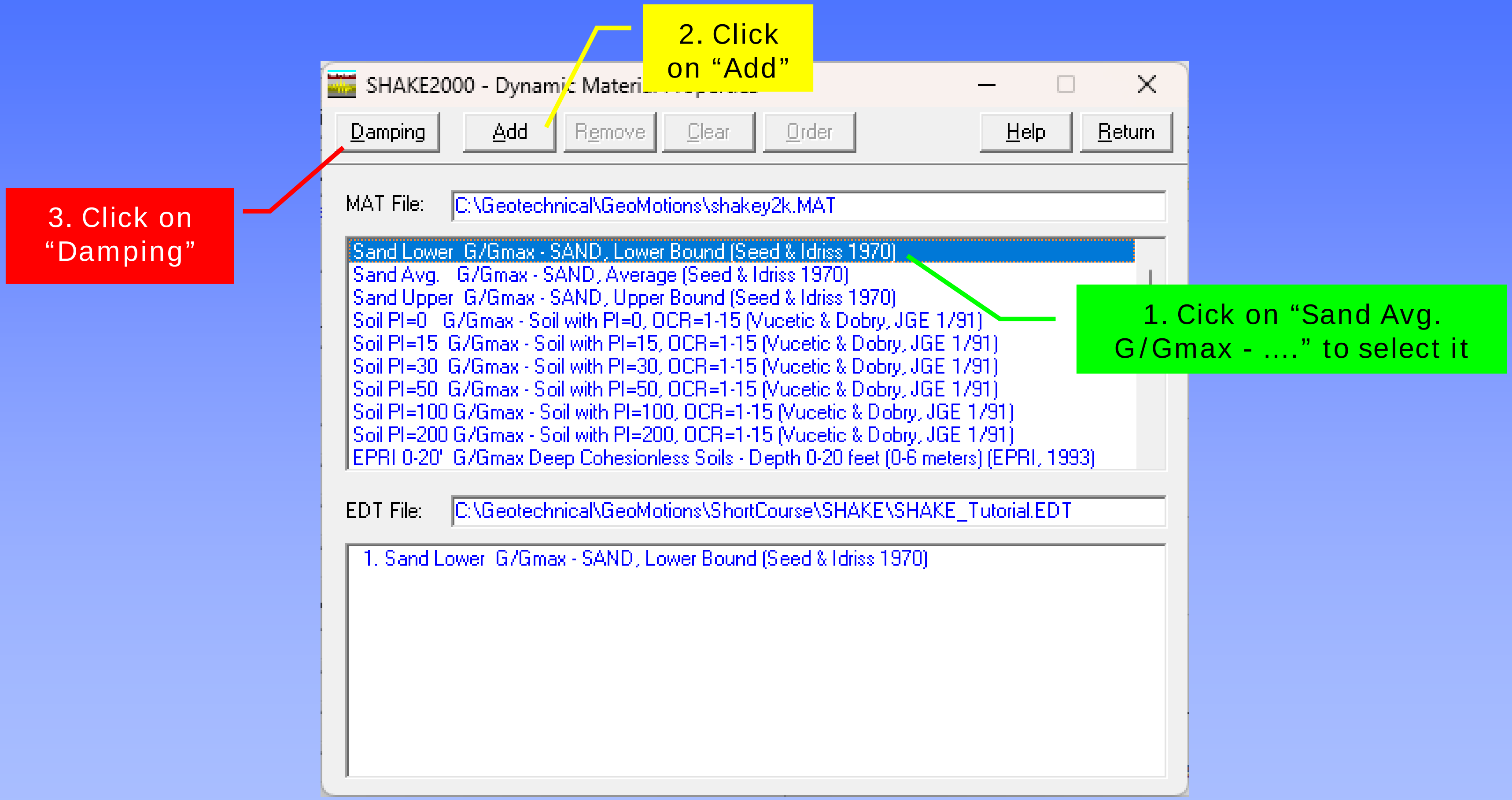
Create Input Data - Option 1: Dynamic Material Properties

1. Click on “MAT”



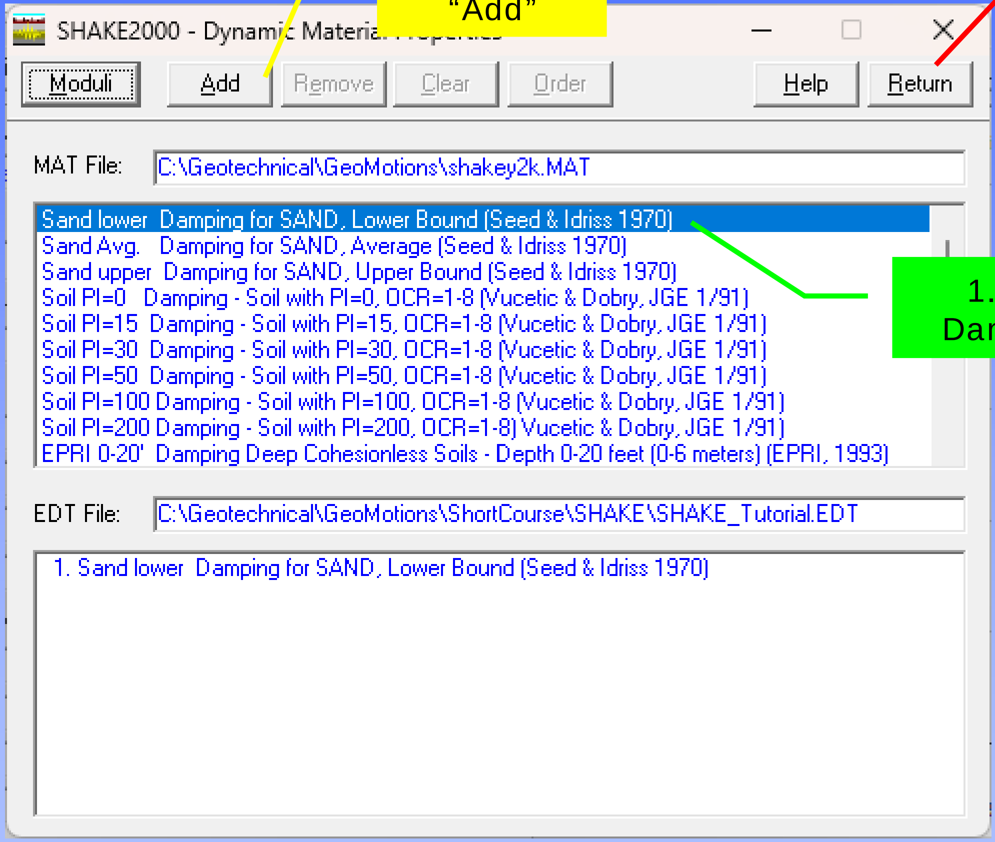
Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties



Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties



2. Click on "Add"

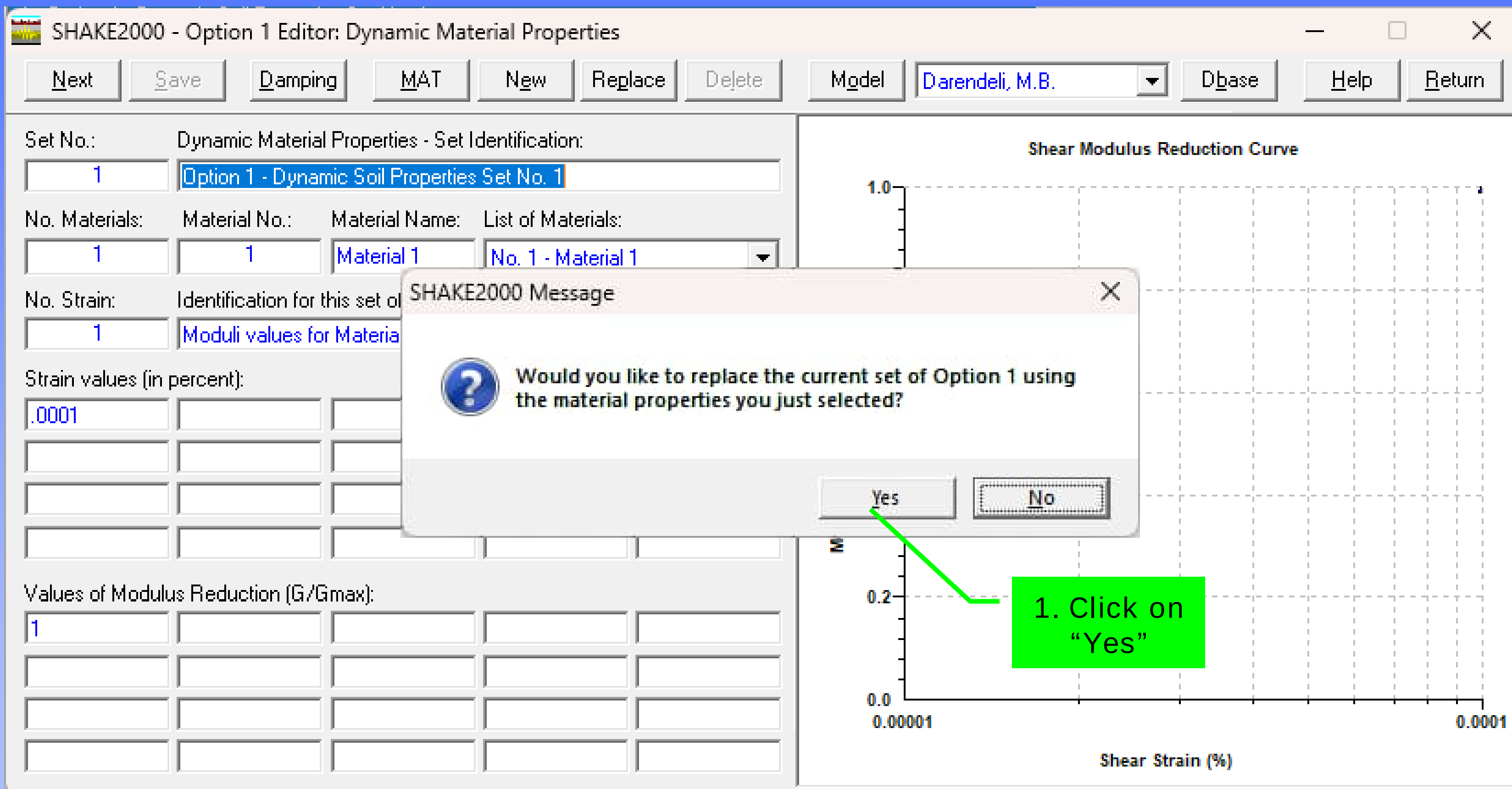
3. Click on "Return"

1. Click on "Sand Avg. Damping ...." to select it

GeoMotions

Site Specific Response Analysis

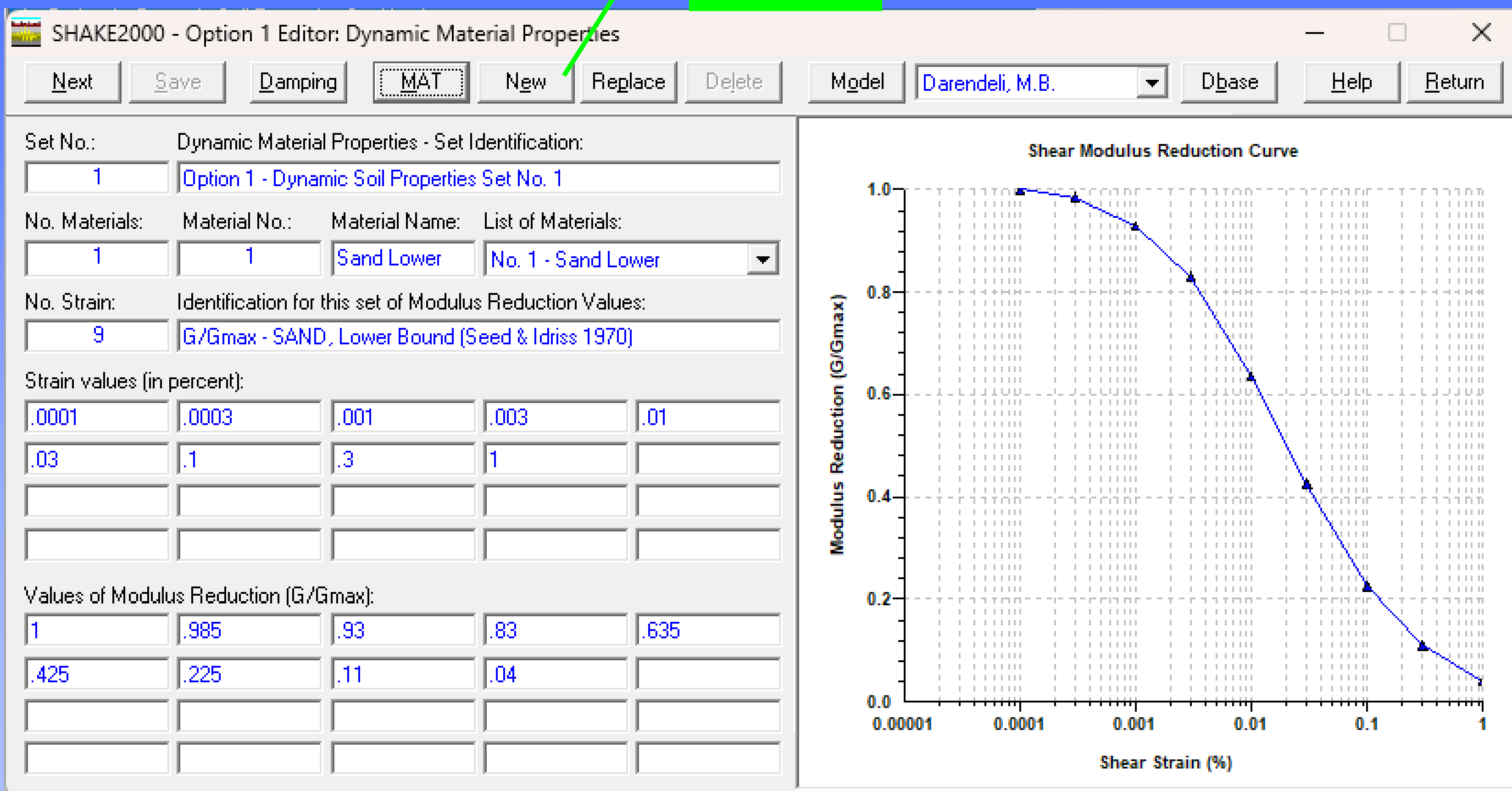
Create Input Data - Option 1: Dynamic Material Properties



Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

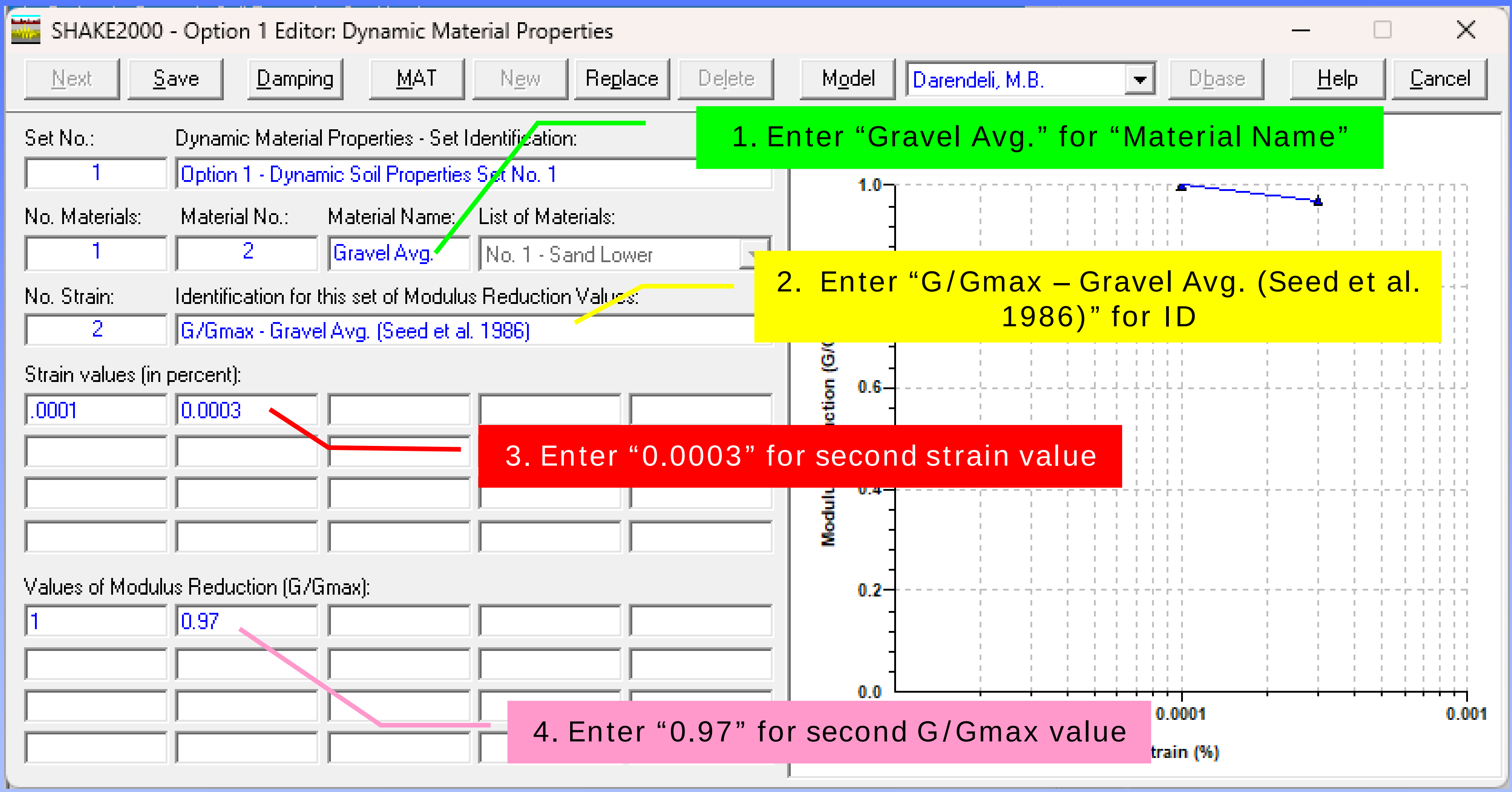
1. Click on "New"



GeoMotions

Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties



GeoMotions

Site Specific Response Analysis

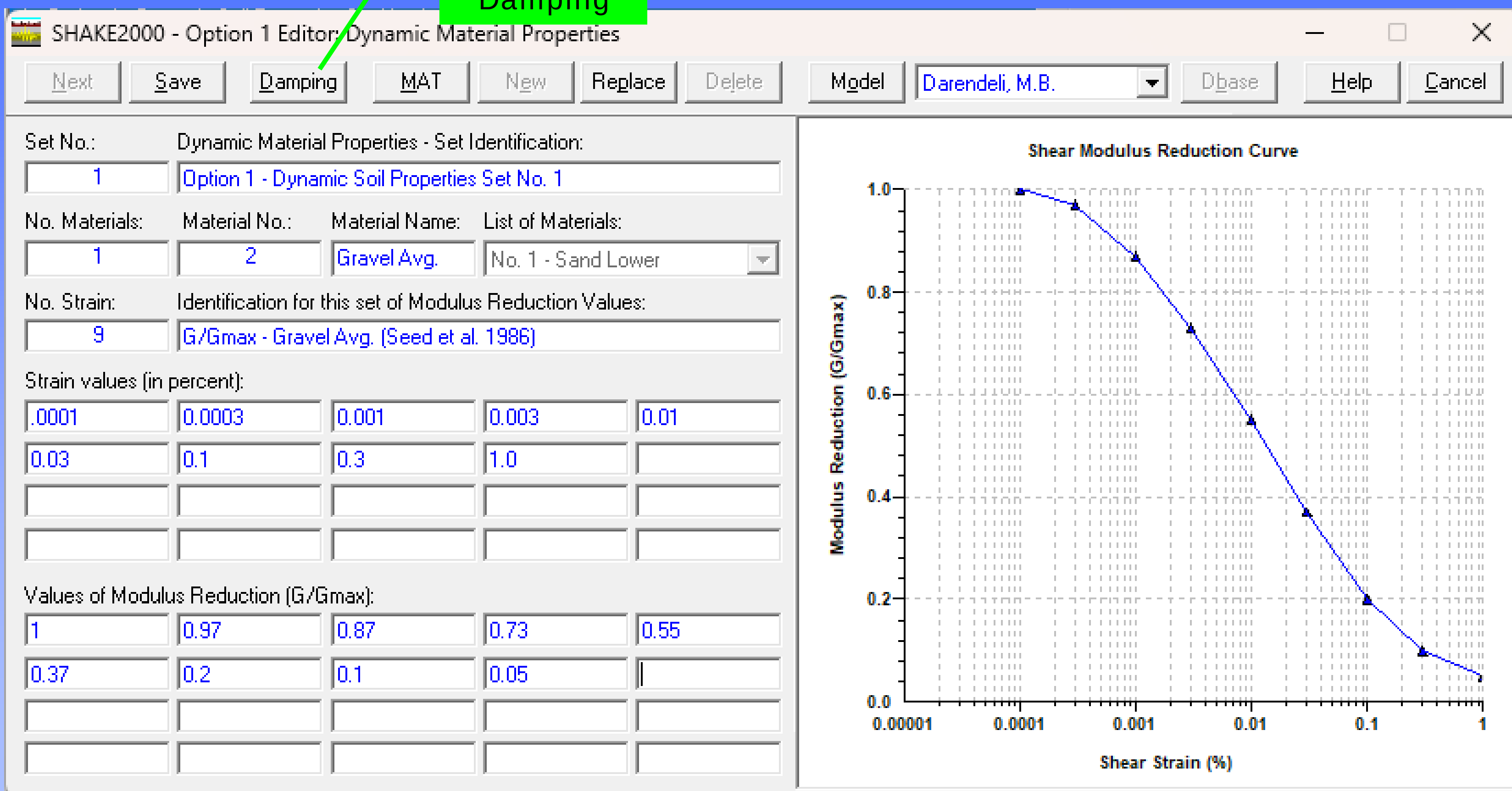
Enter the other Strain vs G/Gmax values

Strain (%)	G/Gmax
0.001	0.87
0.003	0.73
0.01	0.55
0.03	0.37
0.1	0.20
0.3	0.1
1.0	0.05

Site Specific Response Analysis

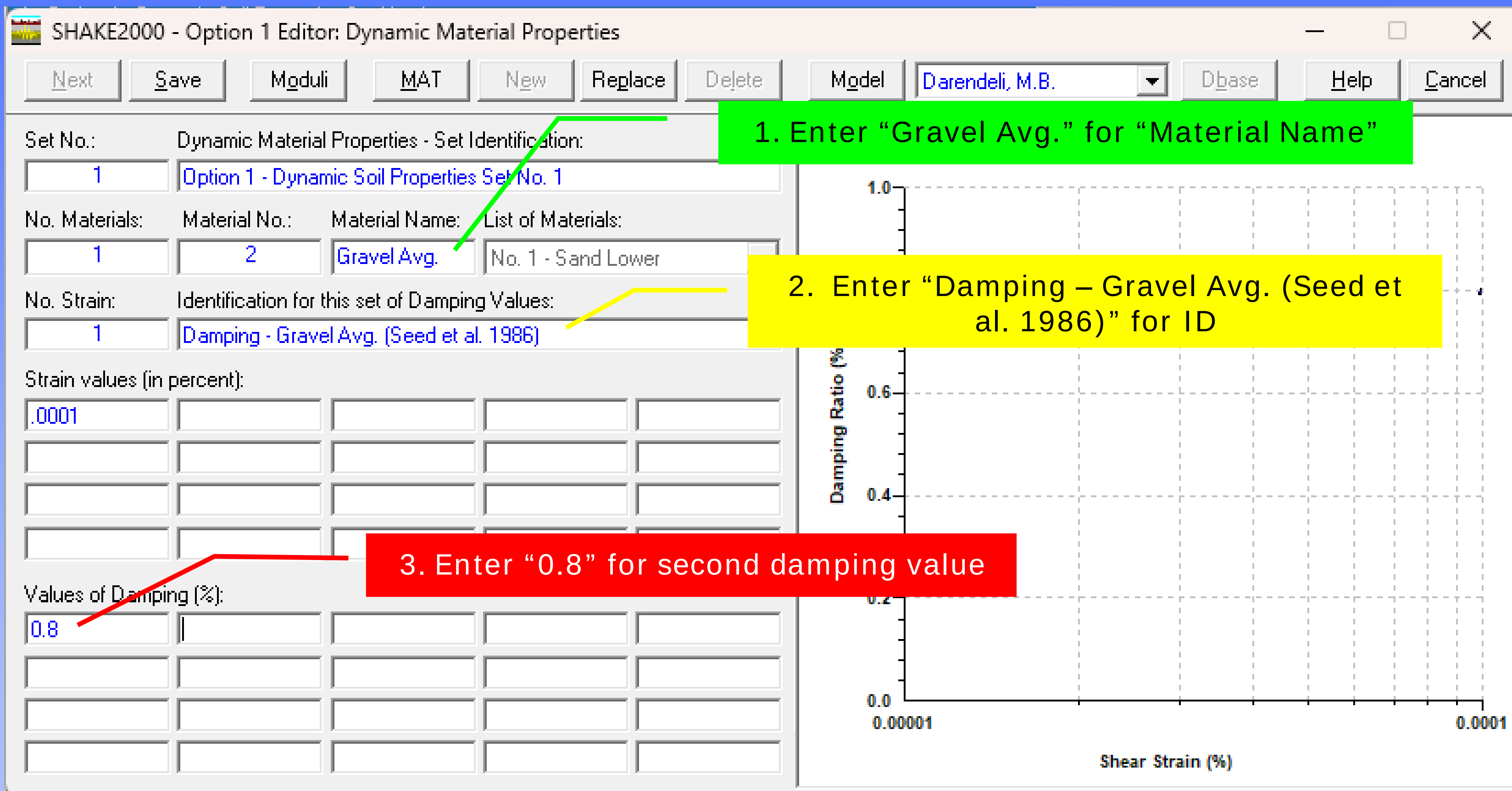
Create Input Data - Option 1: Dynamic Material Properties

1. Click on “Damping”



Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties



GeoMotions

Site Specific Response Analysis

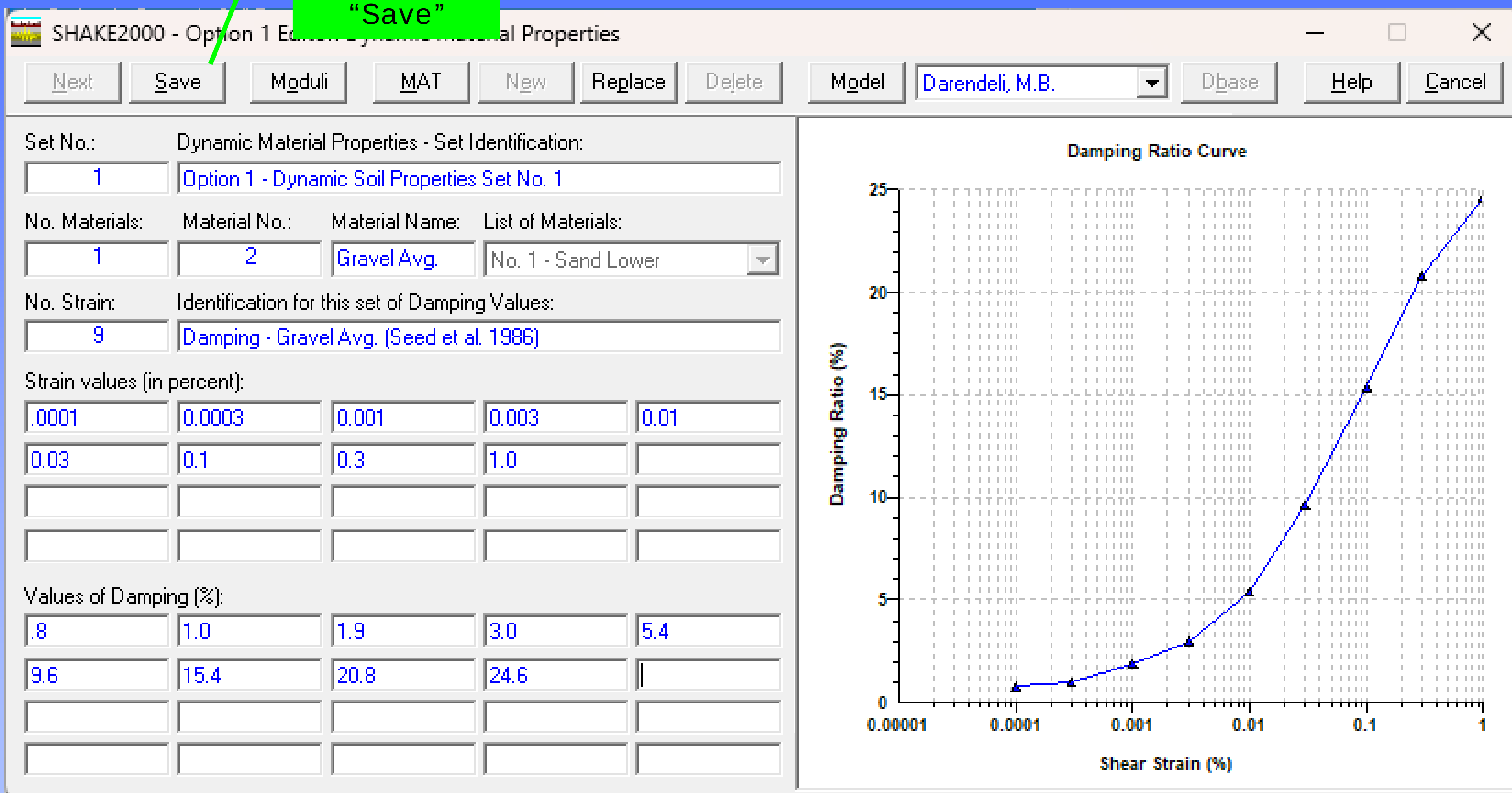
Enter the other Strain vs Damping values

Strain (%)	Damping (%)
0.0003	1.0
0.001	1.9
0.003	3.0
0.01	5.4
0.03	9.6
0.1	15.4
0.3	20.8
1.0	24.6

Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

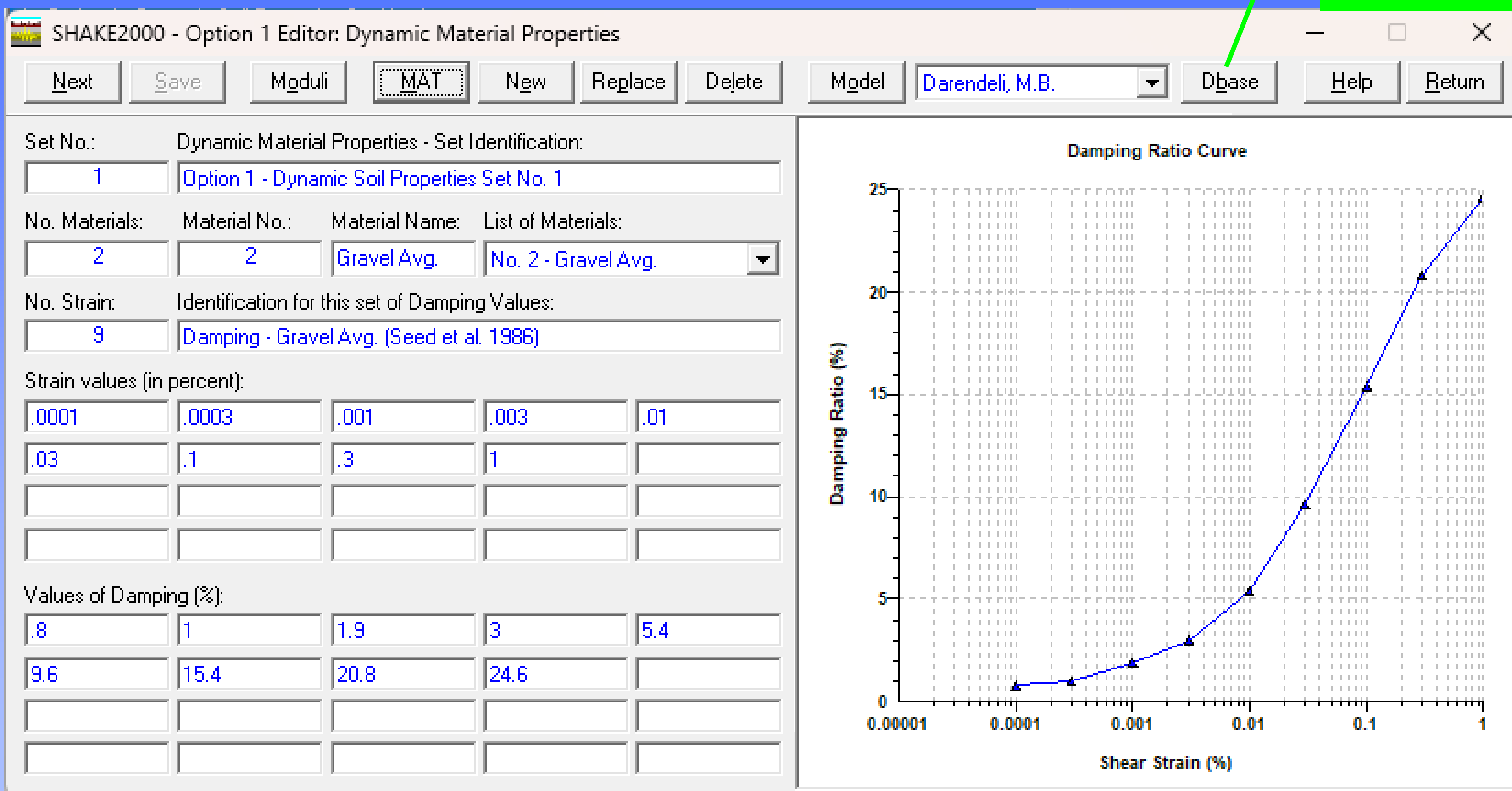
1. Click on “Save”



Site Specific Response Analysis

Save new material in Database of materials file

1. Click on “Dbase”

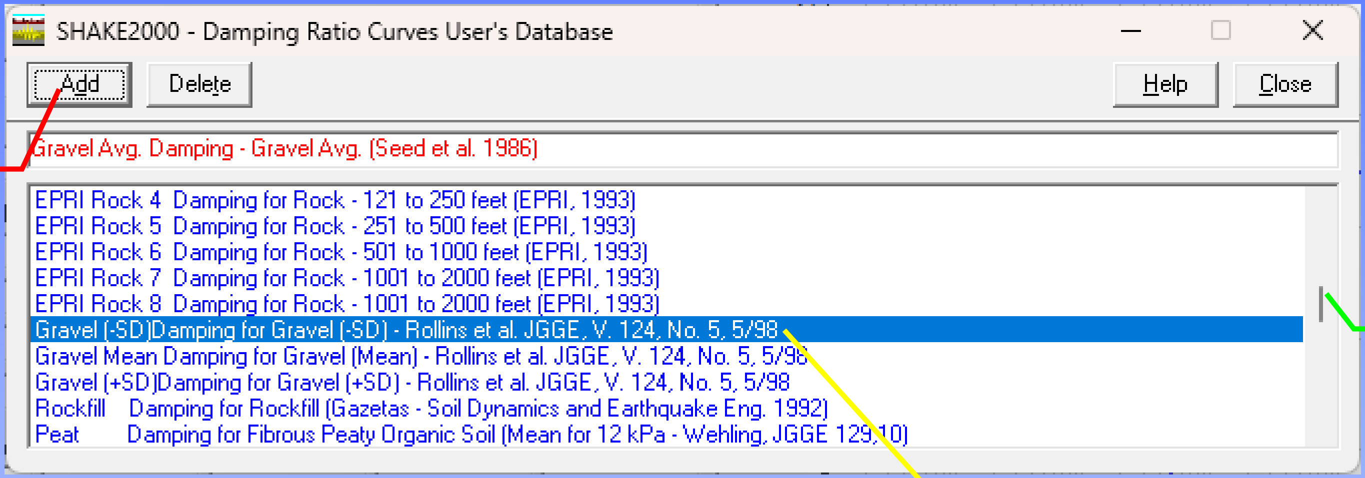


GeoMotions

Site Specific Response Analysis

Save new material in Database of materials file

3. Click on "Add"



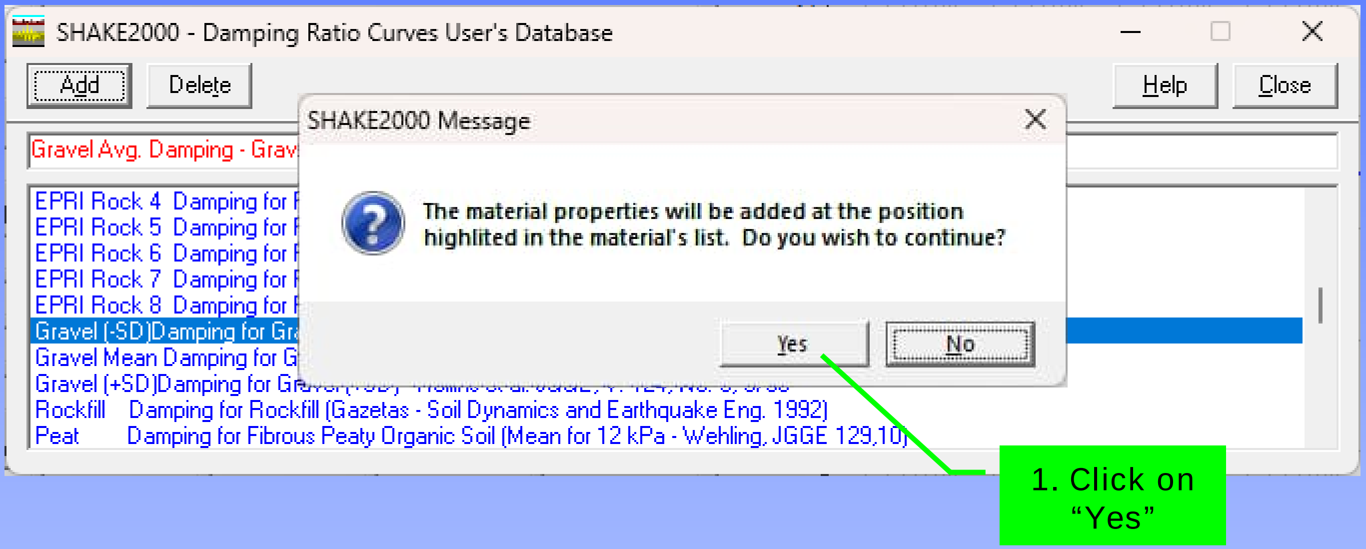
1. Scroll down

2. Select "Gravel (-SD)Damping ..."

GeoMotions

Site Specific Response Analysis

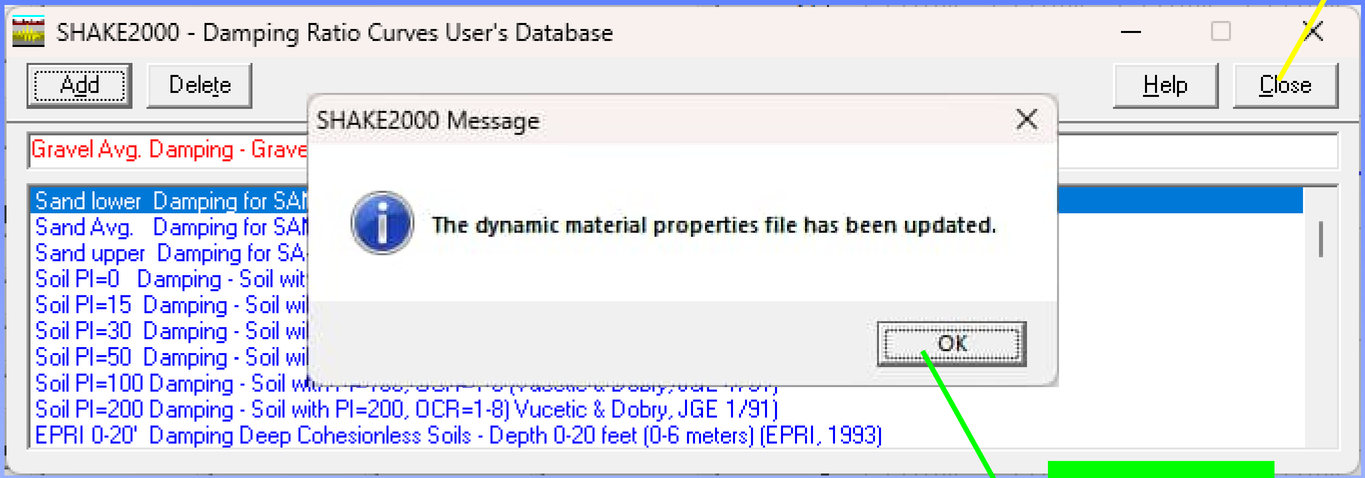
Save new material in Database of materials file



Site Specific Response Analysis

Save new material in Database of materials file

2. Click on "Close"

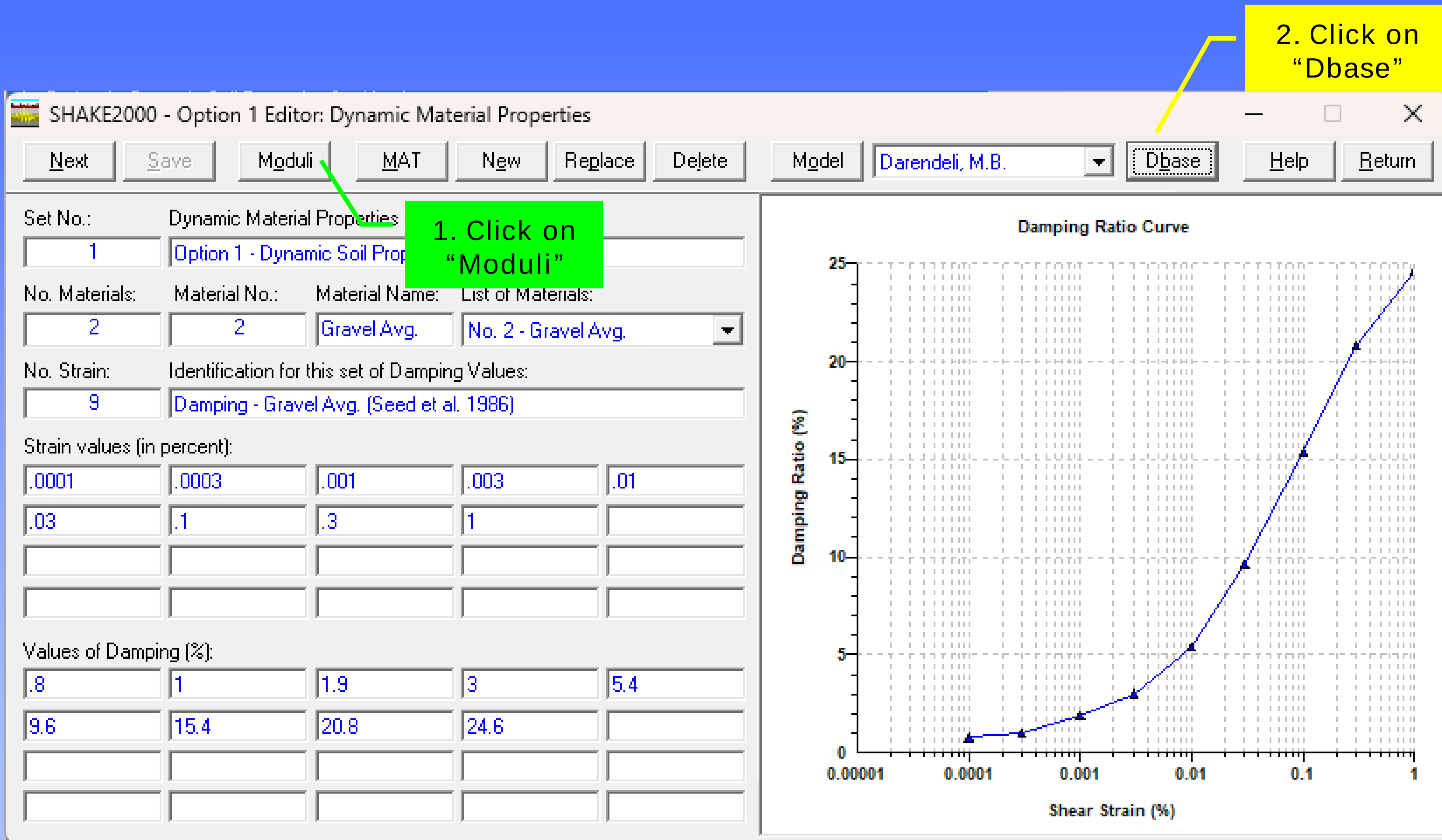


1. Click on "Ok"

GeoMotions

Site Specific Response Analysis

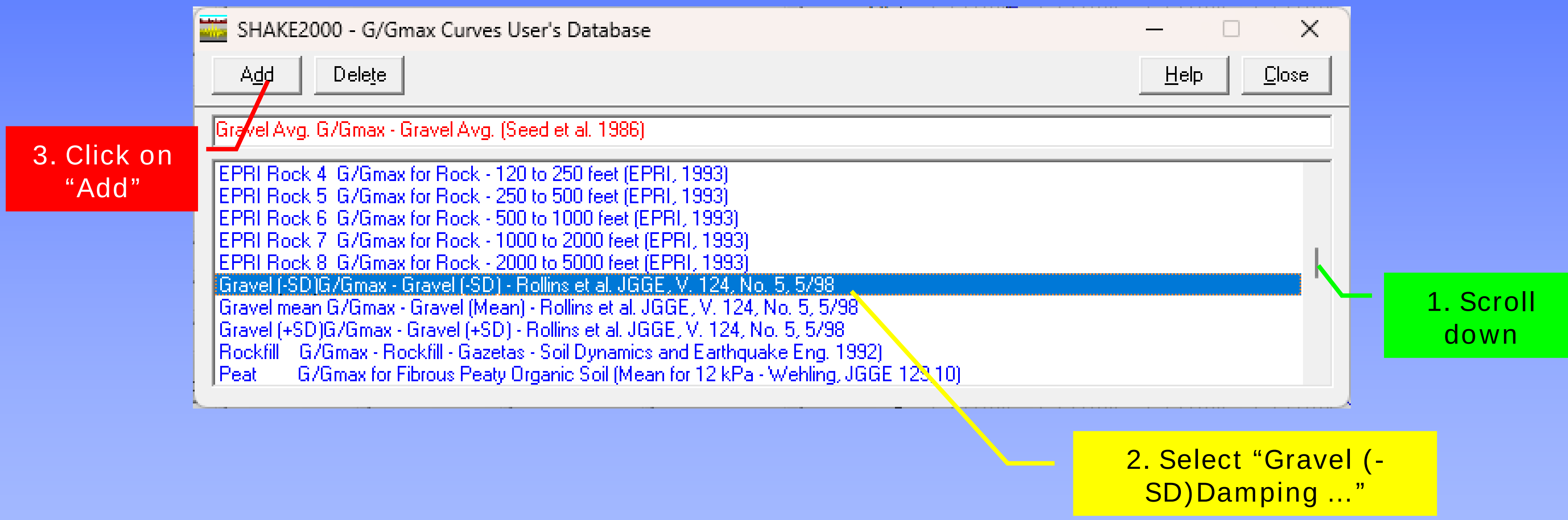
Save new material in Database of materials file



GeoMotions

Site Specific Response Analysis

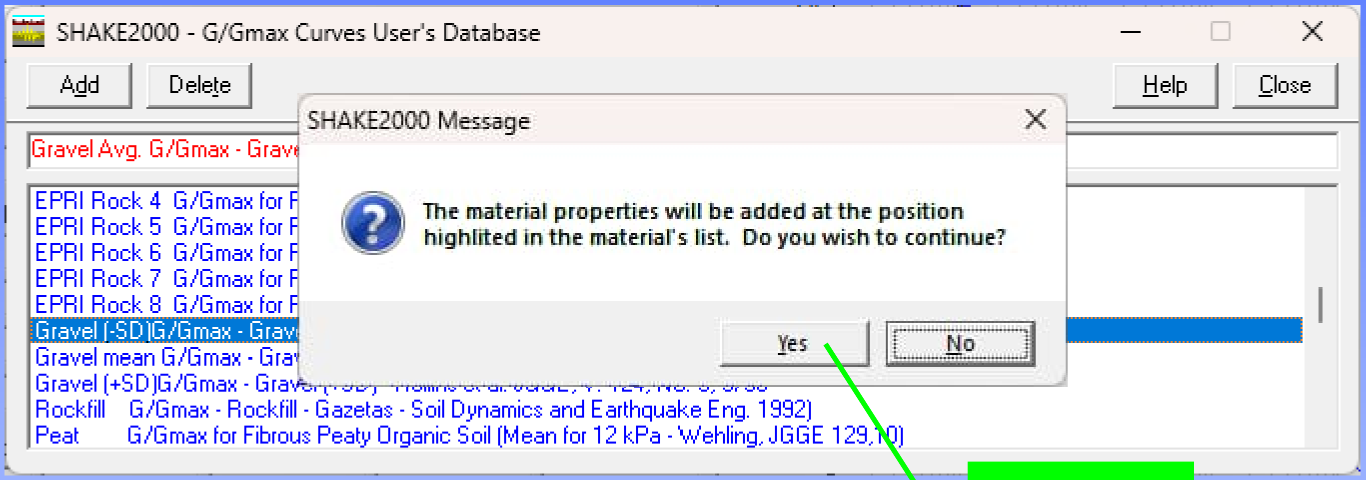
Save new material in Database of materials file



GeoMotions

Site Specific Response Analysis

Save new material in Database of materials file

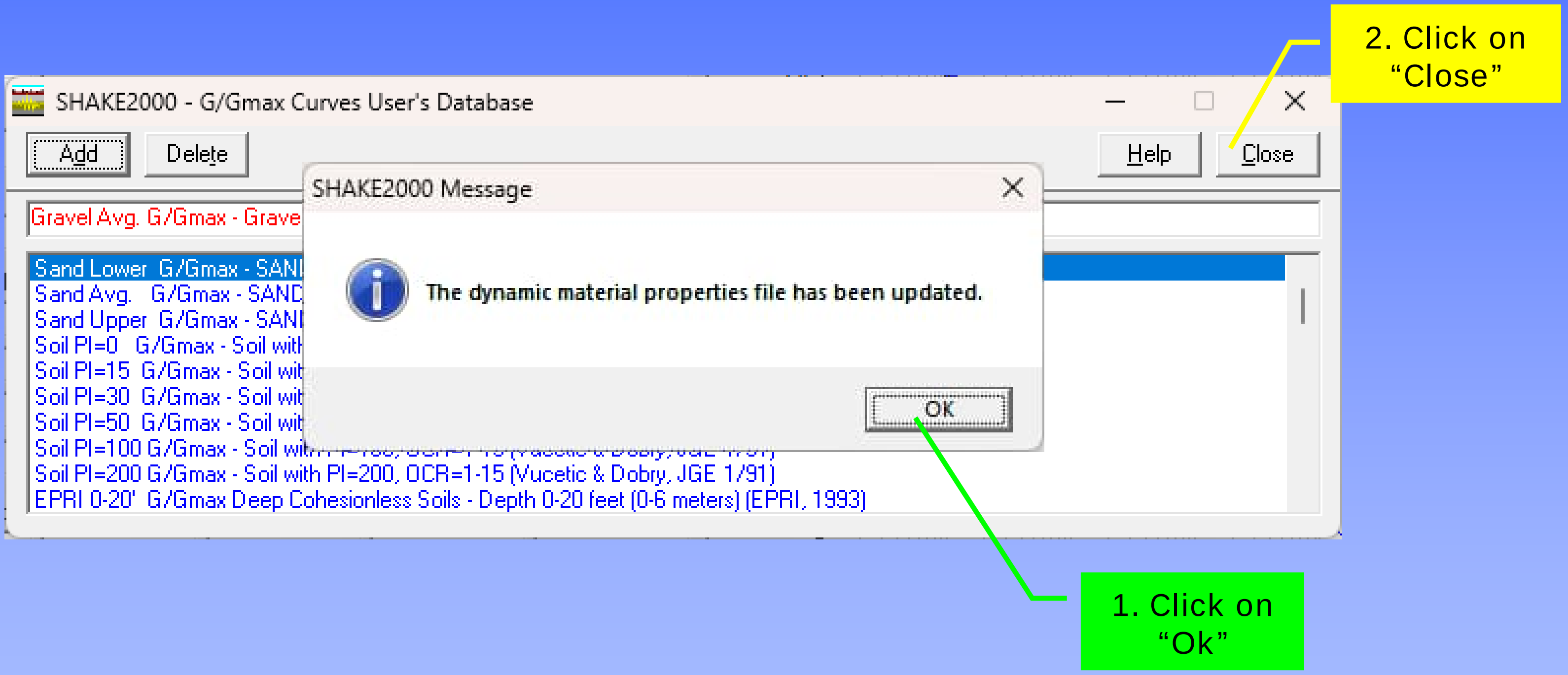


1. Click on "Yes"

GeoMotions

Site Specific Response Analysis

Save new material in Database of materials file

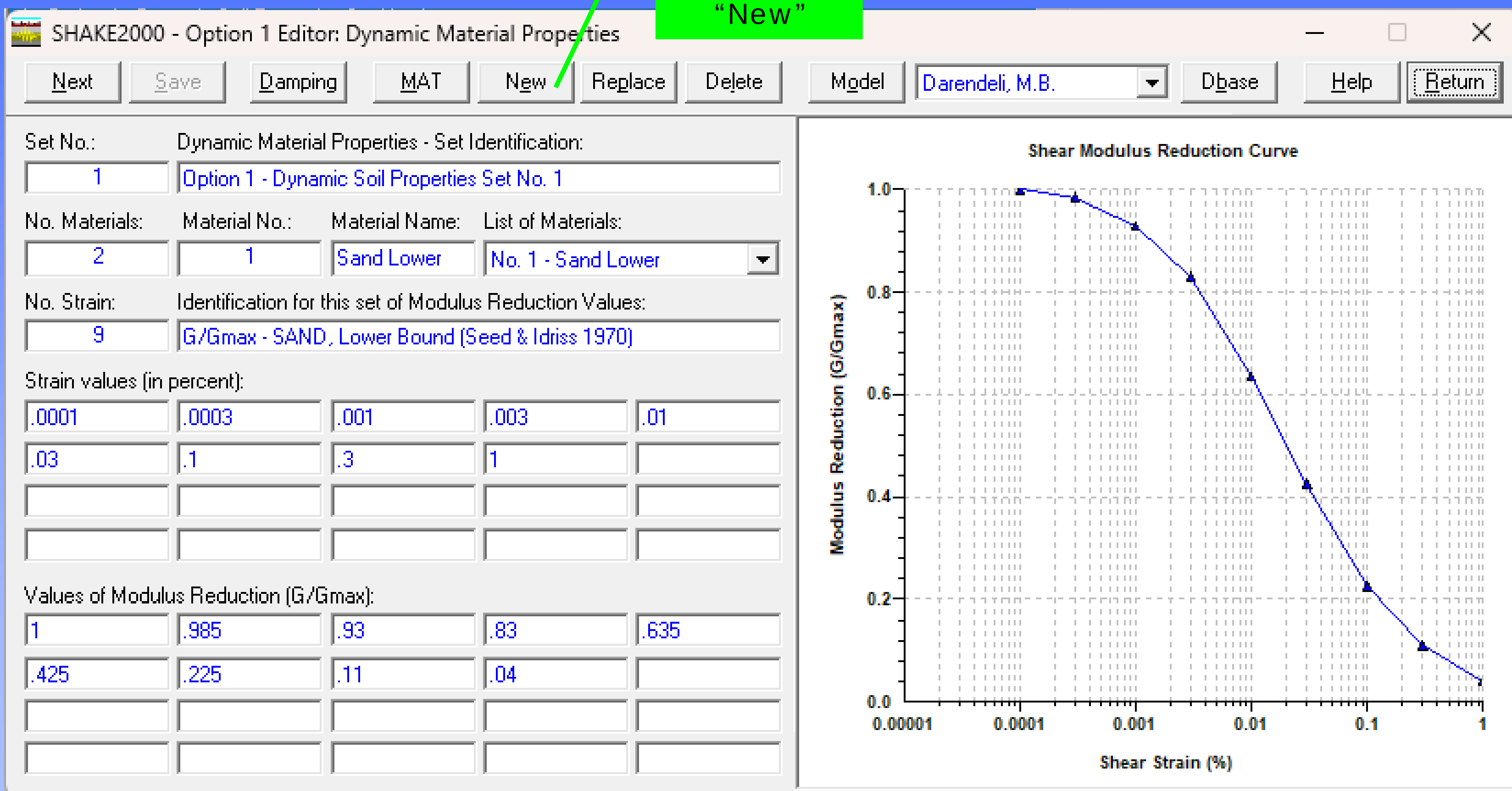


GeoMotions

Site Specific Response Analysis

Use Model to generate curves

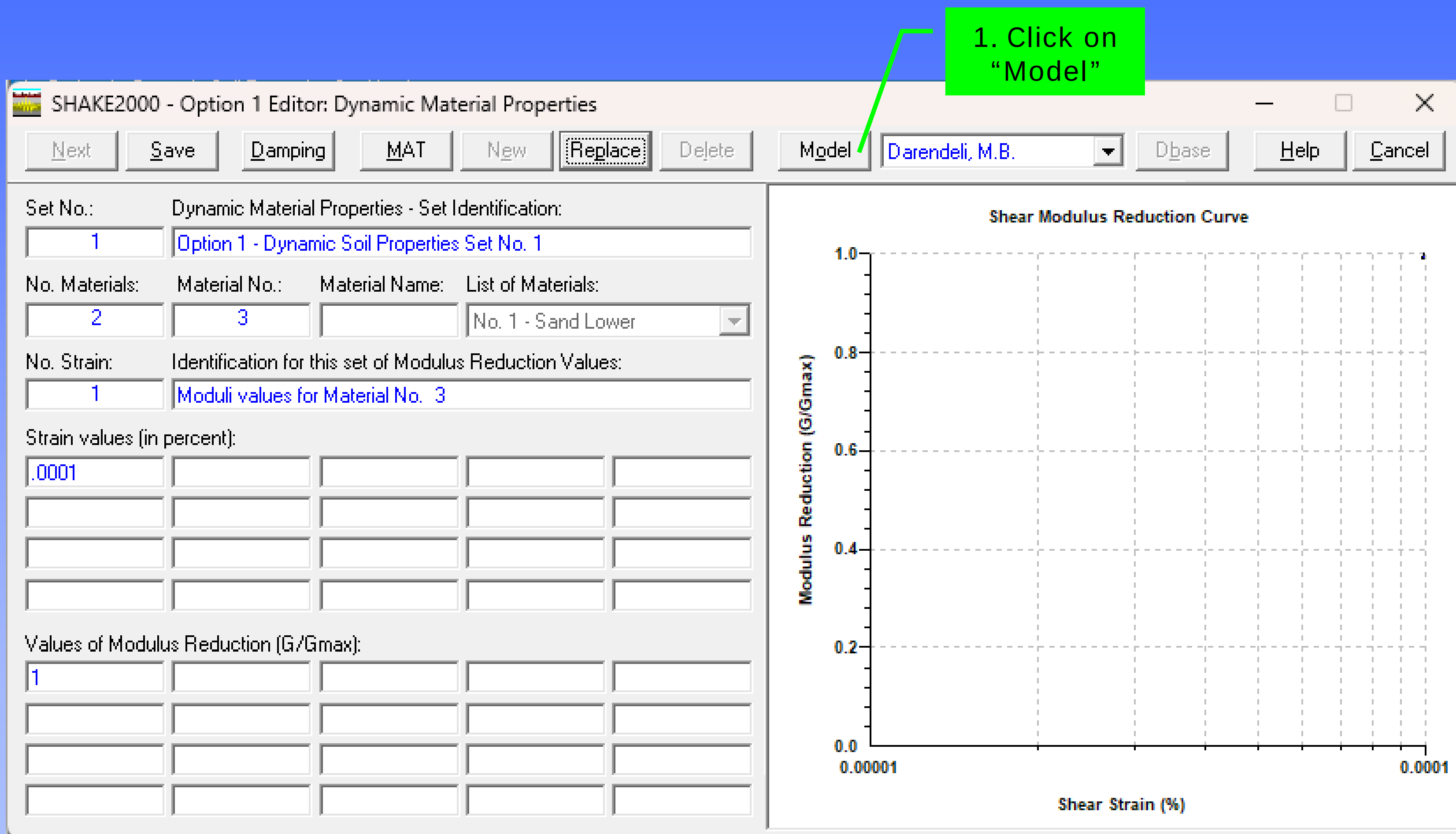
1. Click on “New”



GeoMotions

Site Specific Response Analysis

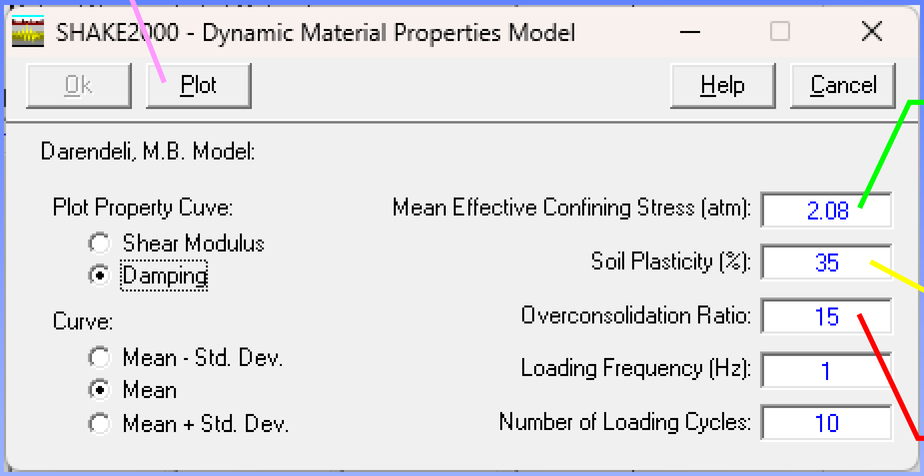
Use Model to generate curves



Site Specific Response Analysis

Use Model to generate curves

4. Click on "Plot"

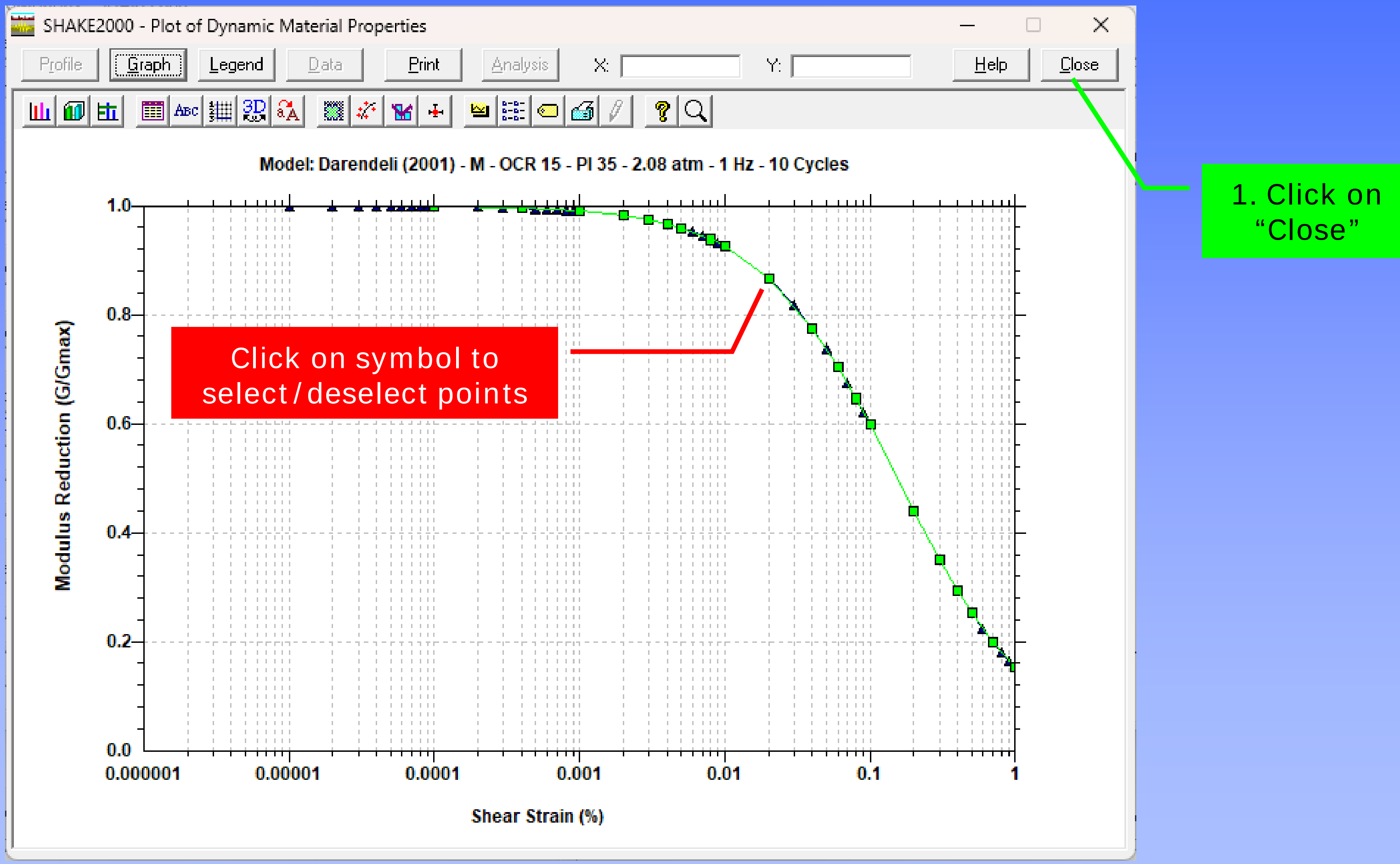


1. Enter "2.08" for $\boldsymbol{\sigma}'_o$

2. Enter "35" for PI

3. Enter "15" for OCR

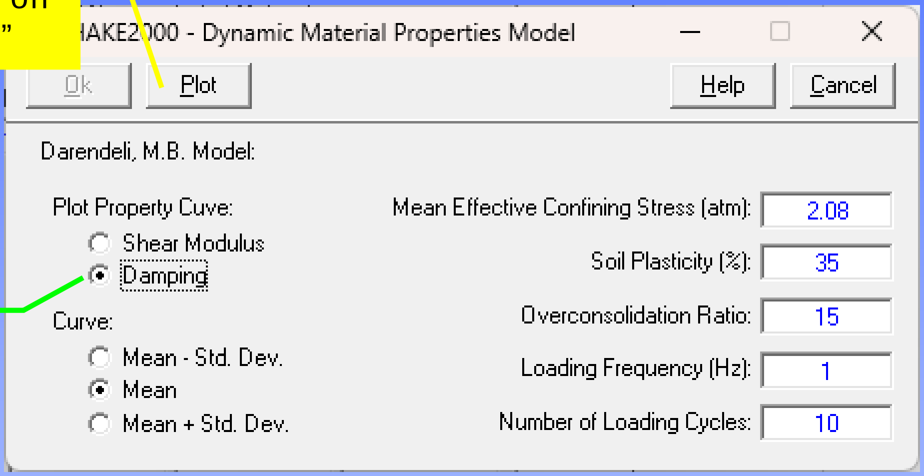
Site Specific Response Analysis
Use Model to generate curves



GeoMotions

Site Specific Response Analysis
Use Model to generate curves

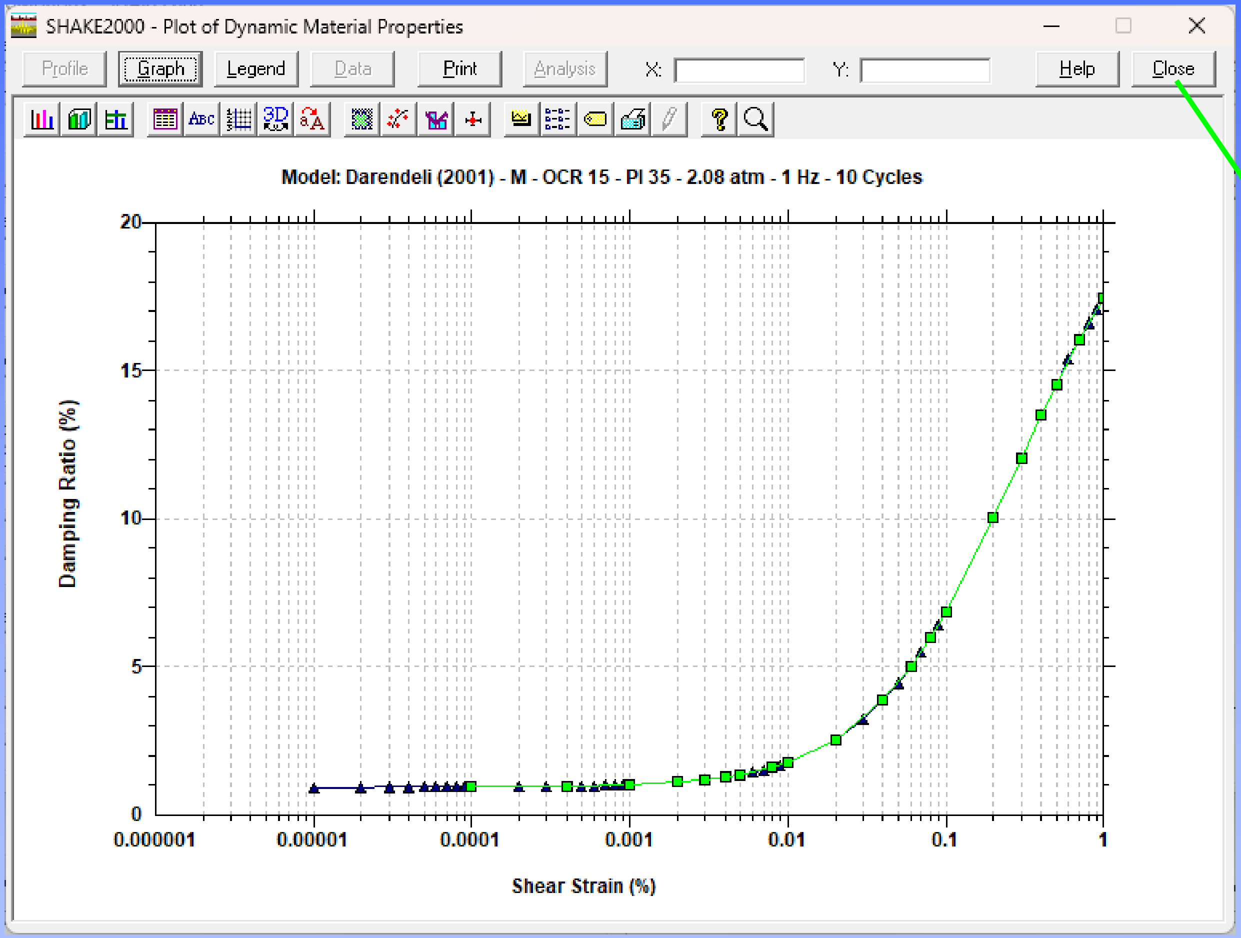
2. Click on "Plot"



1. Click on "Damping"

GeoMotions

Site Specific Response Analysis
Use Model to generate curves



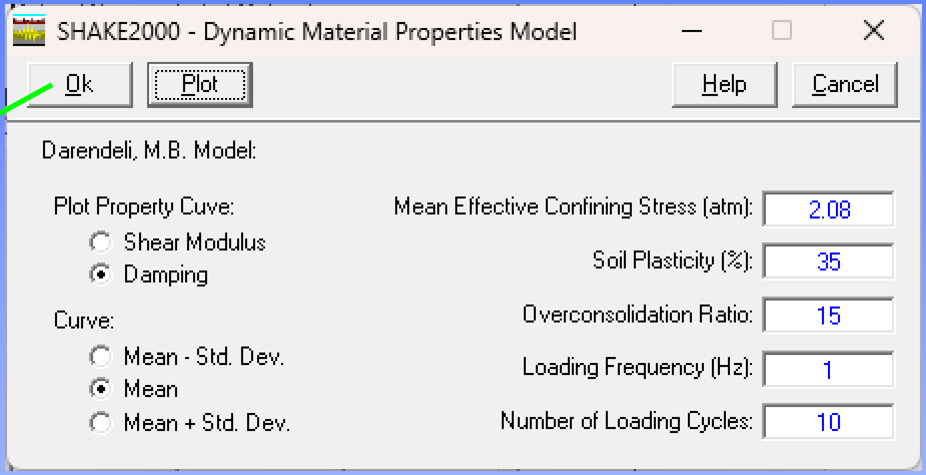
1. Click on "Close"

GeoMotions

Site Specific Response Analysis

Create Input Data - Option 1: Dynamic Material Properties

1. Click on "OK"

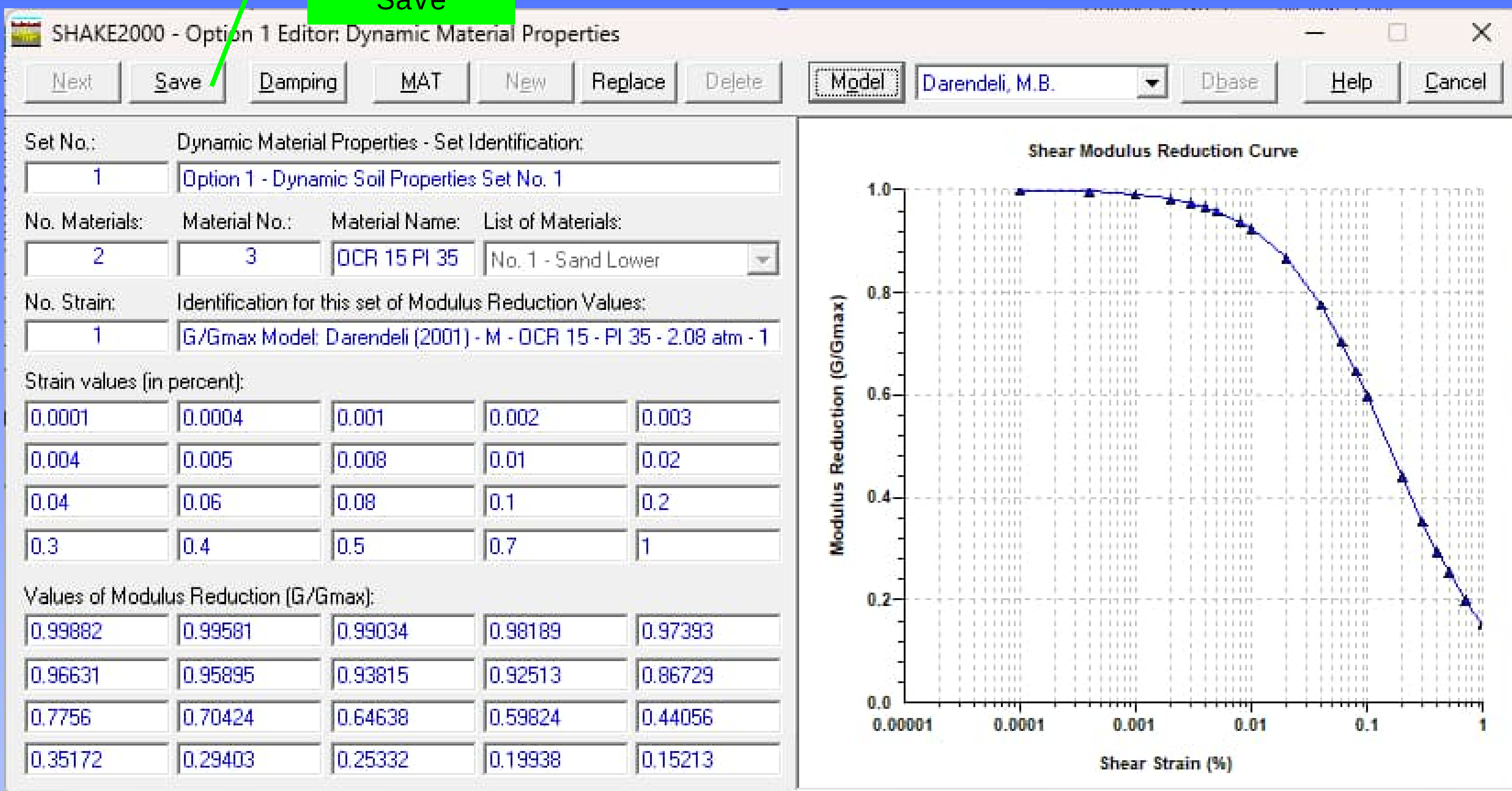


GeoMotions

Site Specific Response Analysis

Use Model to generate curves

1. Click on "Save"

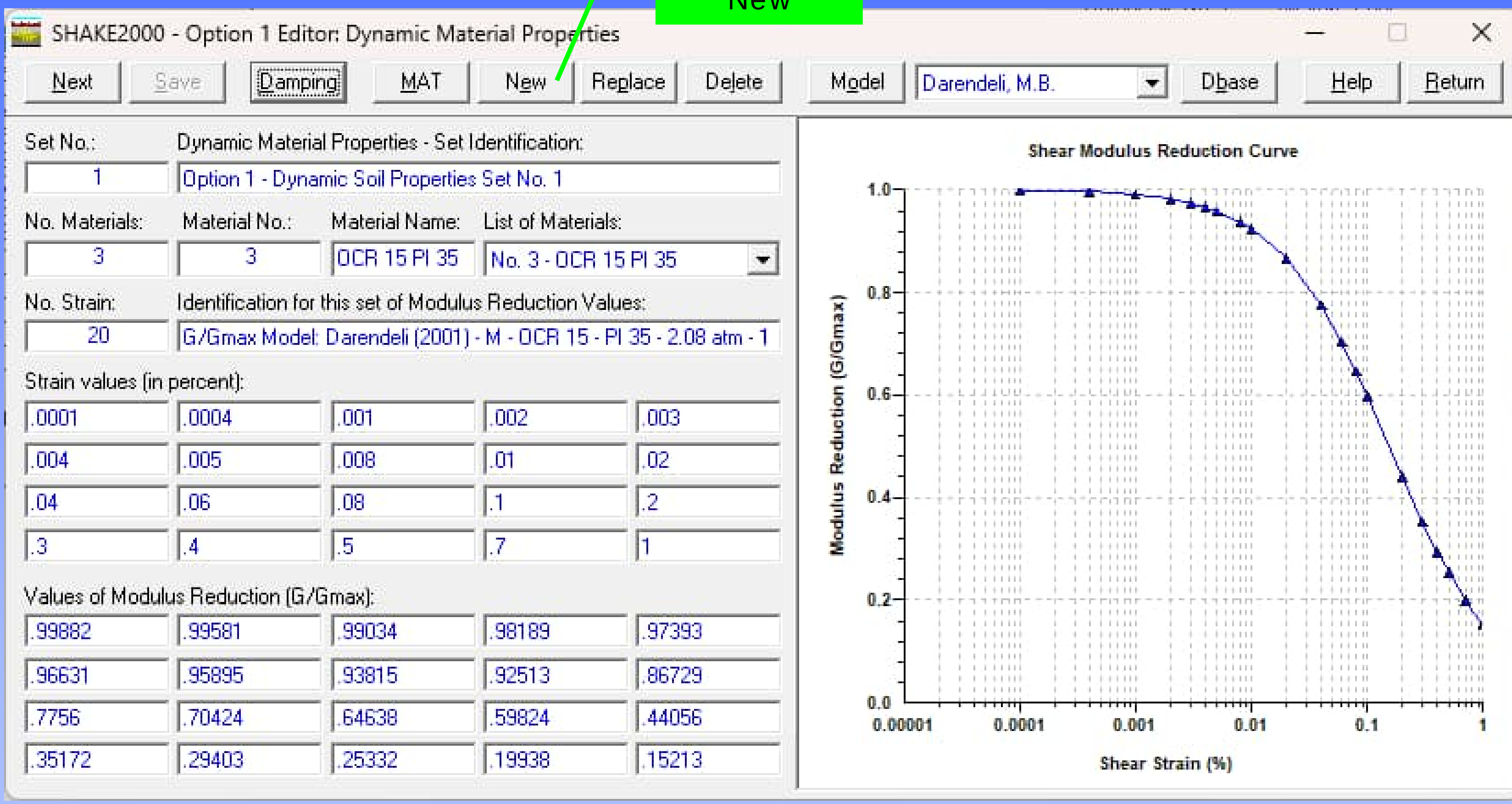


GeoMotions

Site Specific Response Analysis

Obtain curves from database of materials

1. Click on “New”

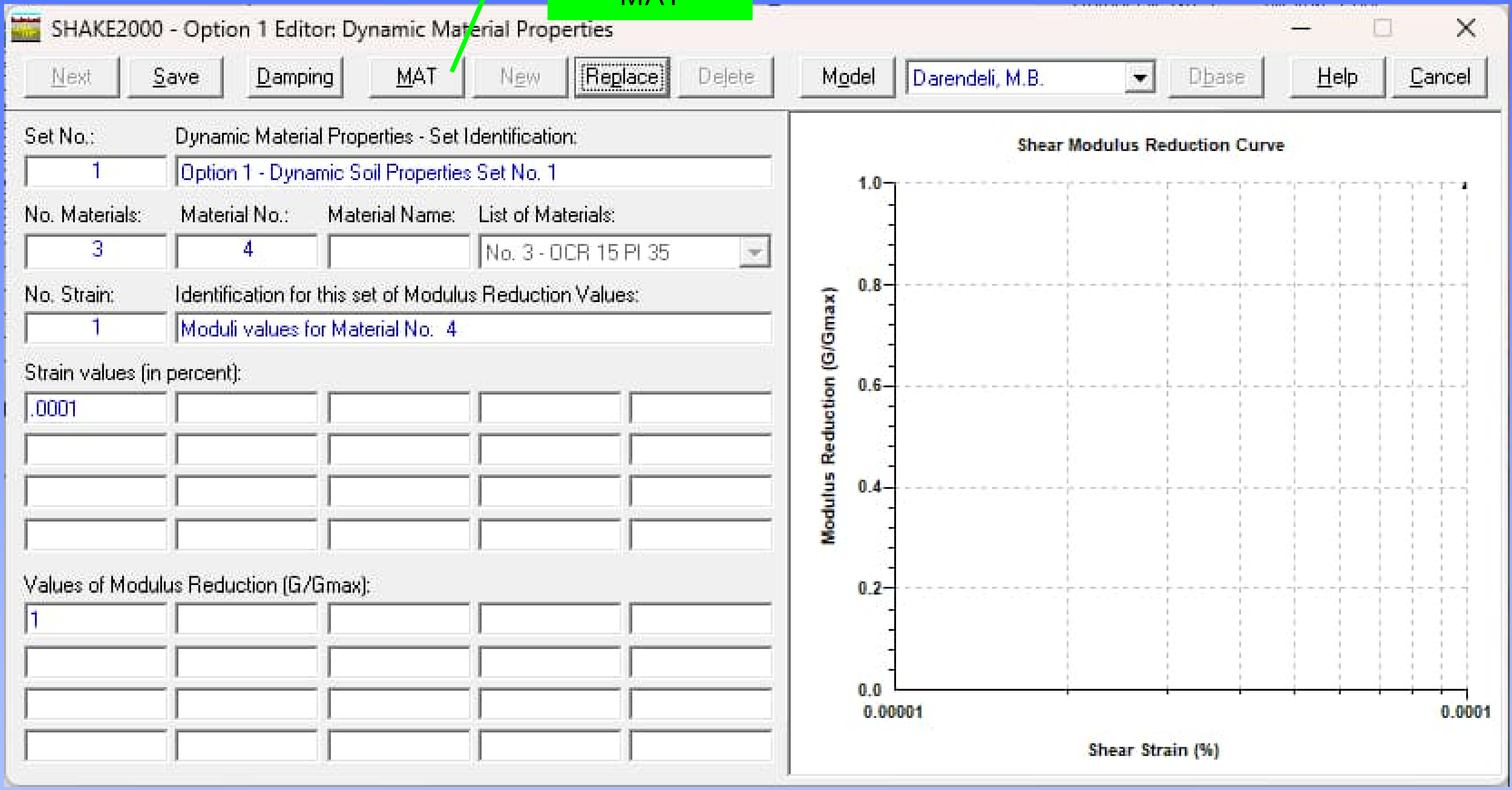


GeoMotions

Site Specific Response Analysis

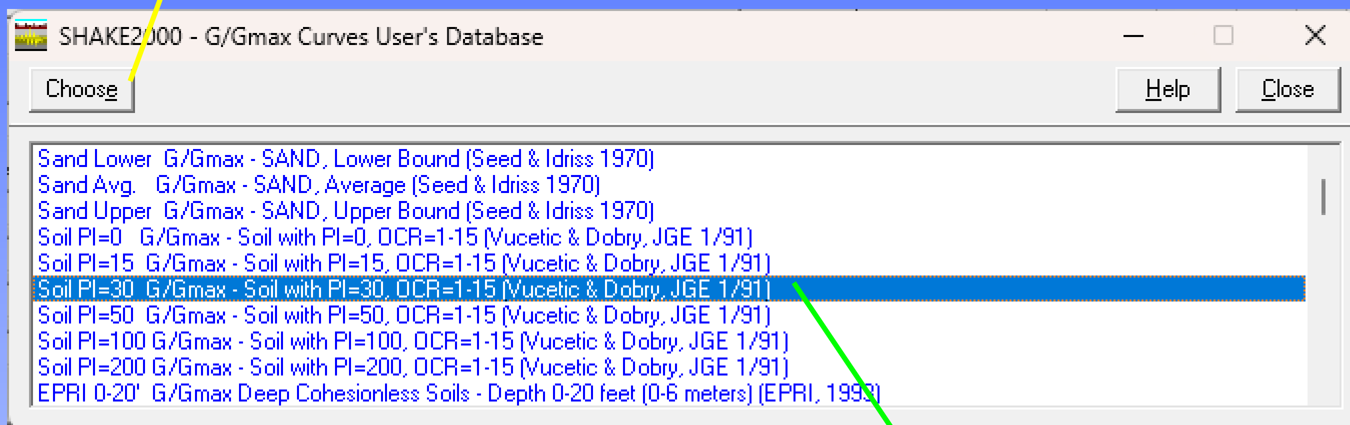
Obtain curves from database of materials

1. Click on "MAT"



Site Specific Response Analysis
Obtain curves from database of materials

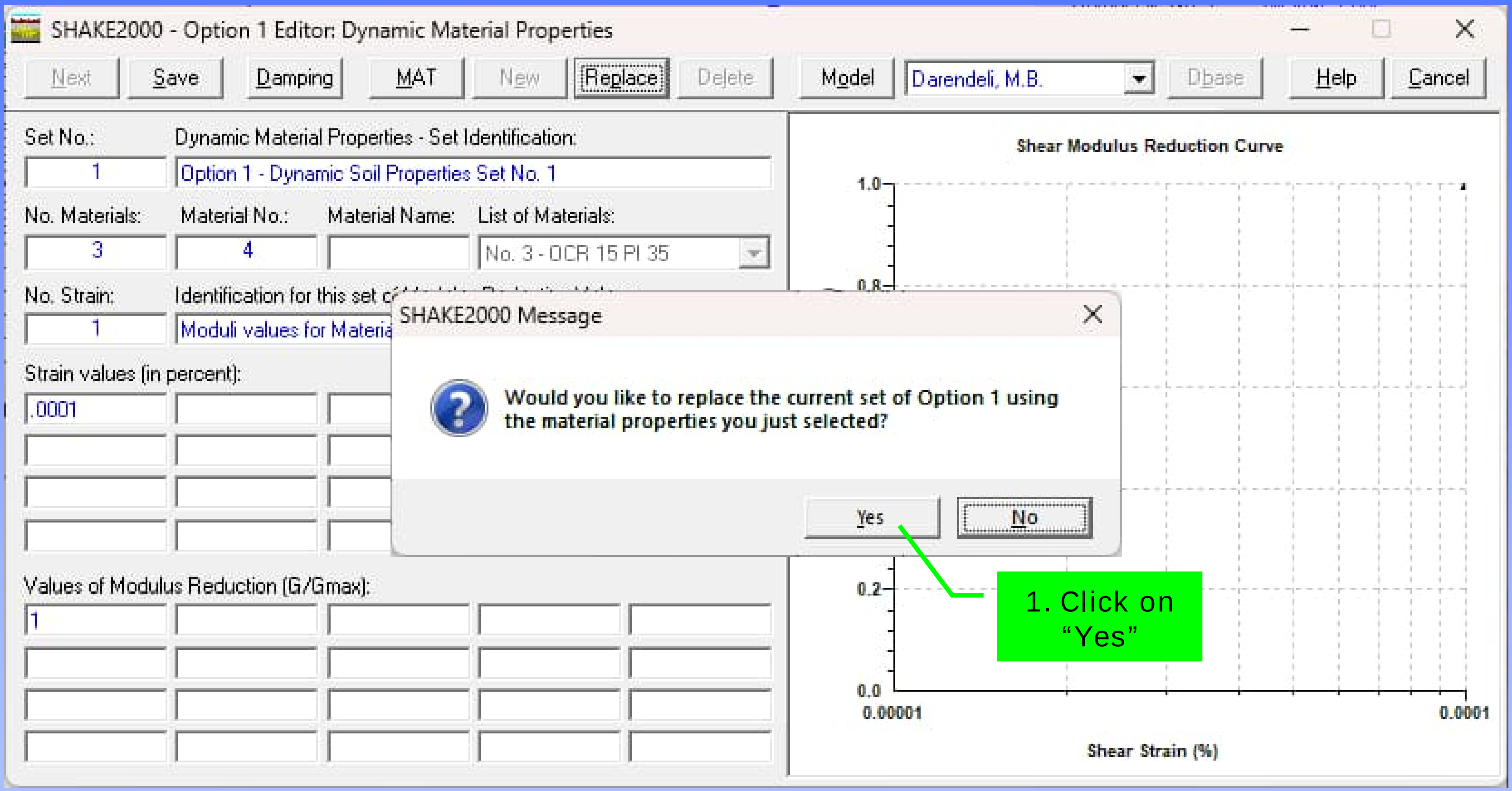
2. Click on "Choose"



1. Click on "Soil PI=30 G/Gmax …" to select it

Site Specific Response Analysis

Obtain curves from database of materials

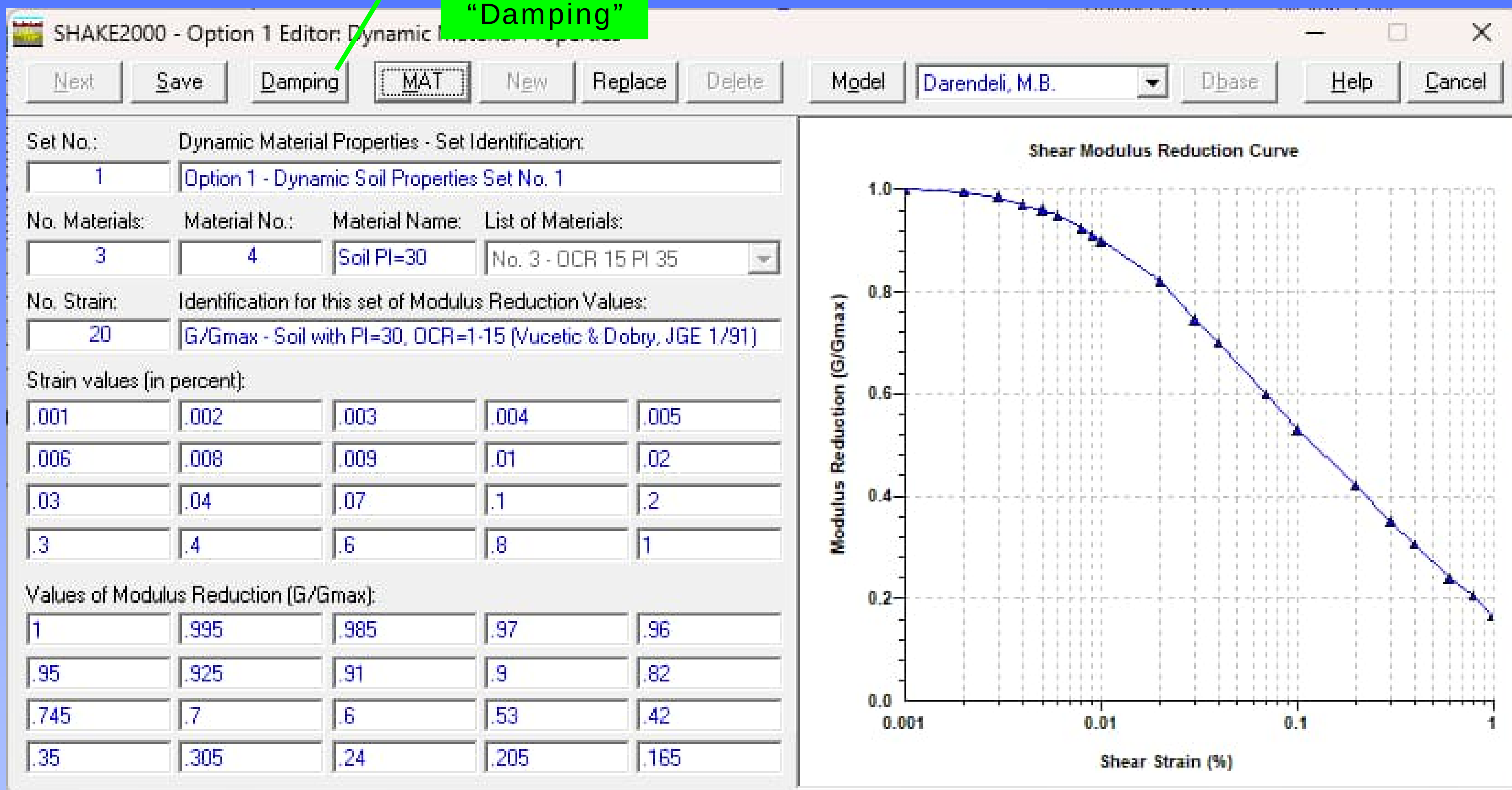


GeoMotions

Site Specific Response Analysis

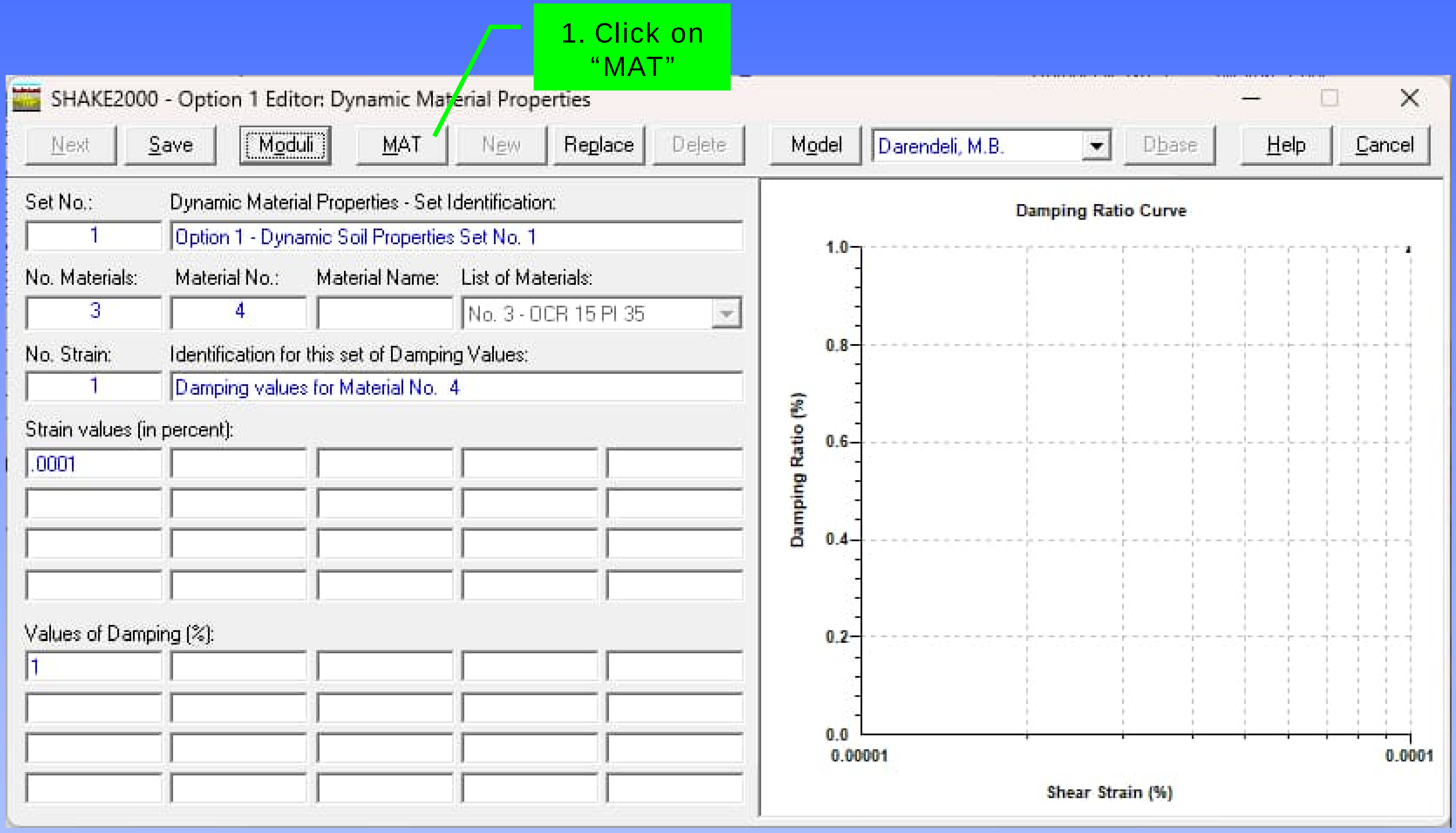
Obtain curves from database of materials

1. Click on “Damping”



Site Specific Response Analysis

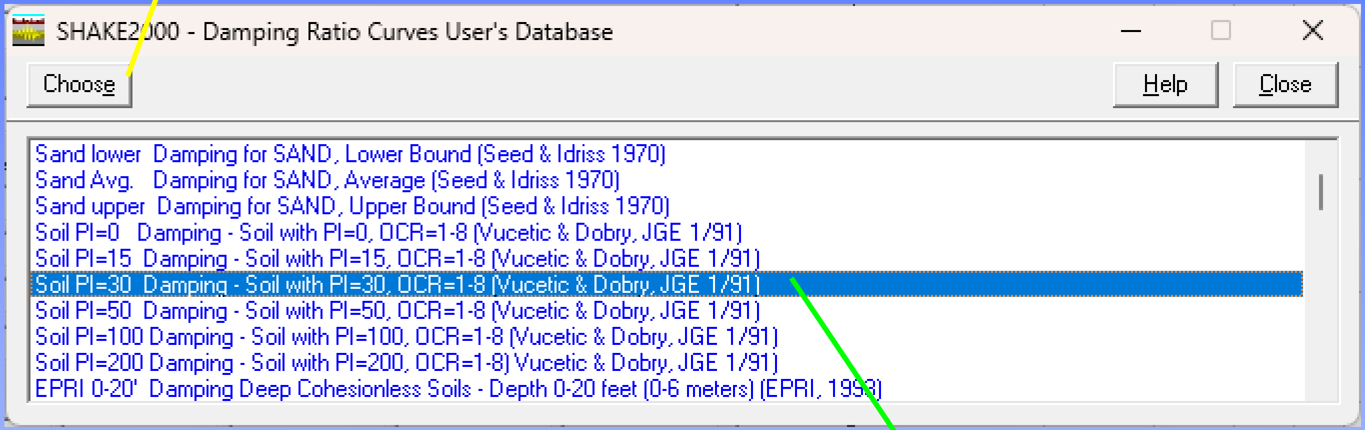
Obtain curves from database of materials



GeoMotions

Site Specific Response Analysis
Obtain curves from database of materials

2. Click on “Choose”

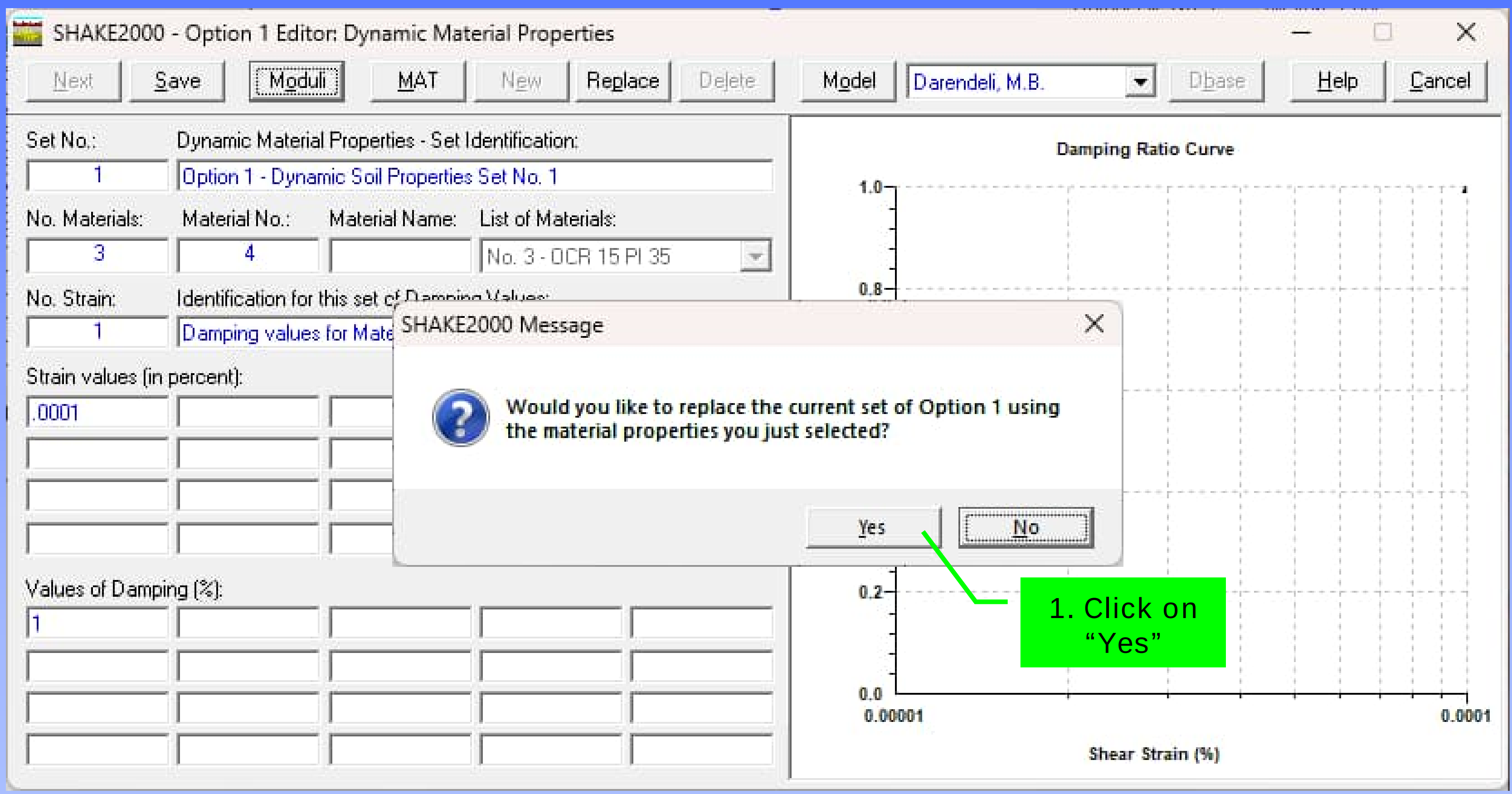


1. Click on “Soil PI=30 Damping …” to select it

GeoMotions

Site Specific Response Analysis

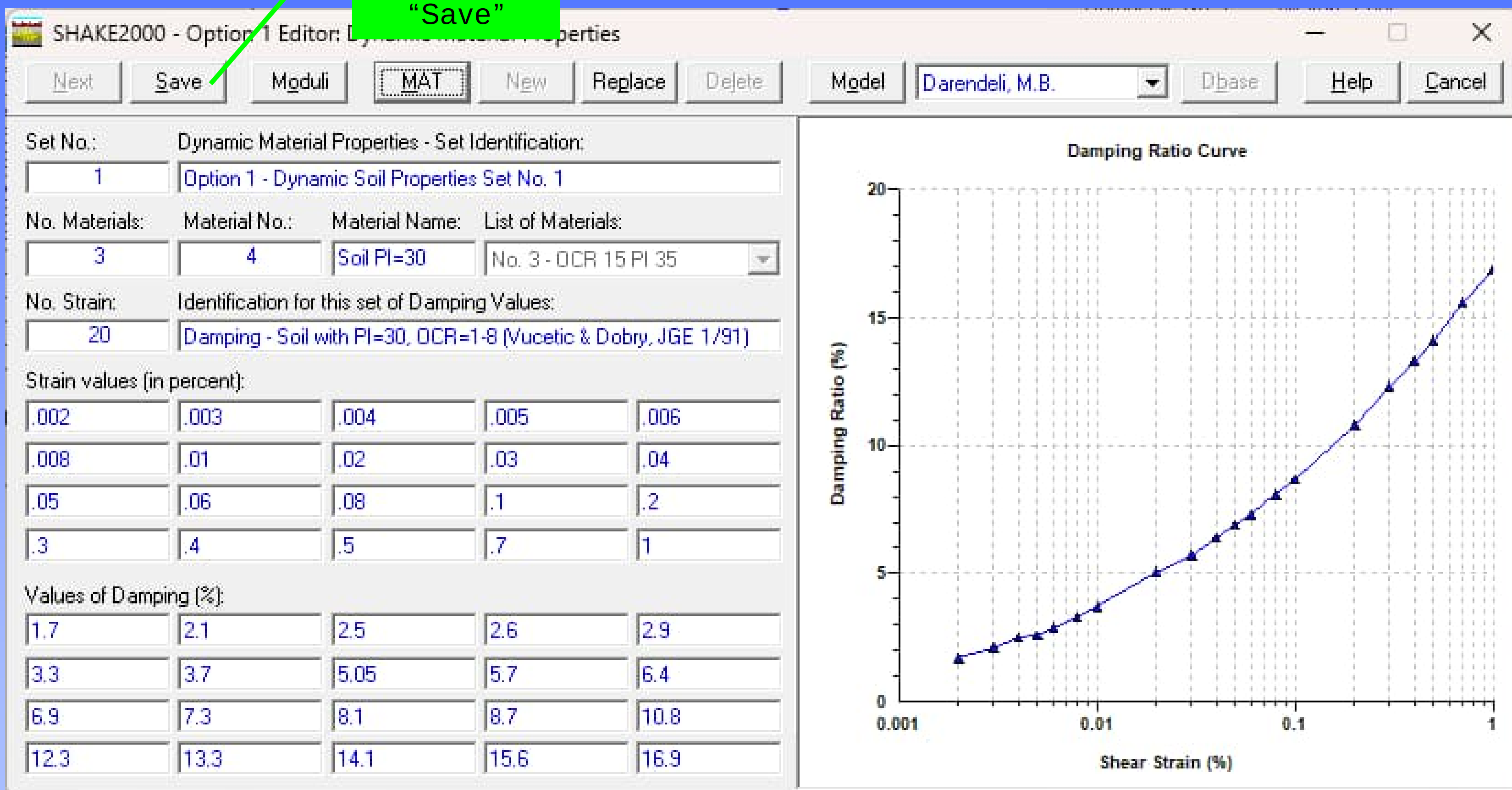
Obtain curves from database of materials



Site Specific Response Analysis

Obtain curves from database of materials

1. Click on "Save"



GeoMotions

Site Specific Response Analysis

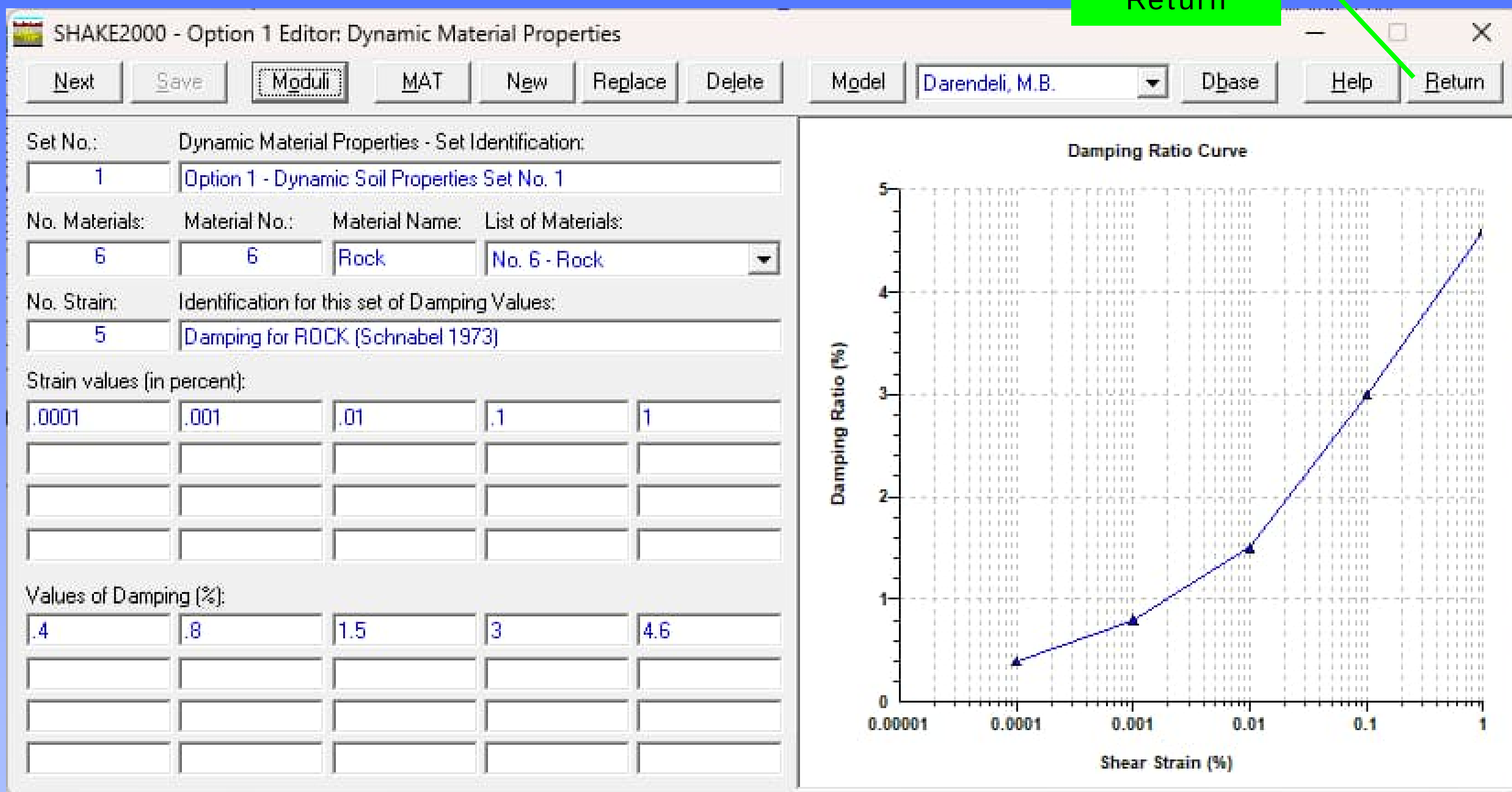
Use the database of materials to get soil types 5 and 6

Mat.	Description
5	Soil PI=15 G/Gmax – Soil with PI=15, OCR 1-15 (Vucetic & Dobry, JGE 1/91)
6	Rock G/Gmax – ROCK (Schnabel 1973)

Site Specific Response Analysis

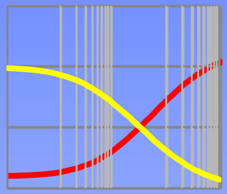
Obtain curves from database of materials

1. Click on "Return"



Site Specific Response Analysis

SHAKE Column Option 2 – Soil Profile



Option 1

Ground Level

Soil Layer 1

Soil Layer 2

Soil Layer 3

Soil Type, Thickness
Damping, γ, G_{max} or V_s

Option 2

Soil Layer n-1

Soil Layer n

Half-Space Layer

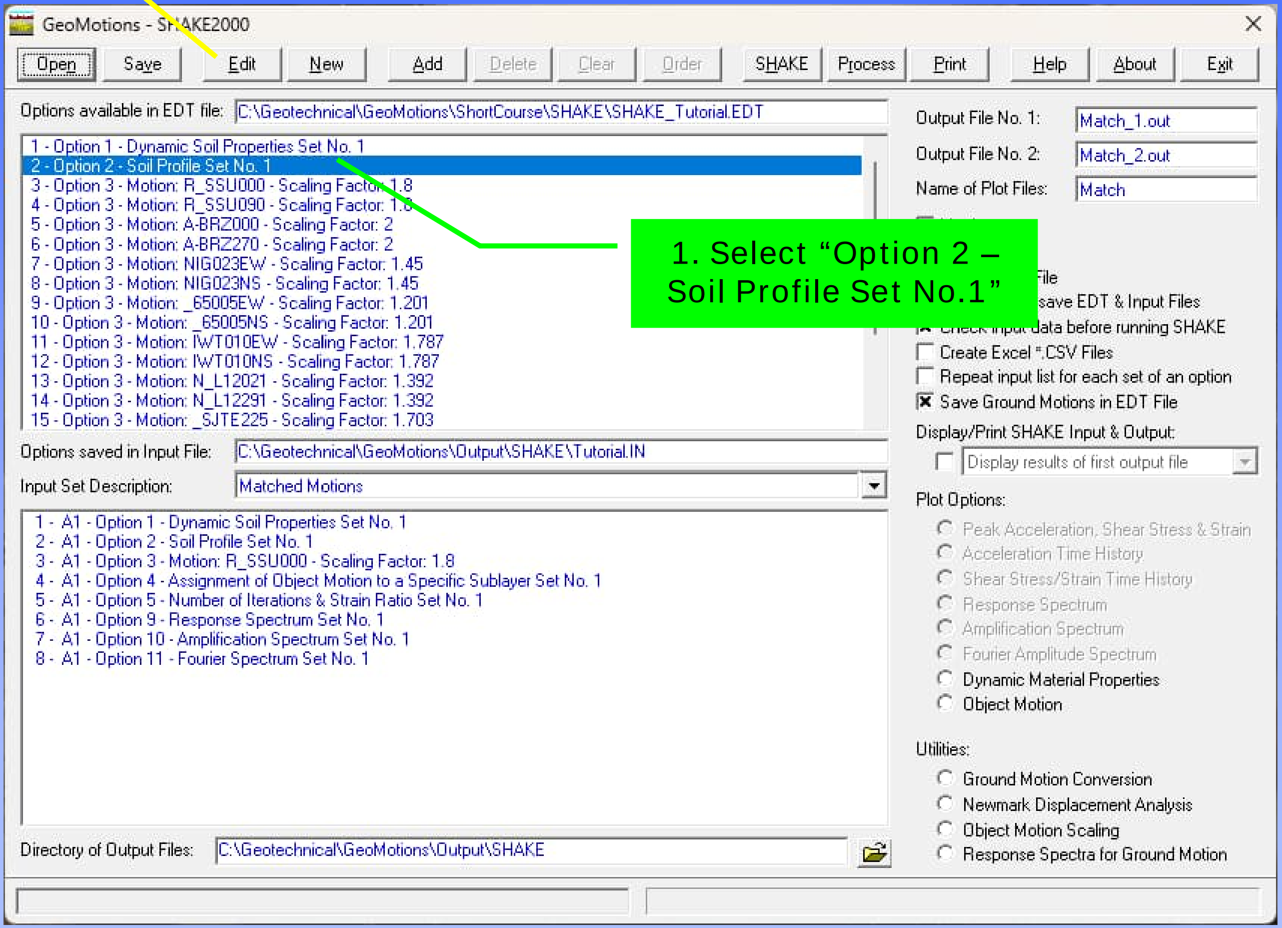
GeoMotions

Site Specific Response Analysis

Edit SHAKE Options – Option 2

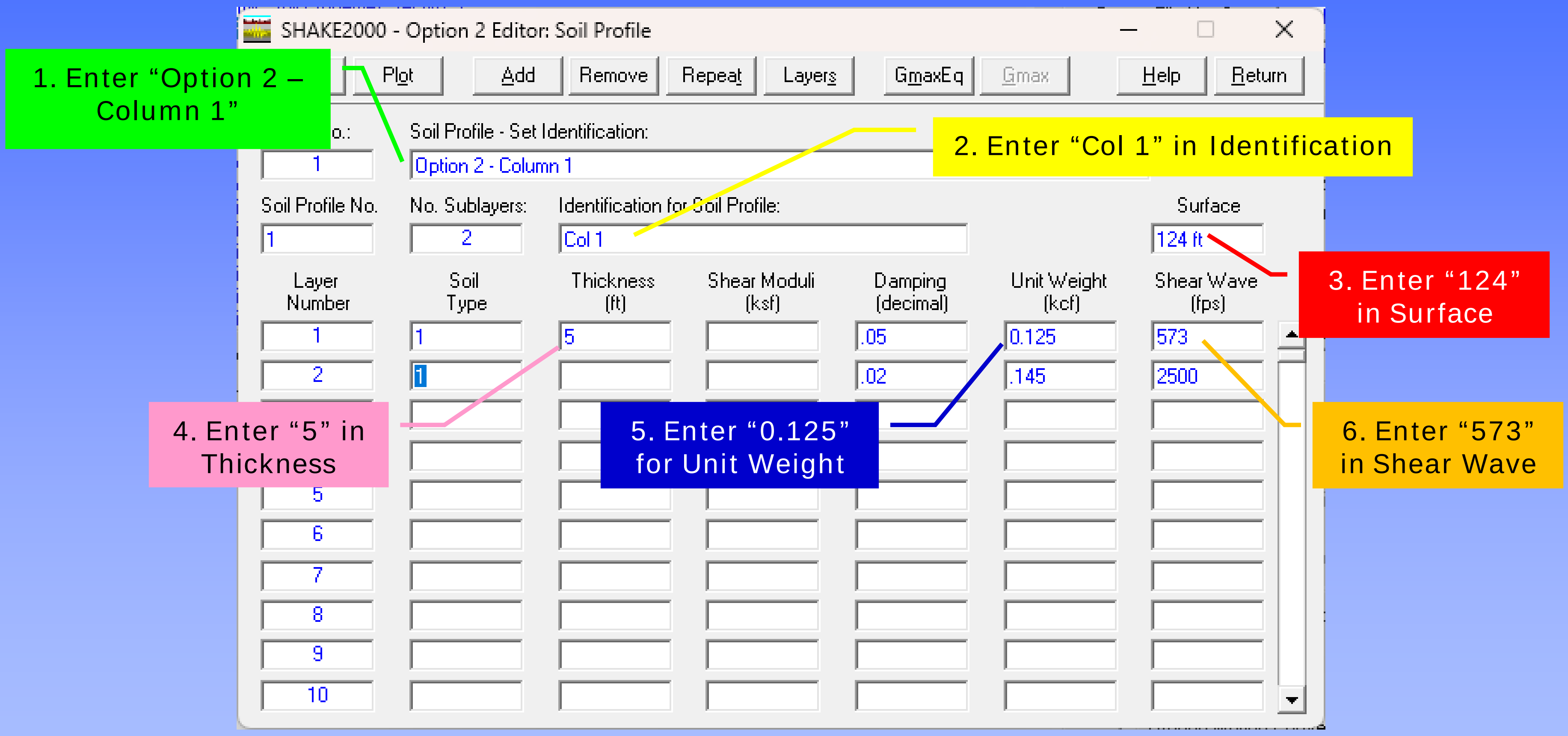
2. Click on “Edit”

1. Select “Option 2 – Soil Profile Set No.1”



Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile



GeoMotions

Site Specific Response Analysis

Option 2 – Enter the data for the other layers

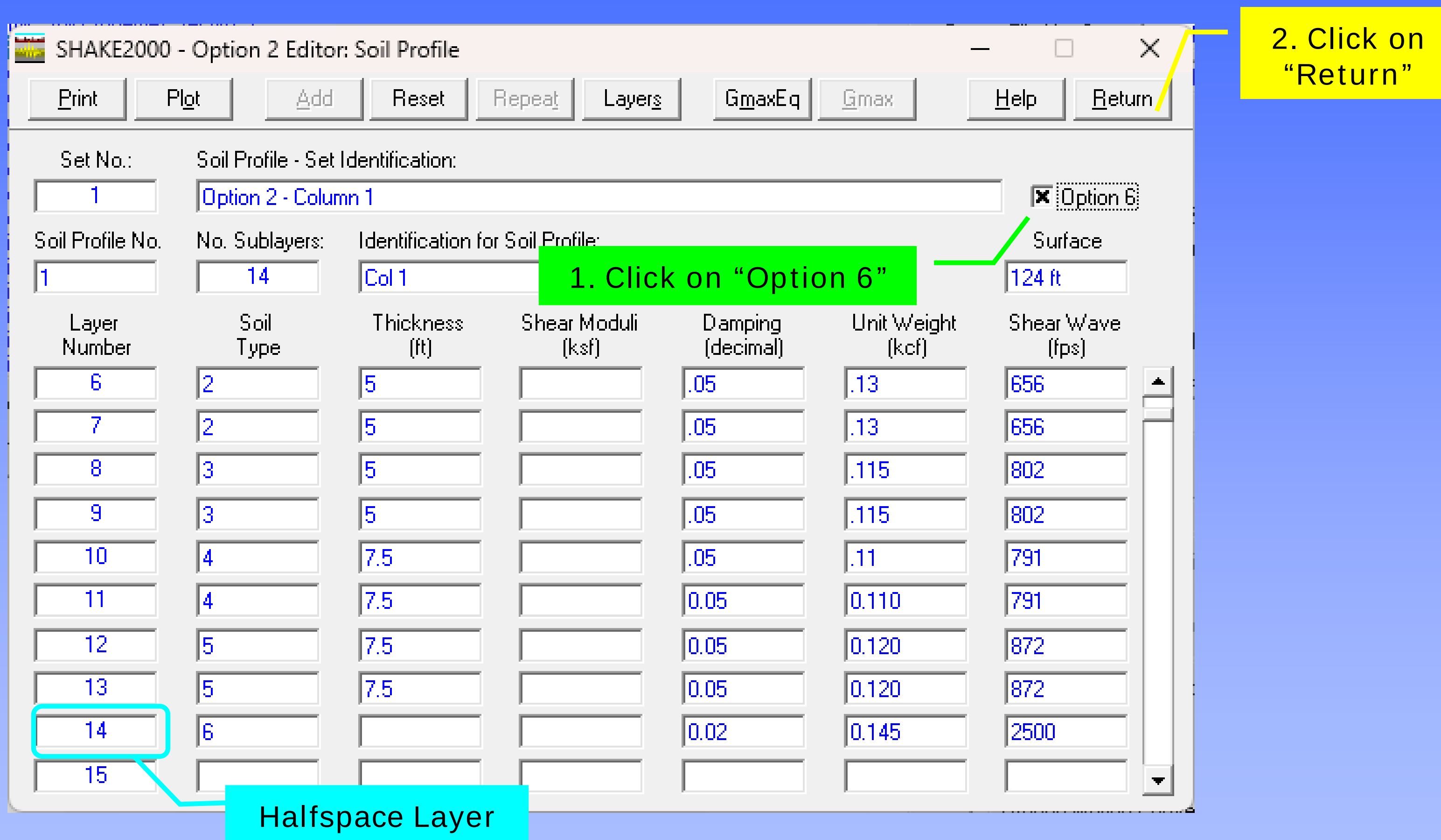
Layer No.	Soil Type	Thickness (feet)	Damping	Unit Weight (kcf)	V_S (fps)	
2	1	5	0.05	0.125	573	
3	1	7.5	0.05	0.125	758	
4	1	7.5	0.05	0.125	758	
5	2	5	0.05	0.130	656	
6	2	5	0.05	0.130	656	
7	2	5	0.05	0.130	656	
8	3	5	0.05	0.115	802	
9	3	5	0.05	0.115	802	
10	4	7.5	0.05	0.110	791	*
11	4	7.5	0.05	0.110	791	
12	5	7.5	0.05	0.120	872	
13	5	7.5	0.05	0.120	872	
14	6		0.02	0.145	2500	

*After entering the V_S value for layer 10 press “Tab” to move out of the cell and then you’ll be able to scroll down

GeoMotions

Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile



GeoMotions

Site Specific Response Analysis

SHAKE Column Option 3 – Ground Motion Files

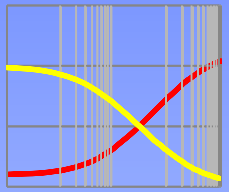
Ground Level

Soil Layer 1

Soil Layer 2

Soil Layer 3

Soil Type, H,
β, γ, G_{max} or V_s



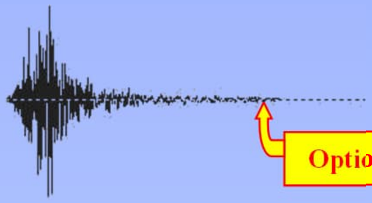
Option 1

Option 2

Soil Layer n-1

Soil Layer n

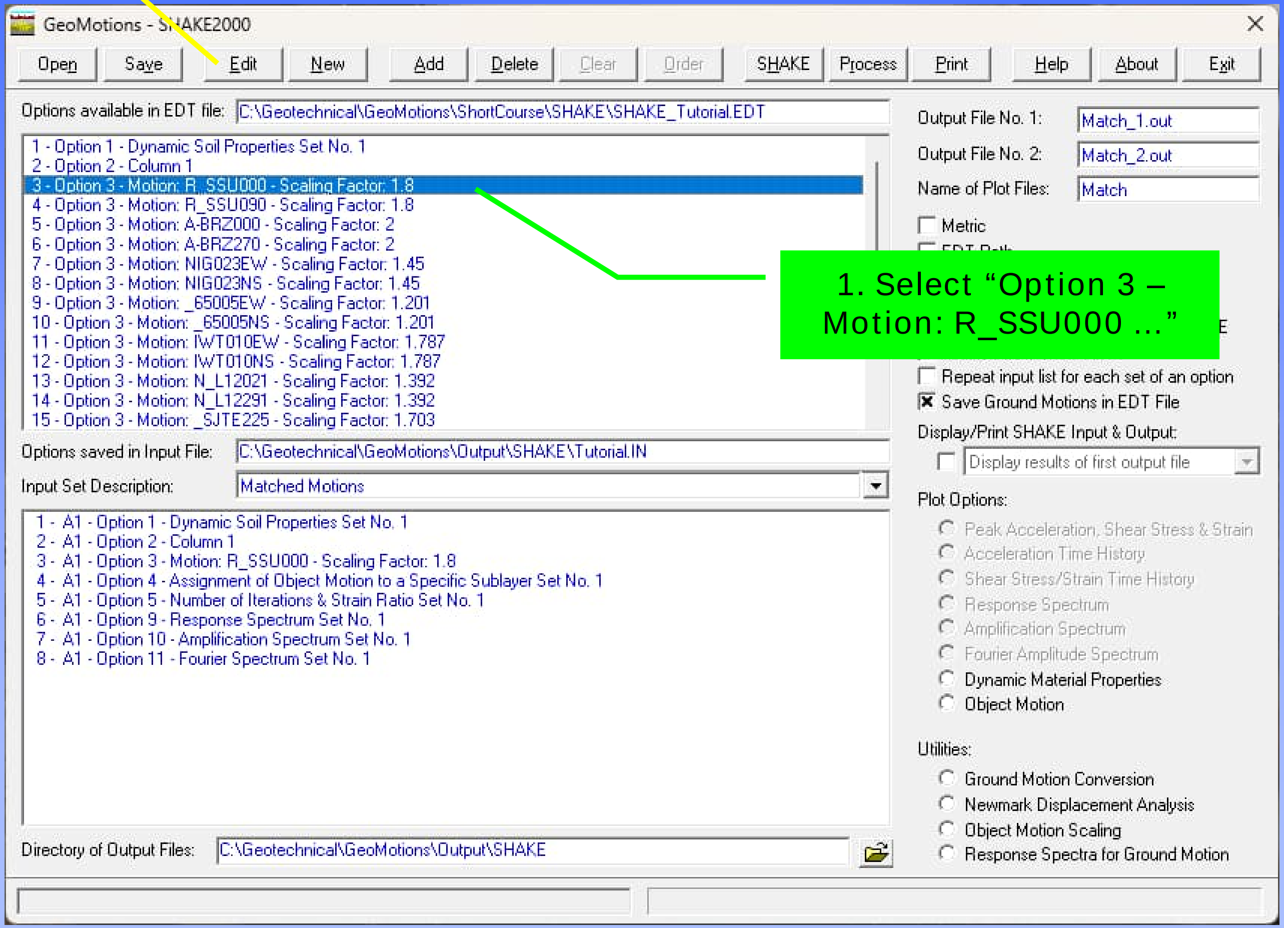
Half-Space Layer



Option 3

Site Specific Response Analysis
Edit SHAKE Options – Option 3

2. Click on “Edit”

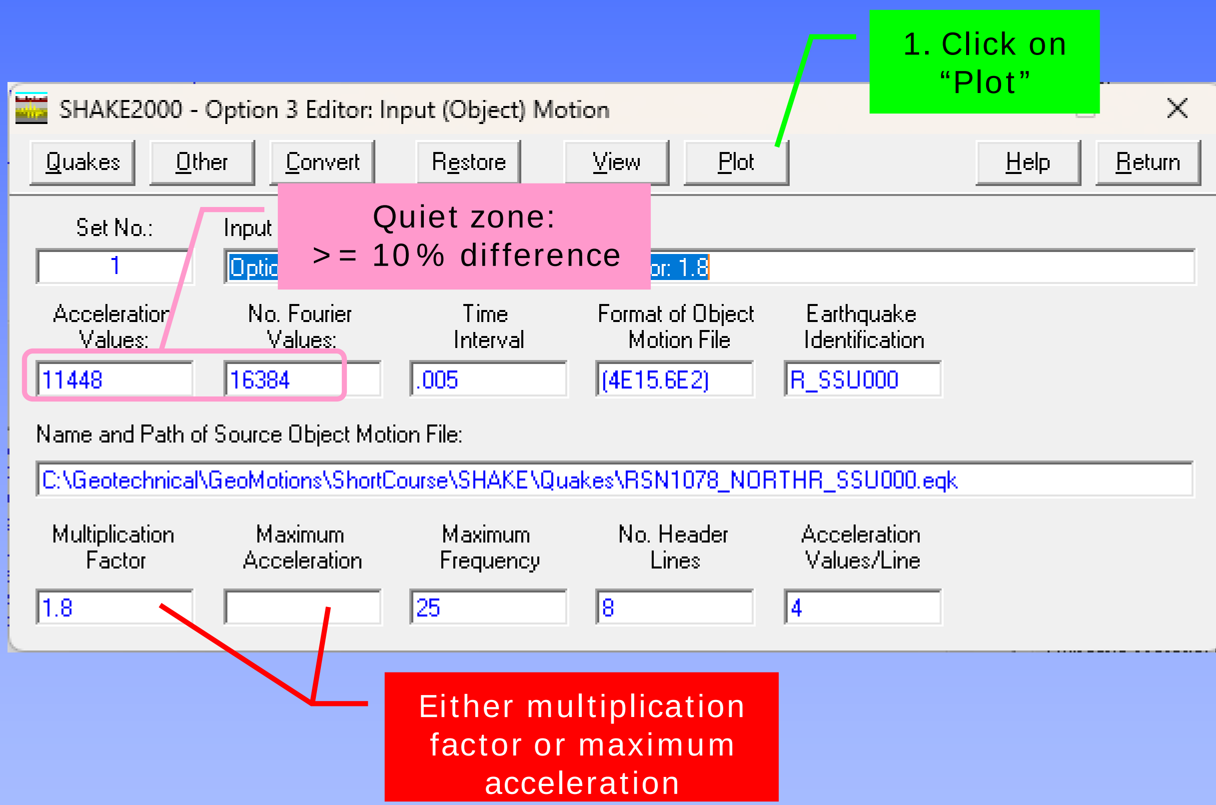


1. Select “Option 3 – Motion: R_SSU000 …”

GeoMotions

Site Specific Response Analysis

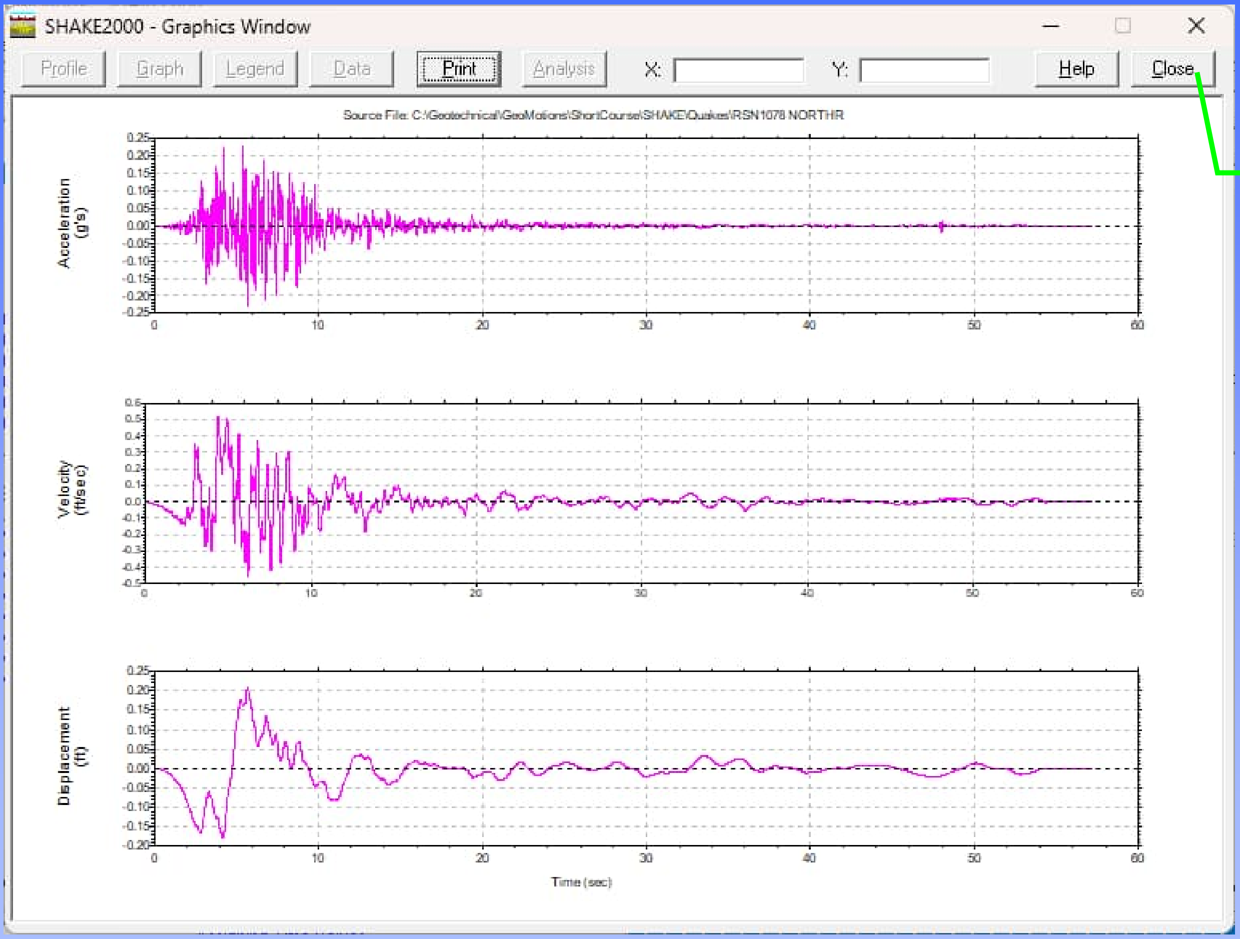
Create Input Data – Option 3: Input Motion



GeoMotions

Site Specific Response Analysis

Create Input Data – Check Input Motion



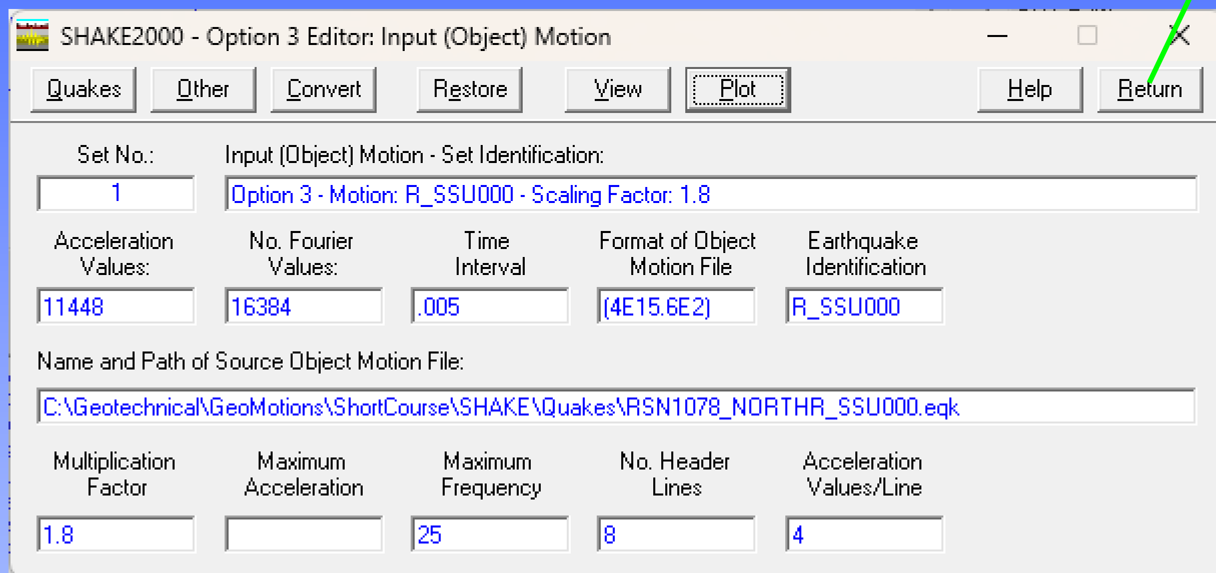
1. Click on “Close”

GeoMotions

Site Specific Response Analysis

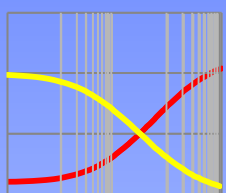
Create Input Data – Option 3: Input Motion

1. Click on “Return”



Site Specific Response Analysis

SHAKE Column Option 4 – Assign Input Motion to Layer



Option 1

Ground Level

Soil Layer 1

Soil Layer 2

Soil Layer 3

Soil Type, H,
β, γ, G_{max} or V_s

Option 2

Soil Layer n-1

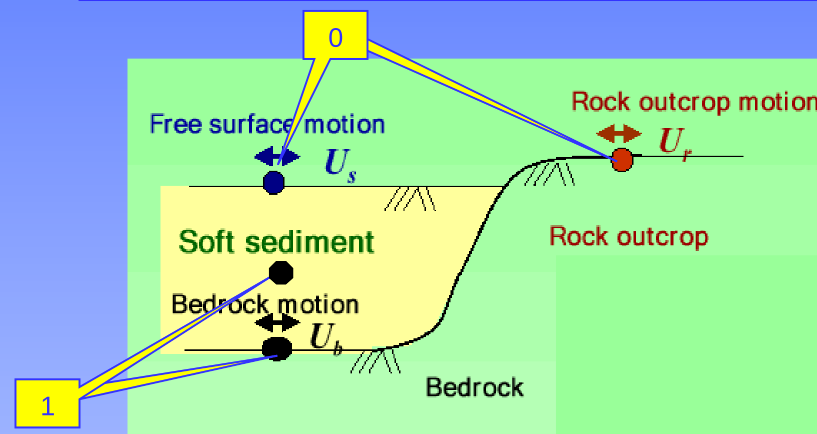
Soil Layer n

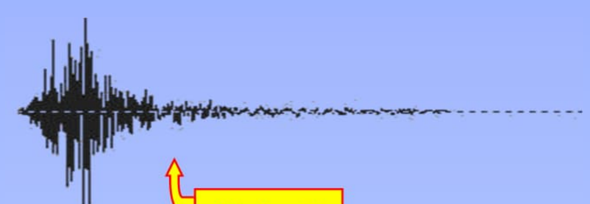
Half-Space Layer

Option 4

0 = Object motion is assigned as outcropping motion

1 = Object motion is applied within the soil profile

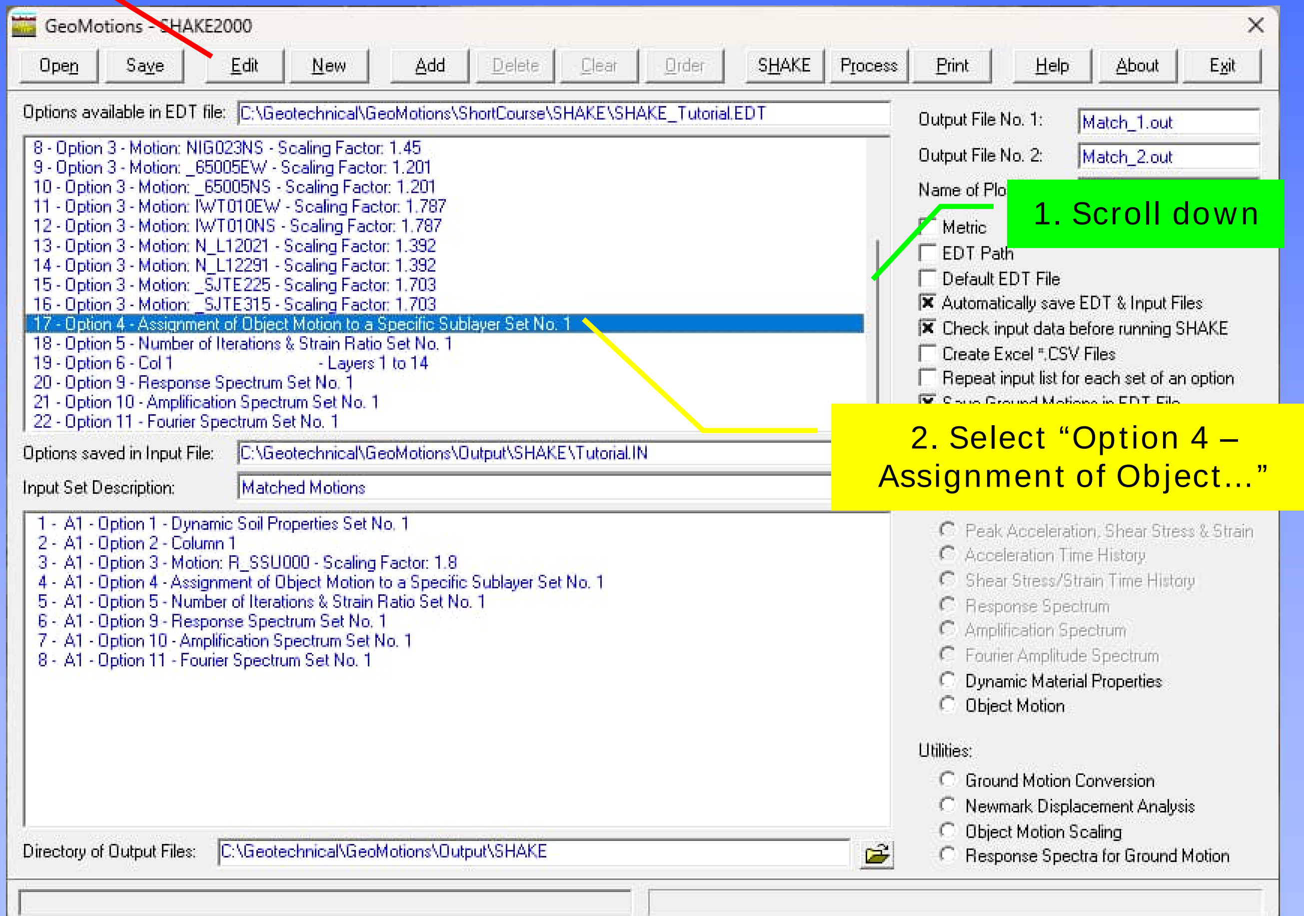




Option 3

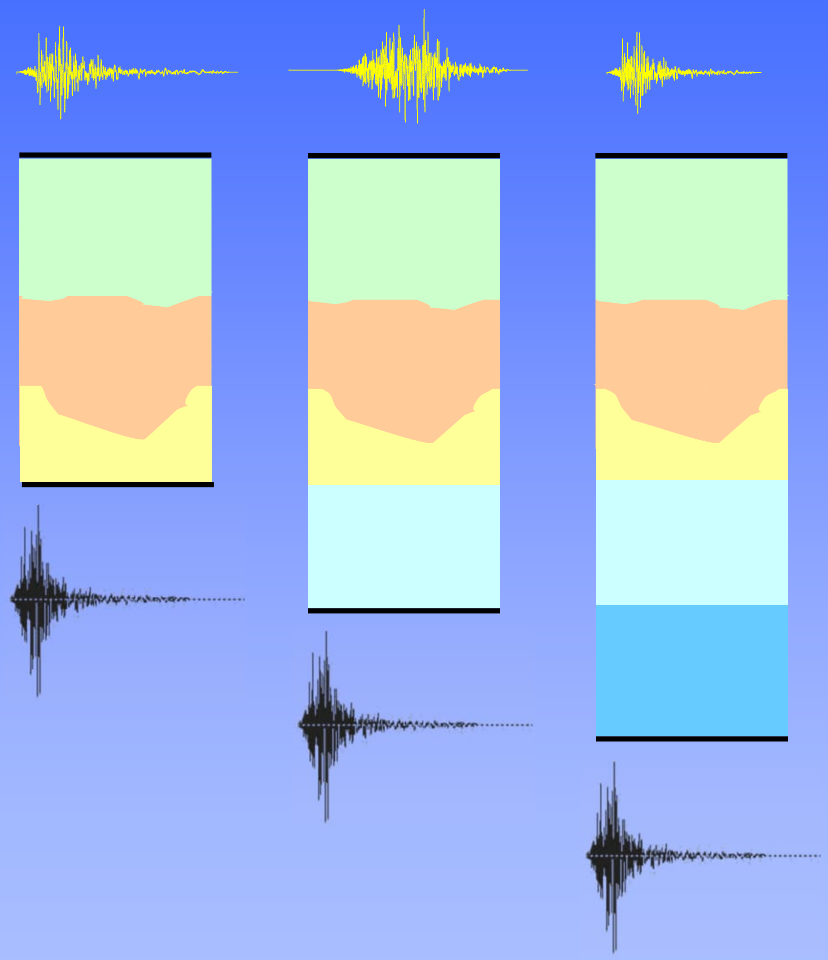
Site Specific Response Analysis
Edit SHAKE Options – Option 4

3. Click on “Edit”



GeoMotions

Where is the Halfspace Layer?



Halfspace: *A mathematical model bounded by a planar surface but otherwise infinite. Properties within the model are commonly assumed to be homogeneous and isotropic, unlike the Earth itself, which is heterogeneous and anisotropic*. (Seismologist's Dictionary at http://www.uwm.edu/Dept/Geosciences)

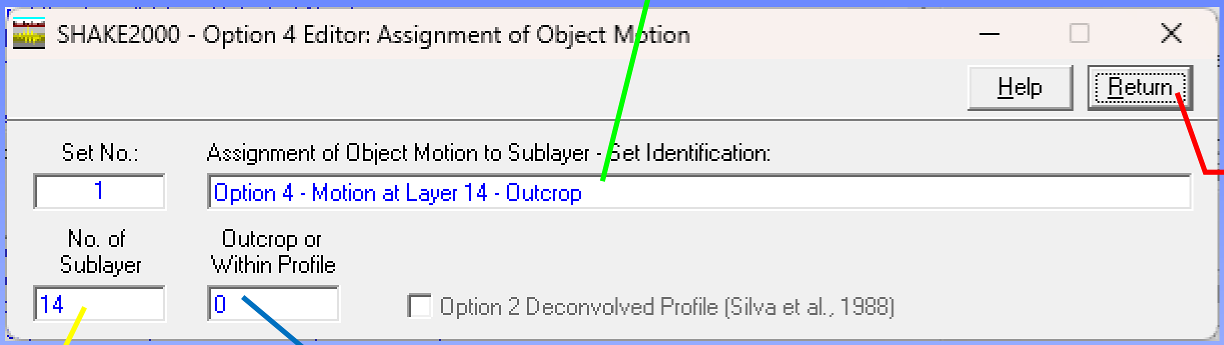
Soft rock ⇒ V_S >= 2,500 ft/sec ?

A halfspace implies that V_S does not increase with depth.

Site Specific Response Analysis

Create Input Data – Option 4: Assignment of Object Motion

1. Enter “Option 4 – Motion at Layer 14 – Outcrop”



3. Click on “Return”

2. Enter “14” for No. of Sublayer

0 = Outcrop
1 = Within

Site Specific Response Analysis

SHAKE Column Option 5 – No. of Iterations & Strain Ratio

Ground Level

Soil Layer 1

Soil Layer 2

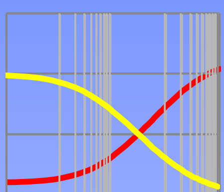
Soil Layer 3

Soil Type, H,
β, γ, G_{max} or V_s

Soil Layer n-1

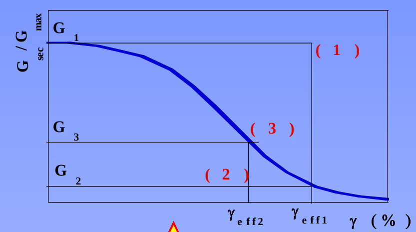
Soil Layer n

Half-Space Layer



Option 1

Option 2



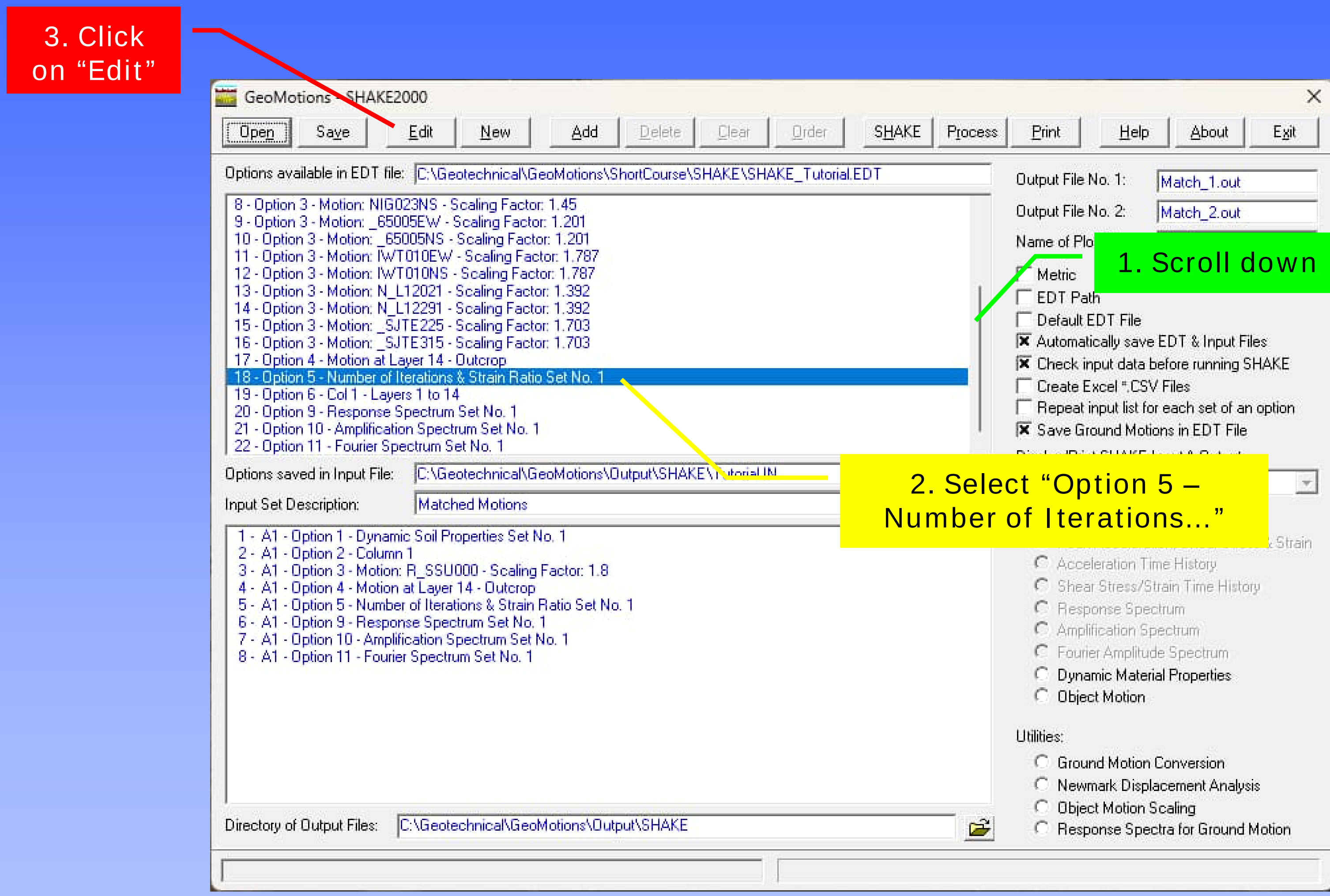
Option 5

Option 3

Option 4

GeoMotions

Site Specific Response Analysis
Edit SHAKE Options – Option 5

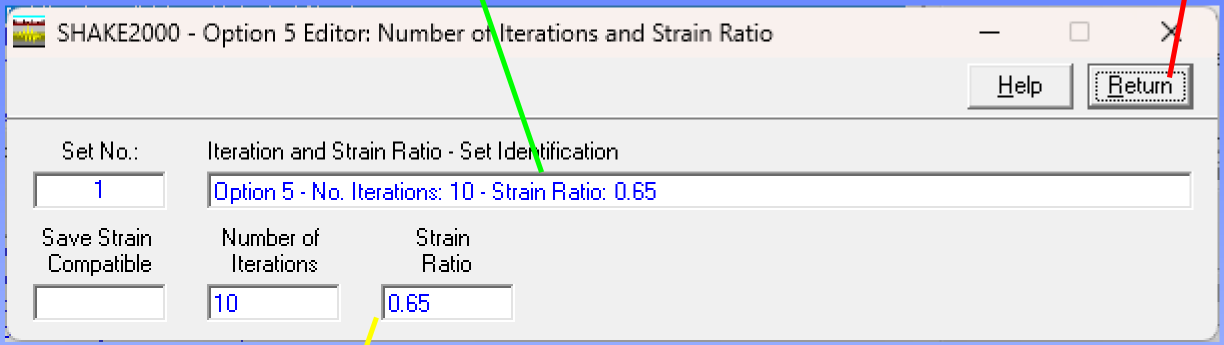


Site Specific Response Analysis

Create Input Data – Option 5: No. Iterations & Strain Ratio

1. Enter “Option 5 – No. Iterations: 10 – Strain Ratio: 0.65” for ID

3. Click on “Return”



2. Enter “0.65” for Strain Ratio

GeoMotions

SHAKE Analysis

- Equivalent loading ⇒ 50% - 70% (Kramer, 1996).
- Equivalent loading ⇒ 40% - 75% (Idriss & Sun, 1992)

ratio = (M – 1) / 10 where M = earthquake magnitude

- Carlton (2015) indicates that using 0.65 gives a 2-10% better fit than using (M-1) /10

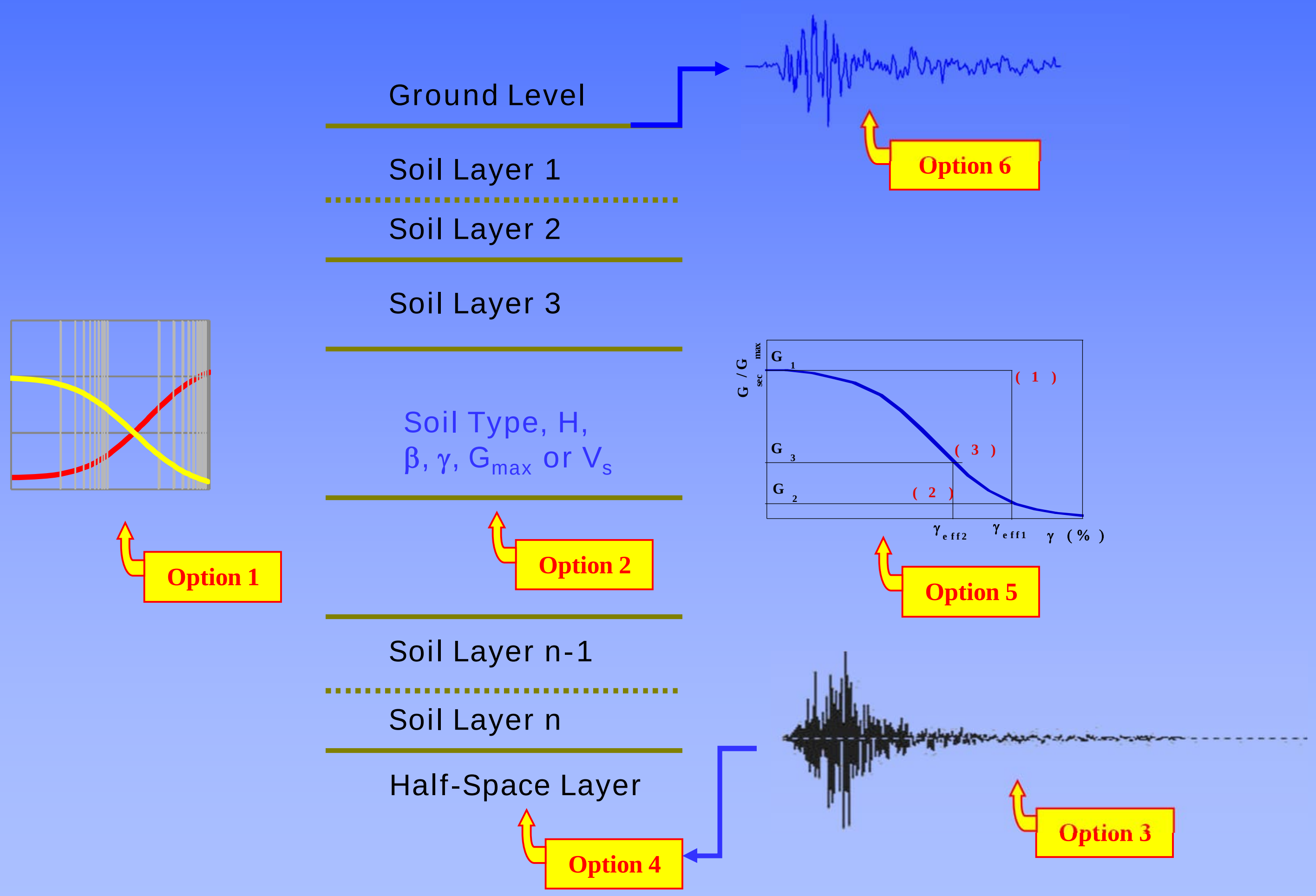
Kramer, S.L. (1996). Geotechnical Earthquake Engineering, Prentice Hall, Inc., Upper Saddle River, New Jersey, 653 pp.

Idriss, I.M. and Joseph I. Sun (1992). *User's Manual for SHAKE91, A Computer Program for Conducting Equivalent Linear Seismic Response Analyses of Horizontally Layered Soil Deposits.* Center for Geotechnical Modeling, Department of Civil & Environmental Engineering, University of California, Davis, California.

Carlton, Brian (2015). *Ground Motion Parameter Sensitivity to Shear Strain Ratio in Equivalent Linear Analyses.* Earthquake Spectra In-Press.

Site Specific Response Analysis

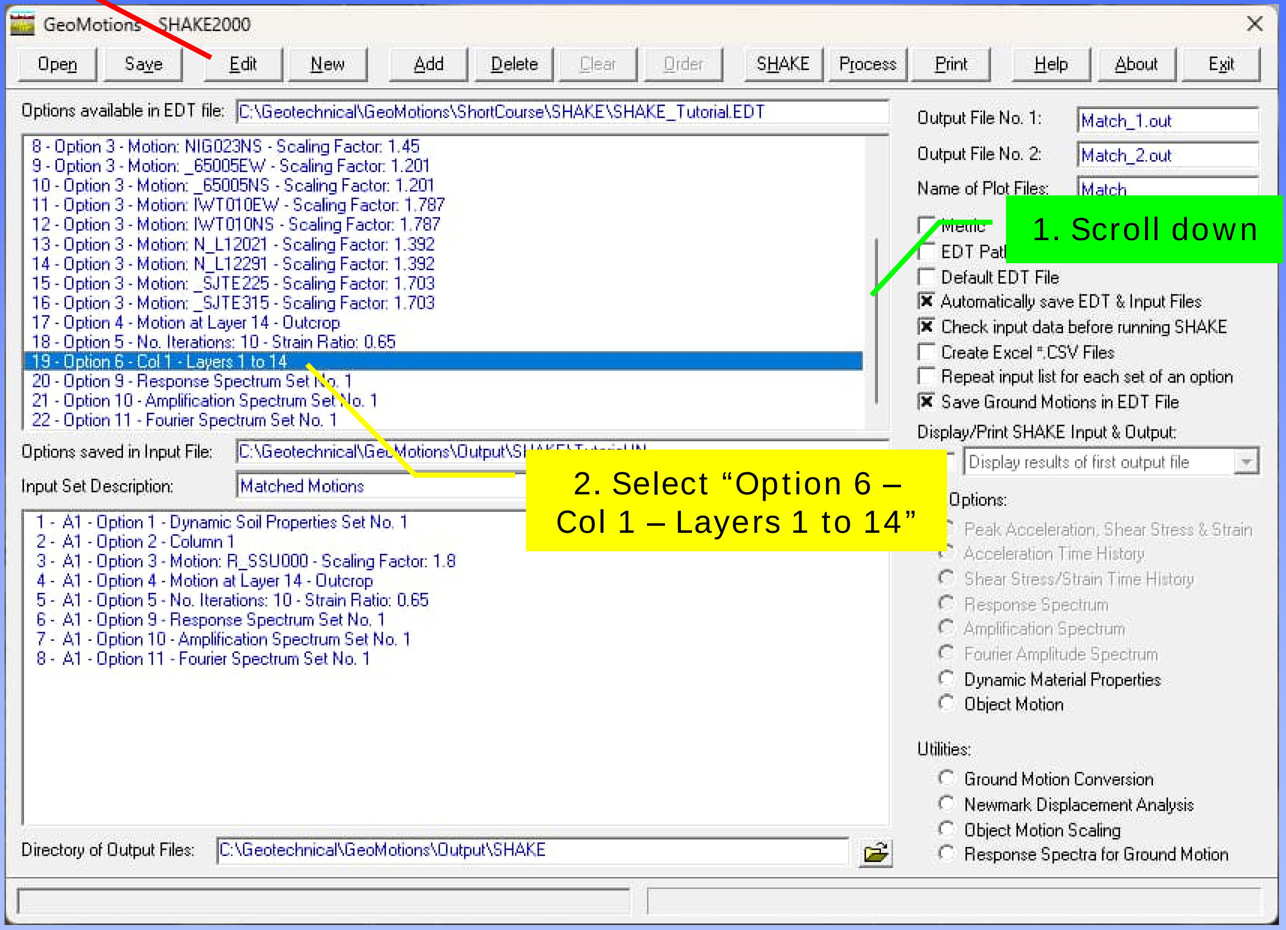
SHAKE Column Option 6 – Acceleration Time Histories



Site Specific Response Analysis

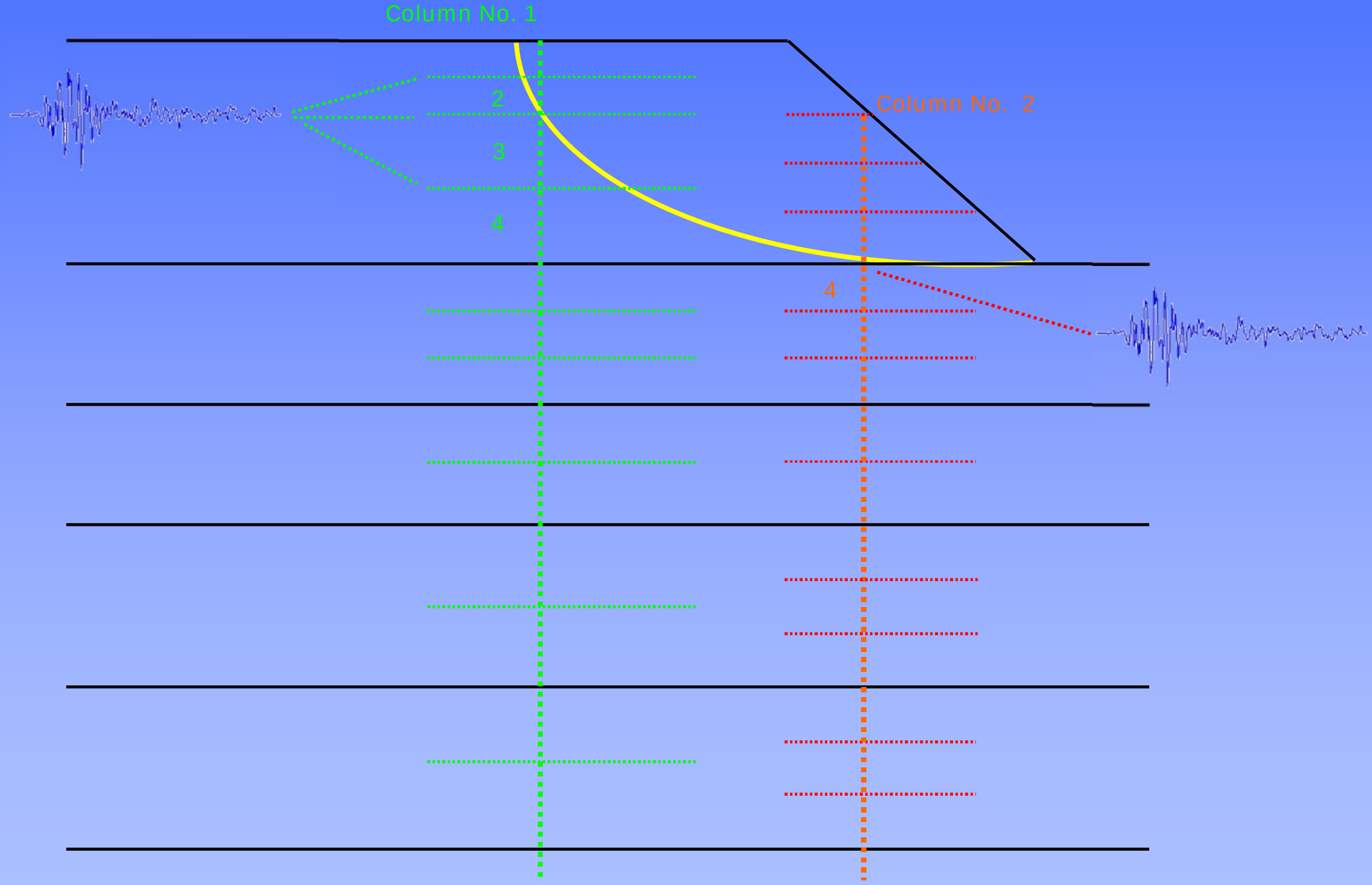
Create Input Data

3. Click on "Edit"



Sample Problem

Acceleration Time Histories for Newmark Analysis

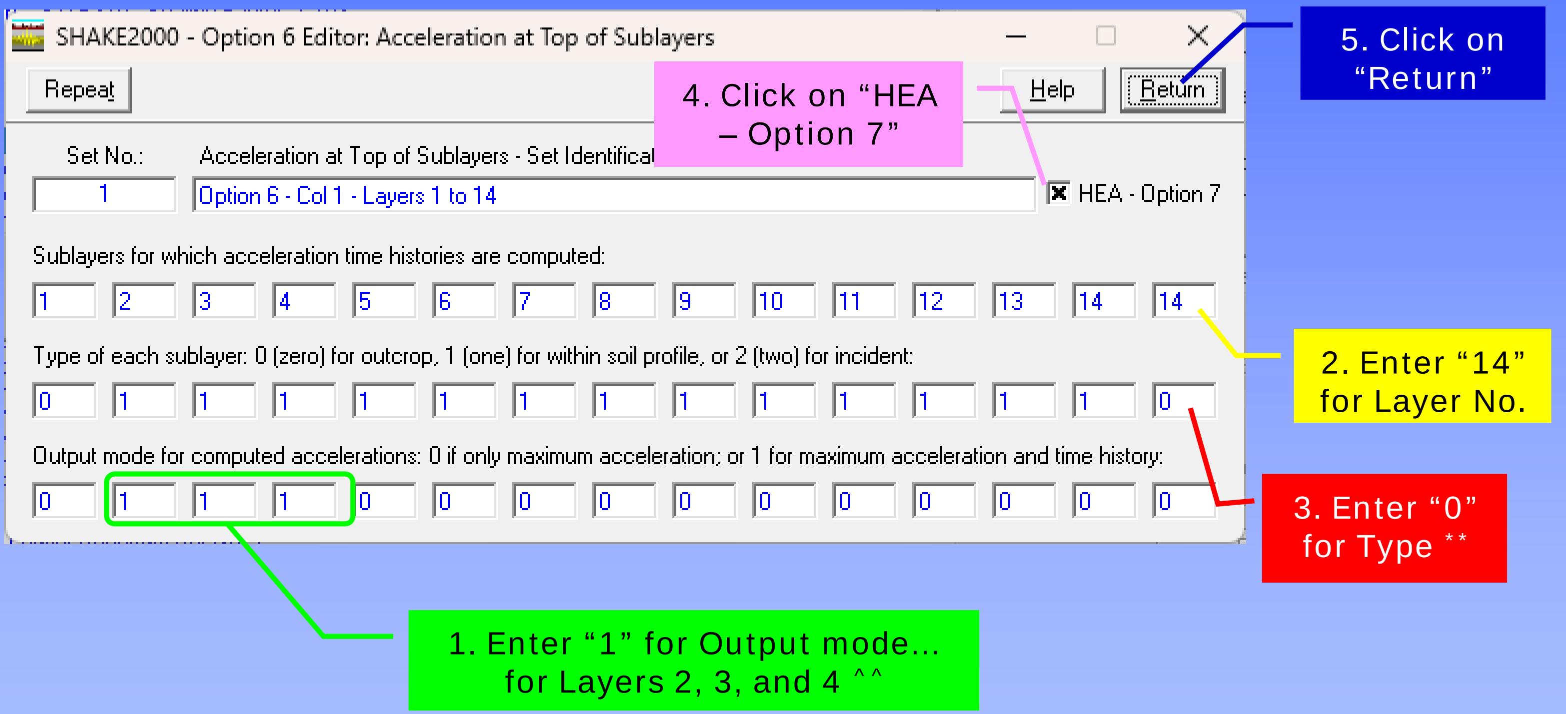


Acceleration time histories at the top of layers 2, 3, and 4 for Column 1, and at the top of layer 4 for Column 2 will be used in the Newmark Displacement Analysis.

GeoMotions

Site Specific Response Analysis

Create Input Data – Option 6: Acceleration Time Histories

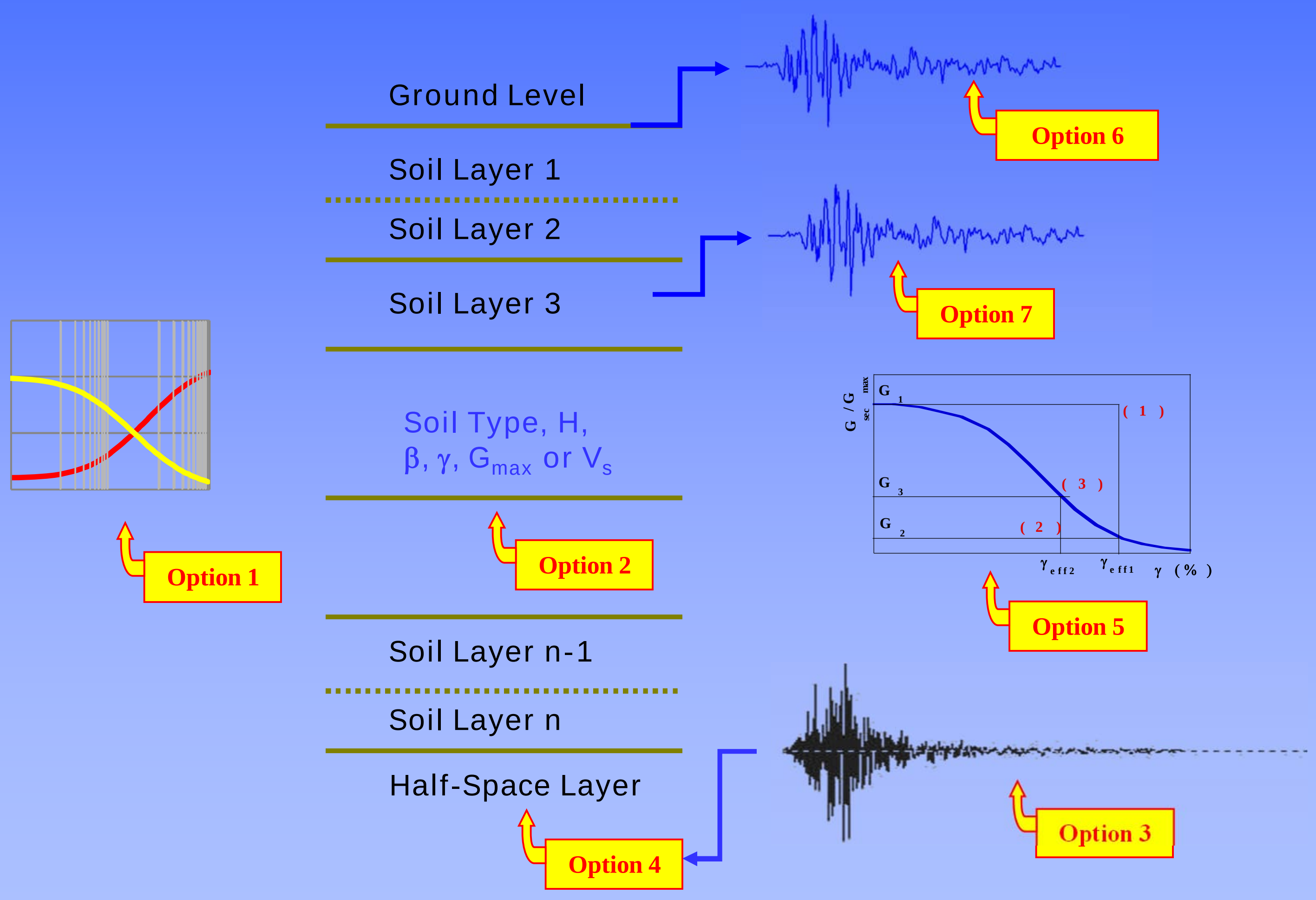


** The second set of values for Layer 14 will just output the input data for the motion assigned as outcrop in Layer 14; the first set will output the results of the analysis at Layer 14, i.e., for the within layer.

^^ Acceleration time histories at the top of layers 2, 3, and 4 will be used in the Newmark Displacement Analysis.

Site Specific Response Analysis

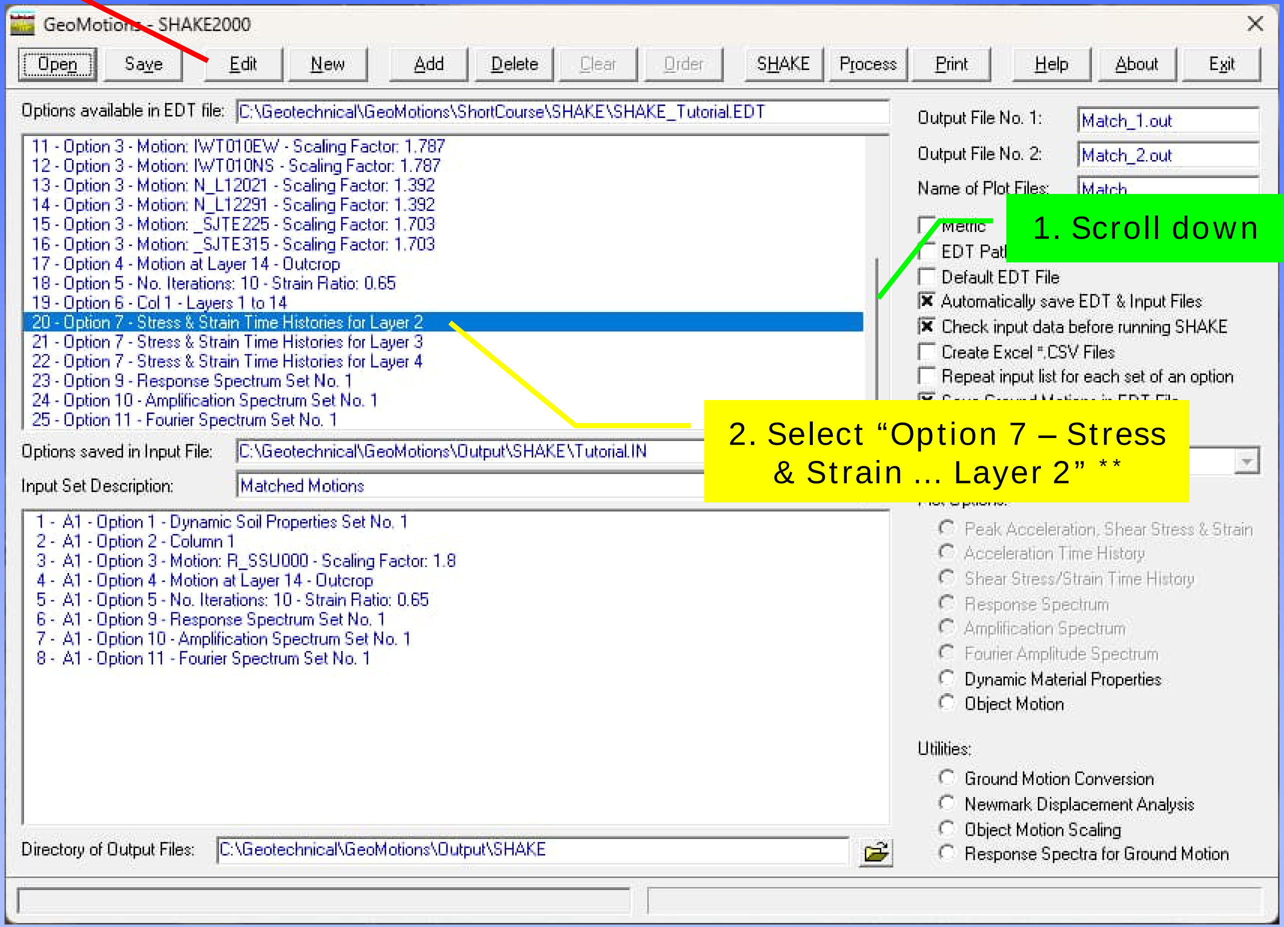
SHAKE Column Option 7 – Stress & Strain Time Histories



Site Specific Response Analysis

Create Input Data

3. Click on “Edit”



1. Scroll down

2. Select “Option 7 – Stress & Strain … Layer 2” **

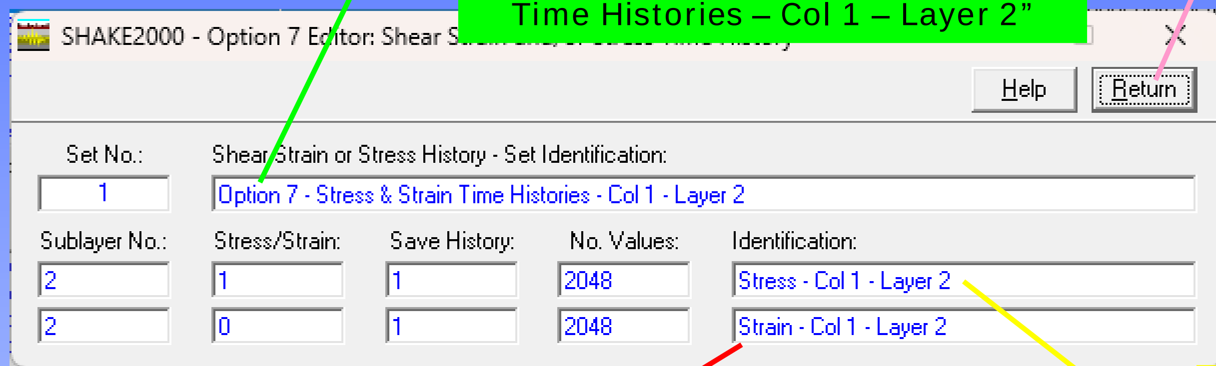
** Option 7 for layers 2, 3, and 4 were automatically created when you selected the “HEA – Option 7” check box in Option 6.

Site Specific Response Analysis

Create Input Data – Option 7: Shear Strain & Shear Stress

1. Enter “Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2”

4. Click on “Return”



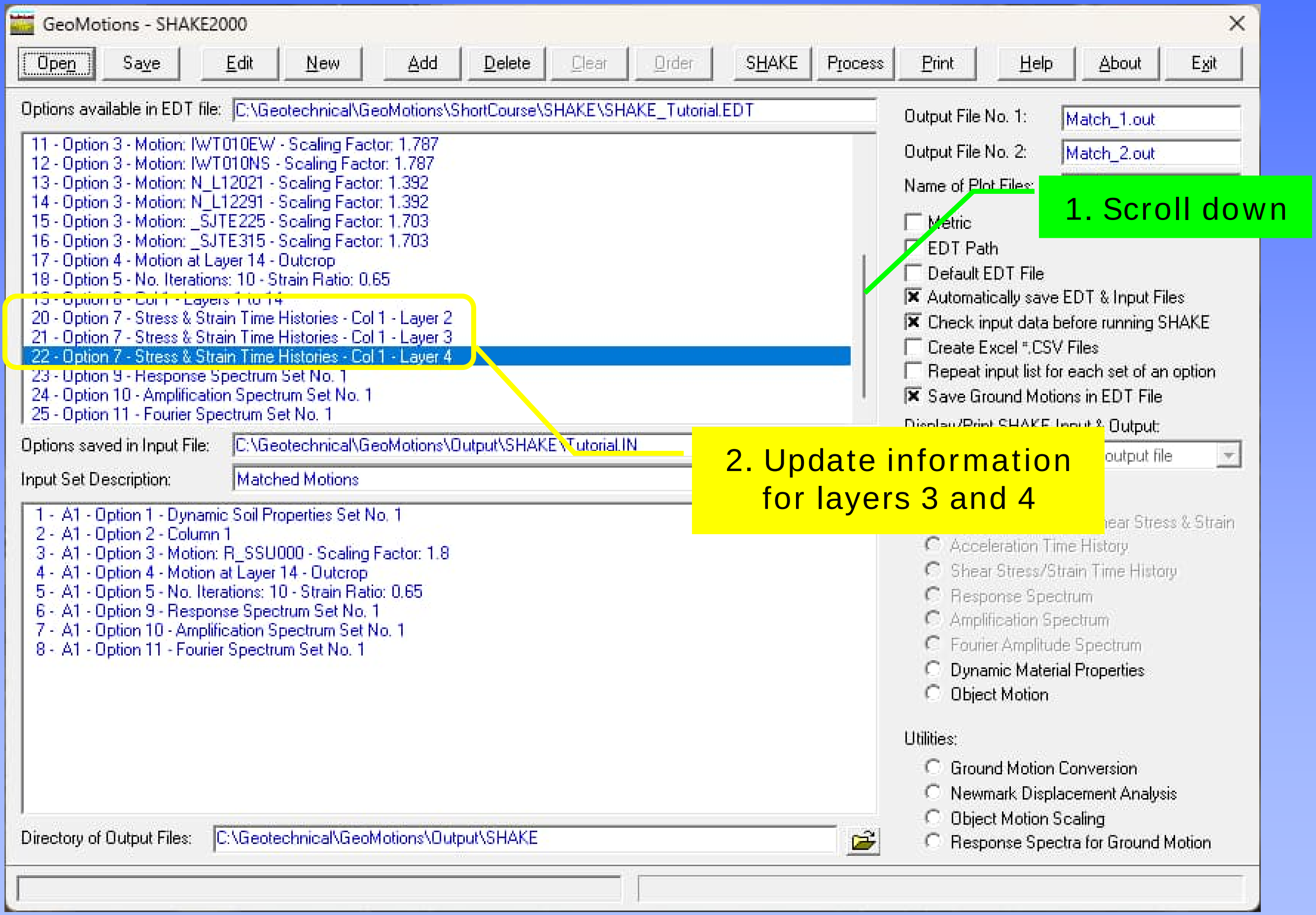
2. Enter “Stress – Col 1 – Layer 2”

3. Enter “Strain – Col 1 – Layer 2”

GeoMotions

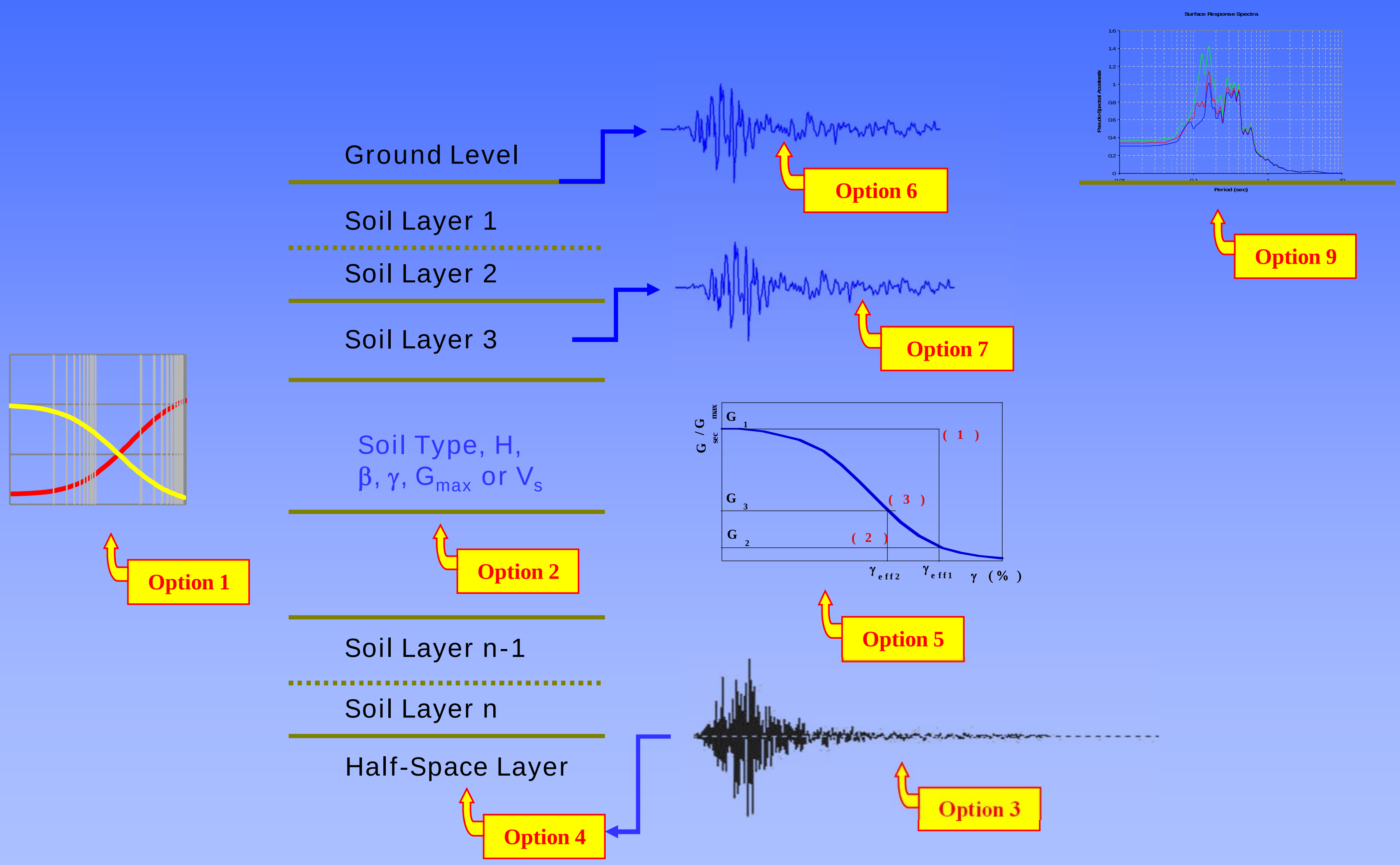
Site Specific Response Analysis

Create Input Data



Site Specific Response Analysis

SHAKE Column Option 9 – Response Spectrum

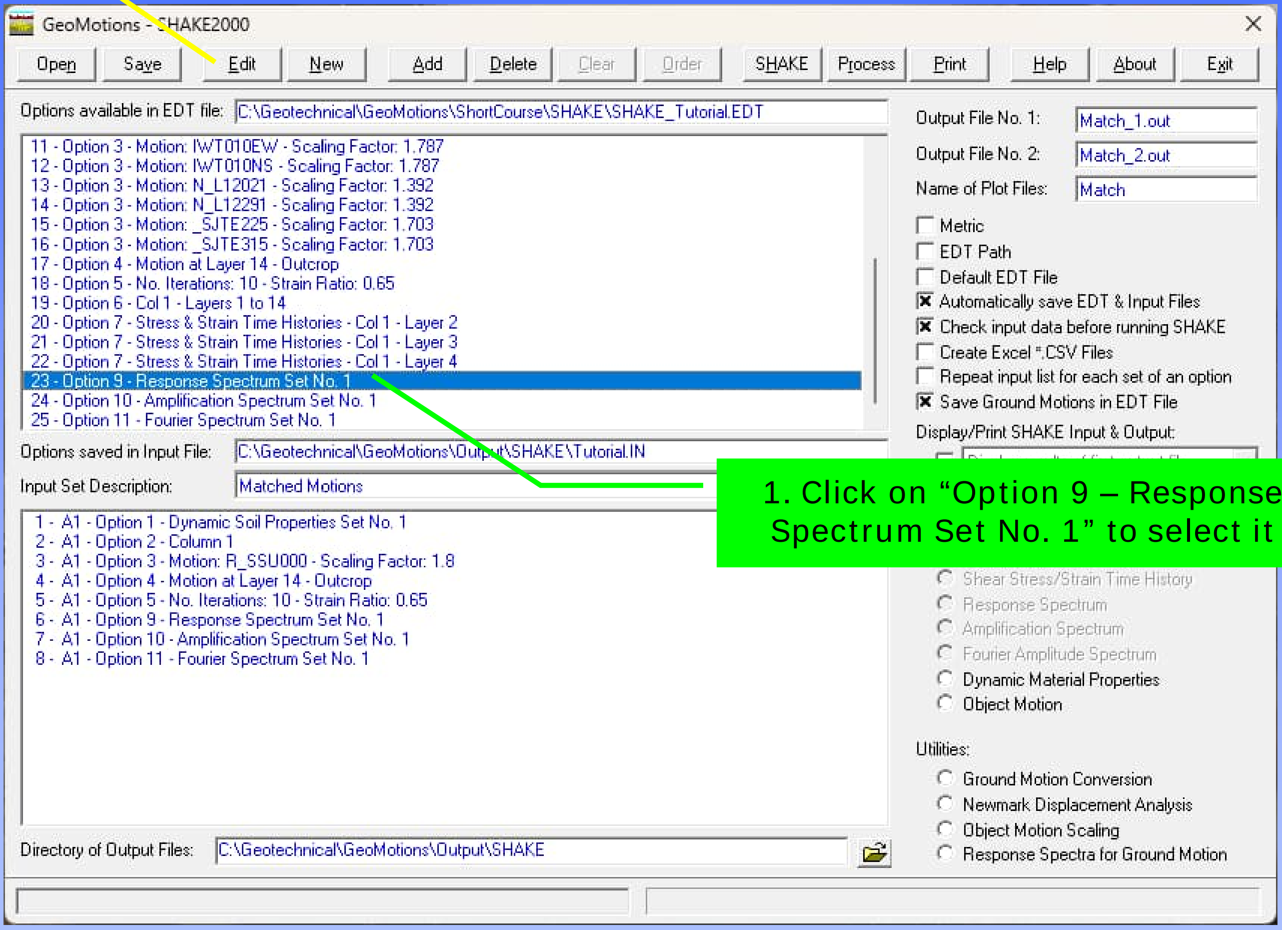


GeoMotions

Site Specific Response Analysis

Create Input Data

2. Click on “Edit”



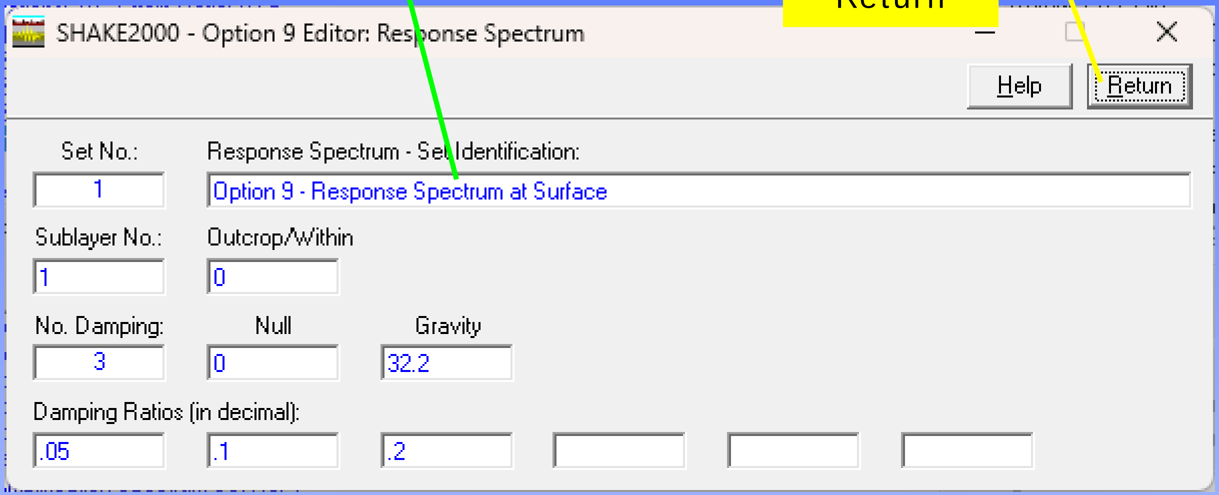
1. Click on “Option 9 – Response Spectrum Set No. 1” to select it

Site Specific Response Analysis

Create Input Data – Option 9: Response Spectrum

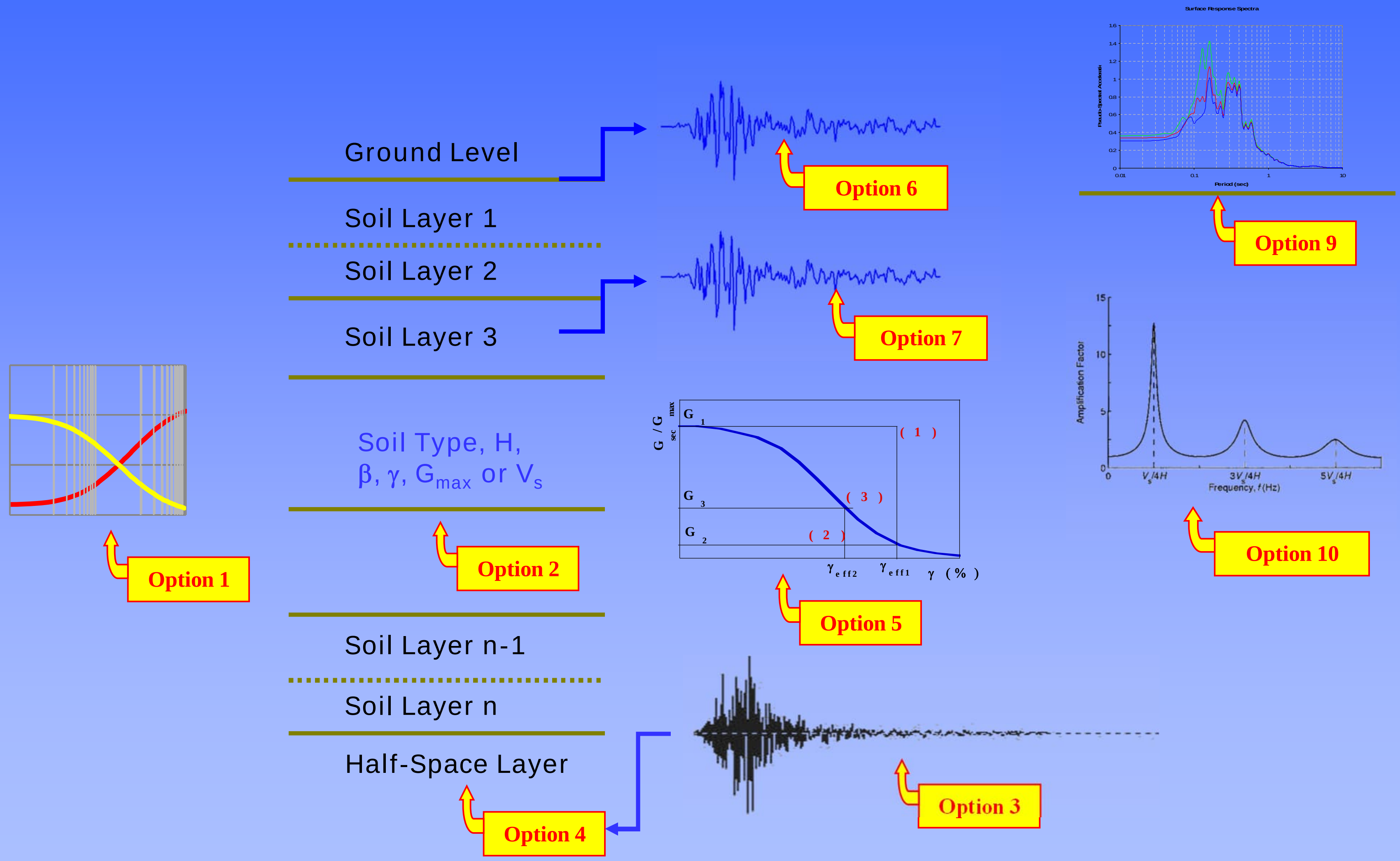
1. Enter “Option 9 – Response Spectrum at Surface”

2. Click on “Return”



Site Specific Response Analysis

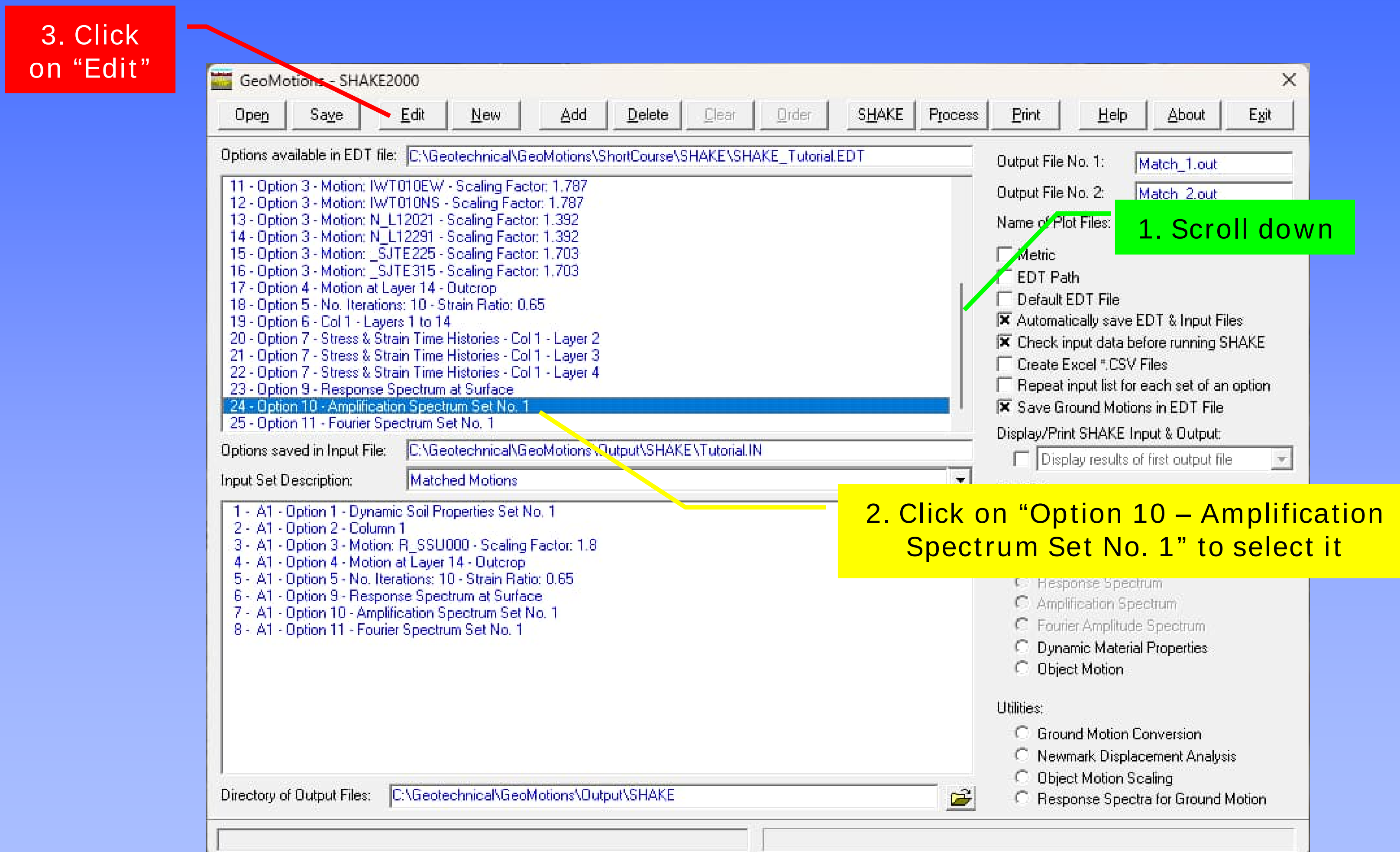
SHAKE Column Option 10 – Amplification Spectrum



GeoMotions

Site Specific Response Analysis

Create Input Data



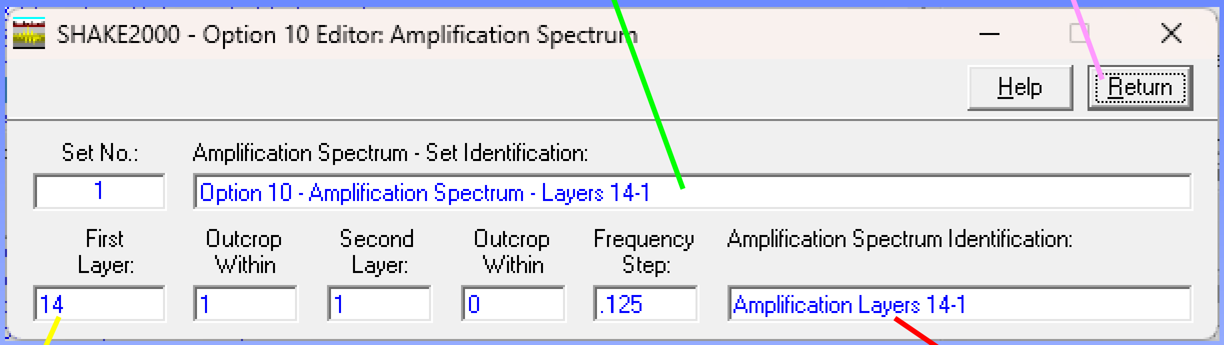
GeoMotions

Site Specific Response Analysis

Create Input Data – Option 10: Amplification Spectrum

1. Enter “Option 10 – Amplification Spectrum – Layers 14-1”

4. Click on “Return”

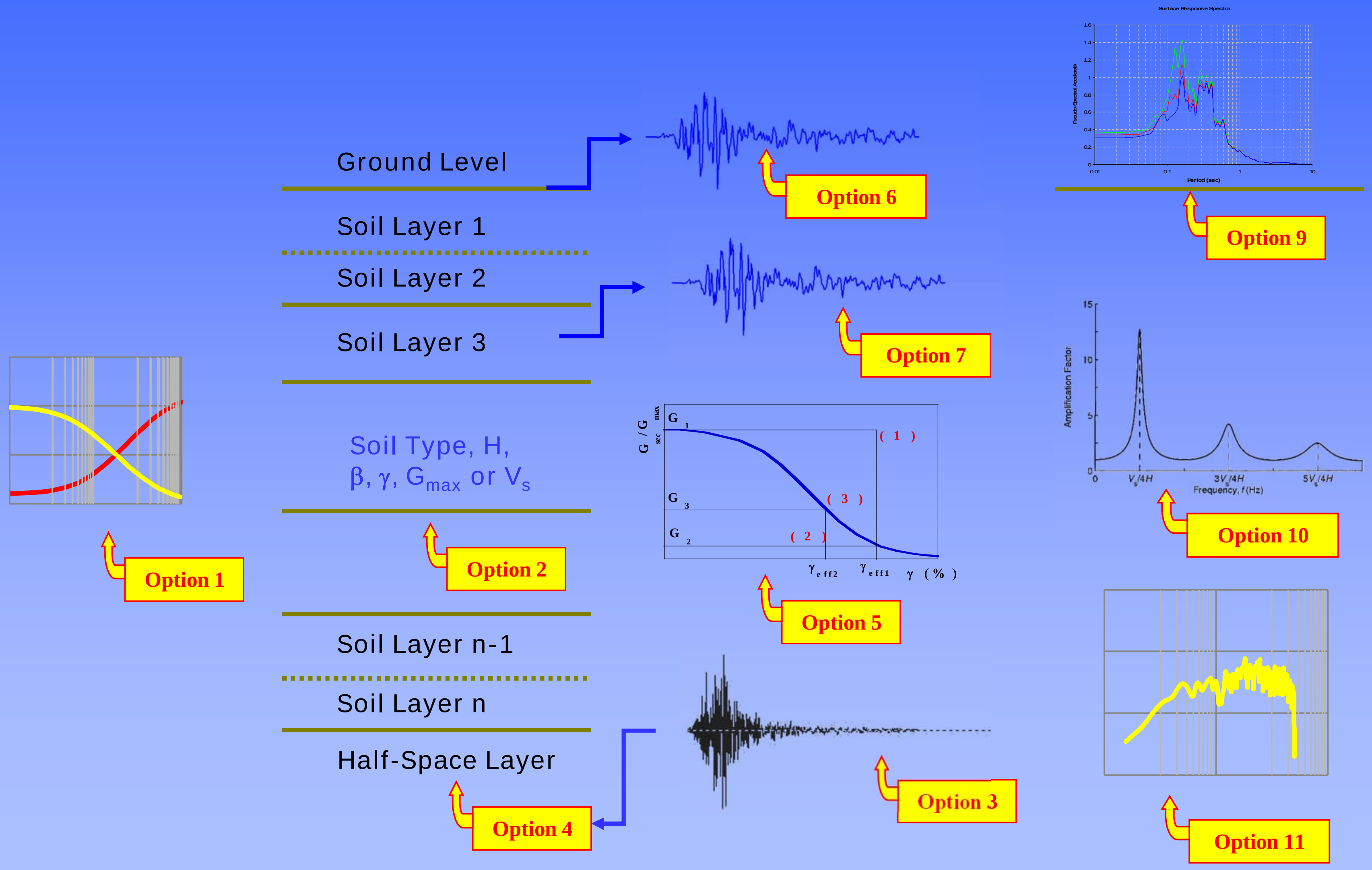


2. Enter “14” in First Layer

3. Enter “Amplification Layers 14-1”

Site Specific Response Analysis

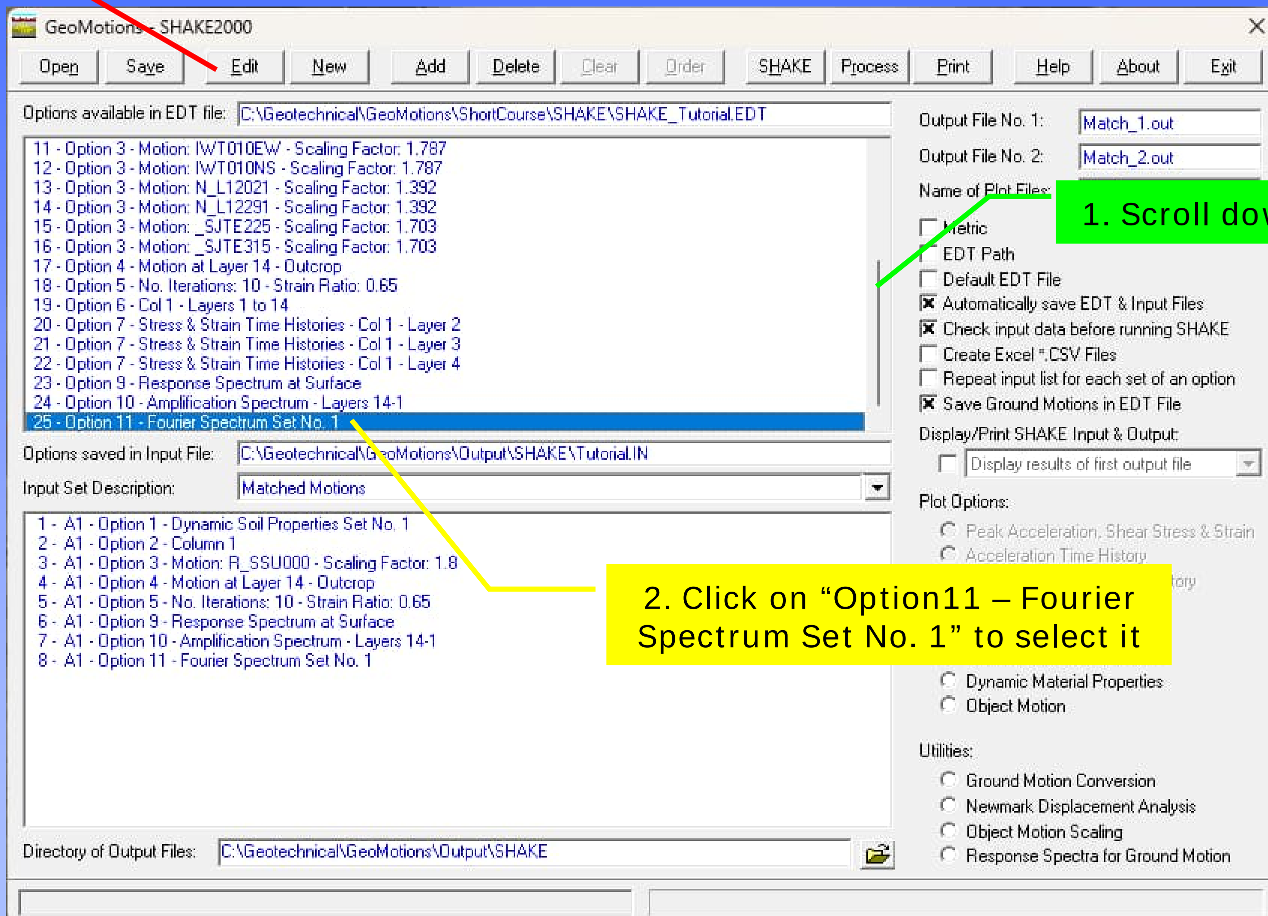
SHAKE Column Option 11 – Fourier Spectrum



Site Specific Response Analysis

Create Input Data

3. Click on “Edit”



1. Scroll down

2. Click on “Option11 – Fourier Spectrum Set No. 1” to select it

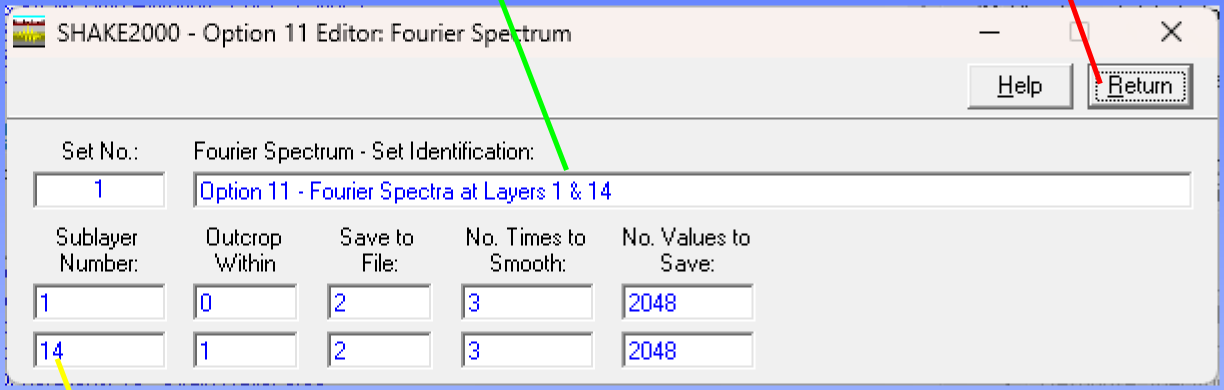
GeoMotions

Site Specific Response Analysis

Create Input Data – Option 11: Fourier Spectrum

1. Enter "Option 11 – Fourier Spectra at Layers 1 & 14"

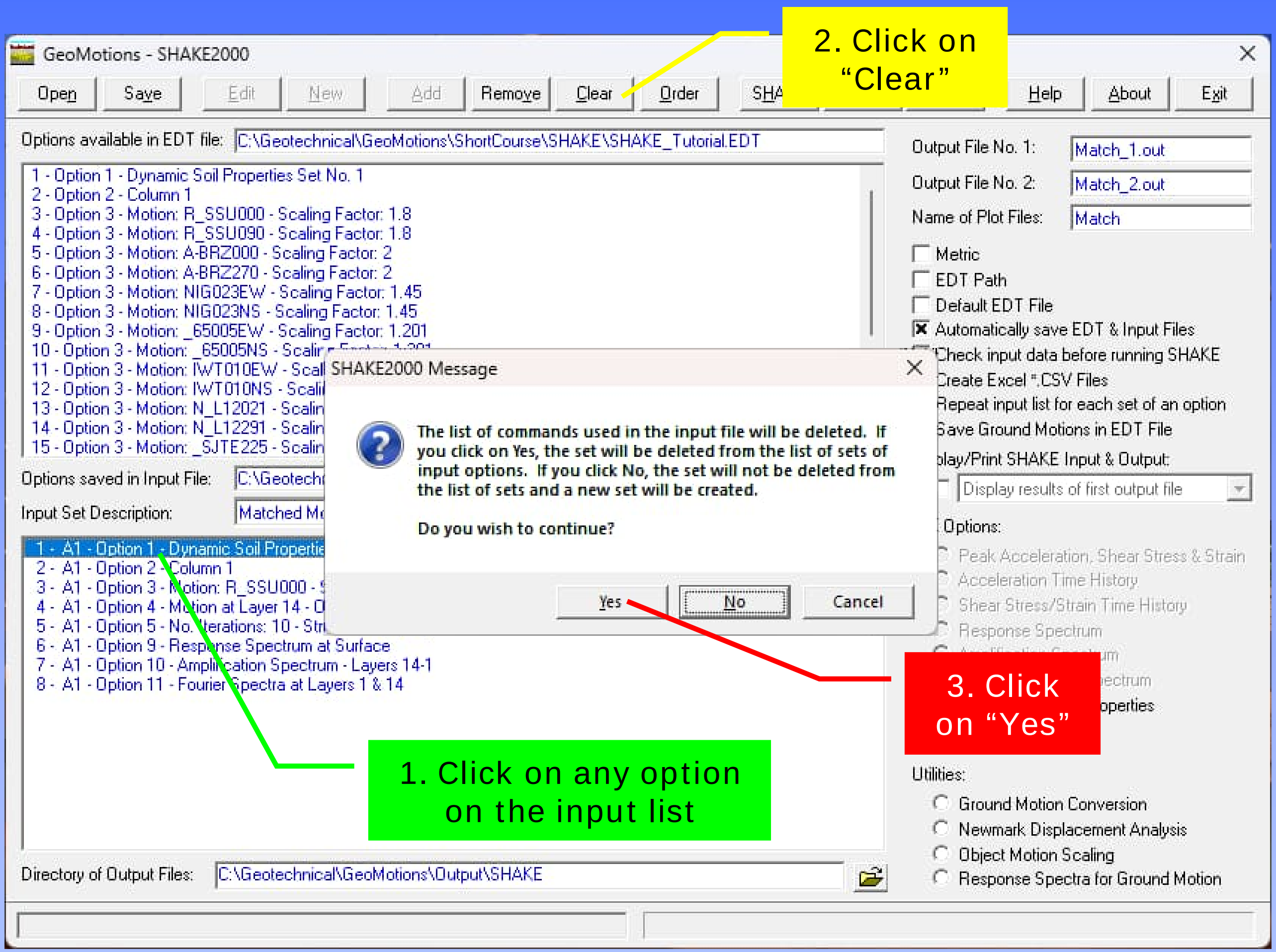
3. Click on "Return"



2. Enter "14" in second cell of Sublayer Number

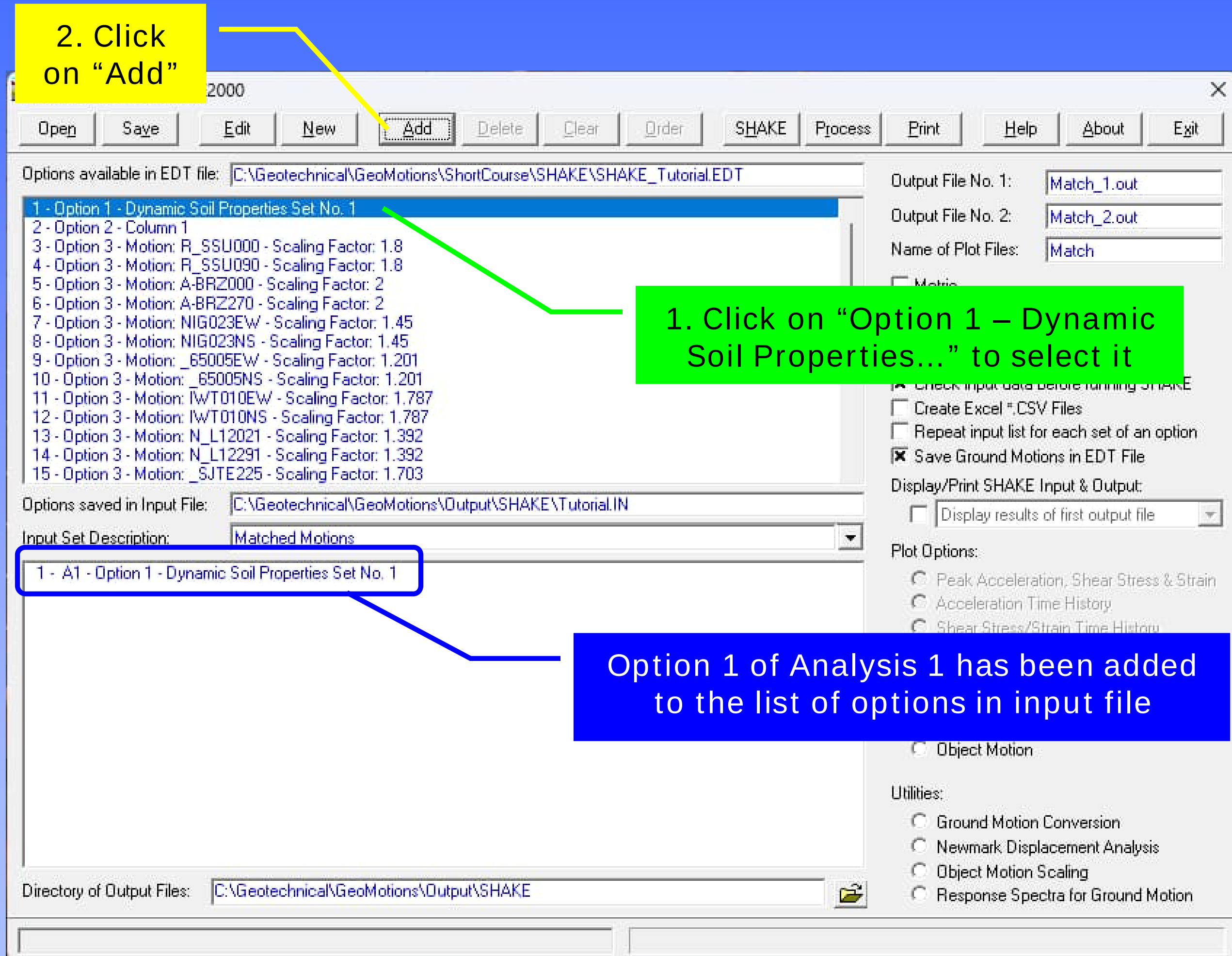
Site Specific Response Analysis

Add Options to Create Input File



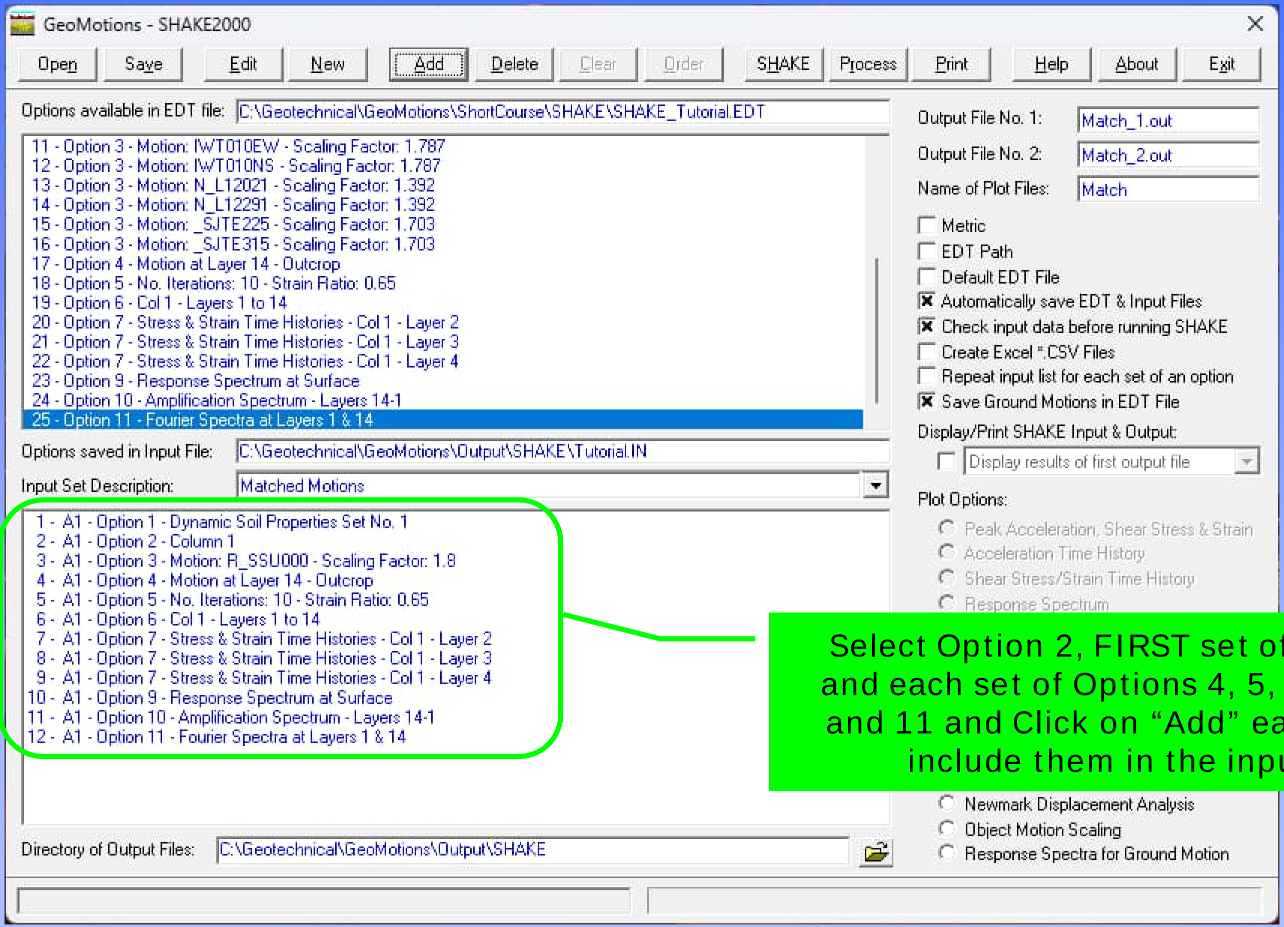
Site Specific Response Analysis

Add Options to Create Input File



Site Specific Response Analysis

Add Options to Create Input File



Select Option 2, FIRST set of Option 3, and each set of Options 4, 5, 6, 7, 9, 10, and 11 and Click on “Add” each time to include them in the input file

GeoMotions

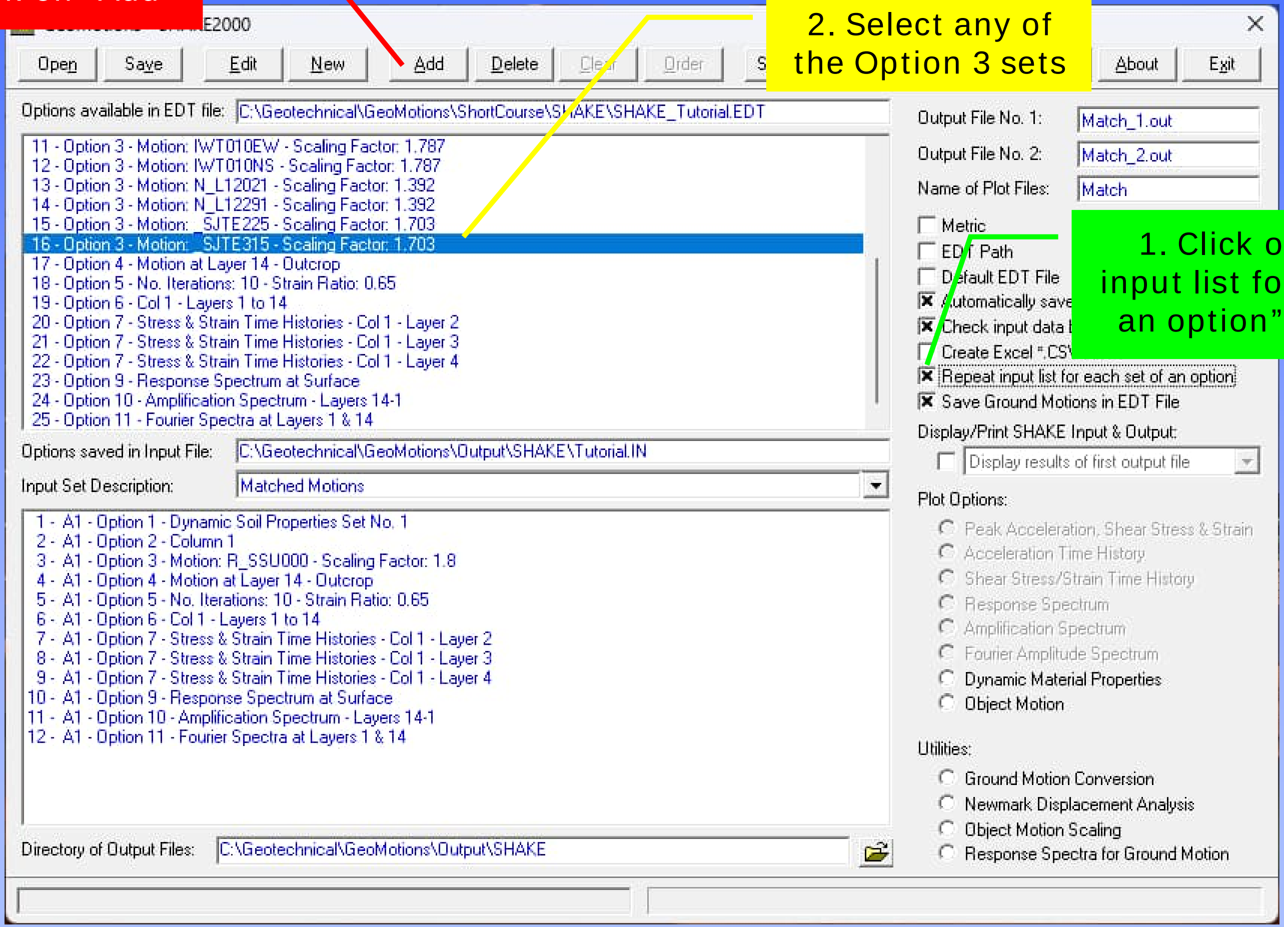
Site Specific Response Analysis

Define Input Options for Multiple Analyses

3. Click on “Add”

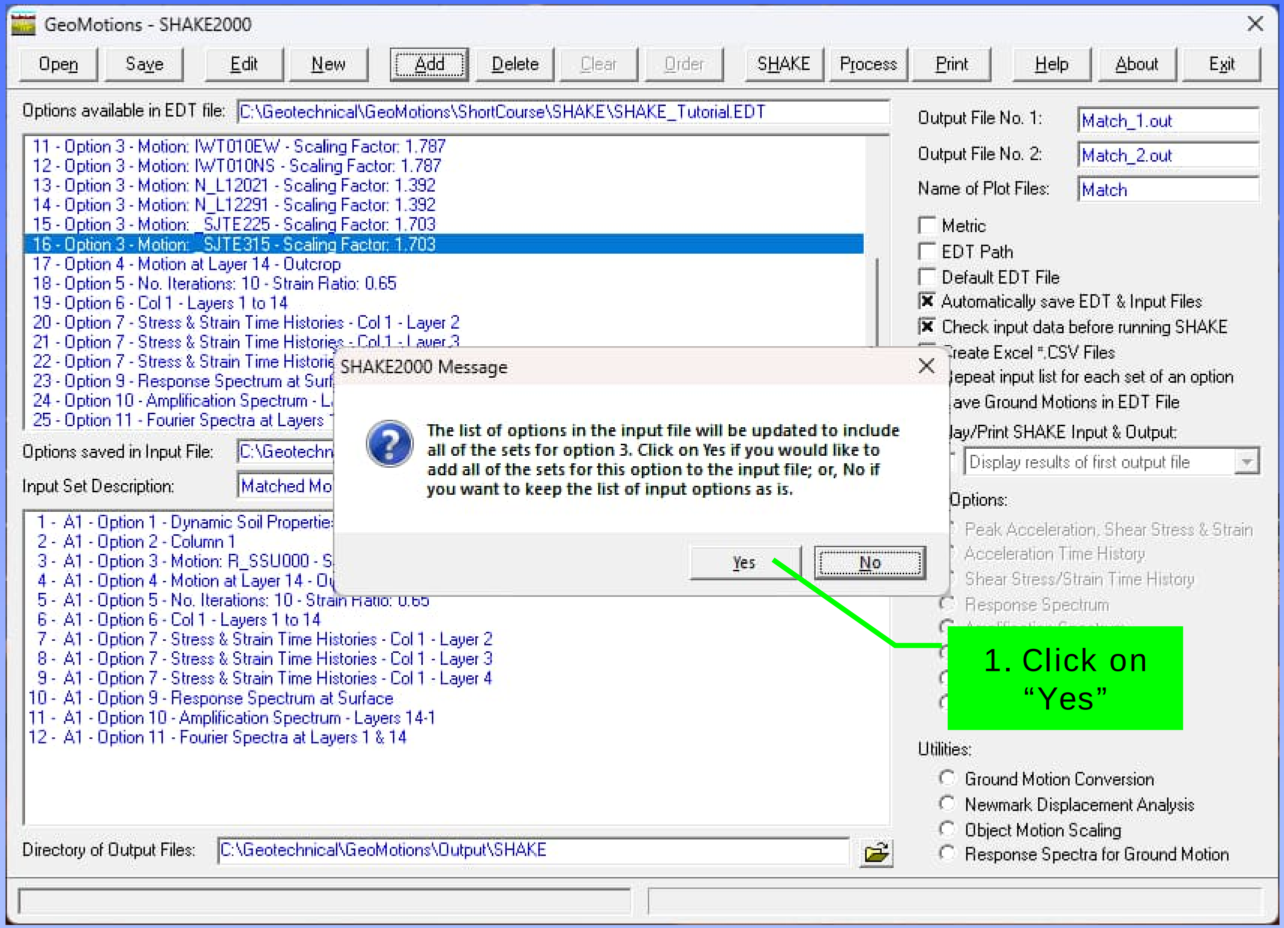
2. Select any of the Option 3 sets

1. Click on “Repeat input list for each set of an option” to select it



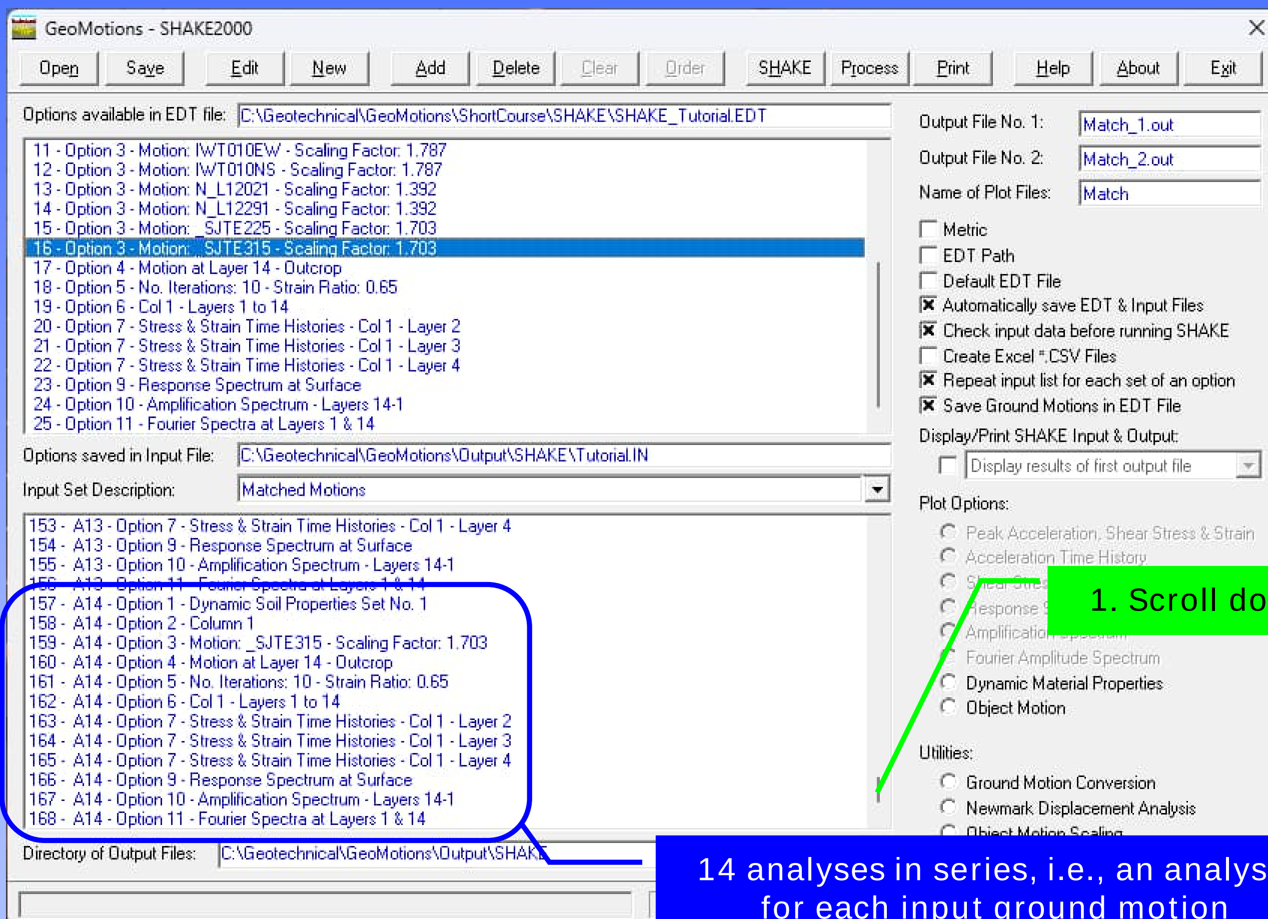
Site Specific Response Analysis

Define Input Options for Multiple Analyses



Site Specific Response Analysis

Define Input Options for Multiple Analyses



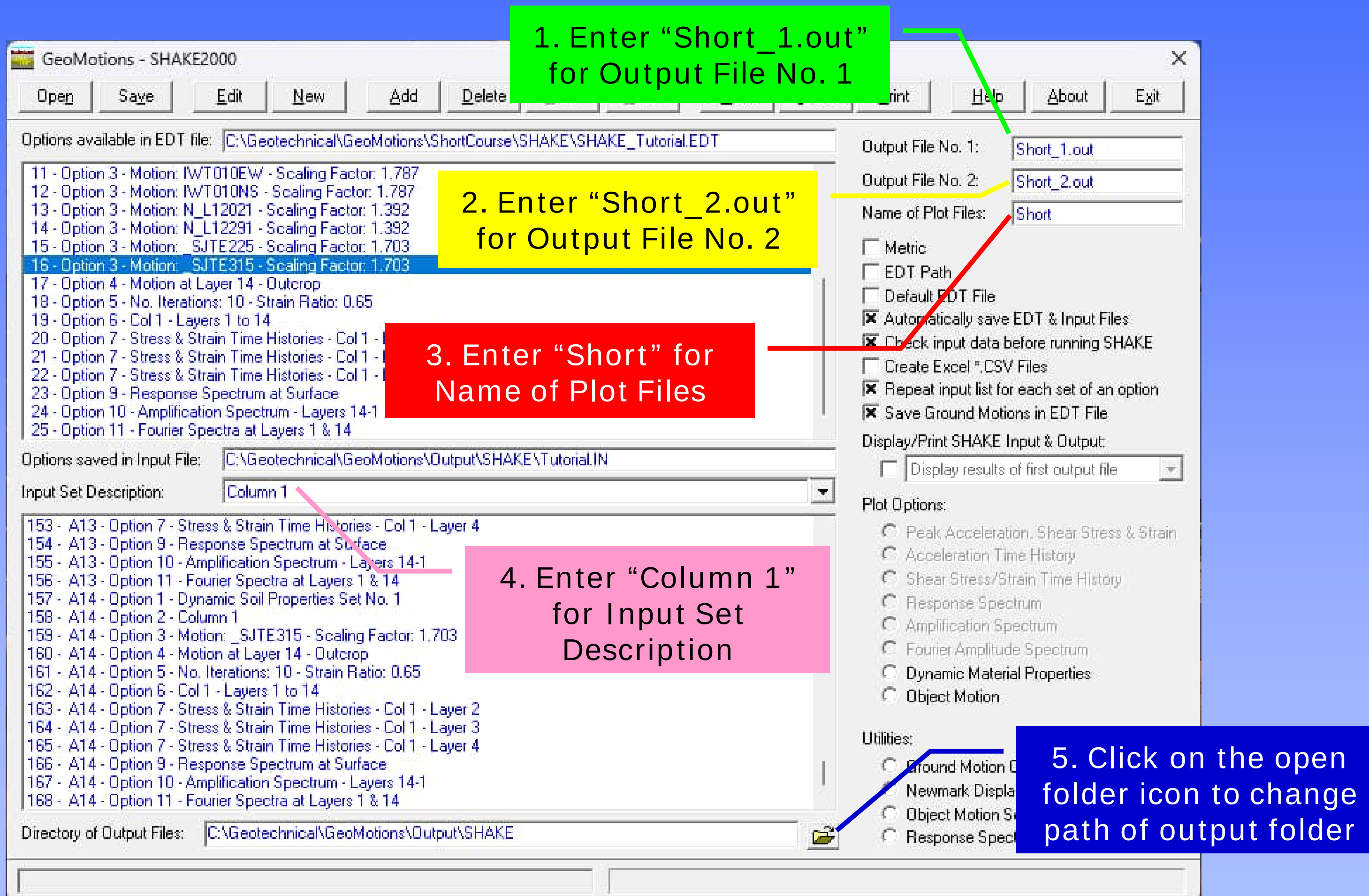
1. Scroll down

14 analyses in series, i.e., an analysis for each input ground motion

GeoMotions

Site Specific Response Analysis

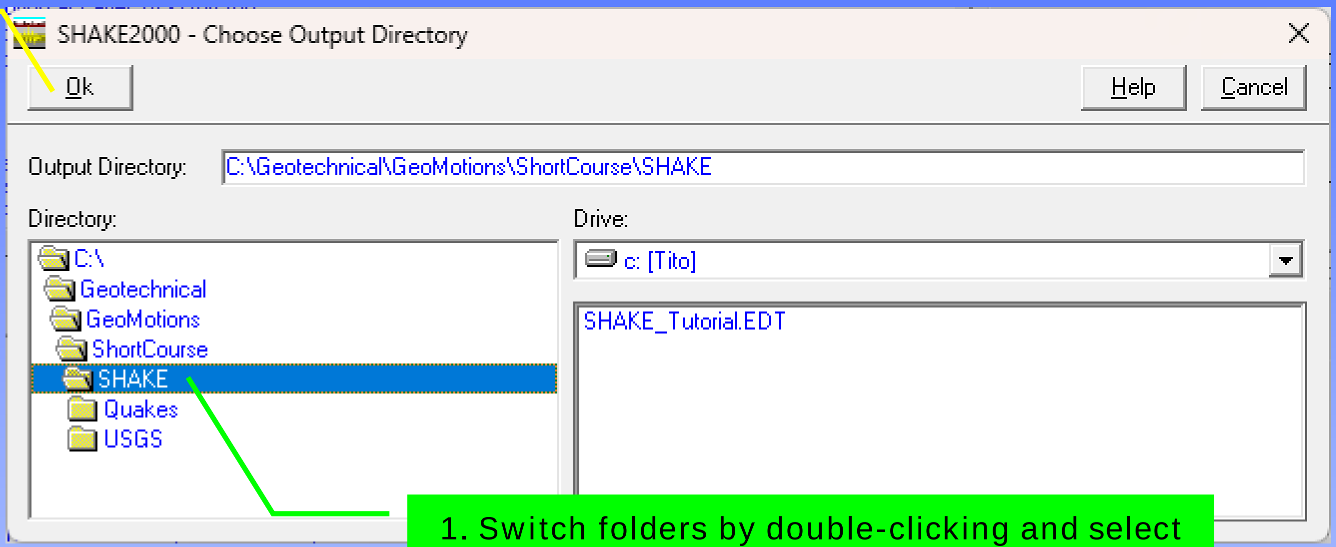
Rename SHAKE’s Output Files and Plot Files



Site Specific Response Analysis

Change Path of Output Folder

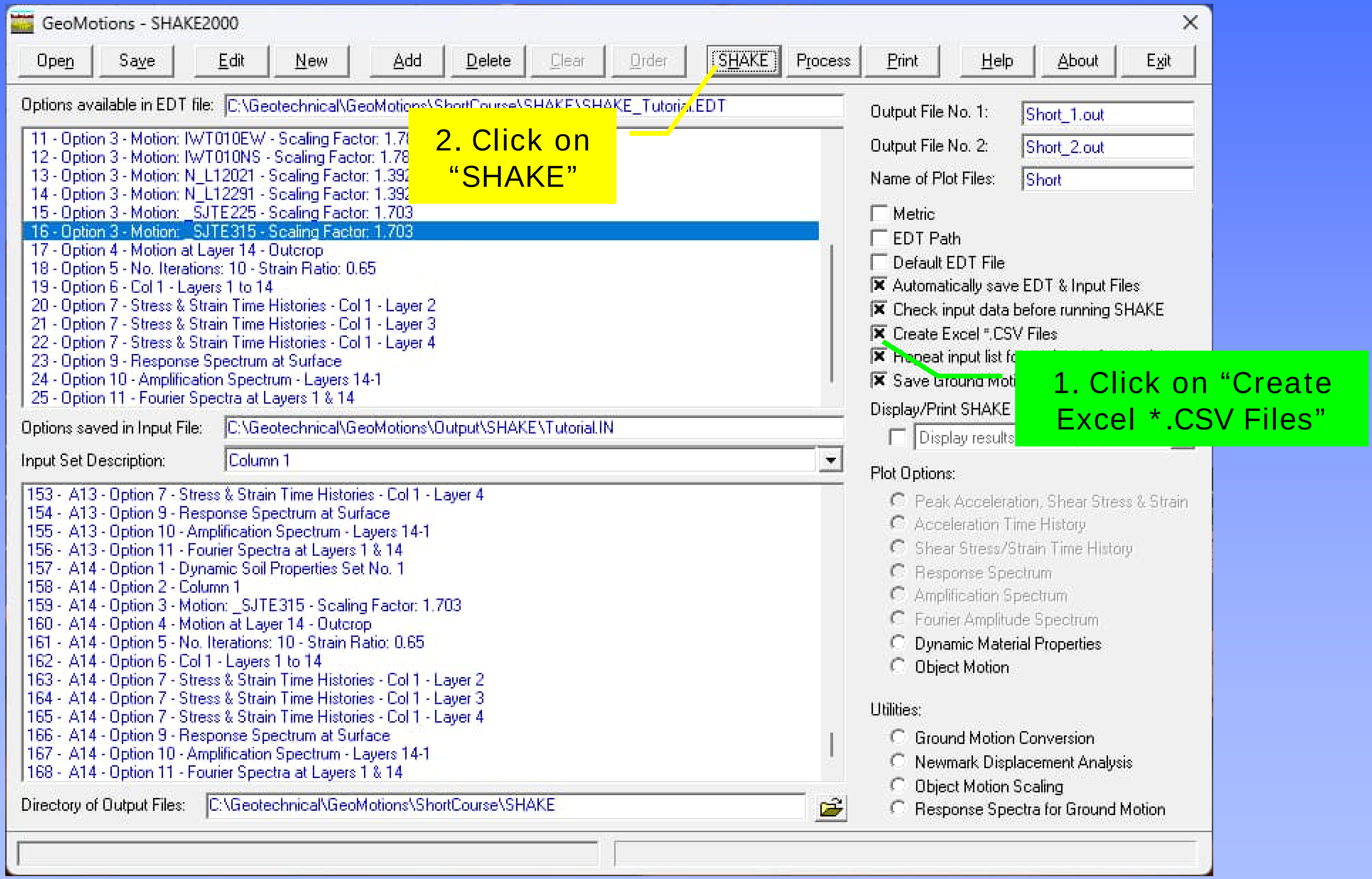
2. Click on “Ok”



1. Switch folders by double-clicking and select “GeoMotions\ShortCourse\SHAKE” folder

Site Specific Response Analysis

Execute SHAKE



Site Specific Response Analysis

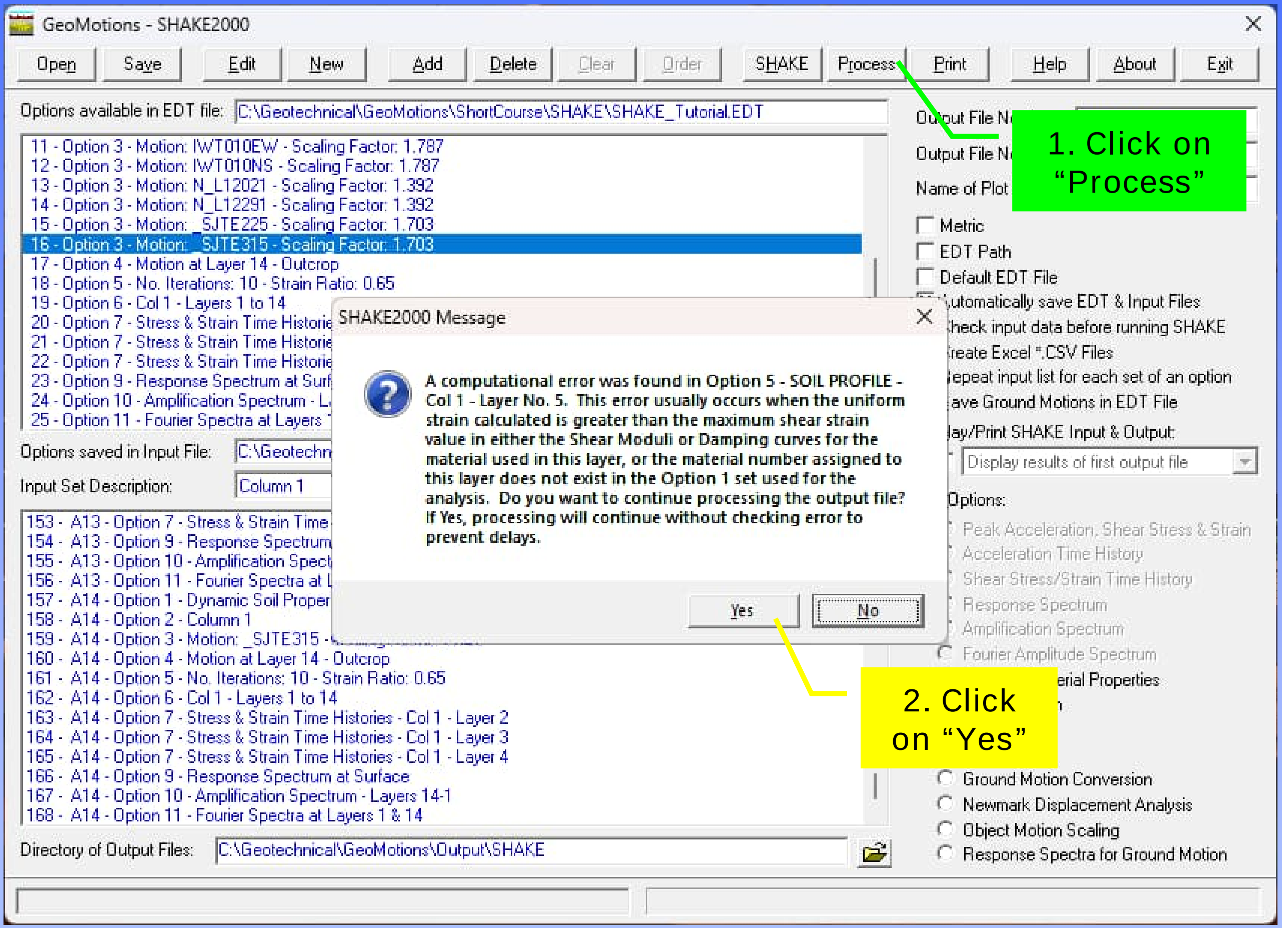
Execute SHAKE

C:\Geotechnical\GeoMotions\

```
***********************************************************
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*     LAYERED SITES by Per Schnable & John Lysmer - 1970  *
* ------------------------------------------------------- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai,Jan 1985 *
* ------------------------------------------------------- *
* SHAKE88 :New modulus reduction curves for clays added   *
*      using results from Sun et al (1988) by J. I. Sun   *
*      & Ramin Golesorkhi February 26, 1988               *
*  -------------------------------------------------------*
* SHAKE90/91: Adjust last iteration; Input now is either  *
*      Gmax or max Vs; up to 13 materials can be specified*
*      by user; up to 50 Layers can be specified; object  *
*      motion can be read in from a separate file and can *
*      user specified format; Different periods for res-  *
*      ponse spectral calculations;options are renumbered;*
*      and general cleanup by: J. I. Sun, I. M. Idriss &  *
*      P. Dirrim June 1990 - February 1991                *
*  ------------------------------------------------------ *
* SHAKE91: General cleanup and finalization of input out- *
*      output format, etc. by: I. M. Idriss December 1991 *
*  ------------------------------------------------------ *
* SHAKE2000: Fix incorrect output of total stress in      *
* option 2, changed path to ground motion file in         *
* SHAKE91, input file, increased motion to 30,000 values  *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020   *
*          RUN DATE  3/15/2025                            *
*          RUN TIME 16:40                                 *
***********************************************************
```

Site Specific Response Analysis

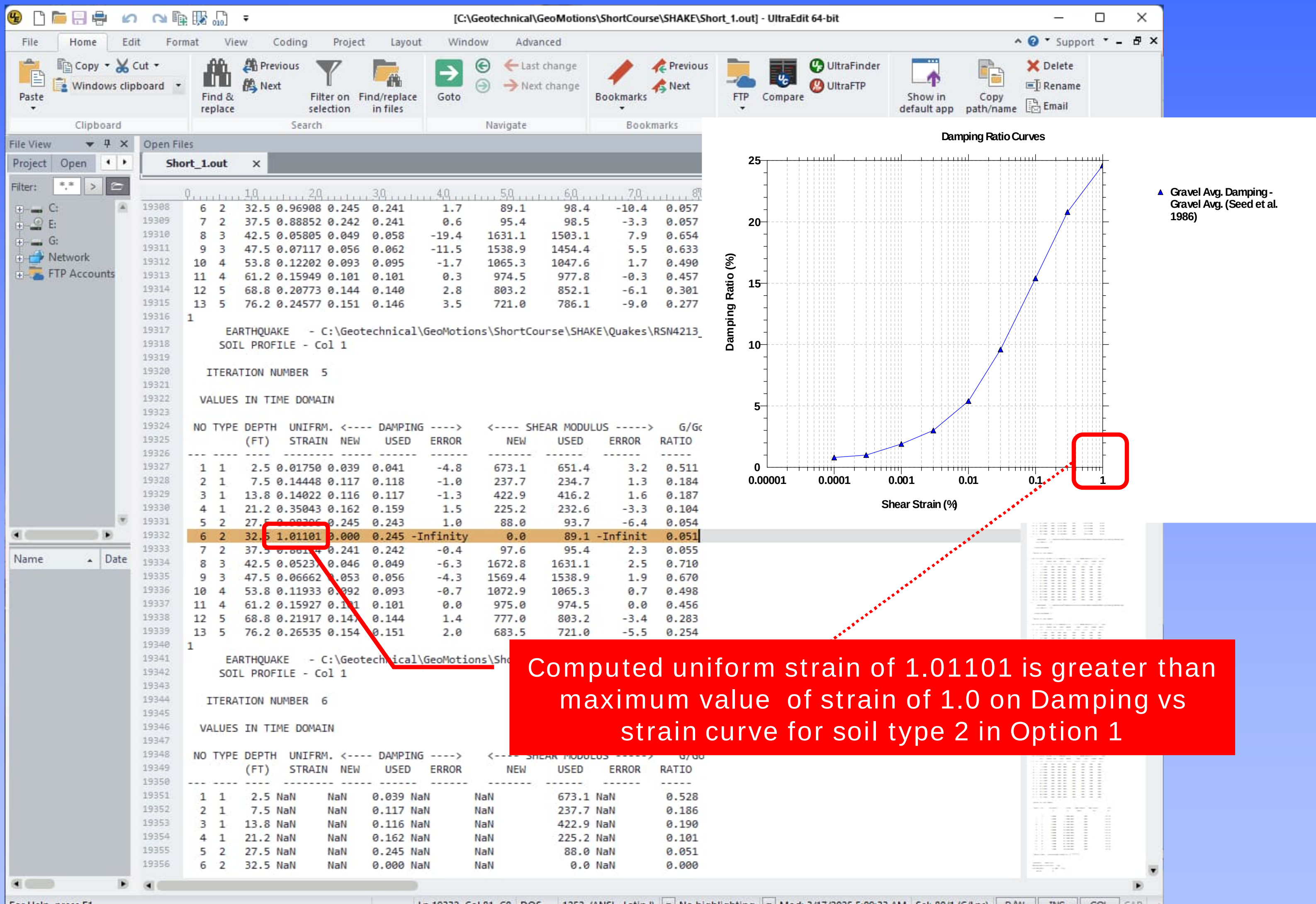
Process SHAKE's Output Files



GeoMotions

Site Specific Response Analysis

Most Common Error when Processing Output Files

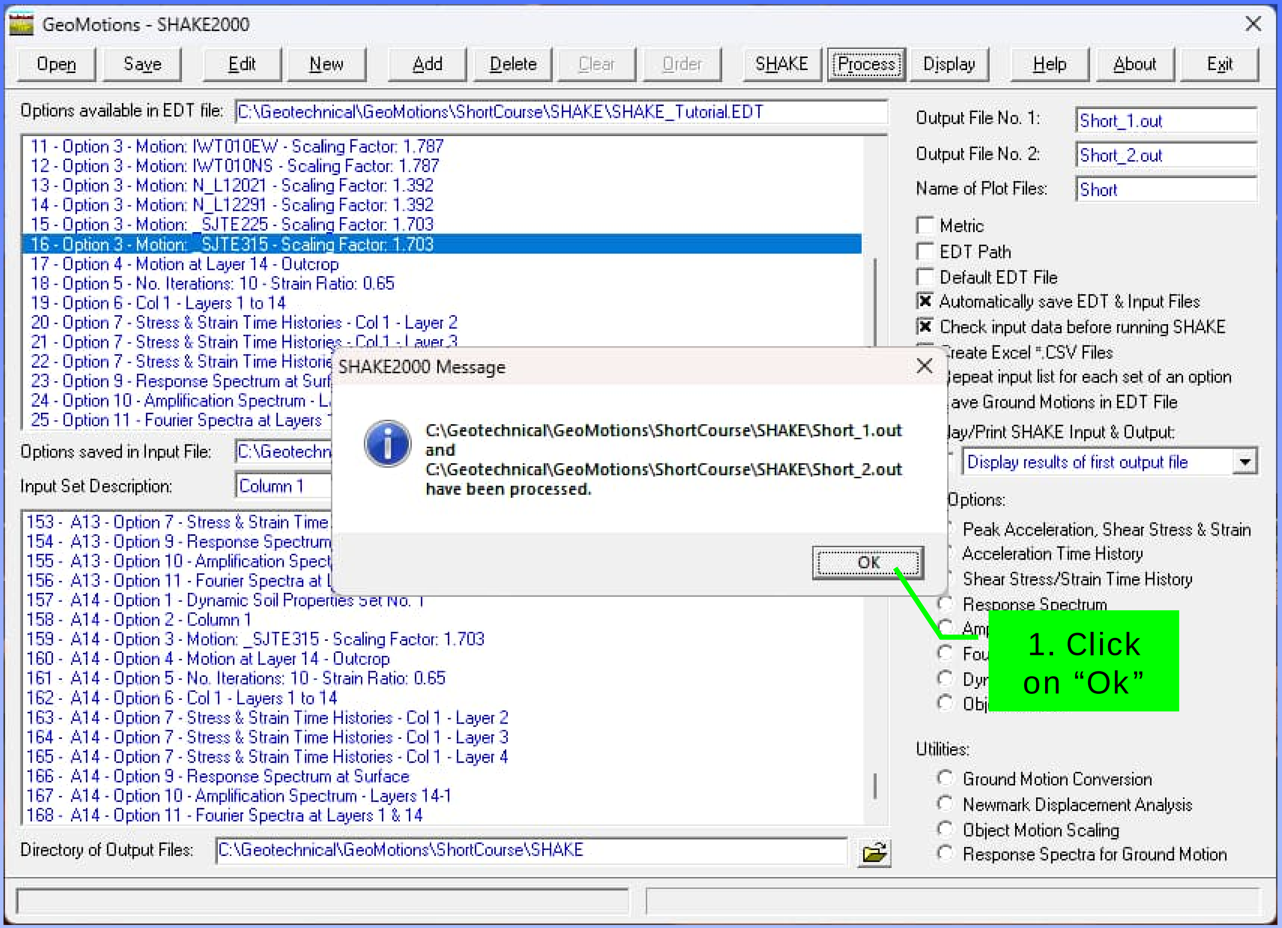



```
  6  2   32.5 0.96908 0.245  0.241     1.7     89.1     98.4    -10.4   0.057
  7  2   37.5 0.88852 0.242  0.241     0.6     95.4     98.5     -3.3   0.057
  8  3   42.5 0.05805 0.049  0.058   -19.4   1631.1   1503.1      7.9   0.654
  9  3   47.5 0.07117 0.056  0.062   -11.5   1538.9   1454.4      5.5   0.633
 10  4   53.8 0.12202 0.093  0.095    -1.7   1065.3   1047.6      1.7   0.490
 11  4   61.2 0.15949 0.101  0.101     0.3    974.5    977.8     -0.3   0.457
 12  5   68.8 0.20773 0.144  0.140     2.8    803.2    852.1     -6.1   0.301
 13  5   76.2 0.24577 0.151  0.146     3.5    721.0    786.1     -9.0   0.277
1
      EARTHQUAKE   - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Quakes\RSN4213_
     SOIL PROFILE - Col 1

   ITERATION NUMBER  5

  VALUES IN TIME DOMAIN

 NO TYPE DEPTH  UNIFRM. <---- DAMPING ---->    <---- SHEAR MODULUS ----->    G/Gc
         (FT)   STRAIN  NEW    USED   ERROR      NEW     USED    ERROR   RATIO
--- ---- ----  -------- ----- ------  ------   -------  ------   ------   -----
  1  1    2.5 0.01750 0.039  0.041    -4.8    673.1    651.4      3.2   0.511
  2  1    7.5 0.14448 0.117  0.118    -1.0    237.7    234.7      1.3   0.184
  3  1   13.8 0.14022 0.116  0.117    -1.3    422.9    416.2      1.6   0.187
  4  1   21.2 0.35043 0.162  0.159     1.5    225.2    232.6     -3.3   0.104
  5  2   27.5 [illegible] 0.245  0.243     1.0     88.0     93.7     -6.4   0.054
  6  2   32.5 1.01101 0.000  0.245 -Infinity     0.0     89.1 -Infinit   0.051
  7  2   37.5 [illegible] 0.241  0.242    -0.4     97.6     95.4      2.3   0.055
  8  3   42.5 0.05237 0.046  0.049    -6.3   1672.8   1631.1      2.5   0.710
  9  3   47.5 0.06662 0.053  0.056    -4.3   1569.4   1538.9      1.9   0.670
 10  4   53.8 0.11933 0.092  0.093    -0.7   1072.9   1065.3      0.7   0.498
 11  4   61.2 0.15927 0.101  0.101     0.0    975.0    974.5      0.0   0.456
 12  5   68.8 0.21917 0.147  0.144     1.4    777.0    803.2     -3.4   0.283
 13  5   76.2 0.26535 0.154  0.151     2.0    683.5    721.0     -5.5   0.254
1
      EARTHQUAKE   - C:\Geotechnical\GeoMotions\Sho
     SOIL PROFILE - Col 1

   ITERATION NUMBER  6

  VALUES IN TIME DOMAIN

 NO TYPE DEPTH  UNIFRM. <---- DAMPING ---->    <---- SHEAR MODULUS ----->    G/Gc
         (FT)   STRAIN  NEW    USED   ERROR      NEW     USED    ERROR   RATIO
--- ---- ----  -------- ----- ------  ------   -------  ------   ------   -----
  1  1    2.5 NaN     NaN    0.039 NaN      NaN      673.1 NaN      0.528
  2  1    7.5 NaN     NaN    0.117 NaN      NaN      237.7 NaN      0.186
  3  1   13.8 NaN     NaN    0.116 NaN      NaN      422.9 NaN      0.190
  4  1   21.2 NaN     NaN    0.162 NaN      NaN      225.2 NaN      0.101
  5  2   27.5 NaN     NaN    0.245 NaN      NaN       88.0 NaN      0.051
  6  2   32.5 NaN     NaN    0.000 NaN      NaN        0.0 NaN      0.000
```


Computed uniform strain of 1.01101 is greater than maximum value of strain of 1.0 on Damping vs strain curve for soil type 2 in Option 1

Site Specific Response Analysis

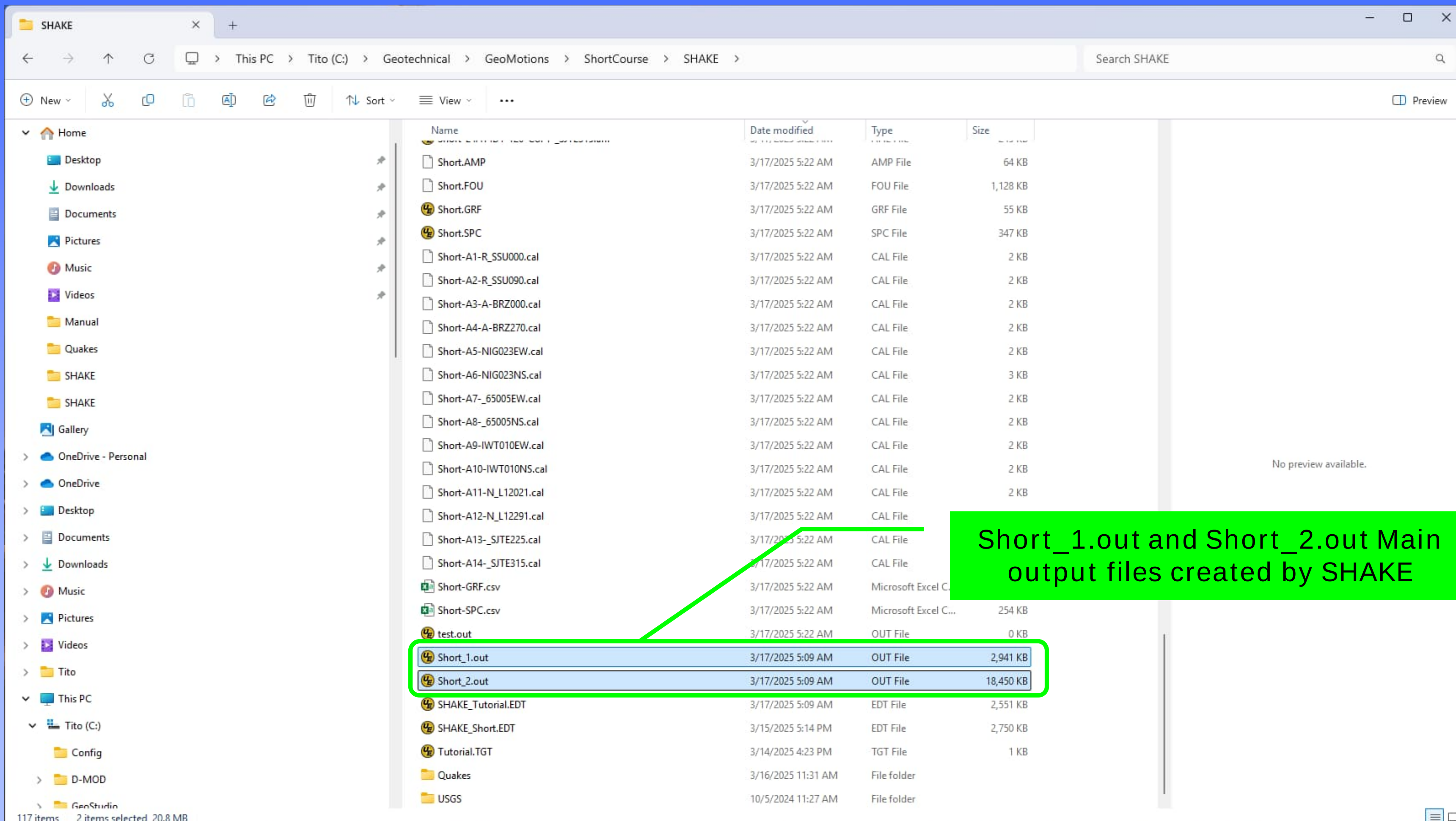
Process SHAKE's Output Files



GeoMotions

Site Specific Response Analysis

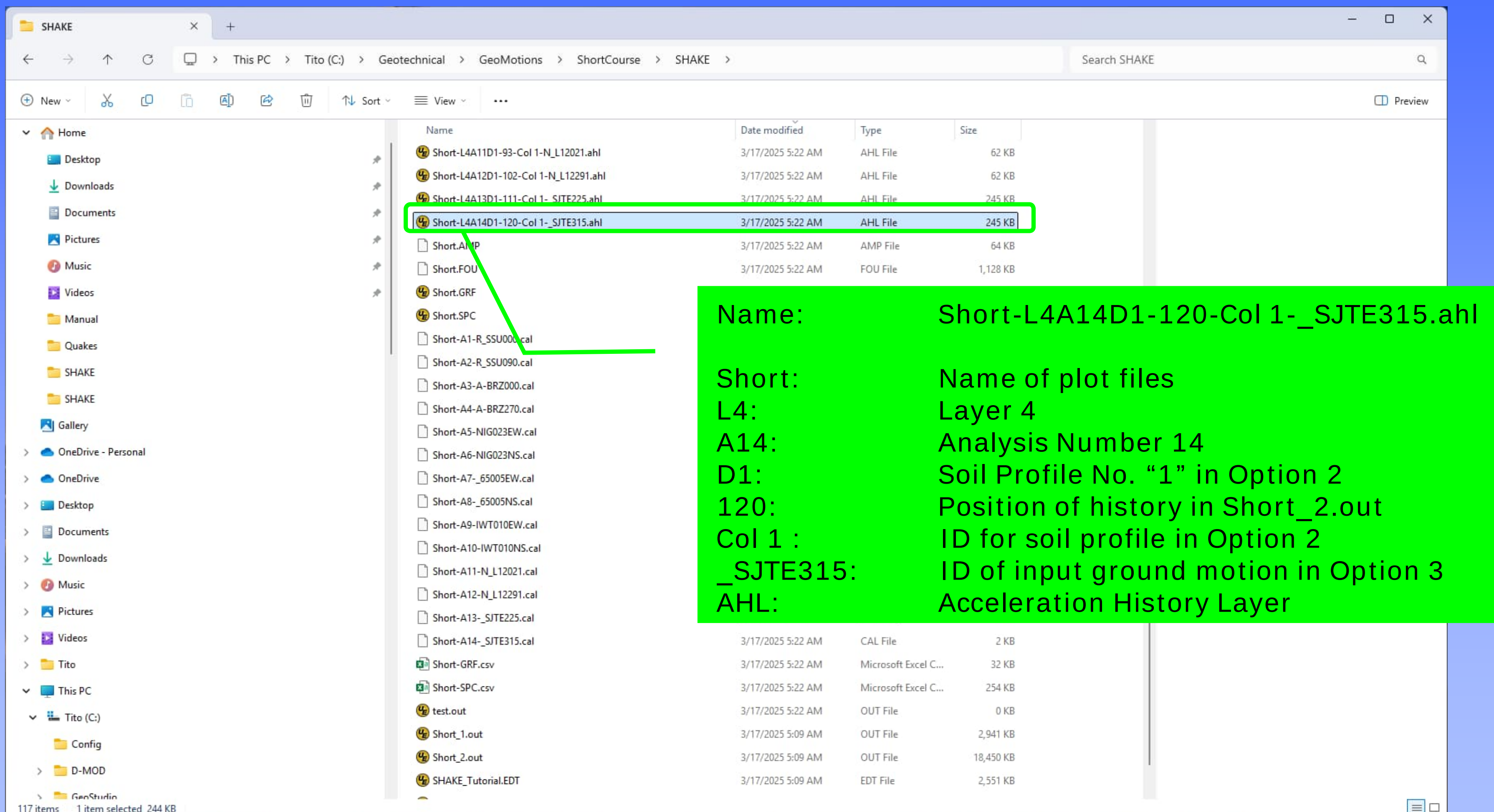
SHAKE2000 Output Files



GeoMotions

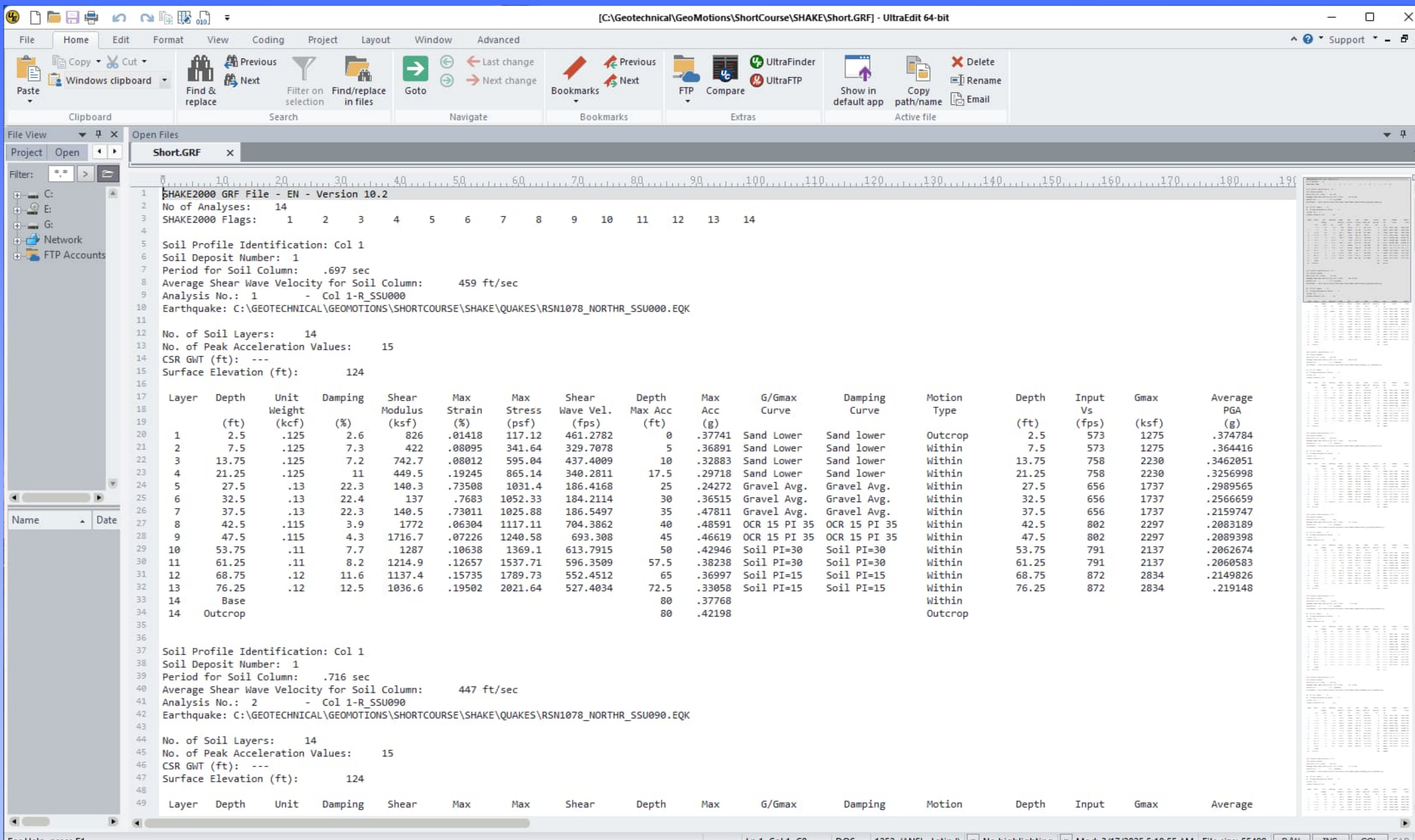
Site Specific Response Analysis

SHAKE2000 Output Files - Nomenclature



Site Specific Response Analysis

Output Files Generated by SHAKE2000 – Text Files



[C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short.GRF] - UltraEdit 64-bit

SHAKE2000 GRF File - EN - Version 10.2
No of Analyses: 14
SHAKE2000 Flags: 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Soil Profile Identification: Col 1
Soil Deposit Number: 1
Period for Soil Column: .697 sec
Average Shear Wave Velocity for Soil Column: 459 ft/sec
Analysis No.: 1 - Col 1-R_SSU000
Earthquake: C:\GEOTECHNICAL\GEOMOTIONS\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTHR_SSU000.EQK

No. of Soil Layers: 14
No. of Peak Acceleration Values: 15
CSR GWT (ft): ---
Surface Elevation (ft): 124

Layer	Depth (ft)	Unit Weight (kcf)	Damping (%)	Shear Modulus (ksf)	Max Strain (%)	Max Stress (psf)	Shear Wave Vel. (fps)	Depth Max Acc (ft)	Max Acc (g)	G/Gmax Curve	Damping Curve	Motion Type	Depth (ft)	Input Vs (fps)	Gmax (ksf)	Average PGA (g)
1	2.5	.125	2.6	826	.01418	117.12	461.2782	0	.37741	Sand Lower	Sand lower	Outcrop	2.5	573	1275	.374784
2	7.5	.125	7.3	422	.08095	341.64	329.7078	5	.36891	Sand Lower	Sand lower	Within	7.5	573	1275	.364416
3	13.75	.125	7.2	742.7	.08012	595.04	437.4009	10	.32883	Sand Lower	Sand lower	Within	13.75	758	2230	.3462051
4	21.25	.125	11	449.5	.19245	865.14	340.2811	17.5	.29718	Sand Lower	Sand lower	Within	21.25	758	2230	.3256998
5	27.5	.13	22.3	140.3	.73508	1031.4	186.4168	25	.24272	Gravel Avg.	Gravel Avg.	Within	27.5	656	1737	.2989565
6	32.5	.13	22.4	137	.7683	1052.33	184.2114	30	.36515	Gravel Avg.	Gravel Avg.	Within	32.5	656	1737	.2566659
7	37.5	.13	22.3	140.5	.73011	1025.88	186.5497	35	.47811	Gravel Avg.	Gravel Avg.	Within	37.5	656	1737	.2159747
8	42.5	.115	3.9	1772	.06304	1117.11	704.3862	40	.48591	OCR 15 PI 35	OCR 15 PI 35	Within	42.5	802	2297	.2083189
9	47.5	.115	4.3	1716.7	.07226	1240.58	693.308	45	.46619	OCR 15 PI 35	OCR 15 PI 35	Within	47.5	802	2297	.2089398
10	53.75	.11	7.7	1287	.10638	1369.1	613.7915	50	.42946	Soil PI=30	Soil PI=30	Within	53.75	791	2137	.2062674
11	61.25	.11	8.2	1214.9	.12657	1537.71	596.3509	57.5	.38238	Soil PI=30	Soil PI=30	Within	61.25	791	2137	.2060583
12	68.75	.12	11.6	1137.4	.15735	1789.73	552.4512	65	.36997	Soil PI=15	Soil PI=15	Within	68.75	872	2834	.2149826
13	76.25	.12	12.5	1036.6	.19502	2021.64	527.4034	72.5	.33058	Soil PI=15	Soil PI=15	Within	76.25	872	2834	.219148
14	Base							80	.37768			Within				
14	Outcrop							80	.42198			Outcrop				

Soil Profile Identification: Col 1
Soil Deposit Number: 1
Period for Soil Column: .716 sec
Average Shear Wave Velocity for Soil Column: 447 ft/sec
Analysis No.: 2 - Col 1-R_SSU090
Earthquake: C:\GEOTECHNICAL\GEOMOTIONS\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTHR_SSU090.EQK

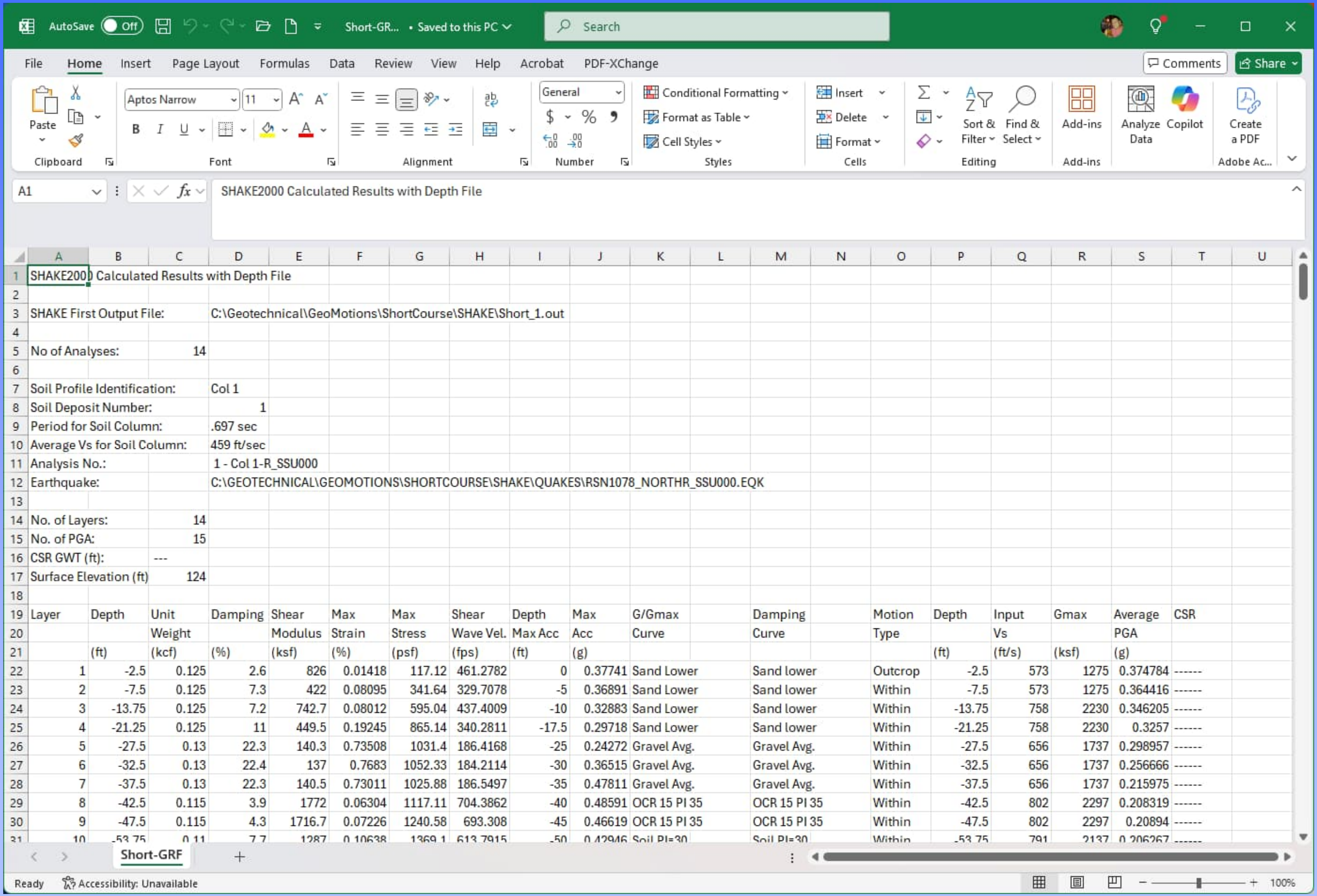
No. of Soil Layers: 14
No. of Peak Acceleration Values: 15
CSR GWT (ft): ---
Surface Elevation (ft): 124

Layer Depth Unit Damping Shear Max Max Shear Depth Max G/Gmax Damping Motion Depth Input Gmax Average

Ln 1, Col 1, C0 DOS 1252 (ANSI - Latin I) No highlighting Mod: 3/17/2025 5:10:55 AM File size: 55499

Site Specific Response Analysis

Output Files Generated by SHAKE2000 – Excel CSV Files



SHAKE2000 Calculated Results with Depth File

SHAKE First Output File: C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short_1.out

No of Analyses: 14

Soil Profile Identification: Col 1
Soil Deposit Number: 1
Period for Soil Column: .697 sec
Average Vs for Soil Column: 459 ft/sec
Analysis No.: 1 - Col 1-R_SSU000
Earthquake: C:\GEOTECHNICAL\GEOMOTIONS\SHORTCOURSE\SHAKE\QUAKES\RSN1078_NORTHR_SSU000.EQK

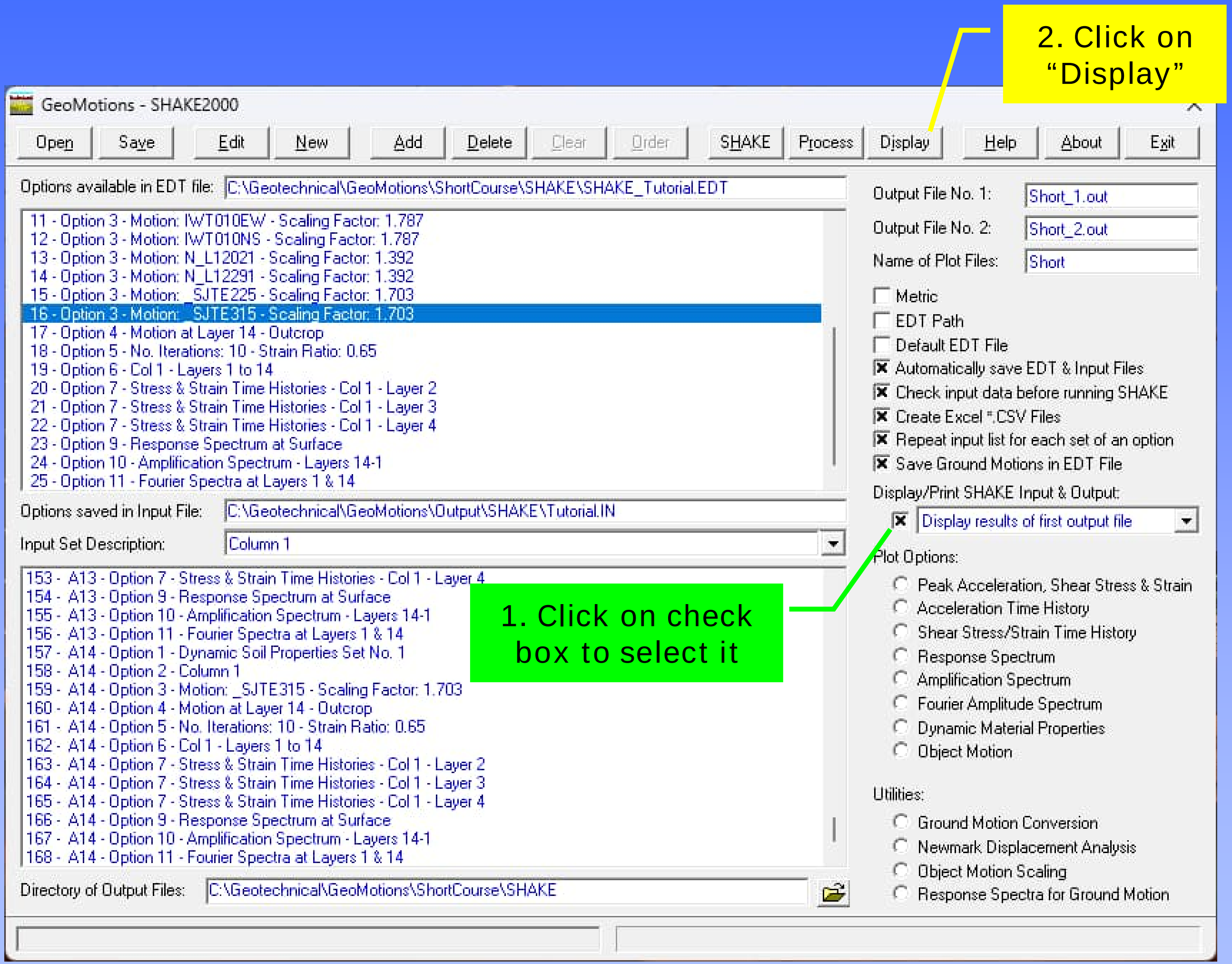
No. of Layers: 14
No. of PGA: 15
CSR GWT (ft): ---
Surface Elevation (ft) 124

Layer	Depth	Unit Weight	Damping	Shear Modulus	Max Strain	Max Stress	Shear Wave Vel.	Depth Max Acc	Max Acc	G/Gmax Curve	Damping Curve	Motion Type	Depth	Input Vs	Gmax	Average PGA	CSR
	(ft)	(kcf)	(%)	(ksf)	(%)	(psf)	(fps)	(ft)	(g)				(ft)	(ft/s)	(ksf)	(g)	
1	-2.5	0.125	2.6	826	0.01418	117.12	461.2782	0	0.37741	Sand Lower	Sand lower	Outcrop	-2.5	573	1275	0.374784	------
2	-7.5	0.125	7.3	422	0.08095	341.64	329.7078	-5	0.36891	Sand Lower	Sand lower	Within	-7.5	573	1275	0.364416	------
3	-13.75	0.125	7.2	742.7	0.08012	595.04	437.4009	-10	0.32883	Sand Lower	Sand lower	Within	-13.75	758	2230	0.346205	------
4	-21.25	0.125	11	449.5	0.19245	865.14	340.2811	-17.5	0.29718	Sand Lower	Sand lower	Within	-21.25	758	2230	0.3257	------
5	-27.5	0.13	22.3	140.3	0.73508	1031.4	186.4168	-25	0.24272	Gravel Avg.	Gravel Avg.	Within	-27.5	656	1737	0.298957	------
6	-32.5	0.13	22.4	137	0.7683	1052.33	184.2114	-30	0.36515	Gravel Avg.	Gravel Avg.	Within	-32.5	656	1737	0.256666	------
7	-37.5	0.13	22.3	140.5	0.73011	1025.88	186.5497	-35	0.47811	Gravel Avg.	Gravel Avg.	Within	-37.5	656	1737	0.215975	------
8	-42.5	0.115	3.9	1772	0.06304	1117.11	704.3862	-40	0.48591	OCR 15 PI 35	OCR 15 PI 35	Within	-42.5	802	2297	0.208319	------
9	-47.5	0.115	4.3	1716.7	0.07226	1240.58	693.308	-45	0.46619	OCR 15 PI 35	OCR 15 PI 35	Within	-47.5	802	2297	0.20894	------
10	-53.75	0.11	7.7	1287	0.10638	1369.1	613.7915	-50	0.42946	Soil PI=30	Soil PI=30	Within	-53.75	791	2137	0.206267	------

GeoMotions

Site Specific Response Analysis

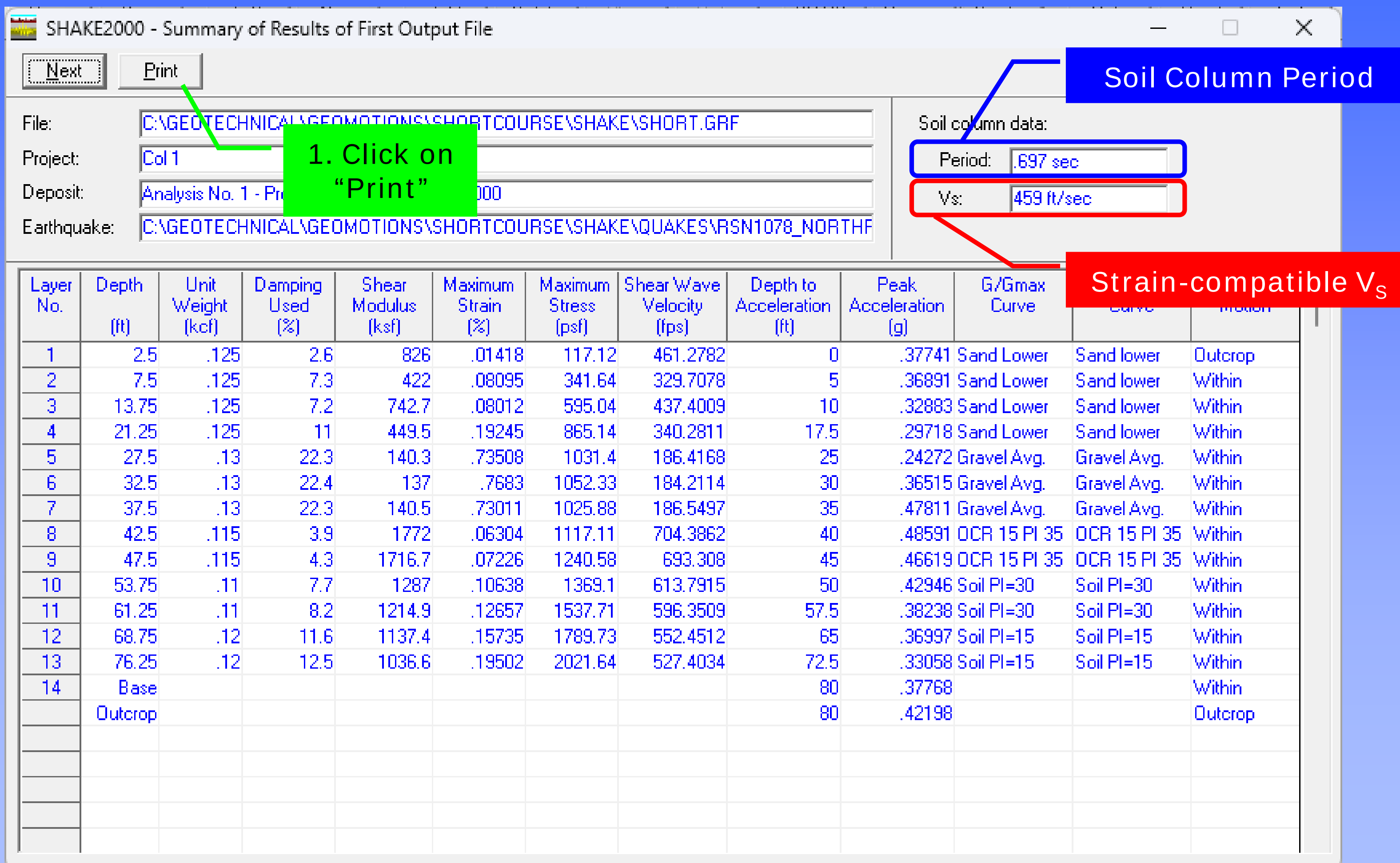
Display Results



GeoMotions

Site Specific Response Analysis

Display Results – Analysis 1

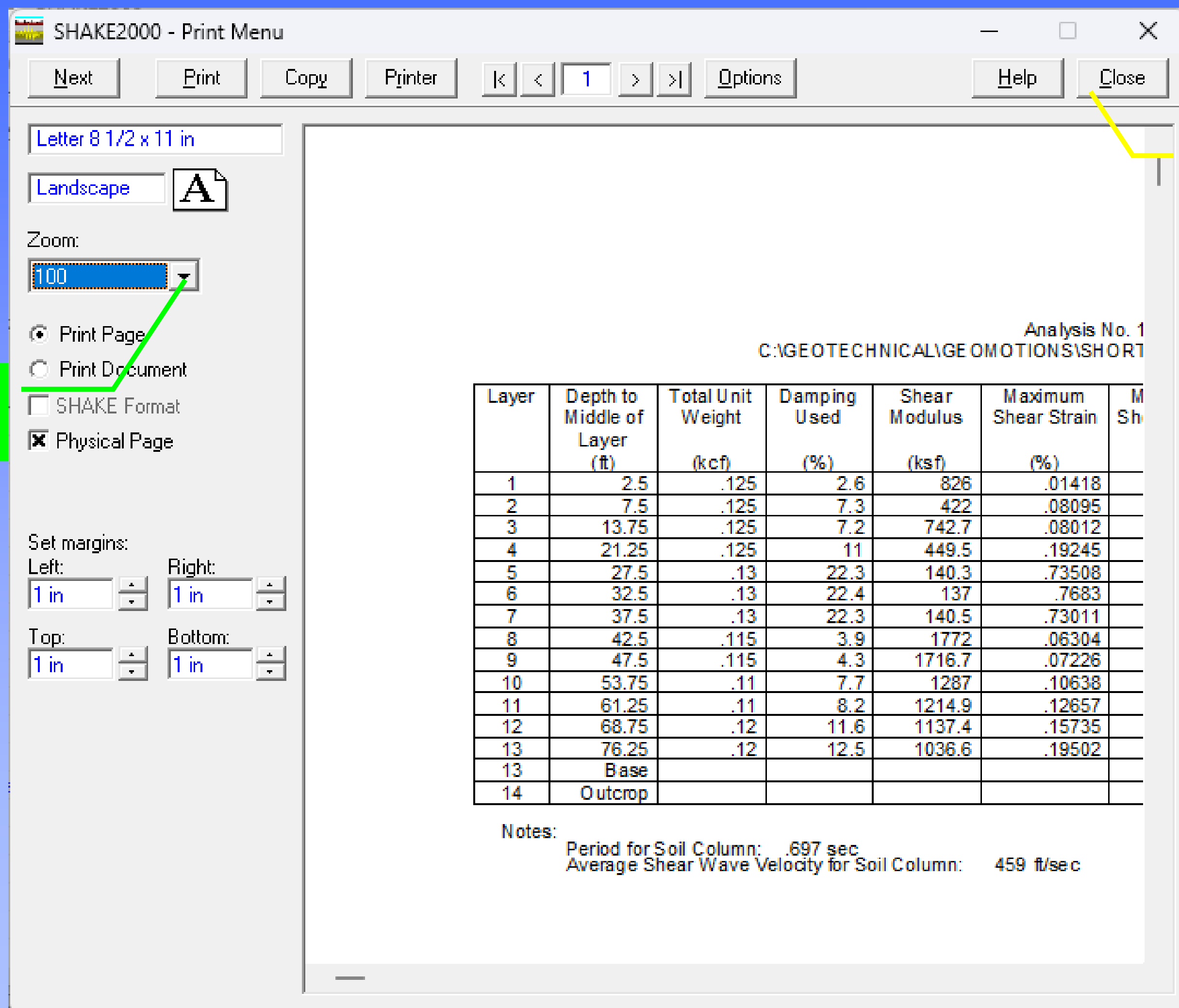


Layer No.	Depth (ft)	Unit Weight (kcf)	Damping Used (%)	Shear Modulus (ksf)	Maximum Strain (%)	Maximum Stress (psf)	Shear Wave Velocity (fps)	Depth to Acceleration (ft)	Peak Acceleration (g)	G/Gmax Curve		
1	2.5	.125	2.6	826	.01418	117.12	461.2782	0	.37741	Sand Lower	Sand lower	Outcrop
2	7.5	.125	7.3	422	.08095	341.64	329.7078	5	.36891	Sand Lower	Sand lower	Within
3	13.75	.125	7.2	742.7	.08012	595.04	437.4009	10	.32883	Sand Lower	Sand lower	Within
4	21.25	.125	11	449.5	.19245	865.14	340.2811	17.5	.29718	Sand Lower	Sand lower	Within
5	27.5	.13	22.3	140.3	.73508	1031.4	186.4168	25	.24272	Gravel Avg.	Gravel Avg.	Within
6	32.5	.13	22.4	137	.7683	1052.33	184.2114	30	.36515	Gravel Avg.	Gravel Avg.	Within
7	37.5	.13	22.3	140.5	.73011	1025.88	186.5497	35	.47811	Gravel Avg.	Gravel Avg.	Within
8	42.5	.115	3.9	1772	.06304	1117.11	704.3862	40	.48591	OCR 15 PI 35	OCR 15 PI 35	Within
9	47.5	.115	4.3	1716.7	.07226	1240.58	693.308	45	.46619	OCR 15 PI 35	OCR 15 PI 35	Within
10	53.75	.11	7.7	1287	.10638	1369.1	613.7915	50	.42946	Soil PI=30	Soil PI=30	Within
11	61.25	.11	8.2	1214.9	.12657	1537.71	596.3509	57.5	.38238	Soil PI=30	Soil PI=30	Within
12	68.75	.12	11.6	1137.4	.15735	1789.73	552.4512	65	.36997	Soil PI=15	Soil PI=15	Within
13	76.25	.12	12.5	1036.6	.19502	2021.64	527.4034	72.5	.33058	Soil PI=15	Soil PI=15	Within
14	Base							80	.37768			Within
	Outcrop							80	.42198			Outcrop

GeoMotions

Site Specific Response Analysis

Display Results



Layer	Depth to Middle of Layer (ft)	Total Unit Weight (kcf)	Damping Used (%)	Shear Modulus (ksf)	Maximum Shear Strain (%)
1	2.5	.125	2.6	826	.01418
2	7.5	.125	7.3	422	.08095
3	13.75	.125	7.2	742.7	.08012
4	21.25	.125	11	449.5	.19245
5	27.5	.13	22.3	140.3	.73508
6	32.5	.13	22.4	137	.7683
7	37.5	.13	22.3	140.5	.73011
8	42.5	.115	3.9	1772	.06304
9	47.5	.115	4.3	1716.7	.07226
10	53.75	.11	7.7	1287	.10638
11	61.25	.11	8.2	1214.9	.12657
12	68.75	.12	11.6	1137.4	.15735
13	76.25	.12	12.5	1036.6	.19502
13	Base				
14	Outcrop				

Notes:
Period for Soil Column: .697 sec
Average Shear Wave Velocity for Soil Column: 459 ft/sec

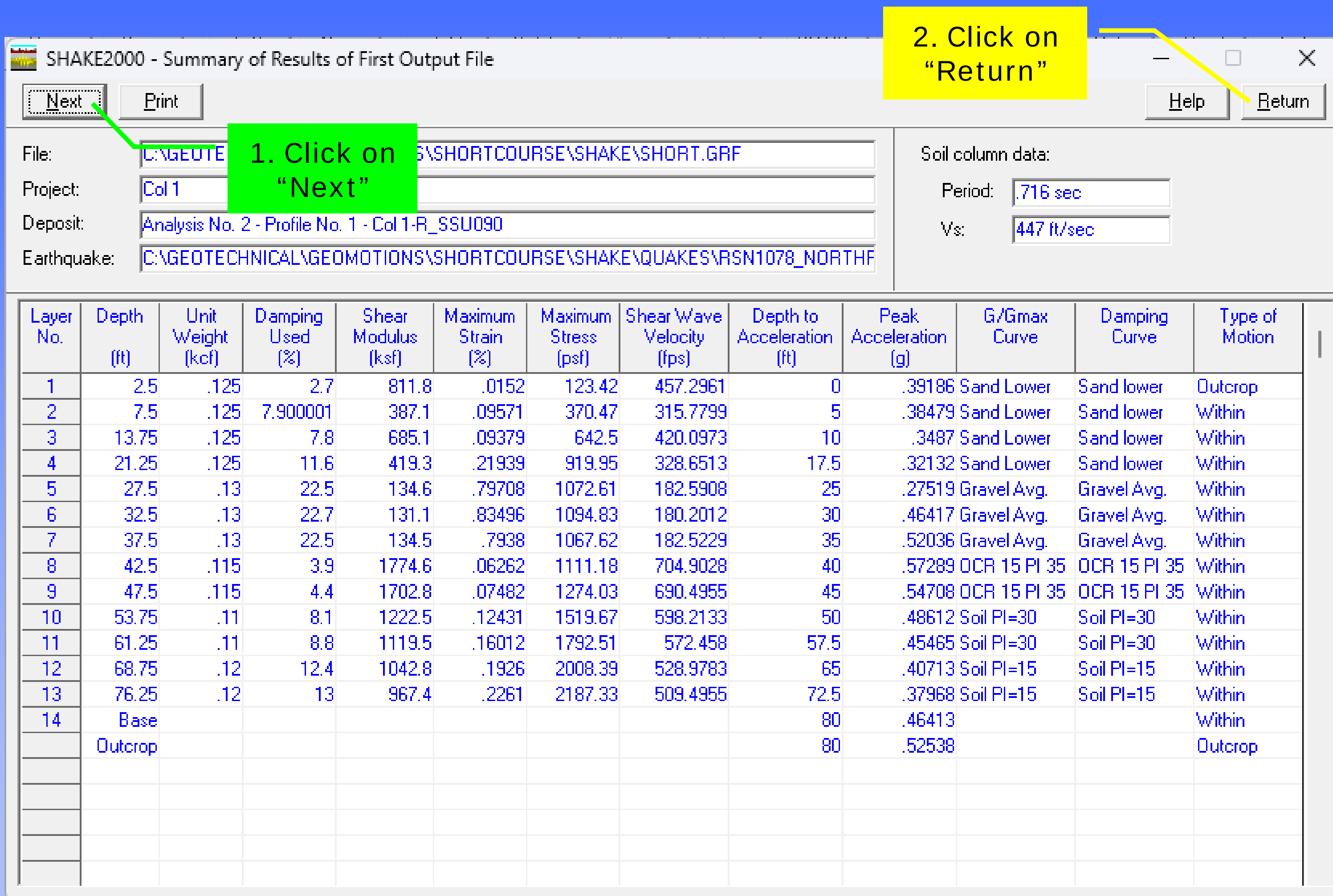
1. Select a zoom factor

2. Click on "Close"

GeoMotions

Site Specific Response Analysis

Display Results – Analysis 2

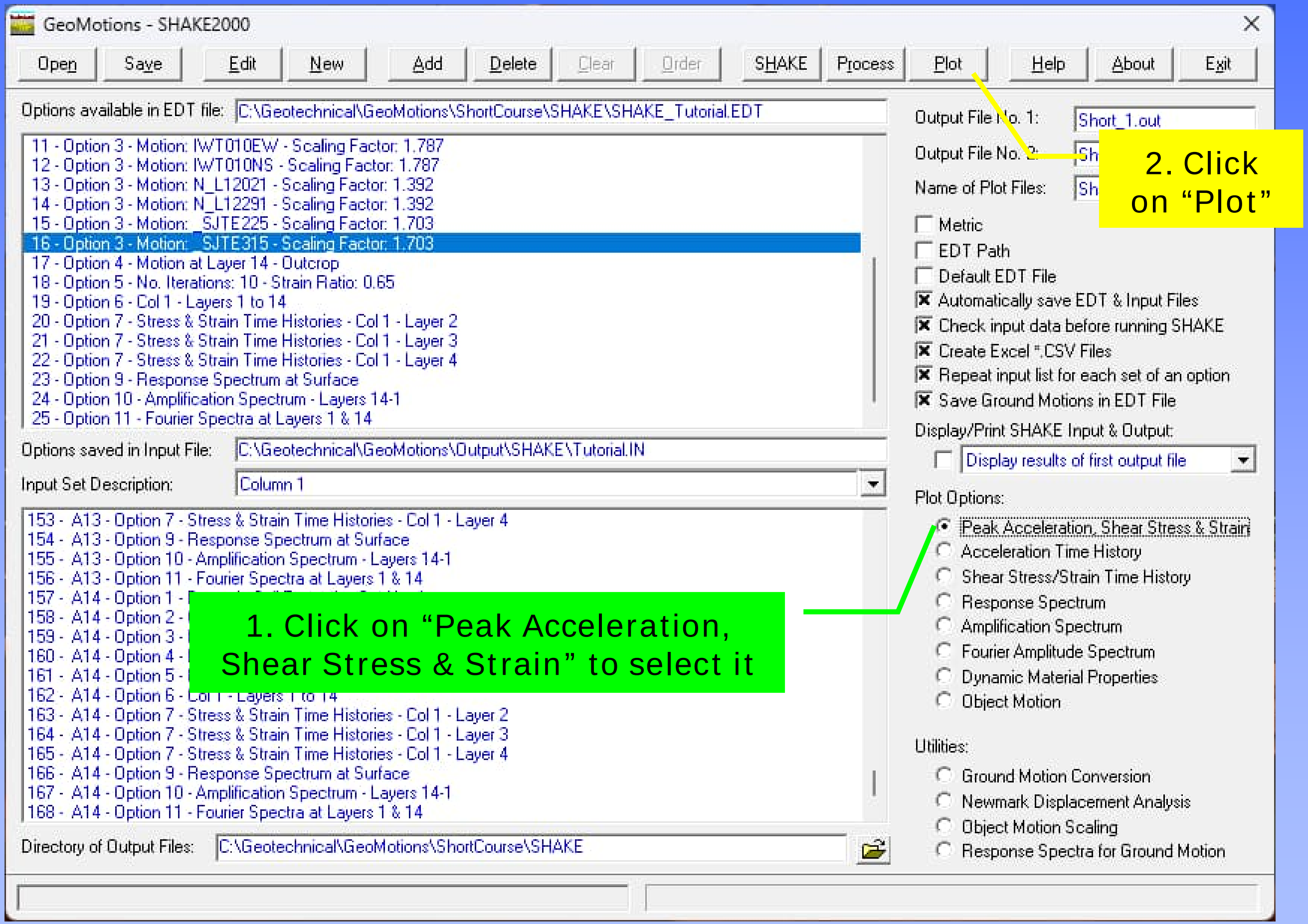


Layer No.	Depth (ft)	Unit Weight (kcf)	Damping Used (%)	Shear Modulus (ksf)	Maximum Strain (%)	Maximum Stress (psf)	Shear Wave Velocity (fps)	Depth to Acceleration (ft)	Peak Acceleration (g)	G/Gmax Curve	Damping Curve	Type of Motion
1	2.5	.125	2.7	811.8	.0152	123.42	457.2961	0	.39186	Sand Lower	Sand lower	Outcrop
2	7.5	.125	7.900001	387.1	.09571	370.47	315.7799	5	.38479	Sand Lower	Sand lower	Within
3	13.75	.125	7.8	685.1	.09379	642.5	420.0973	10	.3487	Sand Lower	Sand lower	Within
4	21.25	.125	11.6	419.3	.21939	919.95	328.6513	17.5	.32132	Sand Lower	Sand lower	Within
5	27.5	.13	22.5	134.6	.79708	1072.61	182.5908	25	.27519	Gravel Avg.	Gravel Avg.	Within
6	32.5	.13	22.7	131.1	.83496	1094.83	180.2012	30	.46417	Gravel Avg.	Gravel Avg.	Within
7	37.5	.13	22.5	134.5	.7938	1067.62	182.5229	35	.52036	Gravel Avg.	Gravel Avg.	Within
8	42.5	.115	3.9	1774.6	.06262	1111.18	704.9028	40	.57289	OCR 15 PI 35	OCR 15 PI 35	Within
9	47.5	.115	4.4	1702.8	.07482	1274.03	690.4955	45	.54708	OCR 15 PI 35	OCR 15 PI 35	Within
10	53.75	.11	8.1	1222.5	.12431	1519.67	598.2133	50	.48612	Soil PI=30	Soil PI=30	Within
11	61.25	.11	8.8	1119.5	.16012	1792.51	572.458	57.5	.45465	Soil PI=30	Soil PI=30	Within
12	68.75	.12	12.4	1042.8	.1926	2008.39	528.9783	65	.40713	Soil PI=15	Soil PI=15	Within
13	76.25	.12	13	967.4	.2261	2187.33	509.4955	72.5	.37968	Soil PI=15	Soil PI=15	Within
14	Base							80	.46413			Within
	Outcrop							80	.52538			Outcrop

GeoMotions

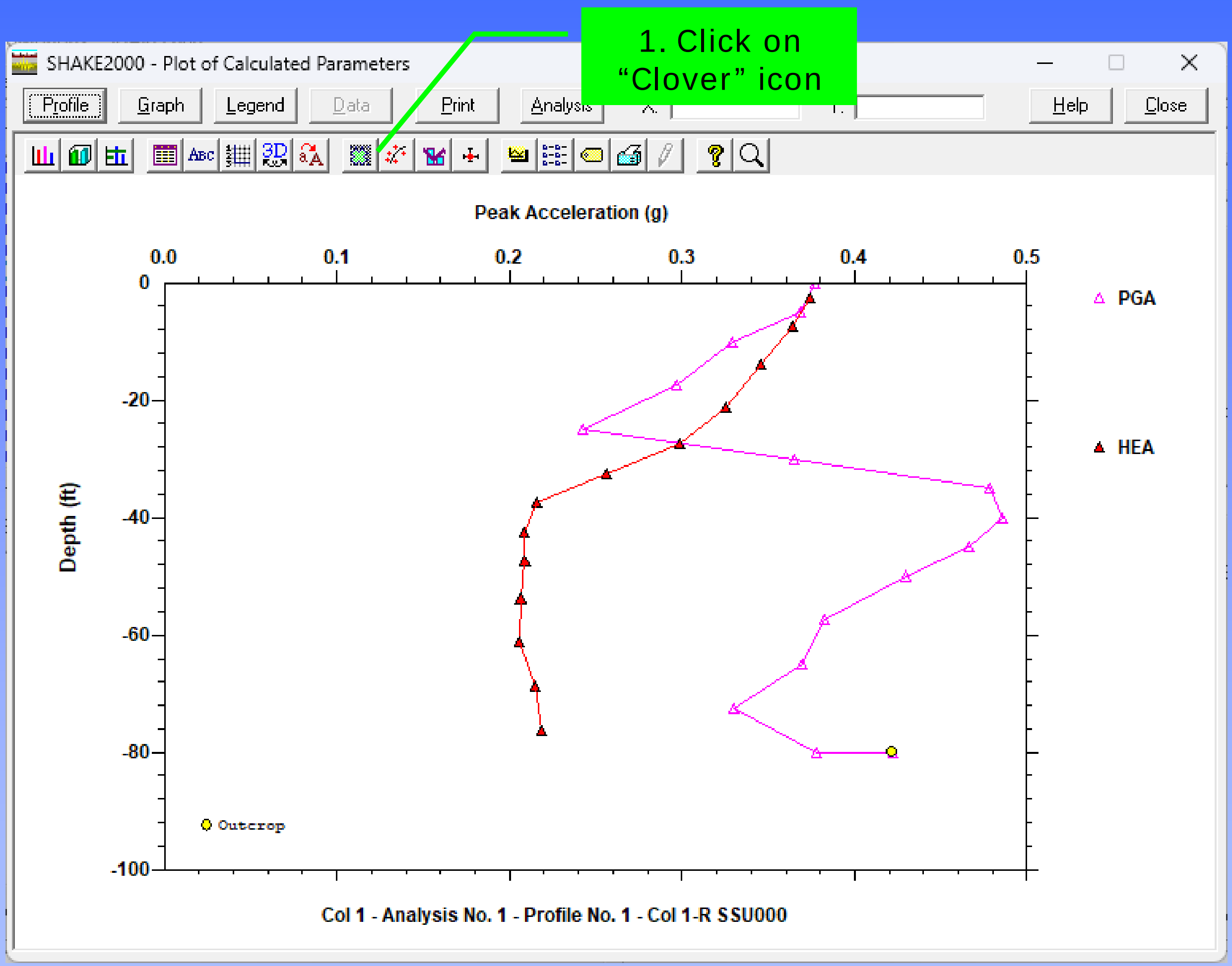
Site Specific Response Analysis

Plot Results



Site Specific Response Analysis

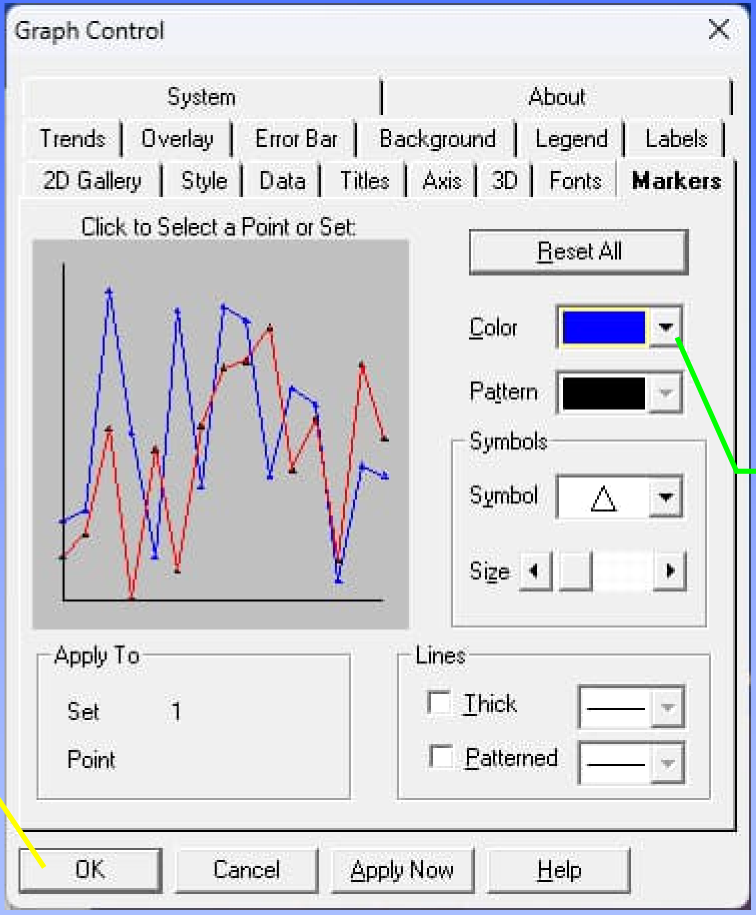
Plot Results



** The "Outcrop" symbol (i.e., a yellow circle) is not shown for the surface values, only for those layers denoted as outcrop in Option 6, other than layer number 1.

Site Specific Response Analysis

Change Graph Properties



1. Click on down-arrow and select a different color

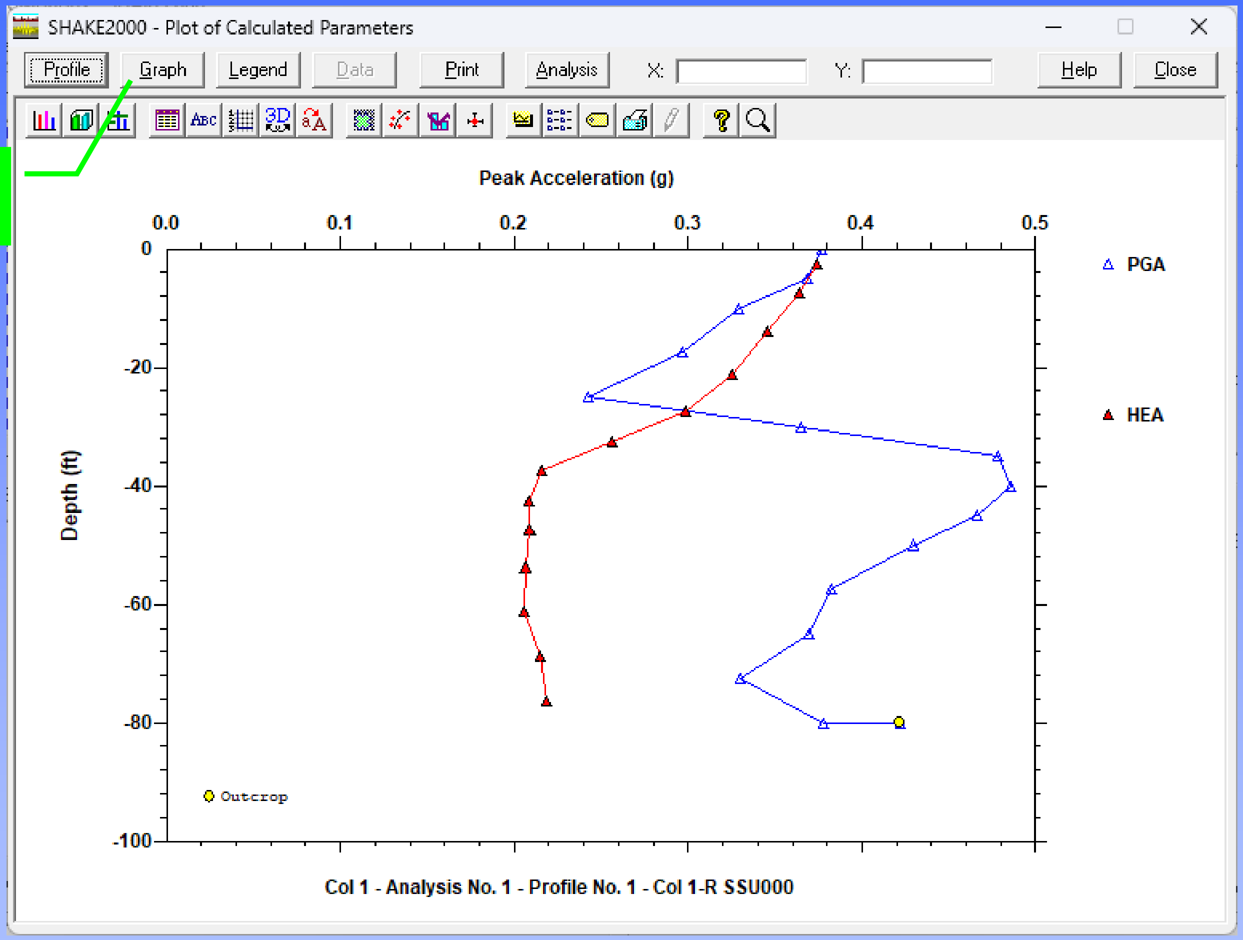
2. Click on “Ok”

GeoMotions

Site Specific Response Analysis

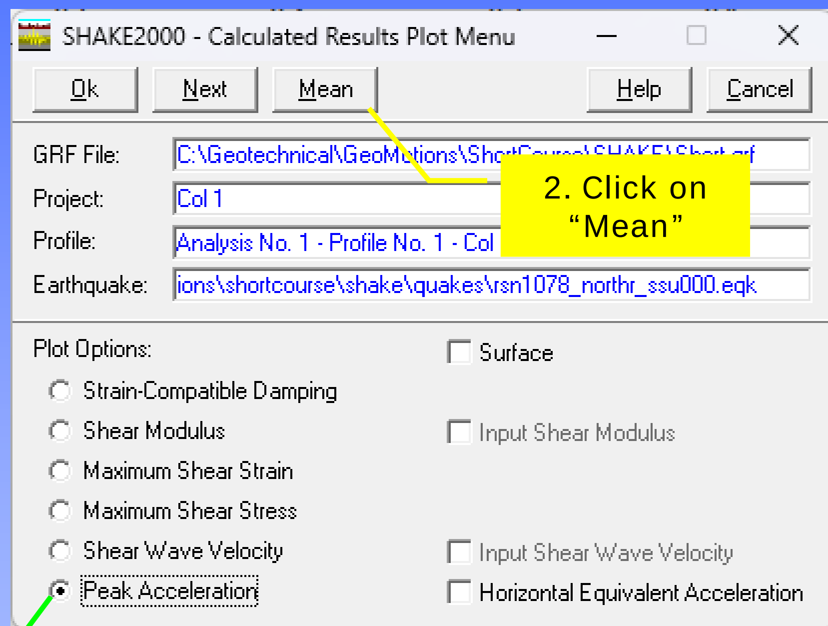
Plot Results

1. Click on “Graph”



Site Specific Response Analysis

Plot Results



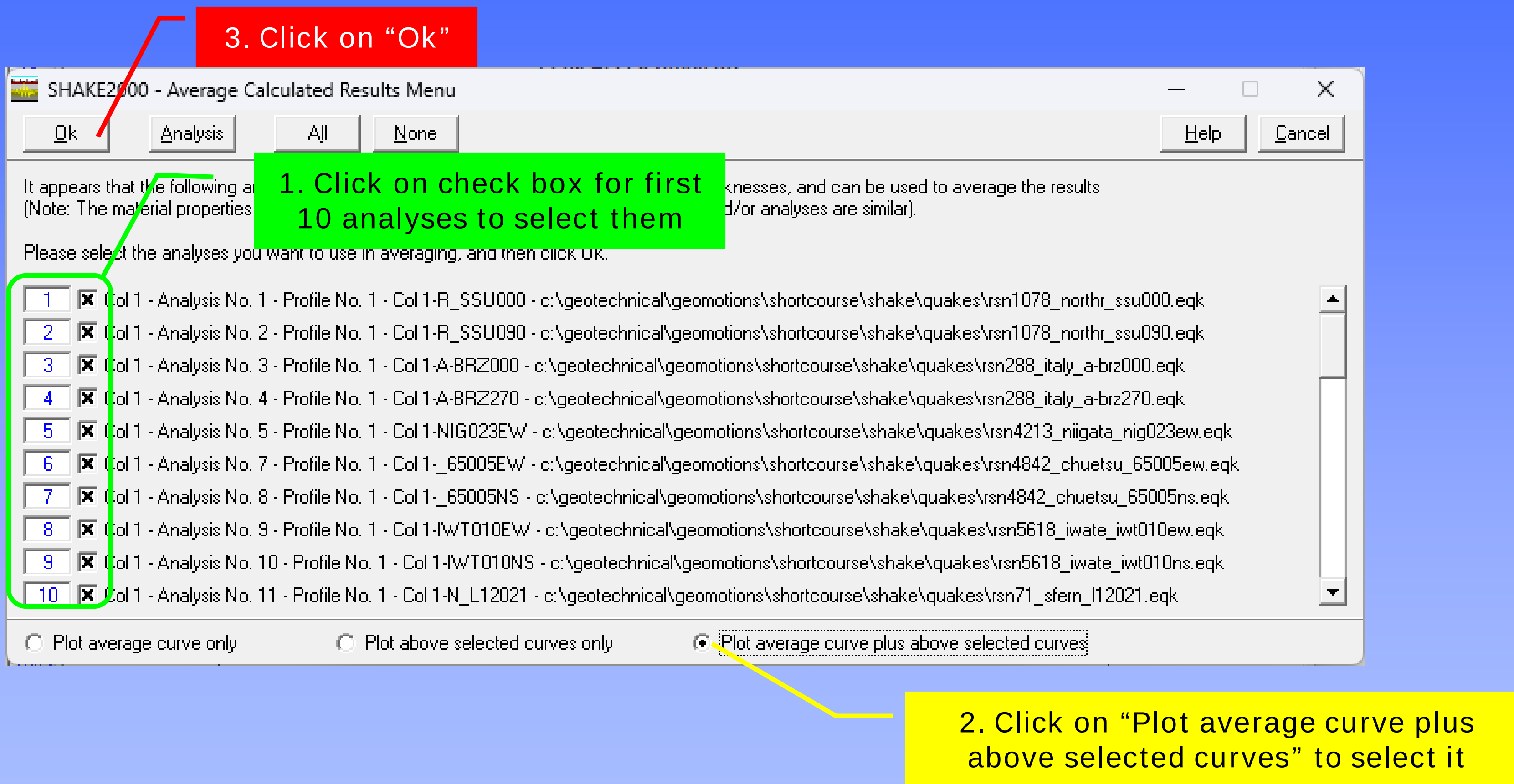
2. Click on "Mean"

1. Click on "Peak Acceleration" to select it

GeoMotions

Site Specific Response Analysis

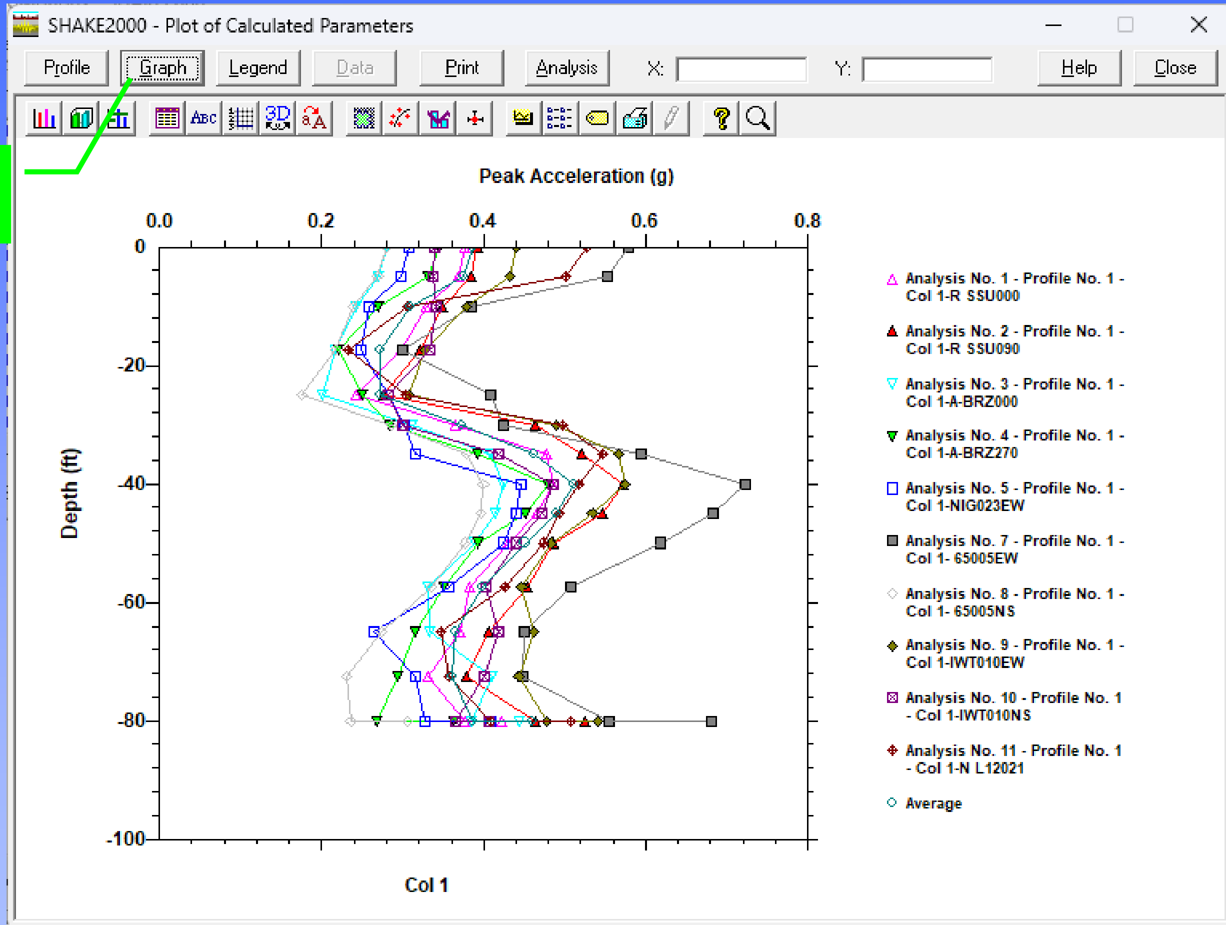
Plot Results



Site Specific Response Analysis

Plot Results

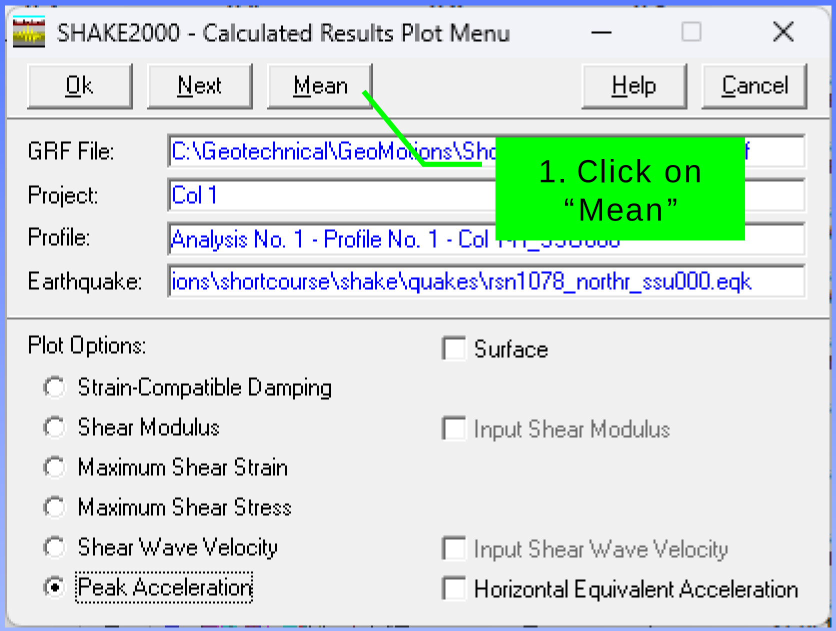
1. Click on "Graph"



GeoMotions

Site Specific Response Analysis

Plot Results

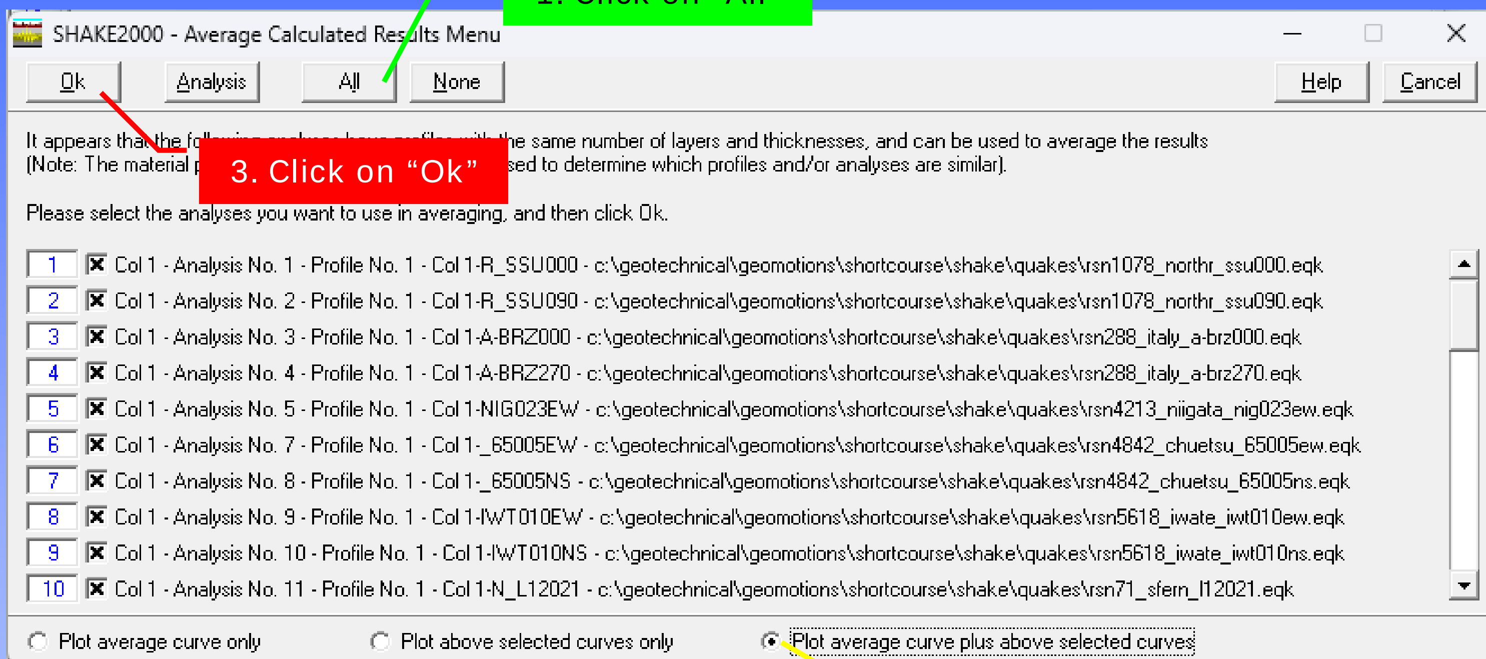


GeoMotions

Site Specific Response Analysis

Plot Results

1. Click on “All”



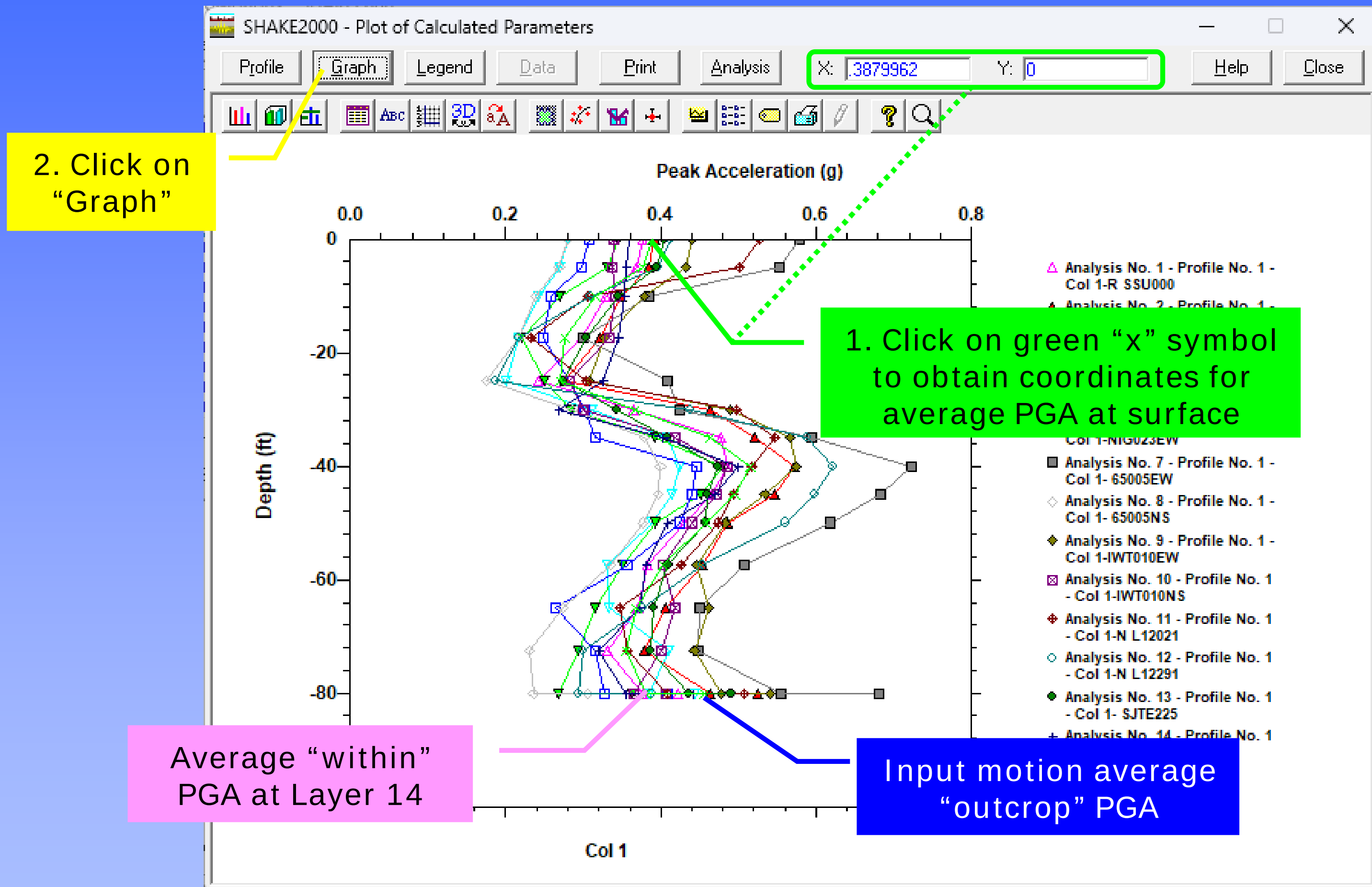
3. Click on “Ok”

2. Click on “Plot average curve plus above selected curves” to select it

GeoMotions

Site Specific Response Analysis

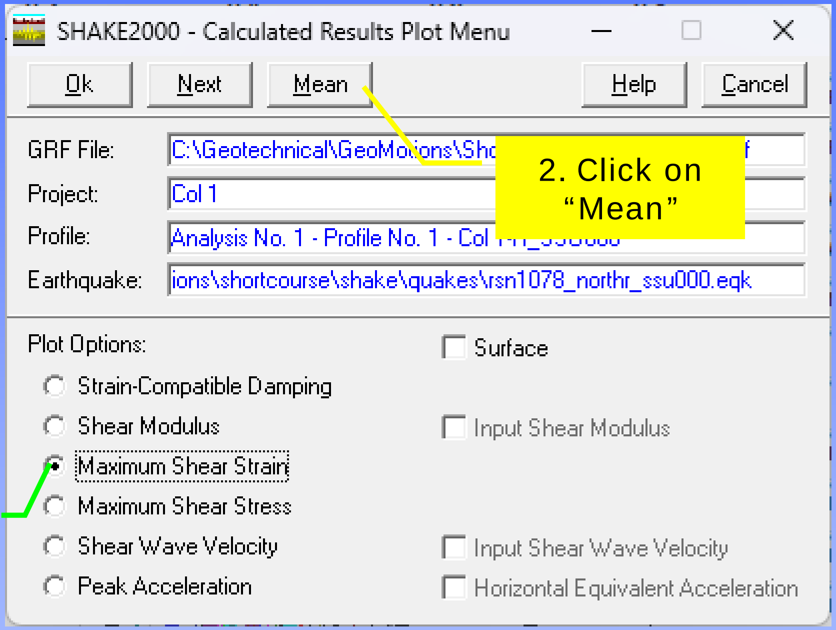
Plot Results



GeoMotions

Site Specific Response Analysis

Plot Results



2. Click on “Mean”

1. Click on “Maximum Shear Strain”

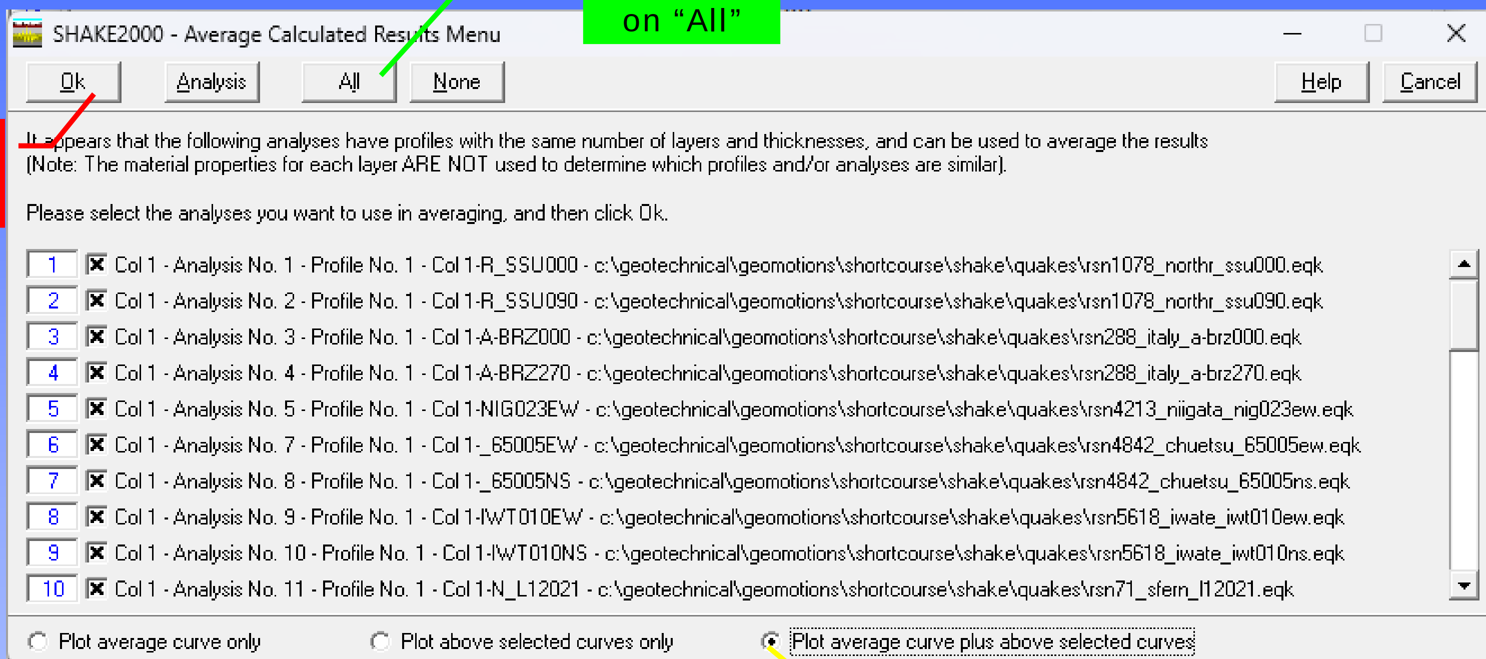
GeoMotions

Site Specific Response Analysis

Plot Results

1. Click on “All”

3. Click on “Ok”

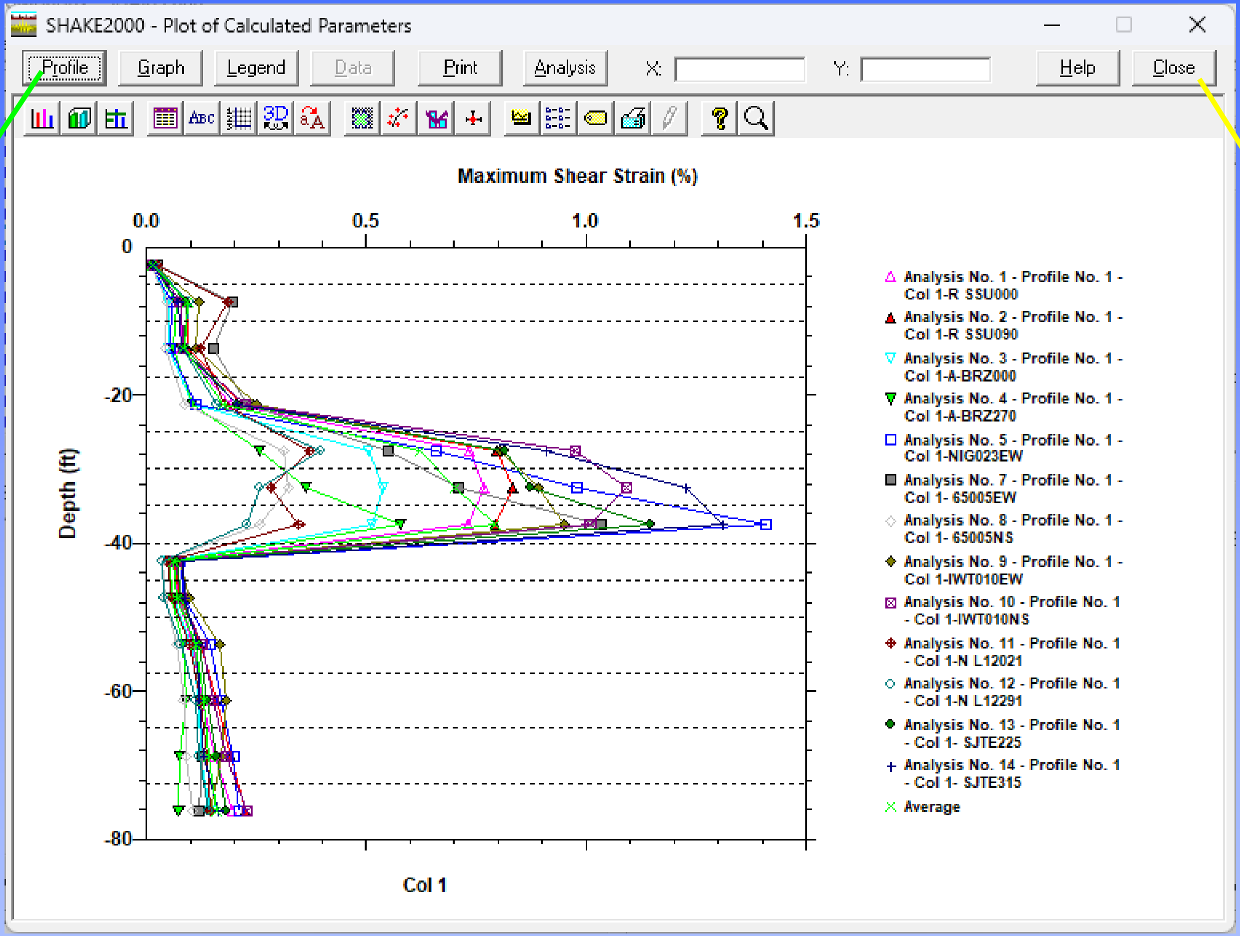


2. Click on “Plot average curve plus above selected curves” to select it

Site Specific Response Analysis

Plot Results

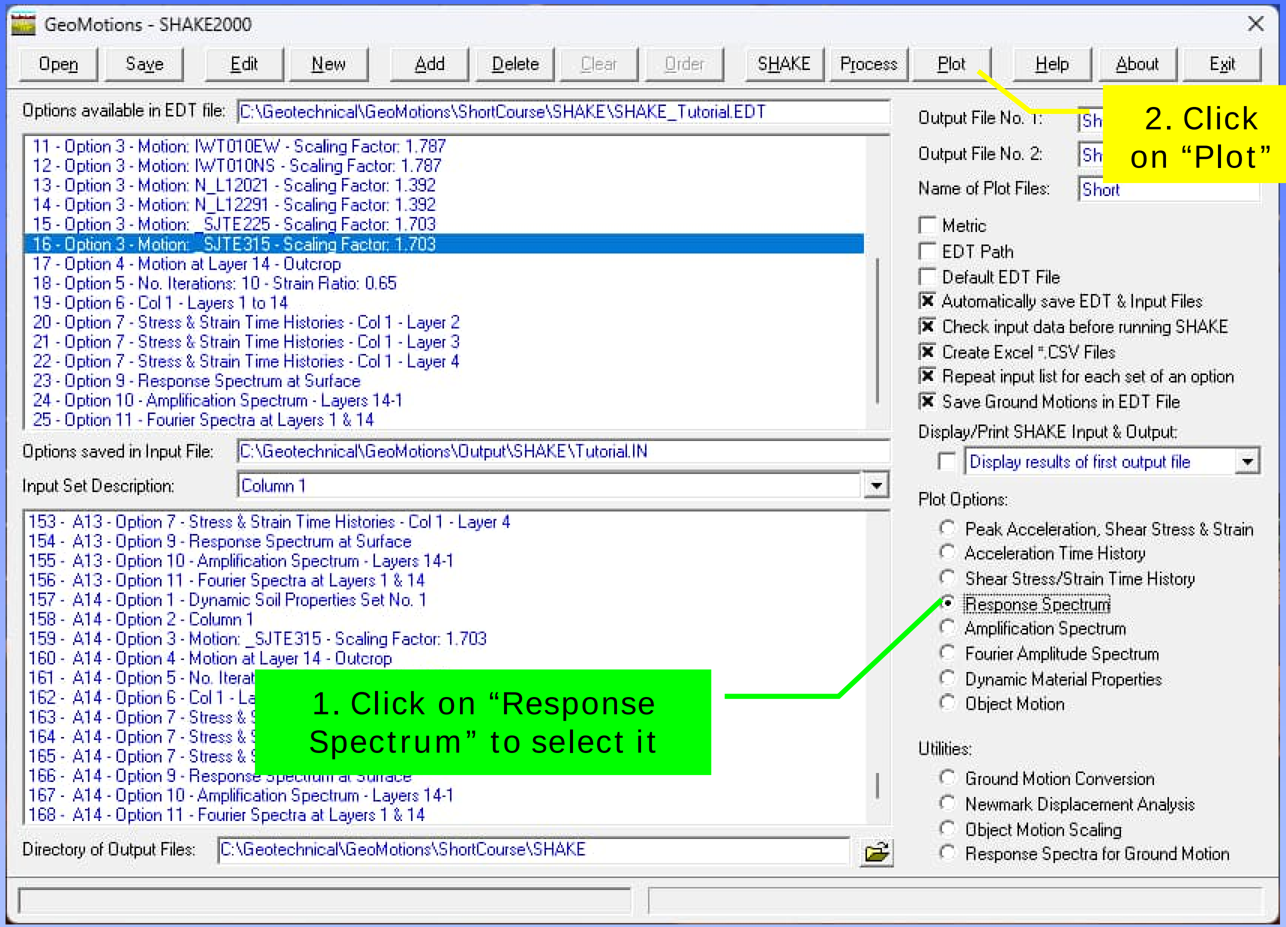
1. Click on “Profile”



2. Click on “Close”

Site Specific Response Analysis

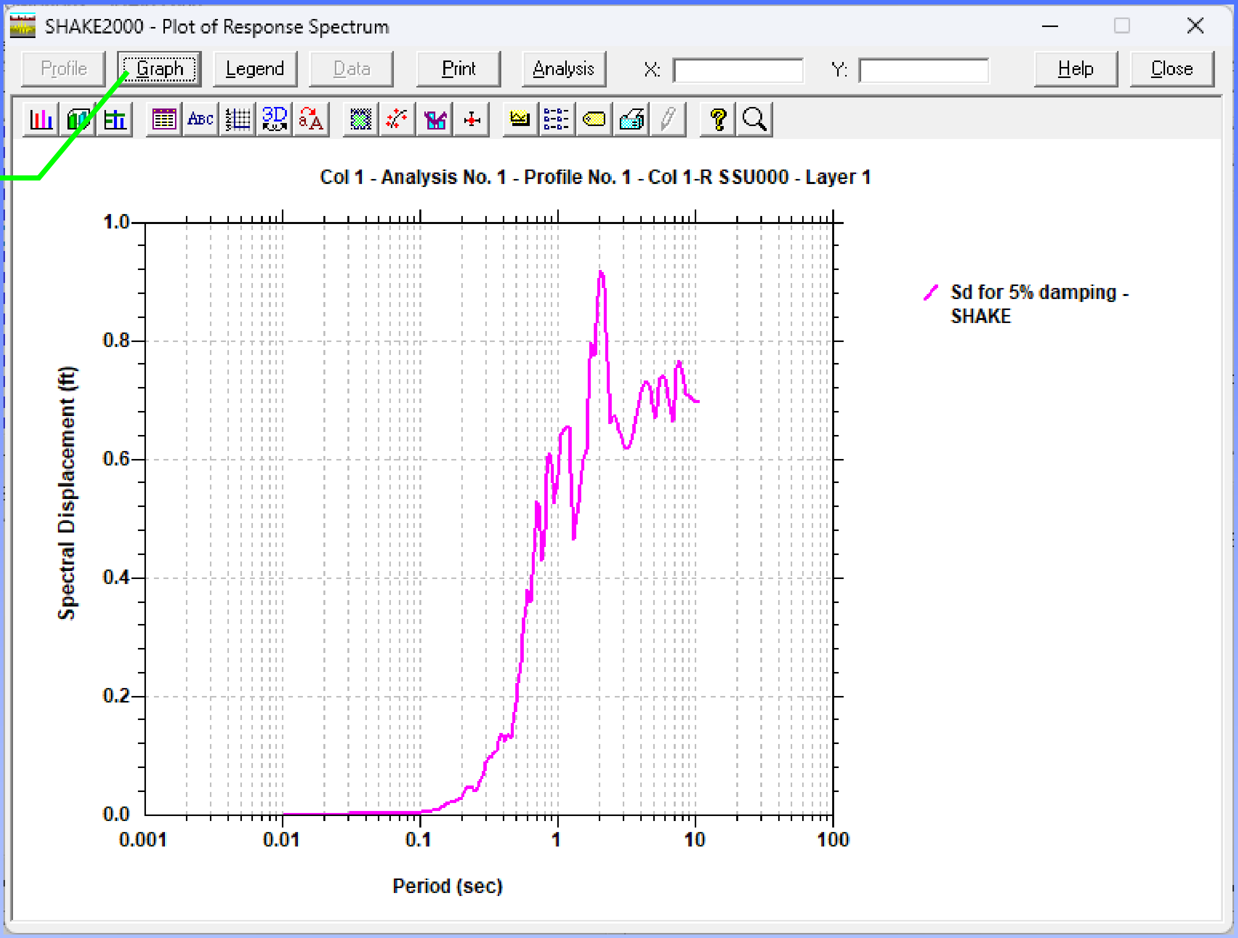
Plot Results



Site Specific Response Analysis

Plot Results

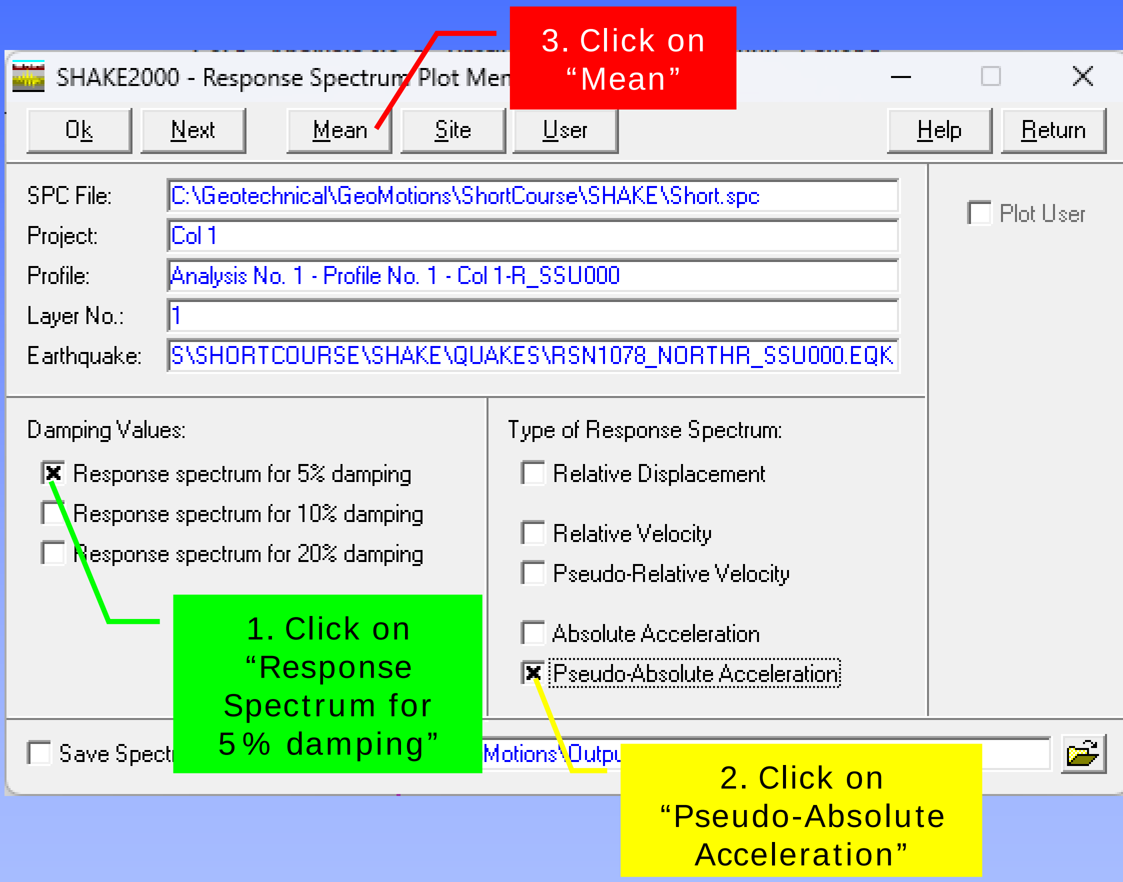
1. Click on “Graph”



GeoMotions

Site Specific Response Analysis

Plot Results



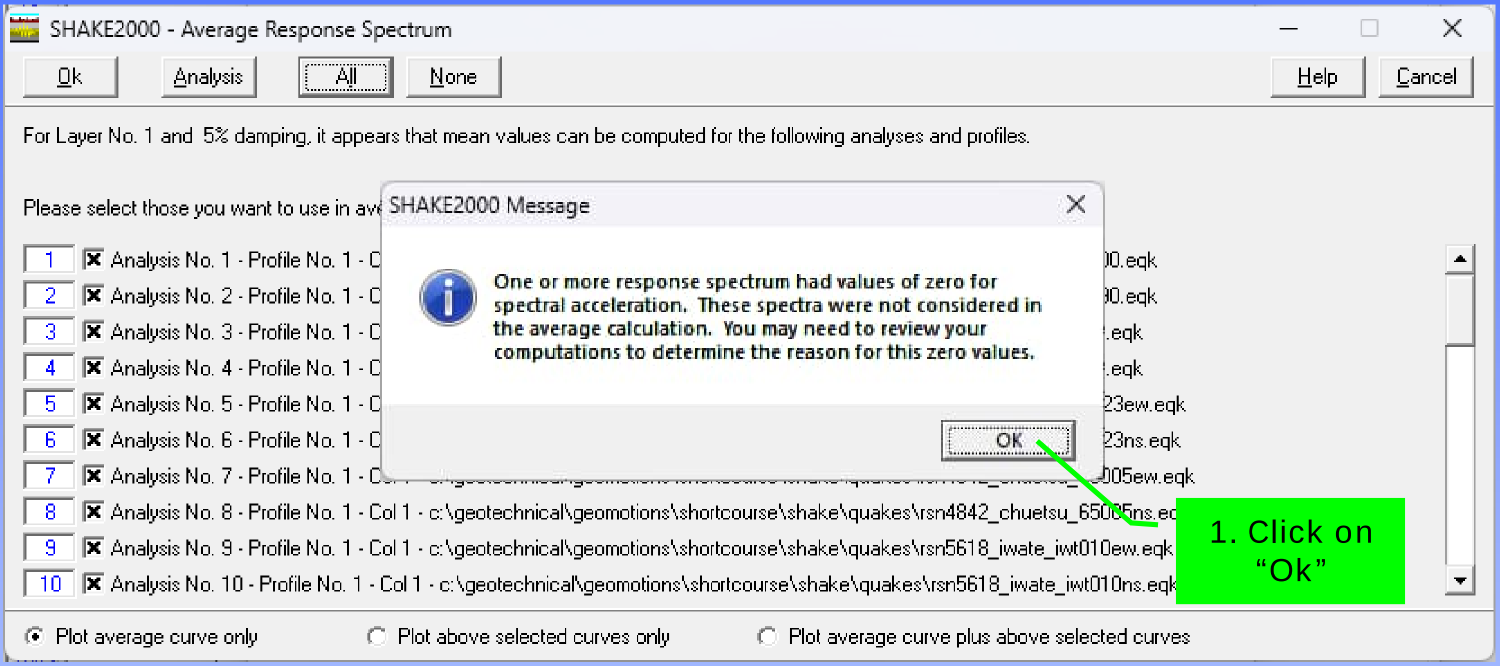
GeoMotions

Site Specific Response Analysis

Plot Results

Site Specific Response Analysis

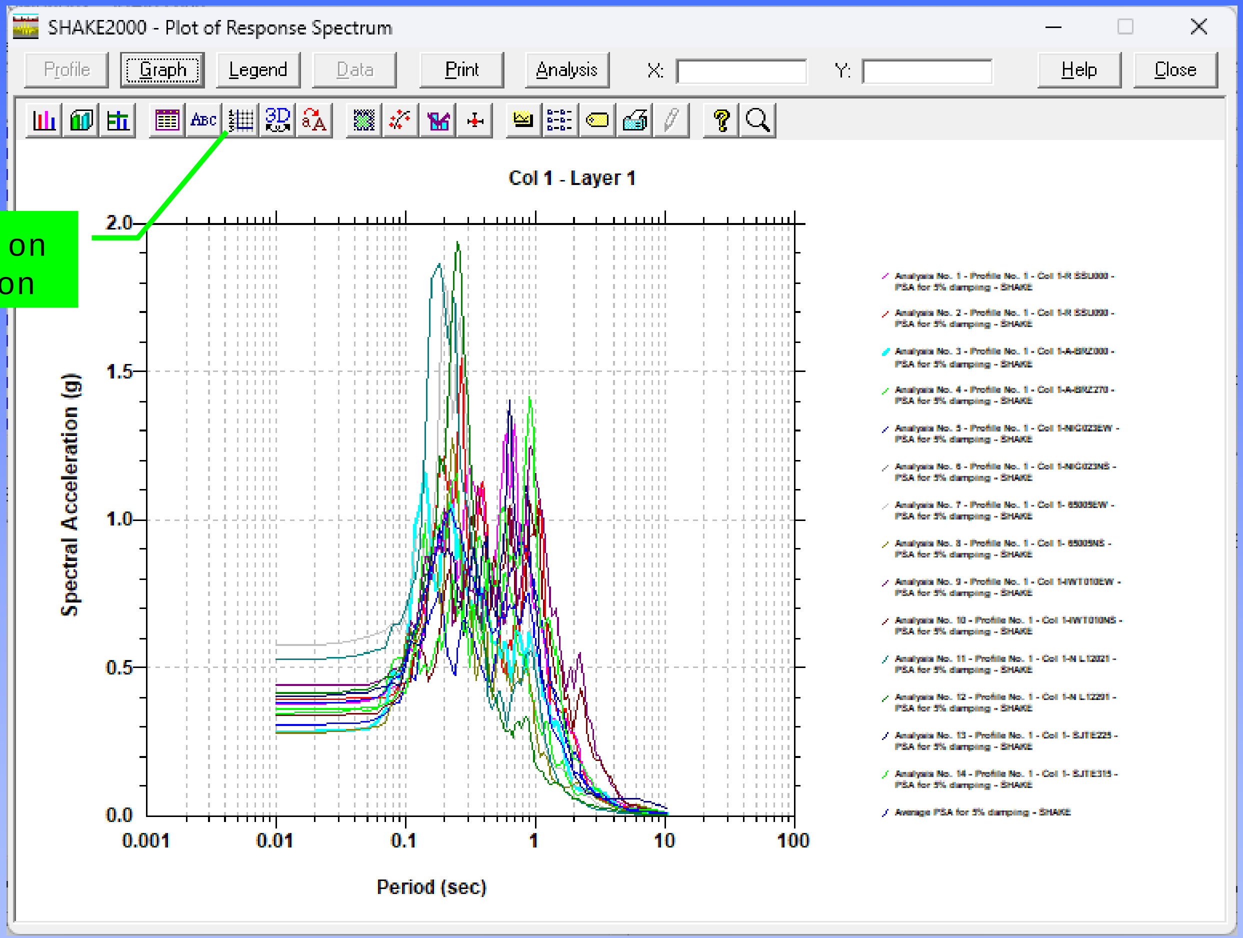
Plot Results



Site Specific Response Analysis

Plot Results

1. Click on Axis icon



GeoMotions

Site Specific Response Analysis

Change Graph Properties

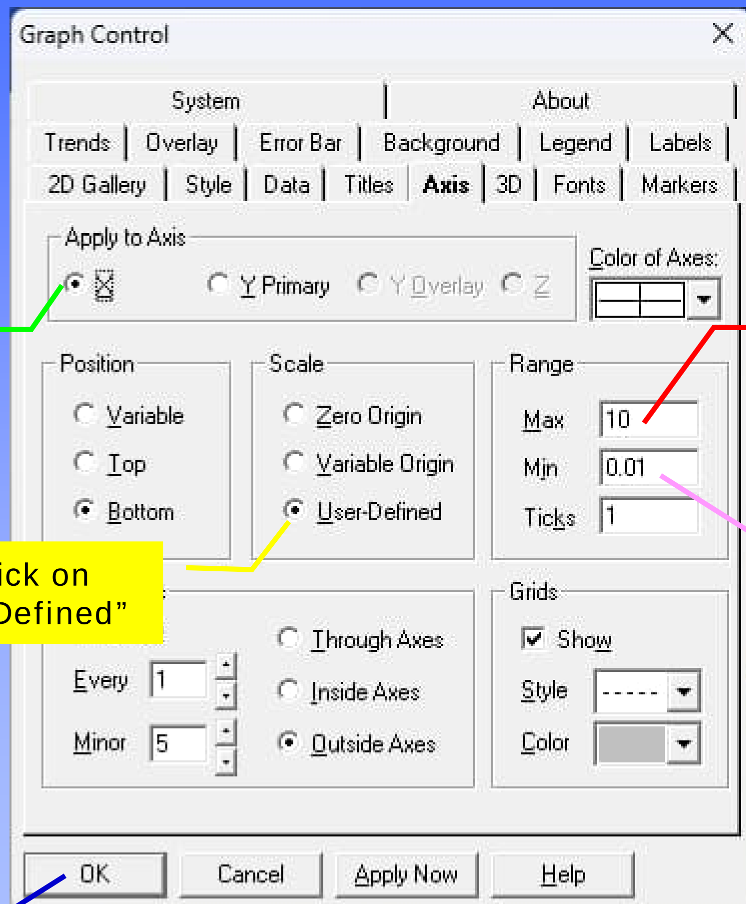
1. Click on "X"

2. Click on "User-Defined"

3. Enter "10" for Max

4. Enter "0.01" for Min

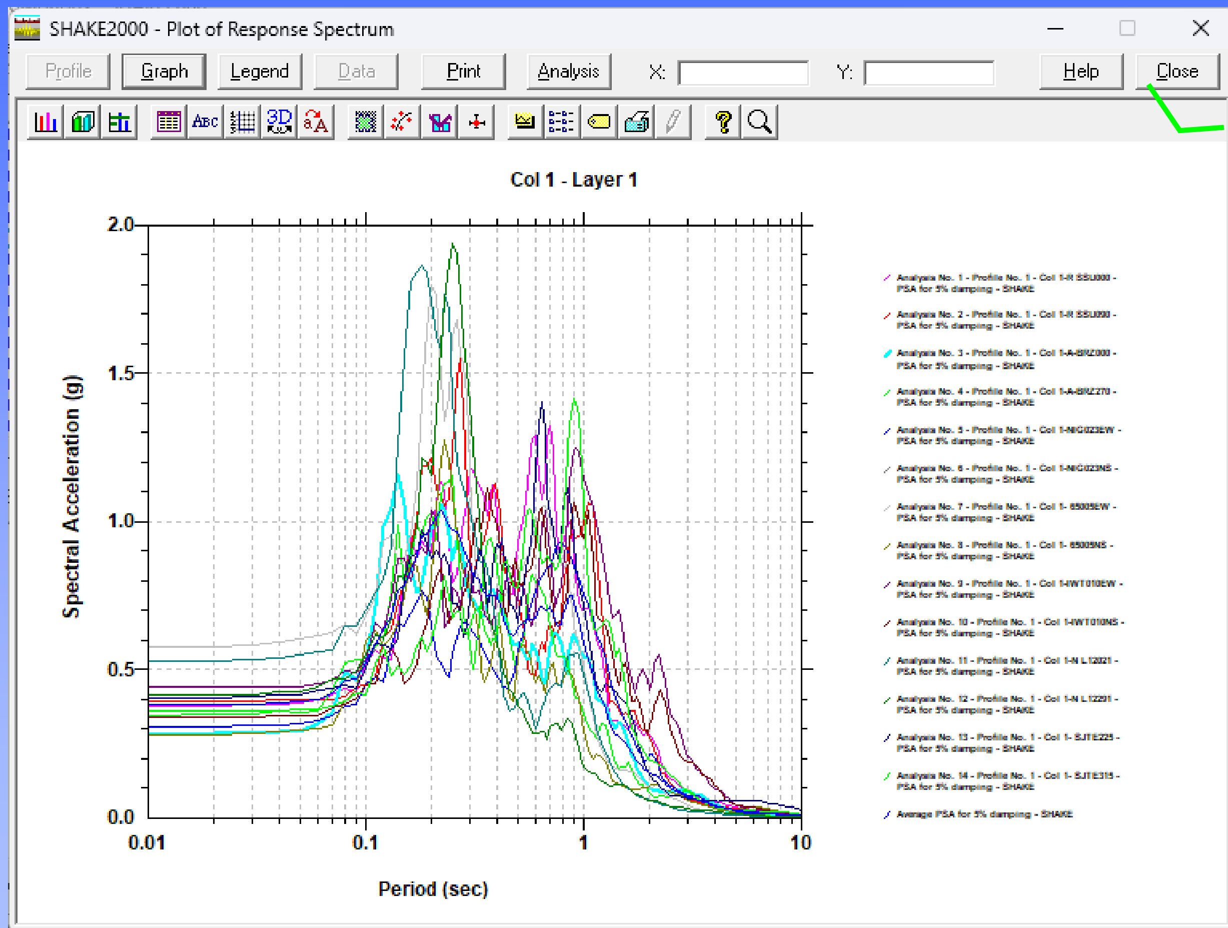
5. Click on "Ok"



GeoMotions

Site Specific Response Analysis

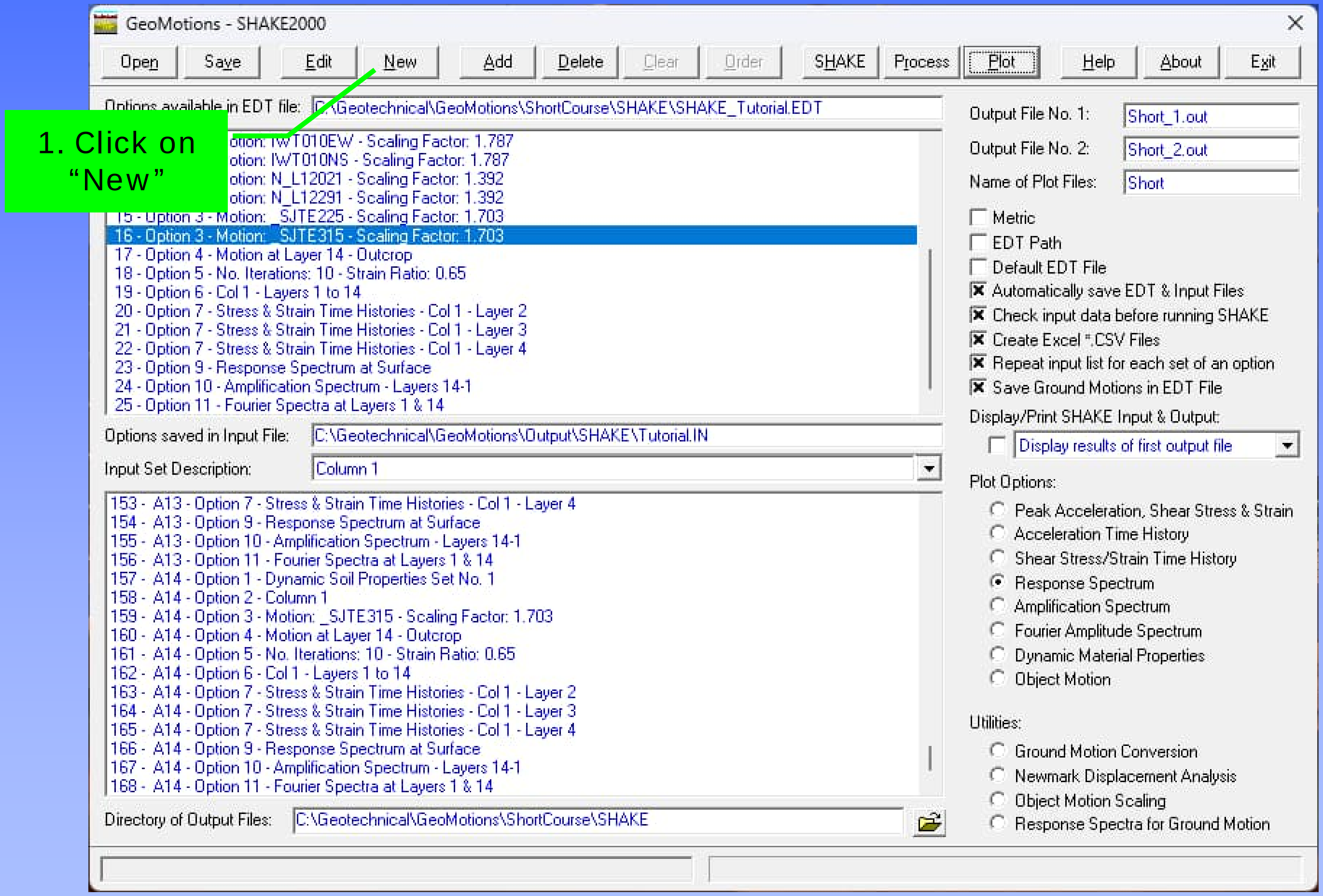
Plot Results



1. Click on “Close”

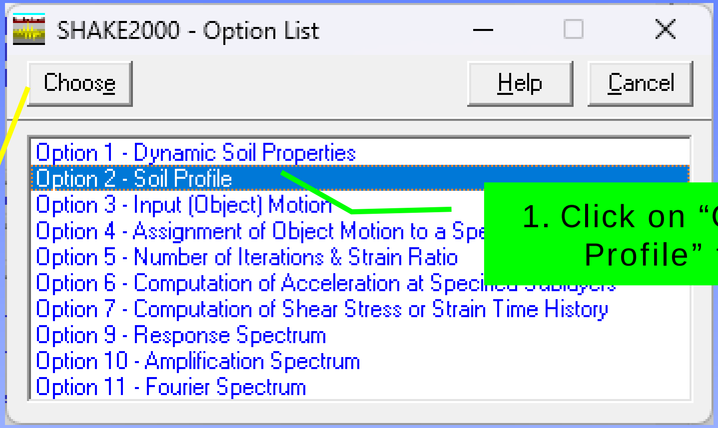
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2



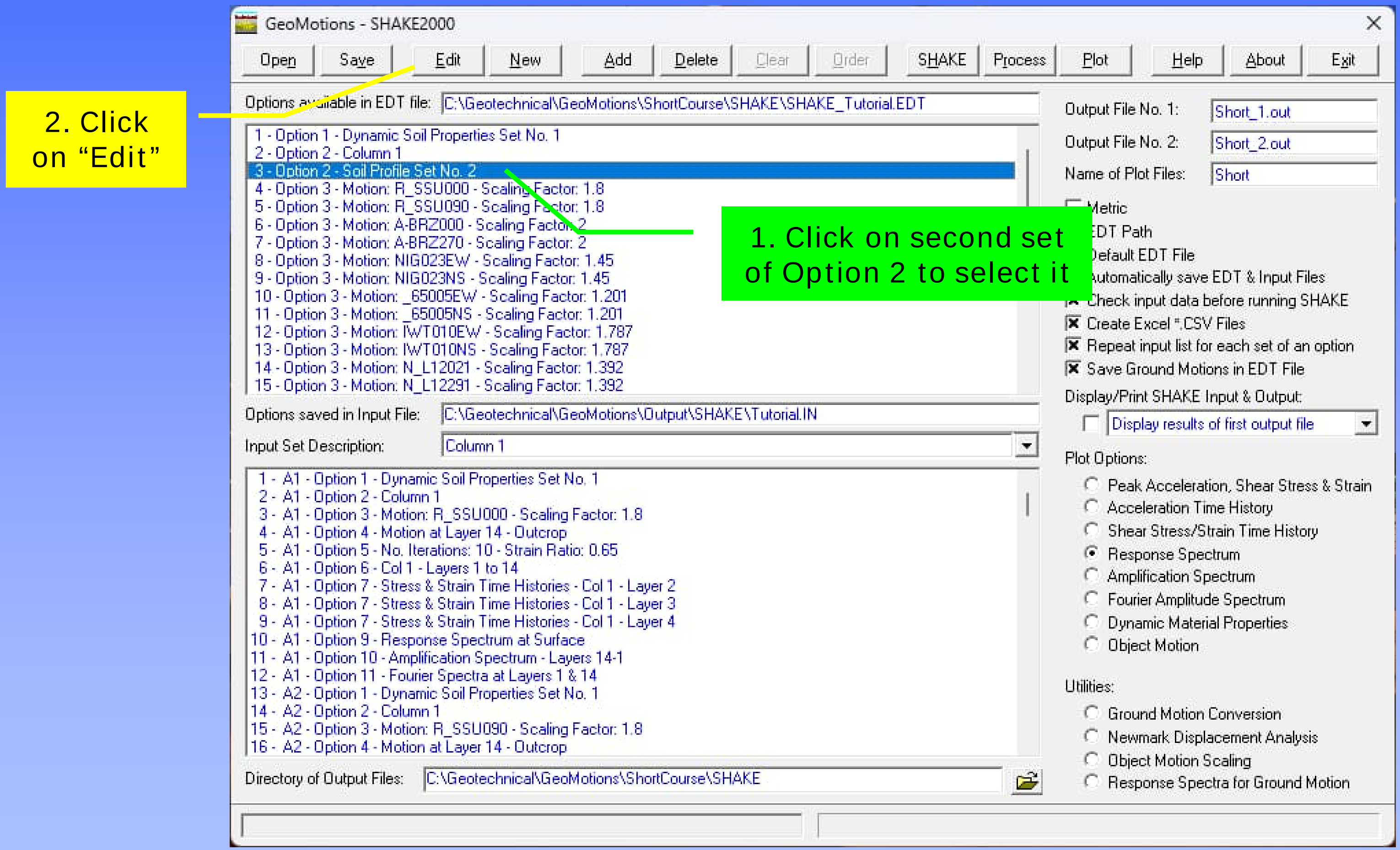
2. Click on “Choose”

1. Click on “Option 2 – Soil Profile” to select it

GeoMotions

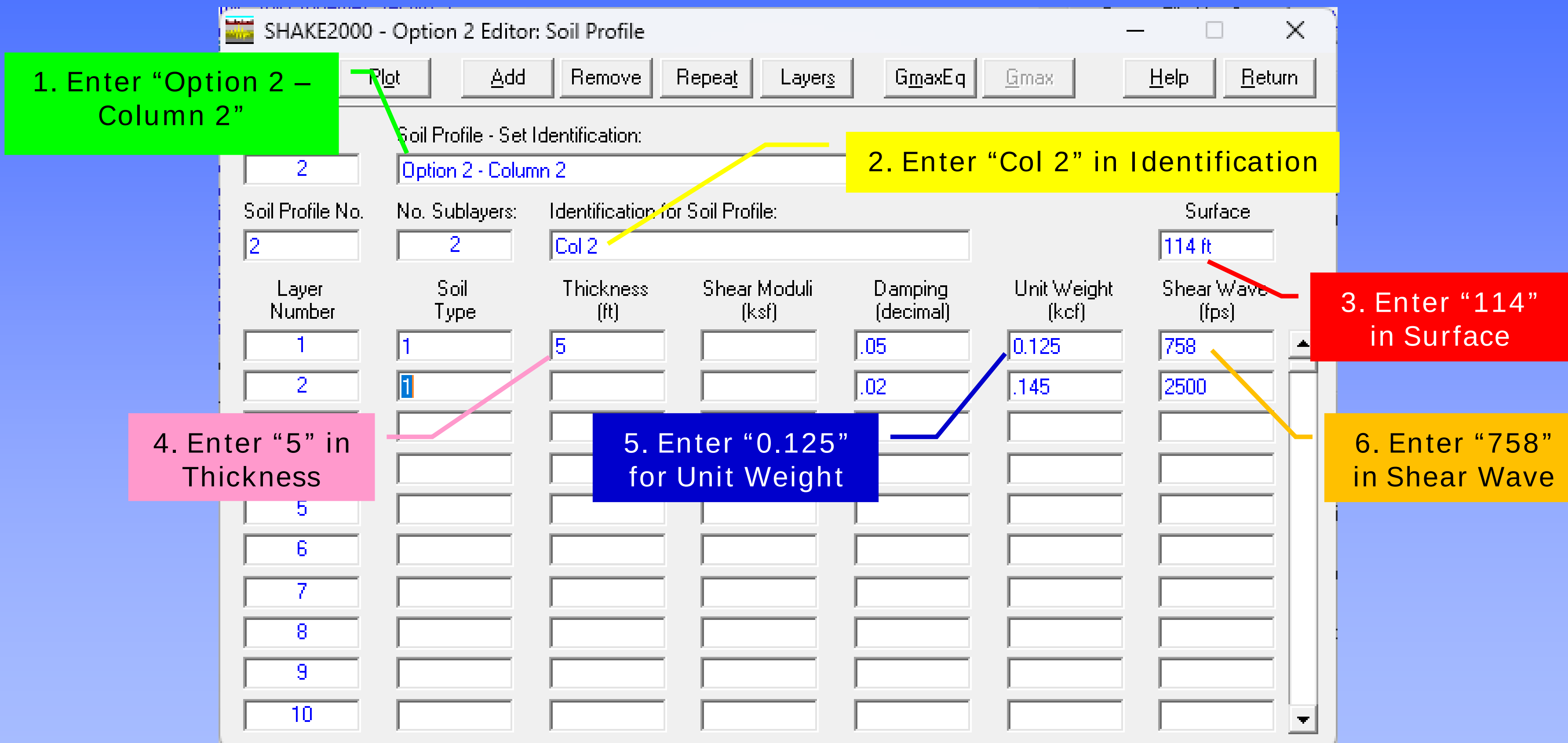
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile – Column 2



GeoMotions

Site Specific Response Analysis

Option 2 – Enter the data for Column No. 2

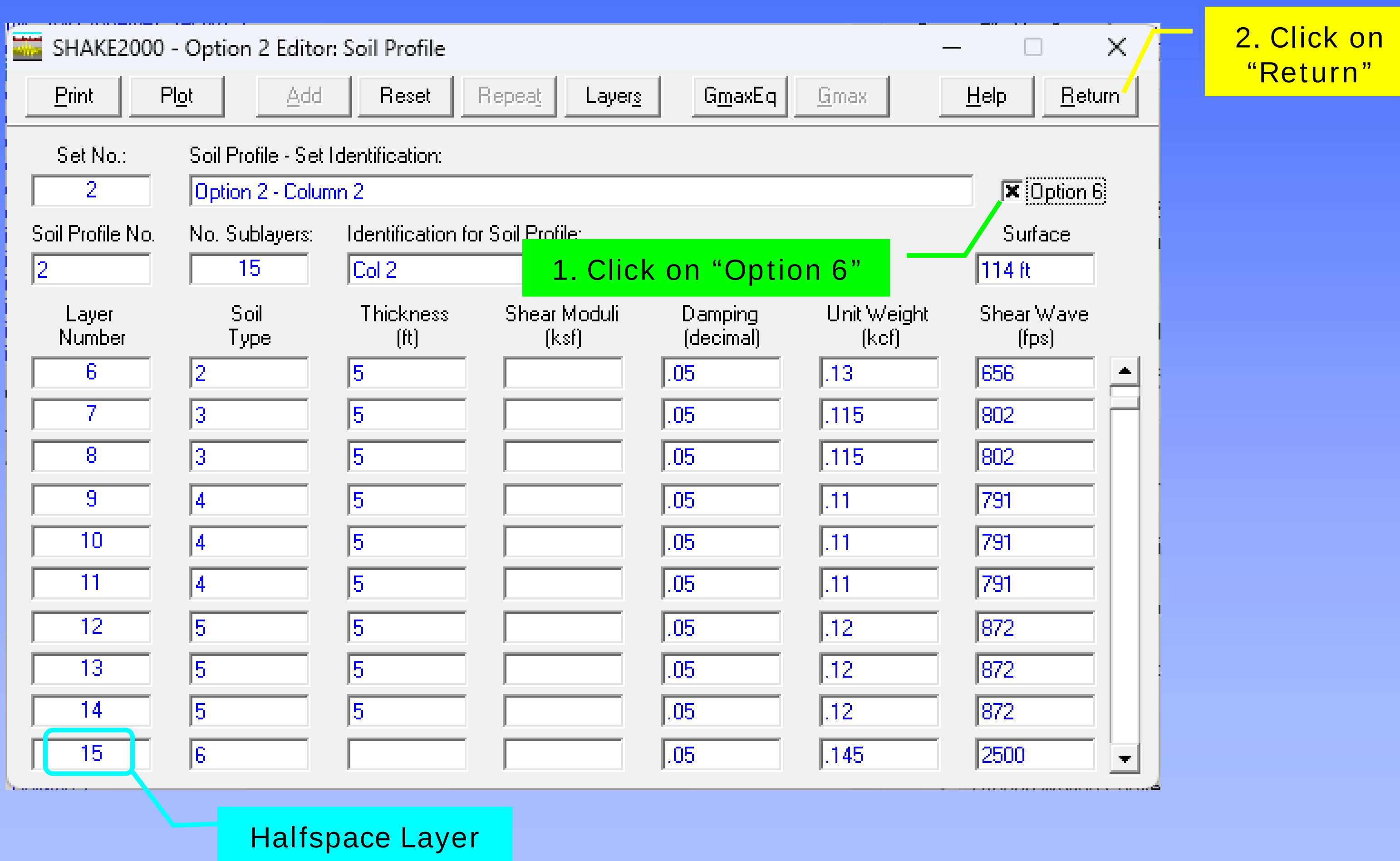
Layer No.	Soil Type	Thickness (feet)	Damping	Unit Weight (kcf)	V_S (fps)
2	1	5	0.05	0.125	758
3	1	5	0.05	0.125	758
4	2	5	0.05	0.130	656
5	2	5	0.05	0.130	656
6	2	5	0.05	0.130	656
7	3	5	0.05	0.115	802
8	3	5	0.05	0.115	802
9	4	5	0.05	0.110	791
10	4	5	0.05	0.110	791*
11	4	5	0.05	0.110	791
12	5	5	0.05	0.120	872
13	5	5	0.05	0.120	872
14	5	5	0.05	0.120	872
15	6		0.02	0.145	2500

*After entering the V_S value for layer 10 press "Tab" to move out of the cell and then you'll be able to scroll down

GeoMotions

Site Specific Response Analysis

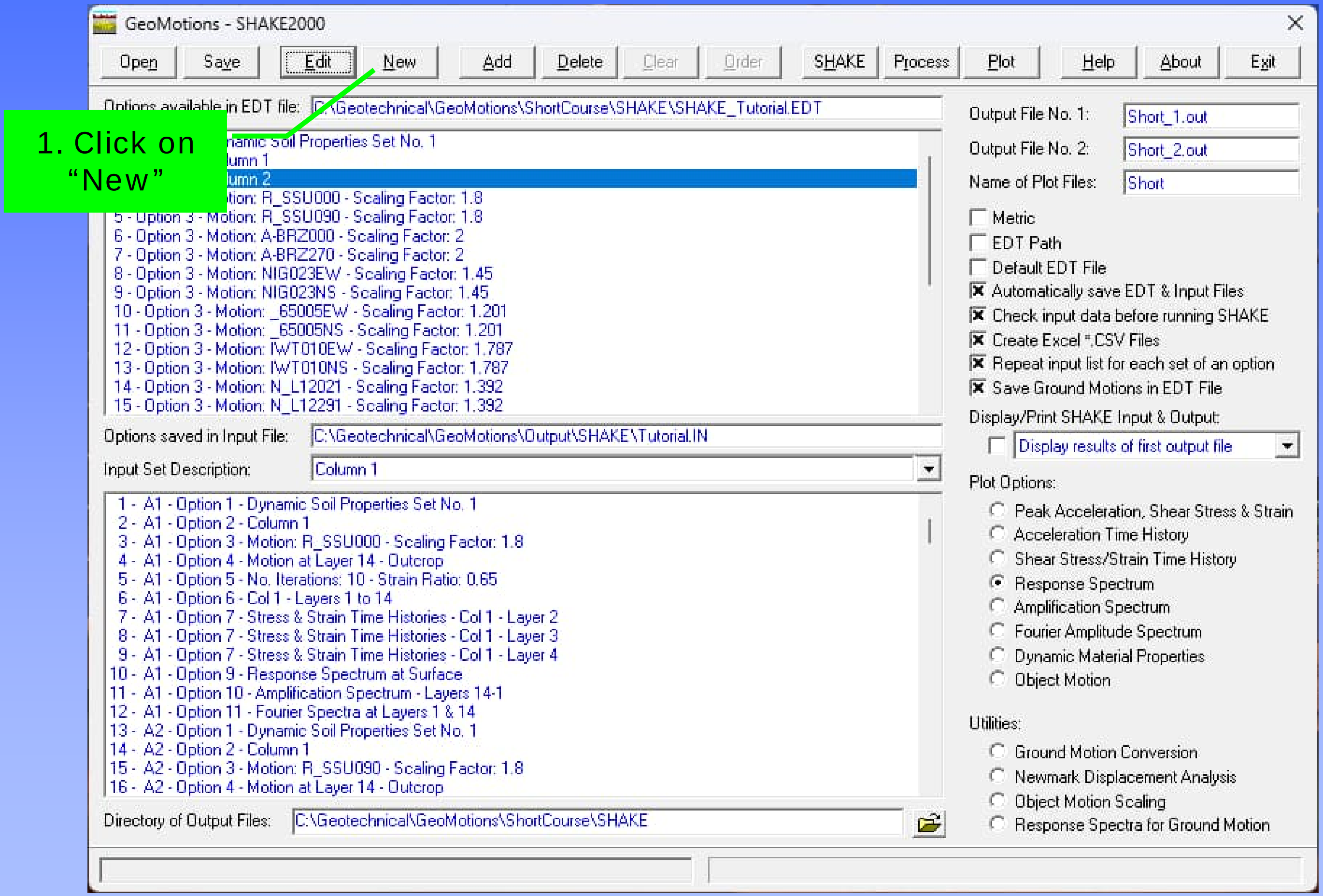
Create Input Data – Option 2: Soil Profile – Column 2



GeoMotions

Site Specific Response Analysis

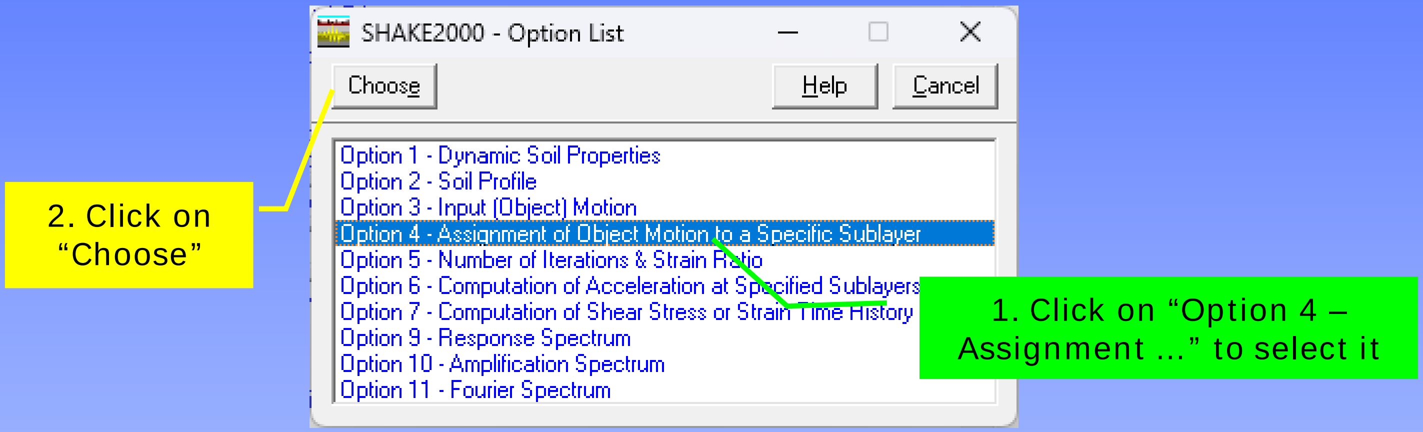
Create Input Data for Column No. 2



GeoMotions

Site Specific Response Analysis

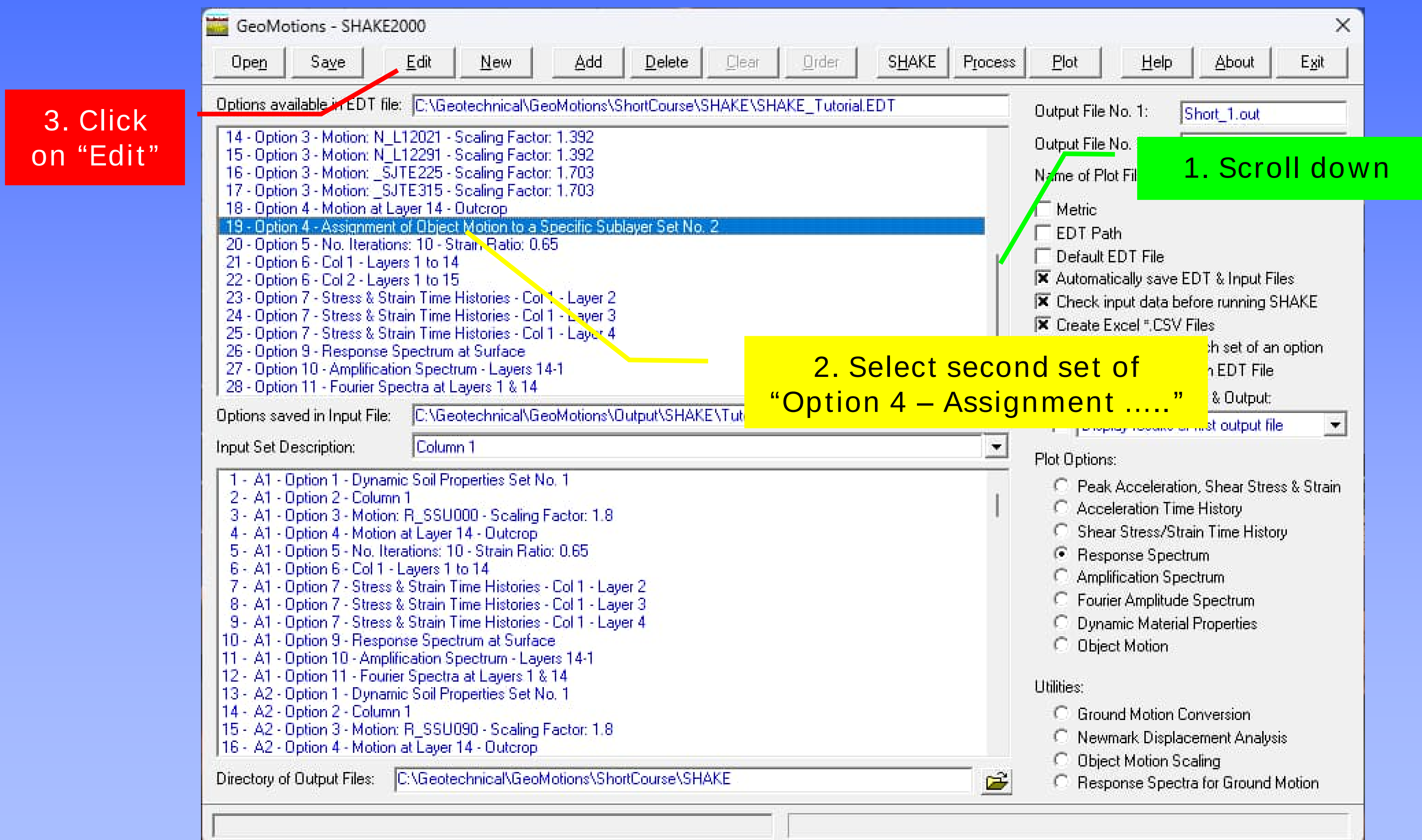
Create Input Data for Column No. 2



GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

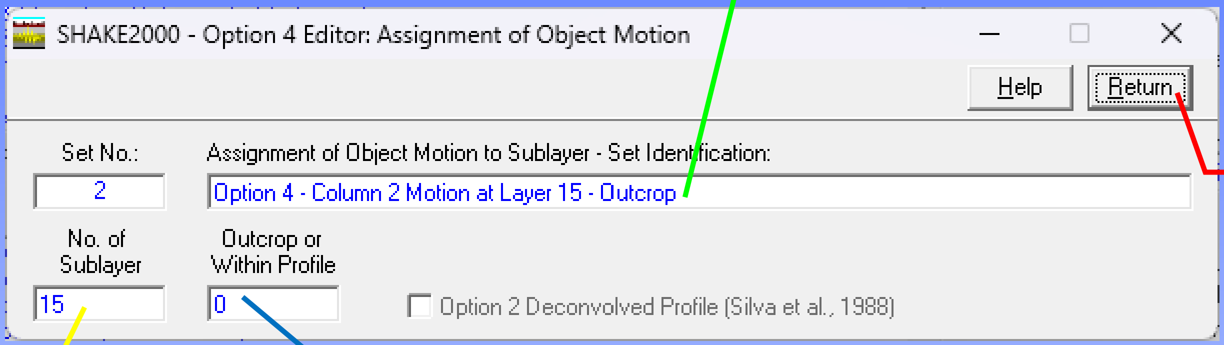


Site Specific Response Analysis

Create Input Data for Column No. 2

Option 4: Assignment of Object Motion

1. Enter "Option 4 – Column 2 Motion at Layer 15 – Outcrop"



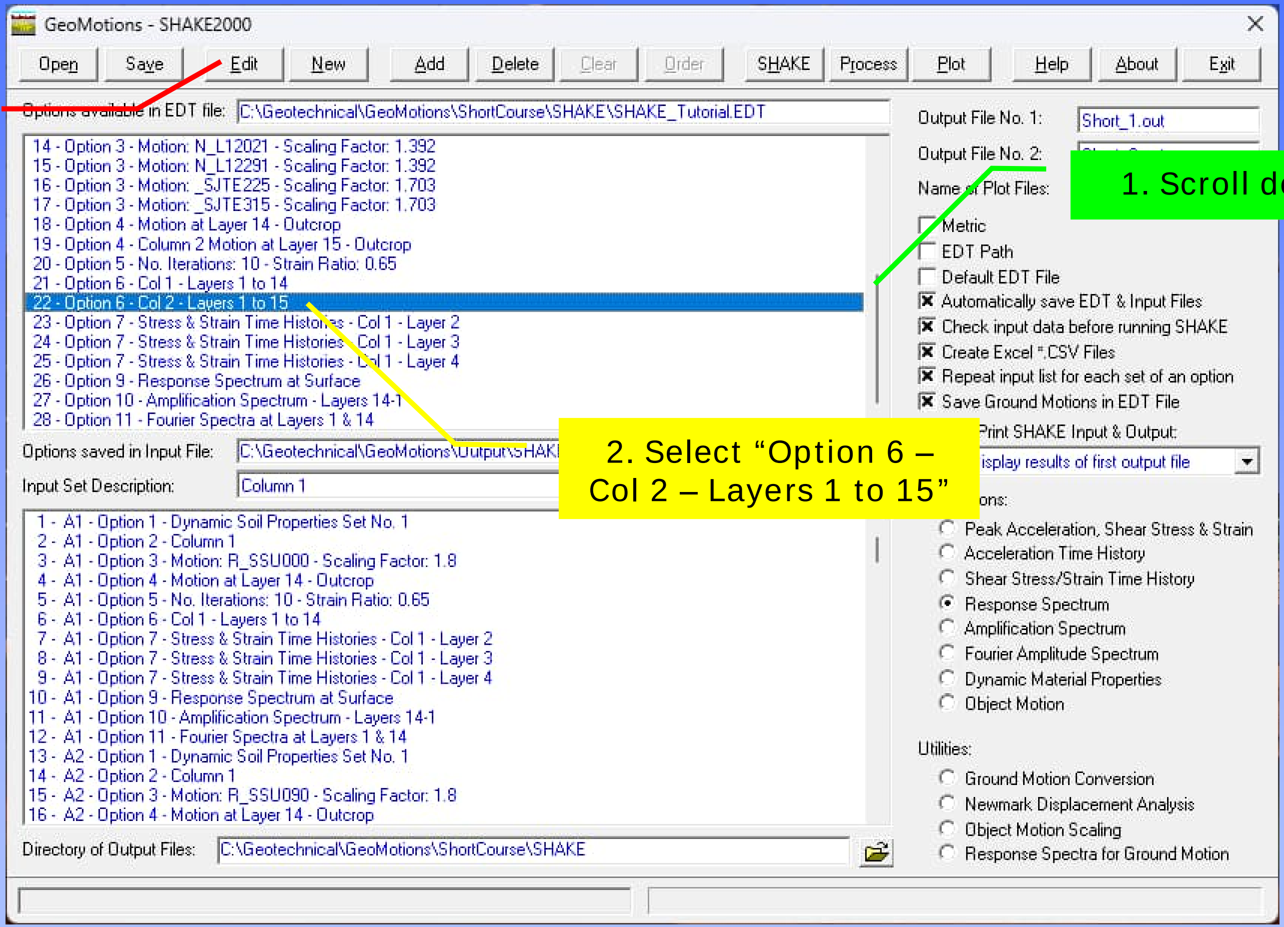
3. Click on "Return"

2. Enter "15" for No. of Sublayer

0 = Outcrop
1 = Within

Site Specific Response Analysis

Create Input Data for Column No. 2

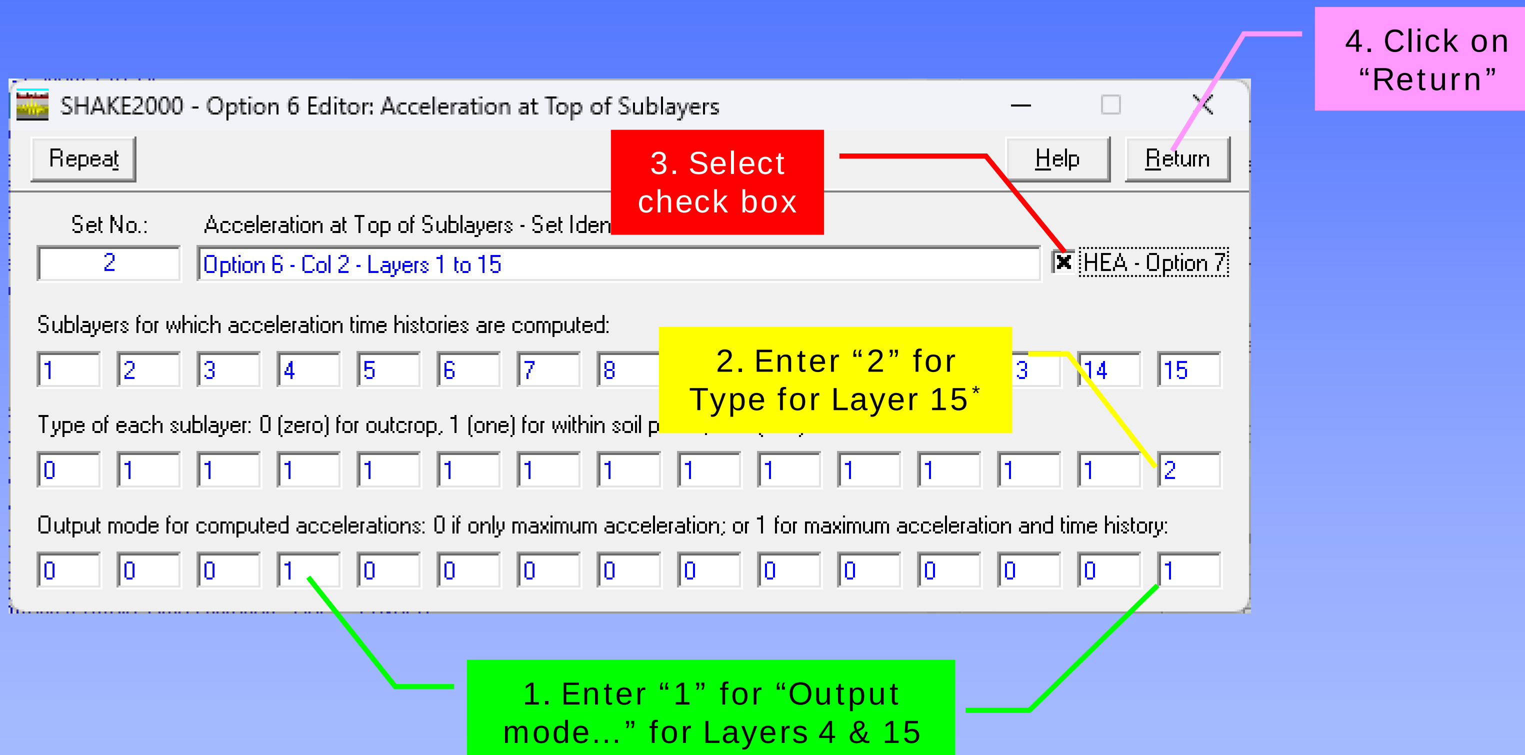


GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

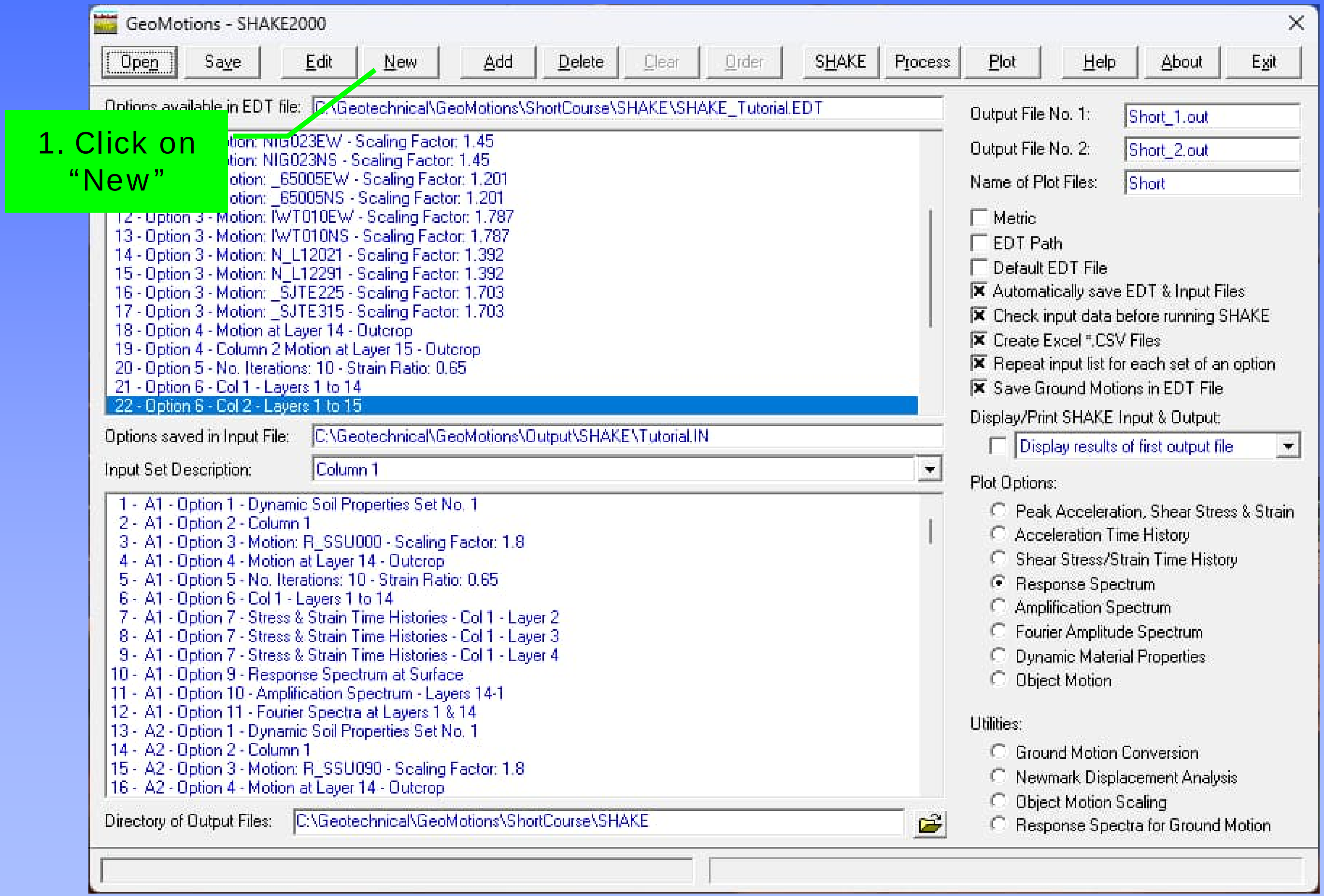
Option 6: Acceleration Time Histories



** Acceleration time history at layer 15 will compute the “incident” component of the resultant acceleration time history.

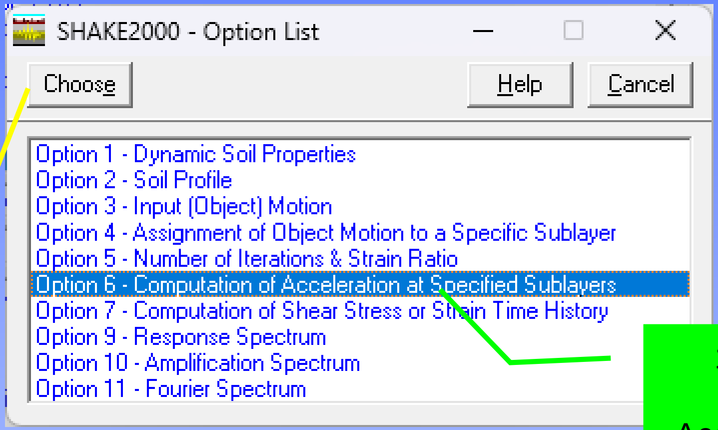
Site Specific Response Analysis

Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No. 2

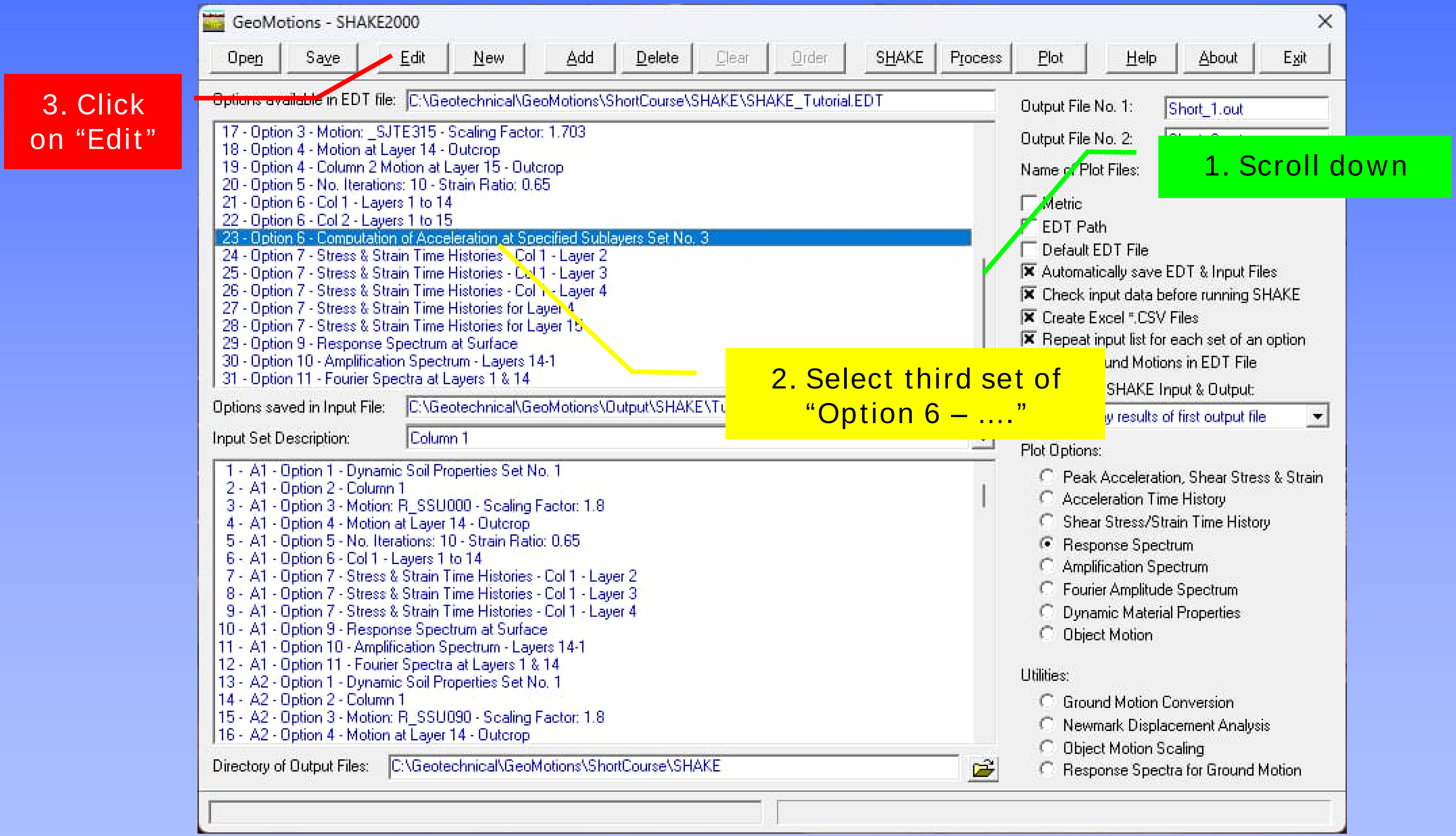


2. Click on "Choose"

1. Click on "Option 6 – Computation of Acceleration ..." to select it

Site Specific Response Analysis

Create Input Data for Column No. 2

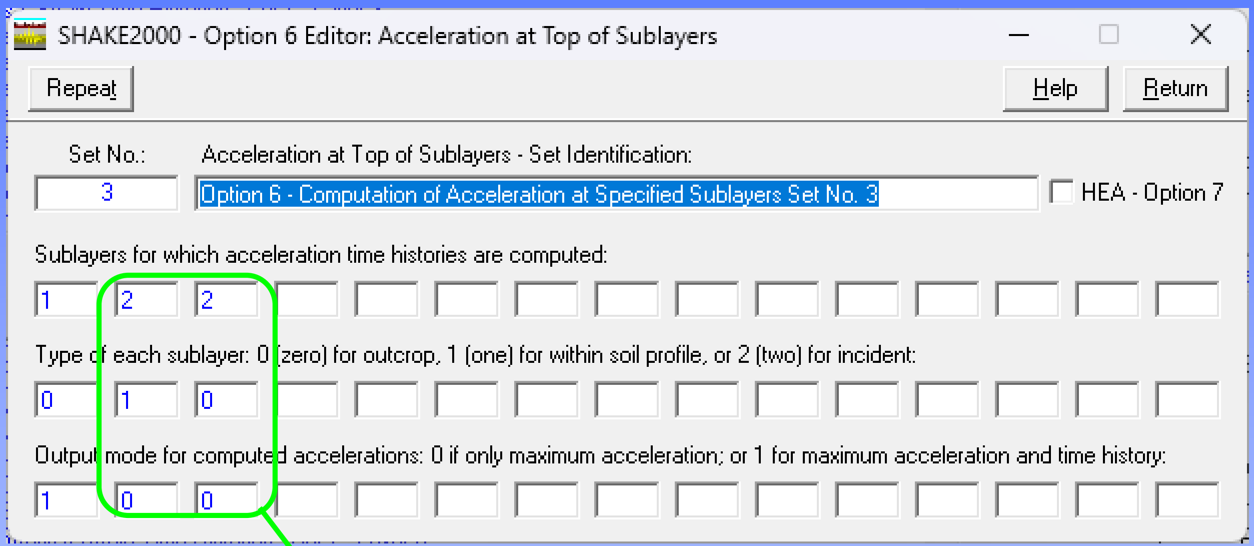


GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

Option 6: Acceleration Time Histories



1. Delete data on these two columns

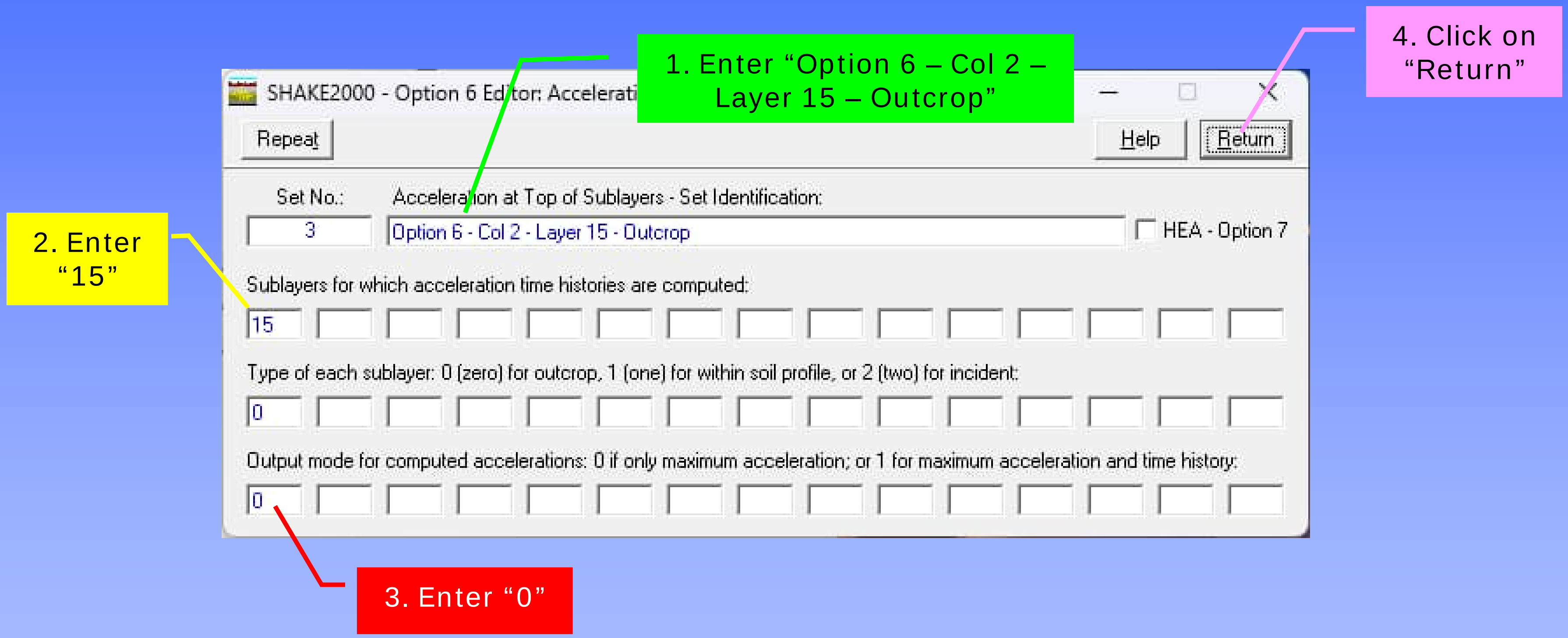
** Acceleration time history at layer 15 will compute the "incident" component of the resultant acceleration time history.

GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

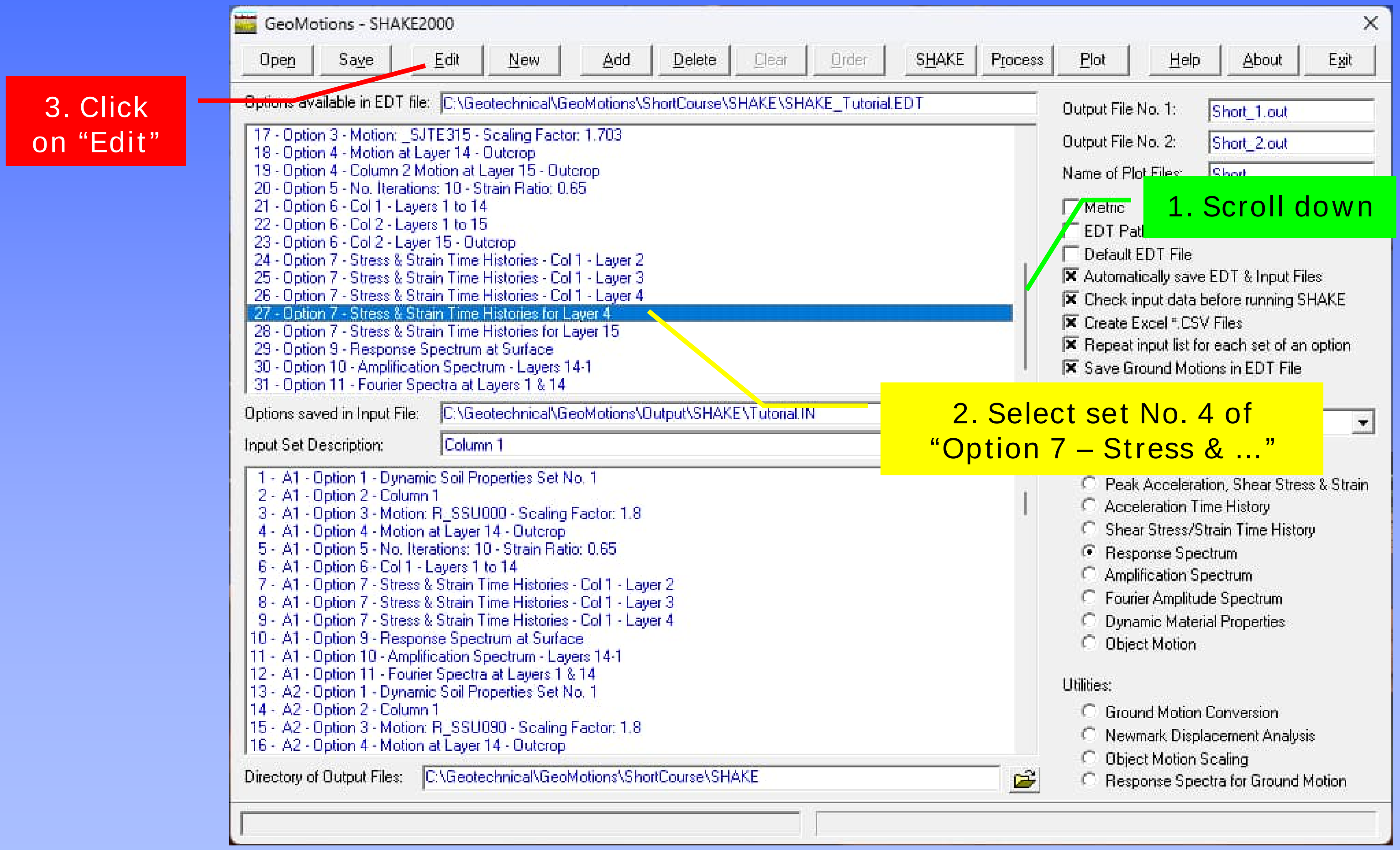
Option 6: Acceleration Time Histories



GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

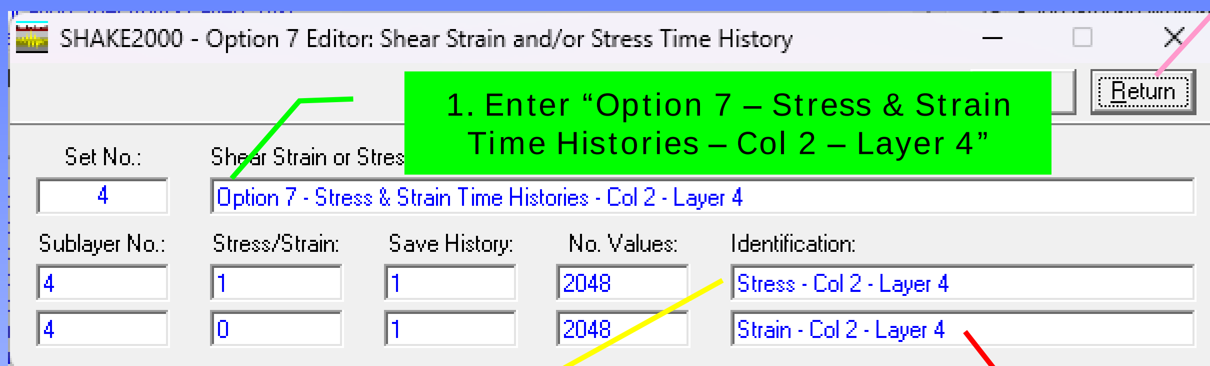


GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

Option 7: Shear Strain & Shear Stress



1. Enter "Option 7 – Stress & Strain Time Histories – Col 2 – Layer 4"

2. Enter "Stress - Col 2 – Layer 4"

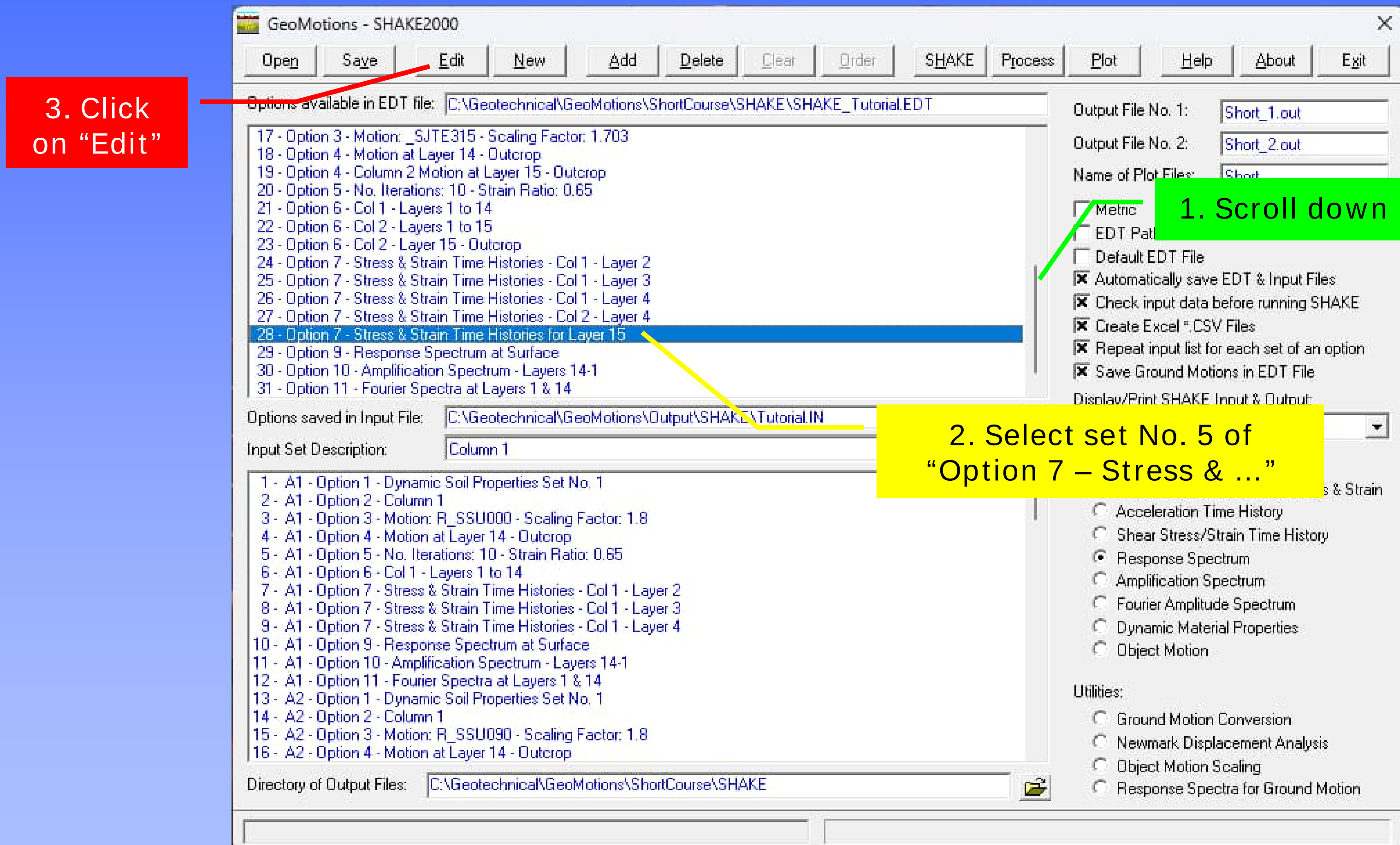
3. Enter "Strain – Col 2 – Layer 4"

4. Click "Return"

GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2



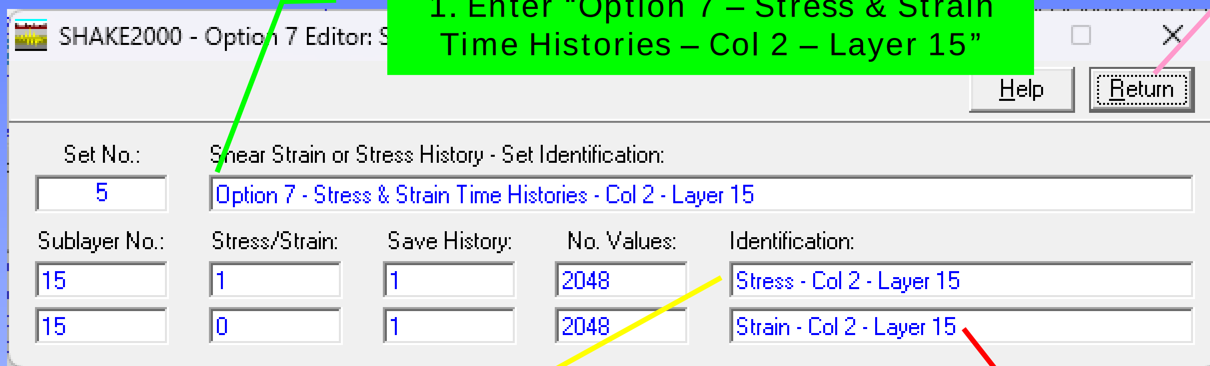
GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

Option 7: Shear Strain & Shear Stress

1. Enter “Option 7 – Stress & Strain Time Histories – Col 2 – Layer 15”



4. Click “Return”

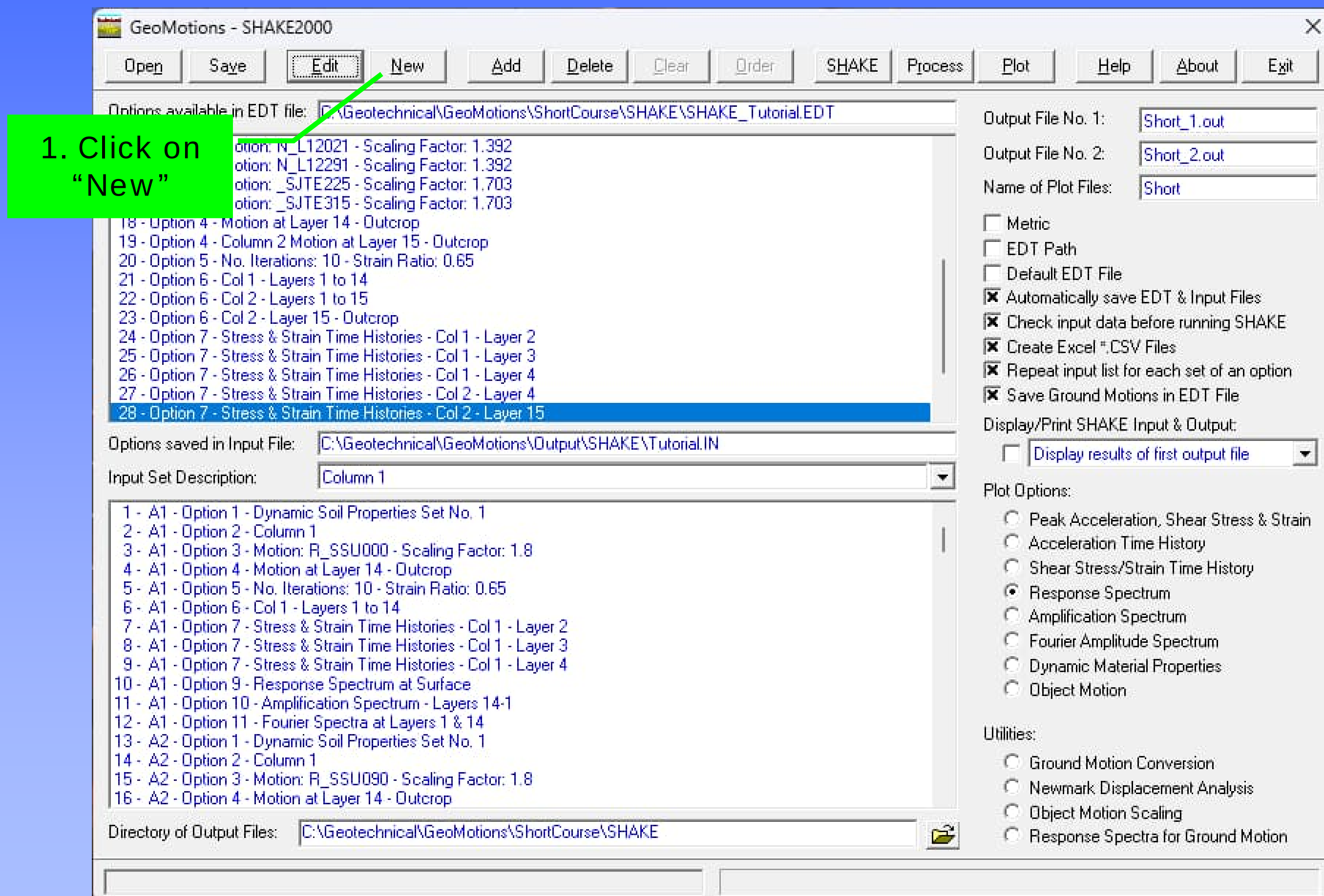
2. Enter “Stress - Col 2 – Layer 15”

3. Enter “Strain – Col 2 – Layer 15”

GeoMotions

Site Specific Response Analysis

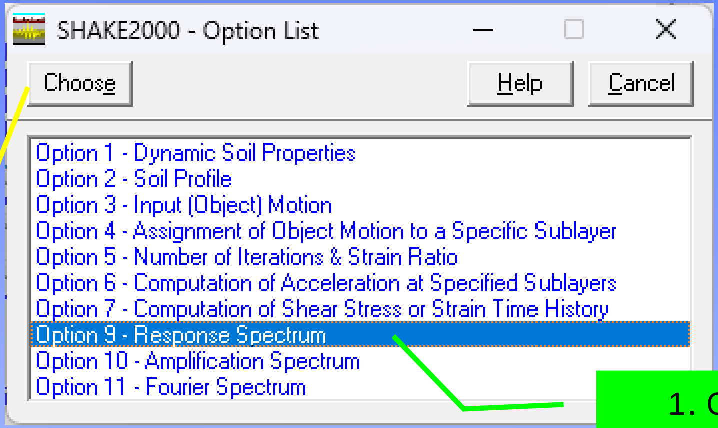
Create Input Data for Column No. 2



GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2



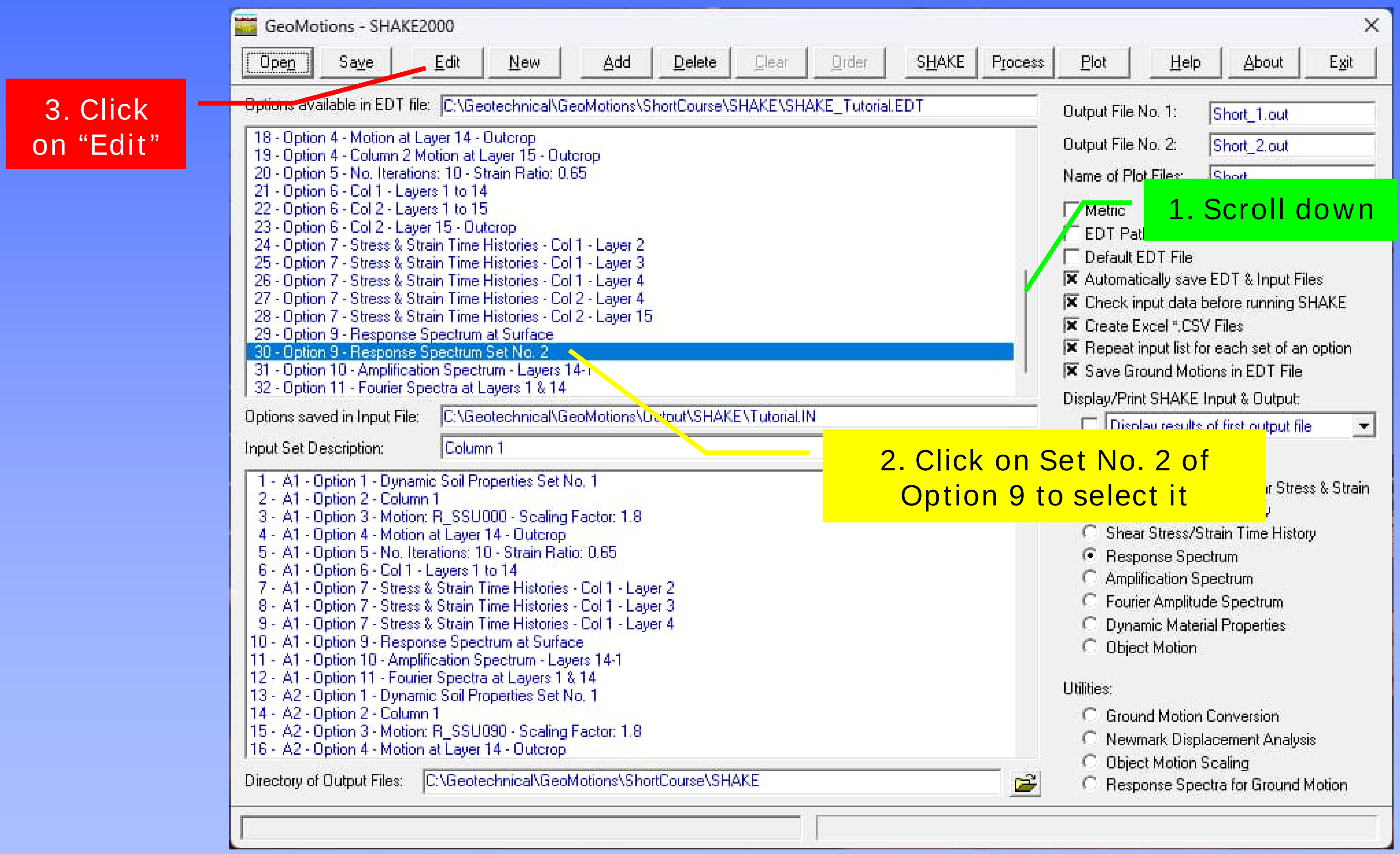
2. Click on "Choose"

1. Click on "Option 9 – Response Spectrum" to select it

GeoMotions

Site Specific Response Analysis

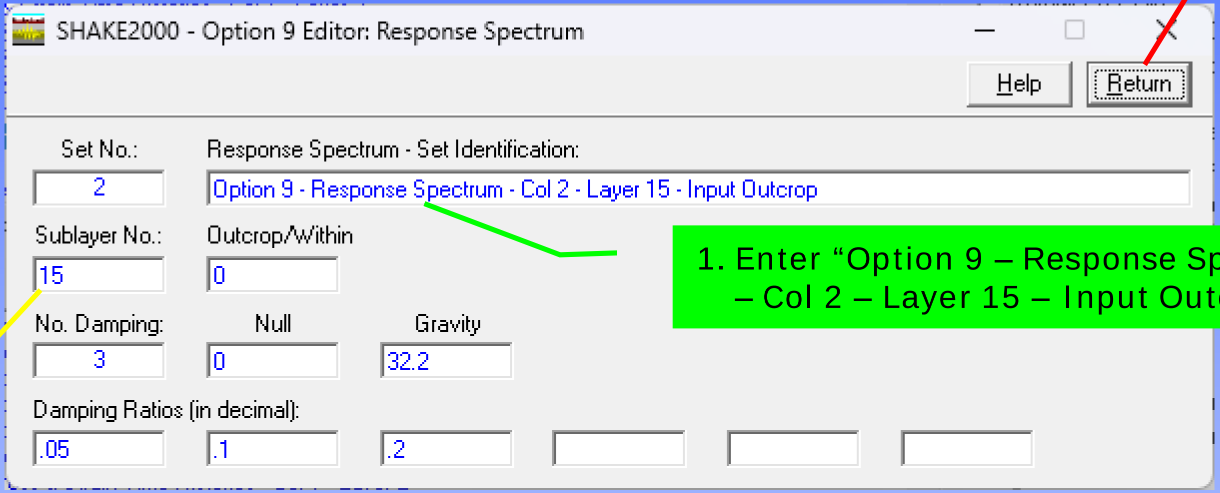
Create Input Data for Column No. 2



Site Specific Response Analysis

Create Input Data for Column No 2

Option 9: Response Spectrum



3. Click on "Return"

1. Enter "Option 9 – Response Spectrum – Col 2 – Layer 15 – Input Outcrop"

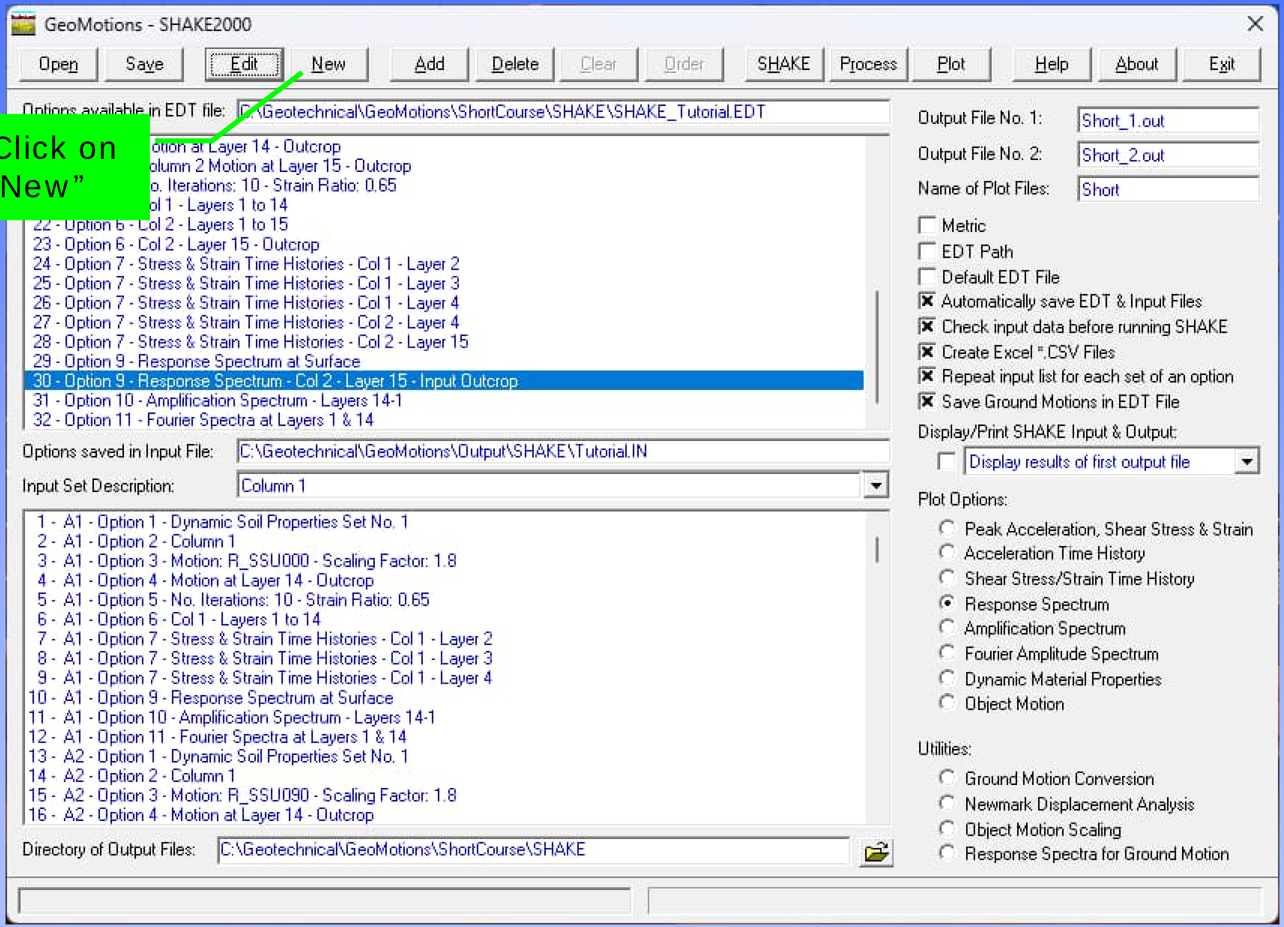
2. Enter "15"

GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2

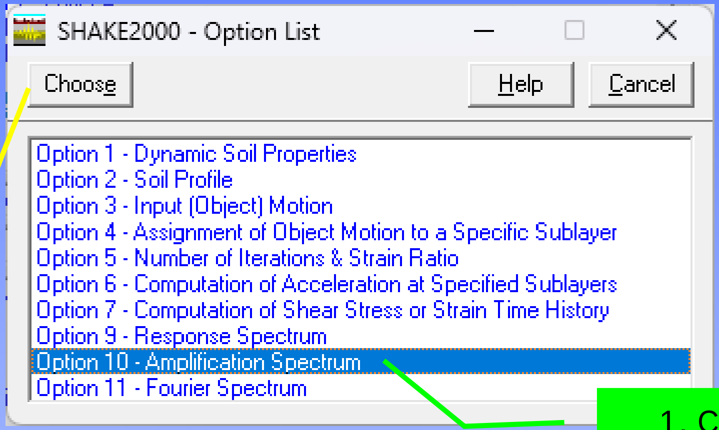
1. Click on "New"



GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2



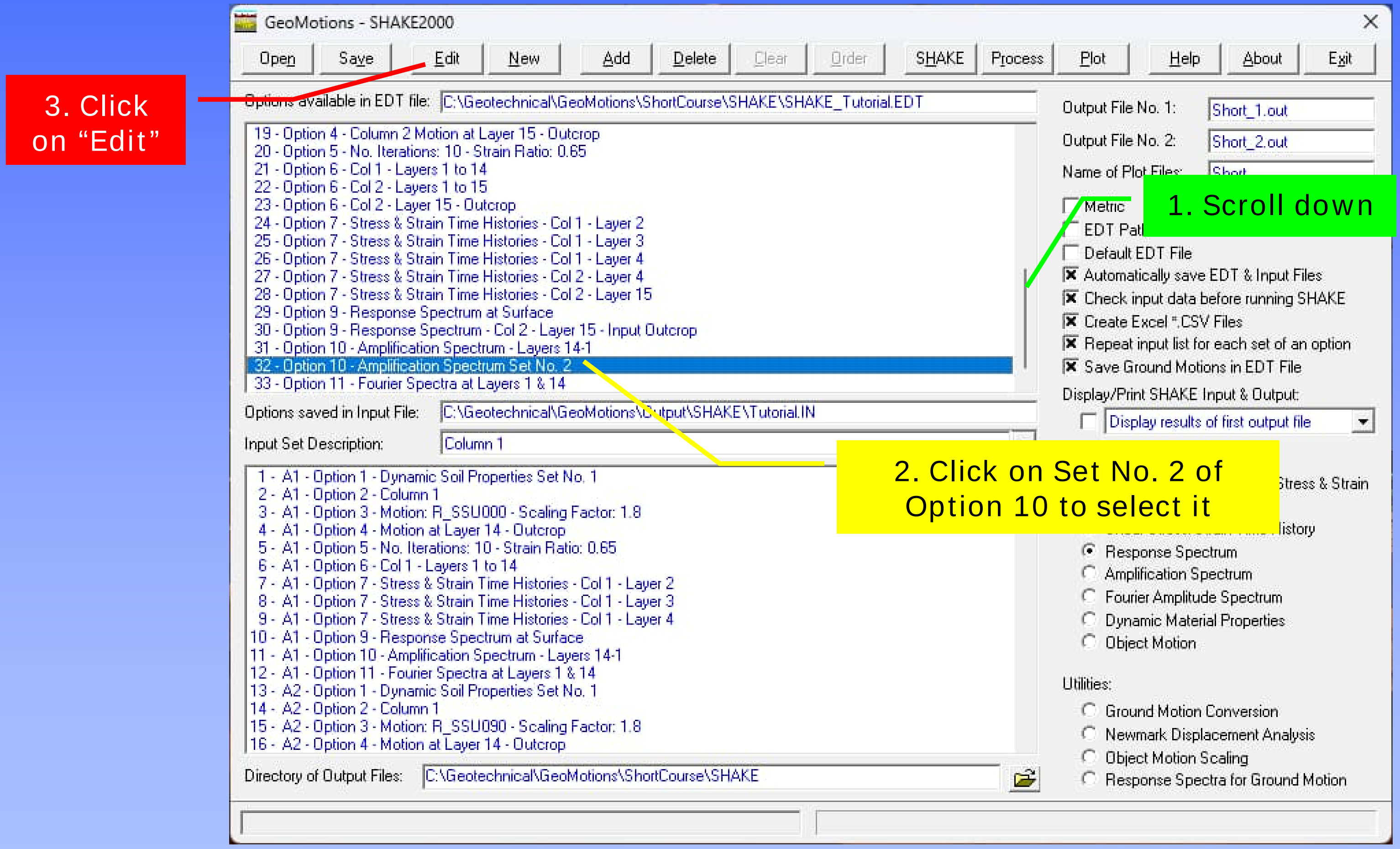
2. Click on "Choose"

1. Click on "Option 10 – Amplification Spectrum" to select it

GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2



GeoMotions

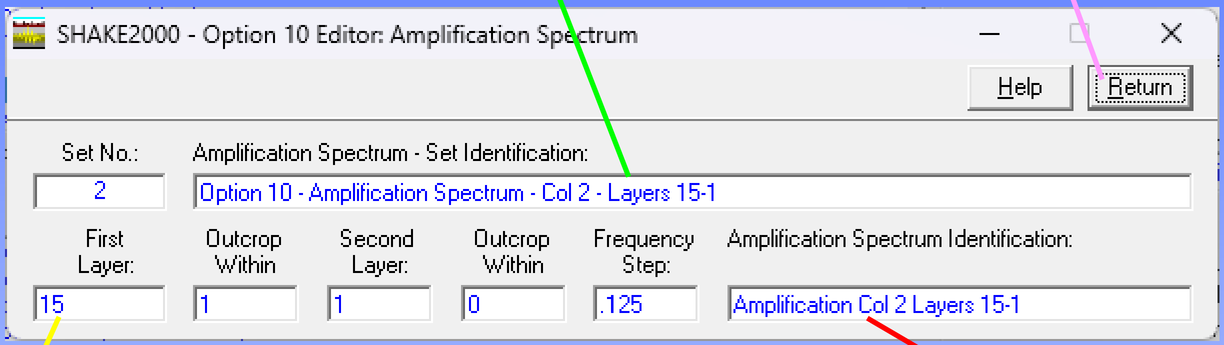
Site Specific Response Analysis

Create Input Data for Column No. 2

Option 10: Amplification Spectrum

1. Enter "Option 10 – Amplification Spectrum – Col 2 – Layers 15-1"

4. Click on "Return"



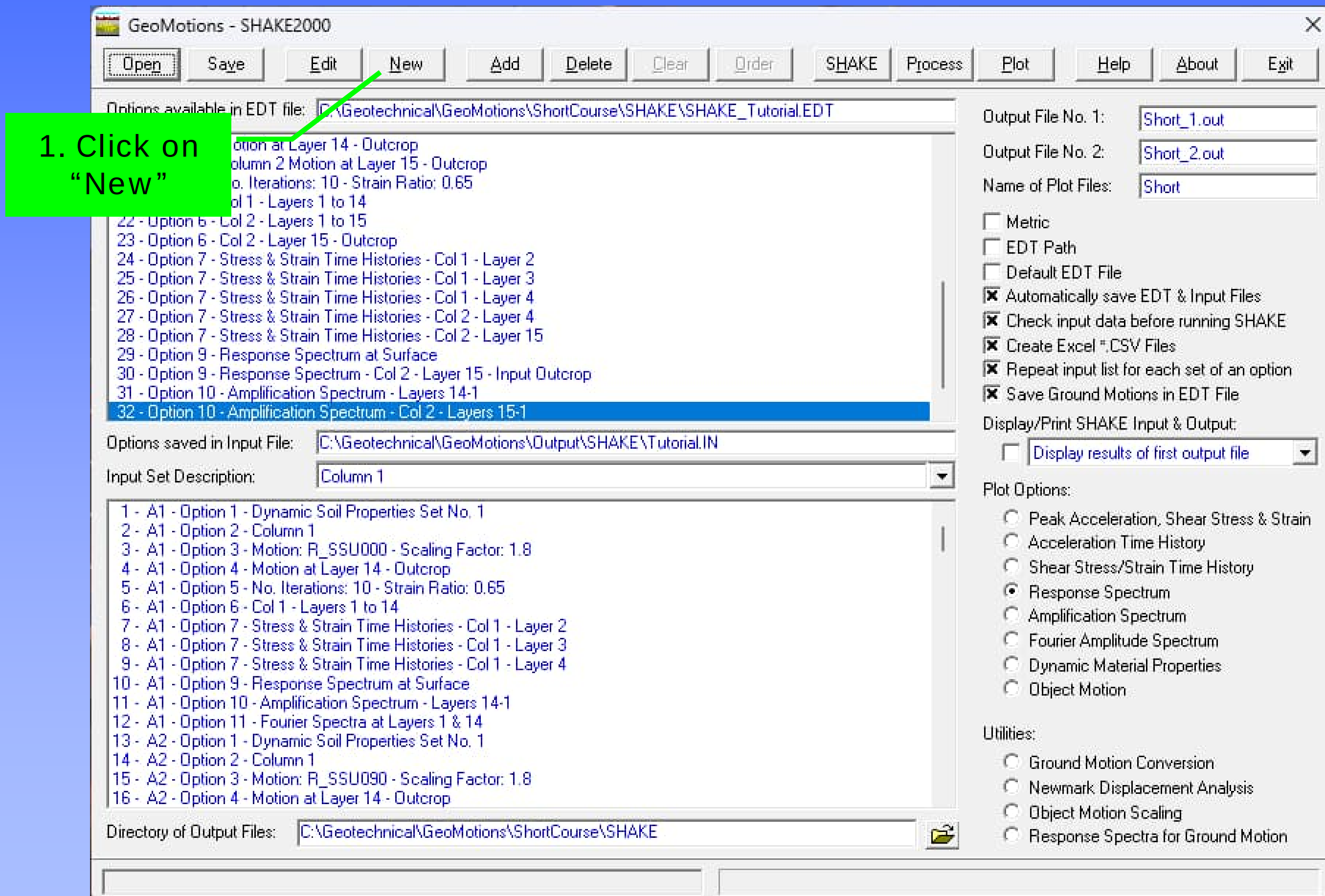
2. Enter "15" in First Layer

3. Enter "Amplification Col 2 Layers 15-1"

GeoMotions

Site Specific Response Analysis

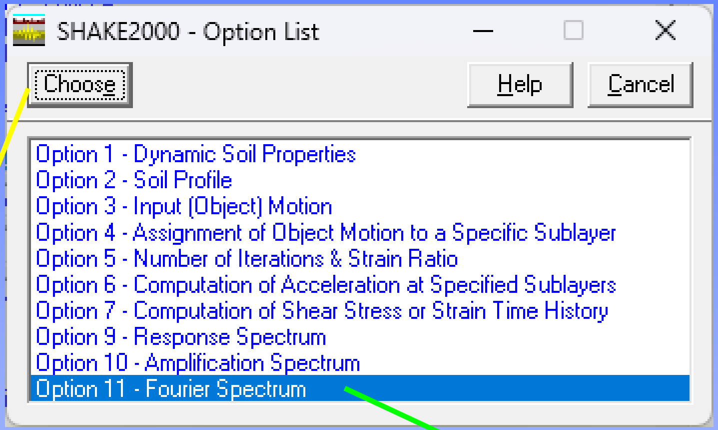
Create Input Data for Column No. 2



GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2



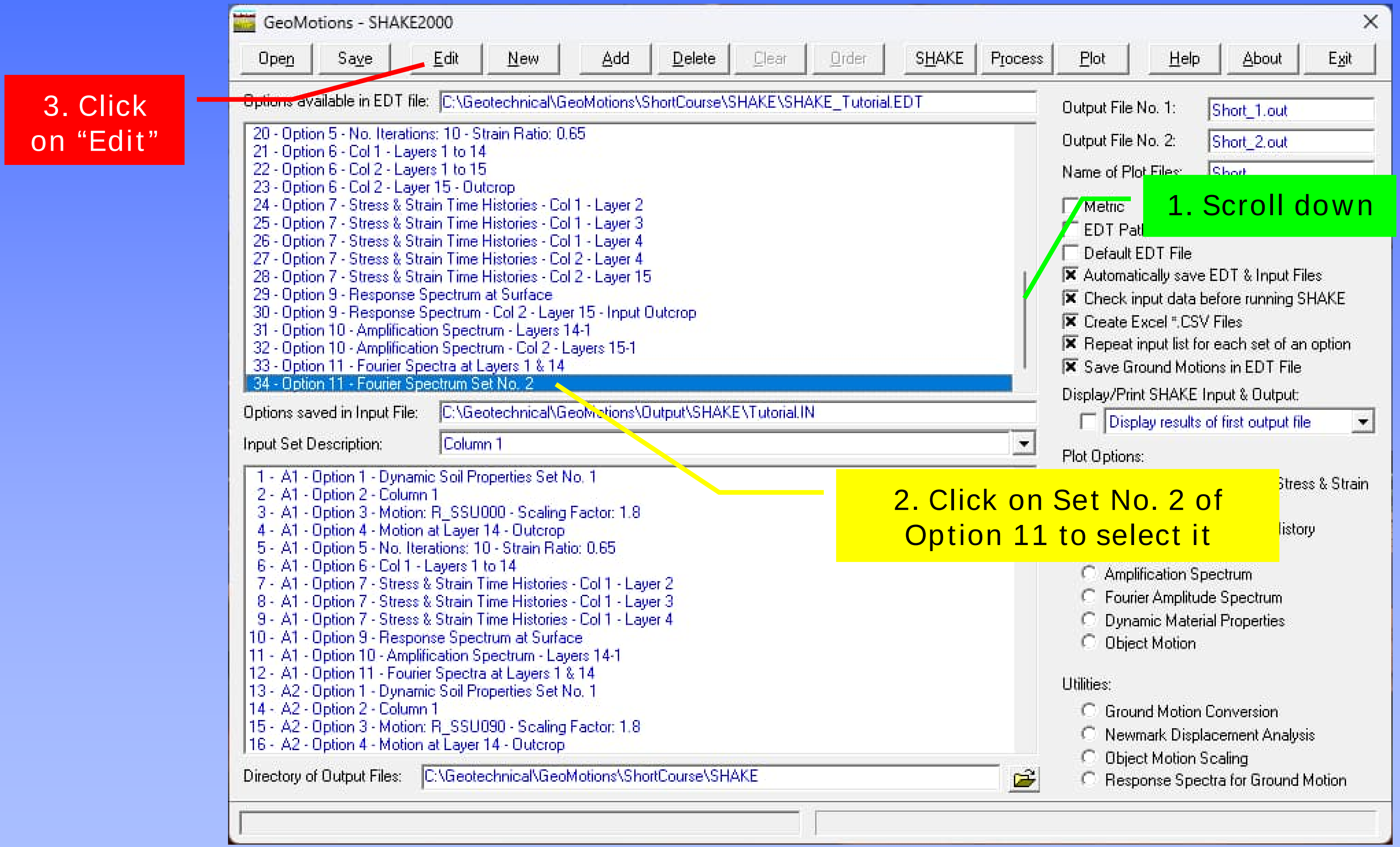
2. Click on "Choose"

1. Click on "Option 11 – Fourier Spectrum" to select it

GeoMotions

Site Specific Response Analysis

Create Input Data for Column No. 2



GeoMotions

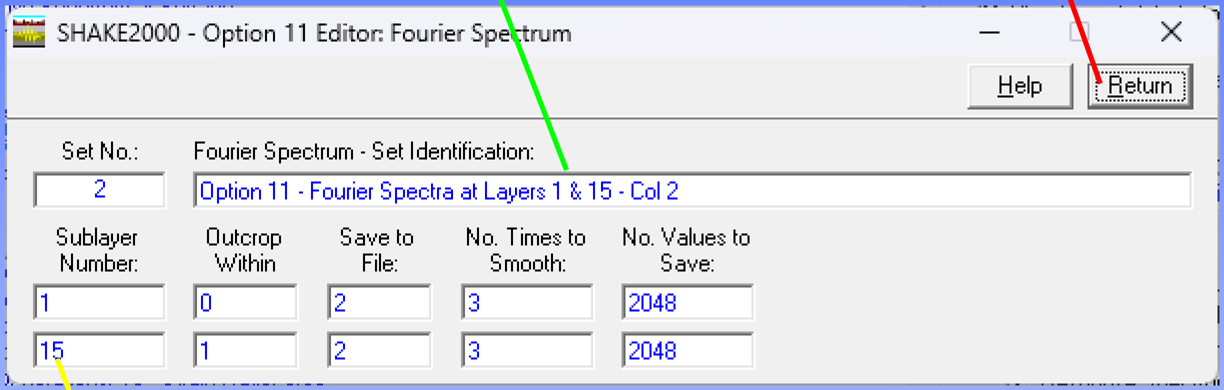
Site Specific Response Analysis

Create Input Data for Column No. 2

Option 11: Fourier Spectrum

1. Enter "Option 11 – Fourier Spectra at Layers 1 & 15 – Col 2"

3. Click on "Return"

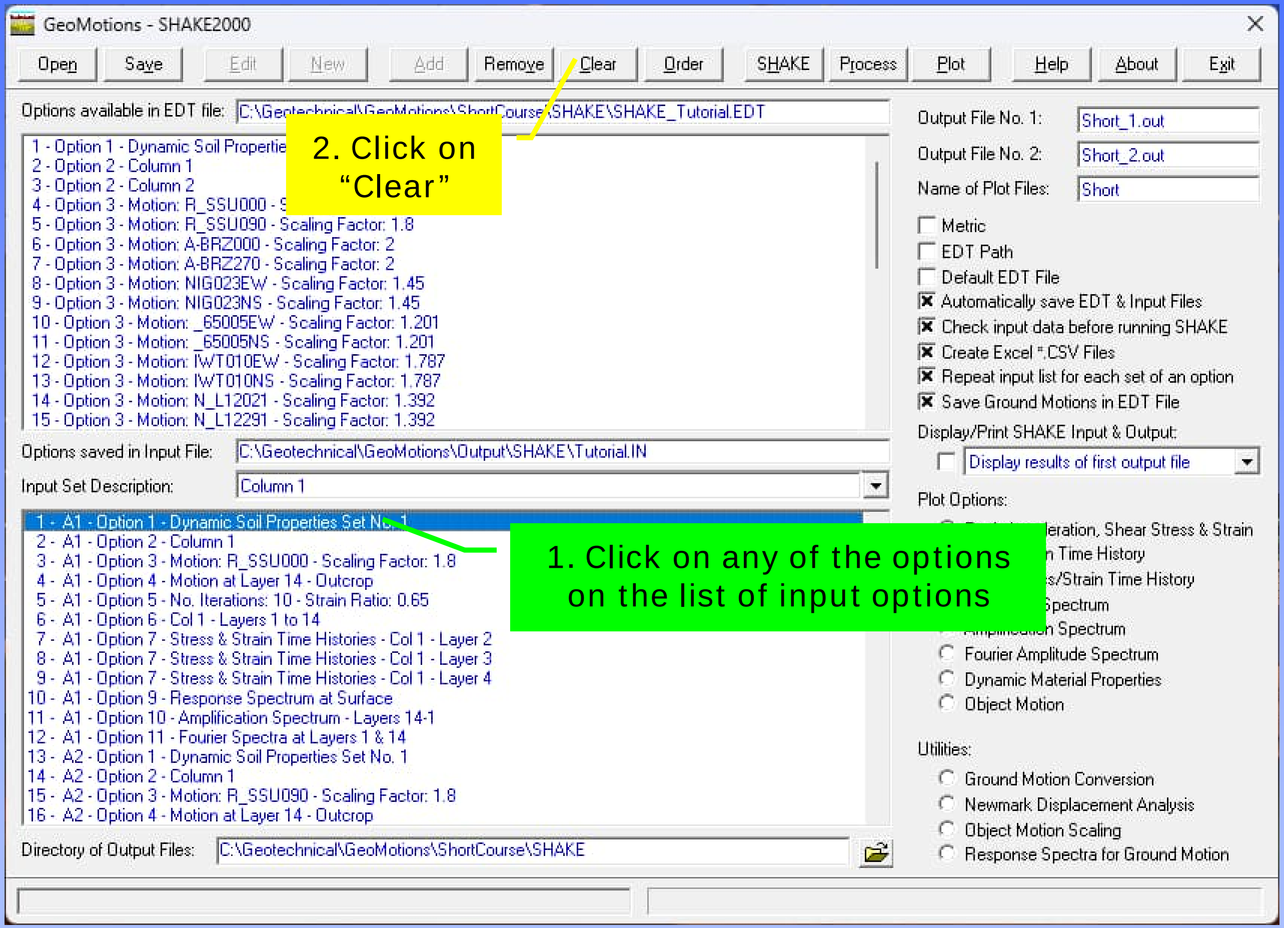


2. Enter "15" in second cell of Sublayer Number

GeoMotions

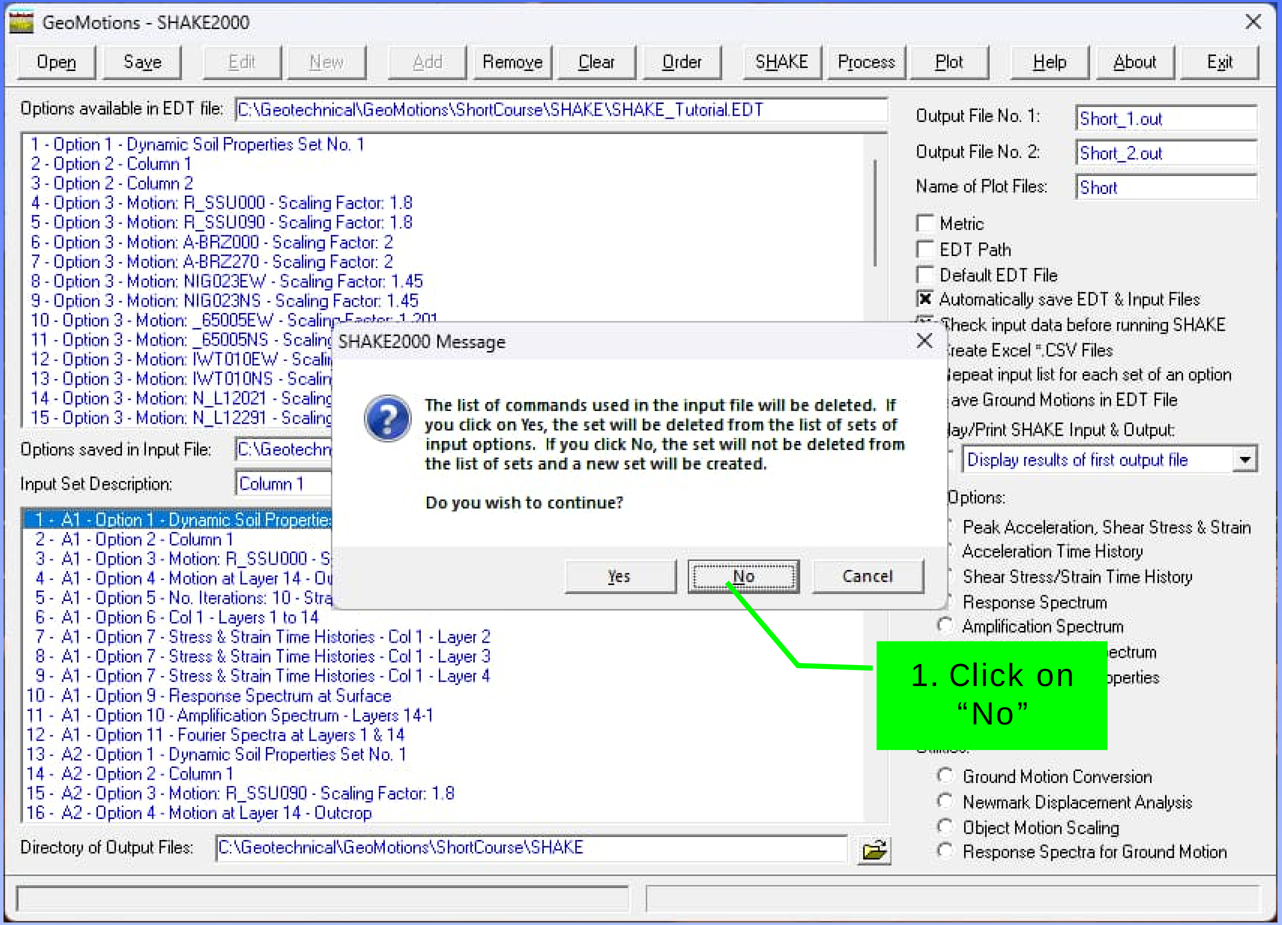
Site Specific Response Analysis

Create List of Input Options for Column 2



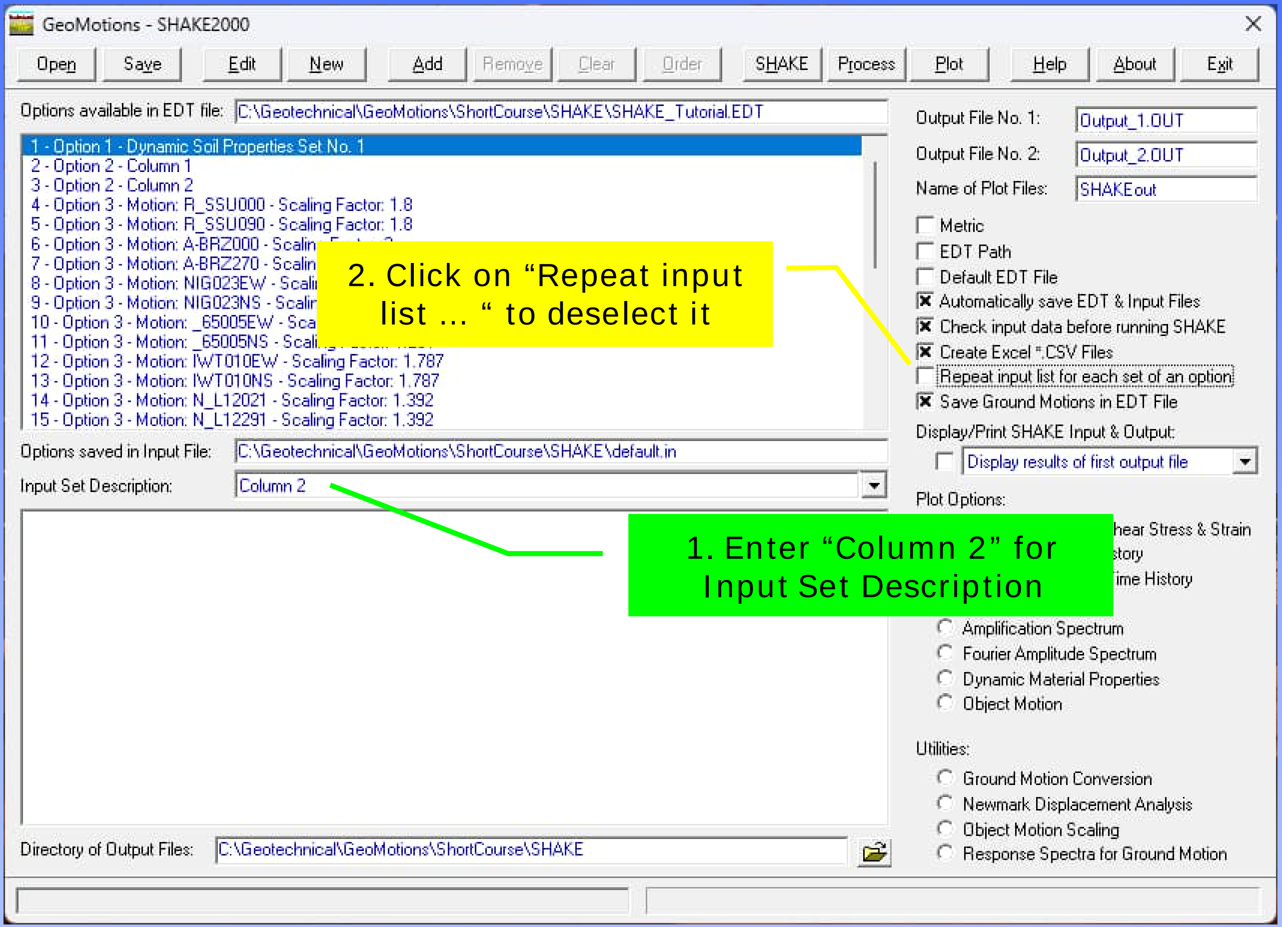
Site Specific Response Analysis

Create List of Input Options for Column 2



Site Specific Response Analysis

Create List of Input Options For Column No. 2



GeoMotions

Site Specific Response Analysis

List of Input Options for Analyses of Column No. 2

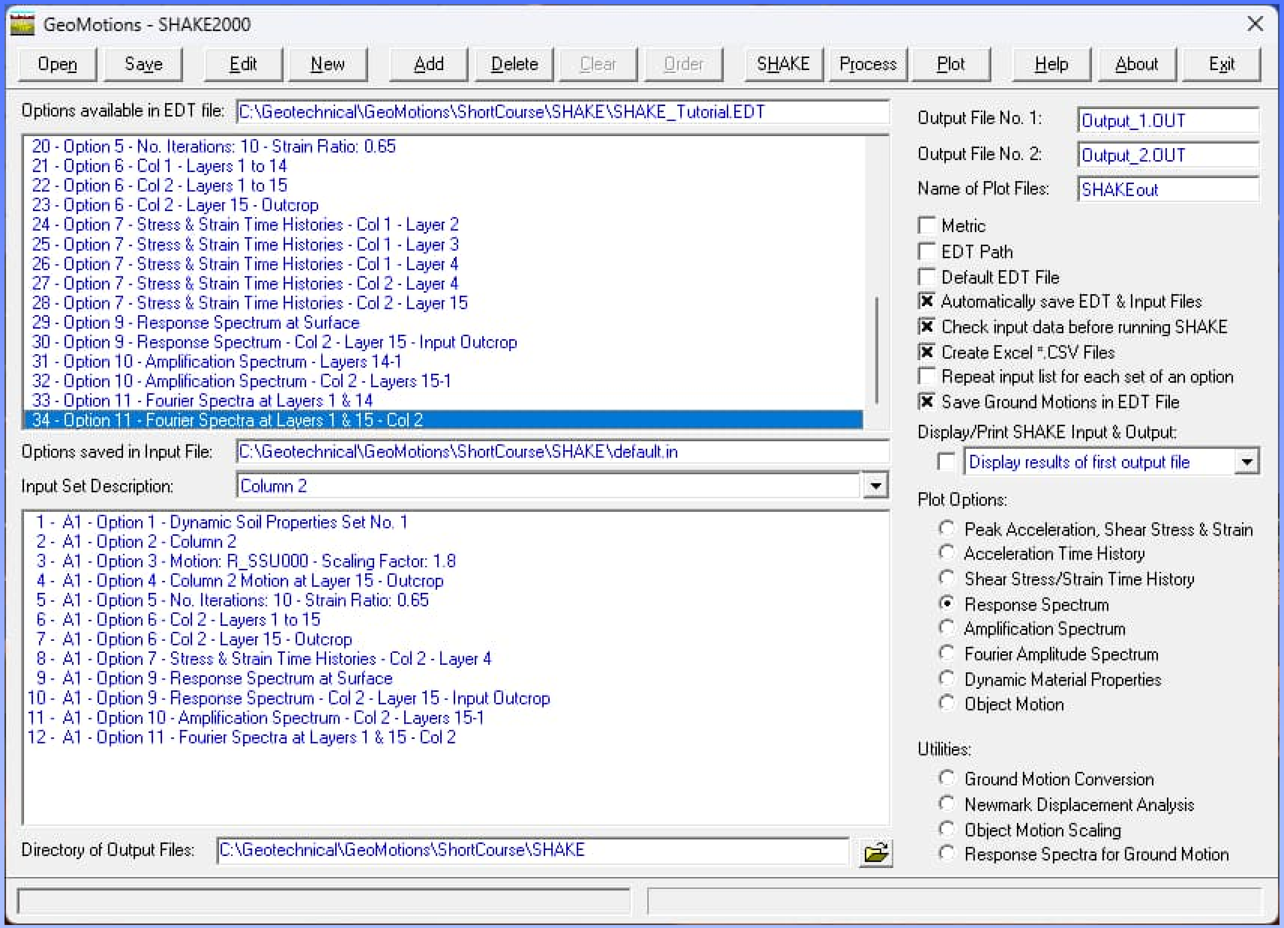
Add the following options to input file list:

Option	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
3	Option 2 – Column 2
4	Option 3 – Motion: R_SSU000 – Scaling Factor: 1.8
19	Option 4 – Column 2 Motion at Layer 15 - Outcrop
20	Option 5 – No. of Iterations: 10 – Strain Ration: 0.65
22	Option 6 – Col 2 – Layers 1 to 15
23	Option 6 – Col 2 – Layer 15 - Outcrop
27	Option 7 – Stress & Strain Time Histories – Col 2 – Layer 4
29	Option 9 – Response Spectrum at Surface
30	Option 9 – Response Spectrum – Col 2 – Layer 15 – Input Outcrop
32	Option 10 – Amplification Spectrum – Col 2 - Layers 15-1
34	Option 11 – Fourier Spectra at Layers 1 & 15 – Col 2

GeoMotions

Site Specific Response Analysis

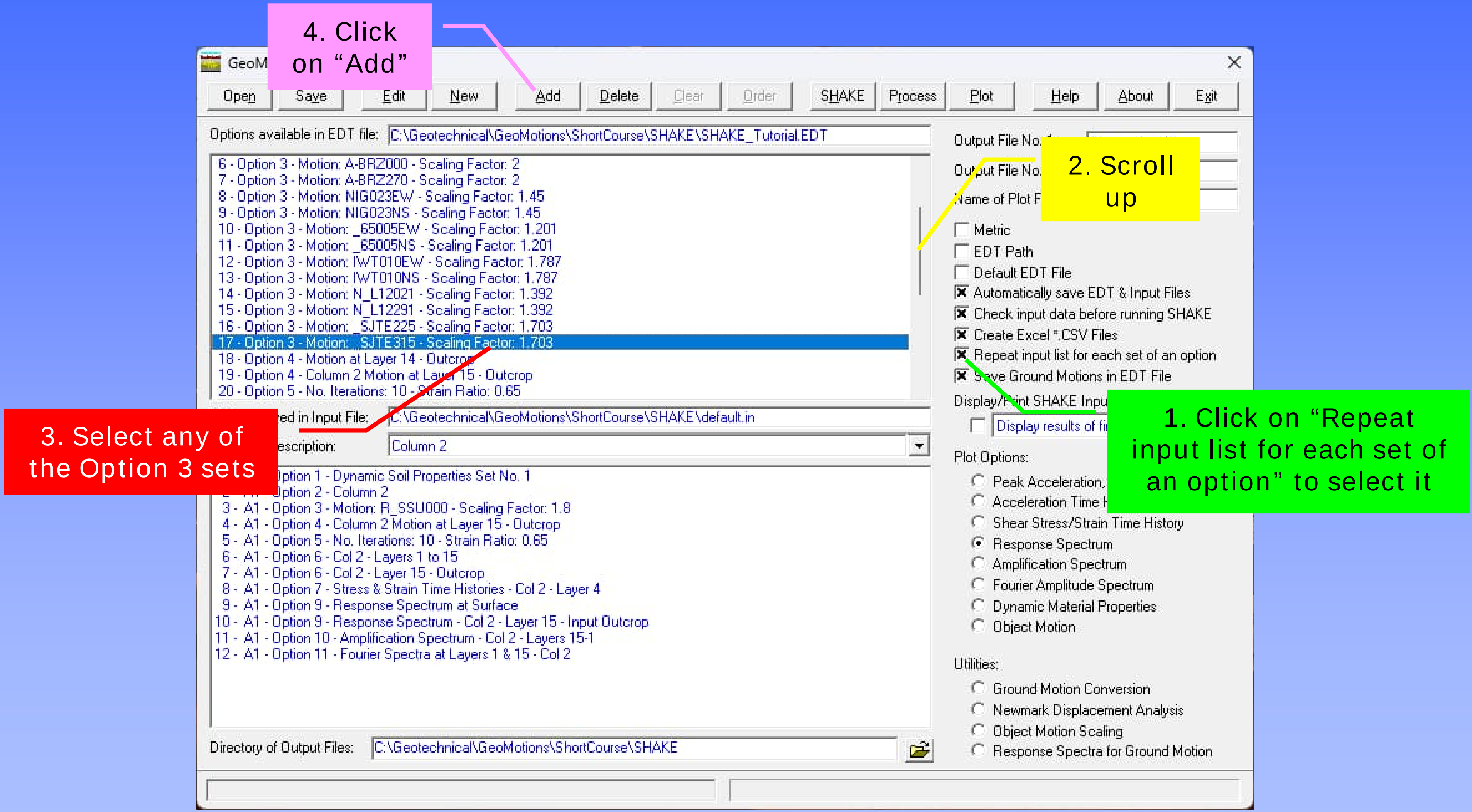
Create List of Input Options for Column No. 2



GeoMotions

Site Specific Response Analysis

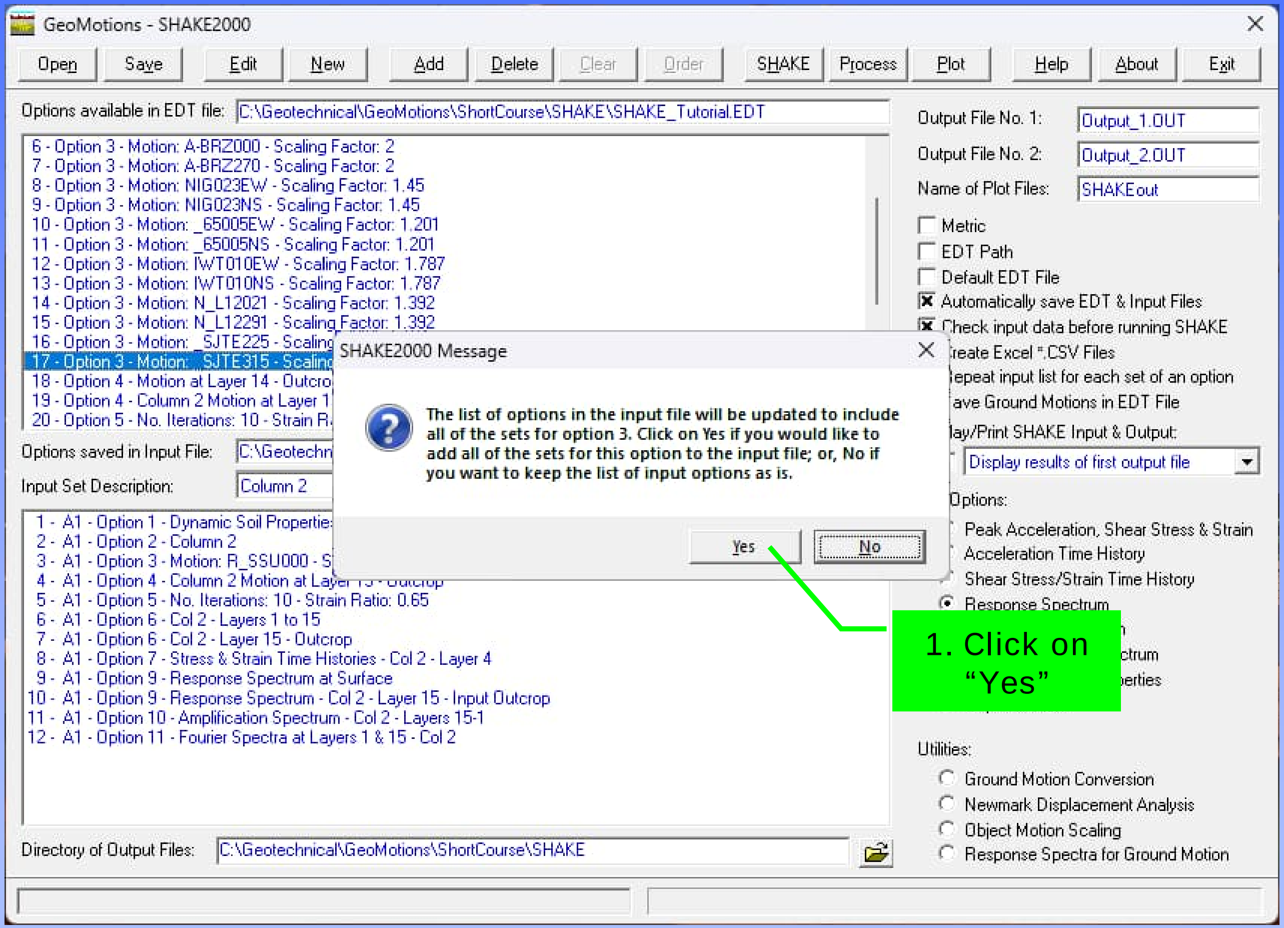
Define Input Options for Multiple Analyses



GeoMotions

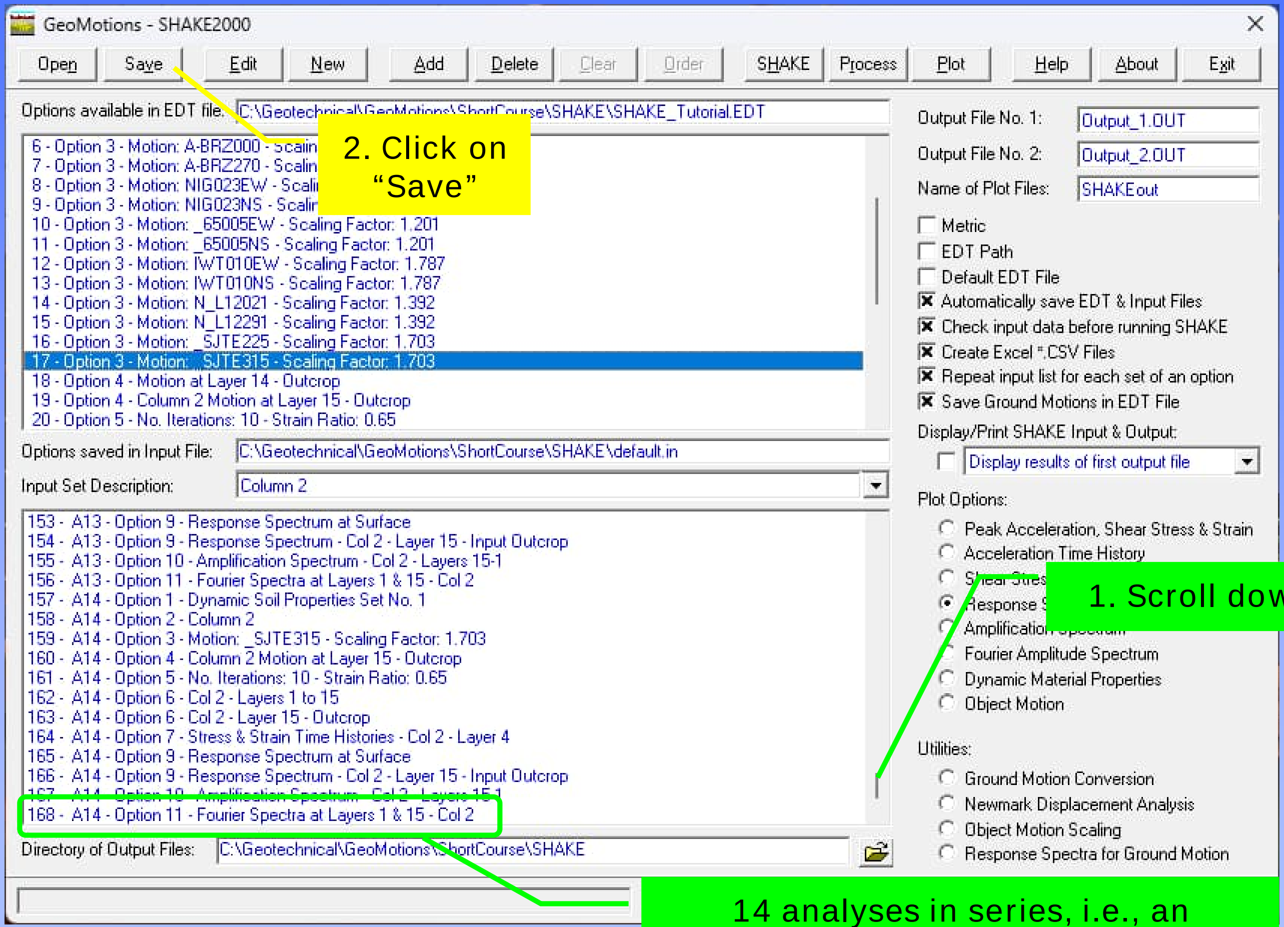
Site Specific Response Analysis

Define Input Options for Multiple Analyses



Site Specific Response Analysis

Save SHAKE EDT & Input Files

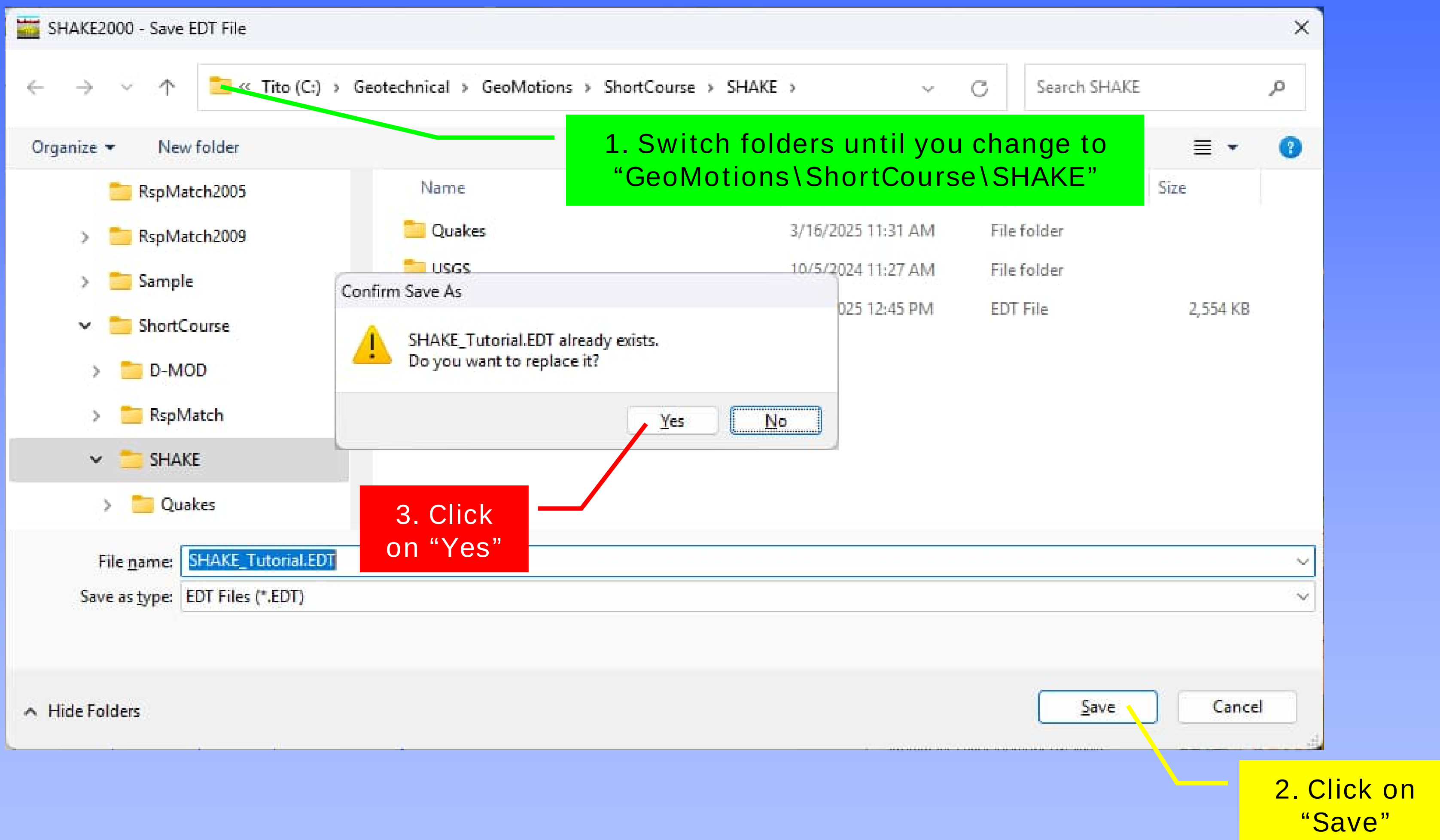


14 analyses in series, i.e., an analysis for input ground motion

GeoMotions

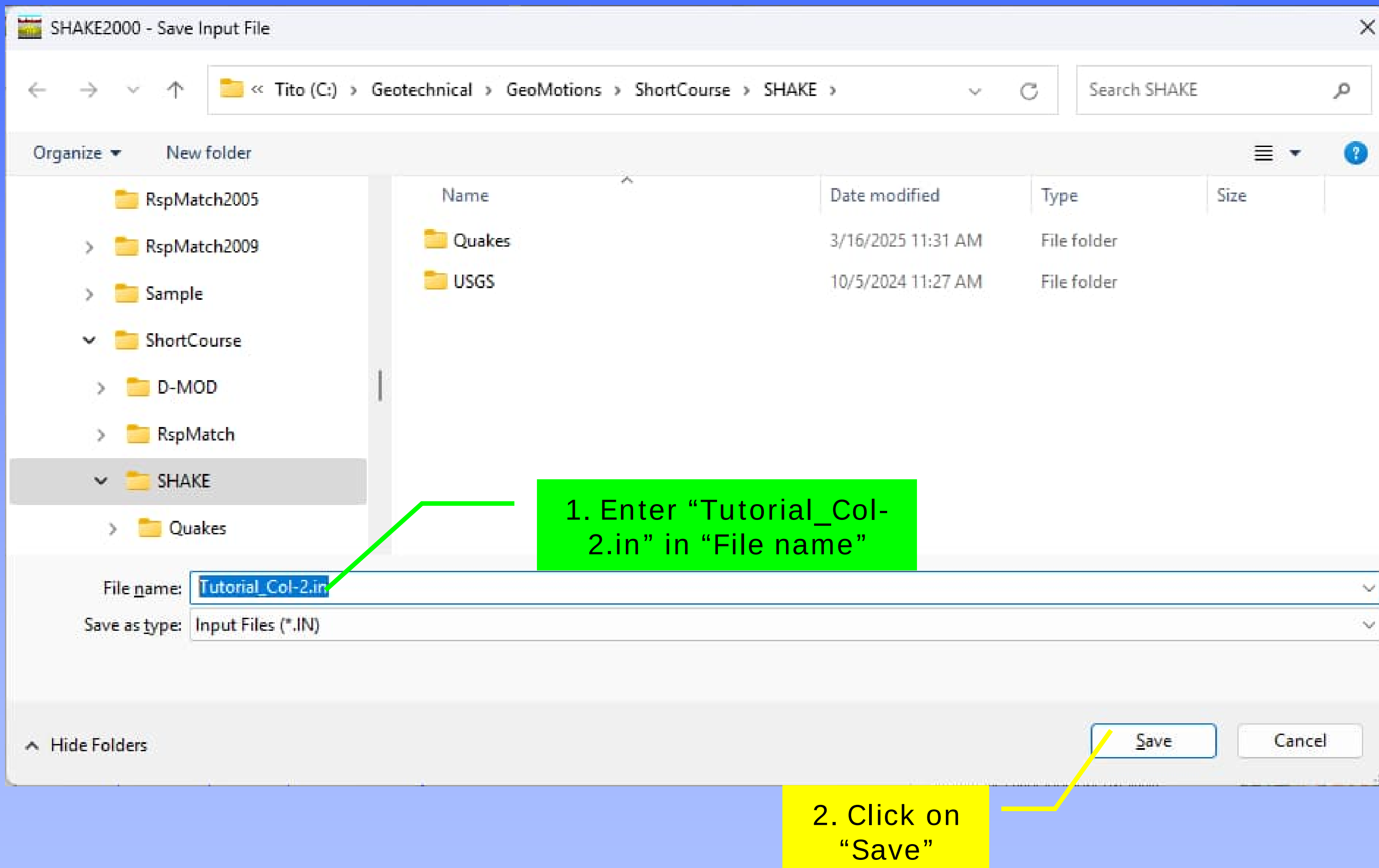
Site Specific Response Analysis

Create EDT & Input Files



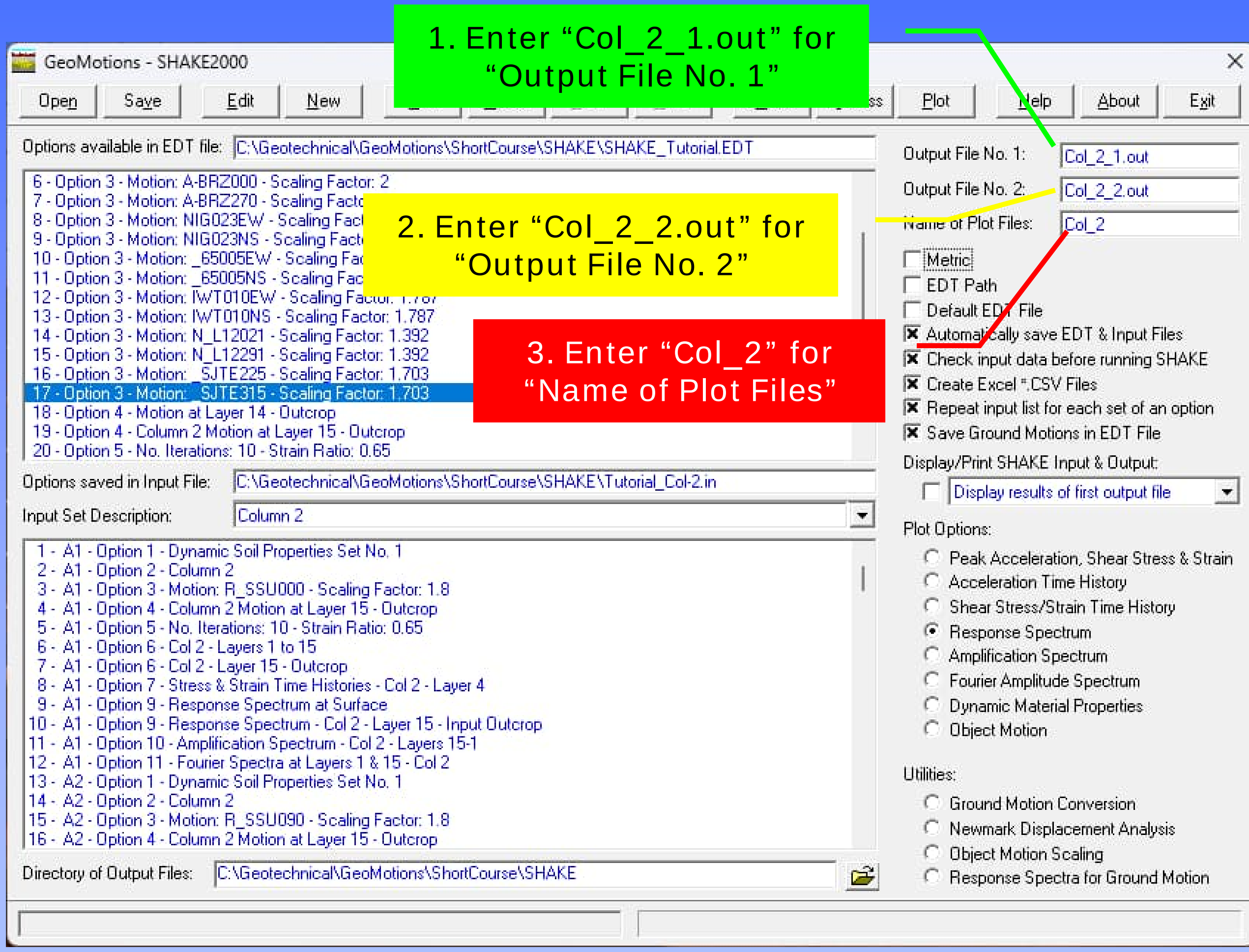
Site Specific Response Analysis

Create EDT & Input Files



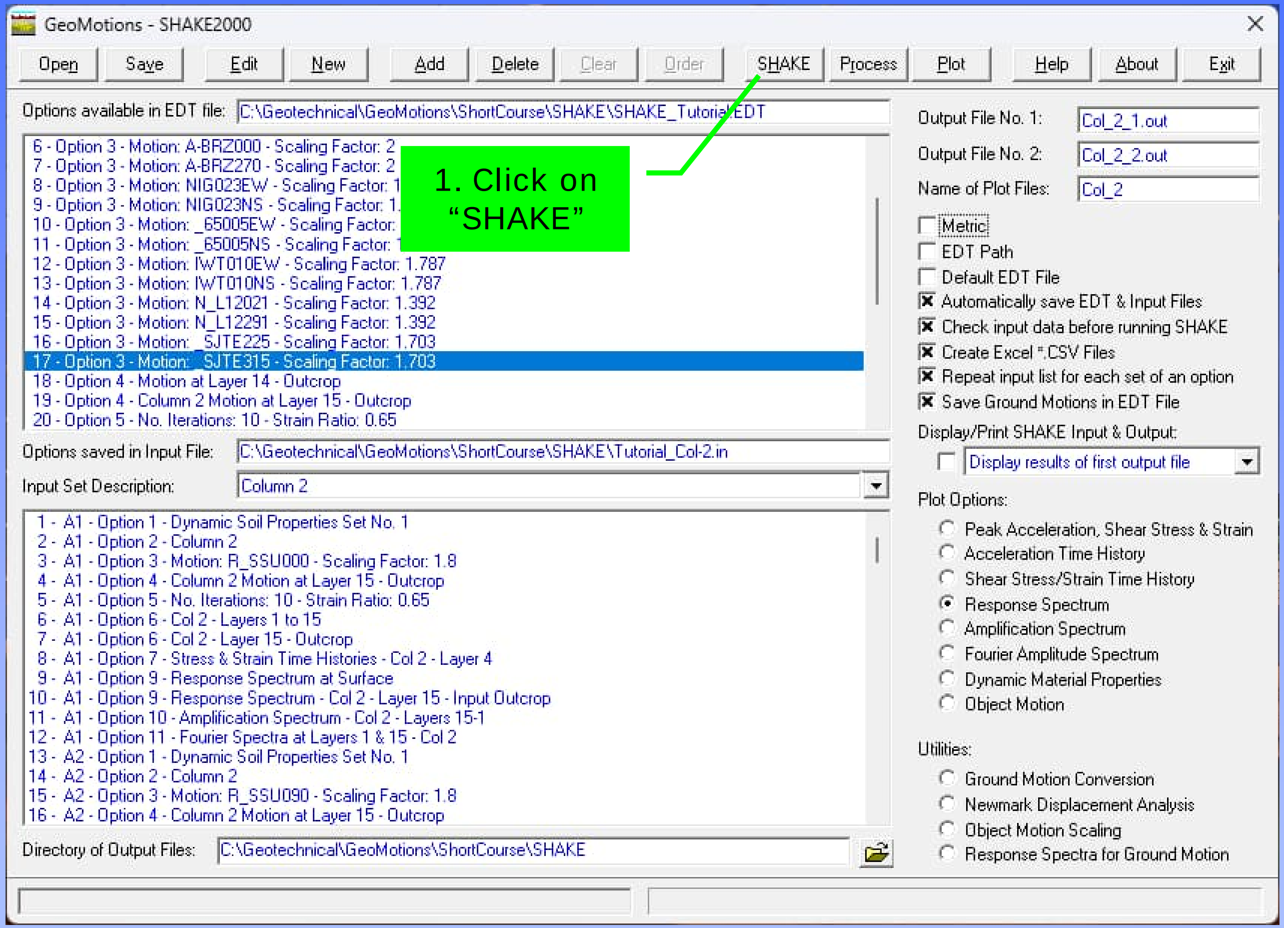
Site Specific Response Analysis

Name Working Files for Column No. 2 2



Site Specific Response Analysis

Run Analyses for Column 2



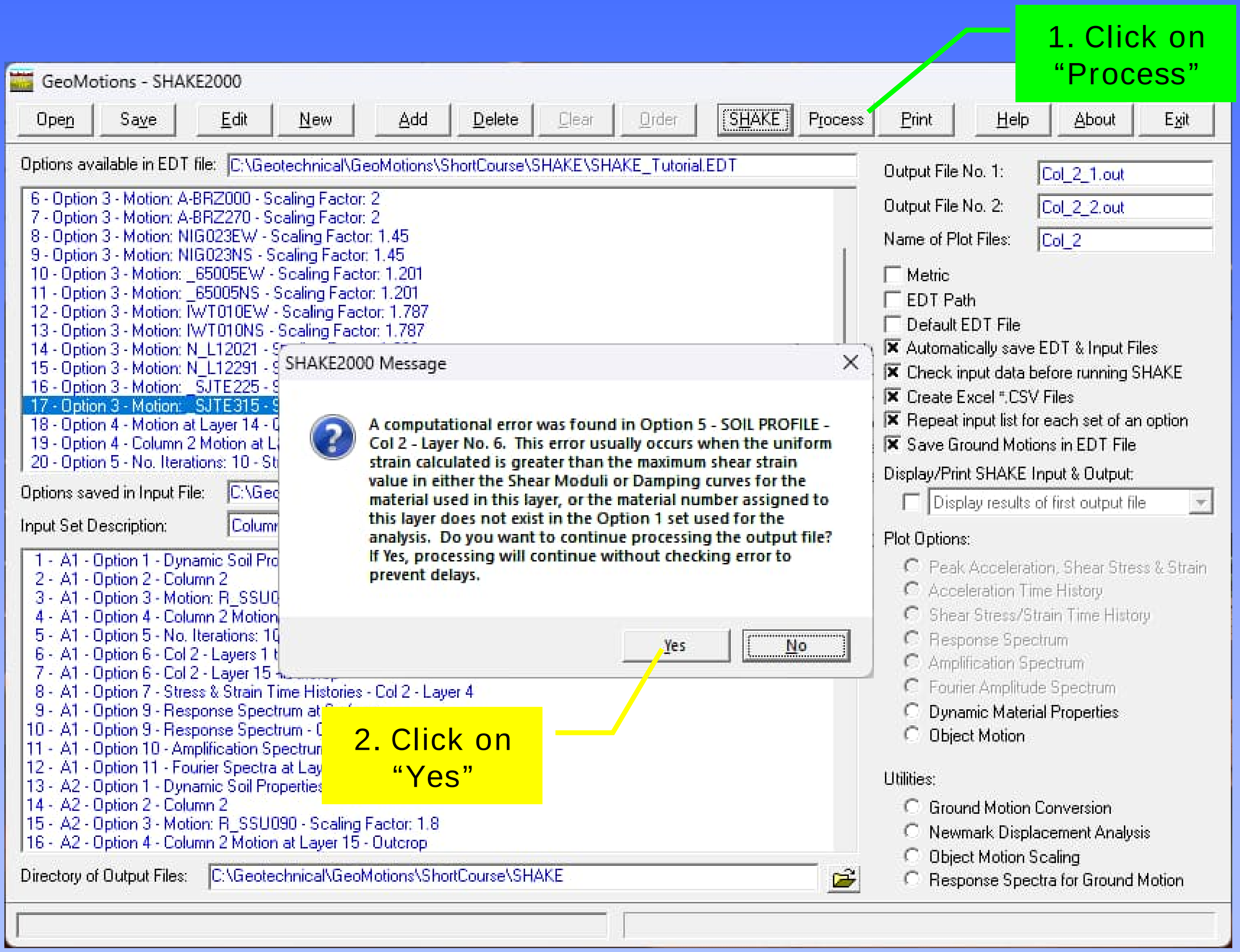
Site Specific Response Analysis

Run Analyses for Column 2

```
Select C:\Geotechnical\GeoMotions\SHAKE.EXE

*************************************************************
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL  *
*     LAYERED SITES by Per Schnable & John Lysmer - 1970   *
* -------------------------------------------------------- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai,Jan 1985  *
* -------------------------------------------------------- *
* SHAKE88 :New modulus reduction curves for clays added    *
*      using results from Sun et al (1988) by J. I. Sun    *
*      & Ramin Golesorkhi February 26, 1988                *
*  --------------------------------------------------------*
* SHAKE90/91: Adjust last iteration; Input now is either   *
*      Gmax or max Vs; up to 13 materials can be specified*
*      by user; up to 50 Layers can be specified; object   *
*      motion can be read in from a separate file and can *
*      user specified format; Different periods for res-   *
*      ponse spectral calculations;options are renumbered;*
*      and general cleanup by: J. I. Sun, I. M. Idriss &   *
*      P. Dirrim June 1990 - February 1991                 *
*  ------------------------------------------------------- *
* SHAKE91: General cleanup and finalization of input out-  *
*      output format, etc. by: I. M. Idriss December 1991 *
*  ------------------------------------------------------- *
* SHAKE2000: Fix incorrect output of total stress in       *
* option 2, changed path to ground motion file in          *
* SHAKE91, input file, increased motion to 30,000 values   *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020    *
*          RUN DATE  8/01/2022                             *
*          RUN TIME 17:32                                  *
*************************************************************

 NAME OF INPUT FILE =
   C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_1-2.in

 NAME OF OUTPUT FILE #1 (input,peak values, etc)=
   C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_1-2_1.out

 NAME OF OUTPUT FILE #2 (layer acc. time histories)=
   C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_1-2_2.out


   OPTION NO.    1   IS STARTED.
   OPTION NO.    1   HAS BEEN CONCLUDED.
```

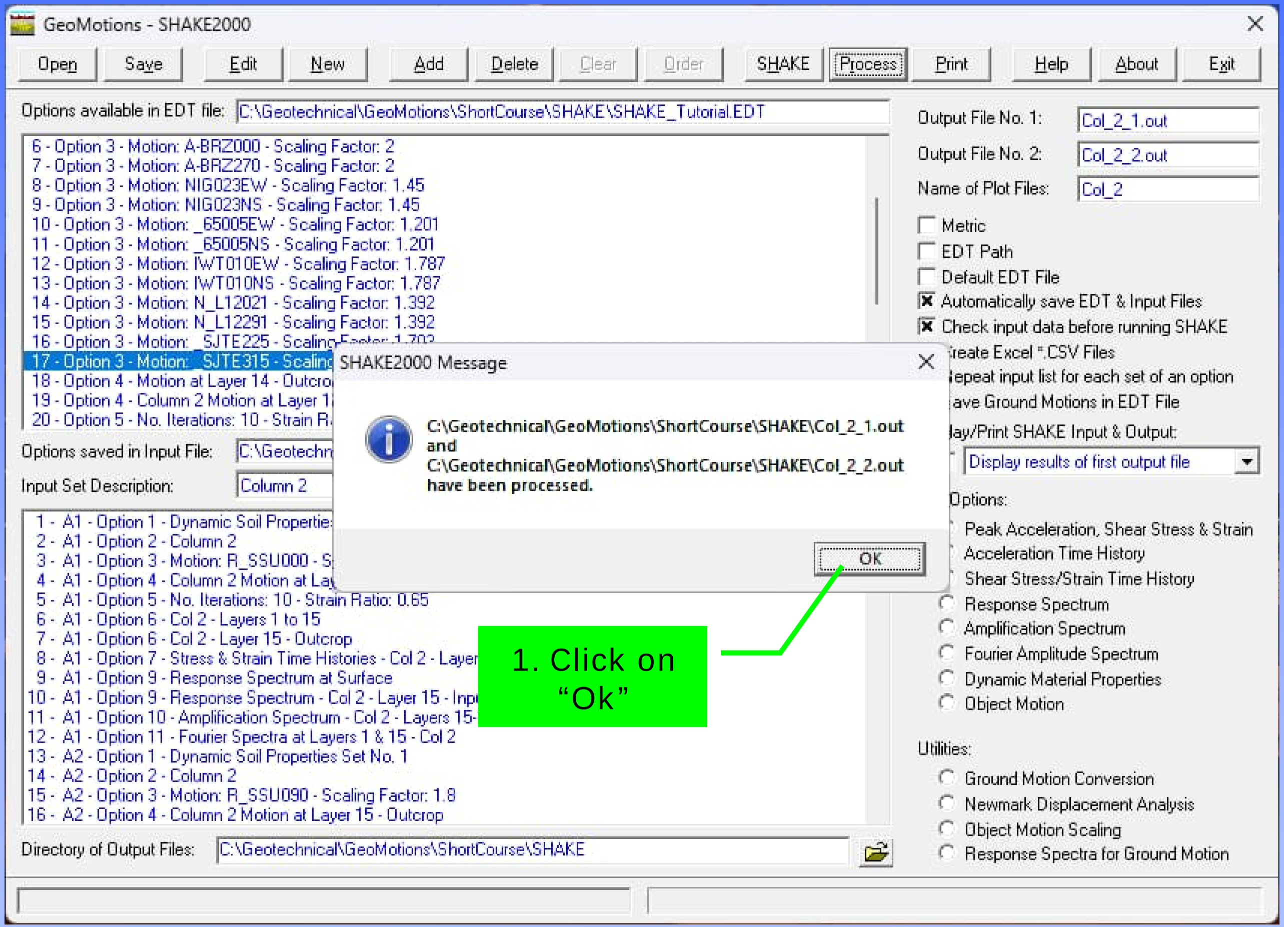
Site Specific Response Analysis

Run Analyses for Column 2



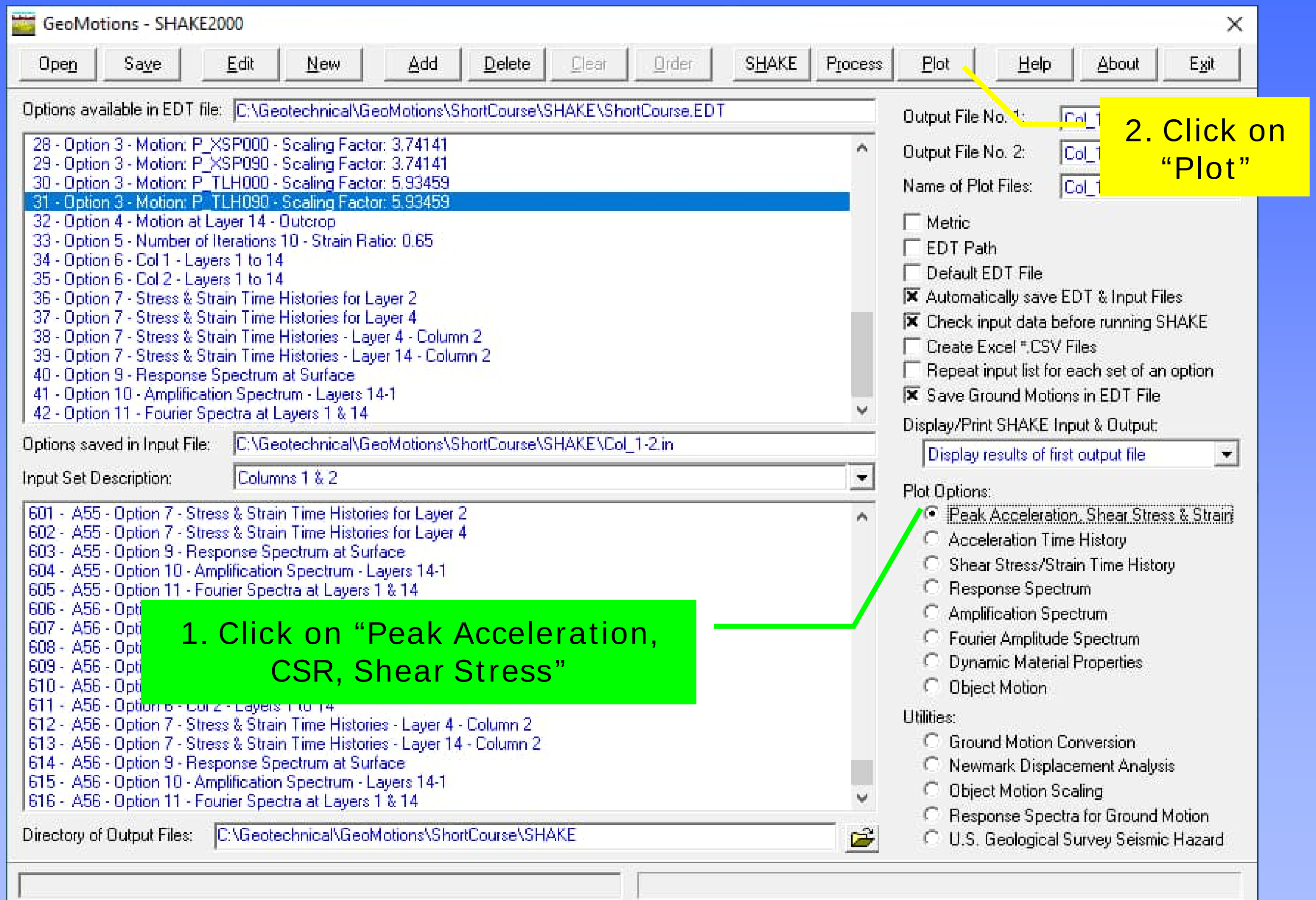
Site Specific Response Analysis

Run Analyses for Column 2



Site Specific Response Analysis

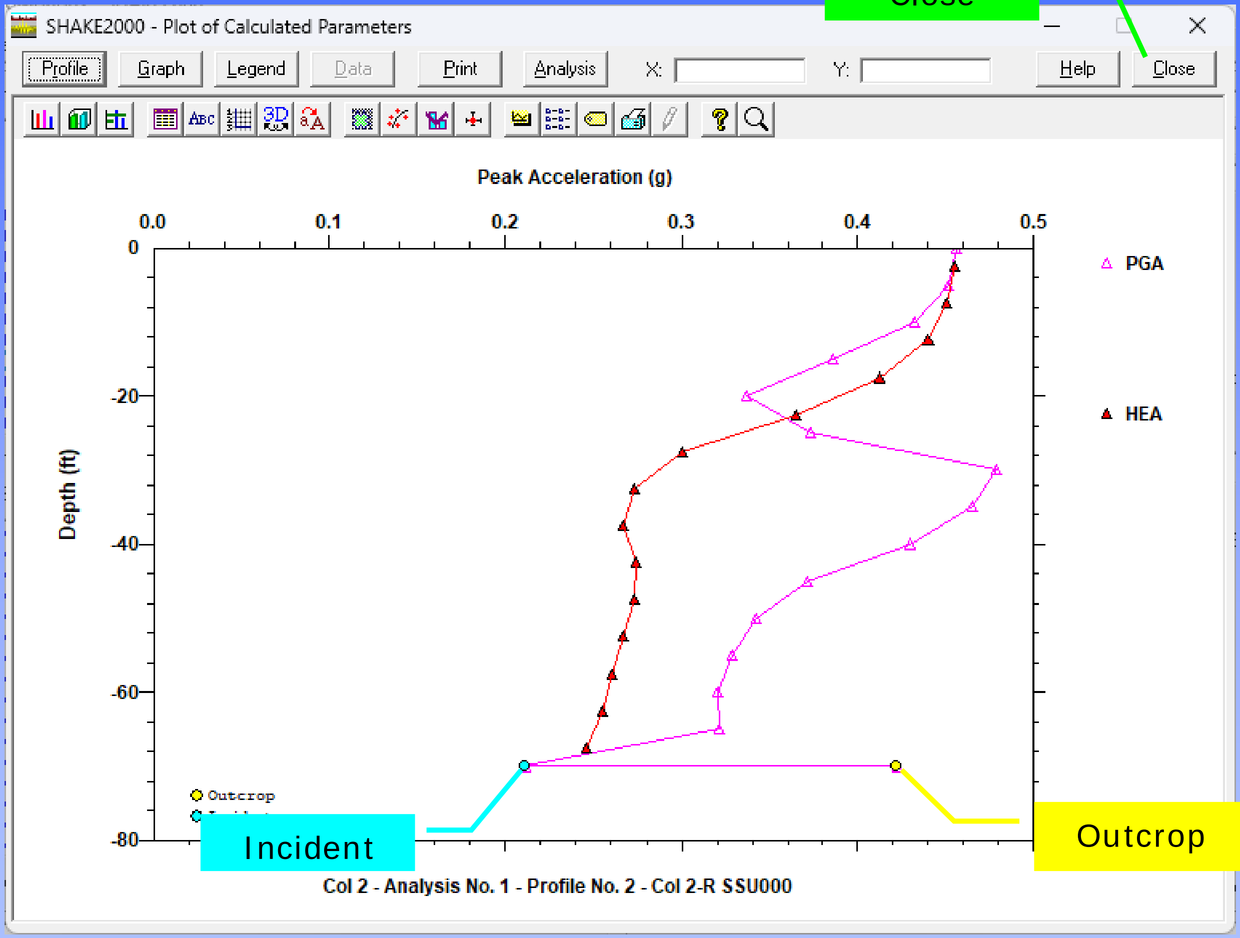
Plot Results



Site Specific Response Analysis

Plot Results

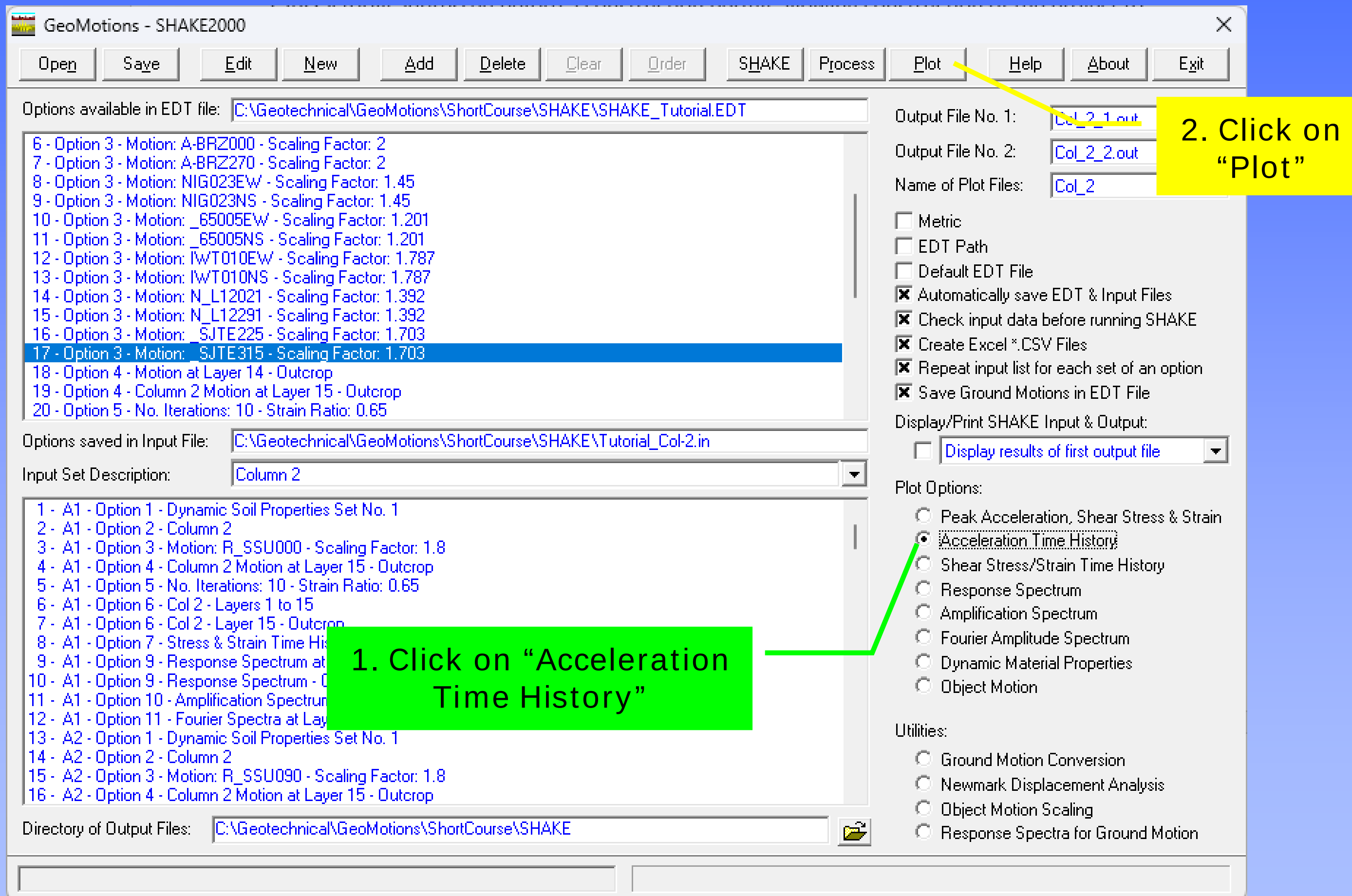
1. Click on "Close"



GeoMotions

Site Specific Response Analysis

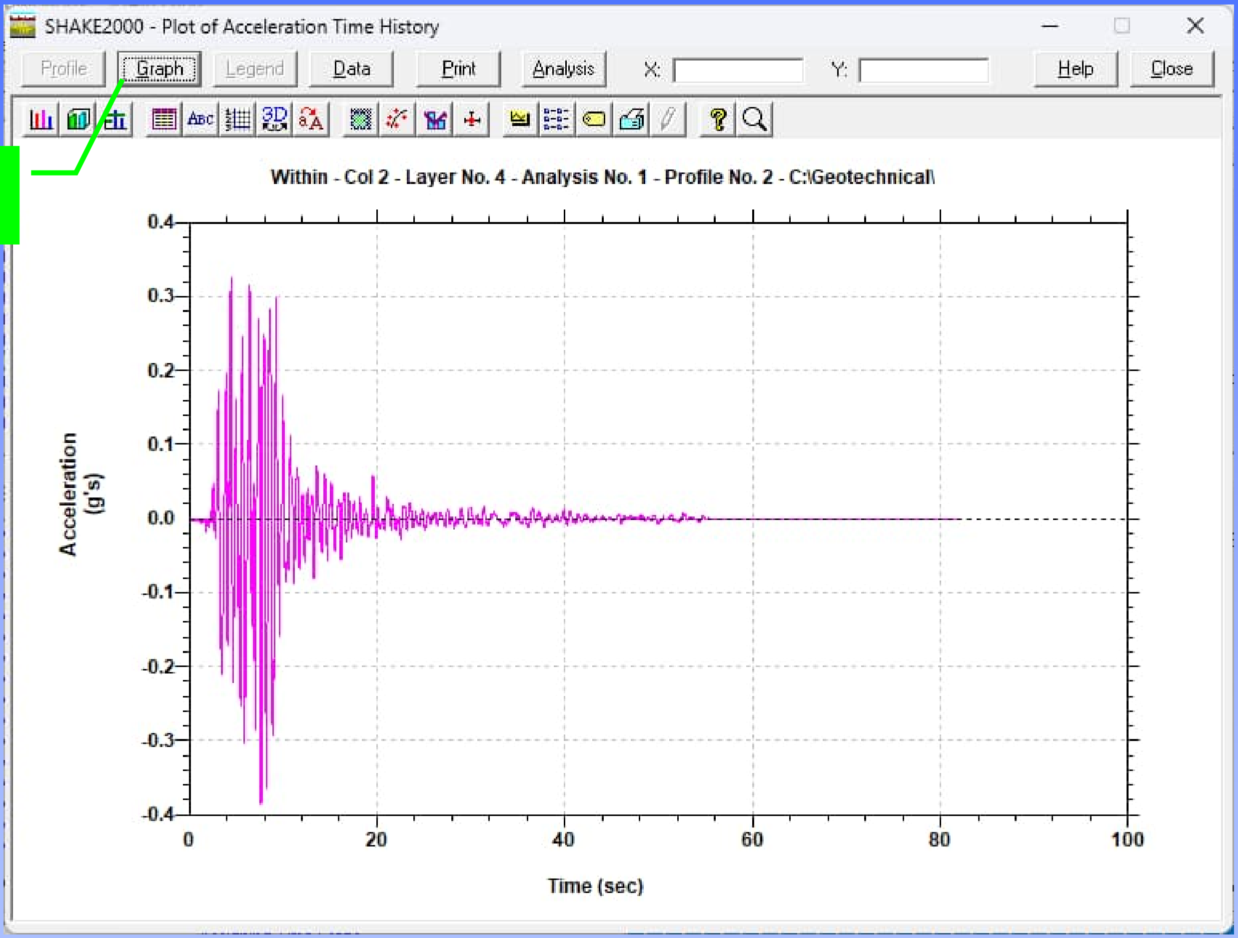
Plot Results



Site Specific Response Analysis

Plot Results

1. Click on "Graph"

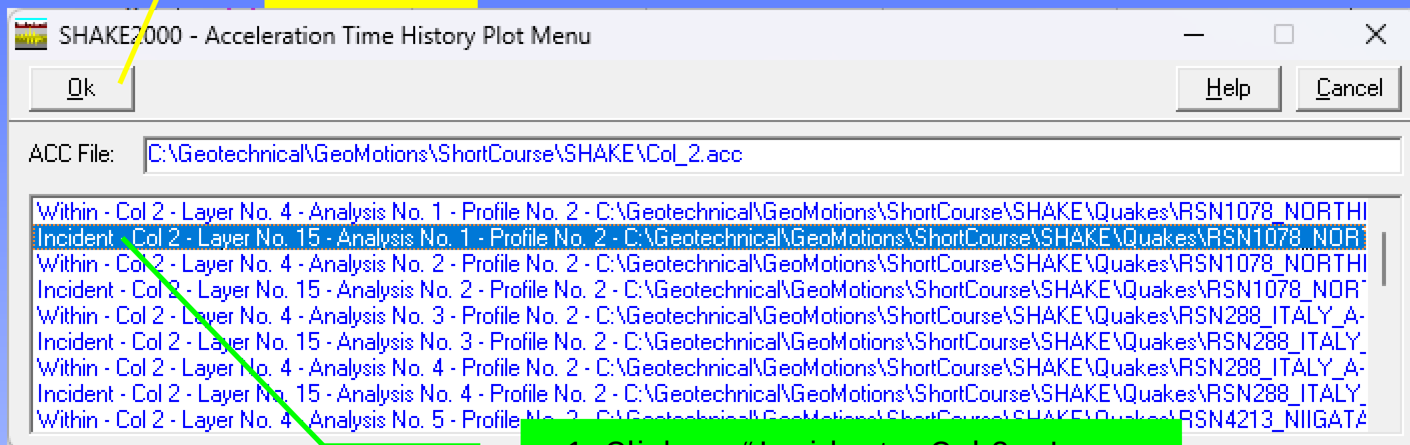


GeoMotions

Site Specific Response Analysis

Plot Results

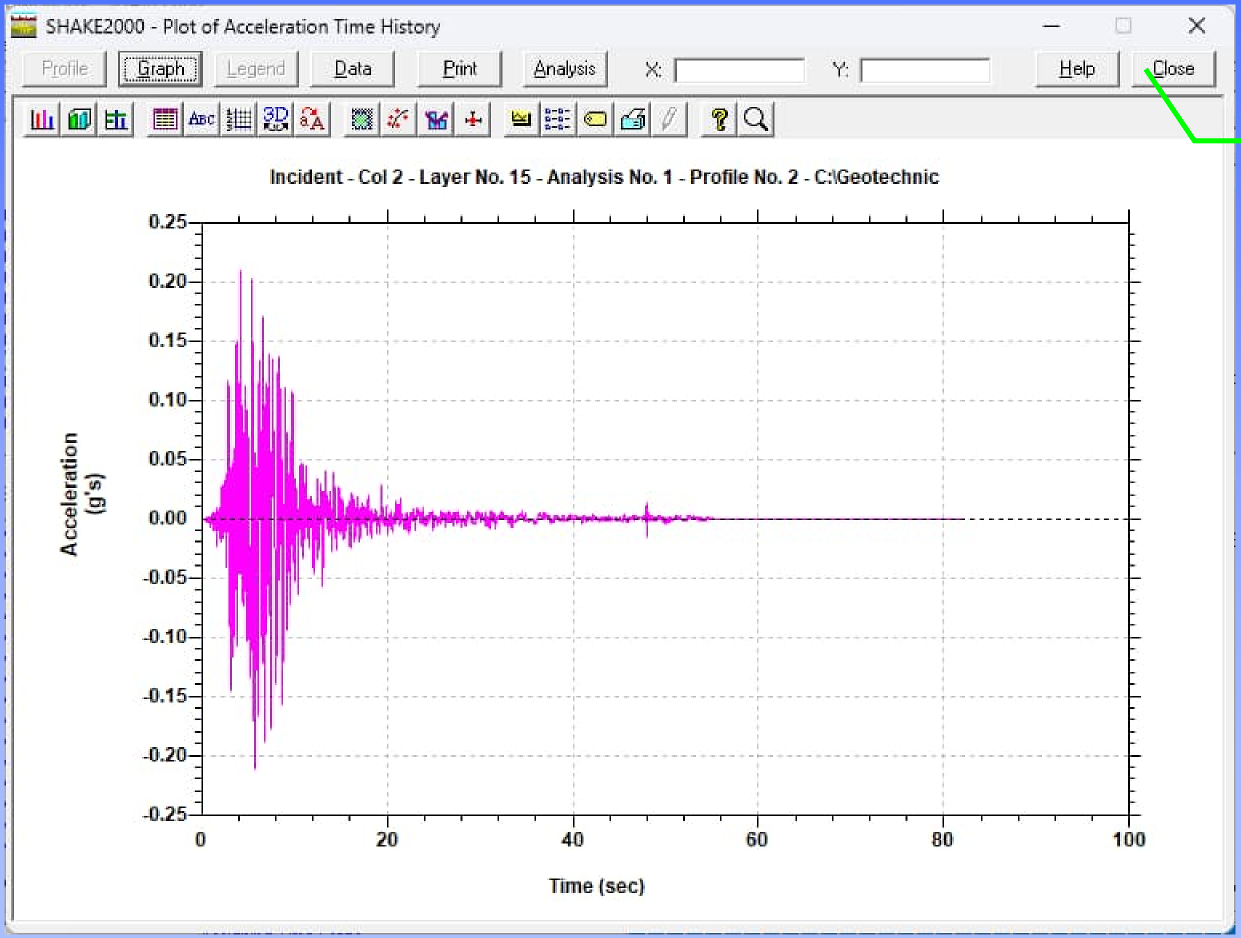
2. Click on “Ok”



1. Click on “Incident – Col 2 – Layer No. 15 – Analysis No. 1 ….” to select it

Site Specific Response Analysis

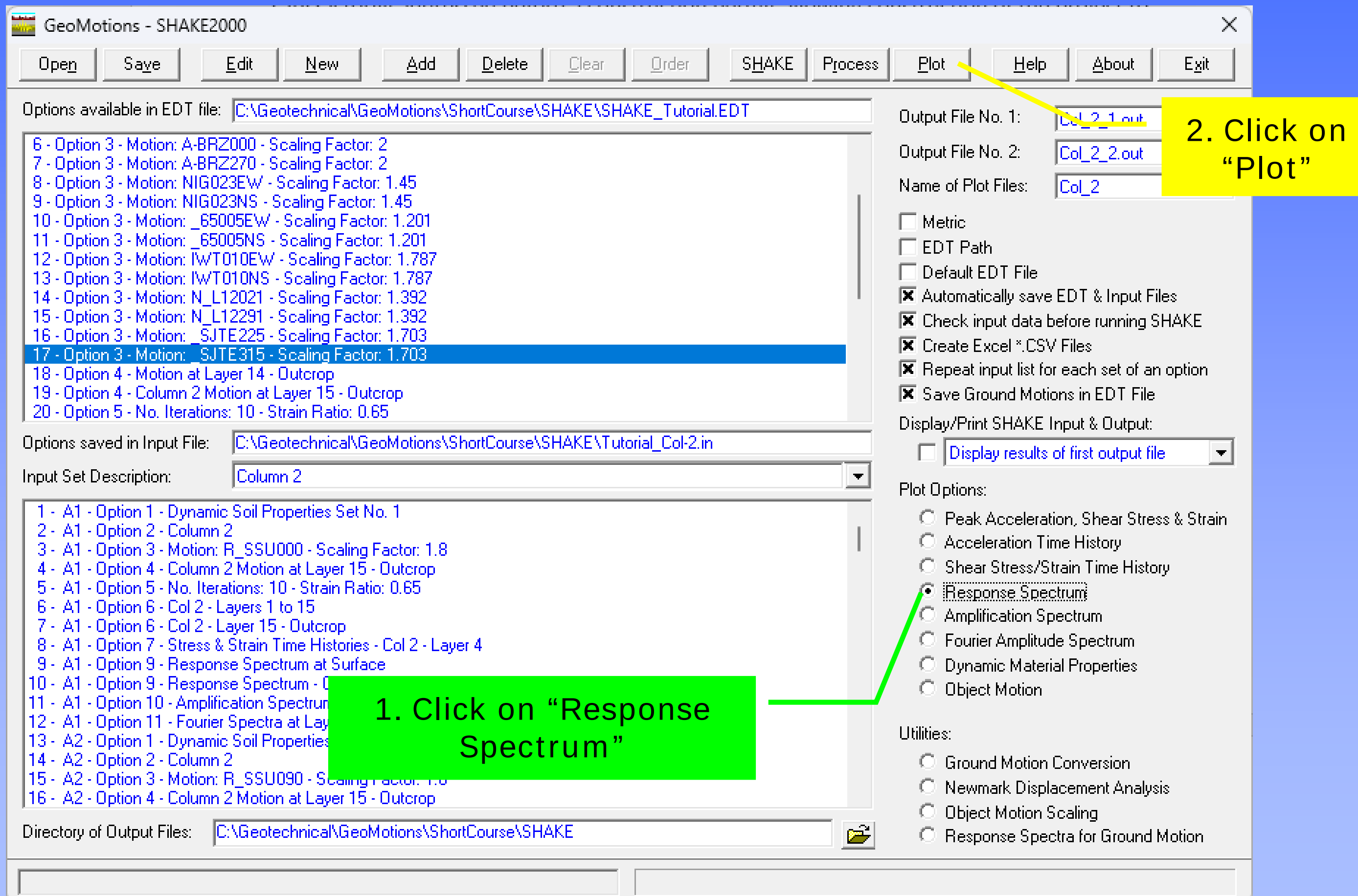
Plot Results



1. Click on "Close"

Site Specific Response Analysis

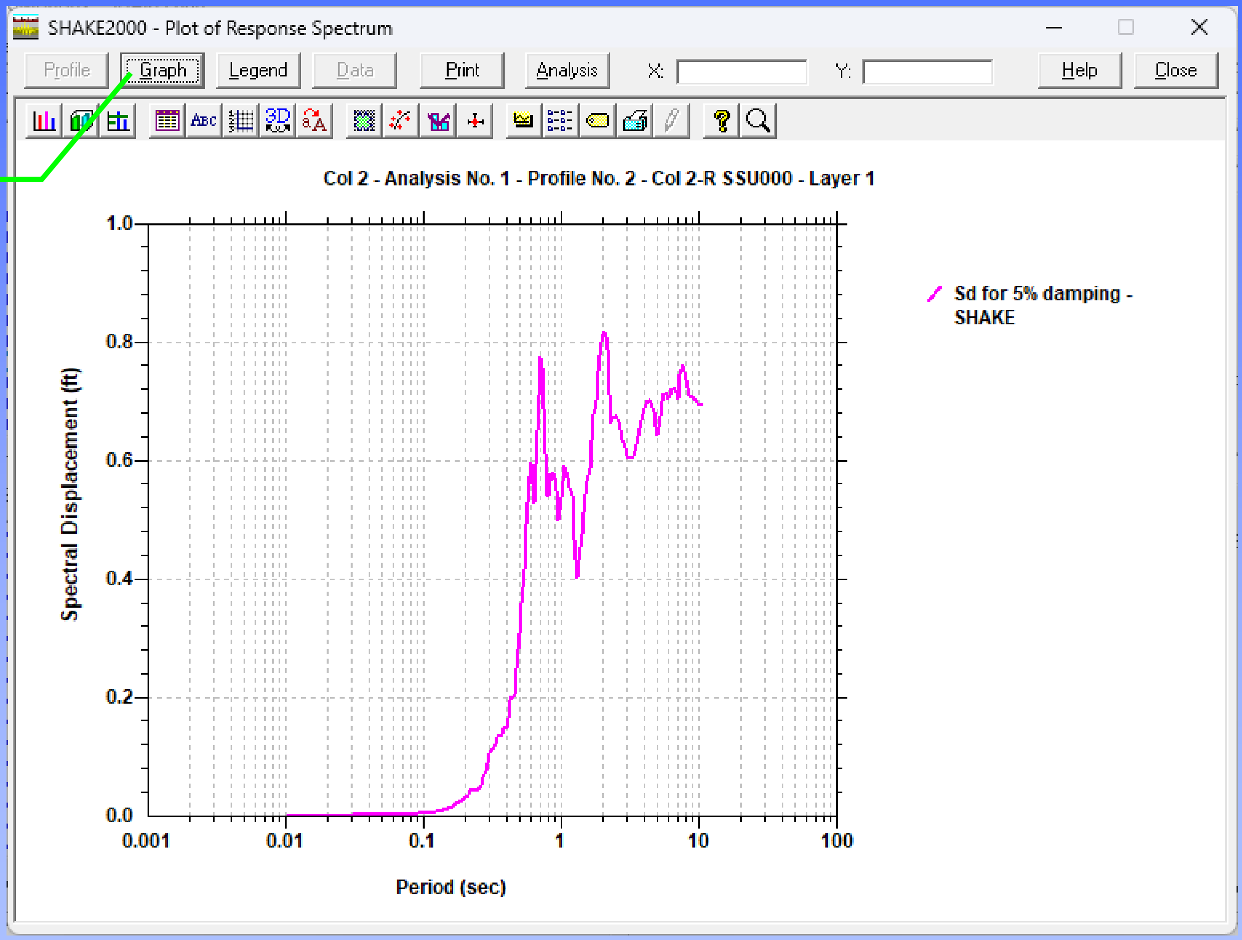
Plot Results



Site Specific Response Analysis

Plot Results

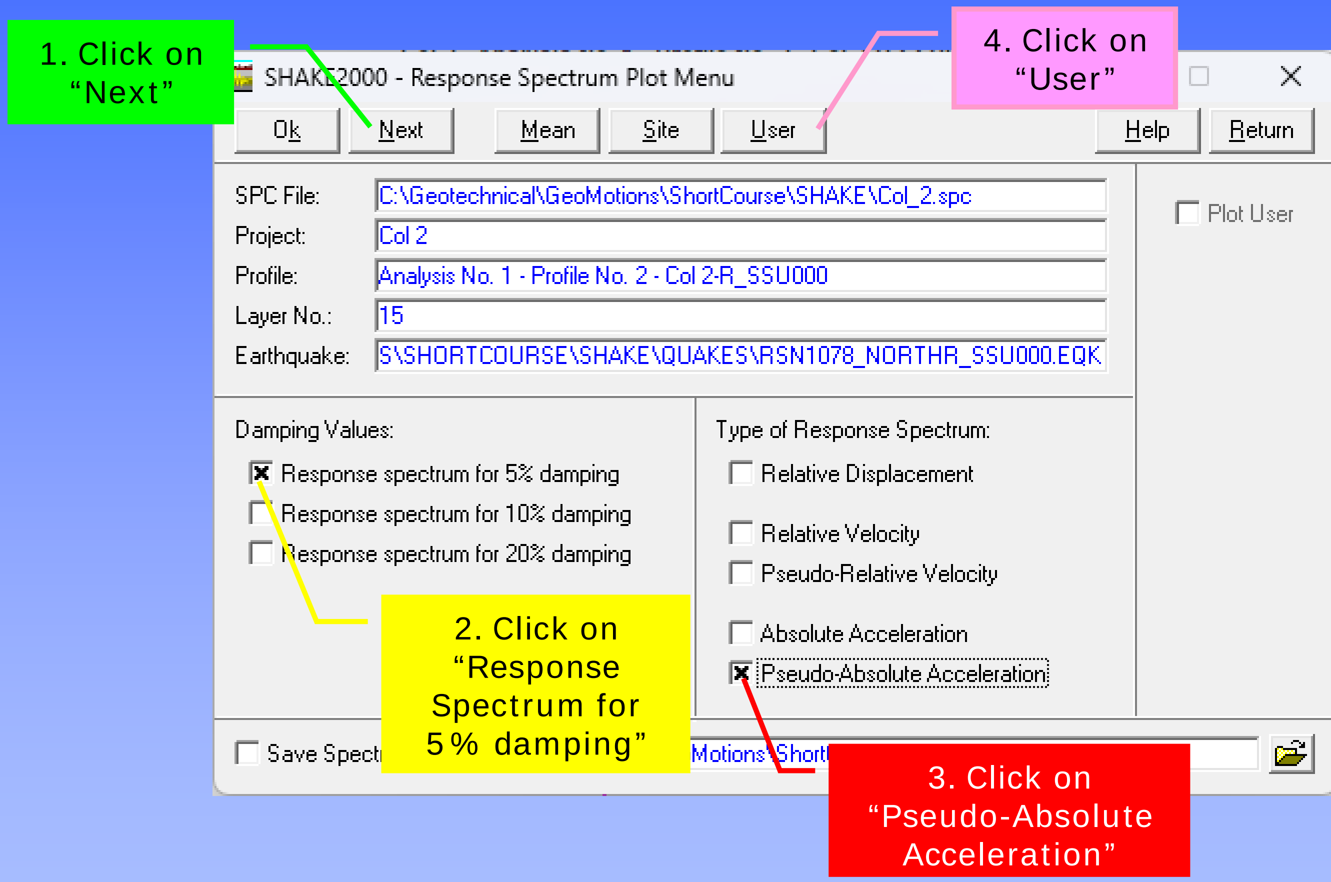
1. Click on "Graph"



GeoMotions

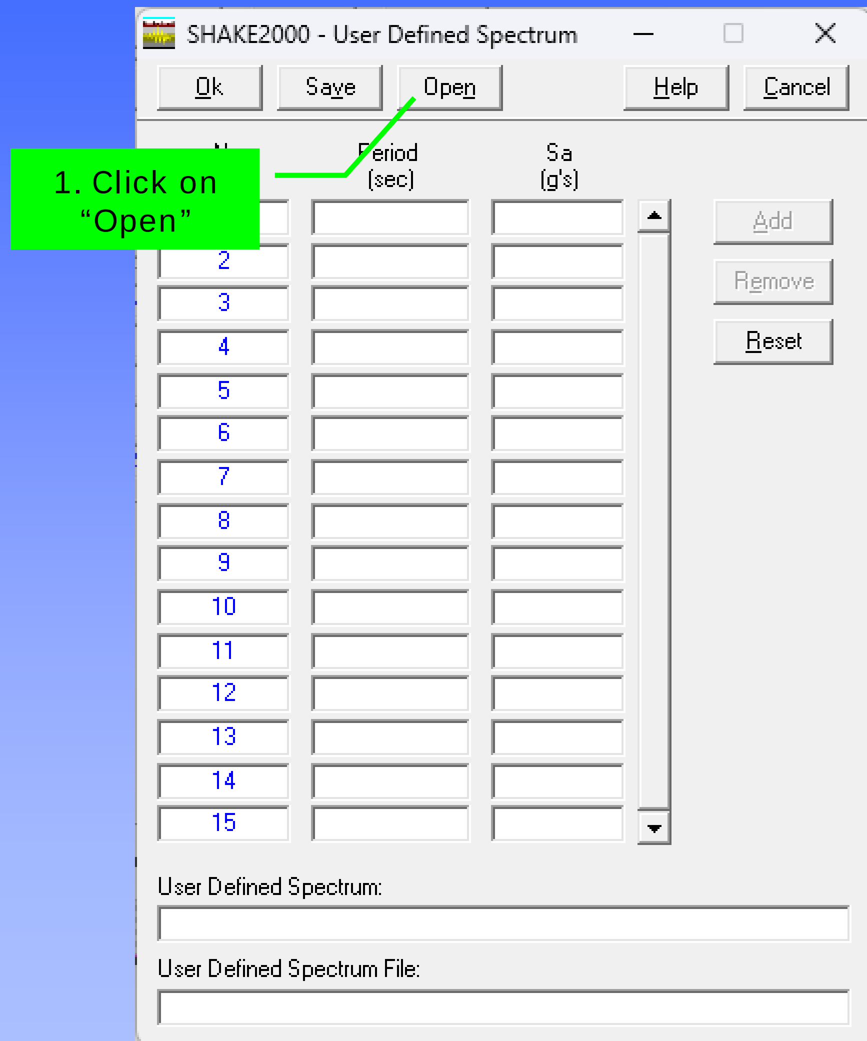
Site Specific Response Analysis

Plot Results



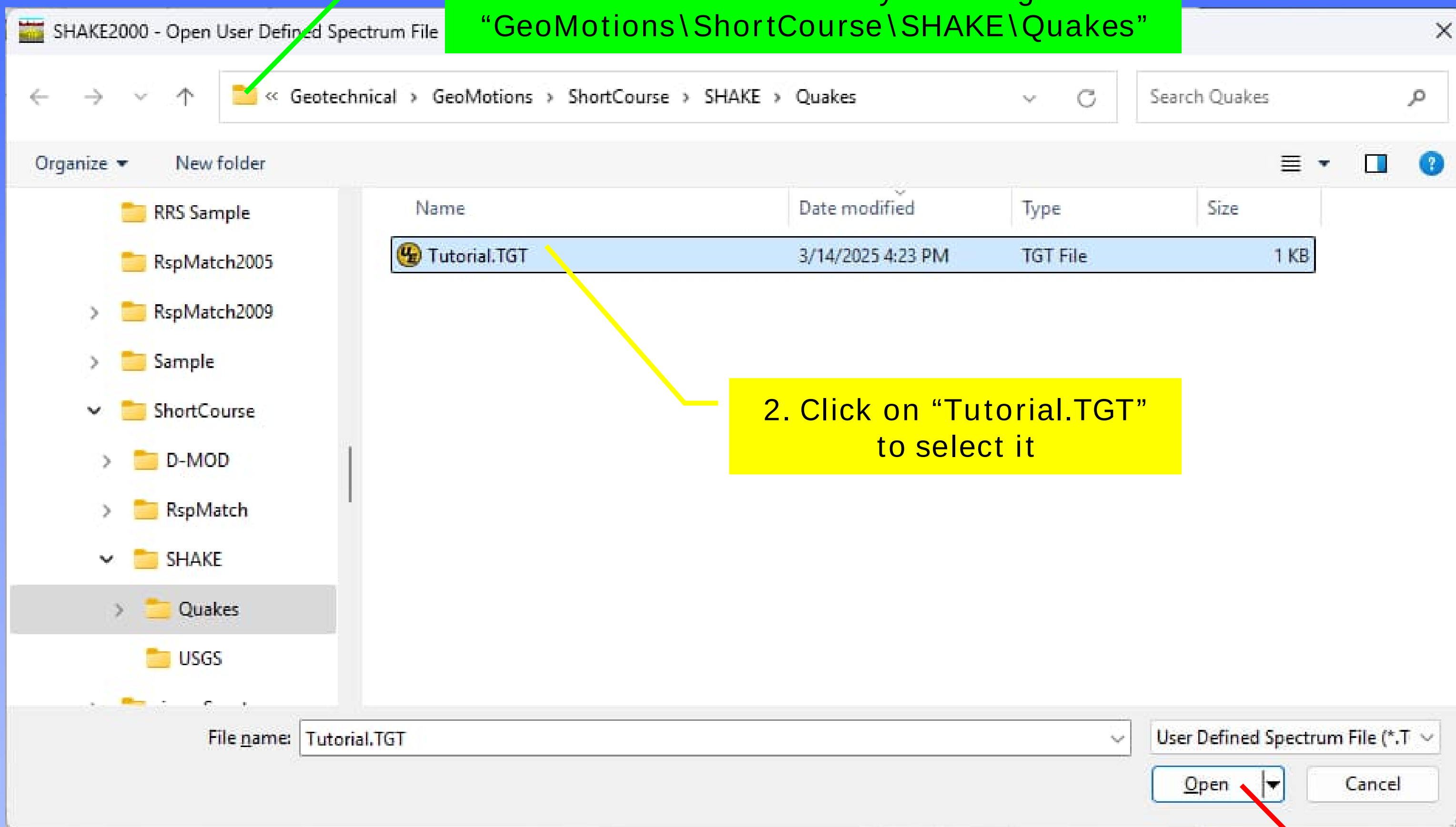
GeoMotions

Enter Target Response Spectrum Values



Save Target Response Spectrum File

1. Switch folders until you change to "GeoMotions\ShortCourse\SHAKE\Quakes"



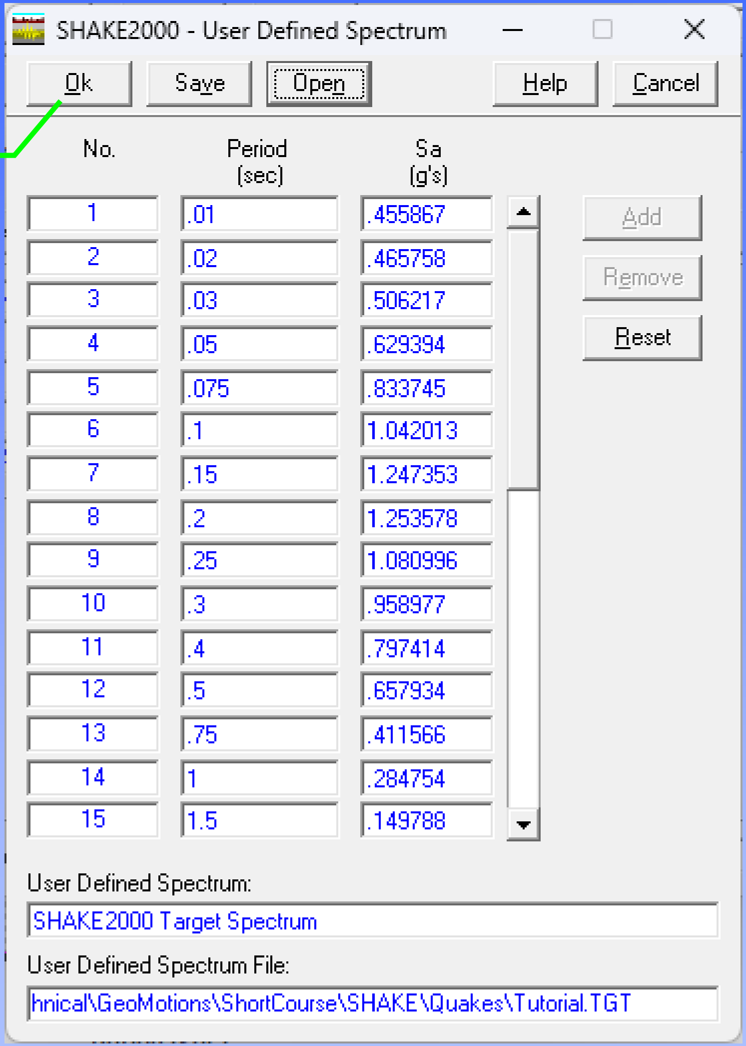
2. Click on "Tutorial.TGT" to select it

3. Click on "Open"

GeoMotions

Select Target Response Spectrum

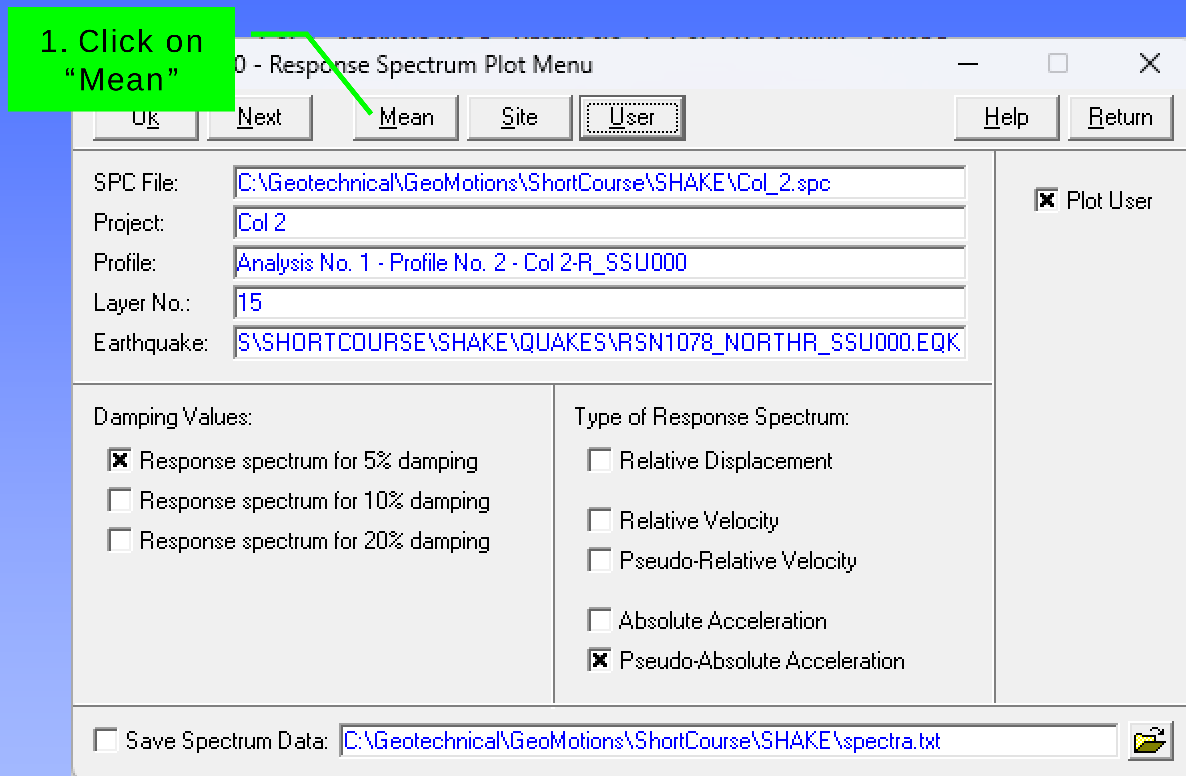
1. Click on “Ok”



GeoMotions

Site Specific Response Analysis

Plot Results



GeoMotions

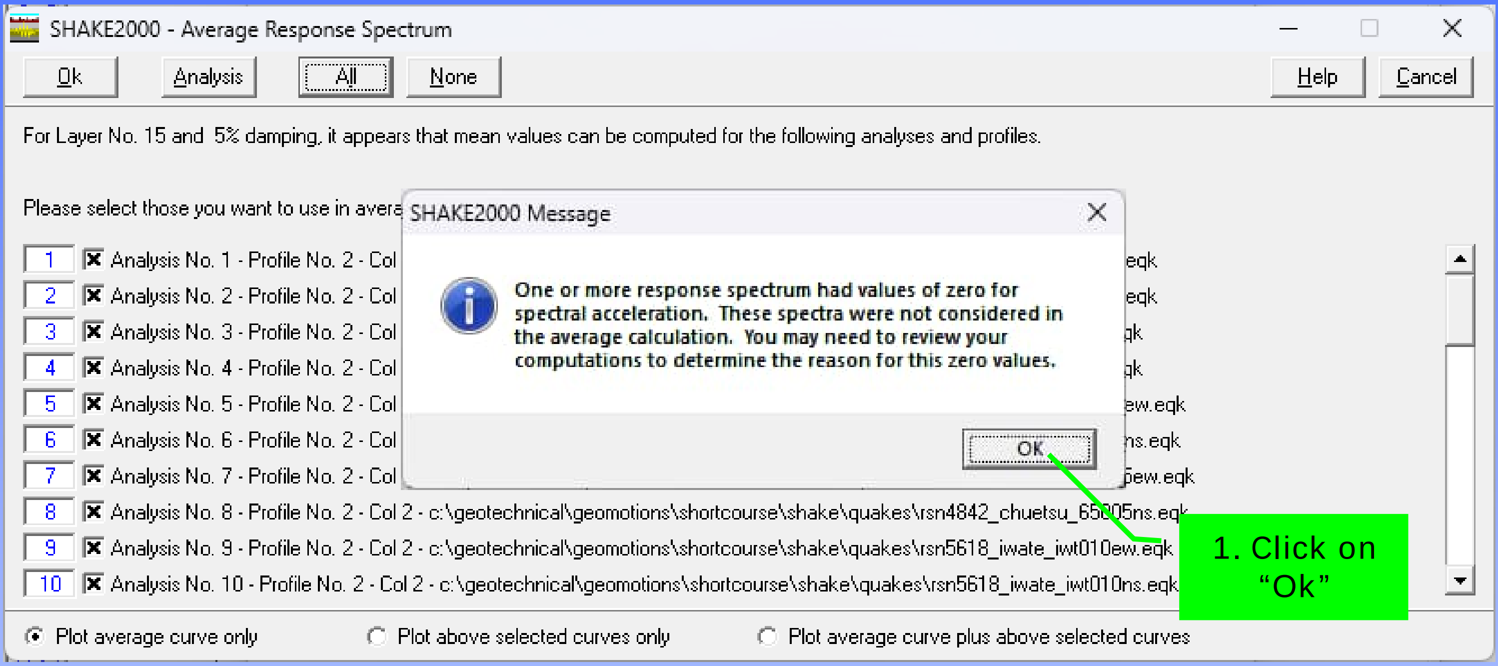
Site Specific Response Analysis

Plot Results

GeoMotions

Site Specific Response Analysis

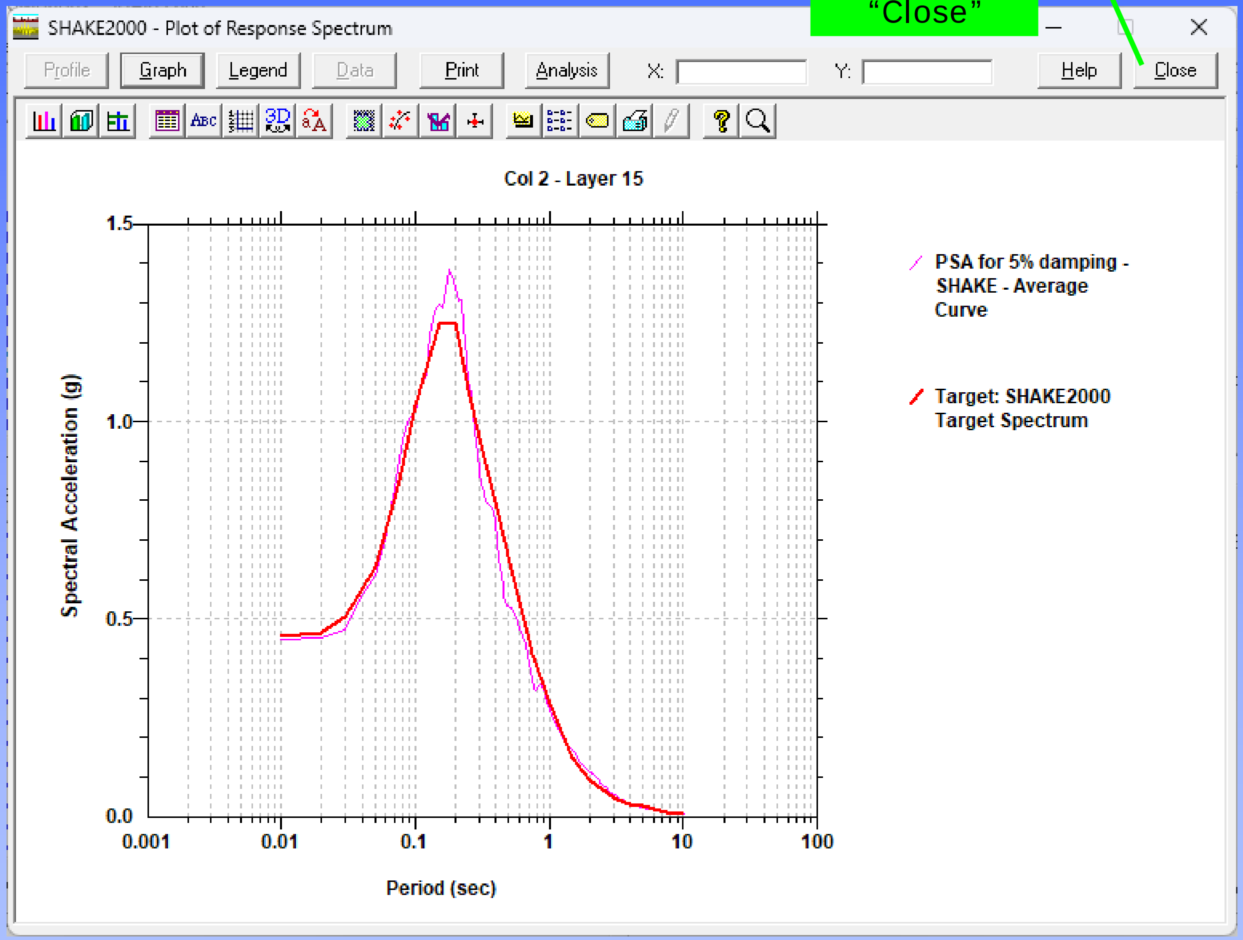
Plot Results



Site Specific Response Analysis

Plot Results

1. Click on “Close”

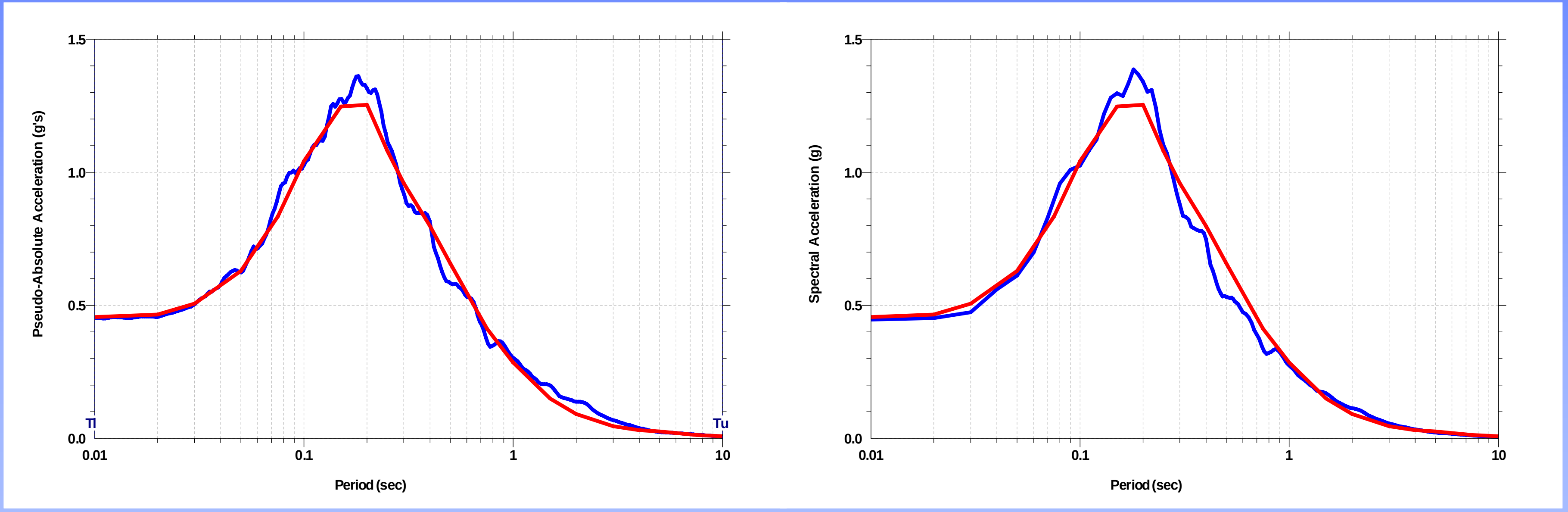


GeoMotions

Selection of Acceleration Time Histories

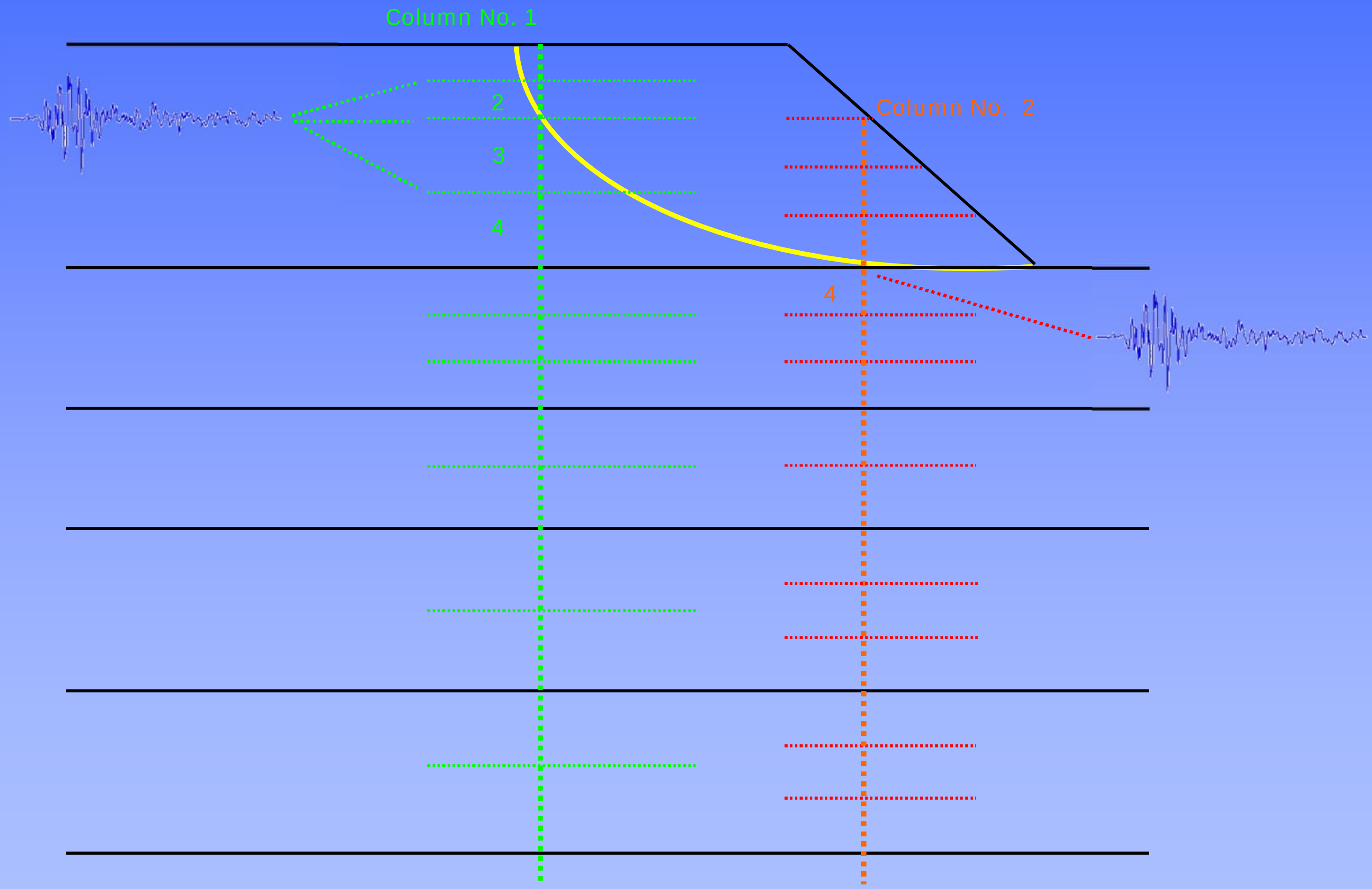
Compare Layer 15 Input-Outcrop average spectrum to Ground Motion Selection average spectrum to check input motions are correctly applied

Ground Motion Selection | SHAKE Outcrop Layer 15



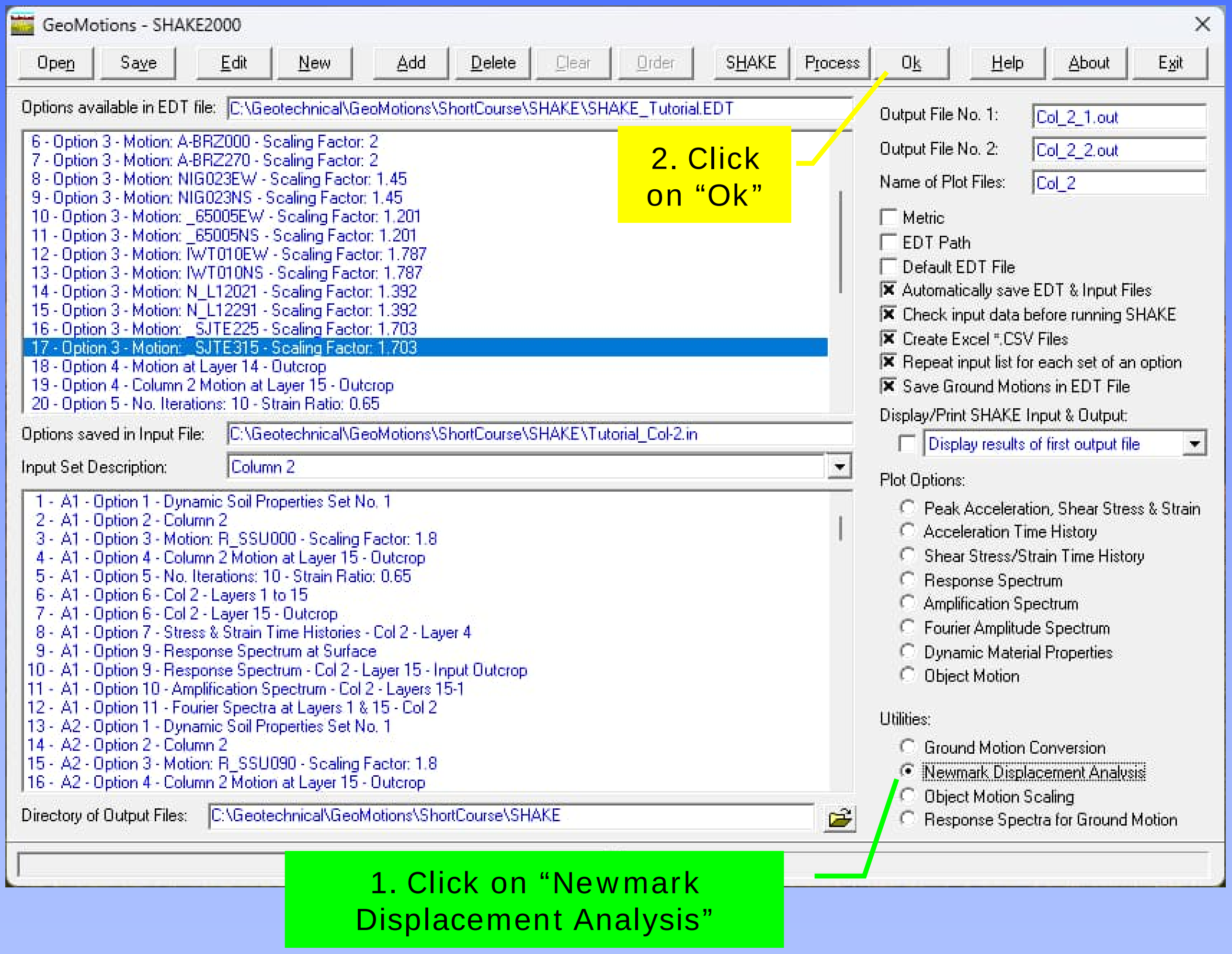
Sample Problem

Newmark Displacement Analysis



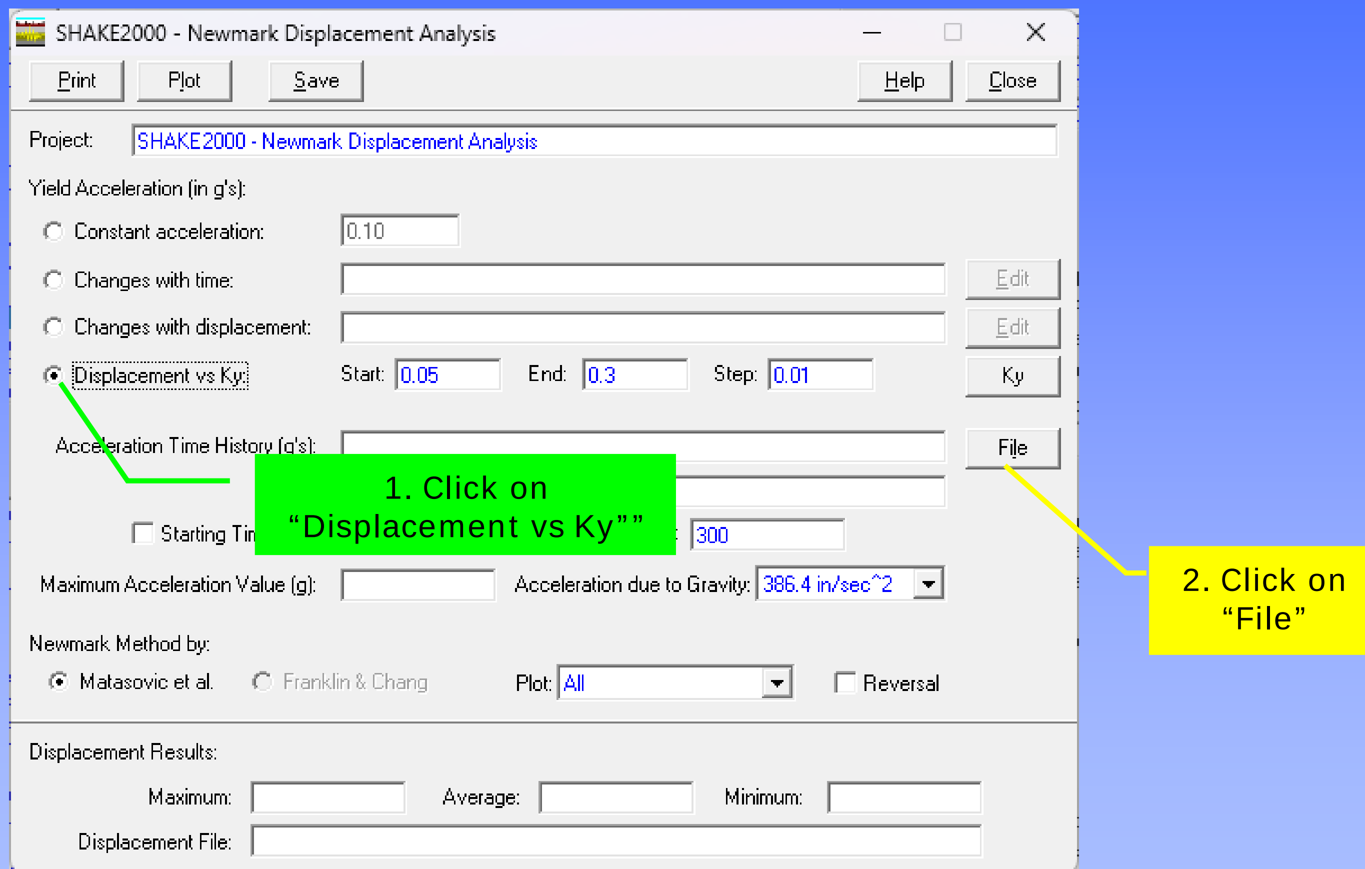
Acceleration time histories at the top of layers 2, 3, and 4 for Column 1, and at the top of layer 4 for Column 2 will be used in the Newmark Displacement Analysis.

Site Specific Response Analysis
Newmark Displacement Analysis



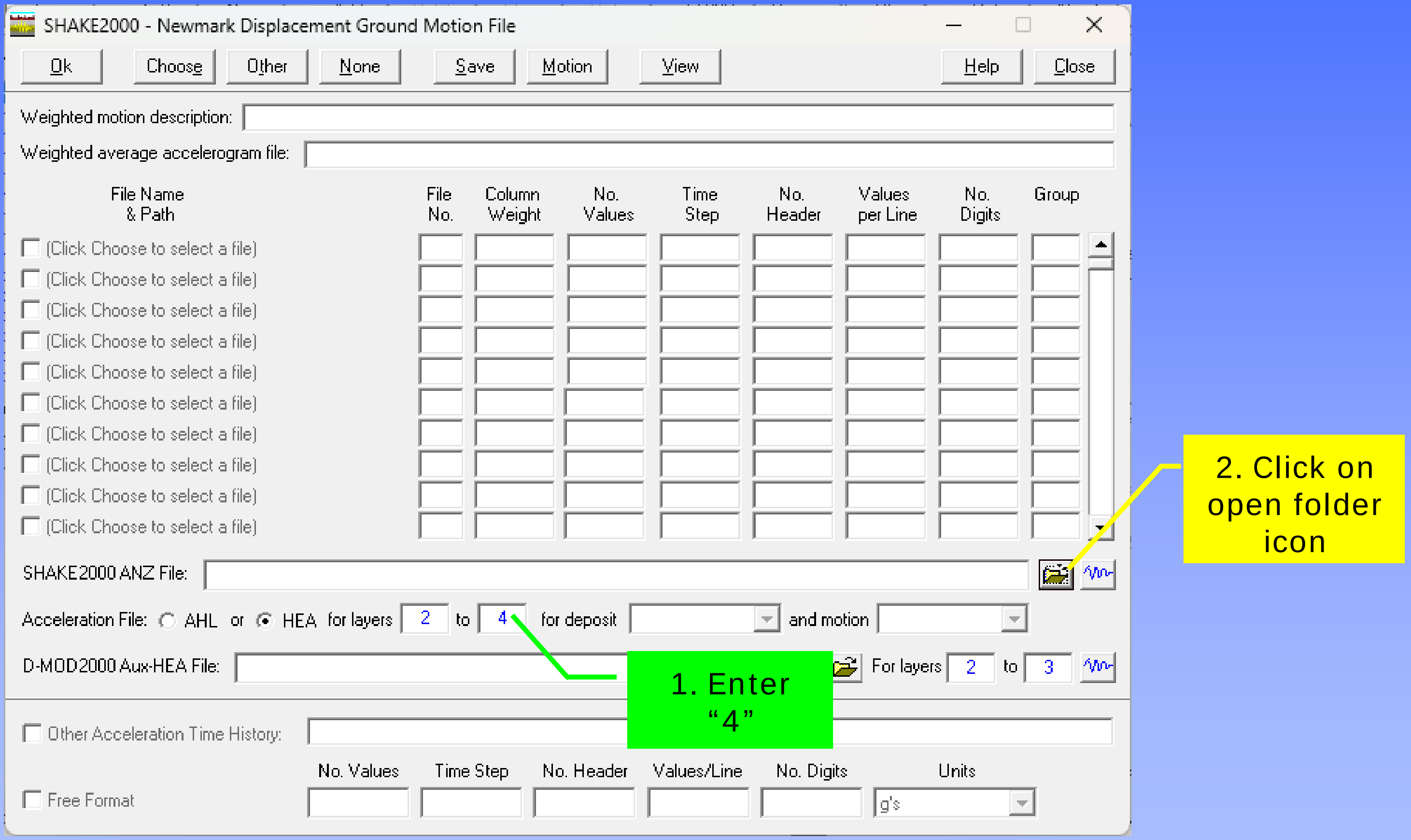
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

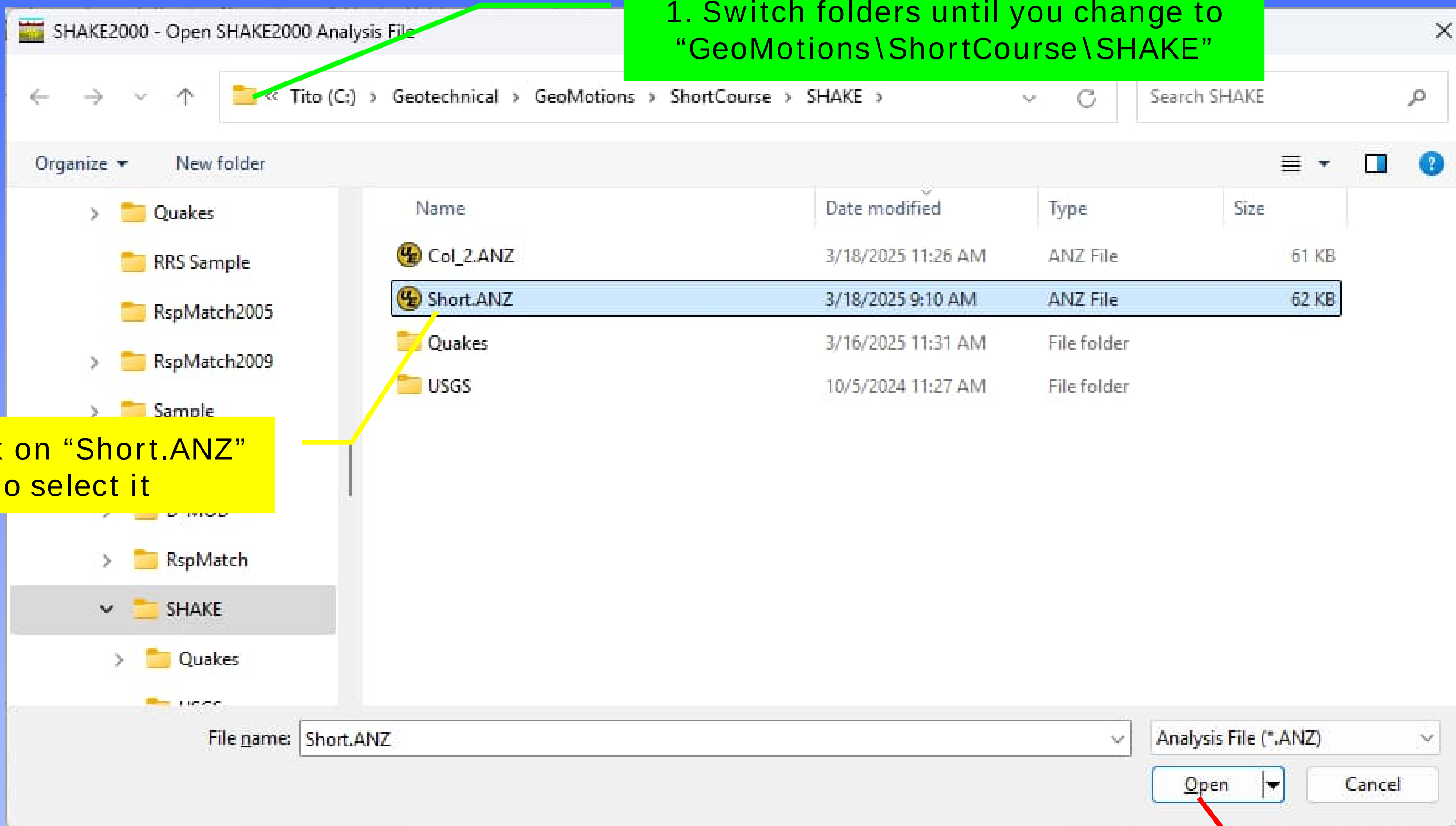


GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”



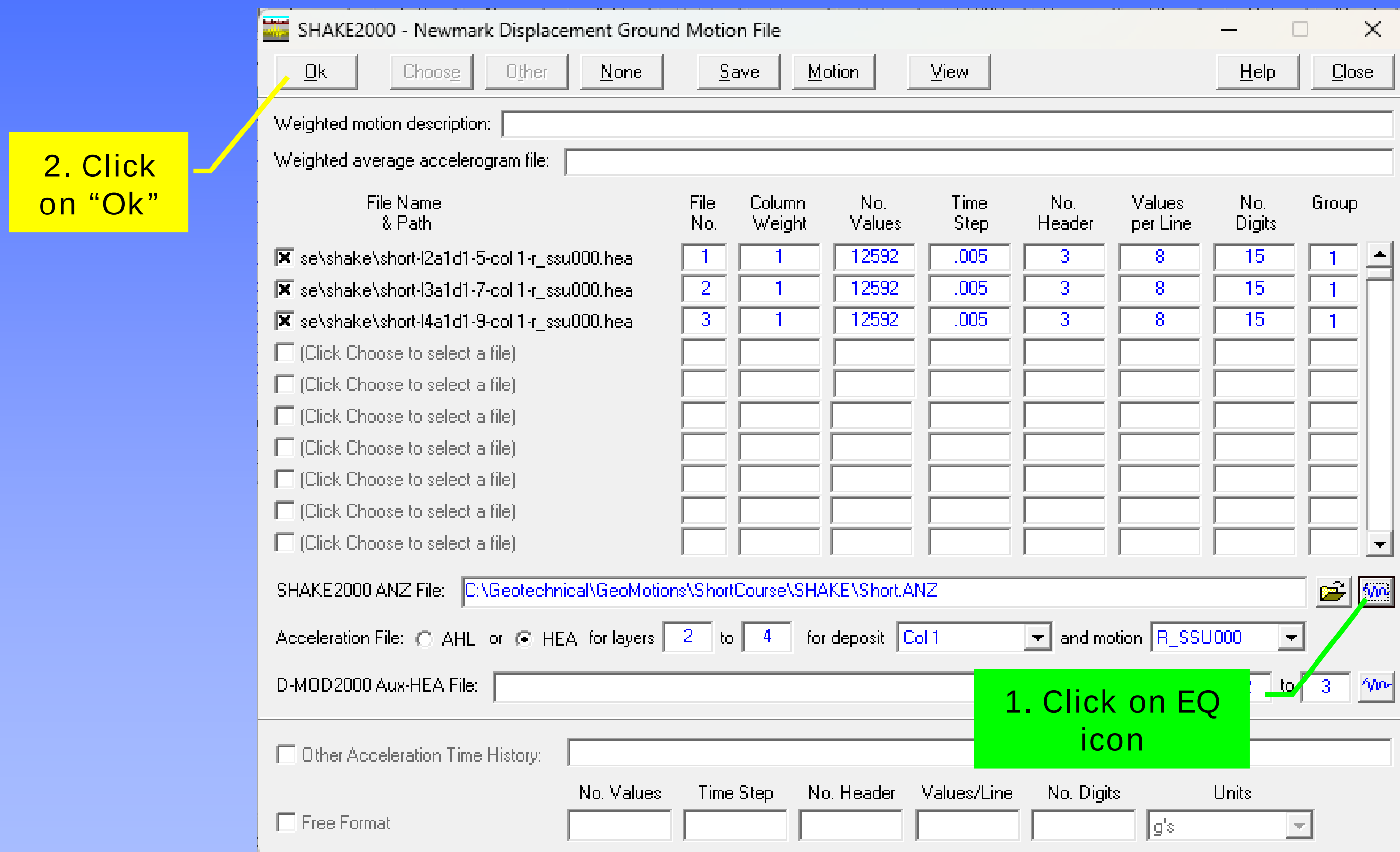
2. Click on “Short.ANZ” to select it

3. Click on “Open”

GeoMotions

Site Specific Response Analysis

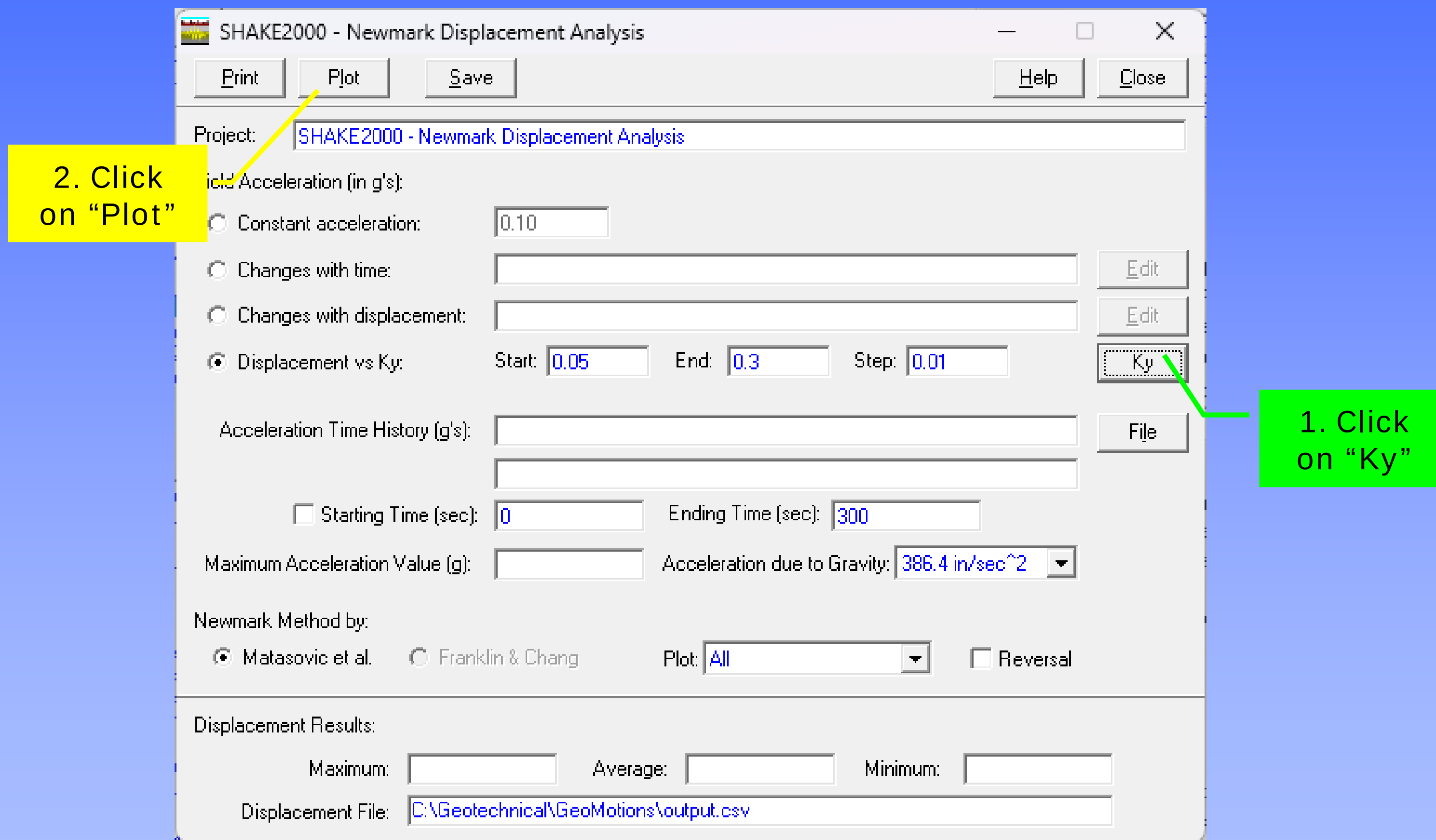
Newmark Displacement Analysis



GeoMotions

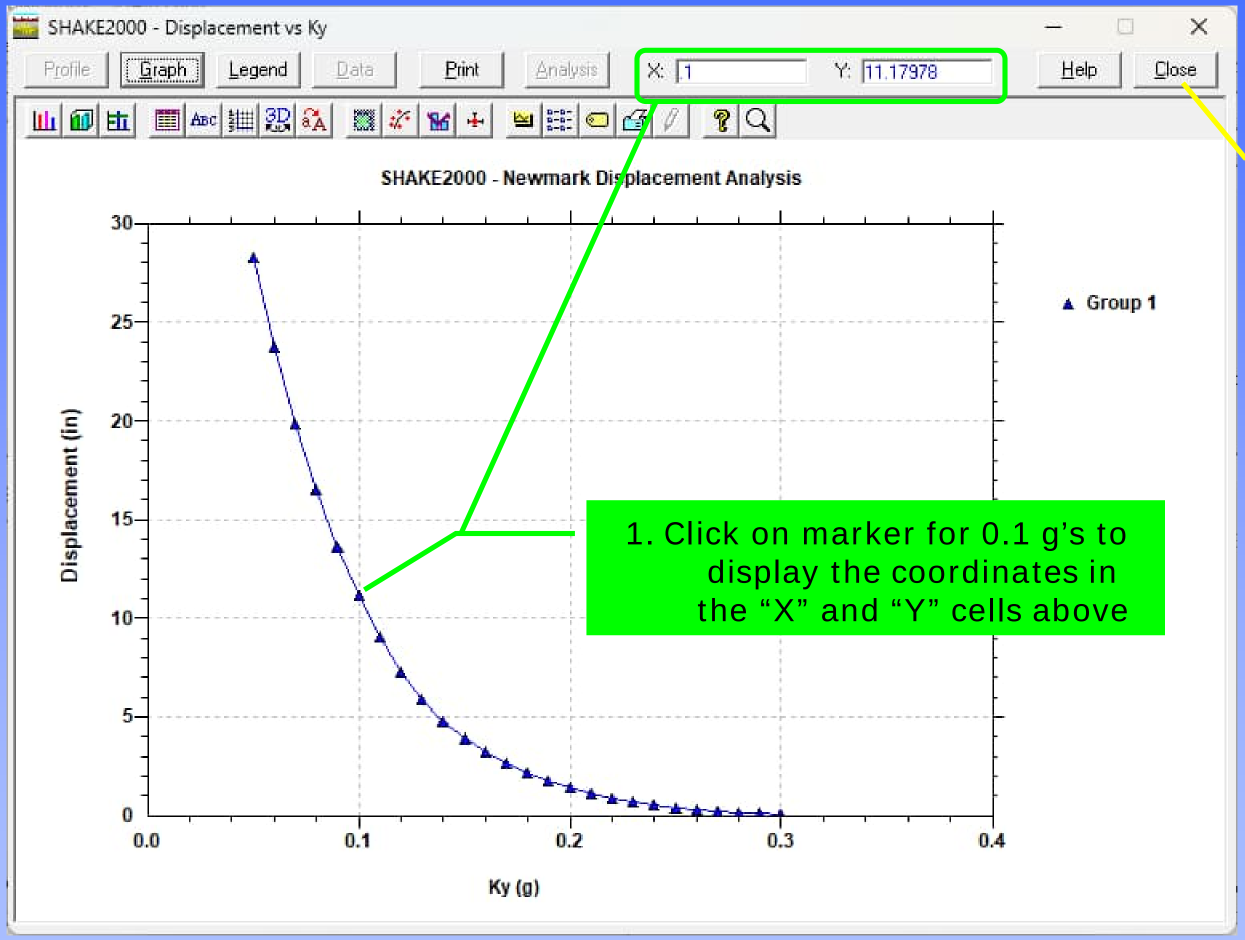
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

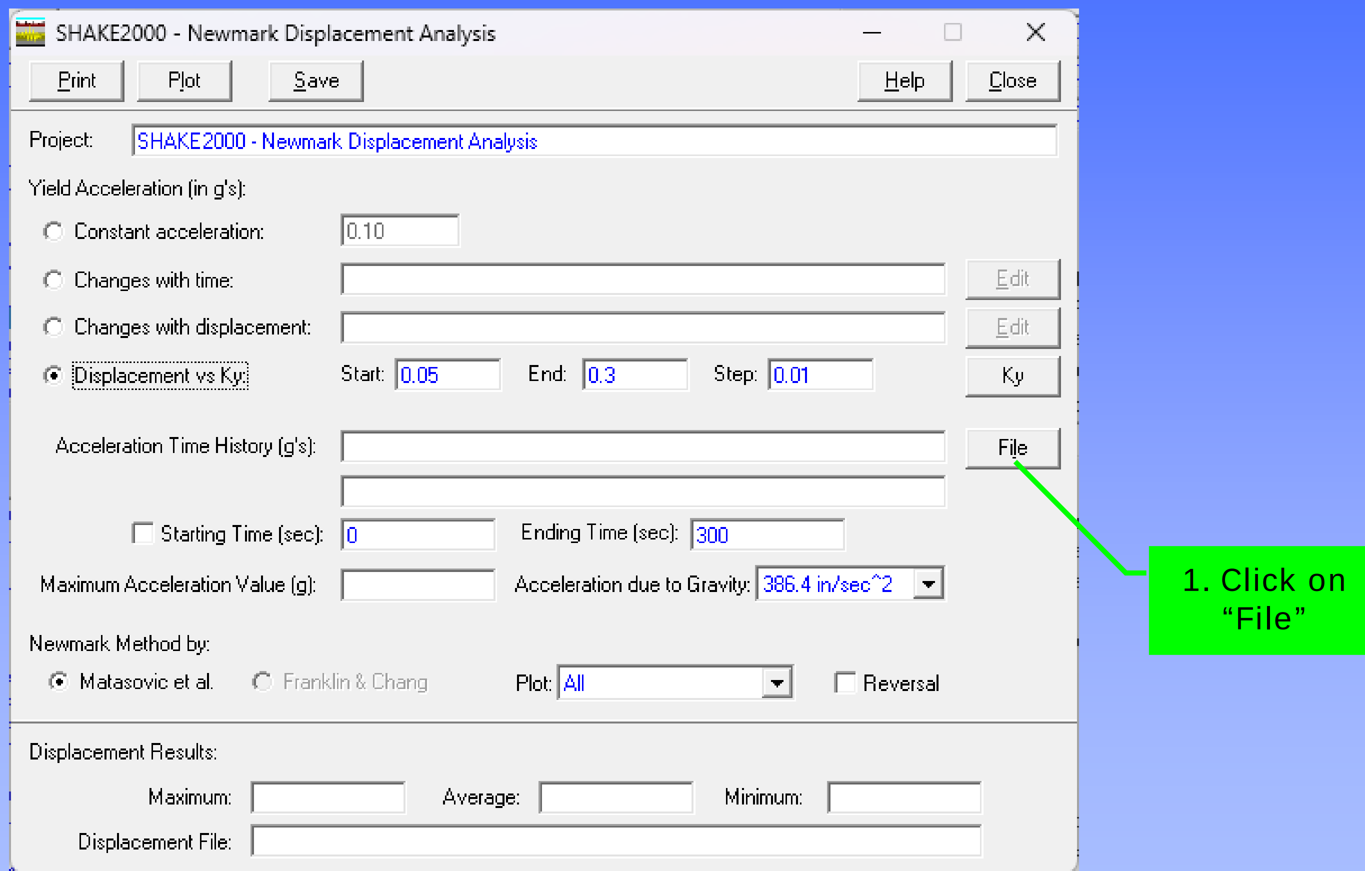
Newmark Displacement Analysis



Displacement computed based on average of acceleration time histories for motion SSU000 for layers 2, 3, and 4 of Column No. 1

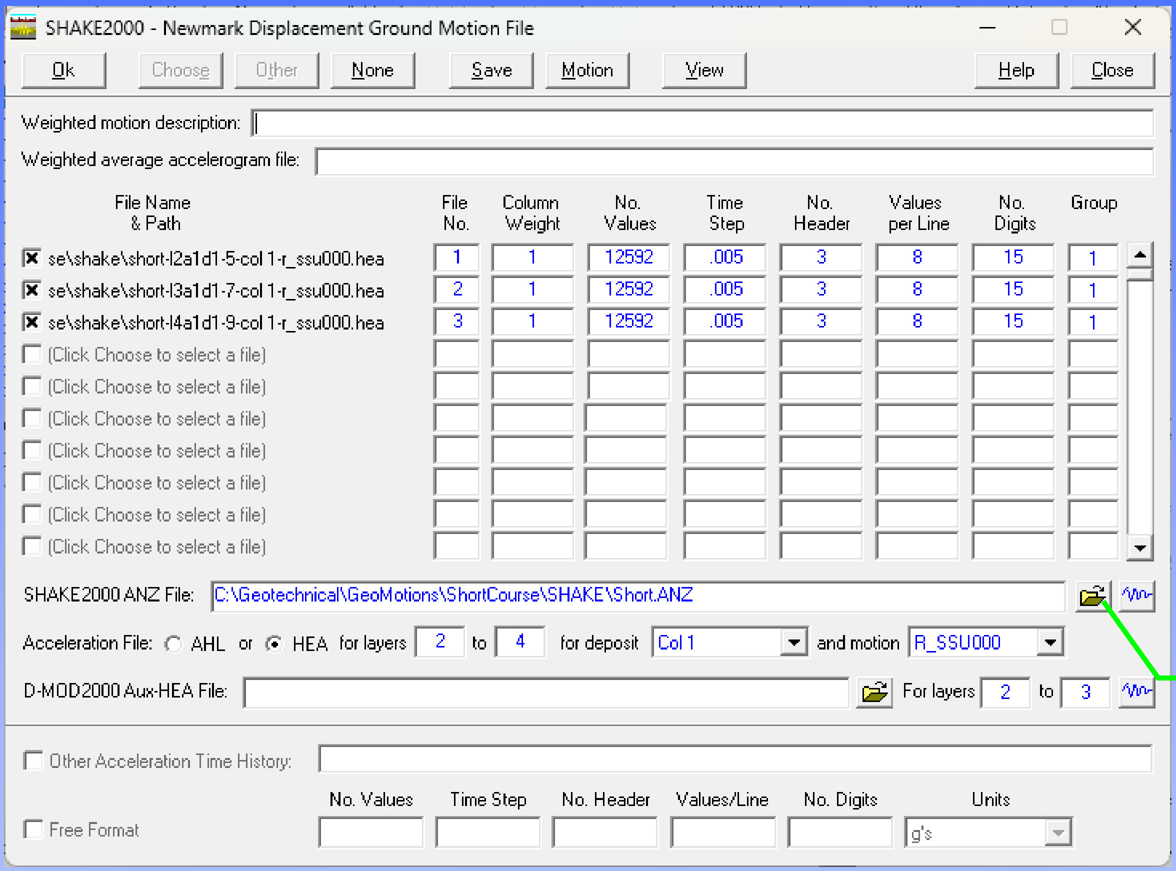
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis



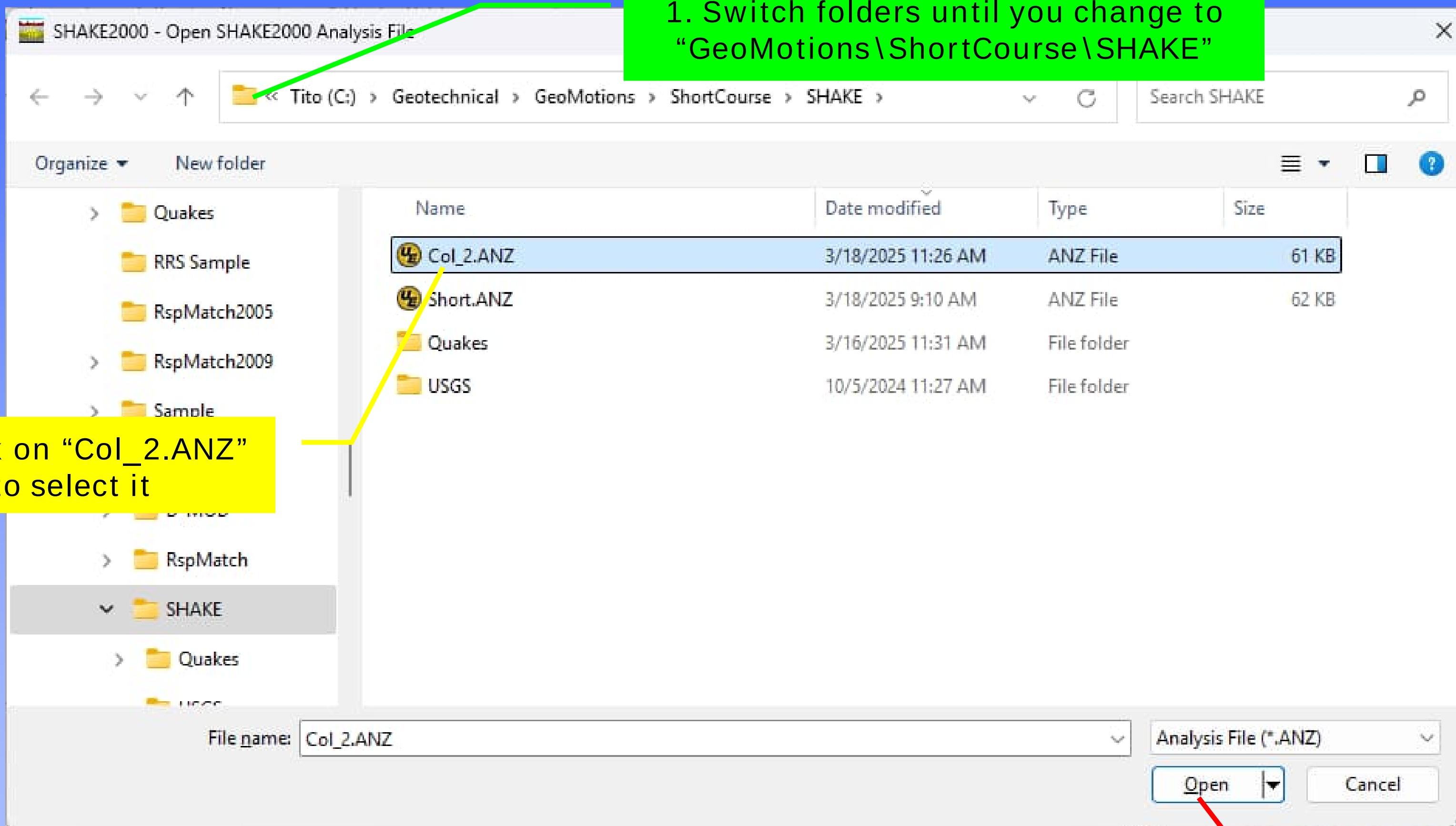
1. Click on open folder icon

GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”

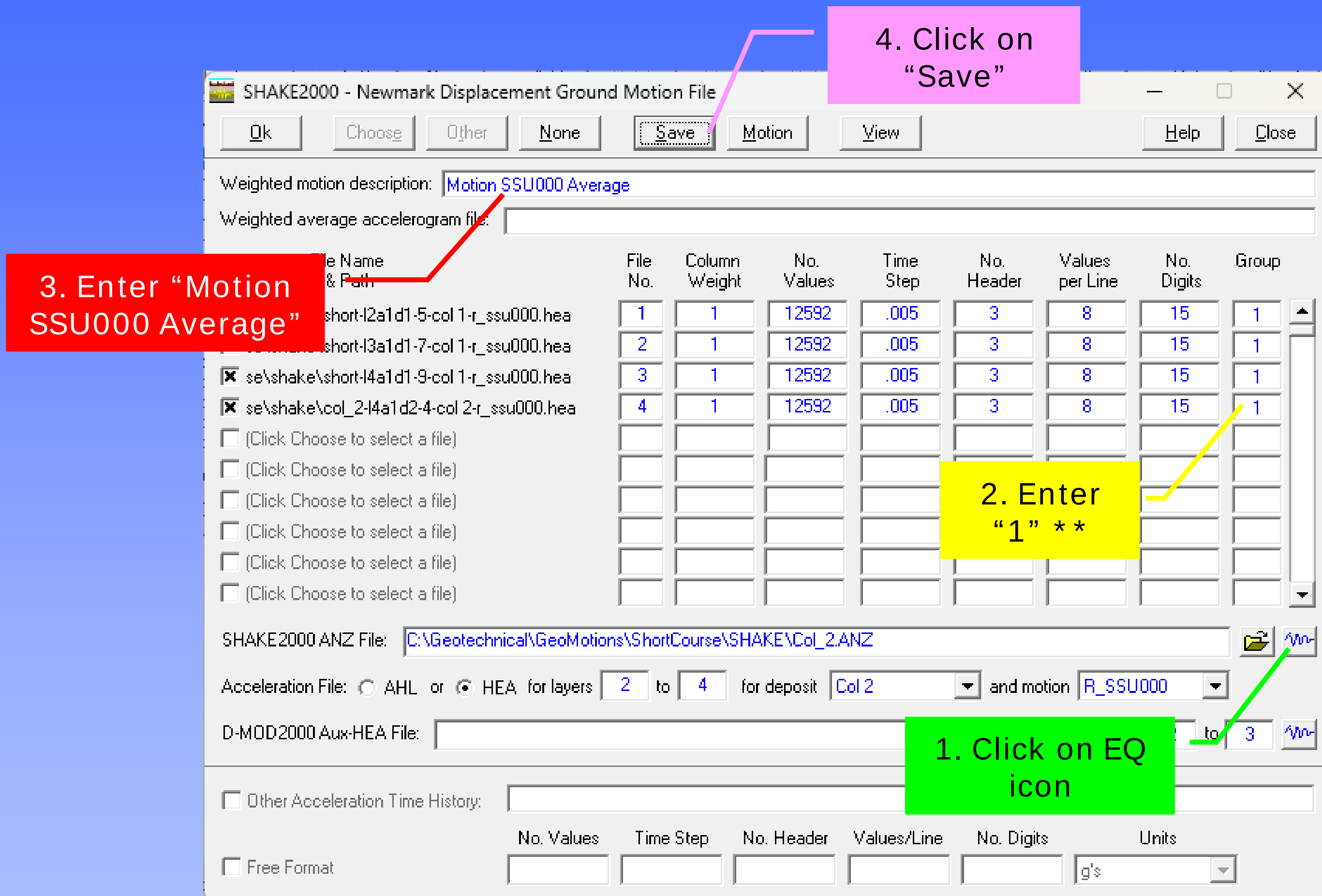


2. Click on “Col_2.ANZ” to select it

3. Click on “Open”

Site Specific Response Analysis

Newmark Displacement Analysis



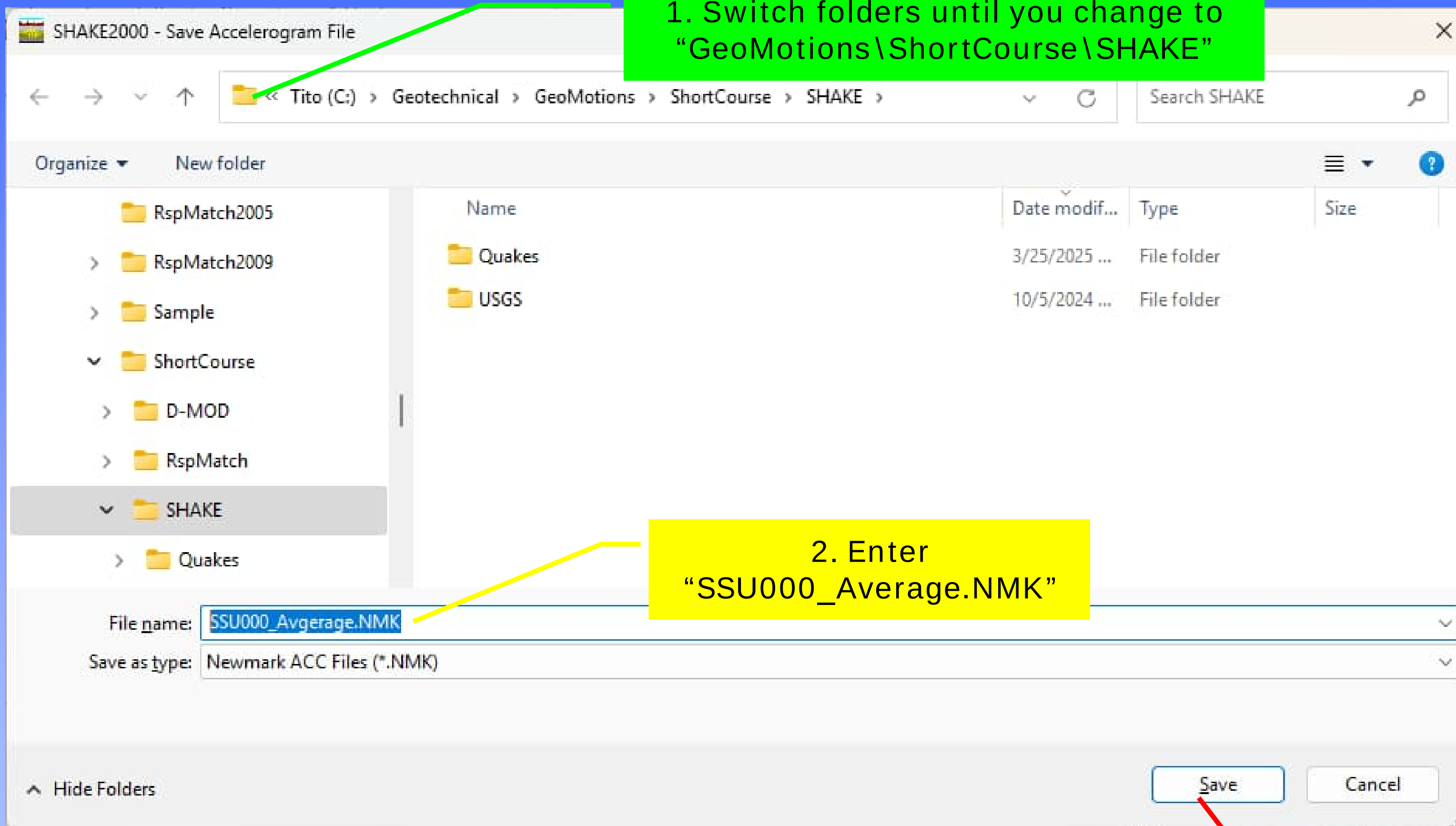
** Changed to 1 so all the motions for Columns 1 and 2 are grouped together to calculate an average motion.

GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”

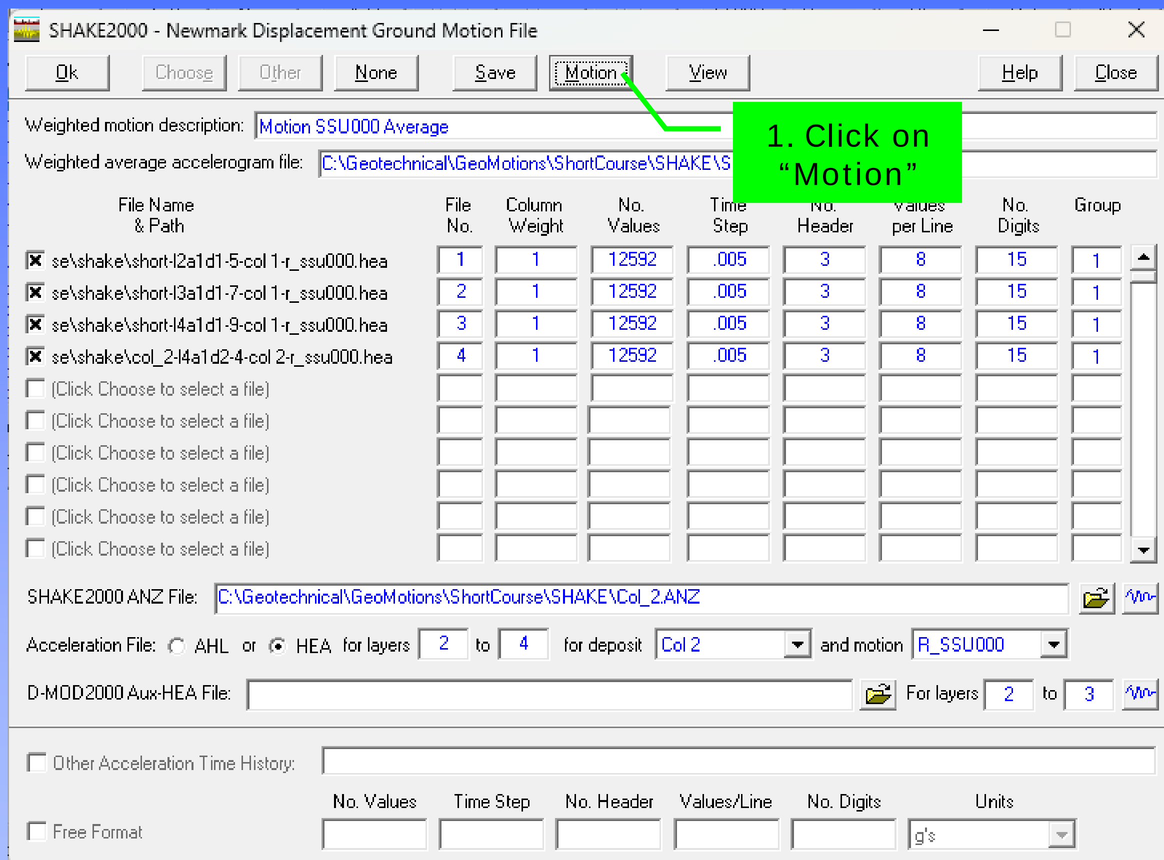


2. Enter “SSU000_Average.NMK”

3. Click on “Save”

Site Specific Response Analysis

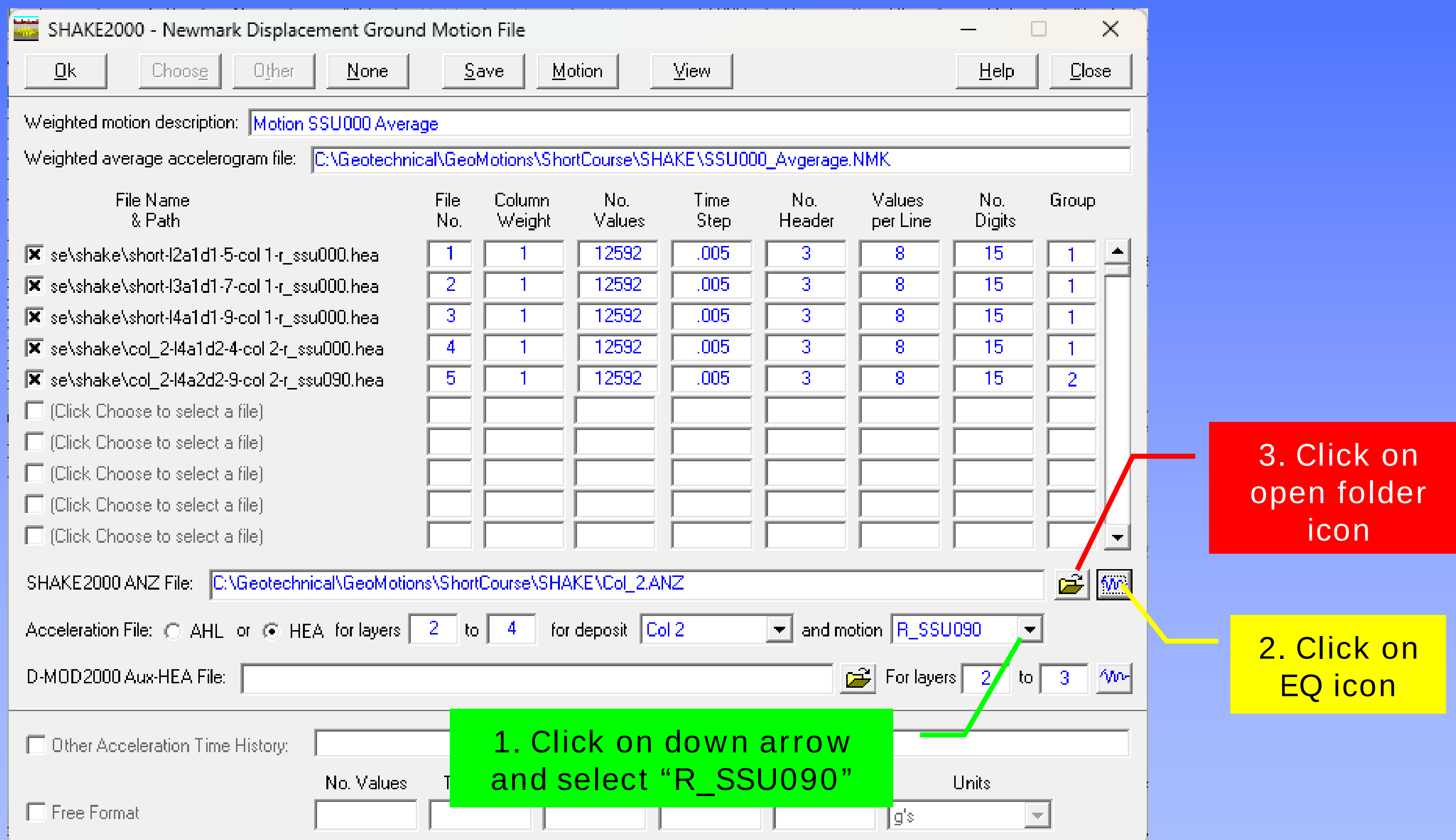
Newmark Displacement Analysis



GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

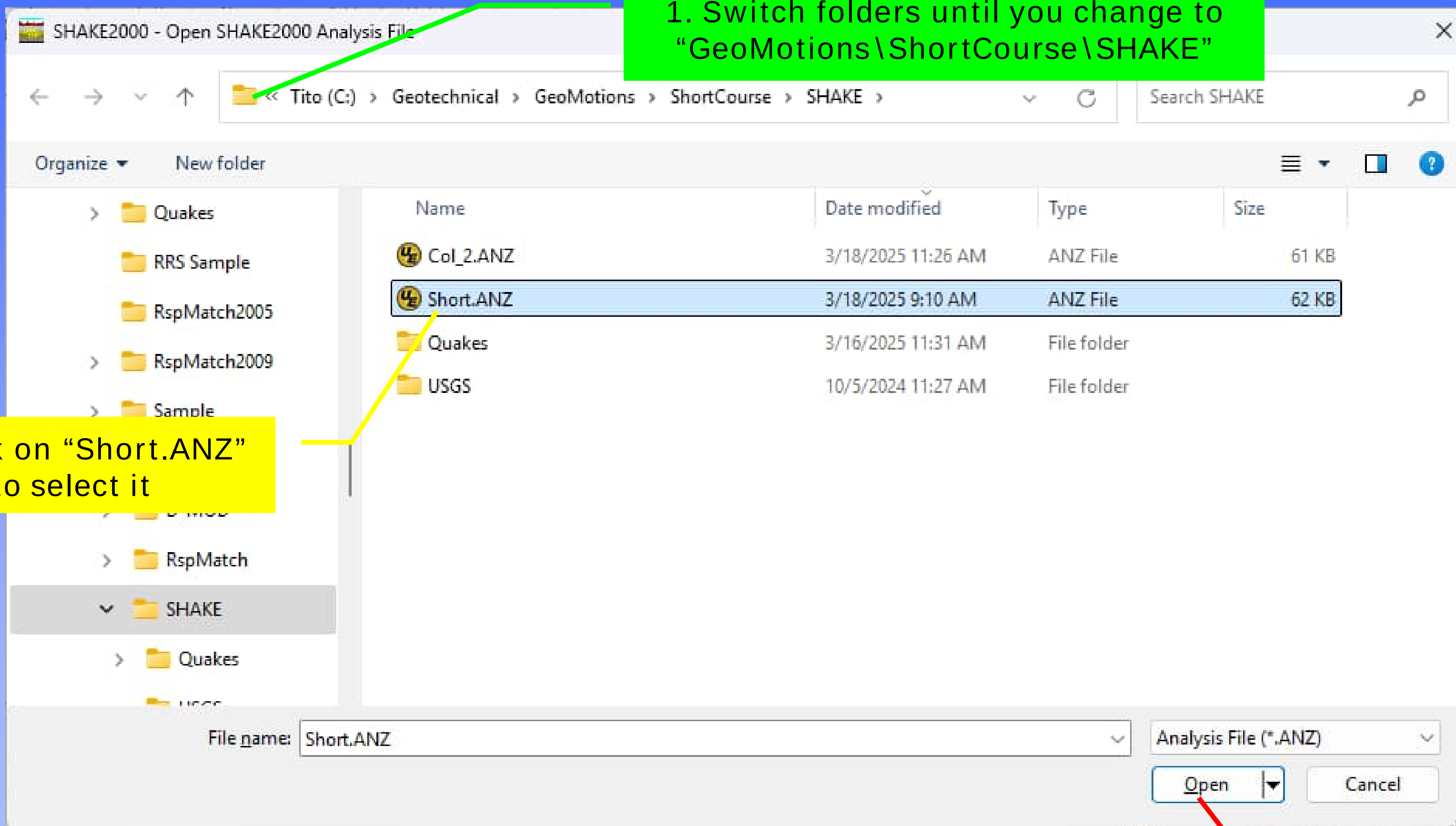


GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”



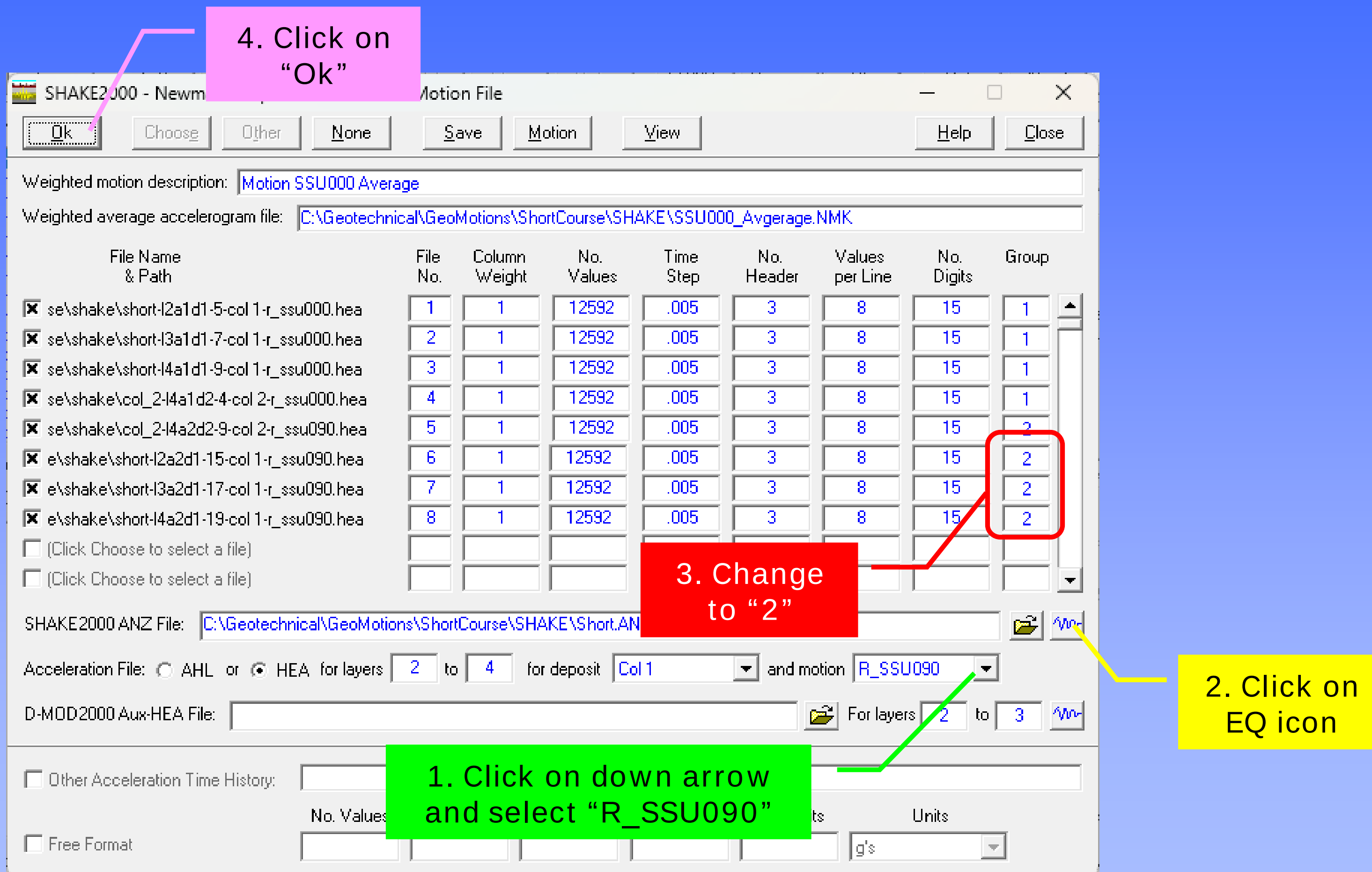
2. Click on “Short.ANZ” to select it

3. Click on “Open”

GeoMotions

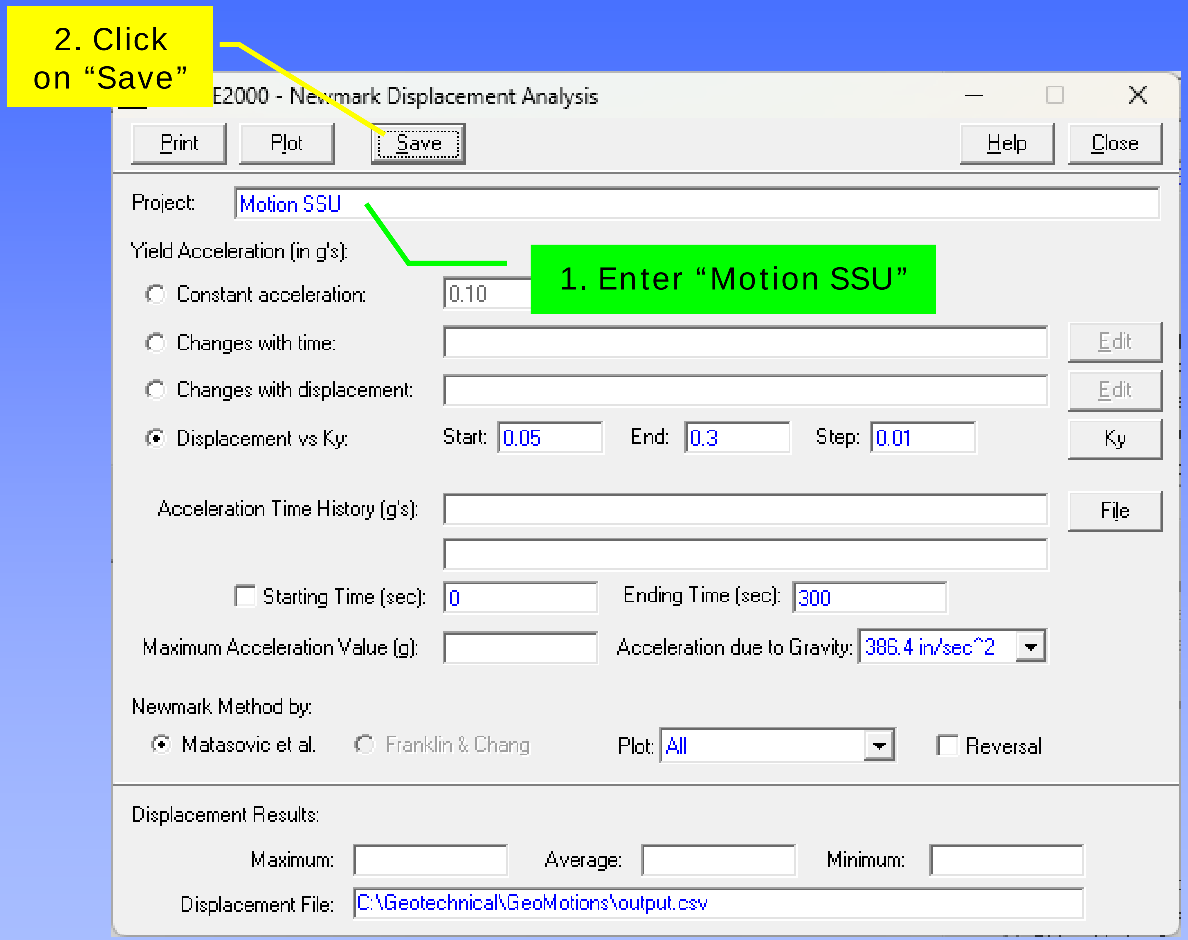
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

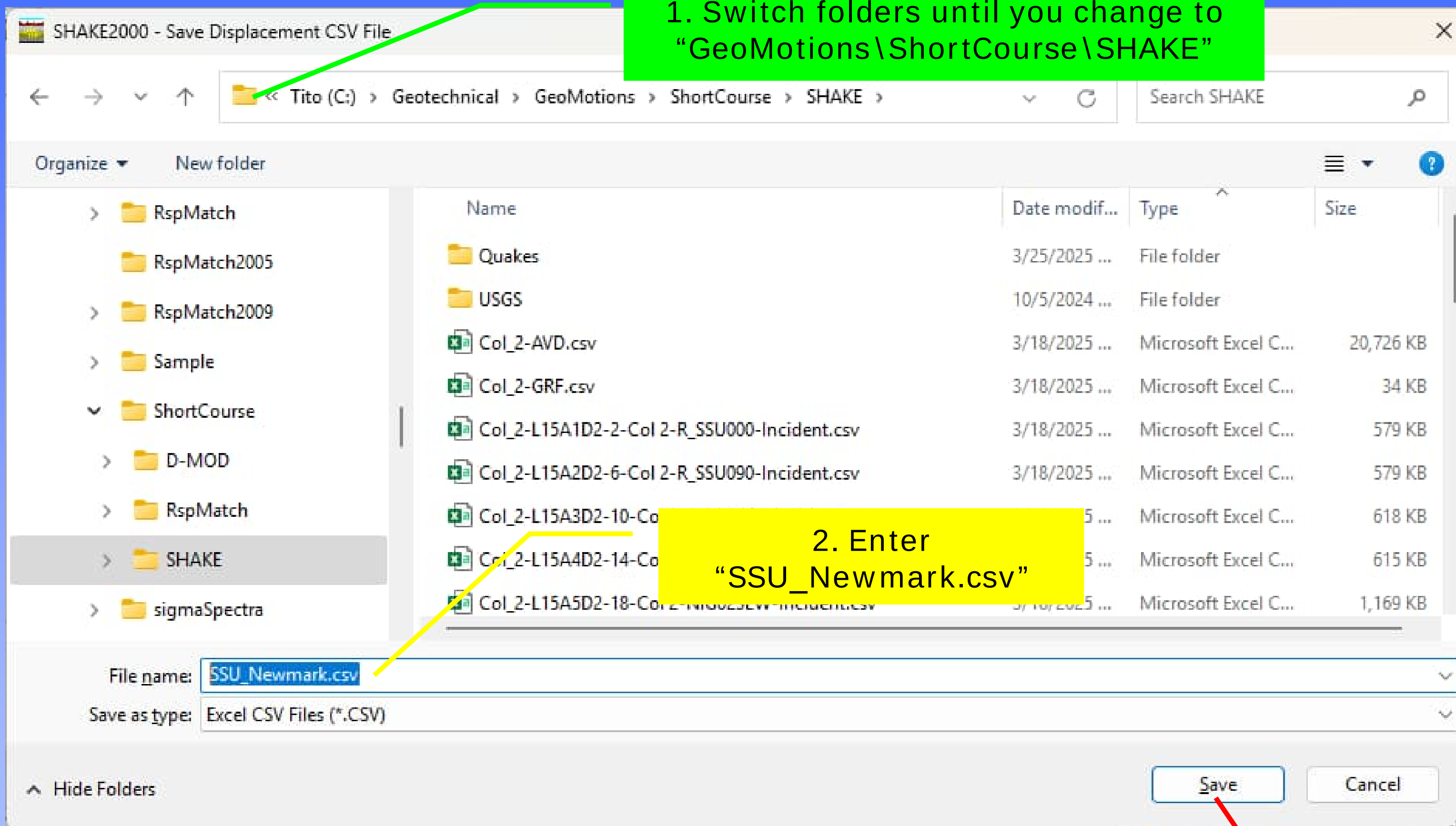


GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”

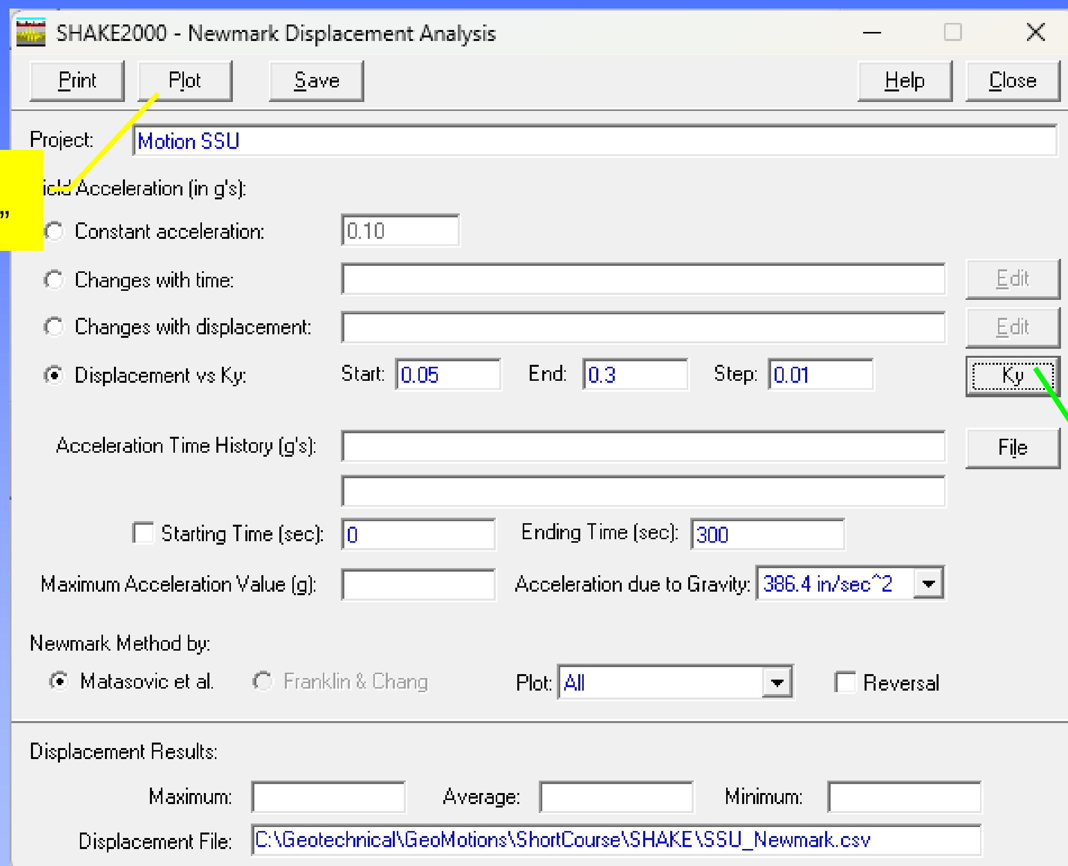


2. Enter “SSU_Newmark.csv”

3. Click on “Save”

Site Specific Response Analysis

Newmark Displacement Analysis



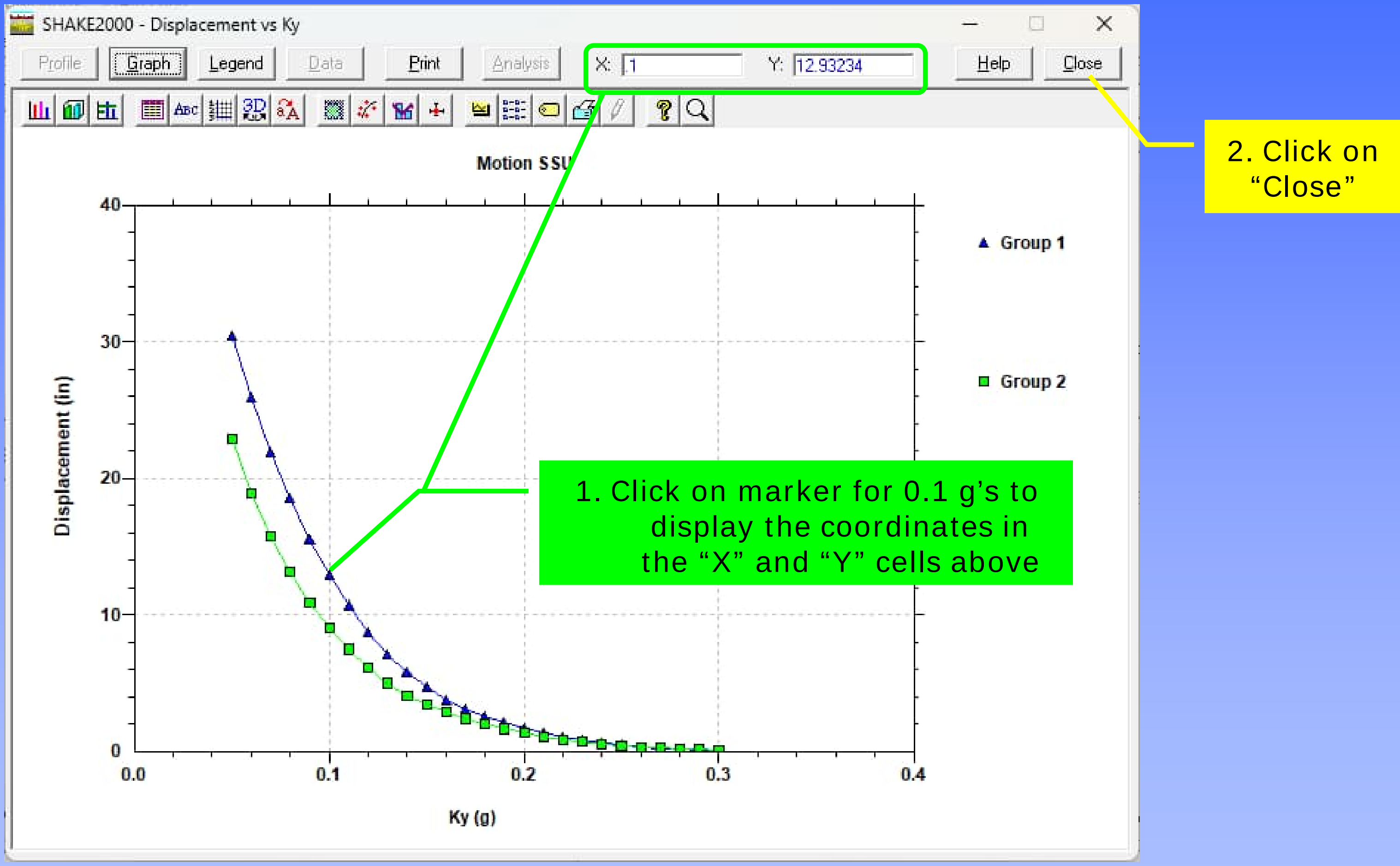
2. Click on “Plot”

1. Click on “Ky”

GeoMotions

Site Specific Response Analysis

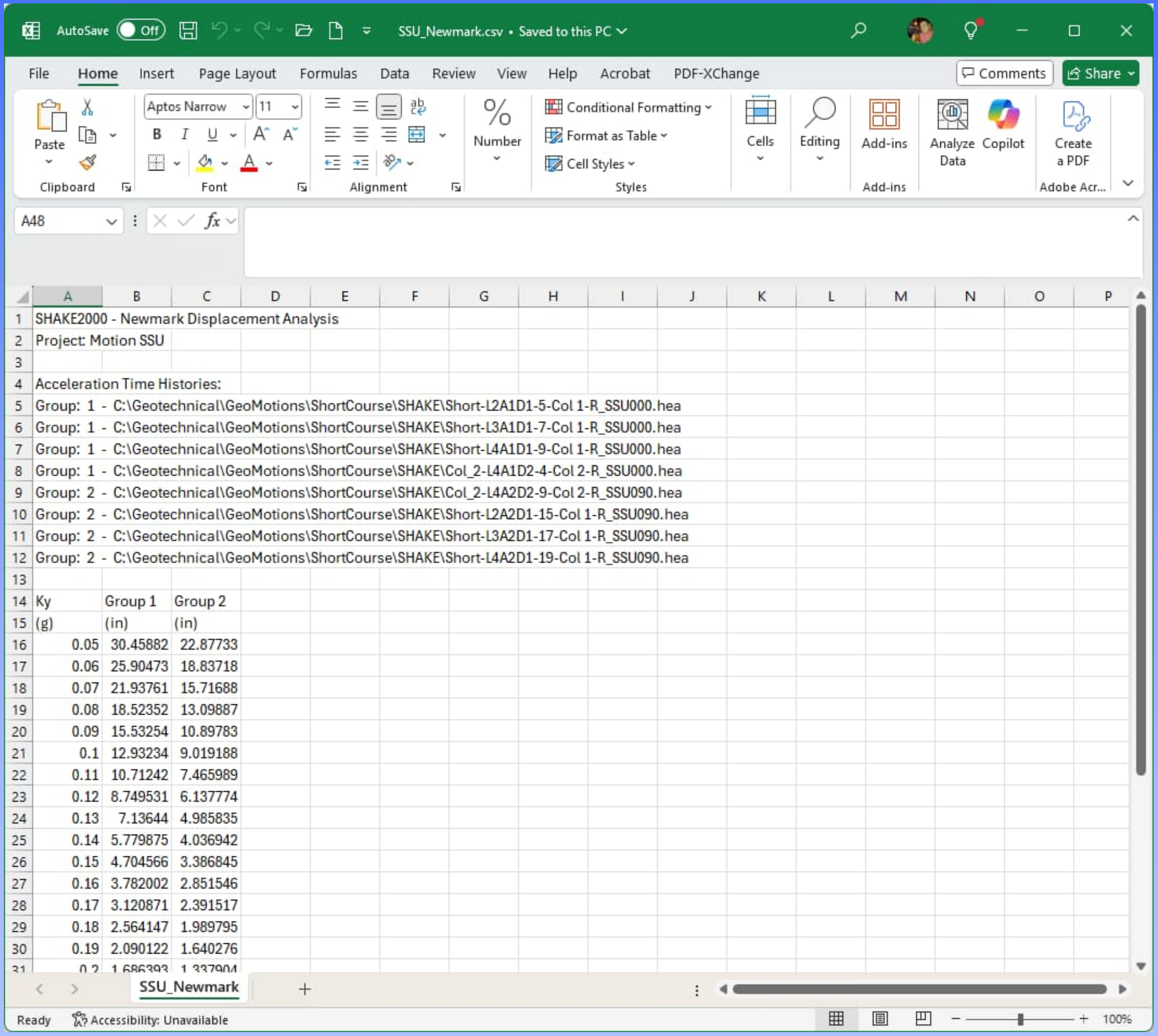
Newmark Displacement Analysis



GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis – Excel CSV File



SHAKE2000 - Newmark Displacement Analysis
Project: Motion SSU

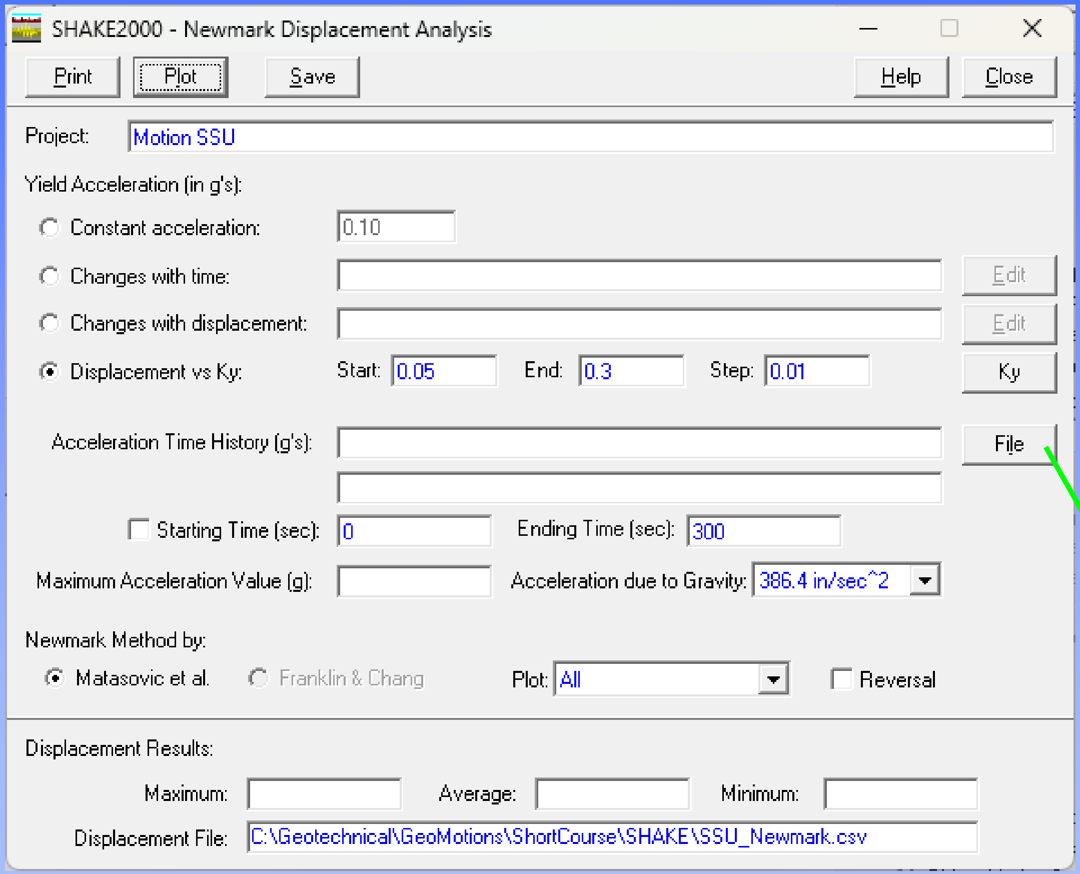
Acceleration Time Histories:
Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A1D1-5-Col 1-R_SSU000.hea
Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A1D1-7-Col 1-R_SSU000.hea
Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A1D1-9-Col 1-R_SSU000.hea
Group: 1 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A1D2-4-Col 2-R_SSU000.hea
Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A2D2-9-Col 2-R_SSU090.hea
Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A2D1-15-Col 1-R_SSU090.hea
Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A2D1-17-Col 1-R_SSU090.hea
Group: 2 - C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A2D1-19-Col 1-R_SSU090.hea

Ky	Group 1	Group 2
(g)	(in)	(in)
0.05	30.45882	22.87733
0.06	25.90473	18.83718
0.07	21.93761	15.71688
0.08	18.52352	13.09887
0.09	15.53254	10.89783
0.1	12.93234	9.019188
0.11	10.71242	7.465989
0.12	8.749531	6.137774
0.13	7.13644	4.985835
0.14	5.779875	4.036942
0.15	4.704566	3.386845
0.16	3.782002	2.851546
0.17	3.120871	2.391517
0.18	2.564147	1.989795
0.19	2.090122	1.640276
0.2	1.686393	1.337904

GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

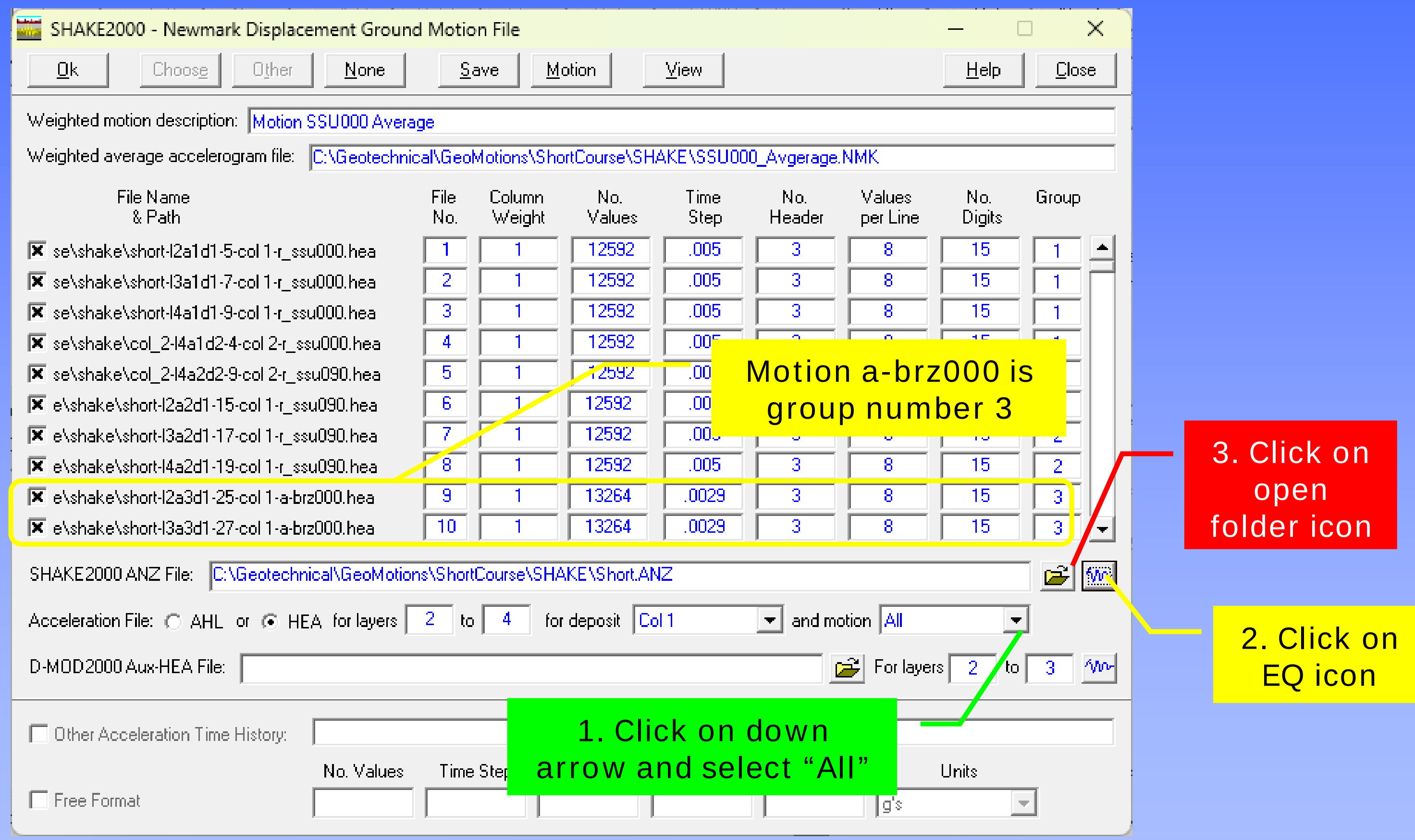


1. Click on "File"

GeoMotions

Site Specific Response Analysis

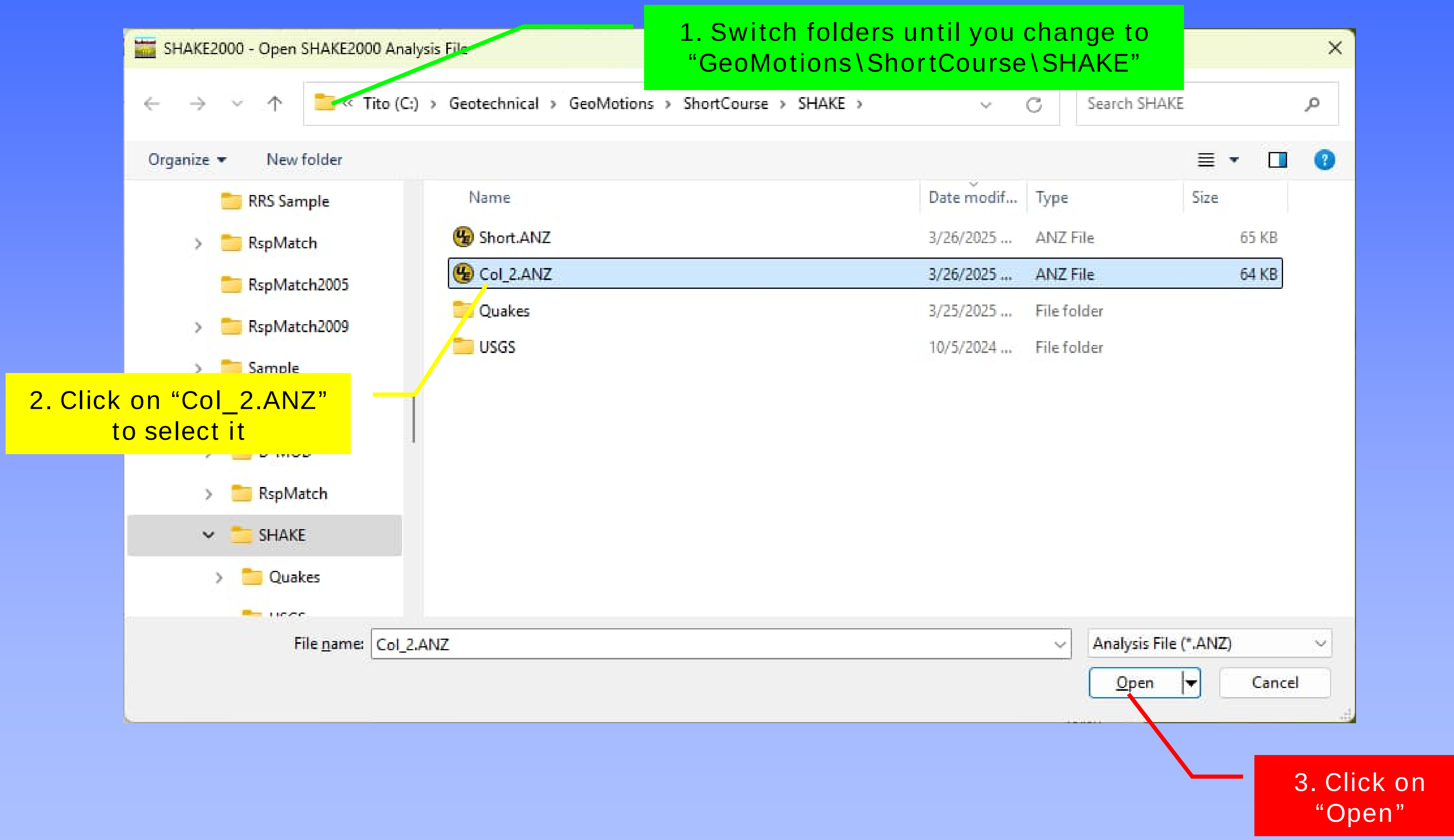
Newmark Displacement Analysis



GeoMotions

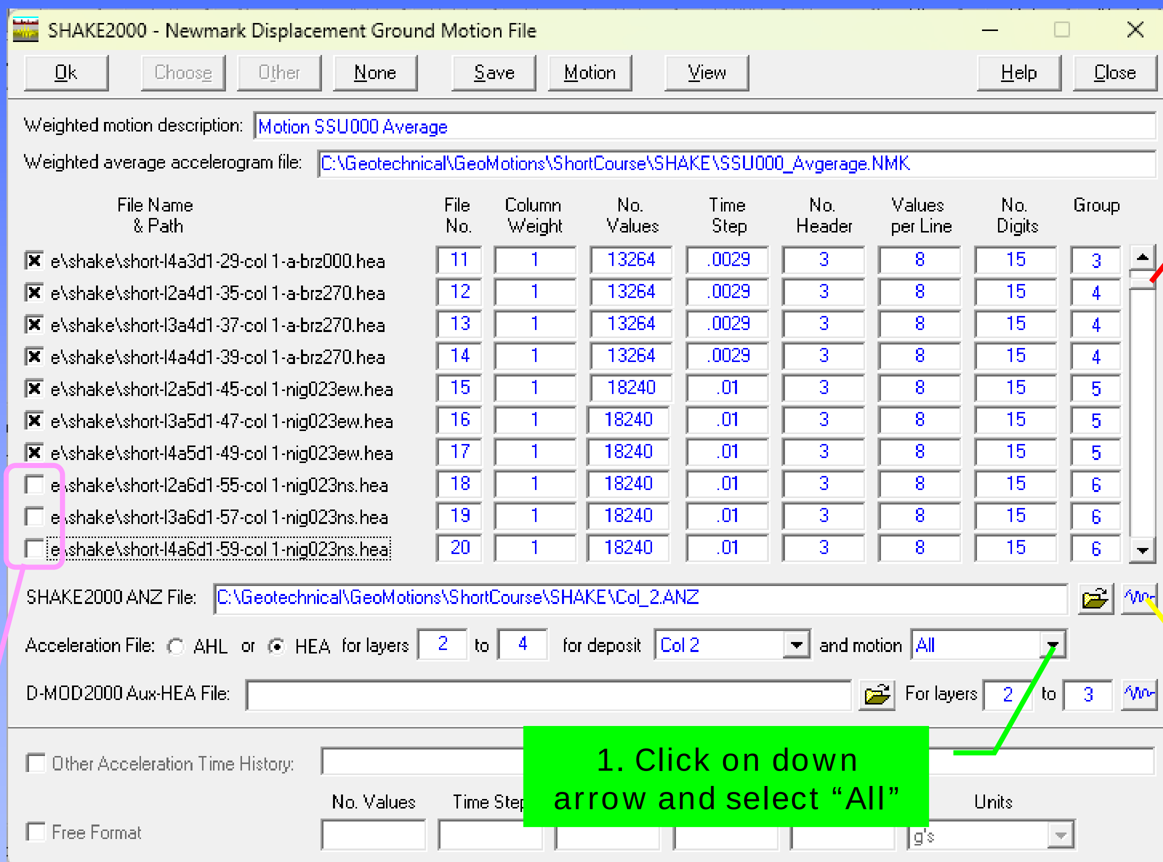
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis



3. Scroll down

2. Click on EQ icon

1. Click on down arrow and select “All”

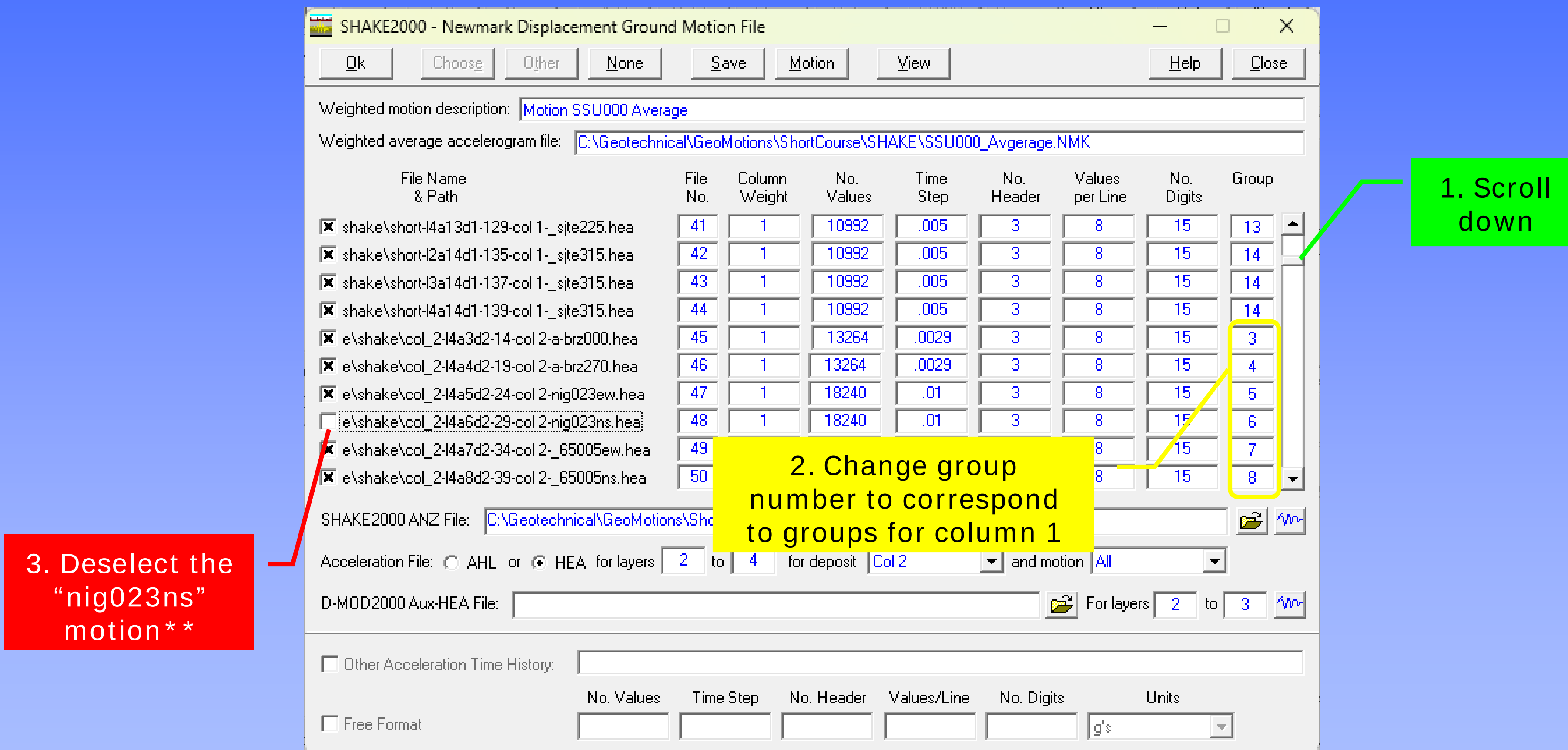
3. Deselect the “nig023ns” motion**

** This motion caused the “Option 5” error when processing the SHAKE output files. Thus, acceleration time histories where not created. Leaving this motion checked would cause an error on the Newmark Displacement calculation.

GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis



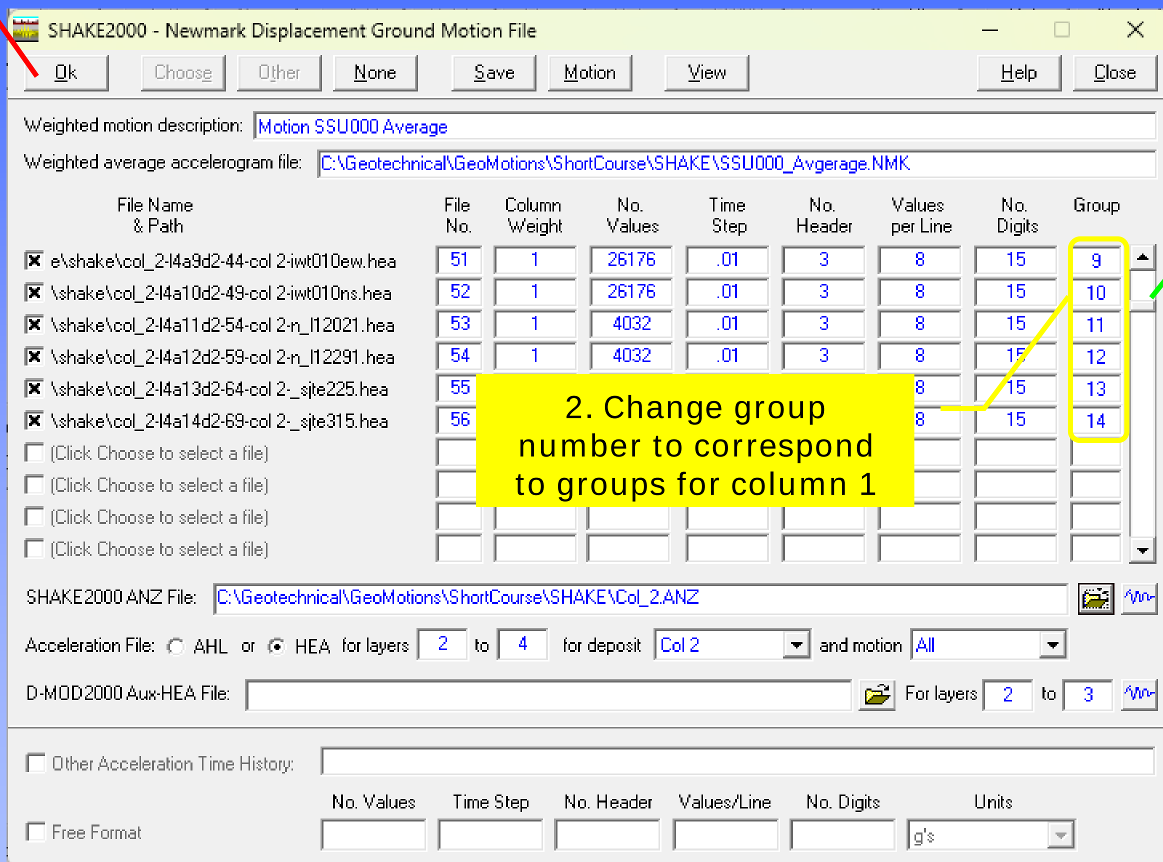
** This motion caused the “Option 5” error when processing the SHAKE output files. Thus, acceleration time histories where not created. Leaving this motion checked would cause an error on the Newmark Displacement calculation.

Site Specific Response Analysis

Newmark Displacement Analysis

3. Click on “Ok”

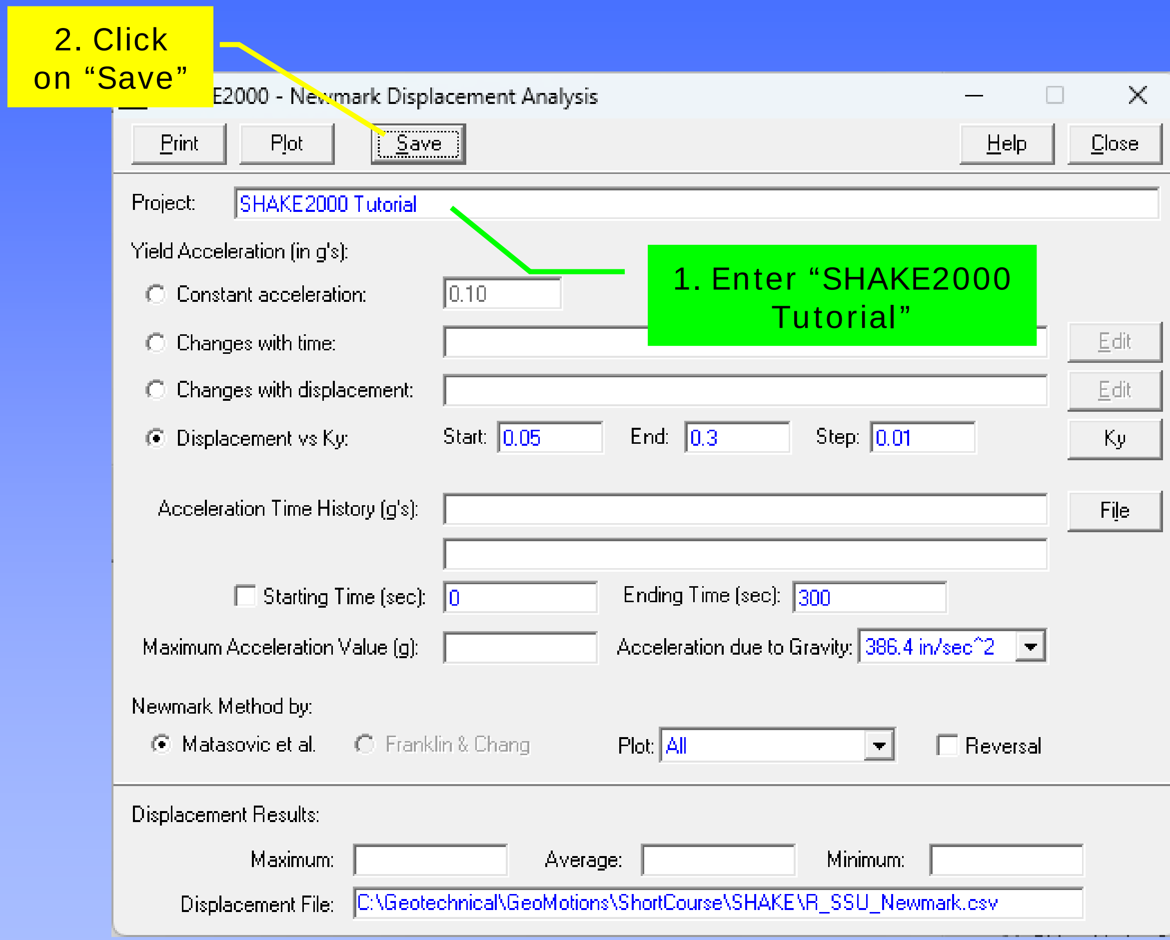
1. Scroll down



2. Change group number to correspond to groups for column 1

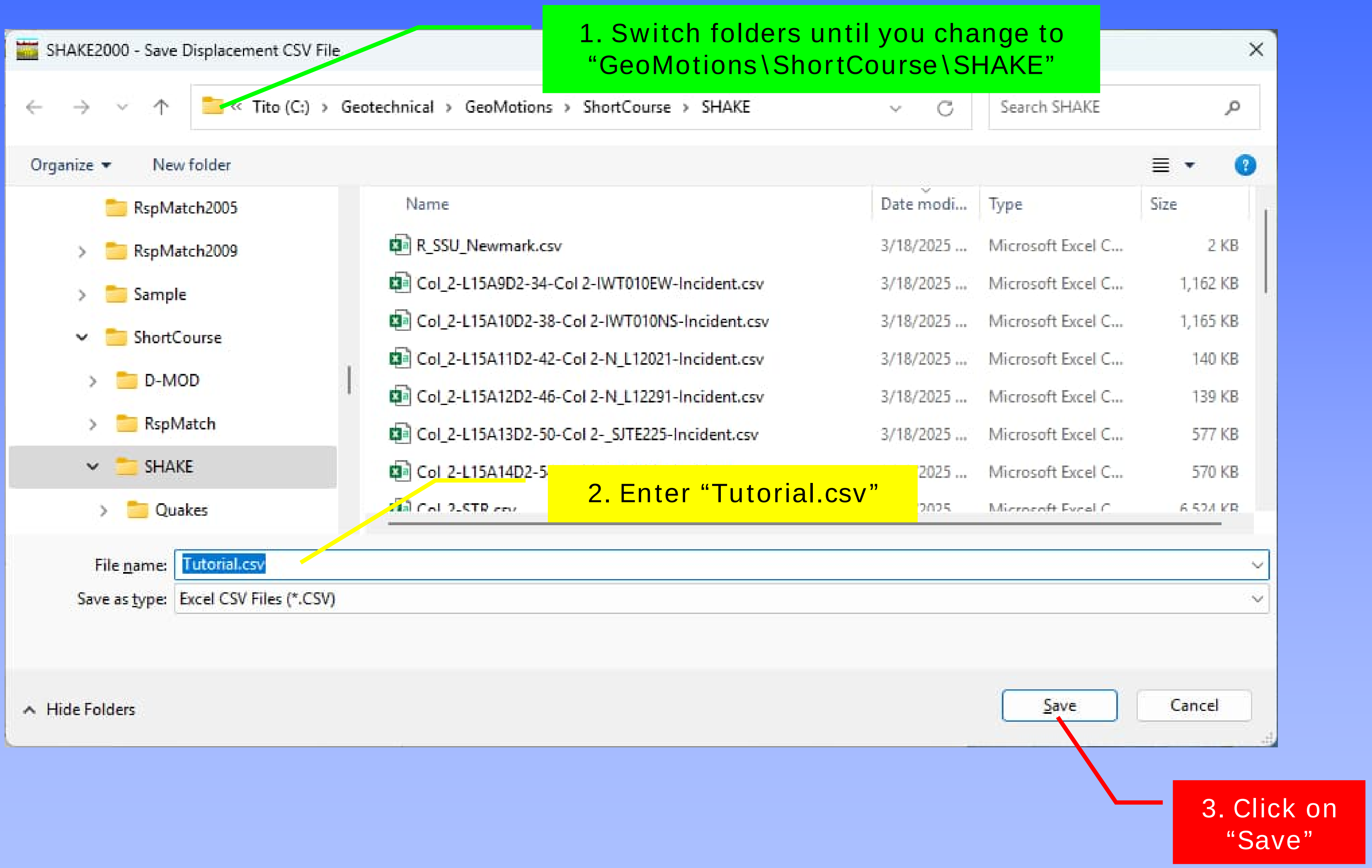
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

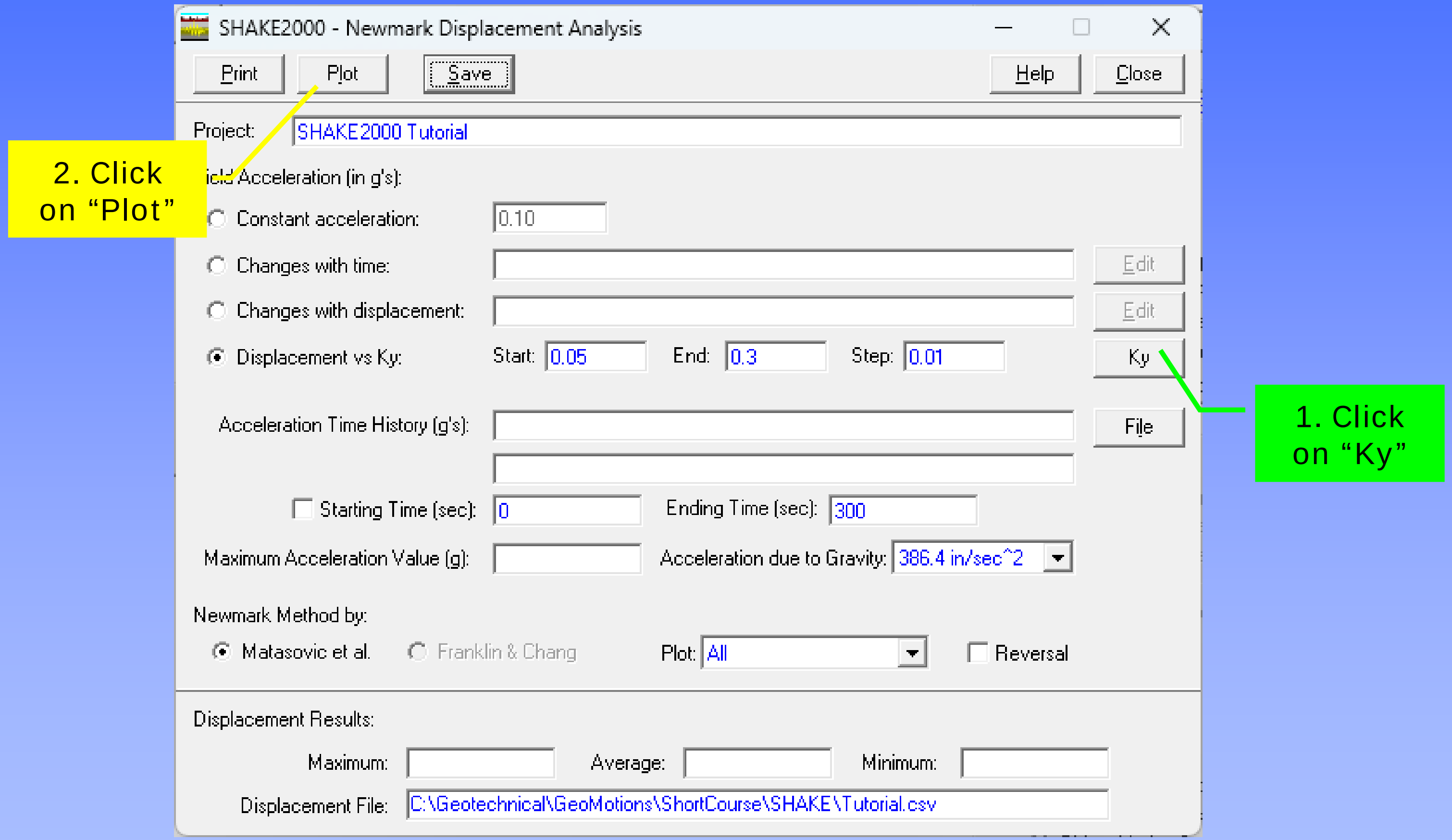
Newmark Displacement Analysis



GeoMotions

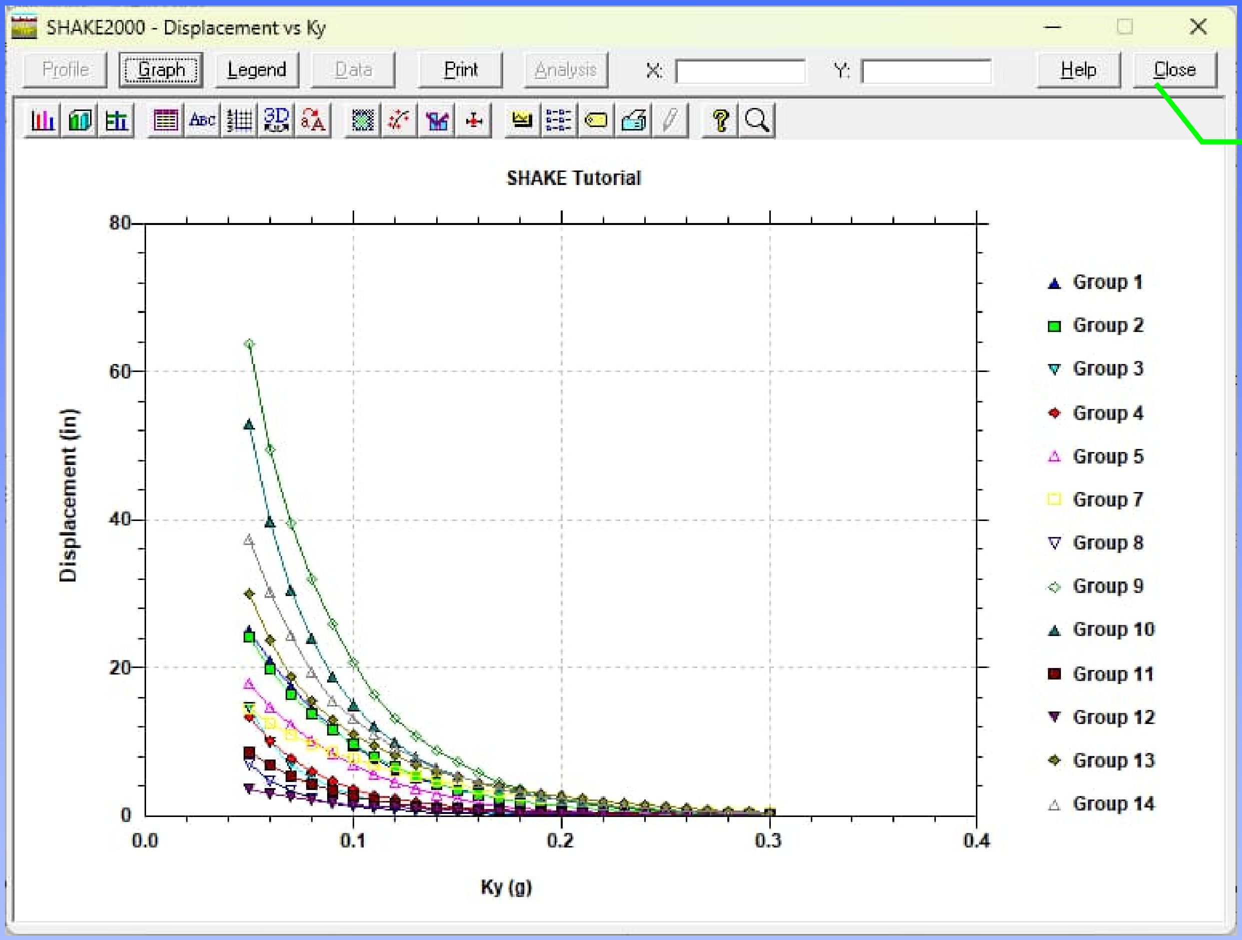
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis

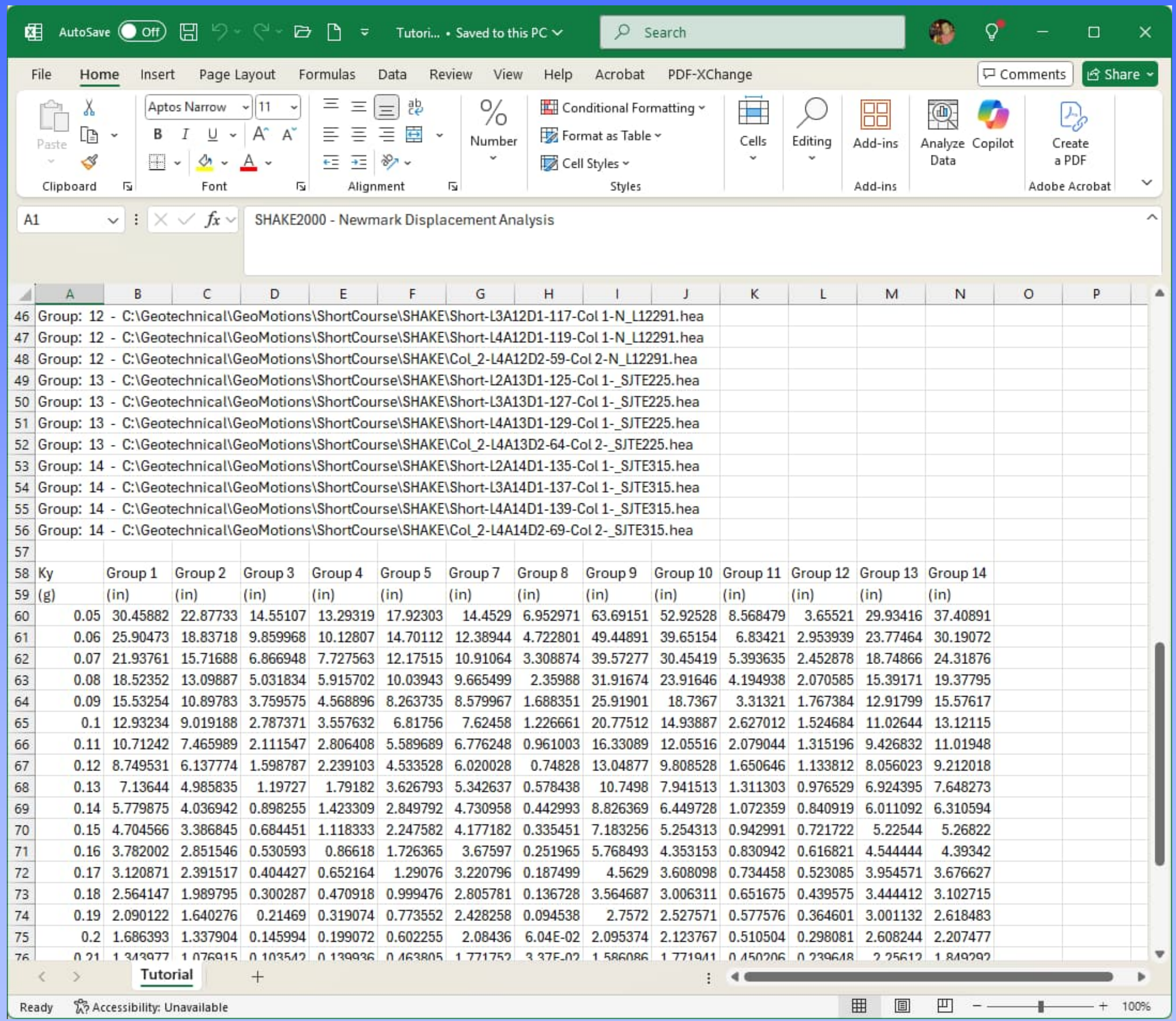


1. Click on "Close"

GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis – Excel CSV File



SHAKE2000 - Newmark Displacement Analysis

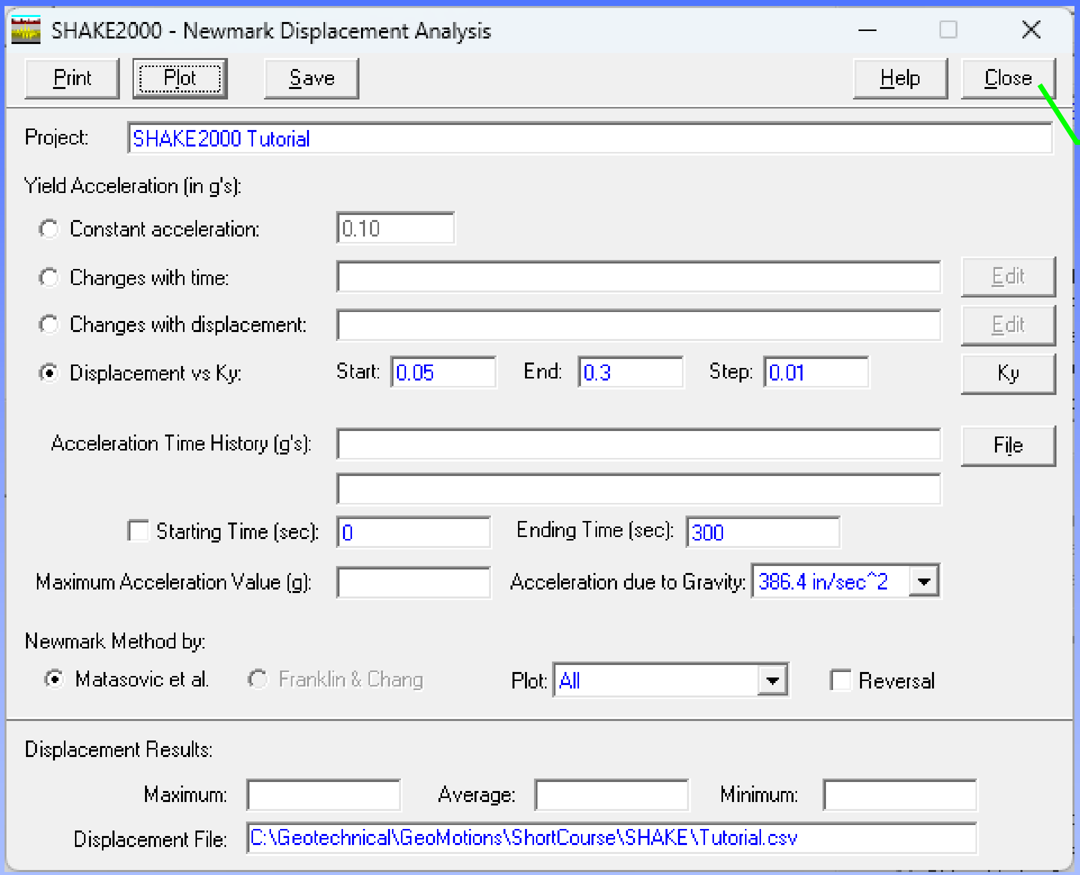
	A	B
46	Group: 12	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A12D1-117-Col 1-N_L12291.hea
47	Group: 12	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A12D1-119-Col 1-N_L12291.hea
48	Group: 12	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A12D2-59-Col 2-N_L12291.hea
49	Group: 13	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A13D1-125-Col 1-_SJTE225.hea
50	Group: 13	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A13D1-127-Col 1-_SJTE225.hea
51	Group: 13	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A13D1-129-Col 1-_SJTE225.hea
52	Group: 13	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A13D2-64-Col 2-_SJTE225.hea
53	Group: 14	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L2A14D1-135-Col 1-_SJTE315.hea
54	Group: 14	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L3A14D1-137-Col 1-_SJTE315.hea
55	Group: 14	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Short-L4A14D1-139-Col 1-_SJTE315.hea
56	Group: 14	- C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\Col_2-L4A14D2-69-Col 2-_SJTE315.hea
57		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
58	Ky	Group 1	Group 2	Group 3	Group 4	Group 5	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12	Group 13	Group 14
59	(g)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)
60	0.05	30.45882	22.87733	14.55107	13.29319	17.92303	14.4529	6.952971	63.69151	52.92528	8.568479	3.65521	29.93416	37.40891
61	0.06	25.90473	18.83718	9.859968	10.12807	14.70112	12.38944	4.722801	49.44891	39.65154	6.83421	2.953939	23.77464	30.19072
62	0.07	21.93761	15.71688	6.866948	7.727563	12.17515	10.91064	3.308874	39.57277	30.45419	5.393635	2.452878	18.74866	24.31876
63	0.08	18.52352	13.09887	5.031834	5.915702	10.03943	9.665499	2.35988	31.91674	23.91646	4.194938	2.070585	15.39171	19.37795
64	0.09	15.53254	10.89783	3.759575	4.568896	8.263735	8.579967	1.688351	25.91901	18.7367	3.31321	1.767384	12.91799	15.57617
65	0.1	12.93234	9.019188	2.787371	3.557632	6.81756	7.62458	1.226661	20.77512	14.93887	2.627012	1.524684	11.02644	13.12115
66	0.11	10.71242	7.465989	2.111547	2.806408	5.589689	6.776248	0.961003	16.33089	12.05516	2.079044	1.315196	9.426832	11.01948
67	0.12	8.749531	6.137774	1.598787	2.239103	4.533528	6.020028	0.74828	13.04877	9.808528	1.650646	1.133812	8.056023	9.212018
68	0.13	7.13644	4.985835	1.19727	1.79182	3.626793	5.342637	0.578438	10.7498	7.941513	1.311303	0.976529	6.924395	7.648273
69	0.14	5.779875	4.036942	0.898255	1.423309	2.849792	4.730958	0.442993	8.826369	6.449728	1.072359	0.840919	6.011092	6.310594
70	0.15	4.704566	3.386845	0.684451	1.118333	2.247582	4.177182	0.335451	7.183256	5.254313	0.942991	0.721722	5.22544	5.26822
71	0.16	3.782002	2.851546	0.530593	0.86618	1.726365	3.67597	0.251965	5.768493	4.353153	0.830942	0.616821	4.544444	4.39342
72	0.17	3.120871	2.391517	0.404427	0.652164	1.29076	3.220796	0.187499	4.5629	3.608098	0.734458	0.523085	3.954571	3.676627
73	0.18	2.564147	1.989795	0.300287	0.470918	0.999476	2.805781	0.136728	3.564687	3.006311	0.651675	0.439575	3.444412	3.102715
74	0.19	2.090122	1.640276	0.21469	0.319074	0.773552	2.428258	0.094538	2.7572	2.527571	0.577576	0.364601	3.001132	2.618483
75	0.2	1.686393	1.337904	0.145994	0.199072	0.602255	2.08436	6.04E-02	2.095374	2.123767	0.510504	0.298081	2.608244	2.207477
76	0.21	1.343977	1.076915	0.103542	0.139936	0.463805	1.771752	3.37E-02	1.586086	1.771941	0.450206	0.239648	2.25612	1.849292

GeoMotions

Site Specific Response Analysis

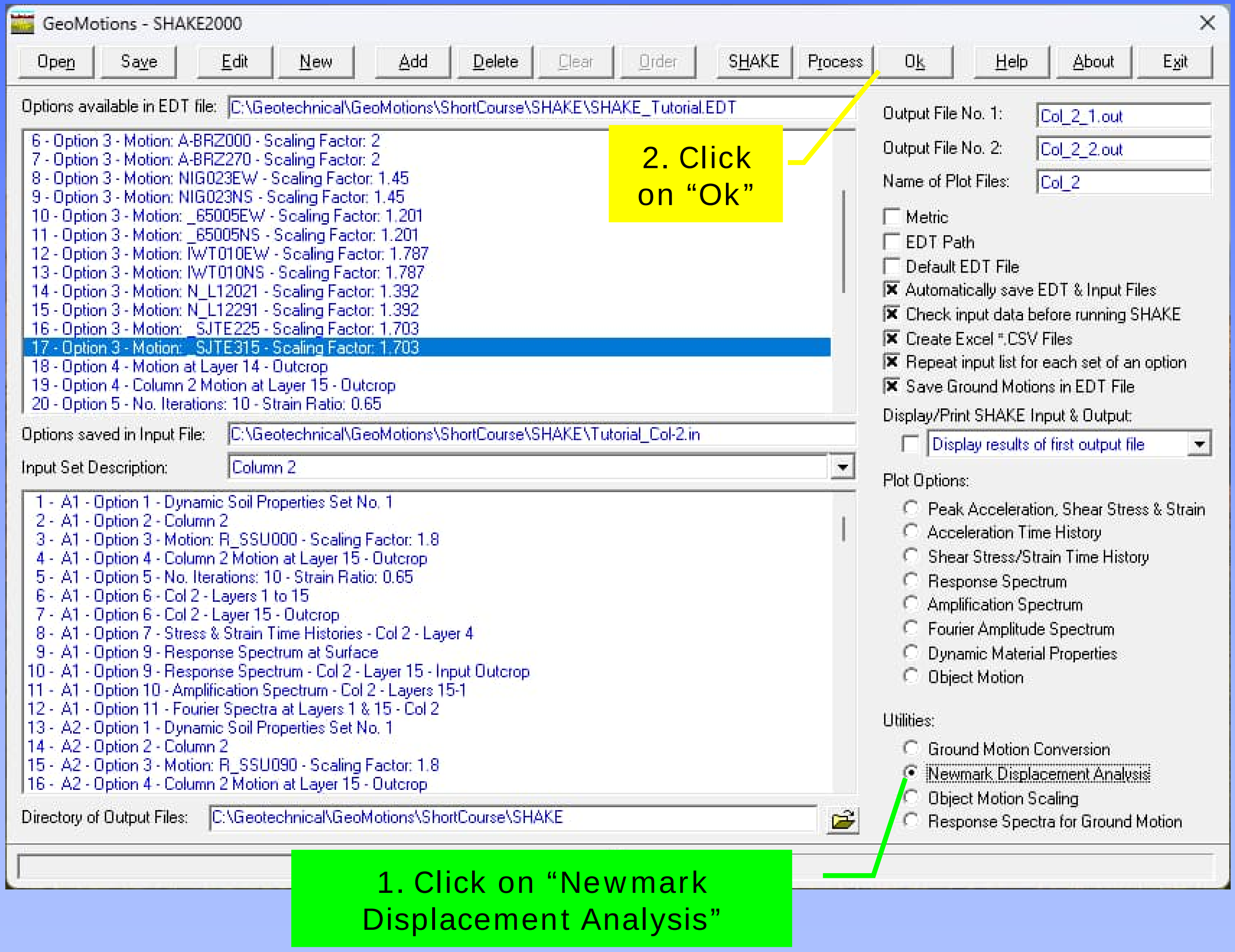
Newmark Displacement Analysis



1. Click on "Close"

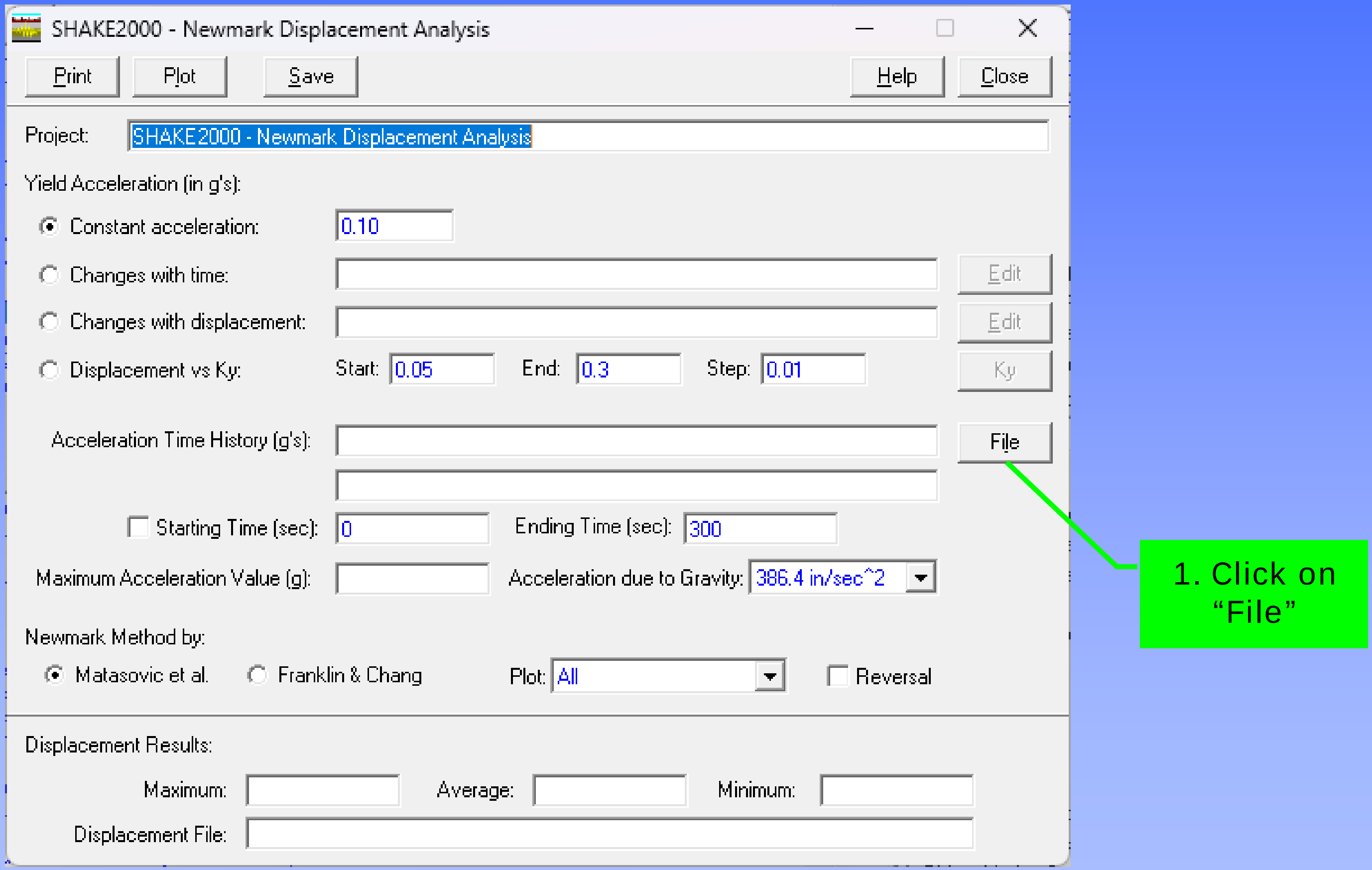
Site Specific Response Analysis

Newmark Displacement Analysis



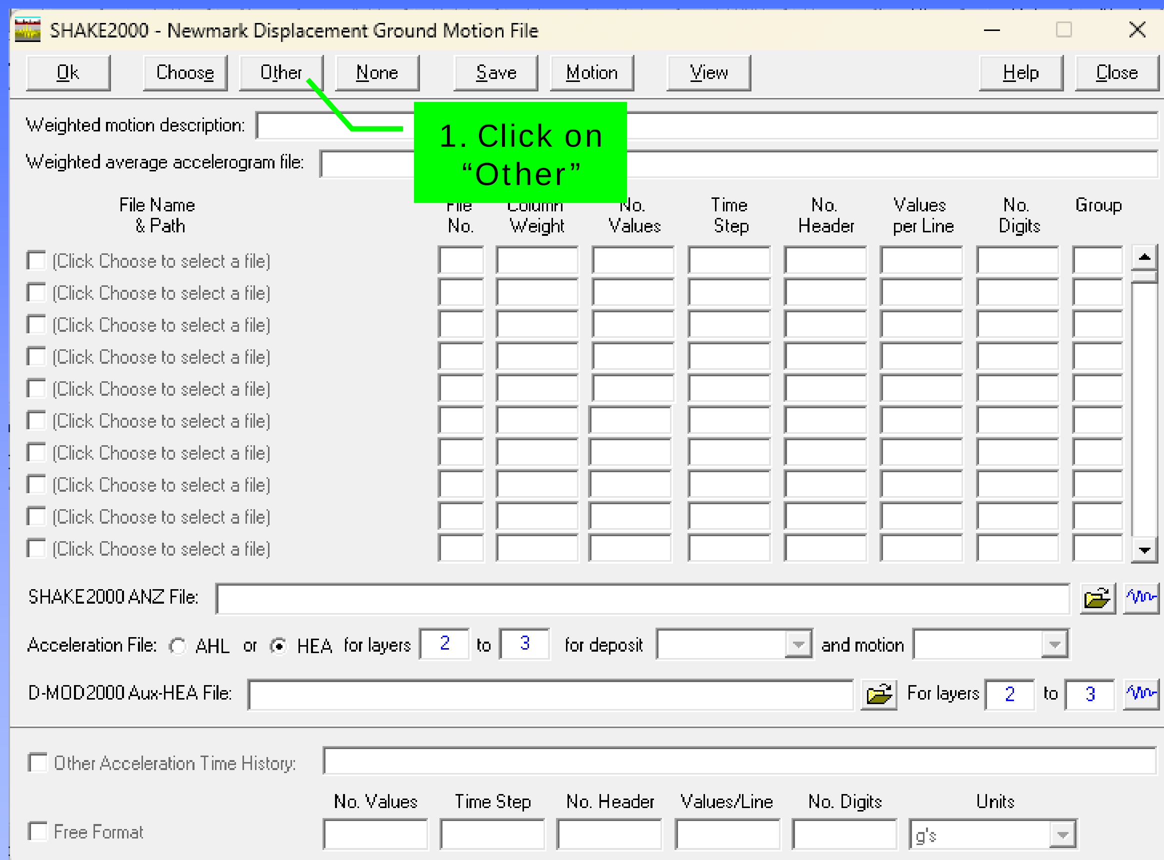
Site Specific Response Analysis

Newmark Displacement Analysis



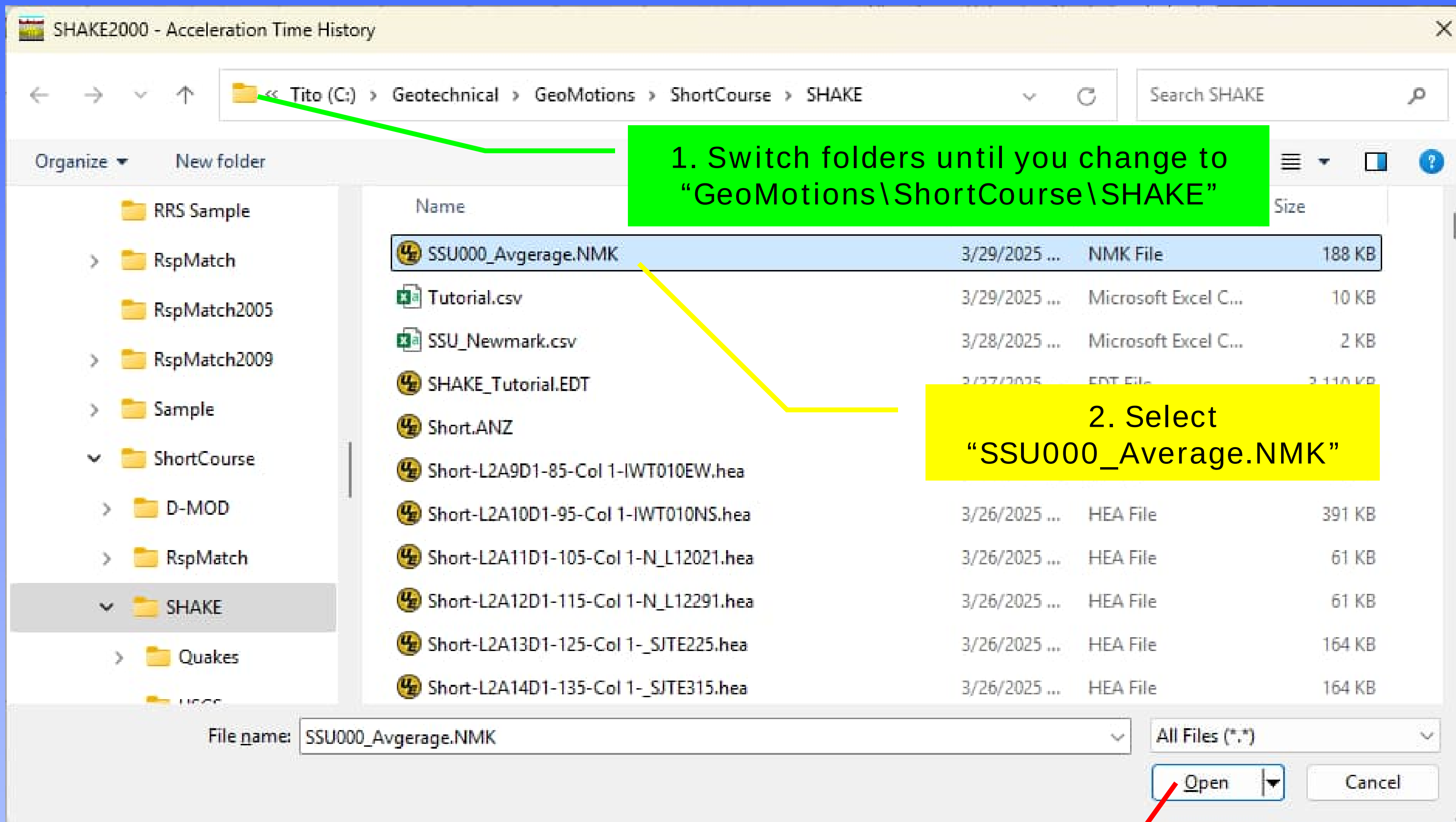
Site Specific Response Analysis

Newmark Displacement Analysis



Site Specific Response Analysis

Newmark Displacement Analysis



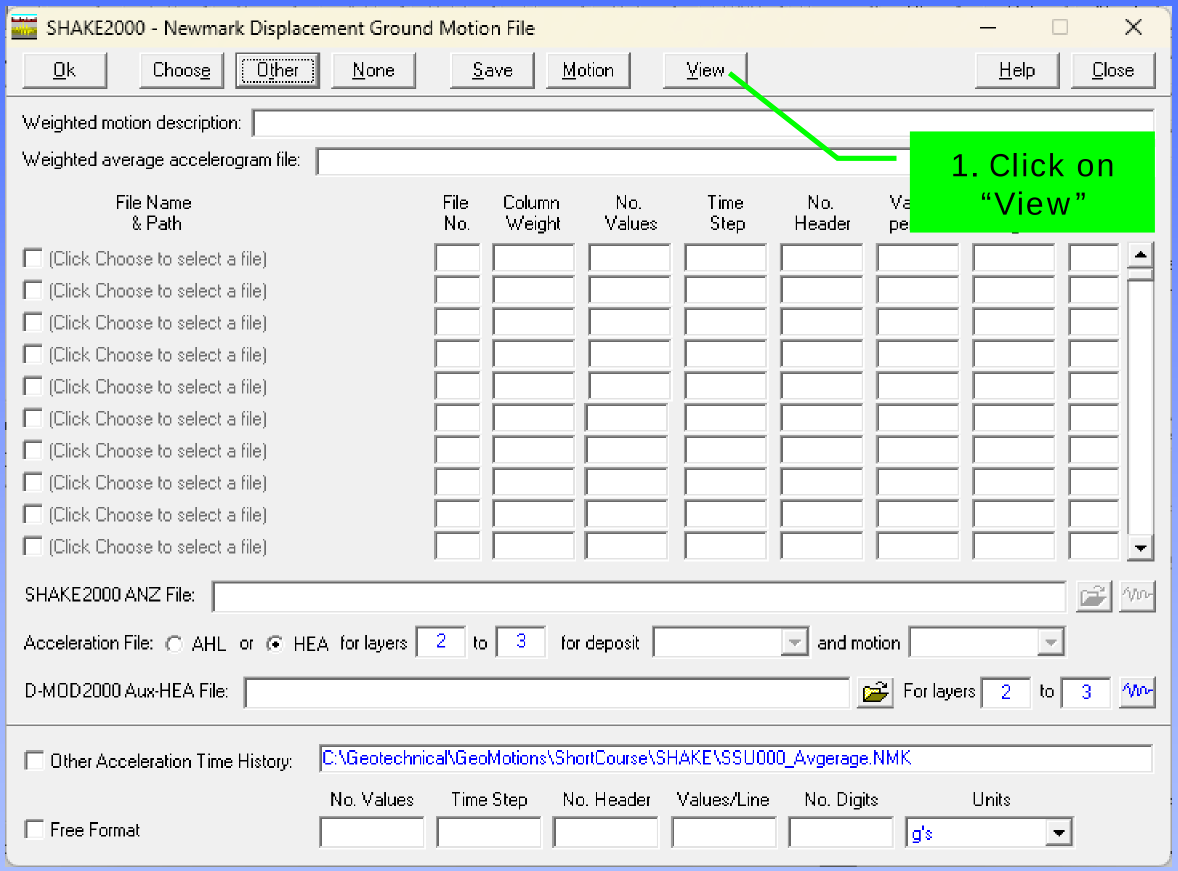
1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”

2. Select “SSU000_Average.NMK”

3. Click on “Open”

Site Specific Response Analysis

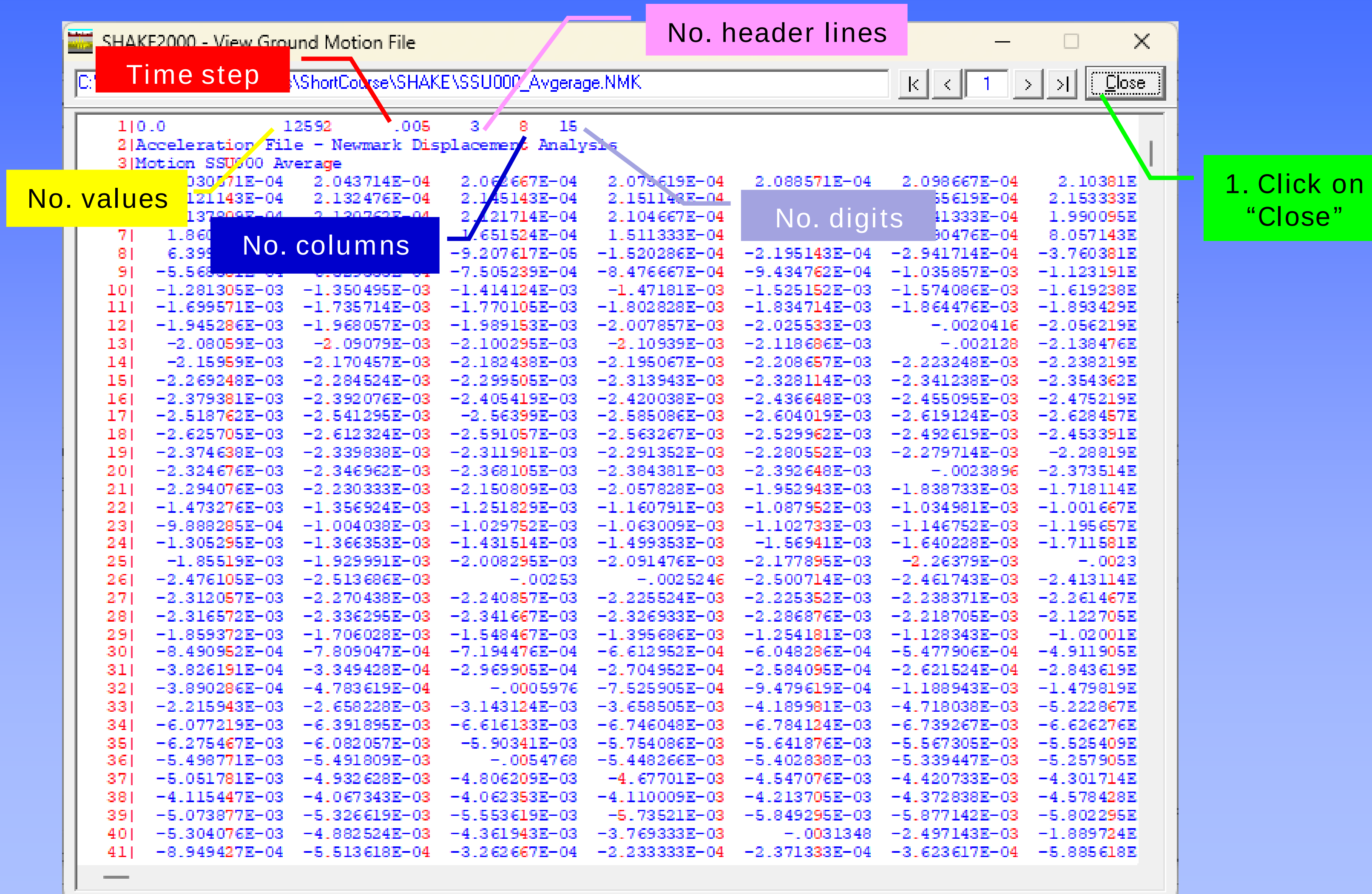
Newmark Displacement Analysis



GeoMotions

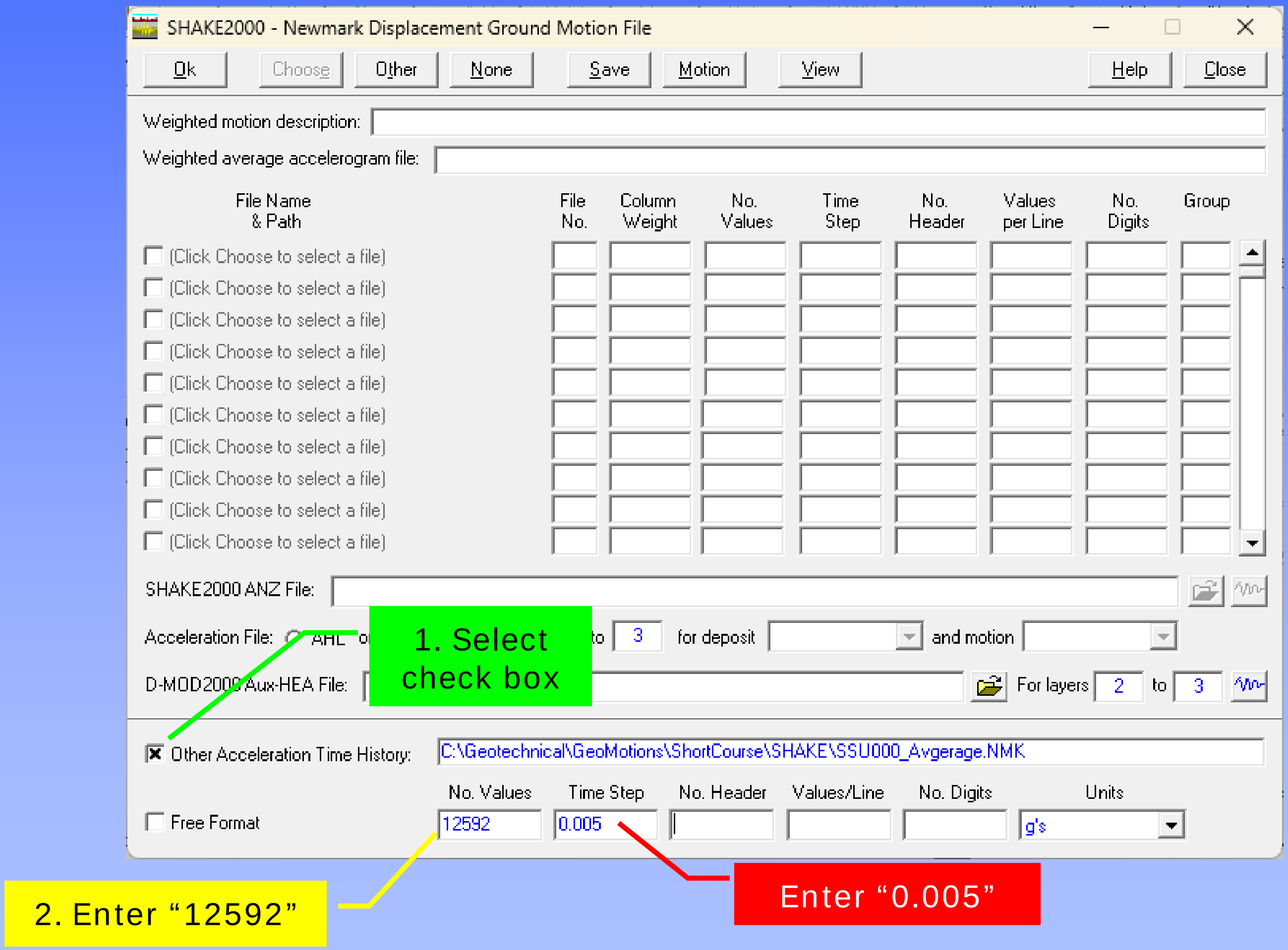
Site Specific Response Analysis

Newmark Displacement Analysis – Format Information



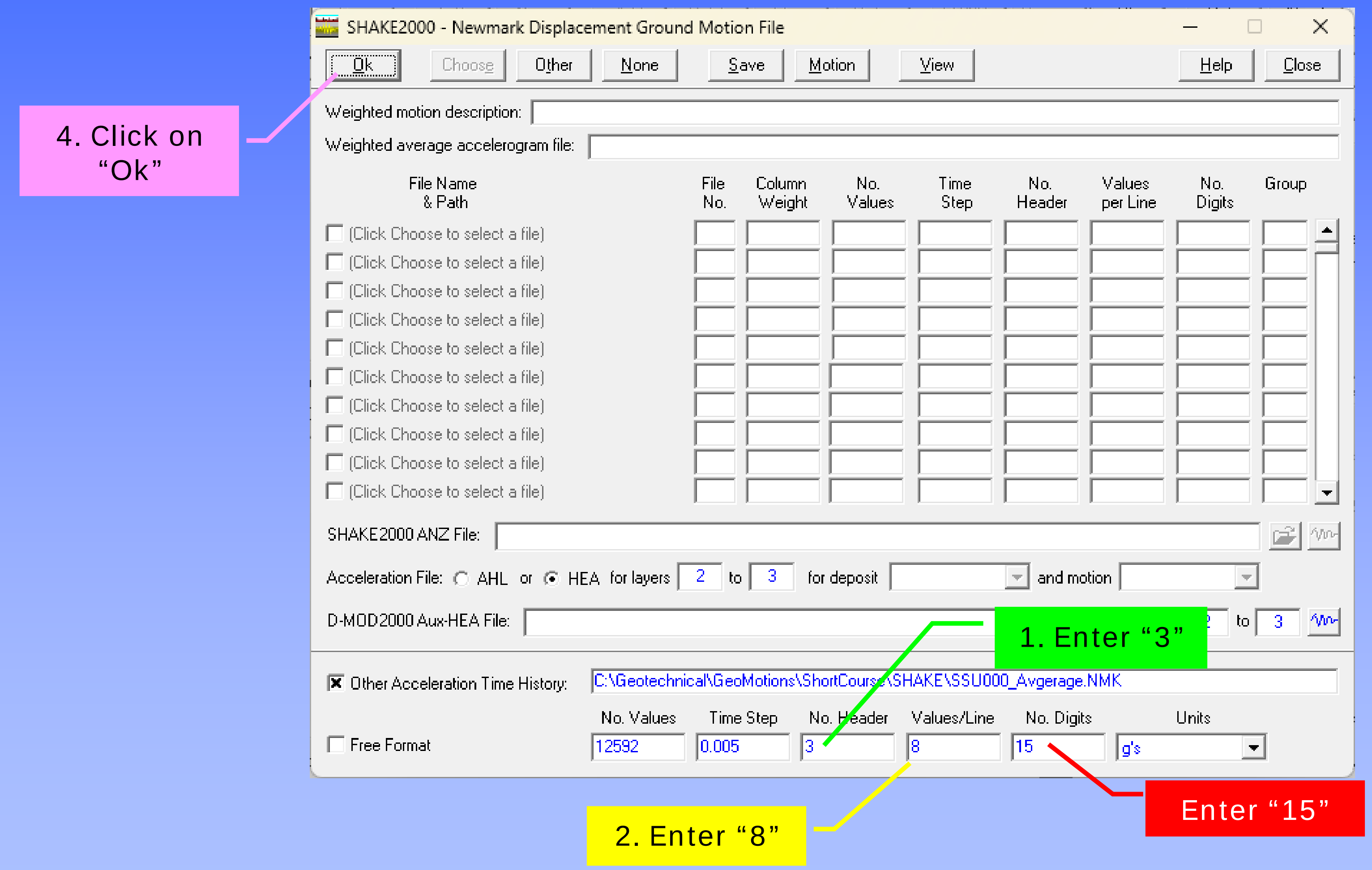
Site Specific Response Analysis

Newmark Displacement Analysis – Format Information



Site Specific Response Analysis

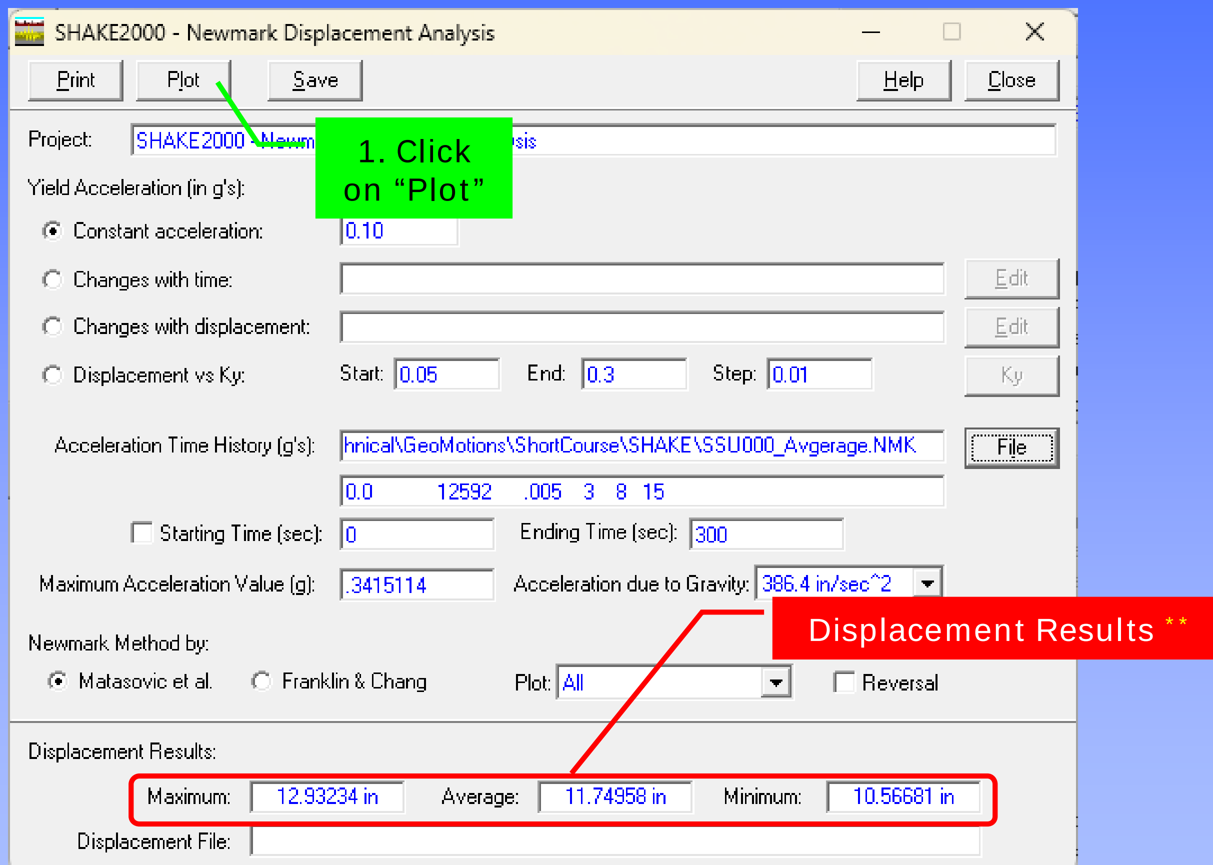
Newmark Displacement Analysis – Format Information



GeoMotions

Site Specific Response Analysis

Newmark Displacement Analysis

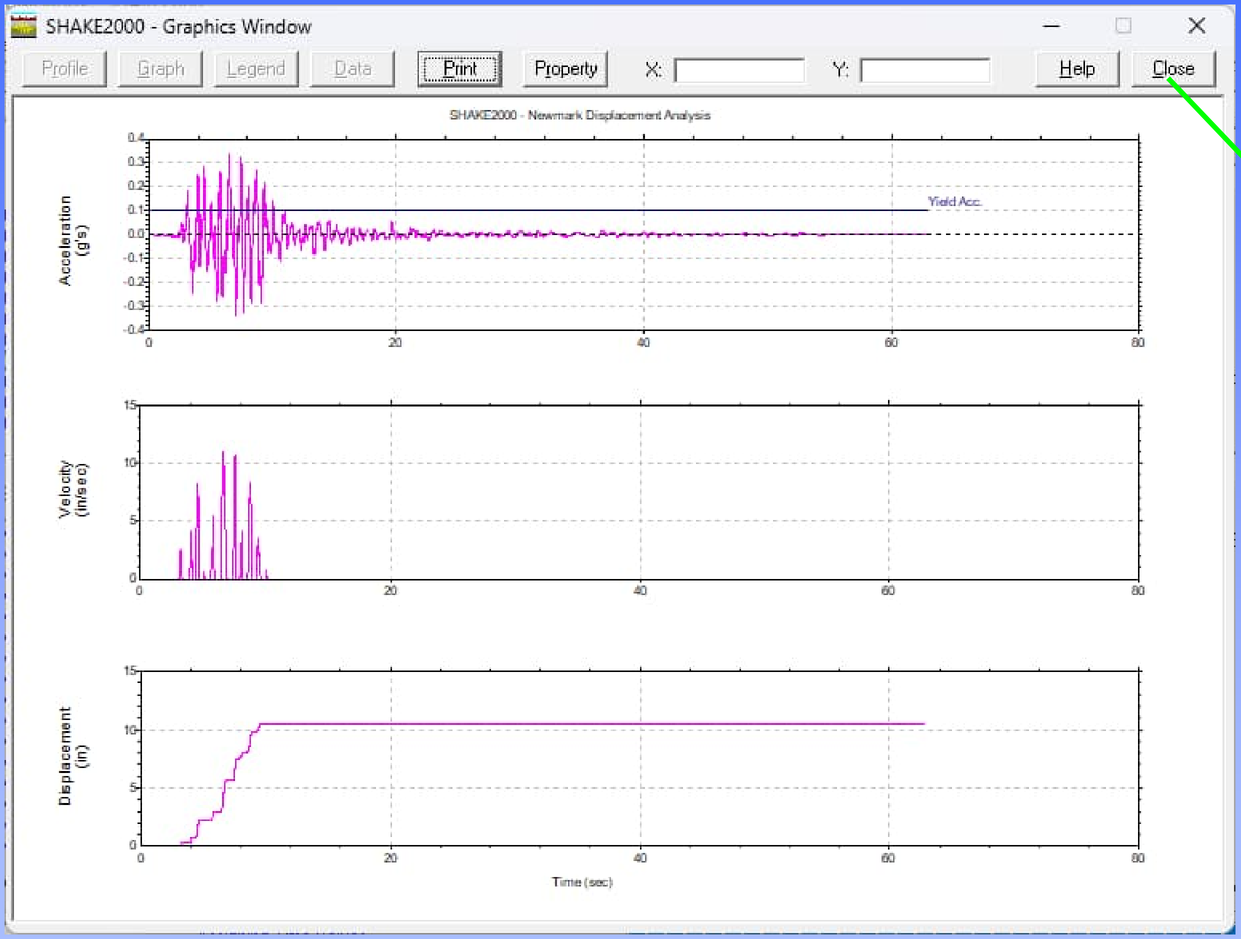


** The results are computed for the computed motion and the “reversed” motion. Maximum of 12.93234 inches is the same as computed before.

GeoMotions

Site Specific Response Analysis

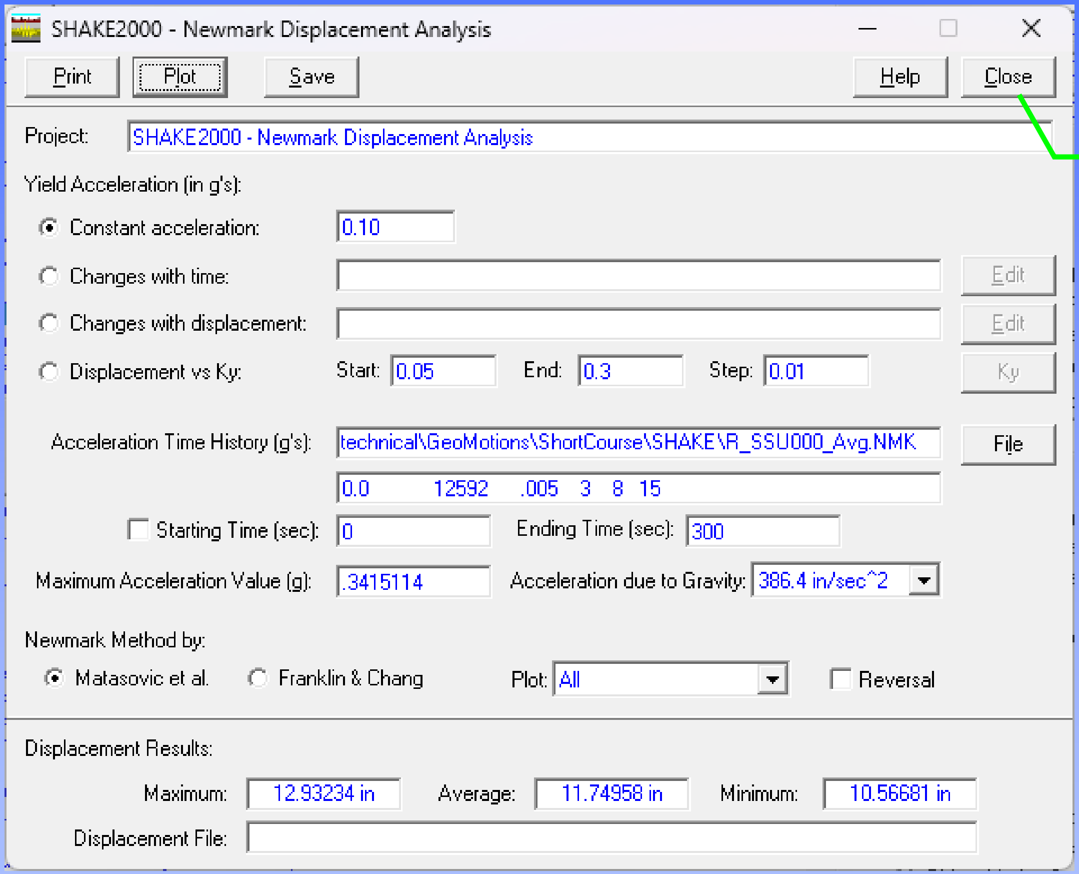
Newmark Displacement Analysis



1. Click on “Close”

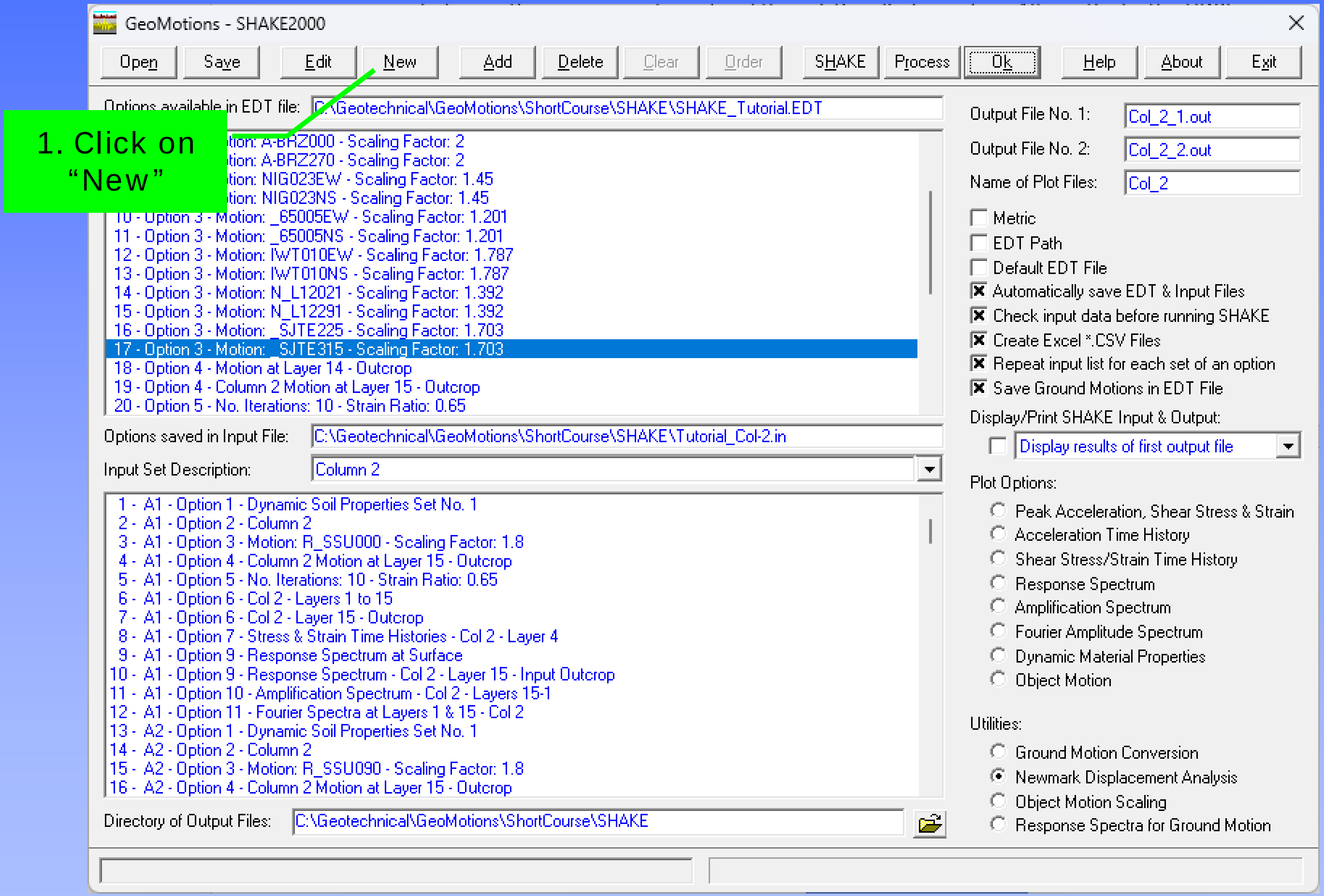
Site Specific Response Analysis

Newmark Displacement Analysis



1. Click on "Close"

Compare Results from Linearly Scaled Motions with Results from Spectrally Matched Motions



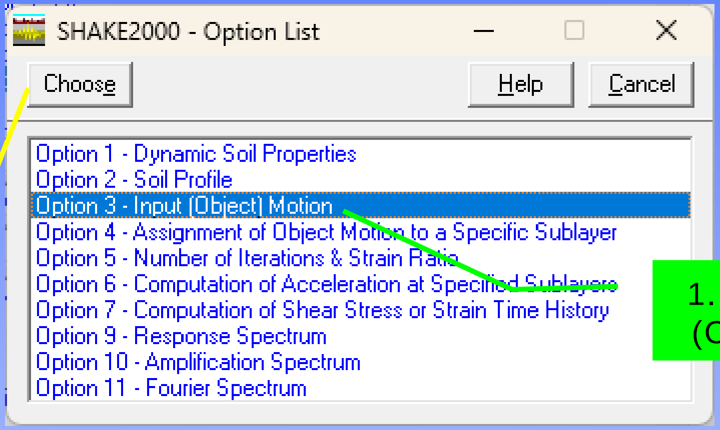
Refer to RspMatchEDT Tutorial for Development of Spectrally Matched Motions Used for this Tutorial

GeoMotions

Site Specific Response Analysis

Create Motion Set

2. Click on "Choose"

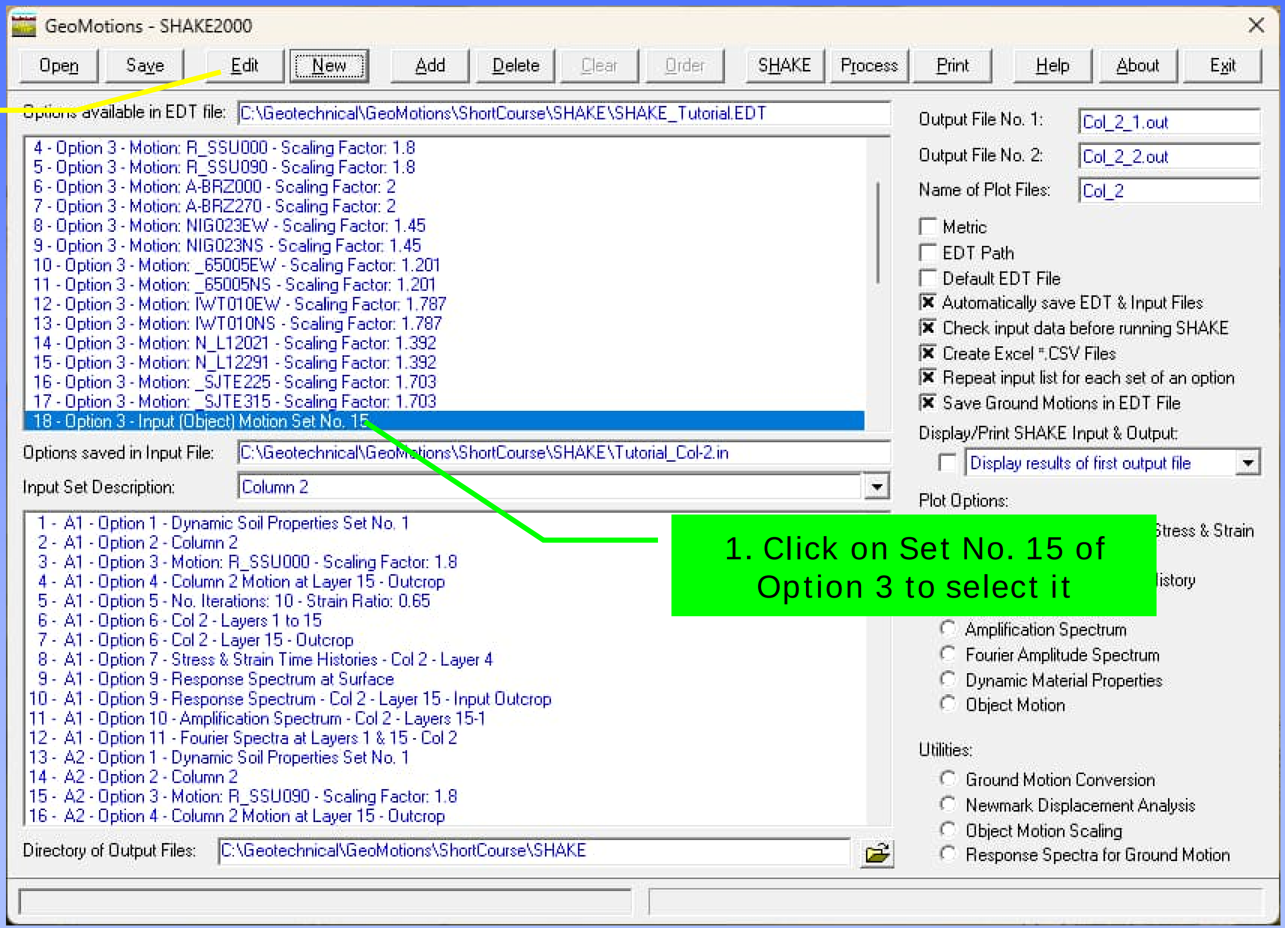


1. Click on "Option 3 – Input (Object) Motion" to select it

Site Specific Response Analysis

Create Option 3 for Spectrally Matched Motion

2. Click on “Edit”

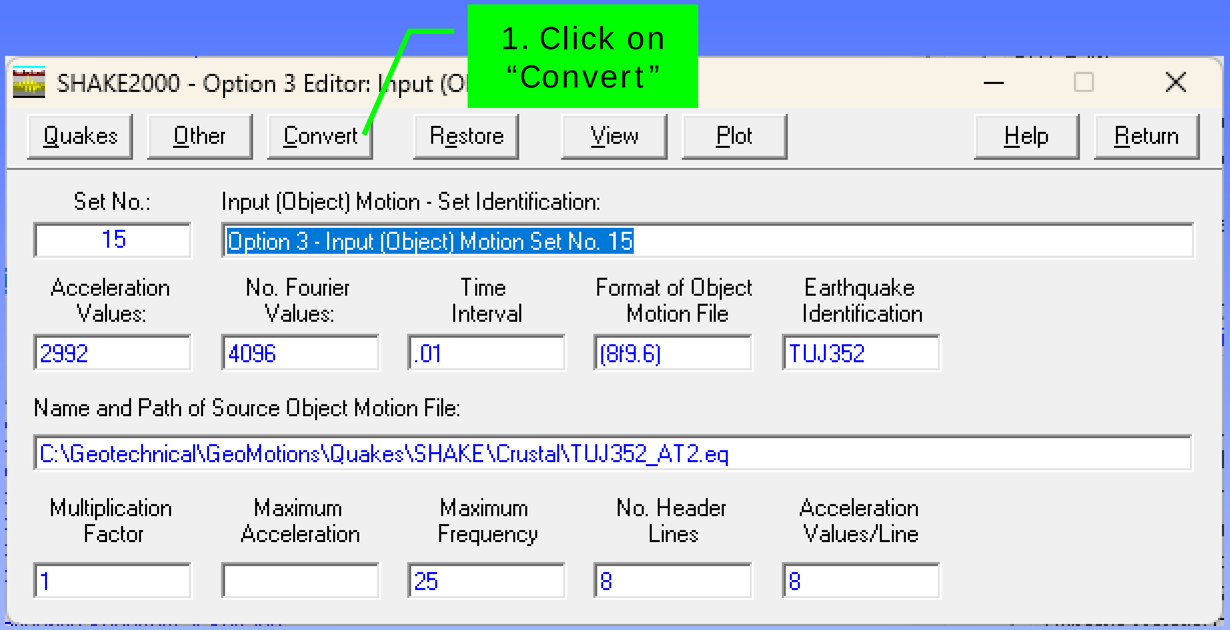


1. Click on Set No. 15 of Option 3 to select it

GeoMotions

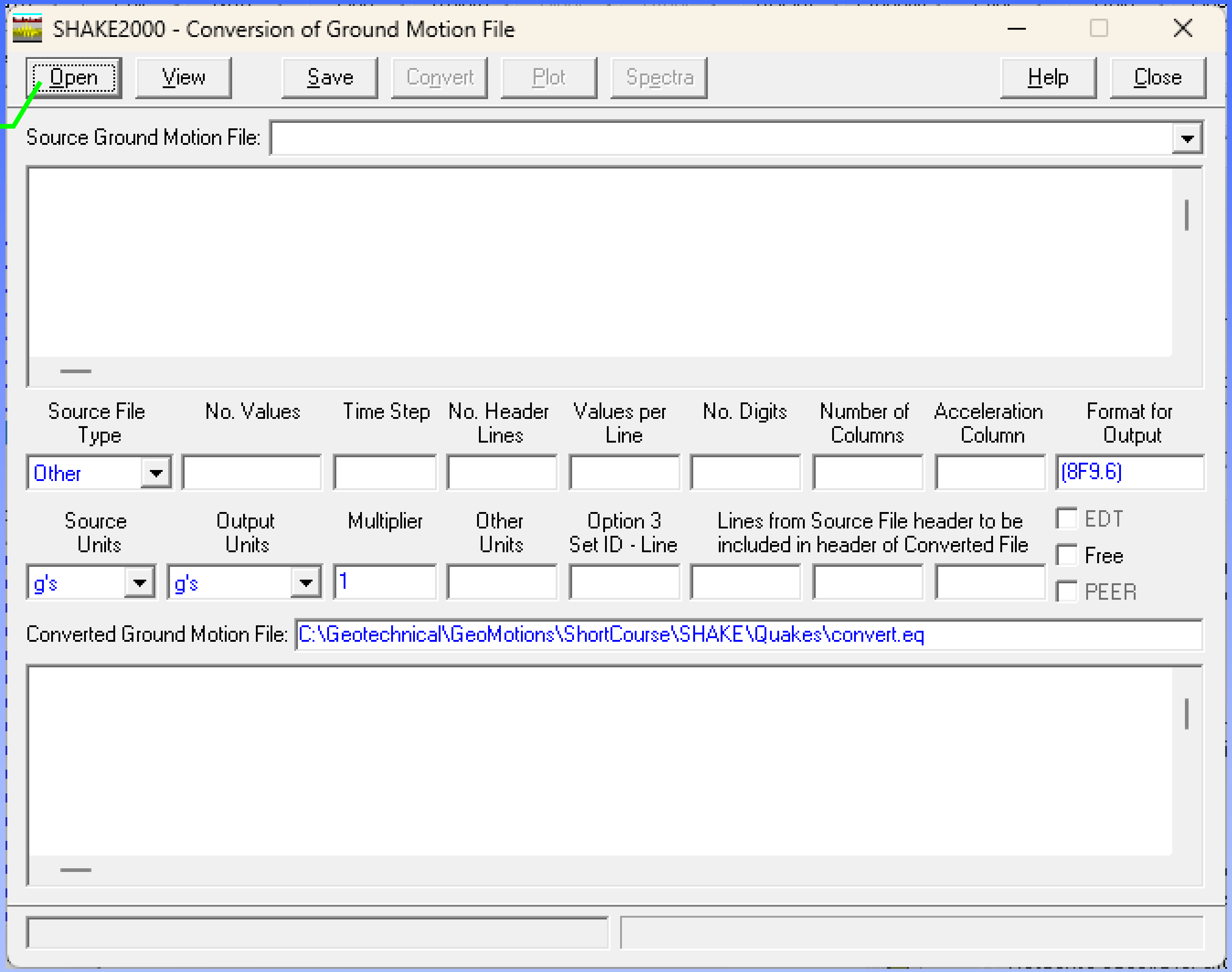
Site Specific Response Analysis

Create Input Data – Option 3: Input Motion



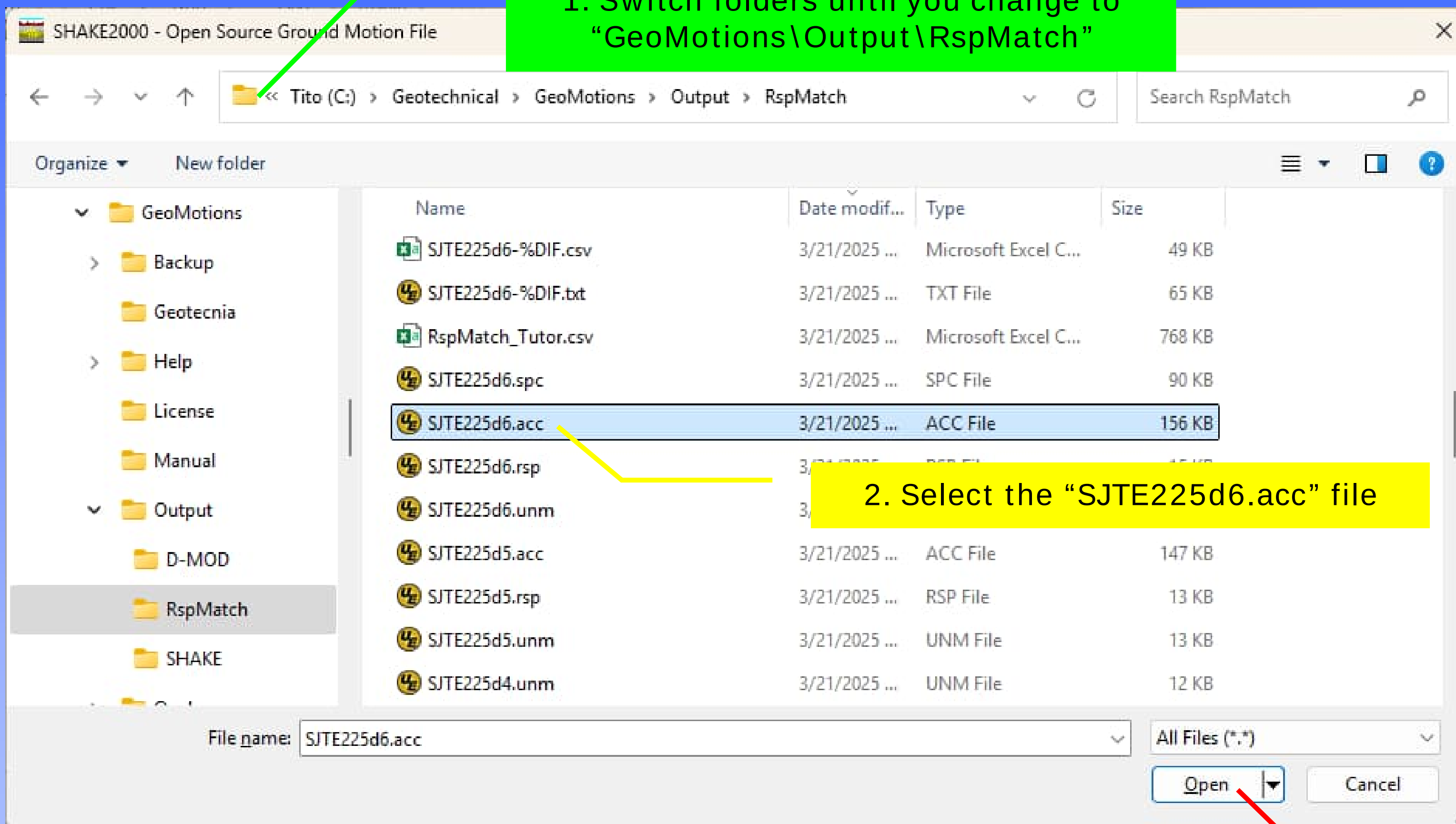
Convert Spectrally Matched Motion File

1. Click on "Open"



Open Spectrally Matched Acceleration File

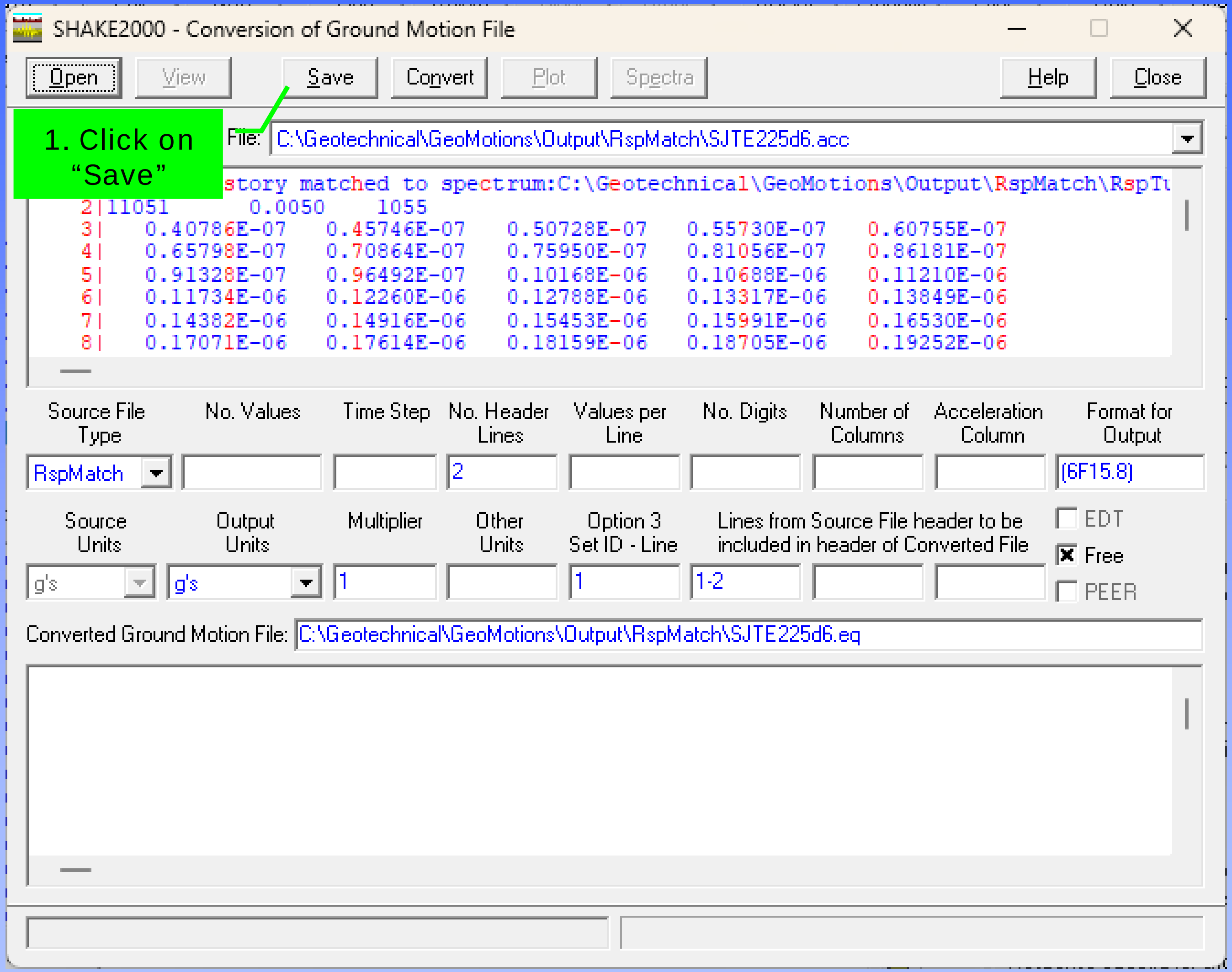
1. Switch folders until you change to “GeoMotions\Output\RspMatch”



2. Select the “SJTE225d6.acc” file

3. Click on “Open”

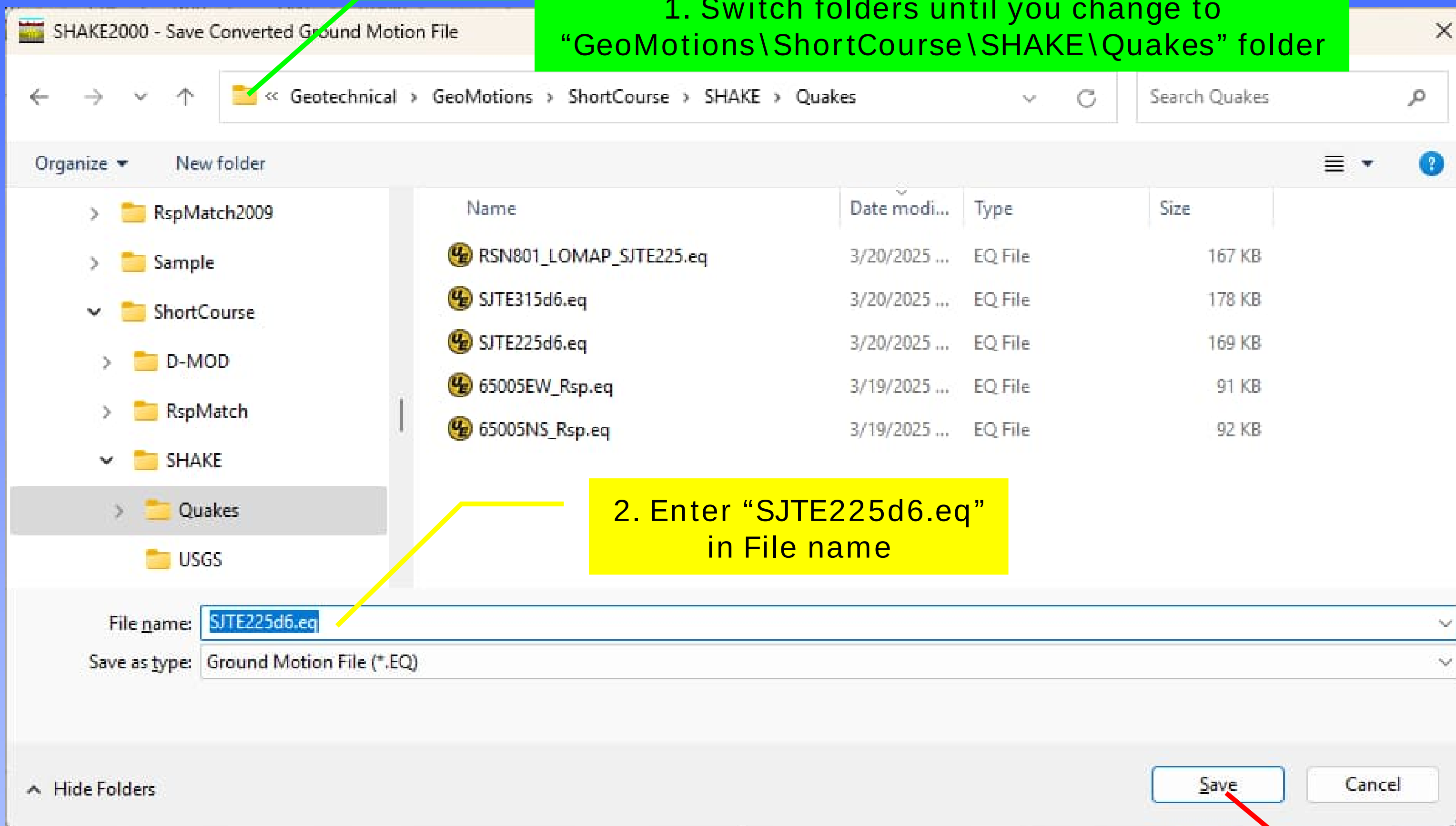
Choose path and name of converted file



GeoMotions

Choose path and name of converted file

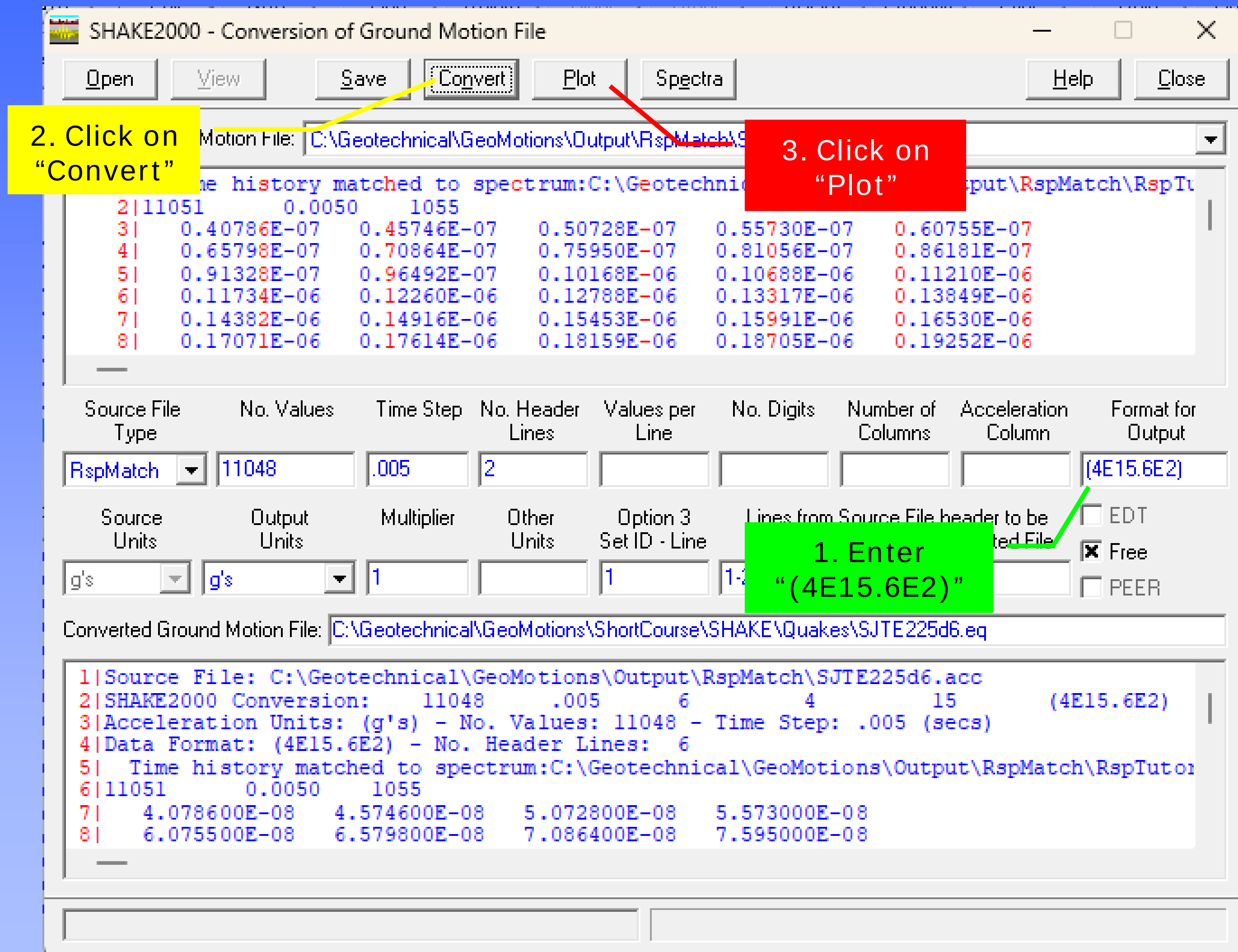
1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE\Quakes” folder



2. Enter “SJTE225d6.eq” in File name

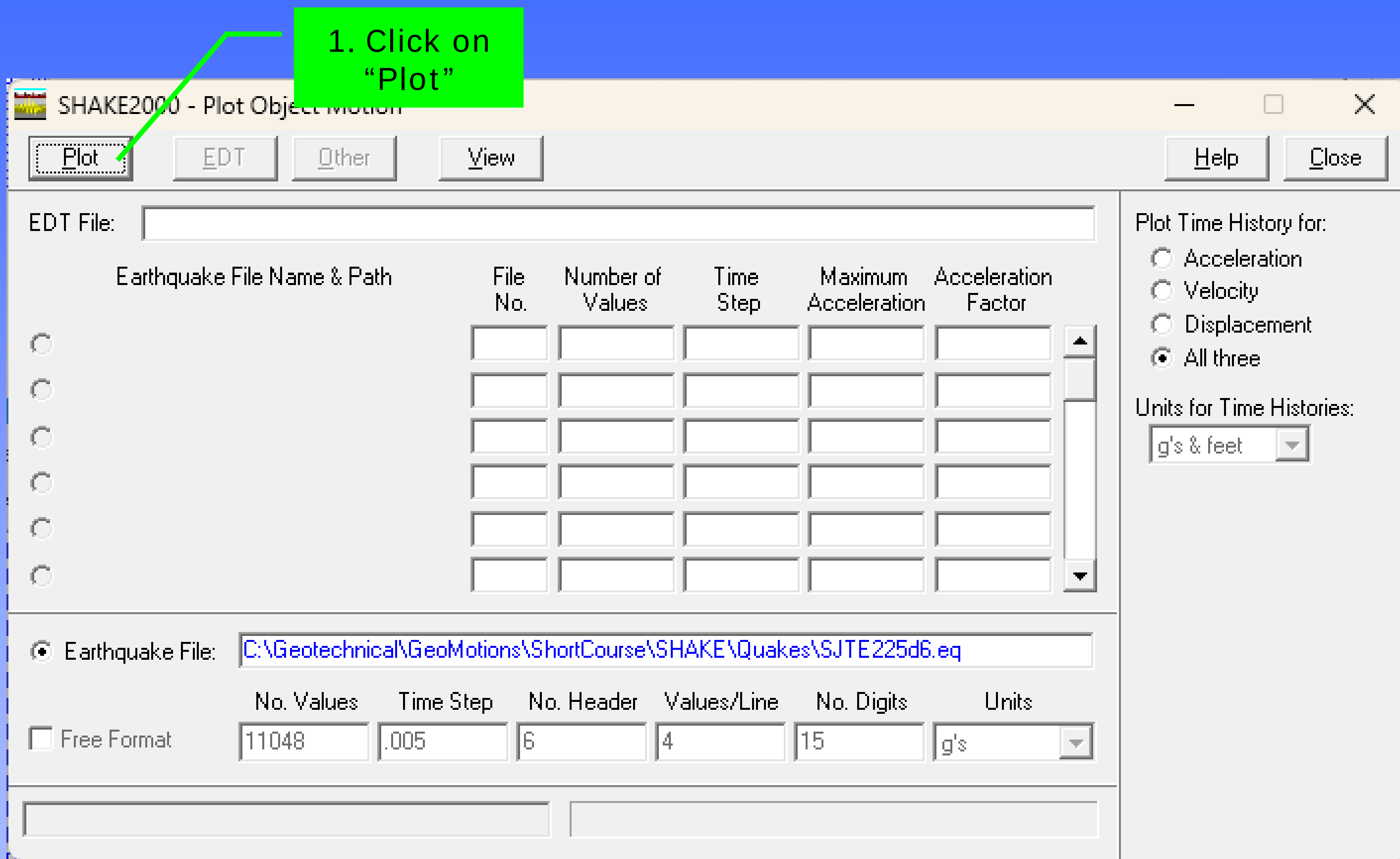
3. Click on “Save”

Convert Spectrally Matched Motion

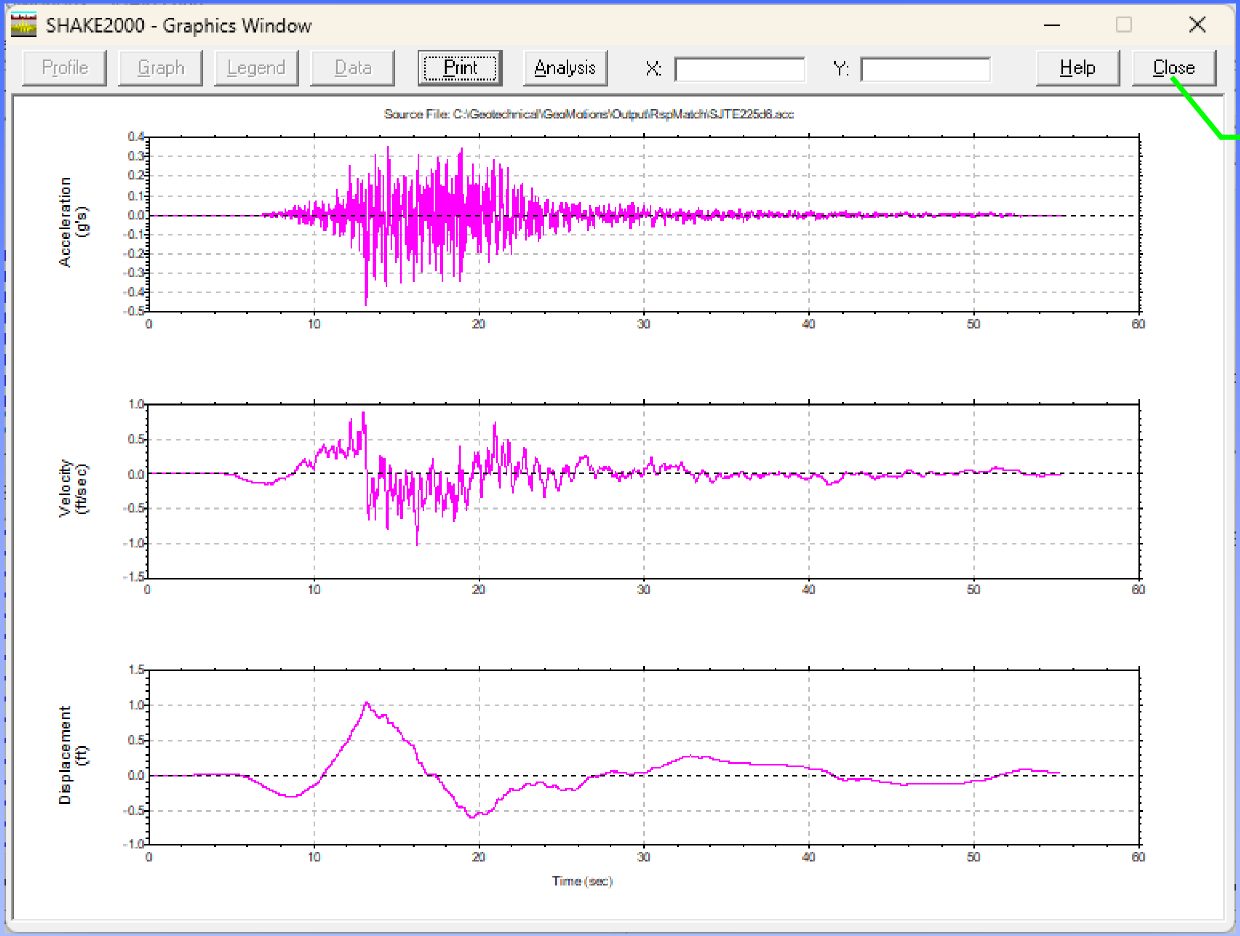


GeoMotions

Plot Converted File to Check Conversion



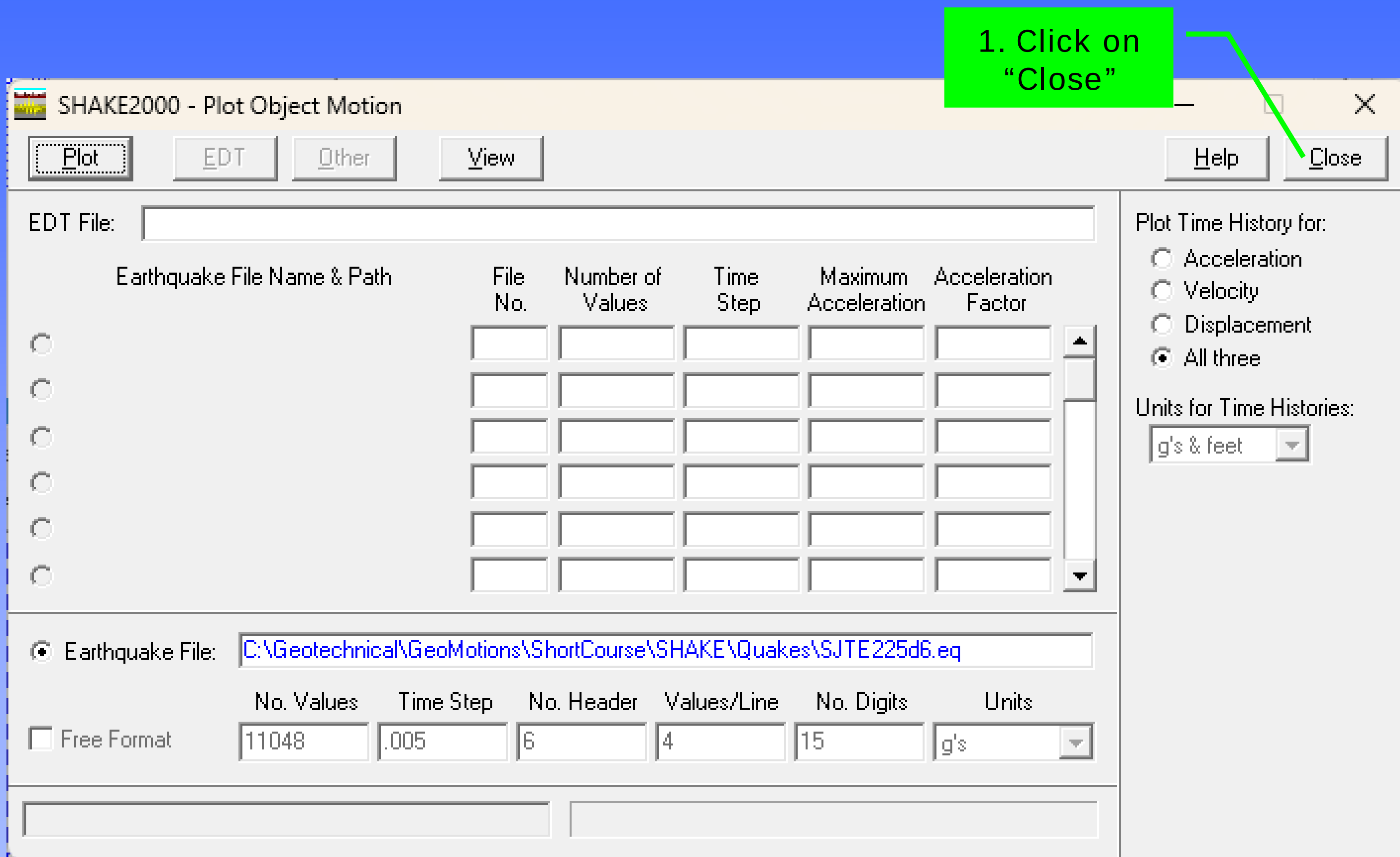
Acceleration, Velocity, and Displacement Time Histories for Converted Input Ground Motion File



1. Click on “Close”

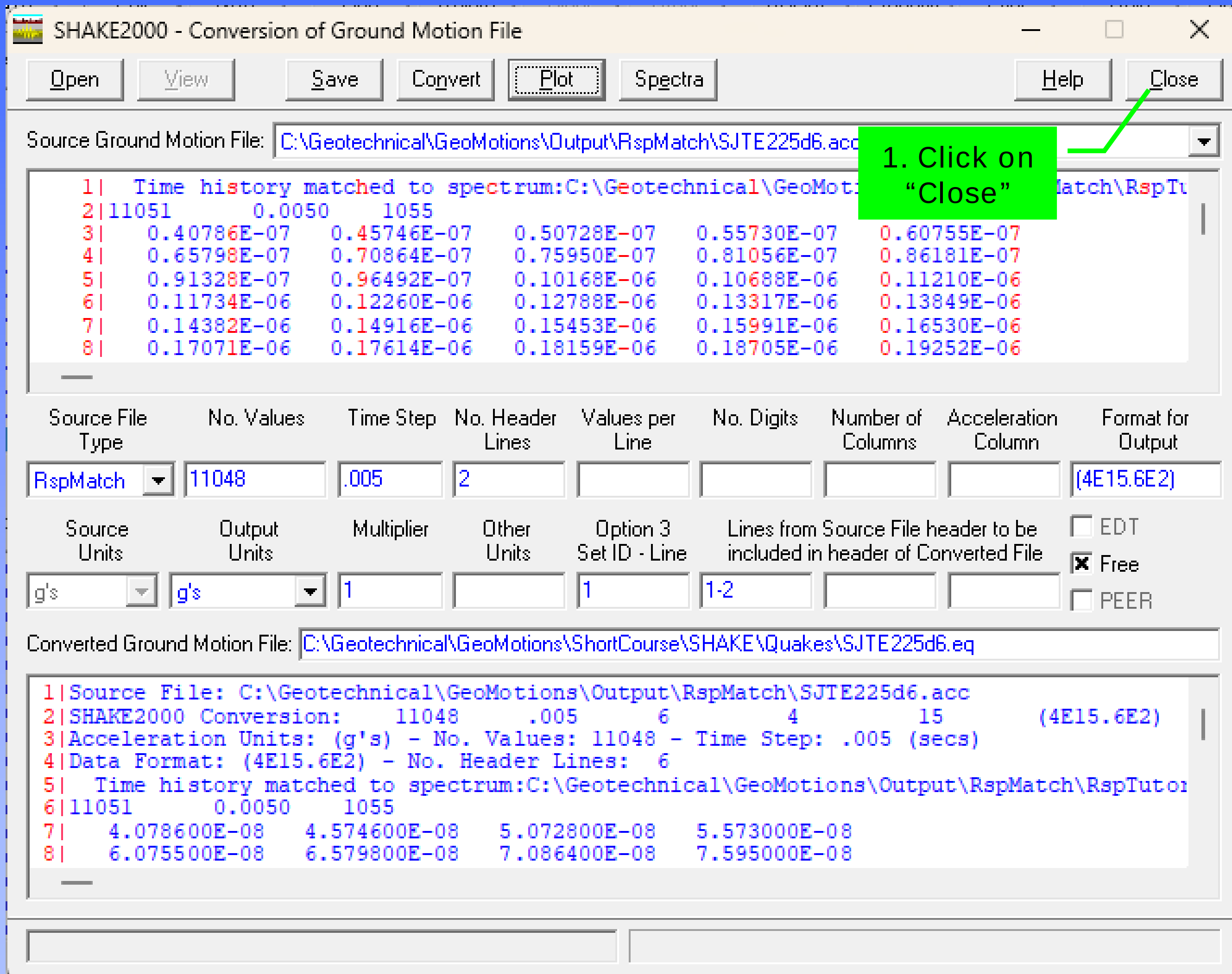
GeoMotions

Plot Converted File to Check Conversion



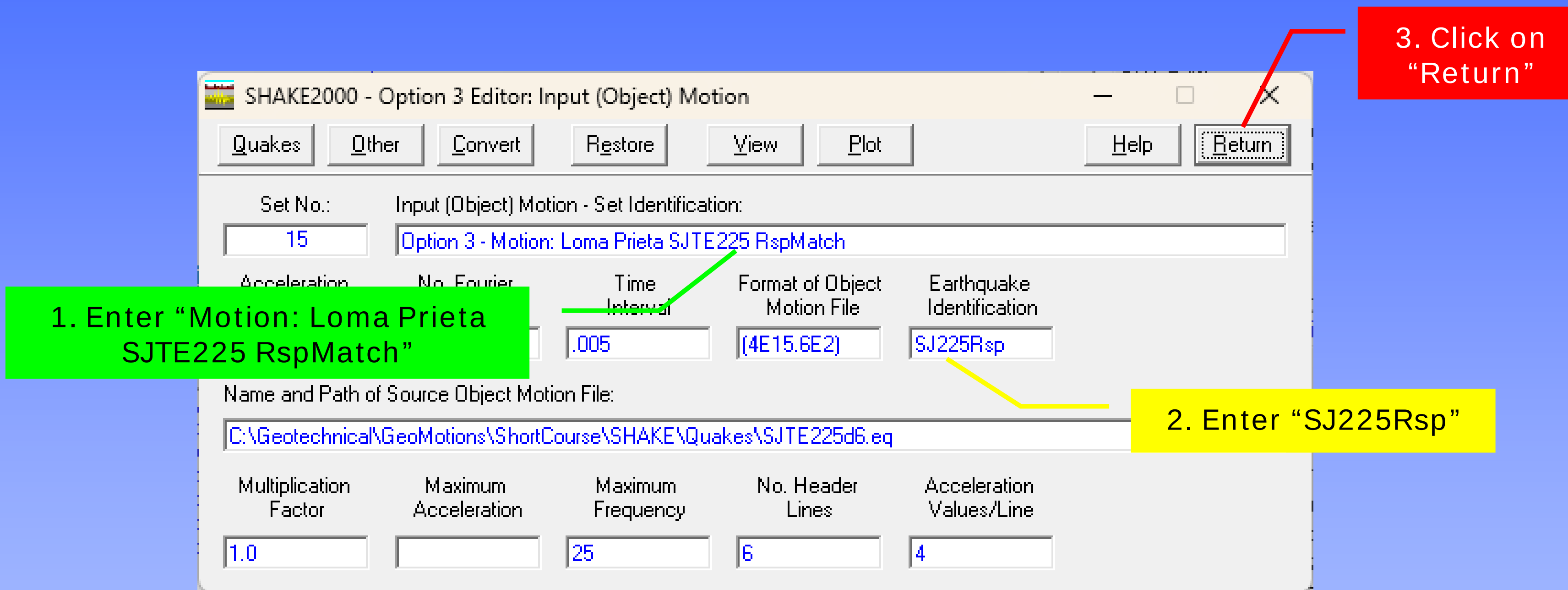
GeoMotions

Create Spectrally Matched Option 3 File



Site Specific Response Analysis

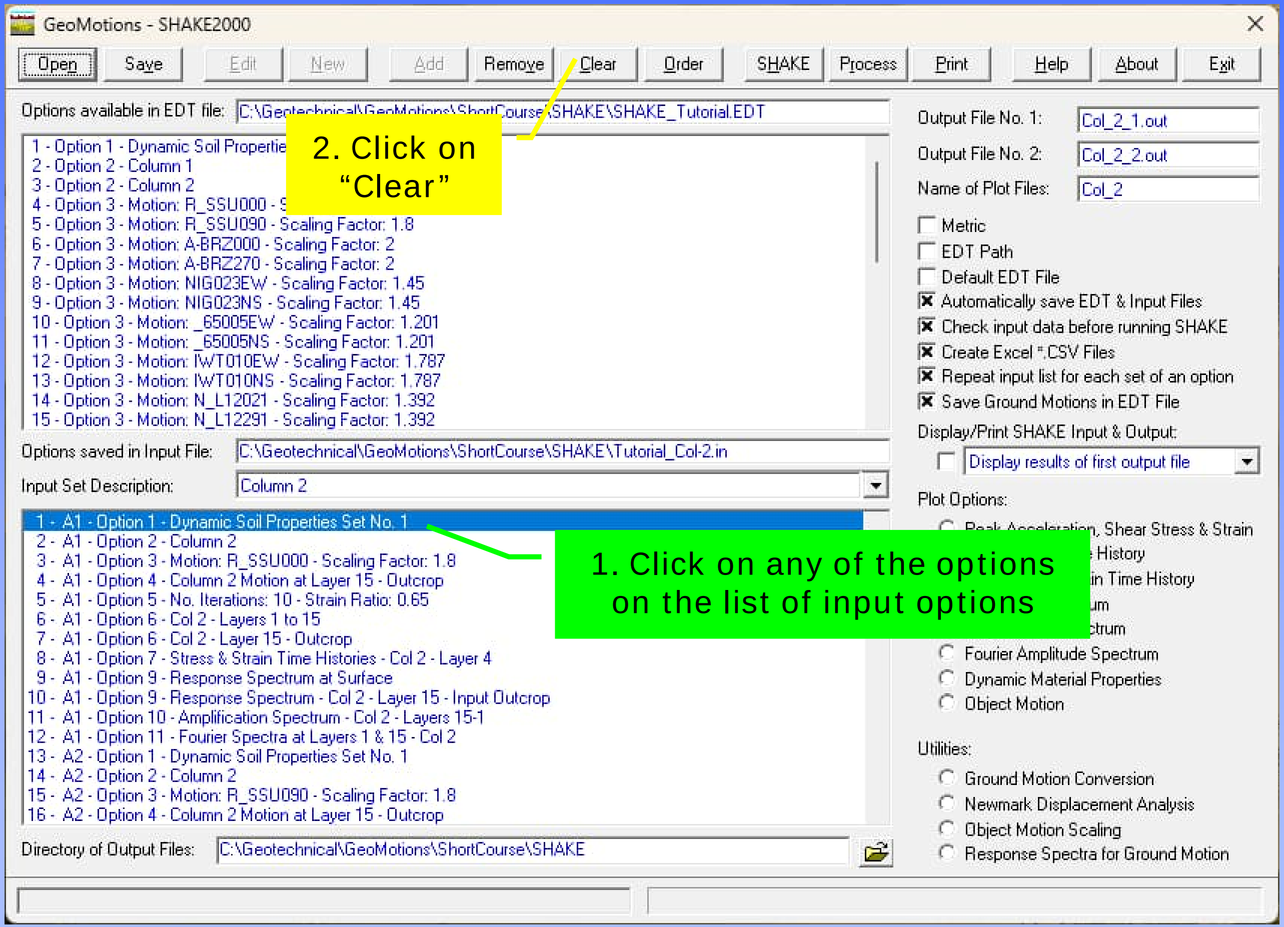
Create Input Data – Option 3: Input Motion



GeoMotions

Site Specific Response Analysis

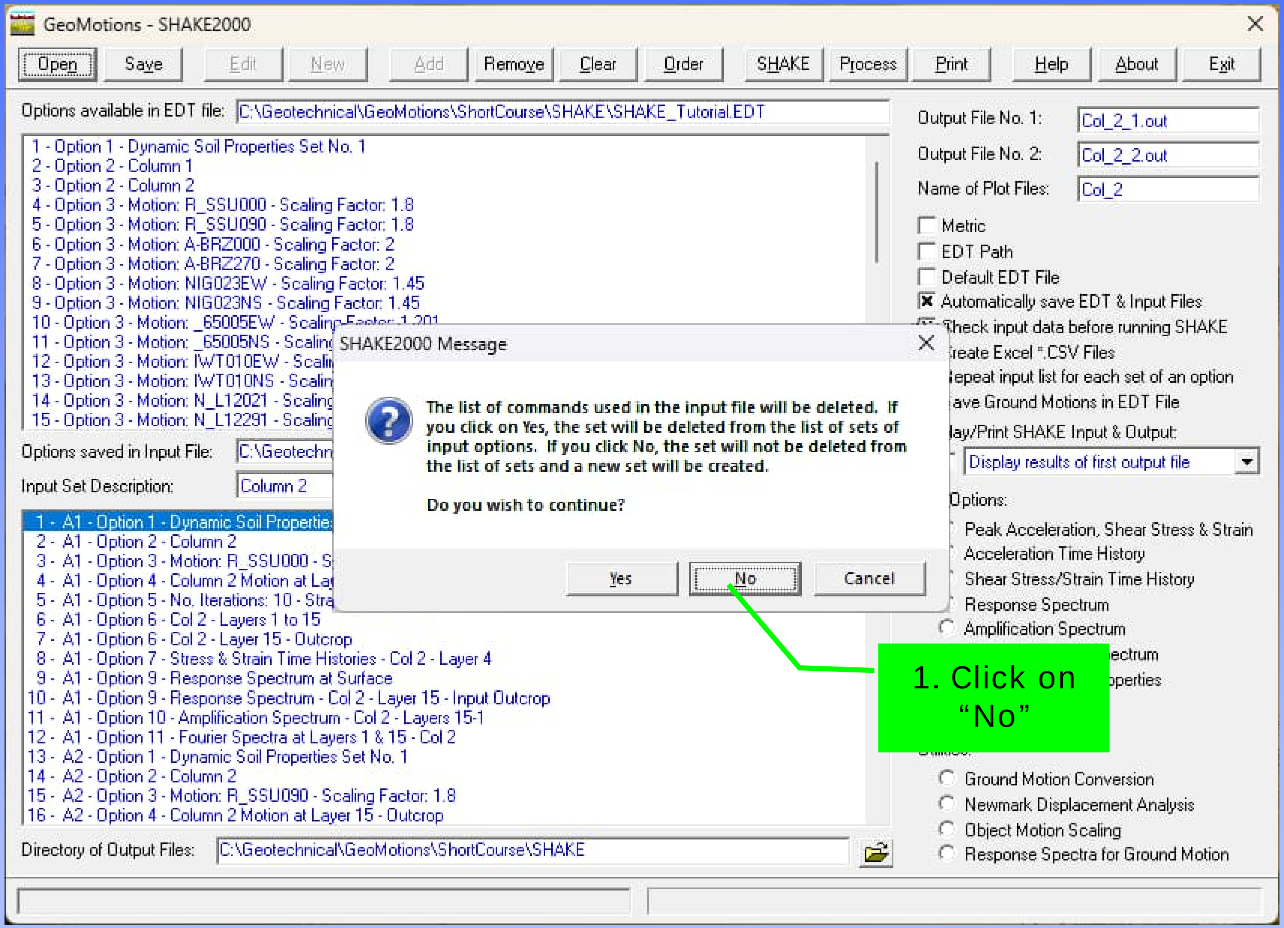
Create List of Input Options for Spectrally Match Comparison



GeoMotions

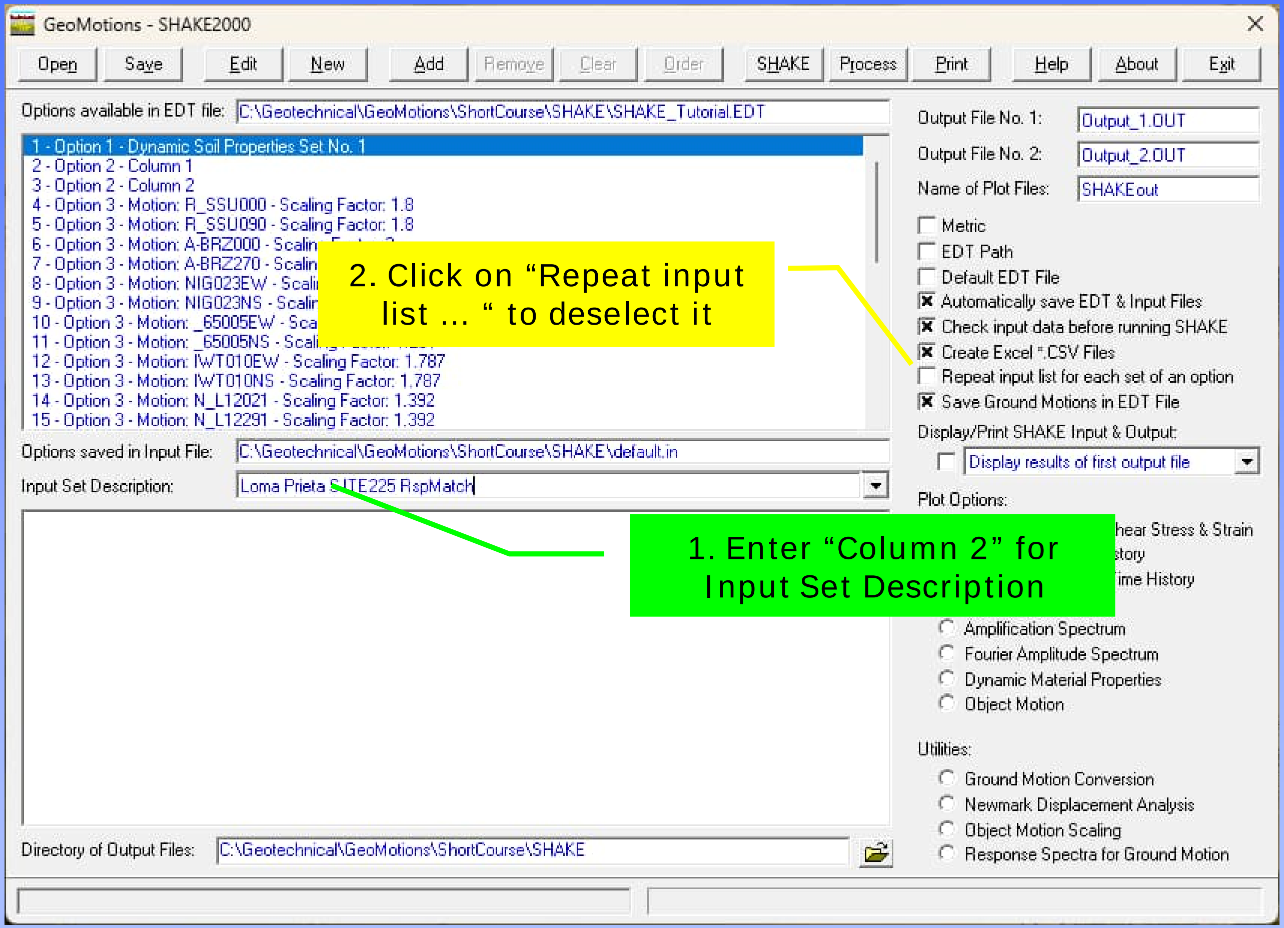
Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison



Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison



Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison

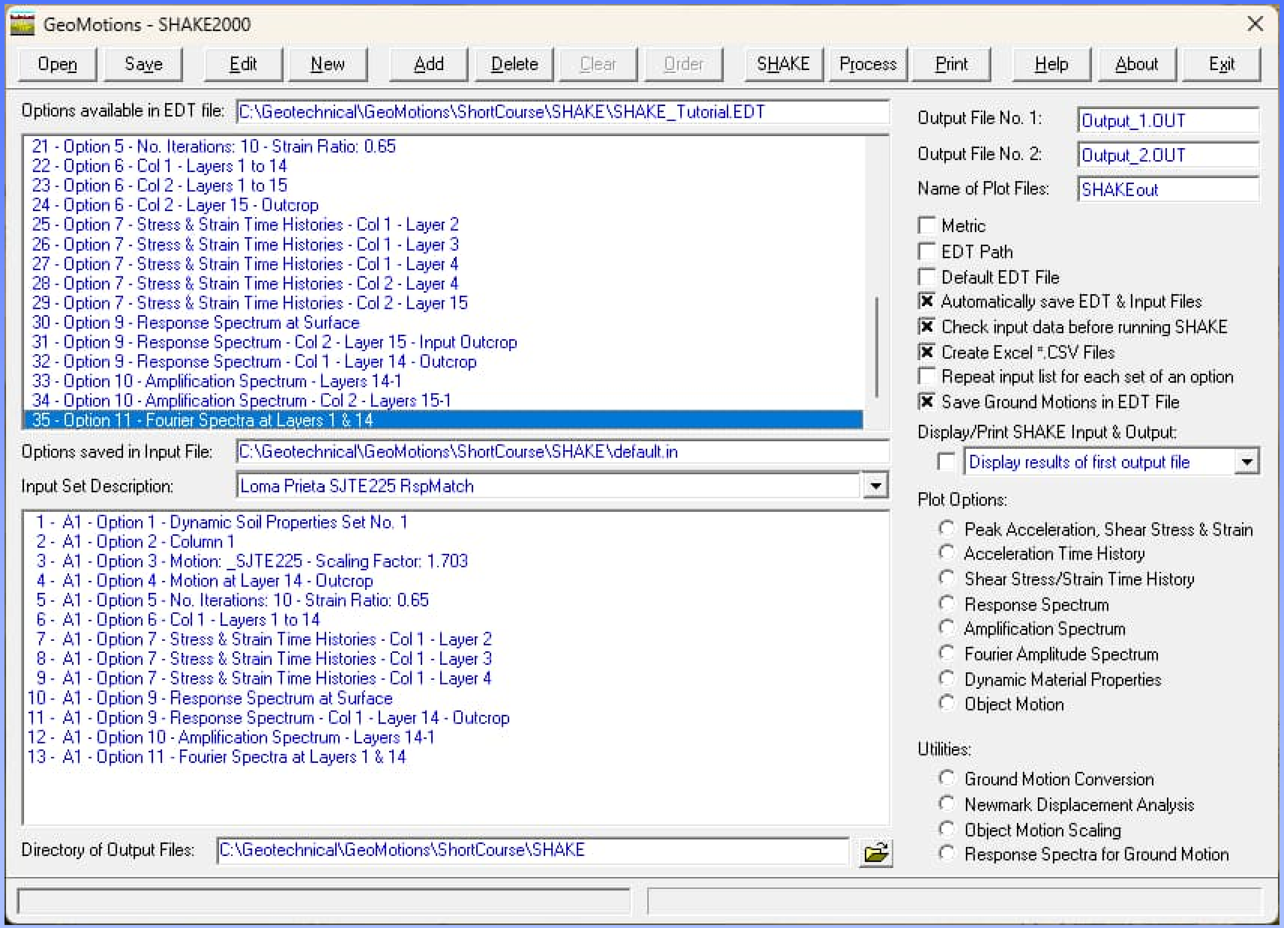
Add the following options to input file list:

Set	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
2	Option 2 – Column 1
16	Option 3 – Motion: _SJTE225 – Scaling Factor 1.703
19	Option 4 – Motion at Layer 14 Outcrop
21	Option 5 – No. of Iterations: 10 – Strain Ration: 0.65
22	Option 6 – Col 1 – Layers 1 to 14
25	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2
26	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 3
27	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 4
30	Option 9 – Response Spectrum at Surface
32	Option 9 – Response Spectrum – Col 1 – Layer 14 – Outcrop
33	Option 10 – Amplification Spectrum – Layers 14-1
35	Option 11 – Fourier Spectra at Layers 1 & 14

GeoMotions

Site Specific Response Analysis

Create List of Input Options for Spectrally Match Comparison



Site Specific Response Analysis

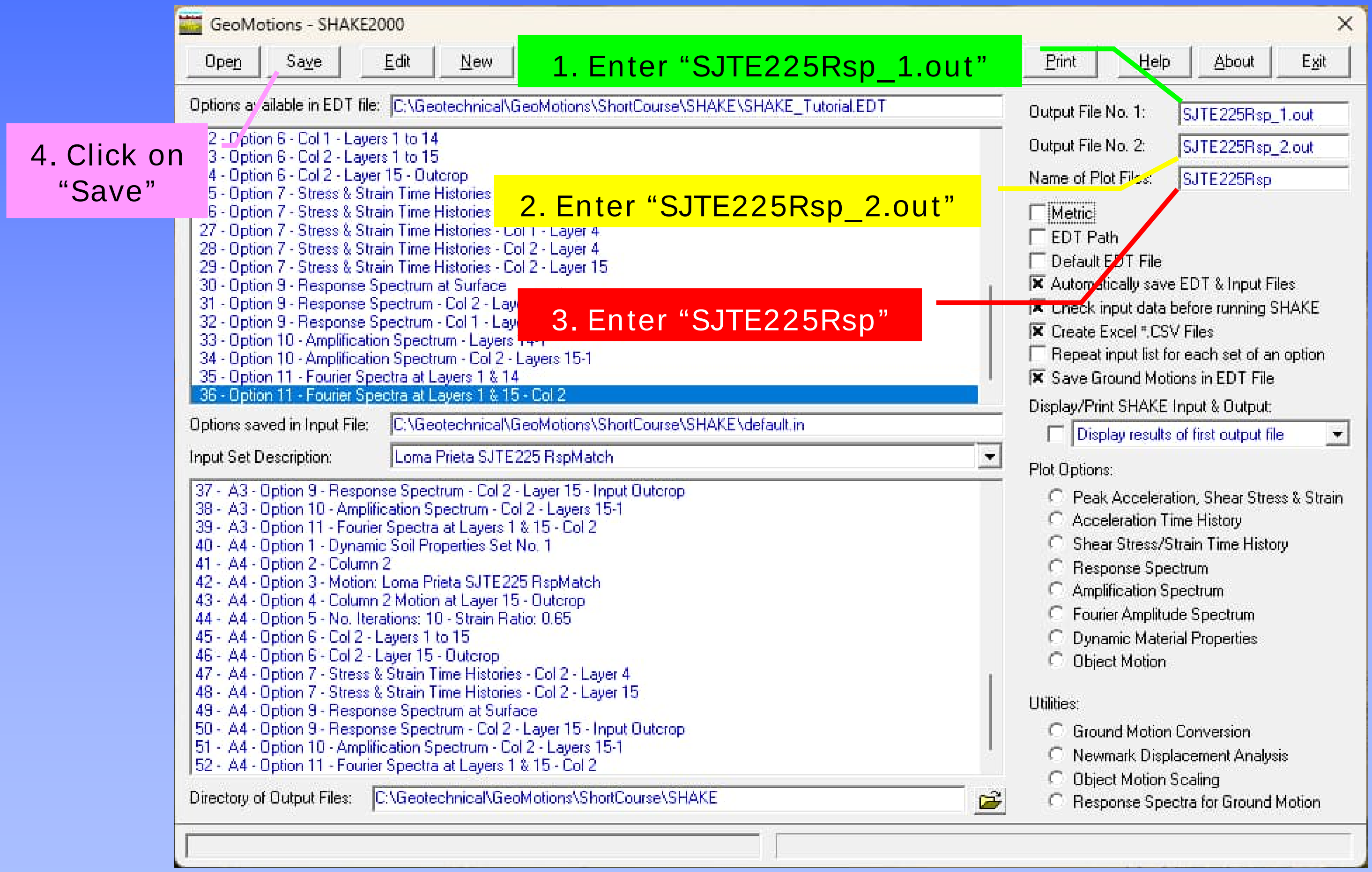
Create List of Input Options for Spectrally Match Comparison

Add options to create analyses for :

SHAKE Column	Ground Motion
Col 1	SJTE225 RspMatch
Col 2	_SJTE225 Saling Factor: 1.703
Col 2	SJTE225 RspMatch

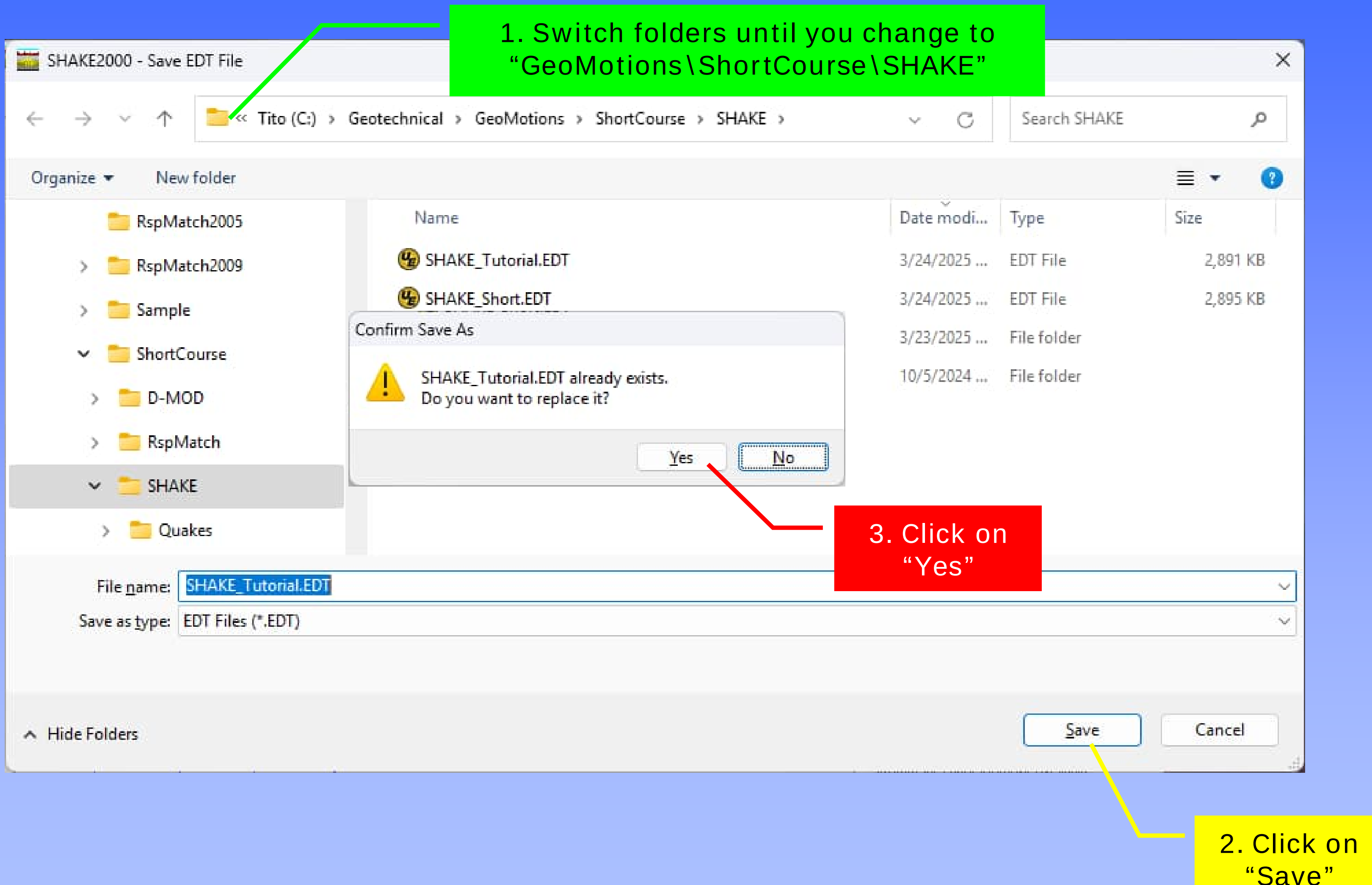
Site Specific Response Analysis

Rename SHAKE's Output Files and Plot Files

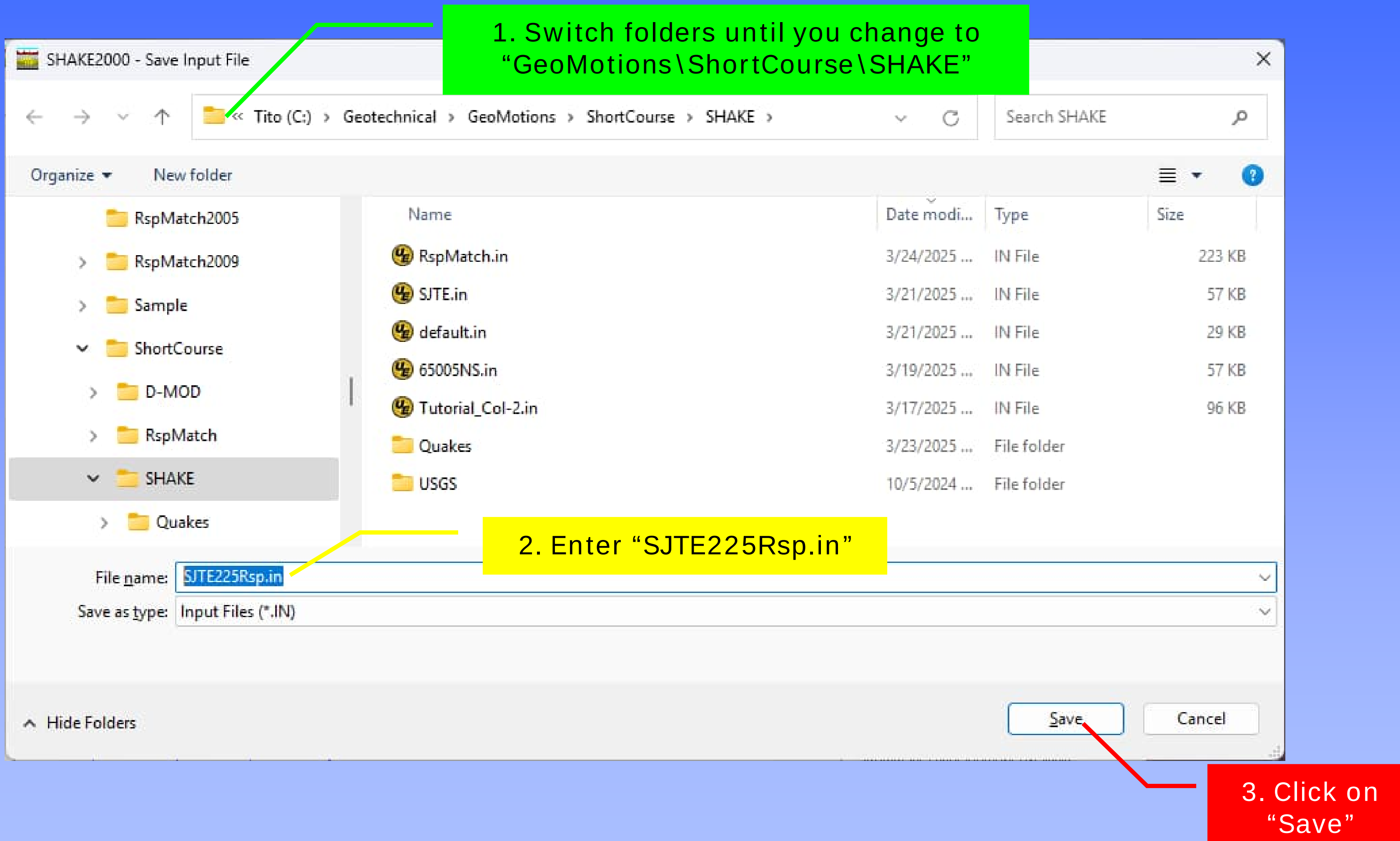


GeoMotions

Save EDT File

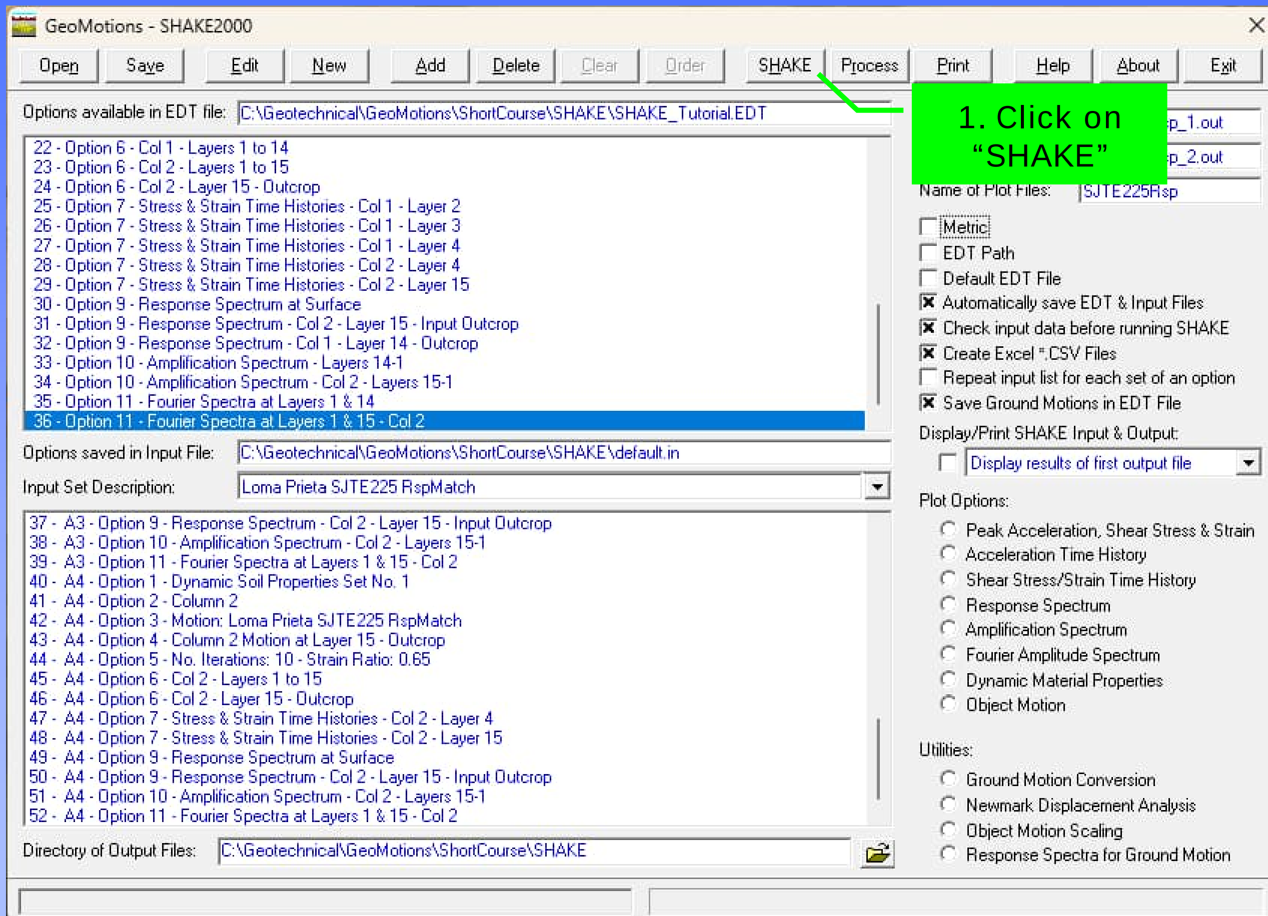


Save Input File



Site Specific Response Analysis

Execute SHAKE



GeoMotions

Site Specific Response Analysis

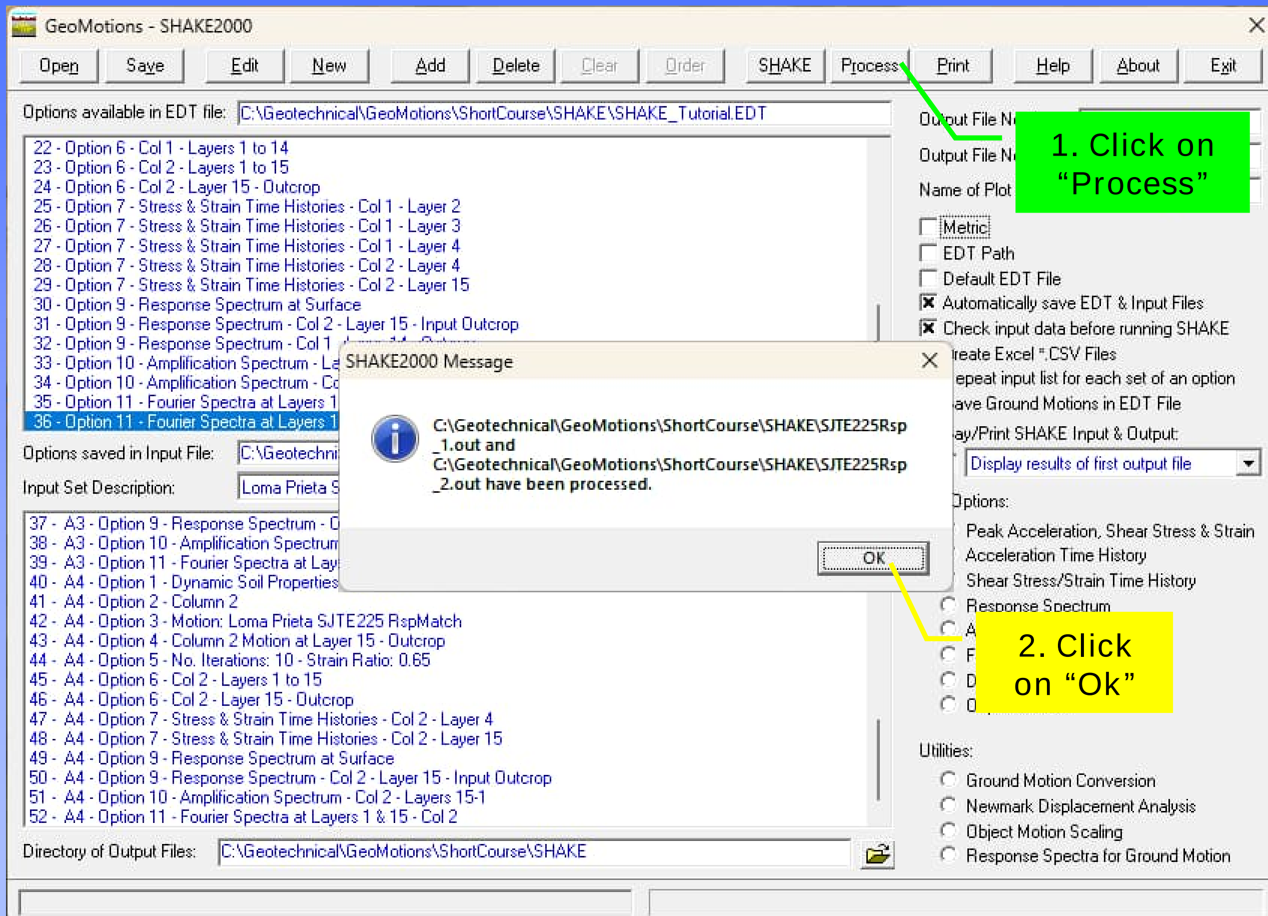
Execute SHAKE

C:\Geotechnical\GeoMotions\

```
************************************************************
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*     LAYERED SITES by Per Schnable & John Lysmer - 1970  *
* ------------------------------------------------------- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai,Jan 1985 *
* ------------------------------------------------------- *
* SHAKE88 :New modulus reduction curves for clays added   *
*      using results from Sun et al (1988) by J. I. Sun   *
*      & Ramin Golesorkhi February 26, 1988               *
*  ------------------------------------------------------*
* SHAKE90/91: Adjust last iteration; Input now is either  *
*      Gmax or max Vs; up to 13 materials can be specified*
*      by user; up to 50 Layers can be specified; object  *
*      motion can be read in from a separate file and can *
*      user specified format; Different periods for res-  *
*      ponse spectral calculations;options are renumbered;*
*      and general cleanup by: J. I. Sun, I. M. Idriss &  *
*      P. Dirrim June 1990 - February 1991                *
*  ------------------------------------------------------ *
* SHAKE91: General cleanup and finalization of input out- *
*      output format, etc. by: I. M. Idriss December 1991 *
*  ------------------------------------------------------ *
* SHAKE2000: Fix incorrect output of total stress in      *
* option 2, changed path to ground motion file in         *
* SHAKE91, input file, increased motion to 30,000 values  *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020   *
*          RUN DATE  3/15/2025                            *
*          RUN TIME 16:40                                 *
************************************************************
```

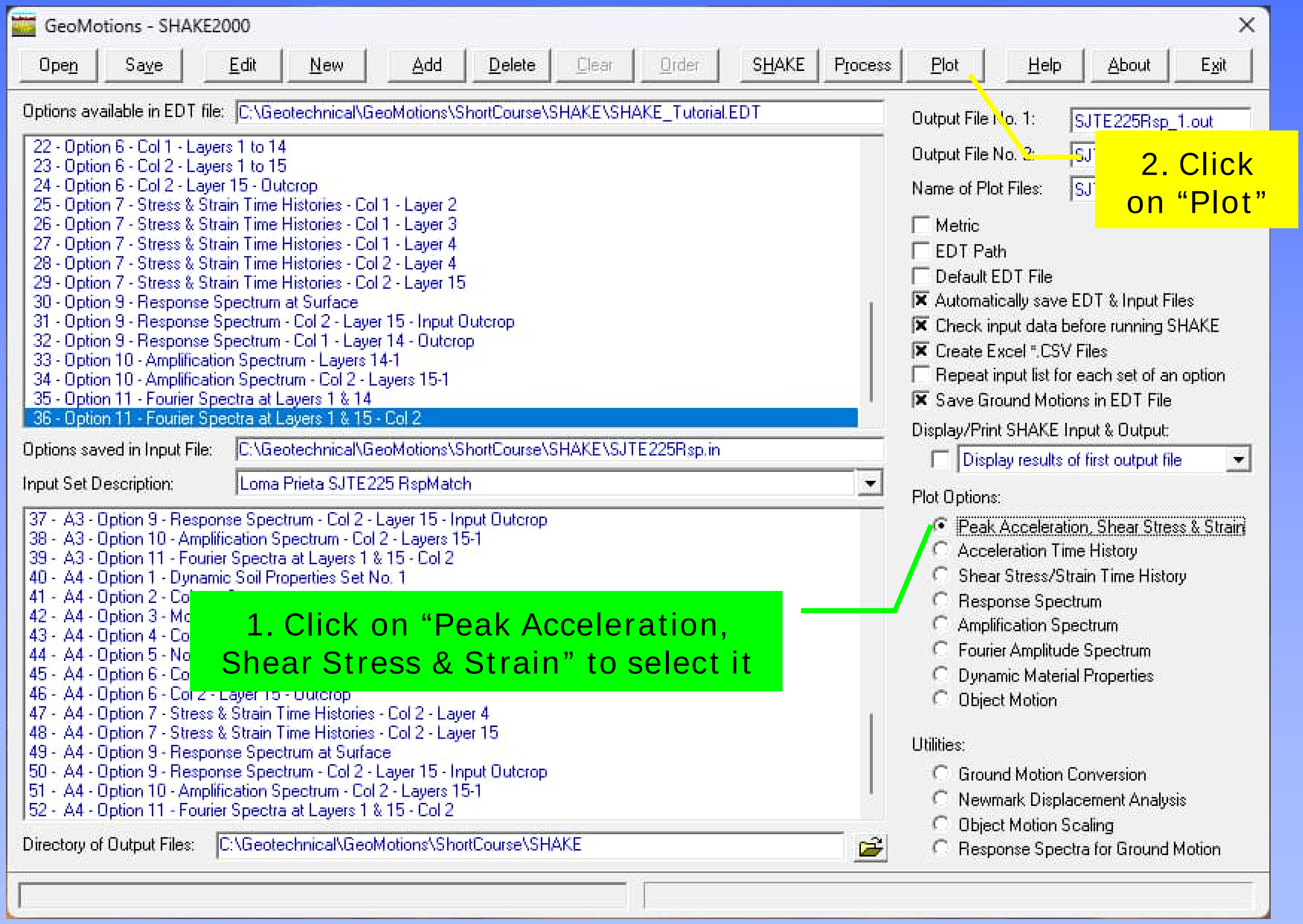
Site Specific Response Analysis

Process SHAKE's Output Files



Site Specific Response Analysis

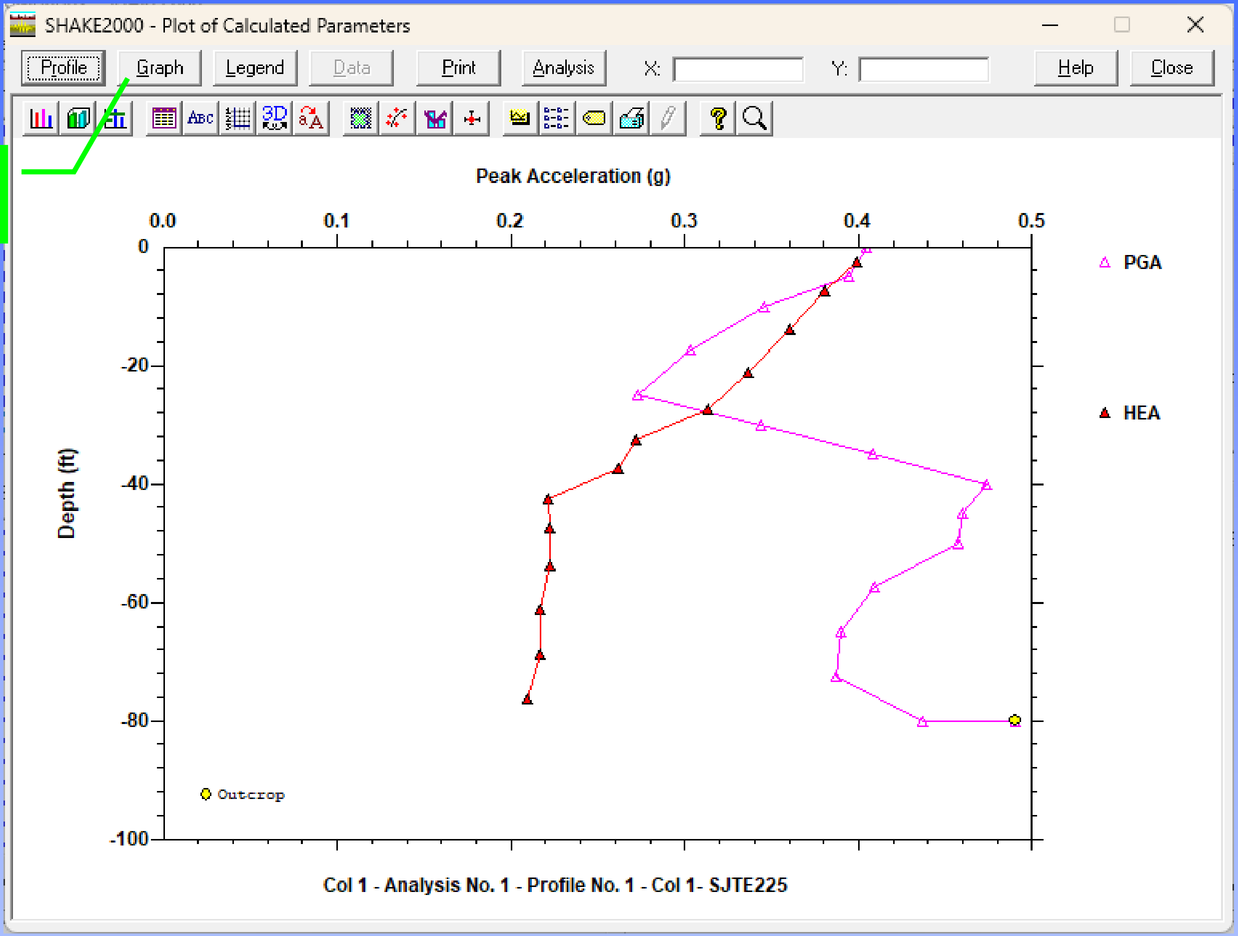
Plot Results



Site Specific Response Analysis

Plot Results

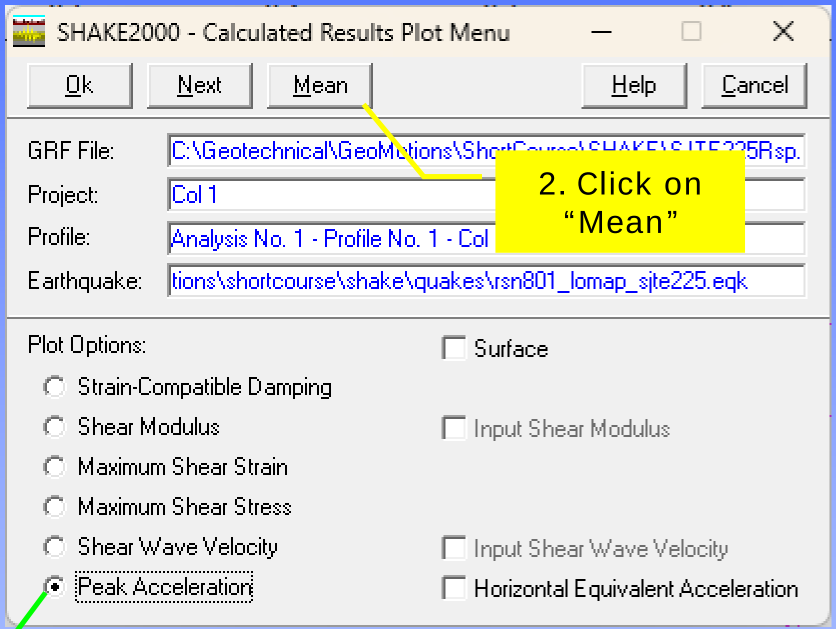
1. Click on "Graph"



** The "Outcrop" symbol (i.e., a yellow circle) is not shown for the surface values, only for those layers denoted as outcrop in Option 6, other than layer number 1.

Site Specific Response Analysis

Plot Results

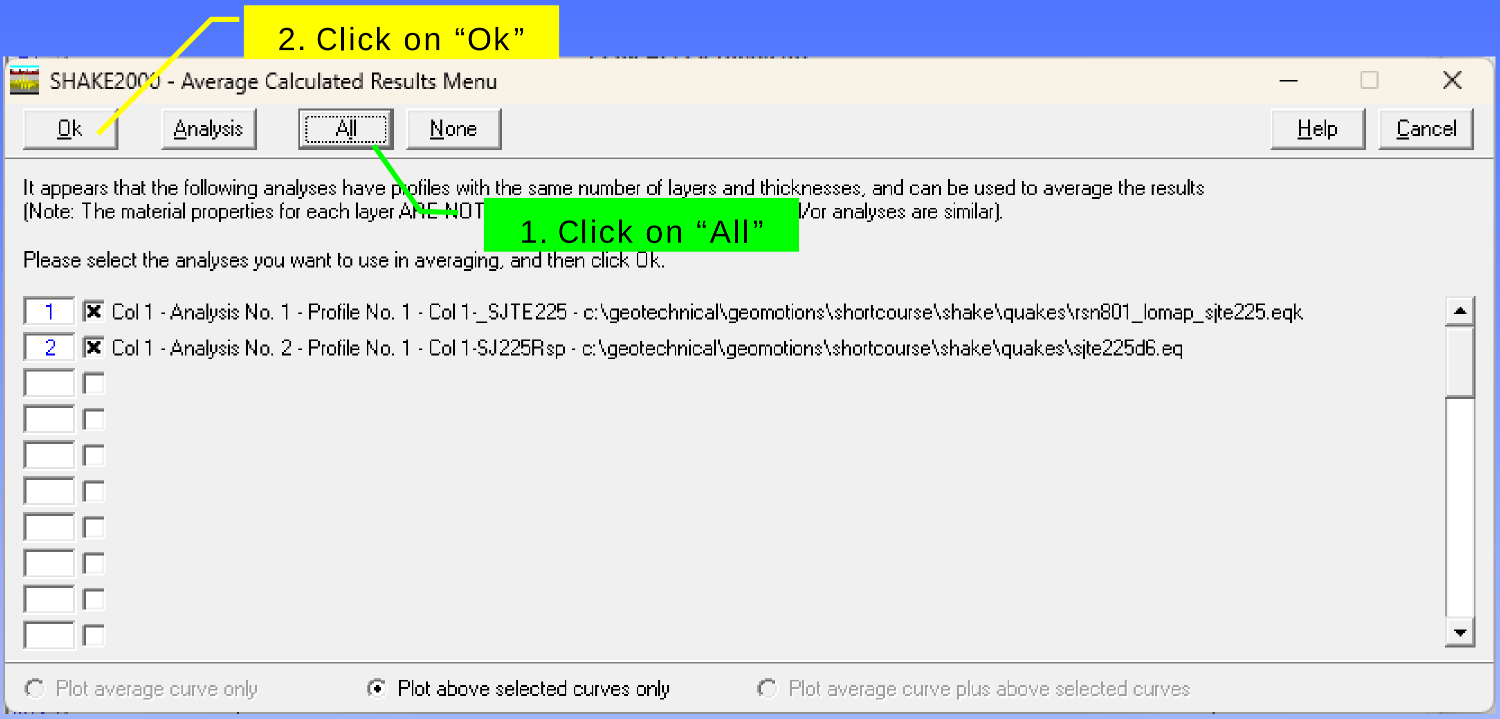


2. Click on “Mean”

1. Click on “Peak Acceleration” to select it

Site Specific Response Analysis

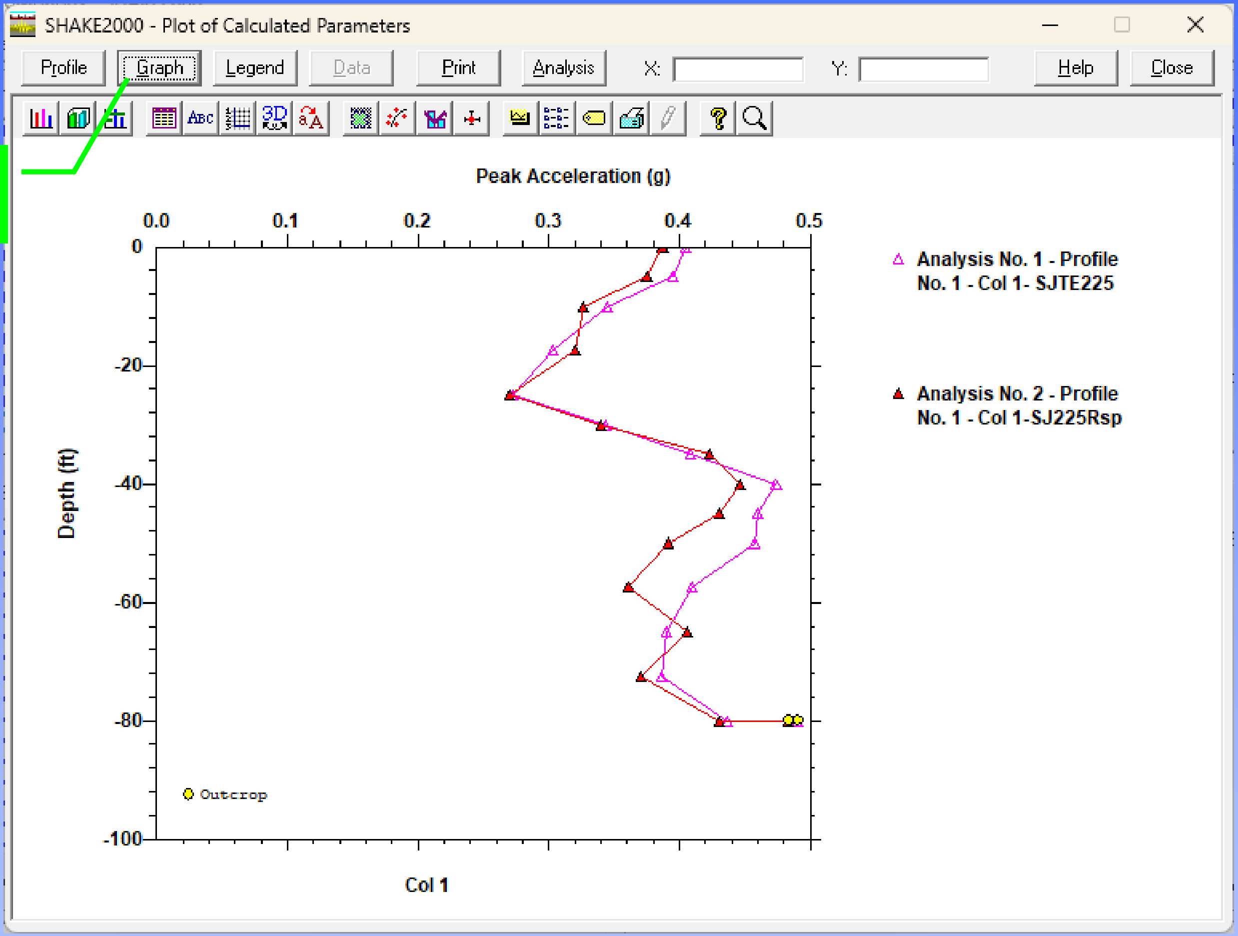
Plot Results



Site Specific Response Analysis

Plot Results

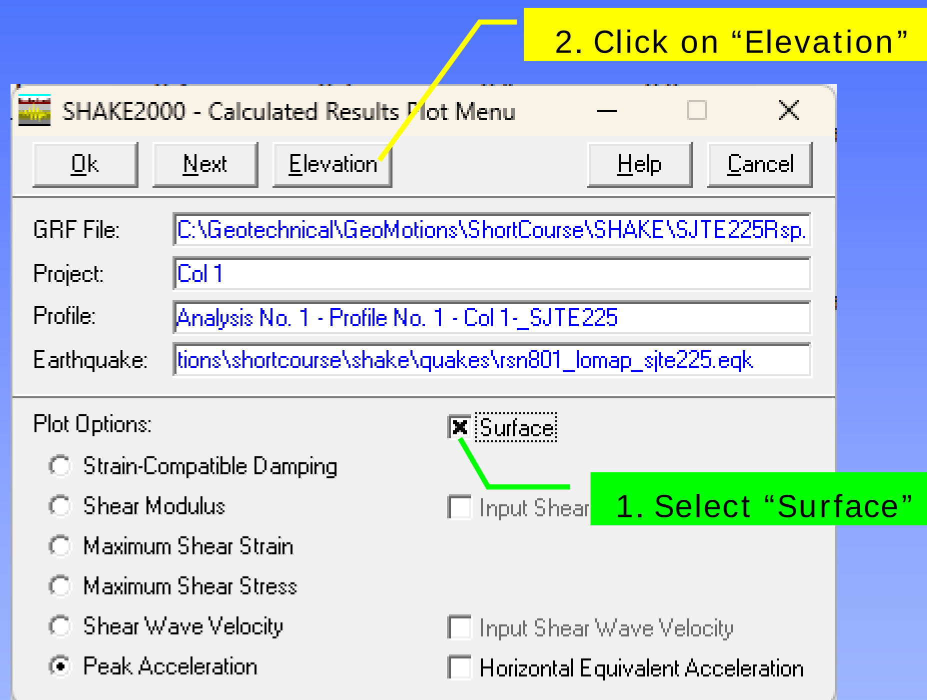
1. Click on "Graph"



GeoMotions

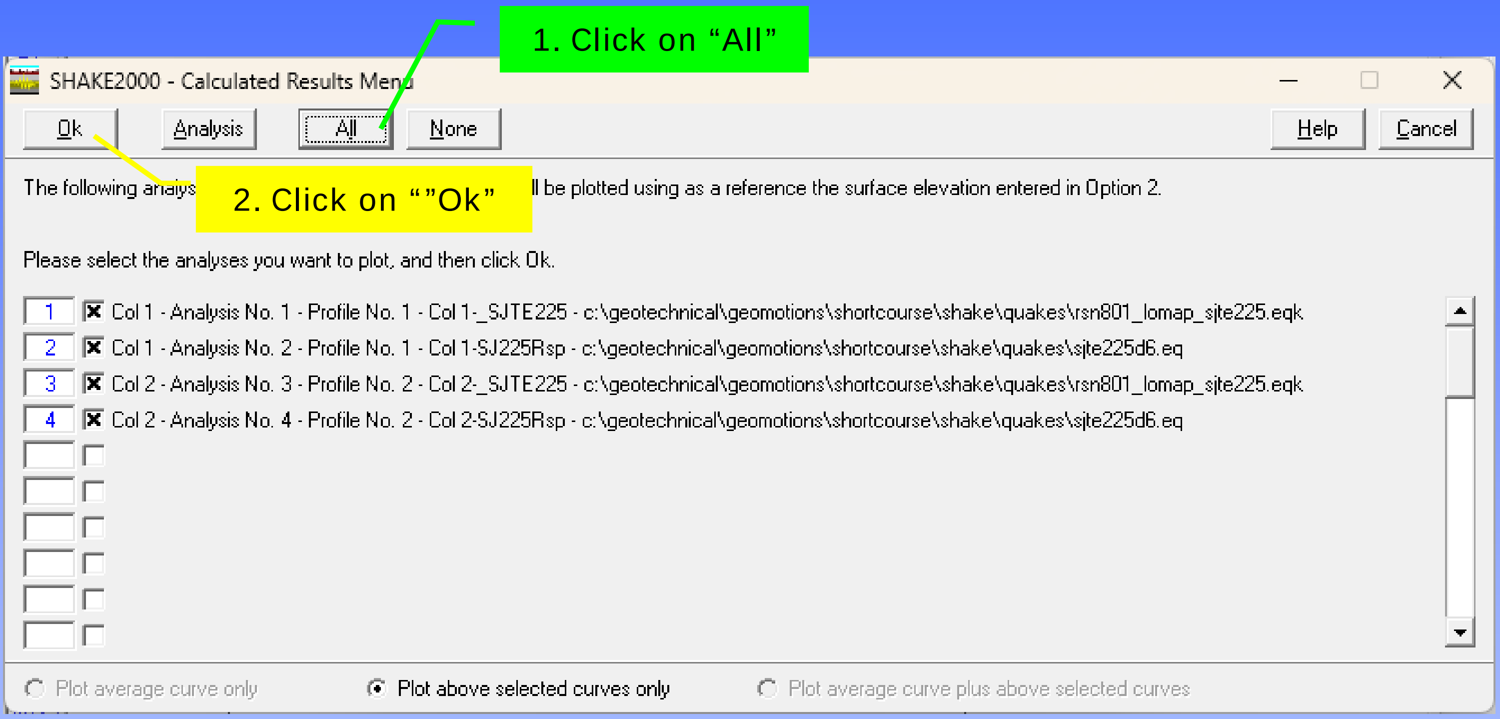
Site Specific Response Analysis

Plot Results



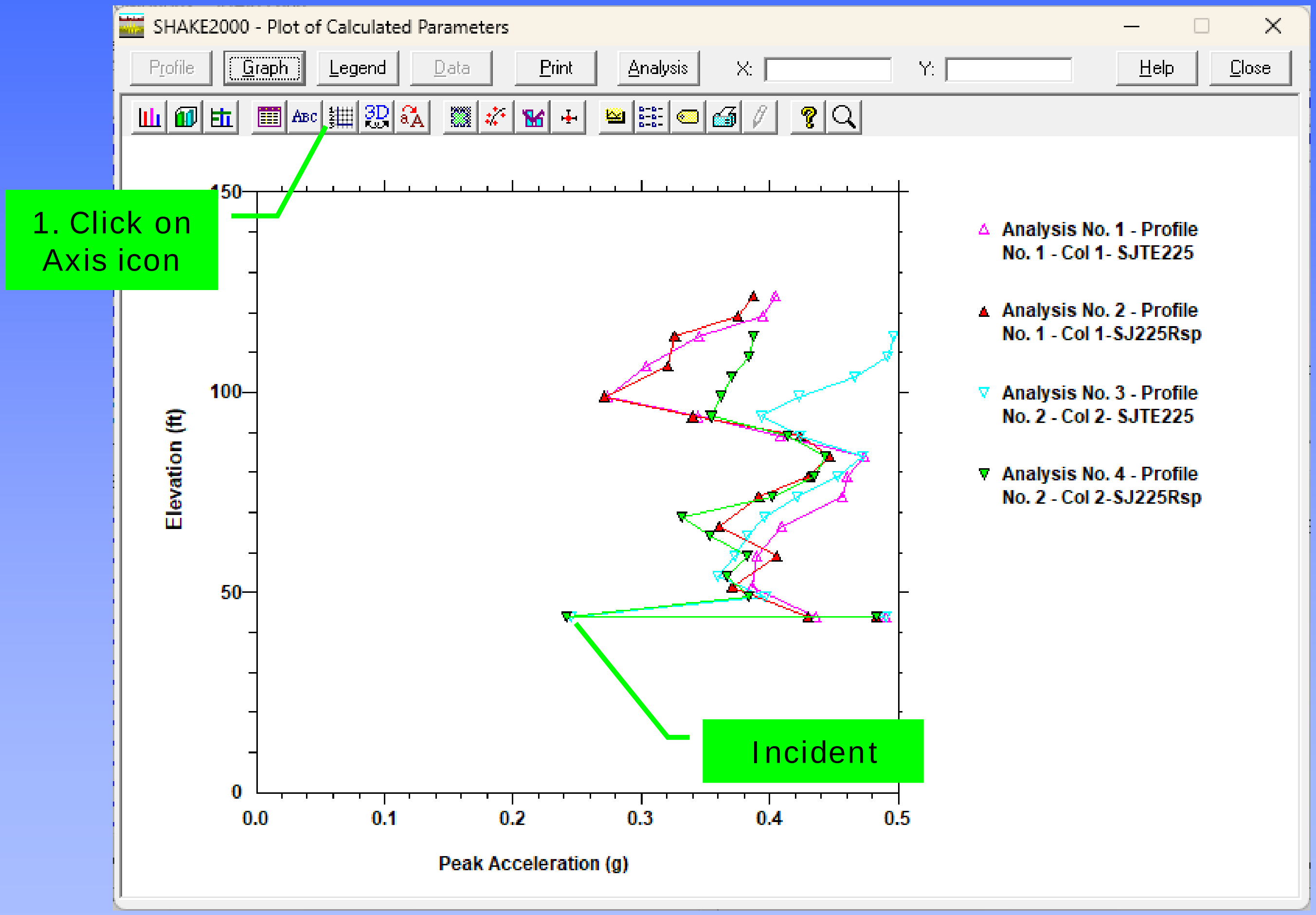
Site Specific Response Analysis

Plot Results



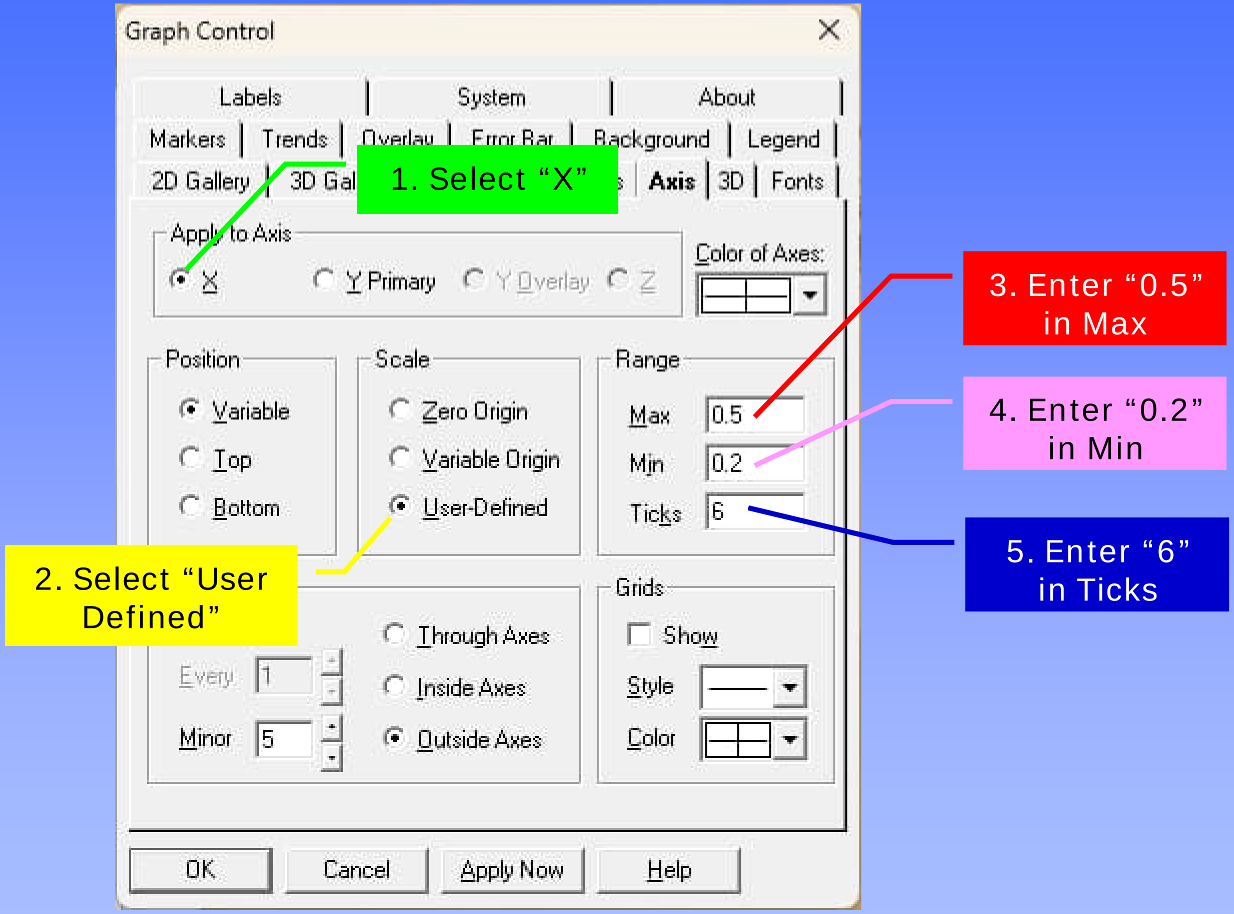
Site Specific Response Analysis

Plot Results

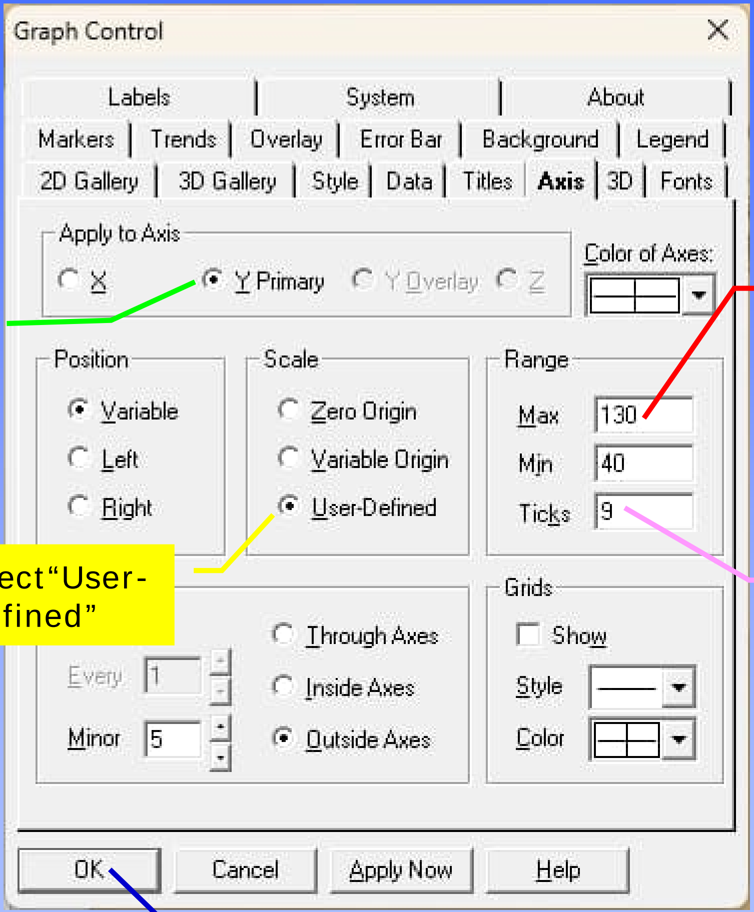


GeoMotions

Change Graph Properties



Change Graph Properties



1. Select "Y"

2. Select"User-Defined"

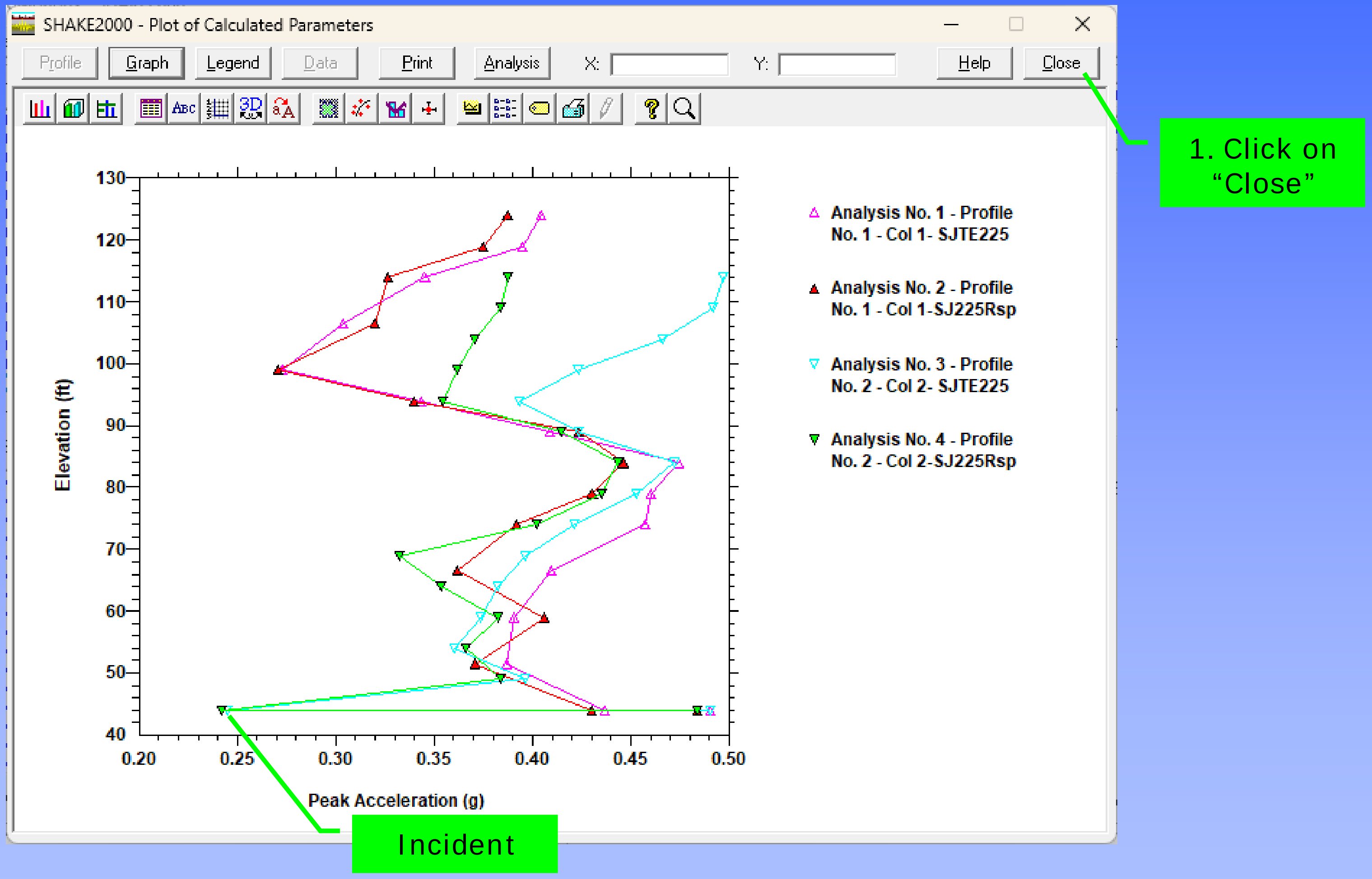
3. Enter "130" in Max

4. Enter "9" in Ticks

5. Click on "Ok"

Site Specific Response Analysis

Plot Results



SHAKE Analysis to Calibrate a D-MOD Analysis

The first step in a nonlinear analysis using D-MOD2000 is to estimate viscous damping by calibrating the D-MOD analysis against results from an equivalent-linear SHAKE analysis that has a constant value of viscous damping at all frequencies. There are two approaches that can be used to evaluate the Rayleigh Damping coefficients, n and ξ, using an iterative procedure based on comparing how well the SHAKE and D-MOD surface response spectra and peak acceleration & shear strain vs. depth compared to each other:

1. Develop a SHAKE column and perform an equivalent-linear SHAKE analysis to obtain the acceleration time history at the surface level. Limit PGA to <= 0.4 g and Shear Strain to < 0.5%.

2. Develop a SHAKE column and perform a small strain, linear SHAKE analysis to obtain the acceleration time history at the surface level. Use G_{max} and 5% damping for all layers (i.e., use “zero” type soils in Option 2). More detailed information about this approach is provided by Stewart et al. (2008).

GeoMotions

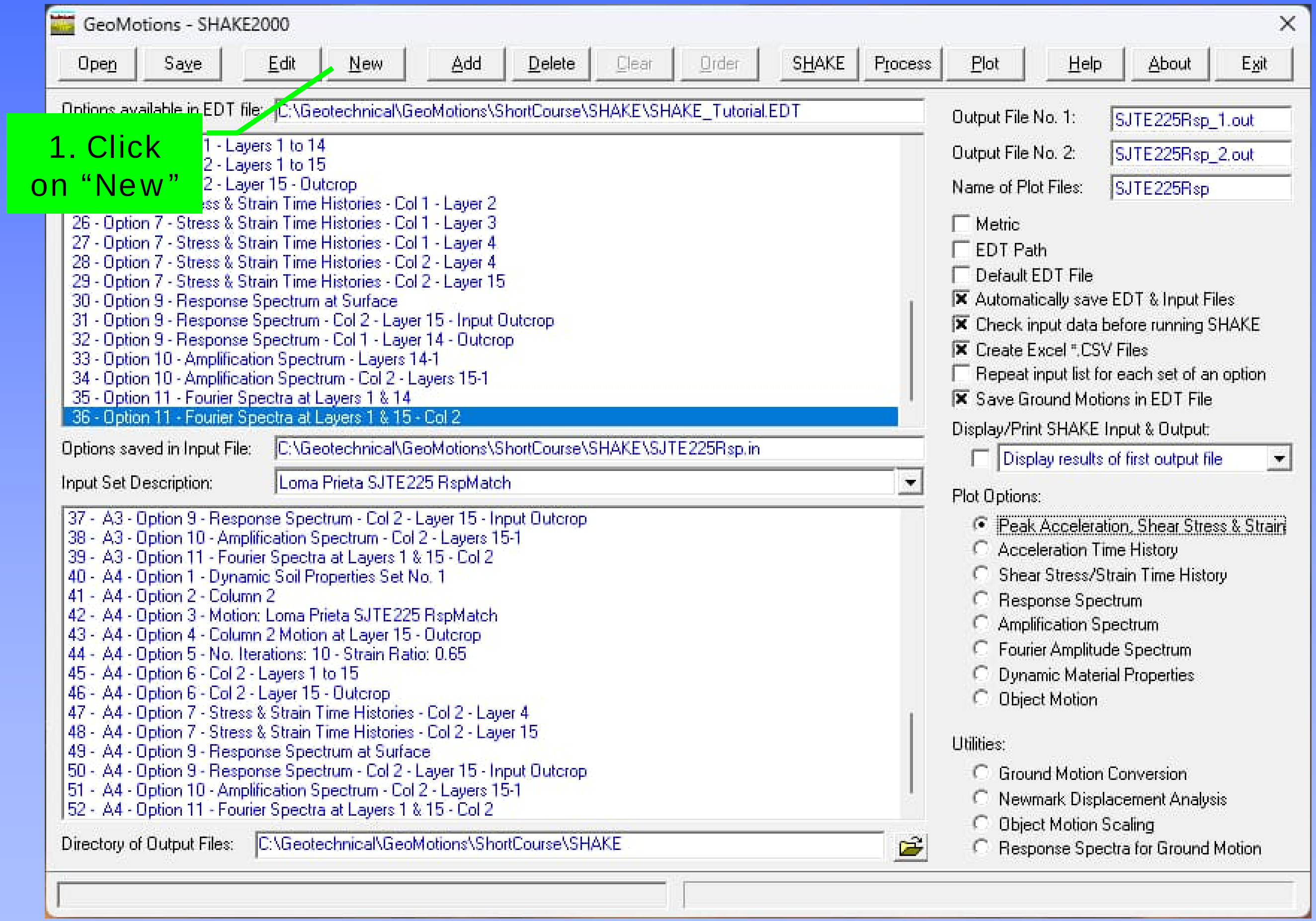
Use First Approach to Calibrate a D-MOD Analysis

The first approach involves evaluation of the Rayleigh Damping coefficients, n and ξ, using an iterative procedure as follows:

1. Develop a SHAKE column and perform the SHAKE analysis to obtain the response spectrum at the surface level. Limit PGA to <= 0.4 g and Shear Strain to < 0.5% (this tutorial).
2. Develop the D-MOD column to match the SHAKE column as close as possible and use n = 0 and ξ = 0.5 for first iteration.
3. Perform a total-stress nonlinear analysis with D-MOD.
4. Compare the surface response spectrum from SHAKE to the response spectrum from D-MOD.
5. Adjust n and ξ and repeat from step 3 until a “satisfactory” match between the SHAKE and D-MOD spectra is obtained. Also, compare the shear strain vs. depth plot from both SHAKE and D-MOD.

SHAKE2000

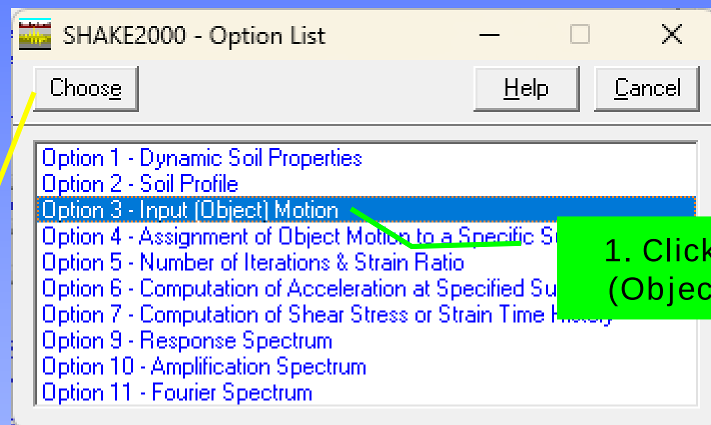
D-MOD Calibration



Site Specific Response Analysis

Create Object Motion for D-MOD Calibration

2. Click on "Choose"



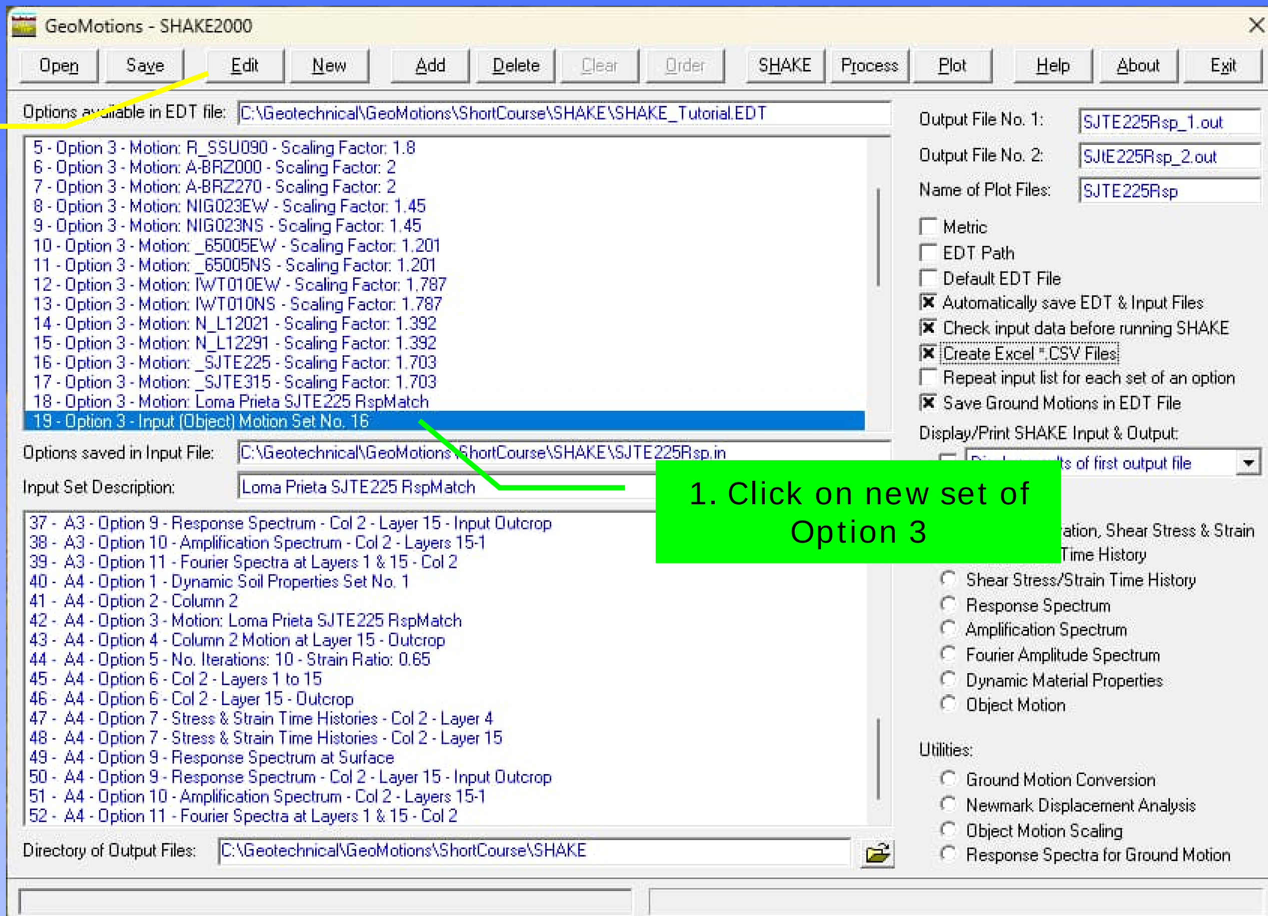
1. Click on "Option 3 – Input (Object) Motion" to select it

GeoMotions

Site Specific Response Analysis

Create Object Motion for D-MOD Calibration

2. Click on "Edit"

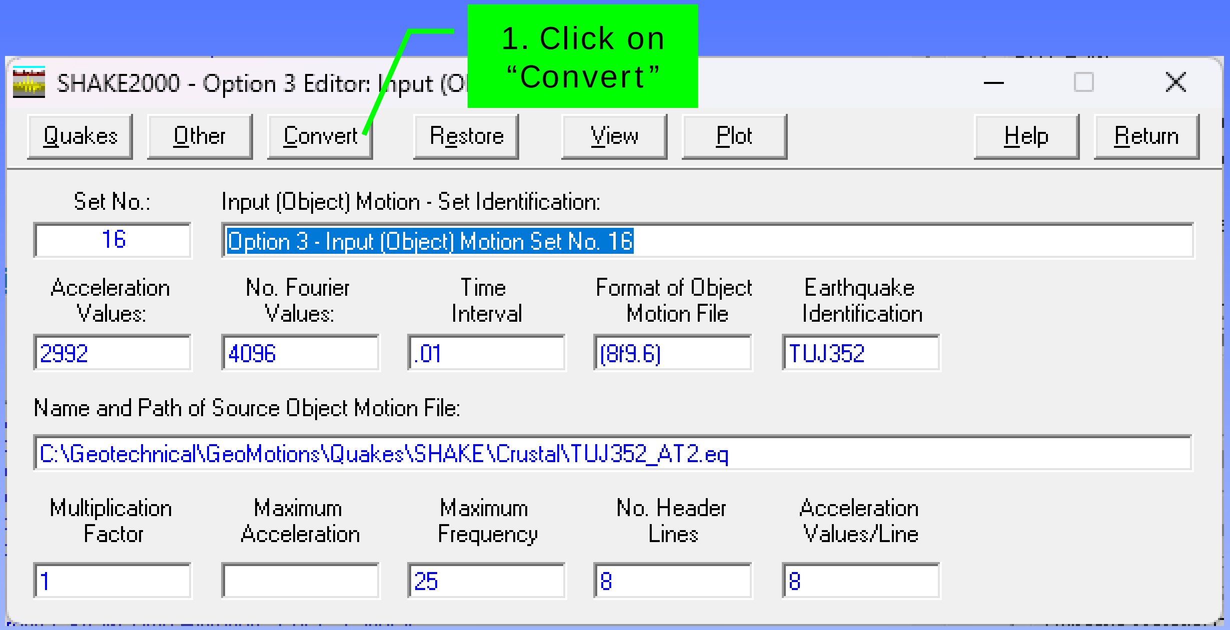


1. Click on new set of Option 3

GeoMotions

Site Specific Response Analysis

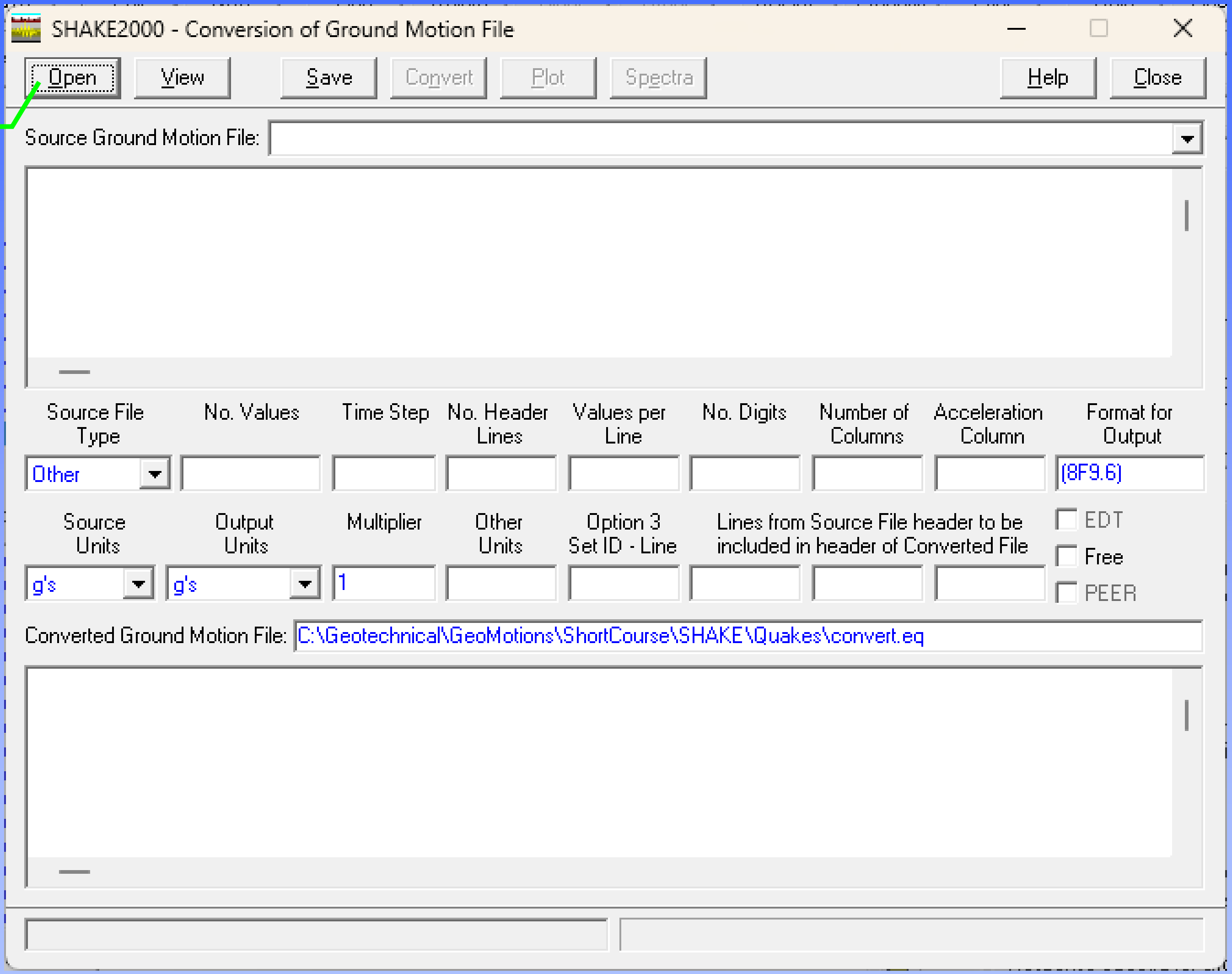
Option 3: Input Motion for D-MOD Calibration



GeoMotions

Convert At2 Motion to D-MOD Format
RSN801_LOMAP_SJTE225.AT2

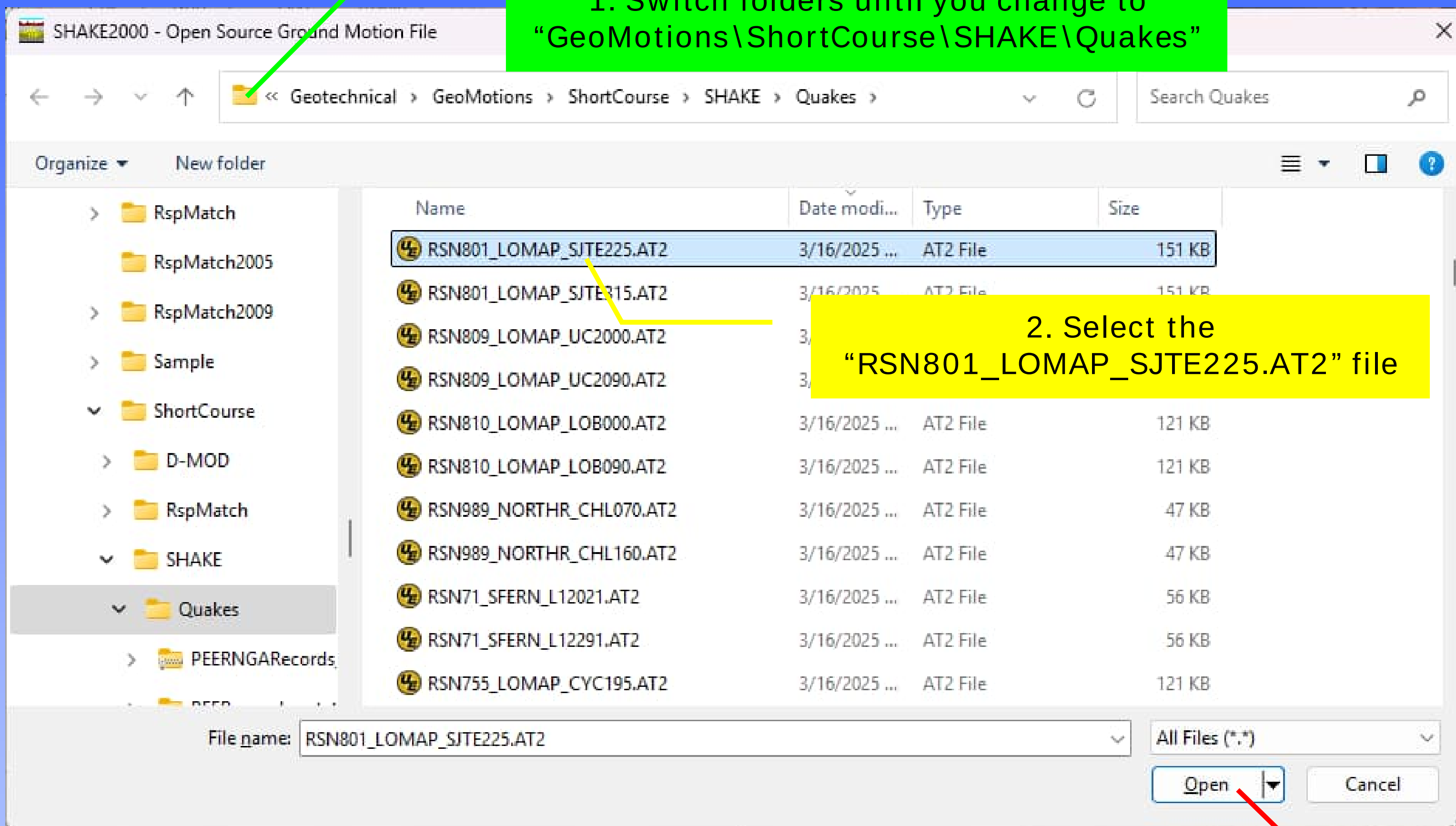
1. Click on "Open"



GeoMotions

Open PEER Acceleration File

1. Switch folders until you change to "GeoMotions\ShortCourse\SHAKE\Quakes"

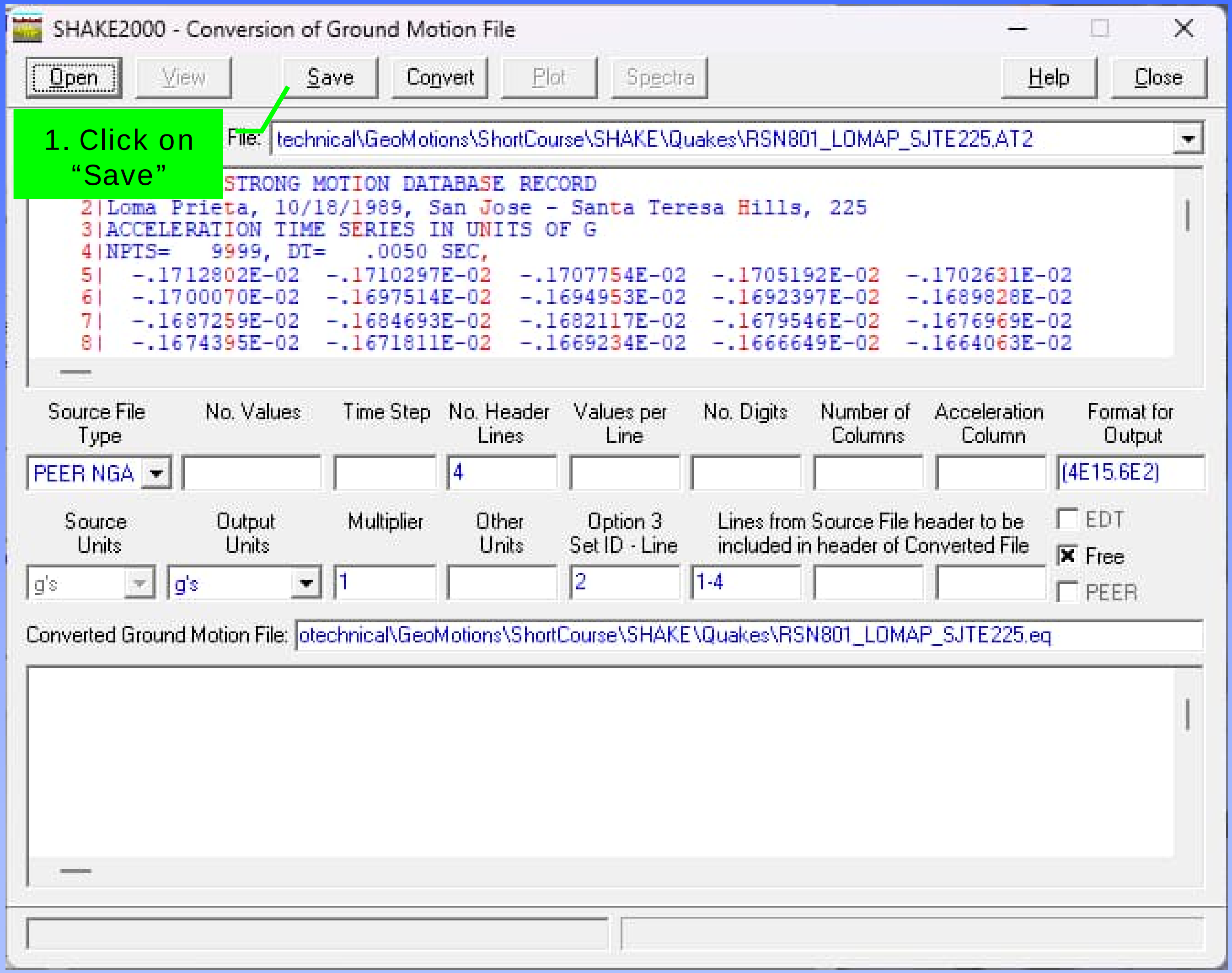


2. Select the "RSN801_LOMAP_SJTE225.AT2" file

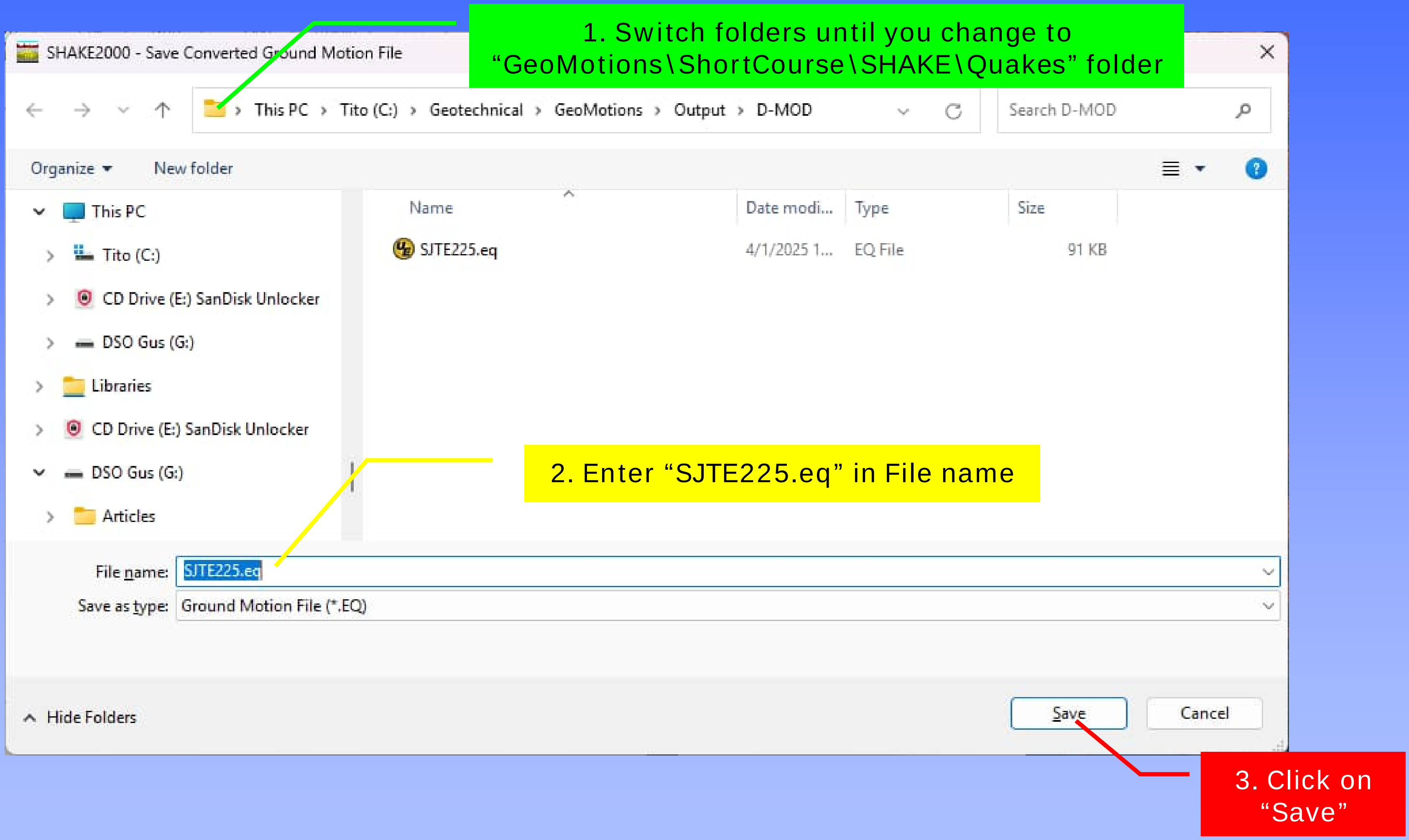
3. Click on "Open"

GeoMotions

Choose path and name of converted file

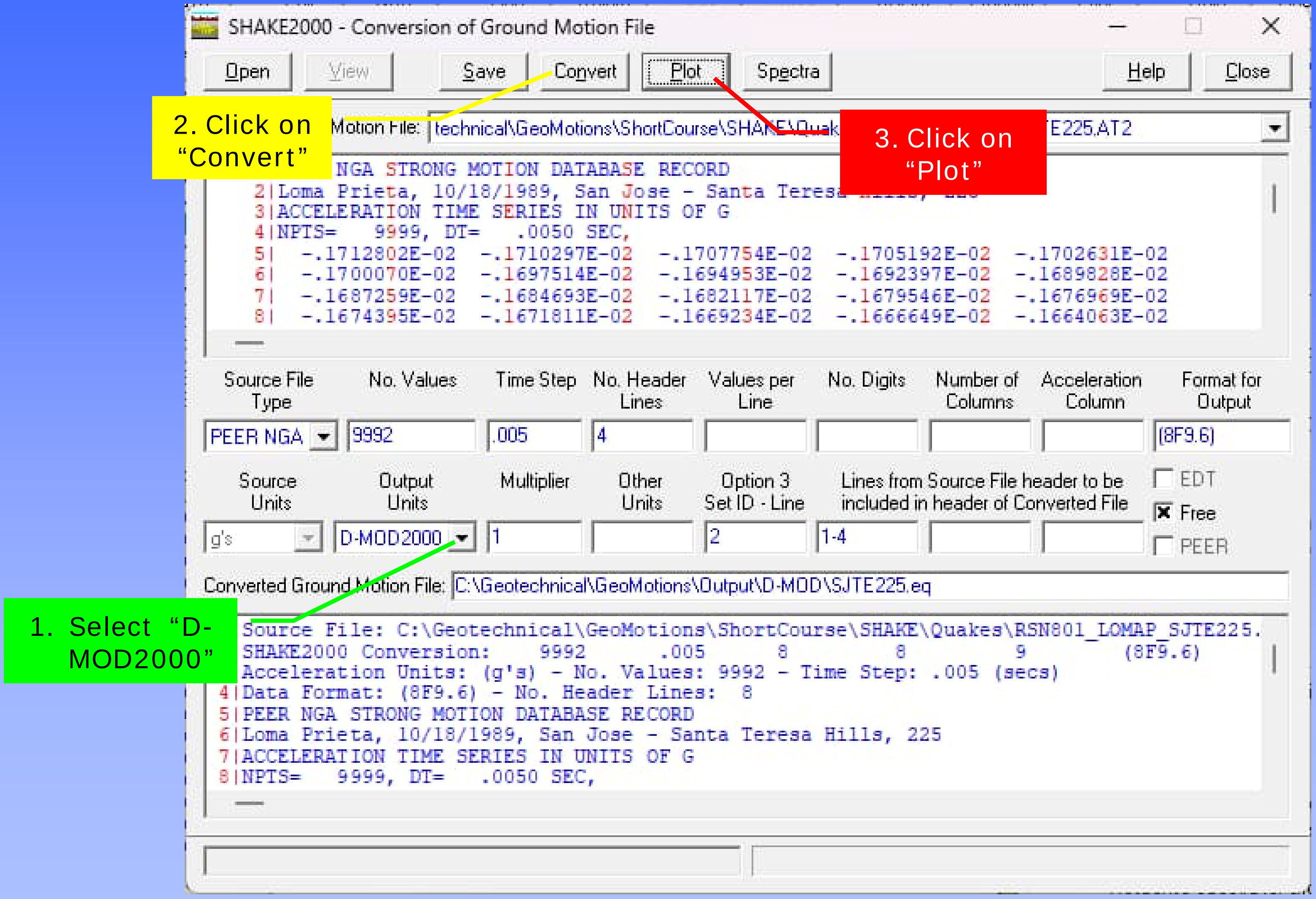


Choose path and name of converted file

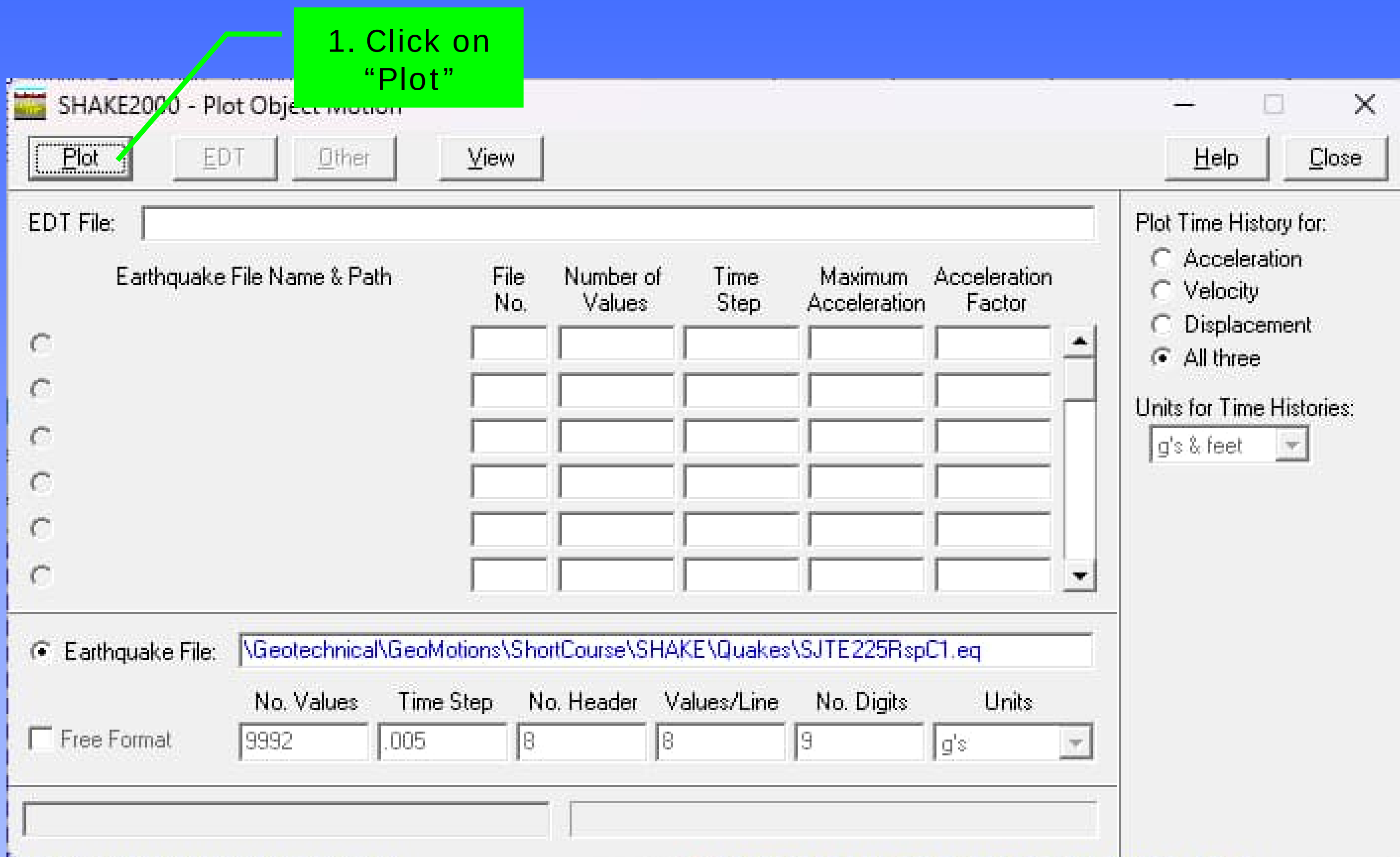


GeoMotions

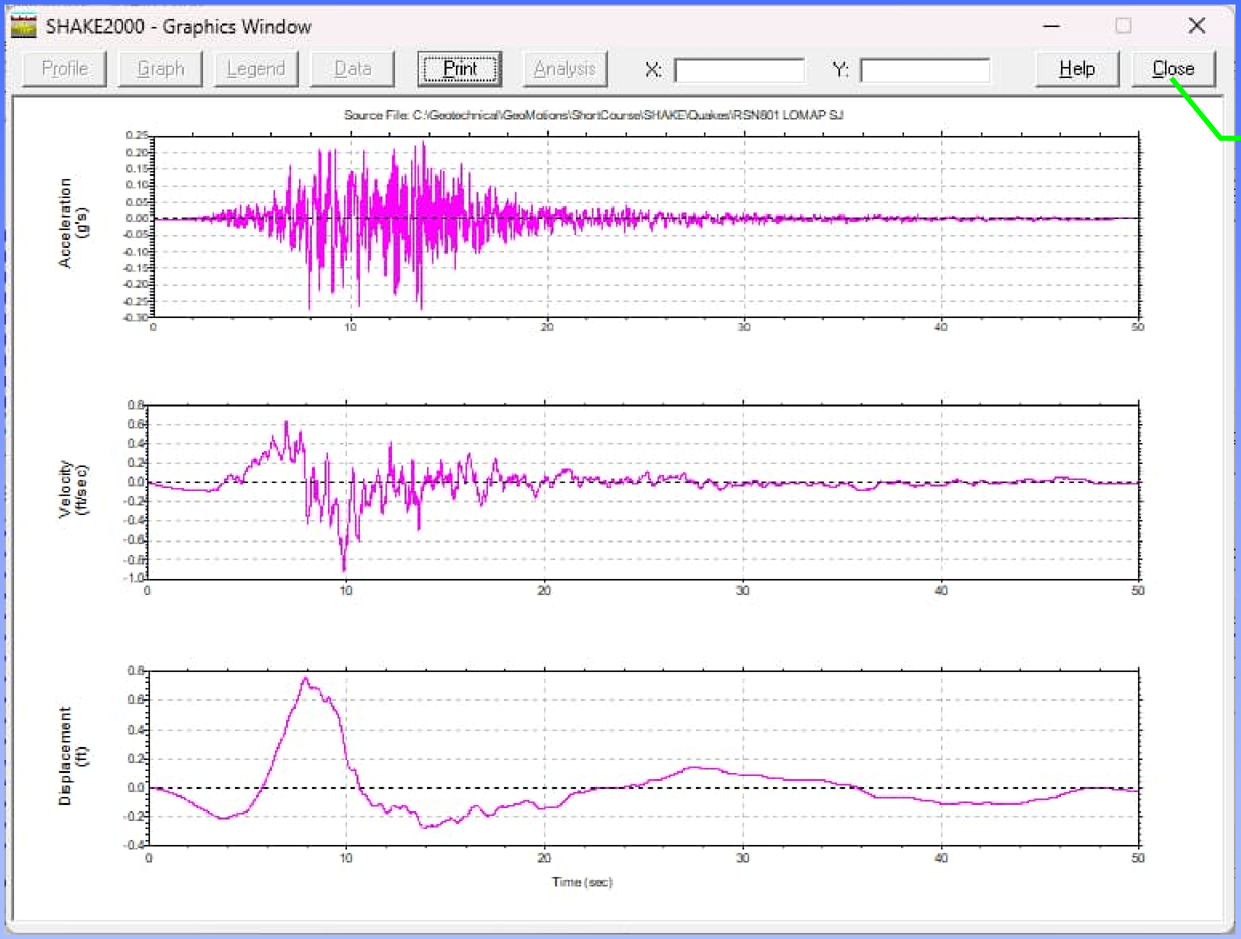
Convert AT2 Motion to D-MOD Format



Plot Converted File to Check Conversion



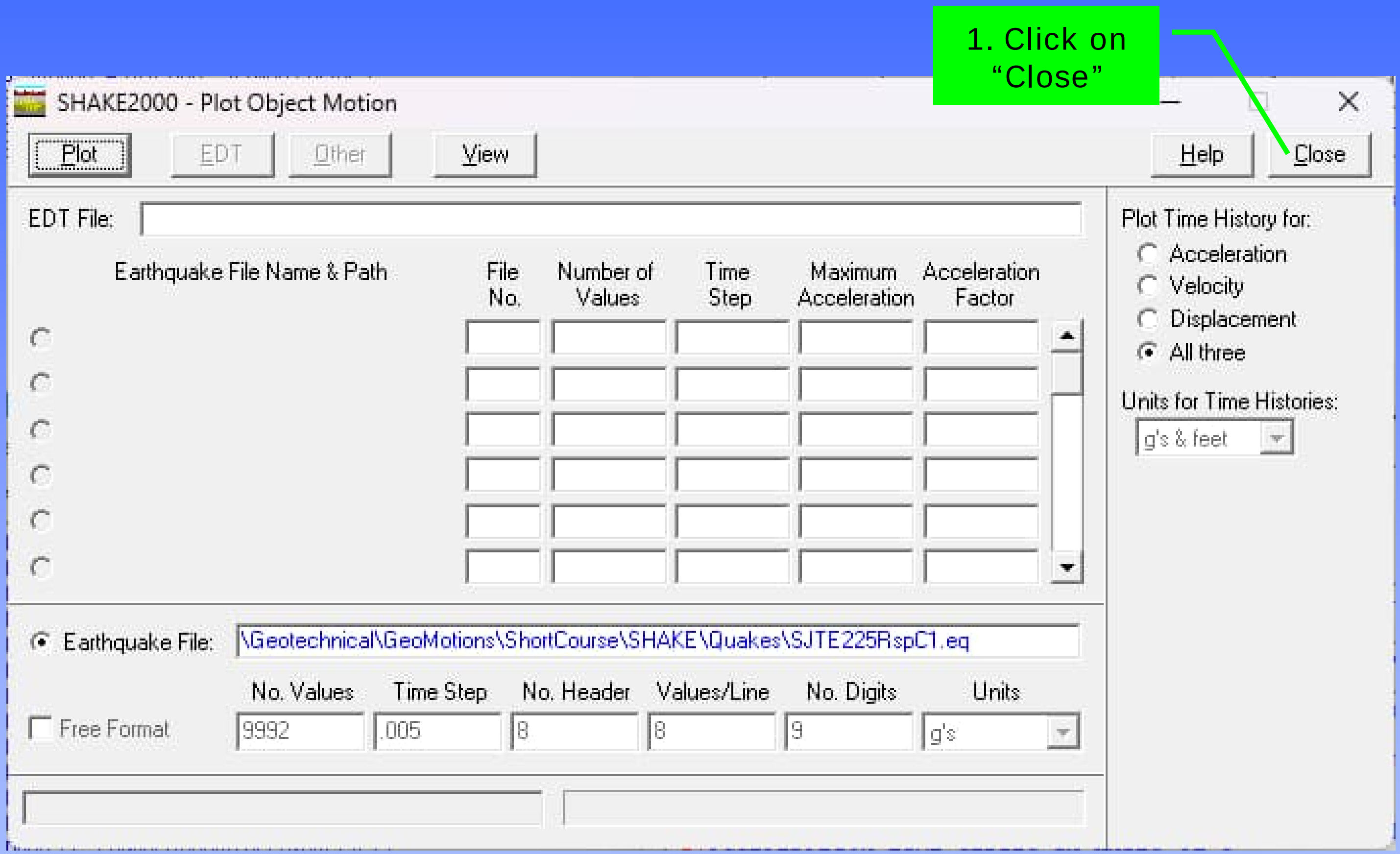
Acceleration, Velocity, and Displacement Time Histories for Converted Input Ground Motion File



1. Click on "Close"

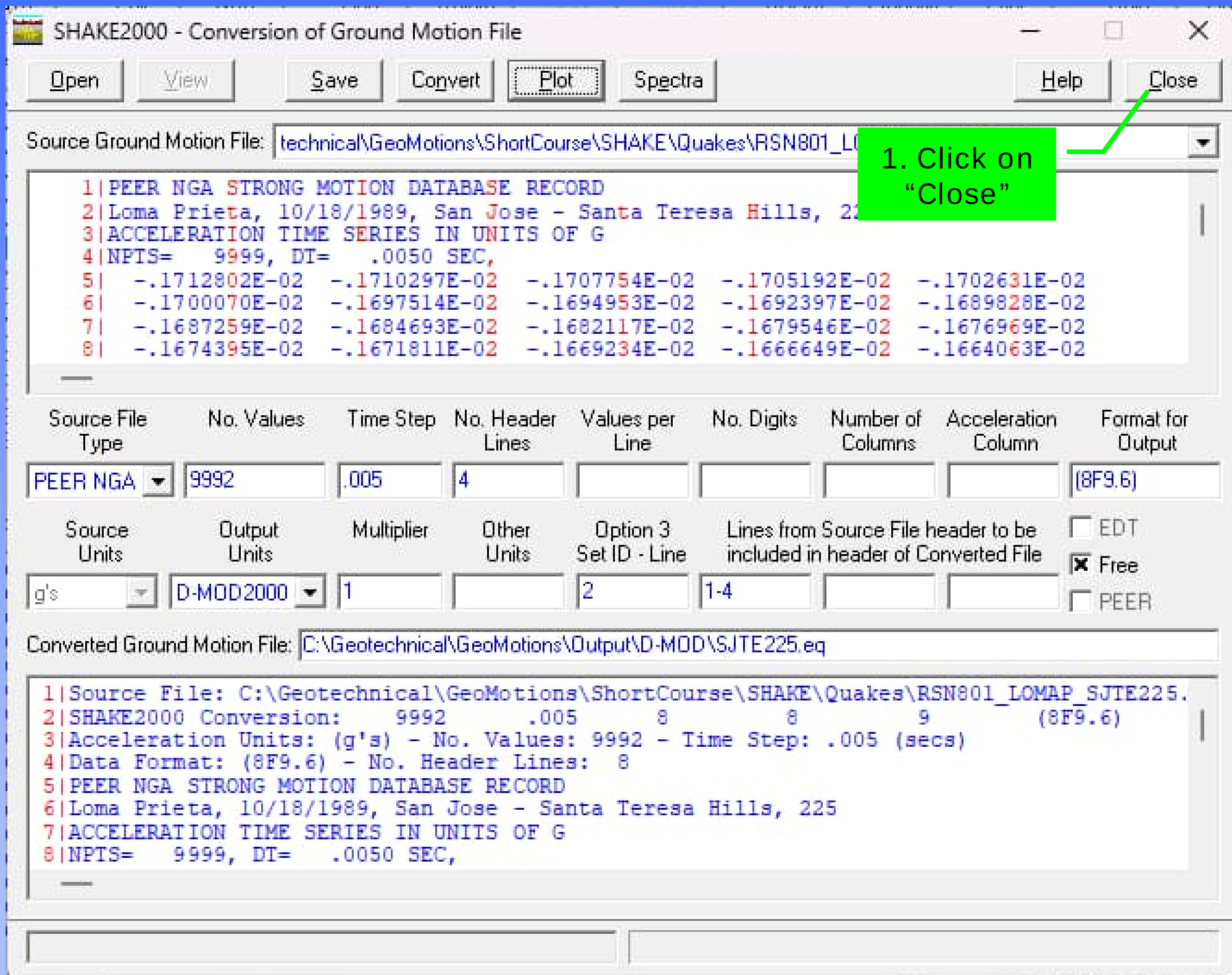
GeoMotions

Plot Converted File to Check Conversion



GeoMotions

Create Spectrally Matched Option 3 File

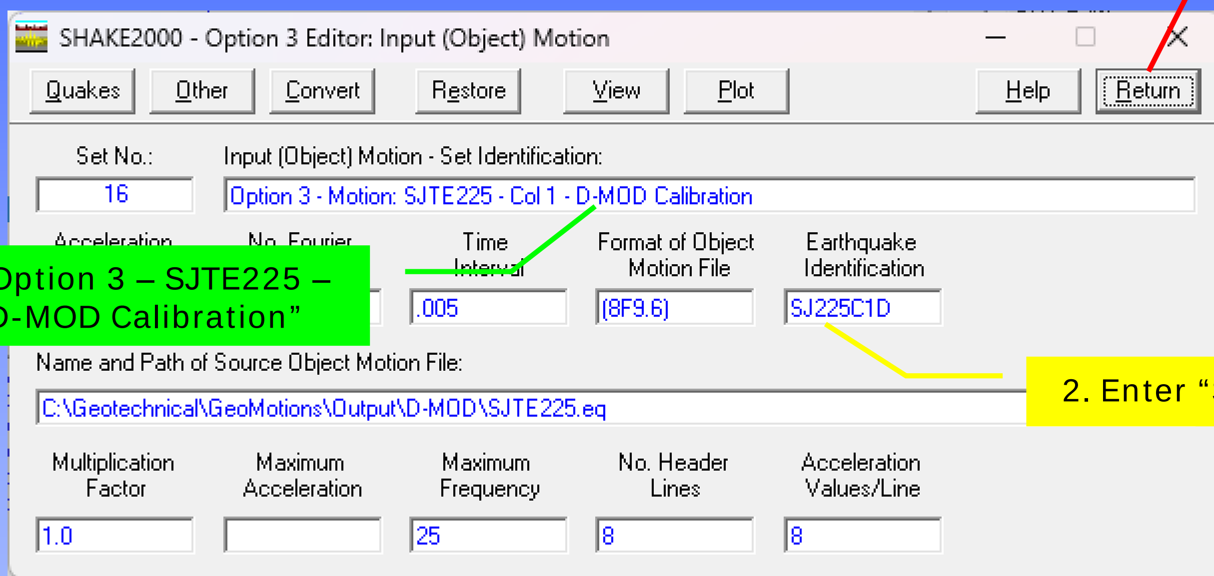


GeoMotions

Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration

3. Click on "Return"



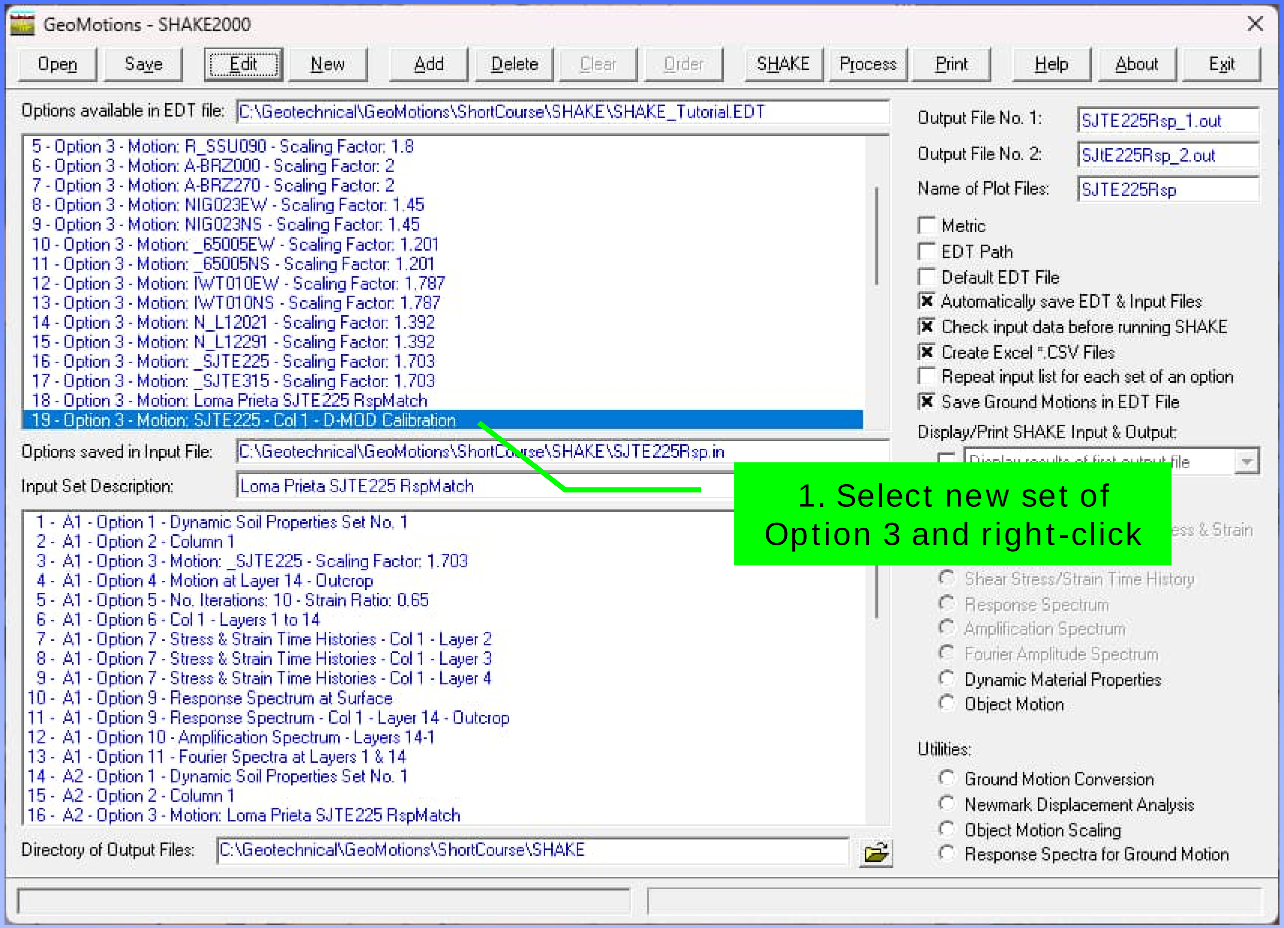
1. Enter "Option 3 – SJTE225 – Col 1 – D-MOD Calibration"

2. Enter "SJ225C1D"

GeoMotions

Site Specific Response Analysis

Create Motion for D-MOD Calibration of Column No. 2

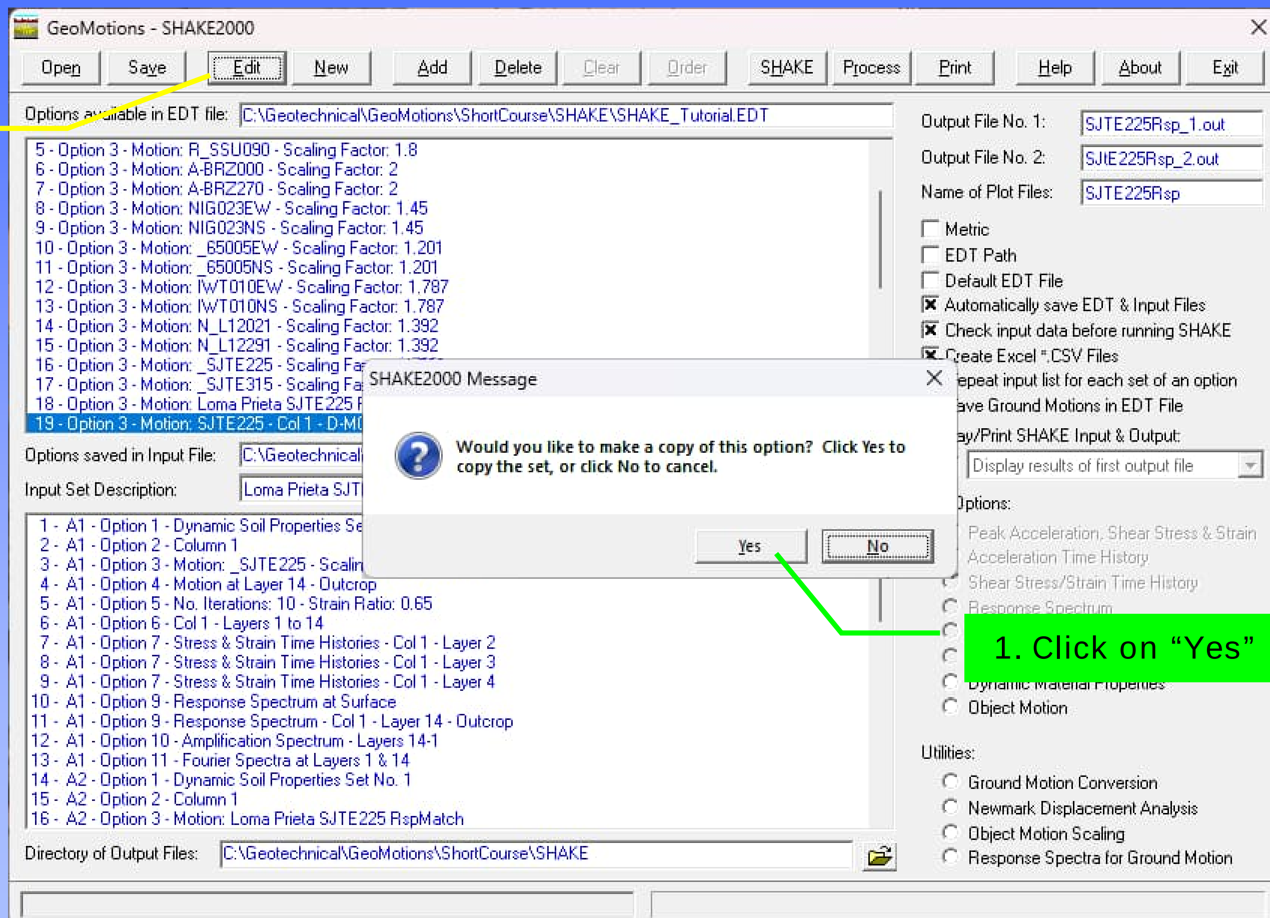


GeoMotions

Site Specific Response Analysis

Create Motion for D-MOD Calibration of Column No. 2

2. Click on “Edit”

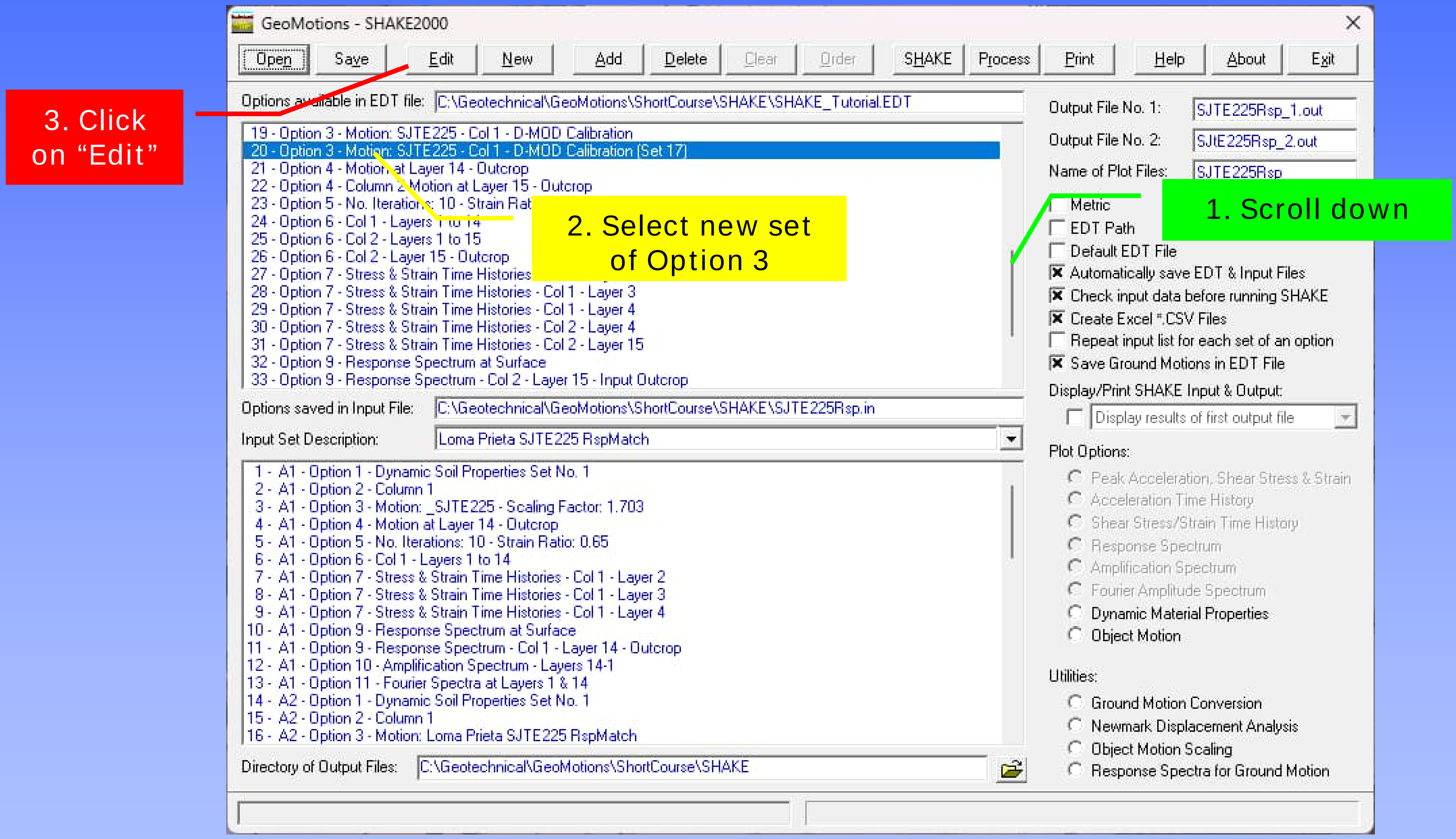


1. Click on “Yes”

GeoMotions

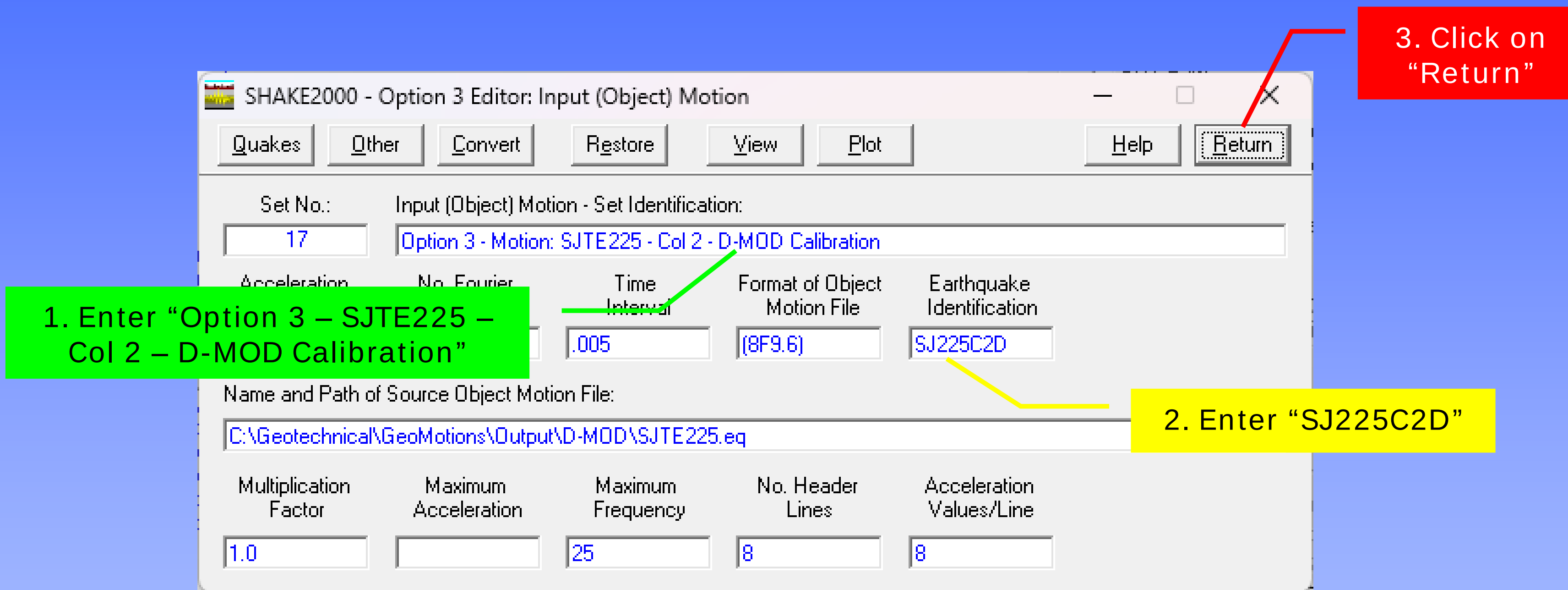
Site Specific Response Analysis

Create Motion for D-MOD Calibration of Column No. 2



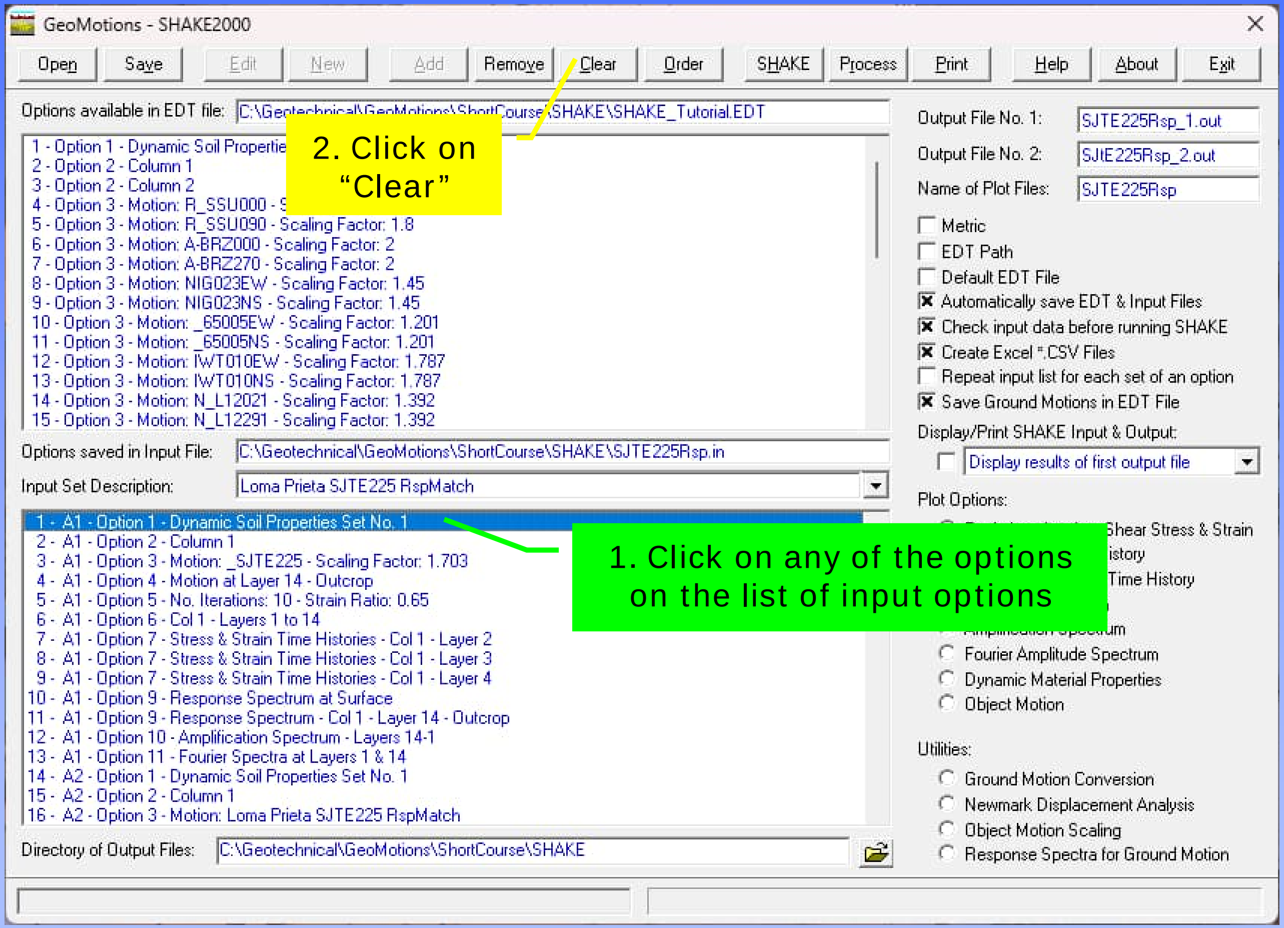
Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration of Column 2



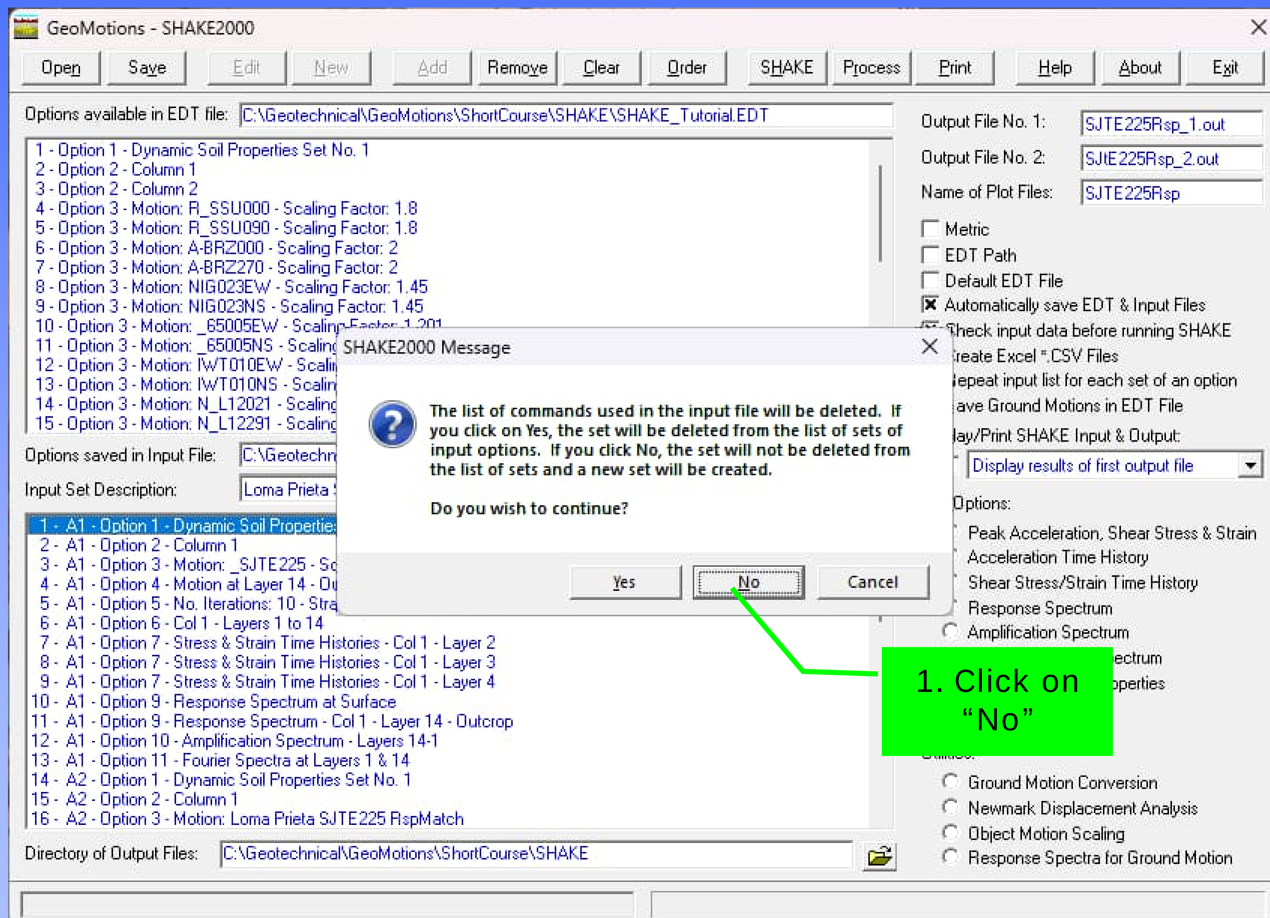
Site Specific Response Analysis

Create List of Input Options for D-MOD Calibration



Site Specific Response Analysis

Create List of Input Options for Column 2



Site Specific Response Analysis

List of Input Options for D-MOD Calibration

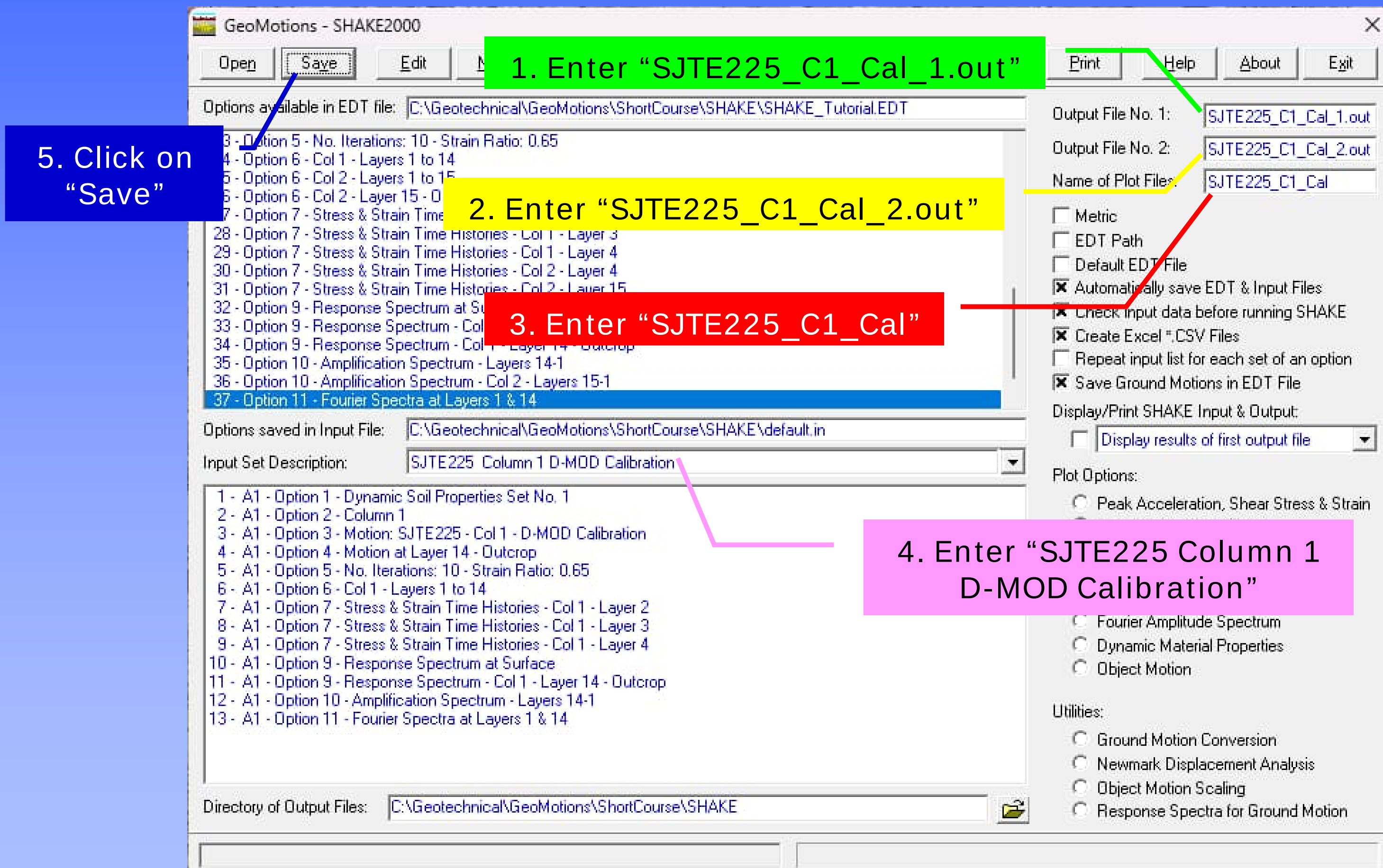
Add the following options to input file list:

Set	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
2	Option 2 – Column 1
19	Option 3 – Motion: SJTE225 – Col 1 – D-MOD Calibration
21	Option 4 – Motion at Layer 14 - Outcrop
23	Option 5 – No. of Iterations: 10 – Strain Ration: 0.65
24	Option 6 – Col 1 – Layers 1 to 14
27	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2
28	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 3
29	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 4
32	Option 9 – Response Spectrum at Surface
34	Option 9 – Response Spectrum – Col 1 – Layer 14 – Outcrop
35	Option 10 – Amplification Spectrum – Layers 14-1
37	Option 11 – Fourier Spectra at Layers 1 & 14

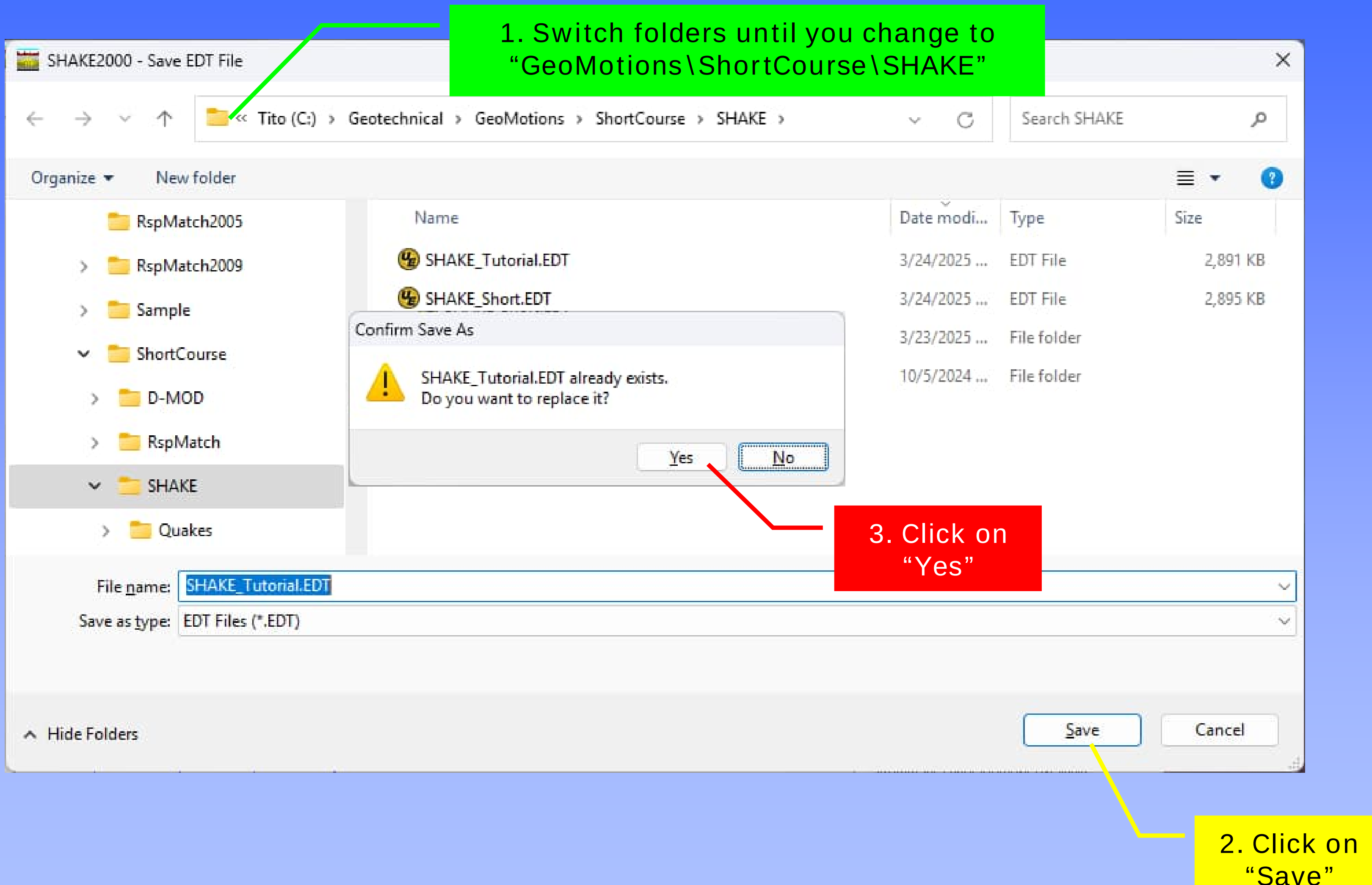
GeoMotions

Site Specific Response Analysis

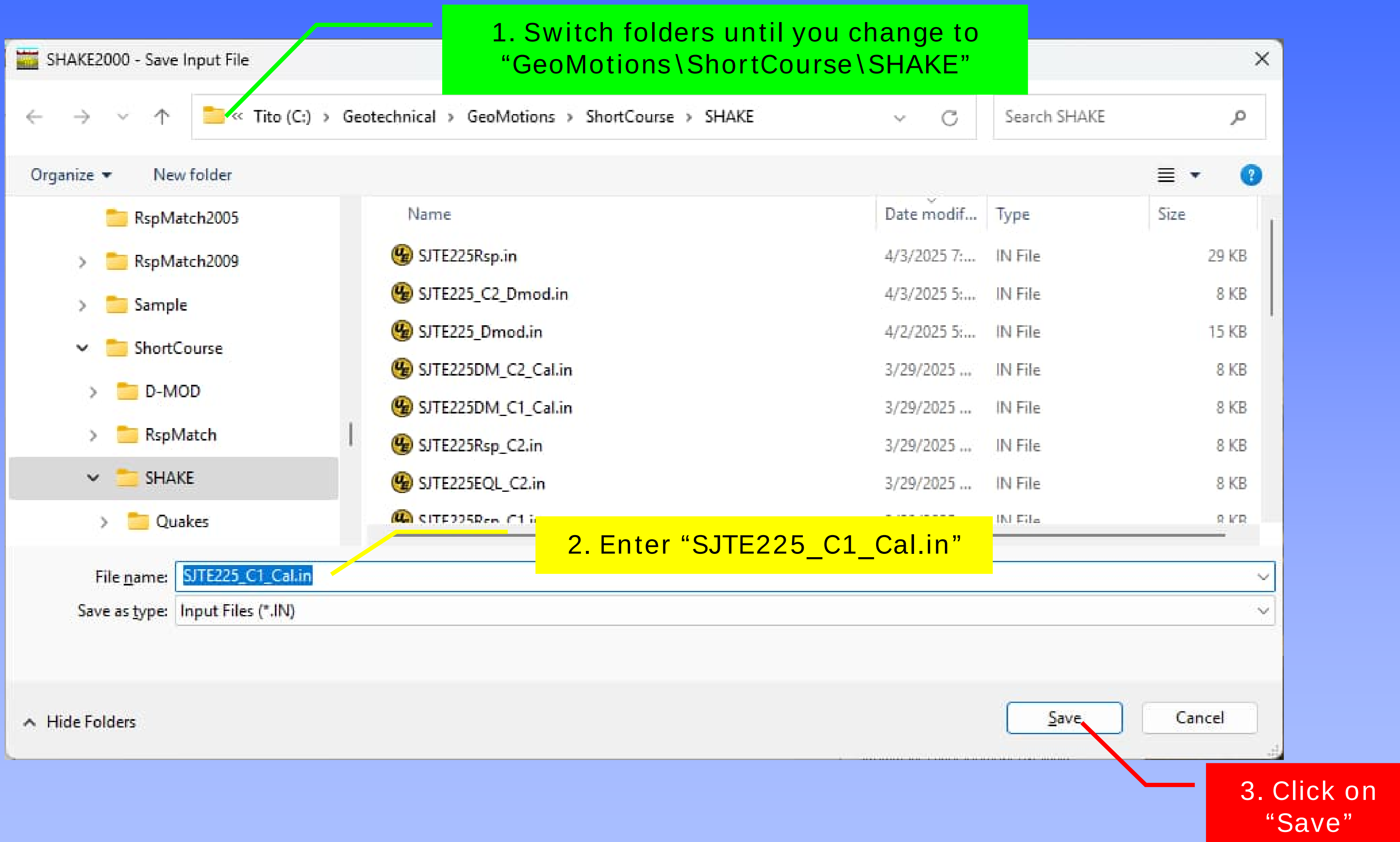
Rename SHAKE's Output and Plot Files



Save EDT File



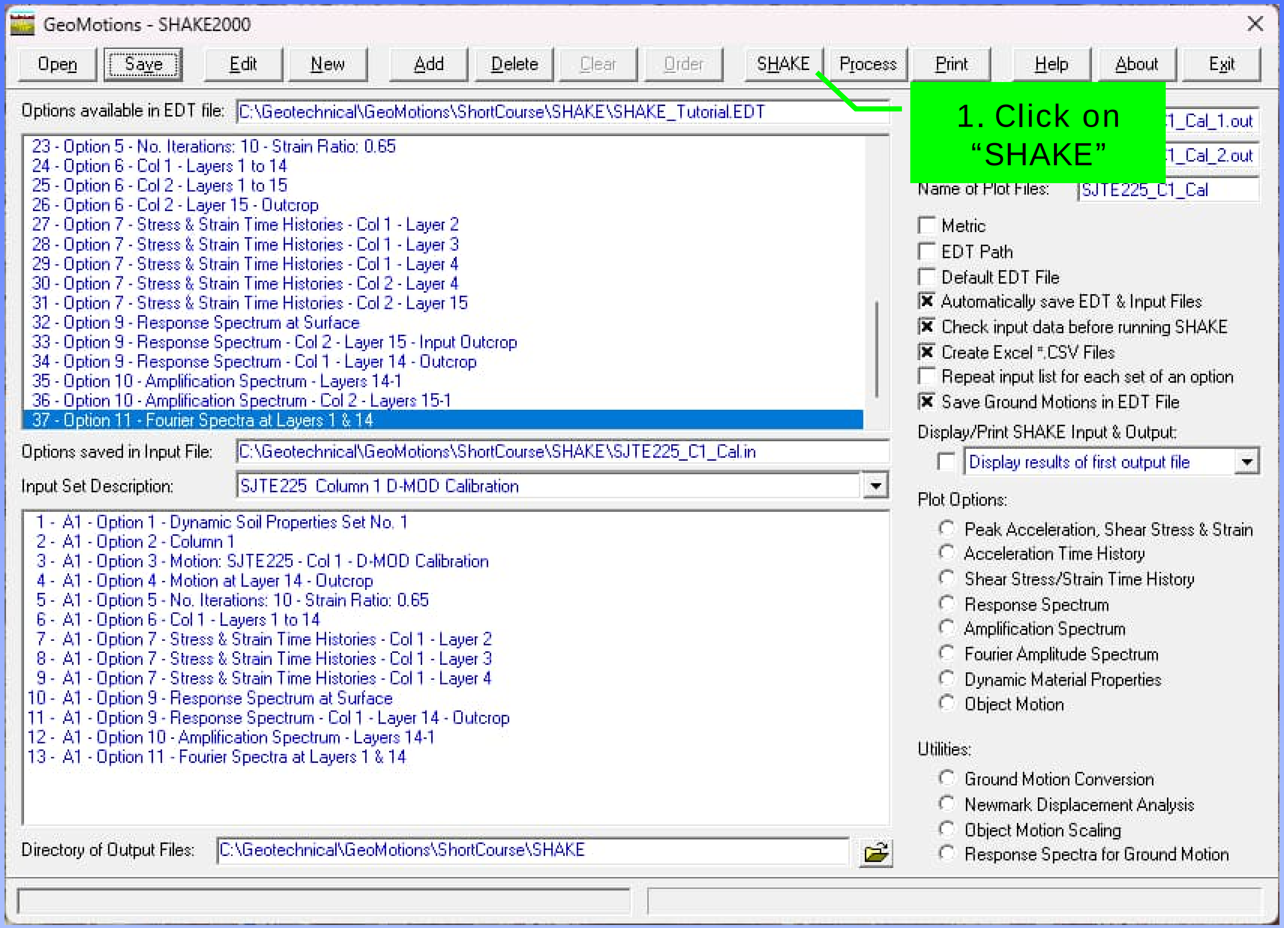
Save Input File



GeoMotions

Site Specific Response Analysis

Execute SHAKE



Site Specific Response Analysis

Execute SHAKE

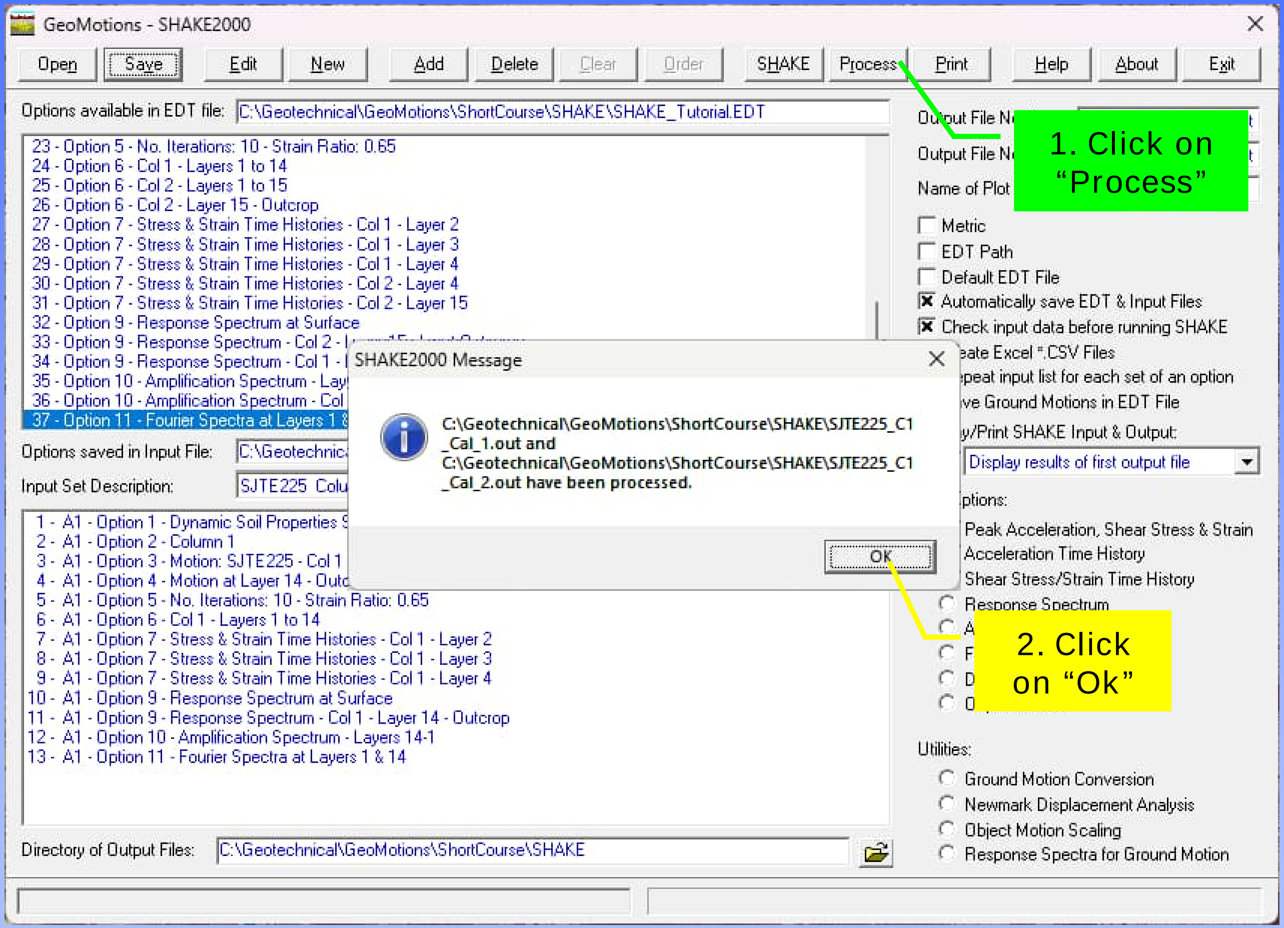
C:\Geotechnical\GeoMotions\

```
*************************************************************
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*     LAYERED SITES by Per Schnable & John Lysmer - 1970  *
* ------------------------------------------------------- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai,Jan 1985 *
* ------------------------------------------------------- *
* SHAKE88 :New modulus reduction curves for clays added   *
*      using results from Sun et al (1988) by J. I. Sun   *
*      & Ramin Golesorkhi February 26, 1988               *
*  -------------------------------------------------------*
* SHAKE90/91: Adjust last iteration; Input now is either  *
*      Gmax or max Vs; up to 13 materials can be specified*
*      by user; up to 50 Layers can be specified; object  *
*      motion can be read in from a separate file and can *
*      user specified format; Different periods for res-  *
*      ponse spectral calculations;options are renumbered;*
*      and general cleanup by: J. I. Sun, I. M. Idriss &  *
*      P. Dirrim June 1990 - February 1991                *
*  ------------------------------------------------------ *
* SHAKE91: General cleanup and finalization of input out- *
*      output format, etc. by: I. M. Idriss December 1991 *
*  ------------------------------------------------------ *
* SHAKE2000: Fix incorrect output of total stress in      *
* option 2, changed path to ground motion file in         *
* SHAKE91, input file, increased motion to 30,000 values  *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020   *
*          RUN DATE  3/15/2025                            *
*          RUN TIME 16:40                                 *
*************************************************************
```


GeoMotions

Site Specific Response Analysis

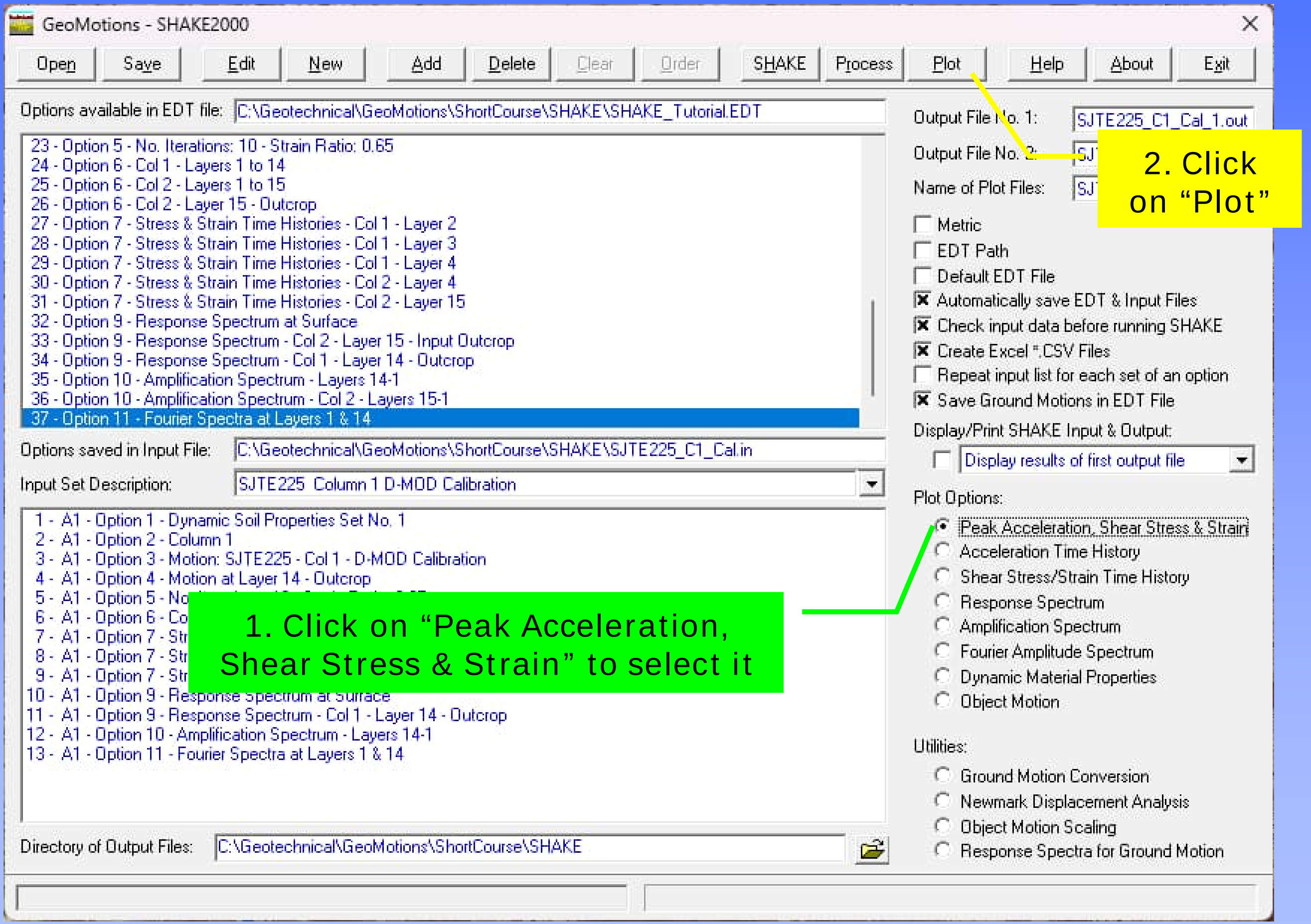
Process SHAKE's Output Files



GeoMotions

Site Specific Response Analysis

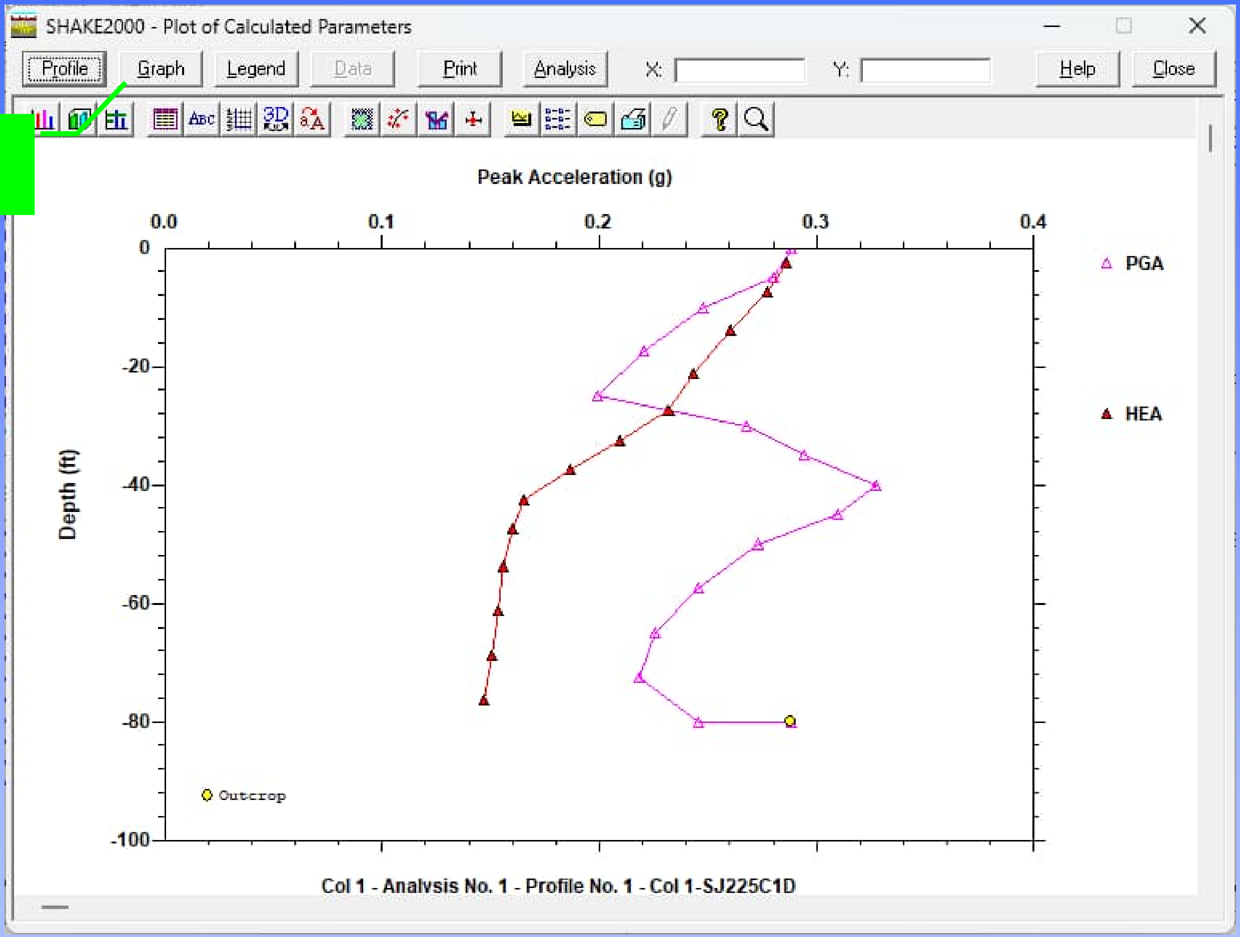
Plot Results



GeoMotions

Plot Acceleration and Strain for Column No. 1

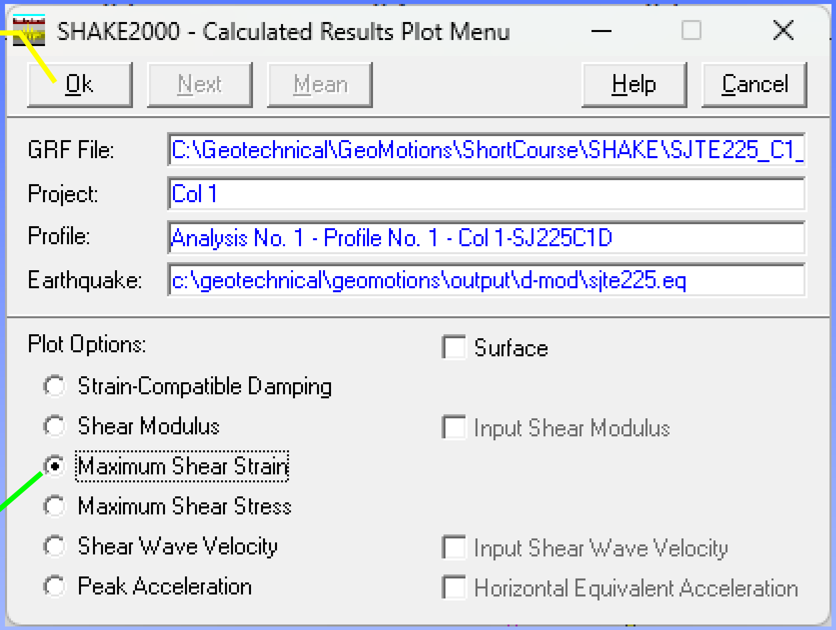
1. Click on "Graph"



If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Plot Acceleration and Strain for Column No. 1

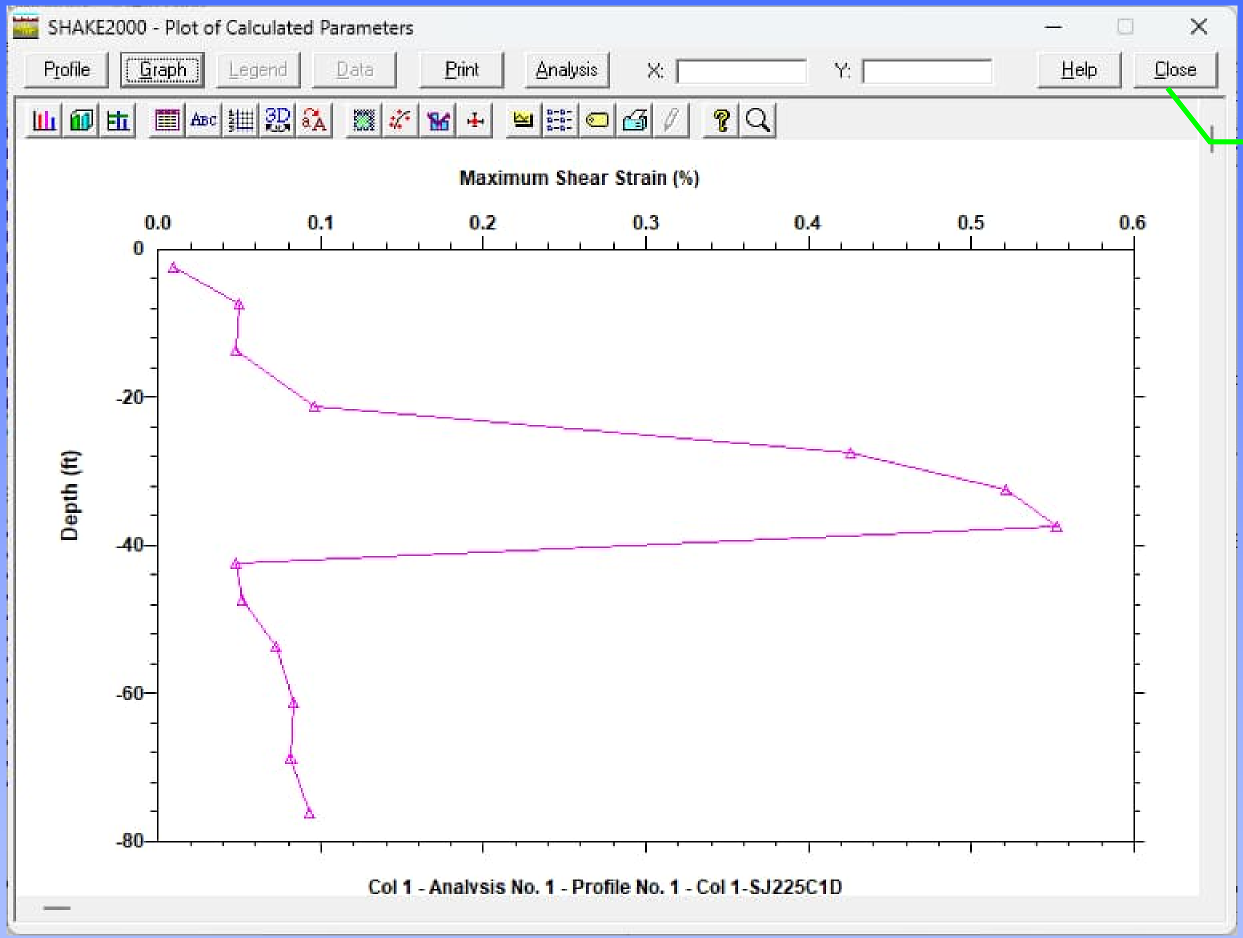
2. Click on "Ok"



1. Select "Maximum … "

GeoMotions

Plot Acceleration and Strain for Column No. 1



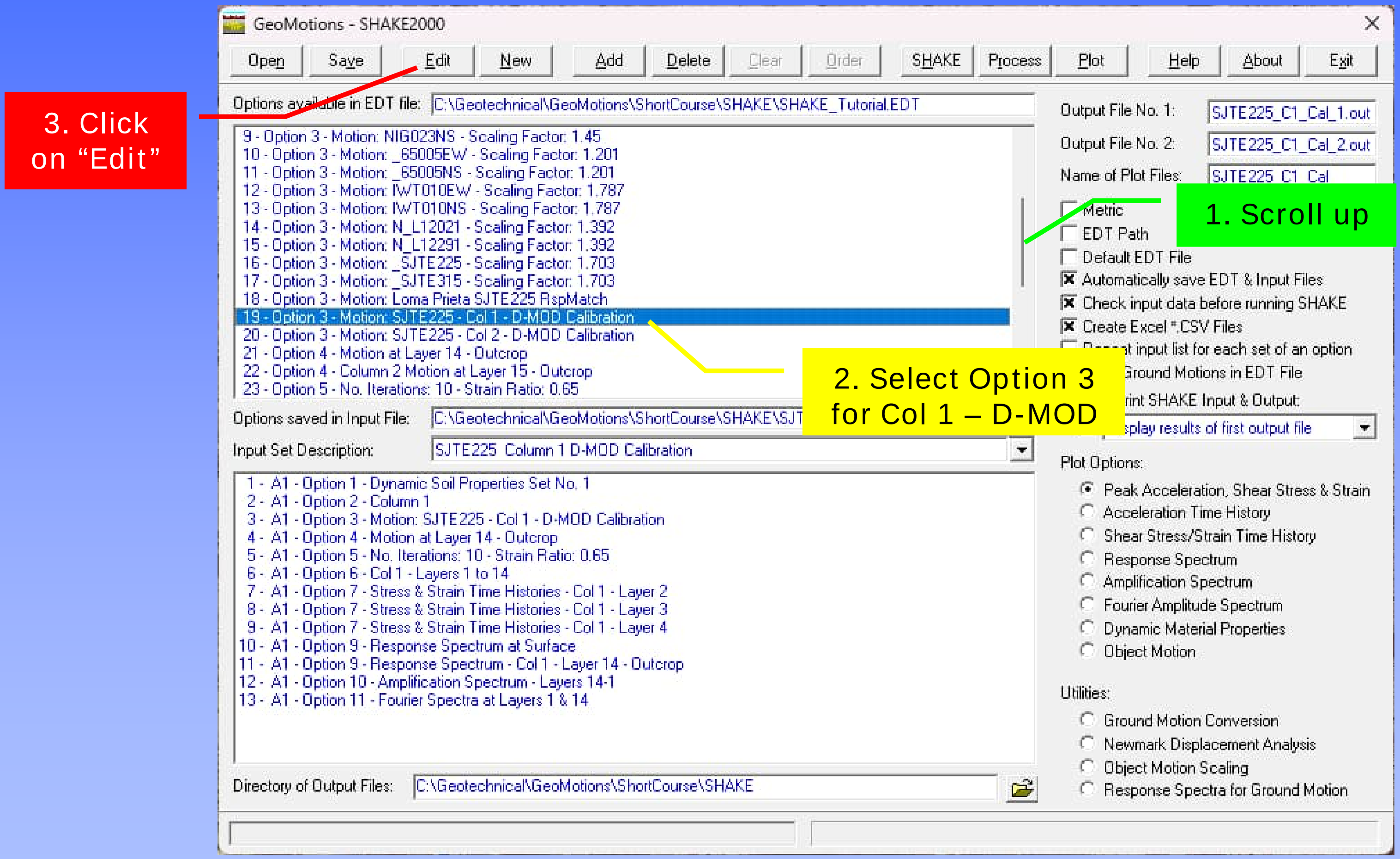
1. Click on "Close"

If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

GeoMotions

Site Specific Response Analysis

Modify Scaling Factor

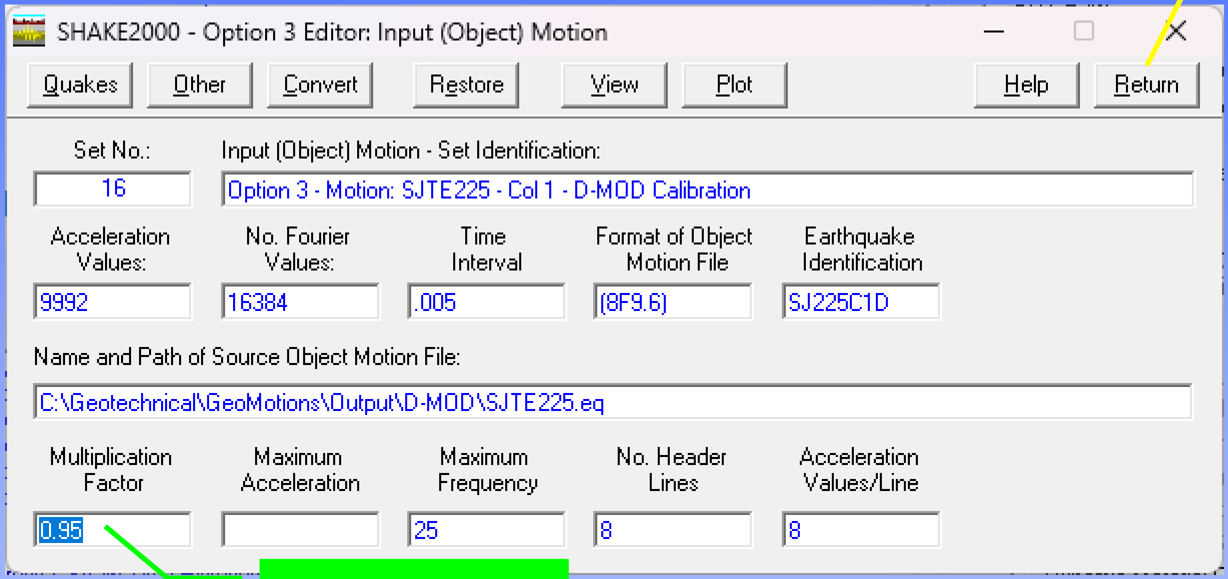


GeoMotions

Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration of Column 1

Modify Scaling Factor



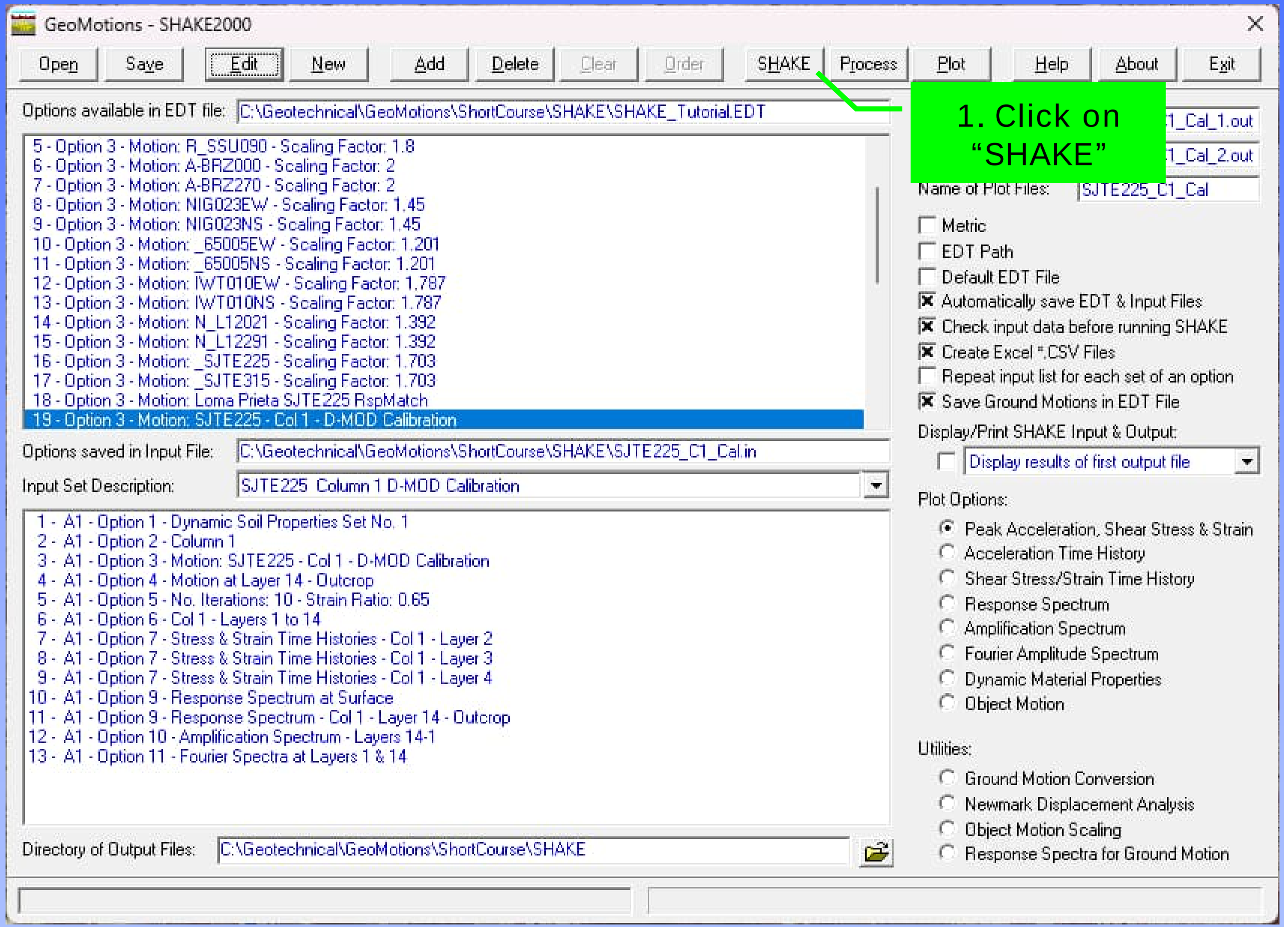
2. Click on "Return"

1. Enter "0.95"

GeoMotions

Site Specific Response Analysis

Execute SHAKE



Site Specific Response Analysis

Execute SHAKE

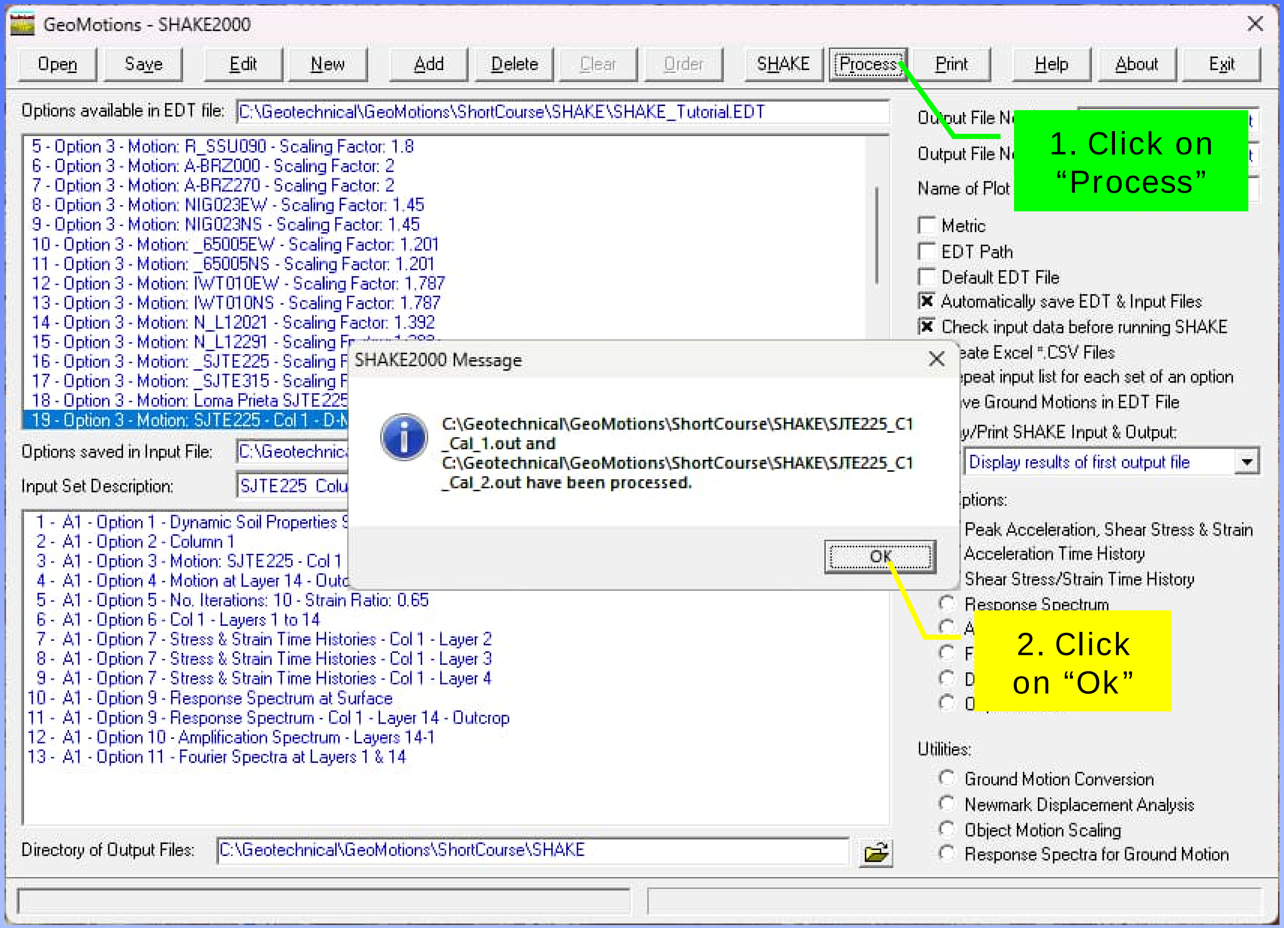
C:\Geotechnical\GeoMotions\

```
**************************************************************
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*    LAYERED SITES by Per Schnable & John Lysmer - 1970  *
* ------------------------------------------------------- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai,Jan 1985 *
* ------------------------------------------------------- *
* SHAKE88 :New modulus reduction curves for clays added   *
*      using results from Sun et al (1988) by J. I. Sun   *
*      & Ramin Golesorkhi February 26, 1988               *
*  -------------------------------------------------------*
* SHAKE90/91: Adjust last iteration; Input now is either  *
*      Gmax or max Vs; up to 13 materials can be specified*
*      by user; up to 50 Layers can be specified; object  *
*      motion can be read in from a separate file and can *
*      user specified format; Different periods for res-  *
*      ponse spectral calculations;options are renumbered;*
*      and general cleanup by: J. I. Sun, I. M. Idriss &  *
*      P. Dirrim June 1990 - February 1991                *
*  ------------------------------------------------------ *
* SHAKE91: General cleanup and finalization of input out- *
*      output format, etc. by: I. M. Idriss December 1991 *
*  ------------------------------------------------------ *
* SHAKE2000: Fix incorrect output of total stress in      *
* option 2, changed path to ground motion file in         *
* SHAKE91, input file, increased motion to 30,000 values  *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020   *
*          RUN DATE  3/15/2025                            *
*          RUN TIME 16:40                                 *
**************************************************************
```


GeoMotions

Site Specific Response Analysis

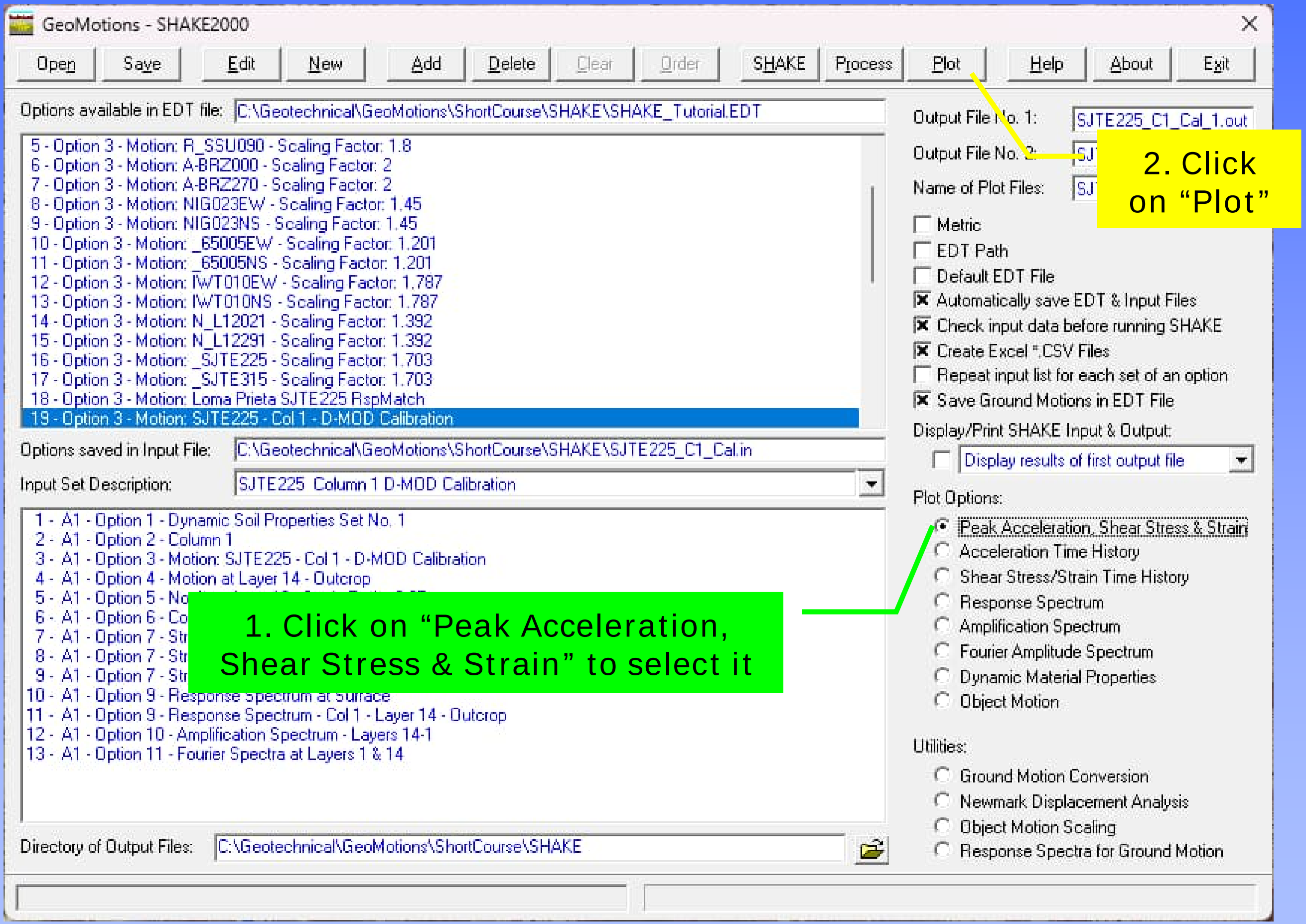
Process SHAKE's Output Files



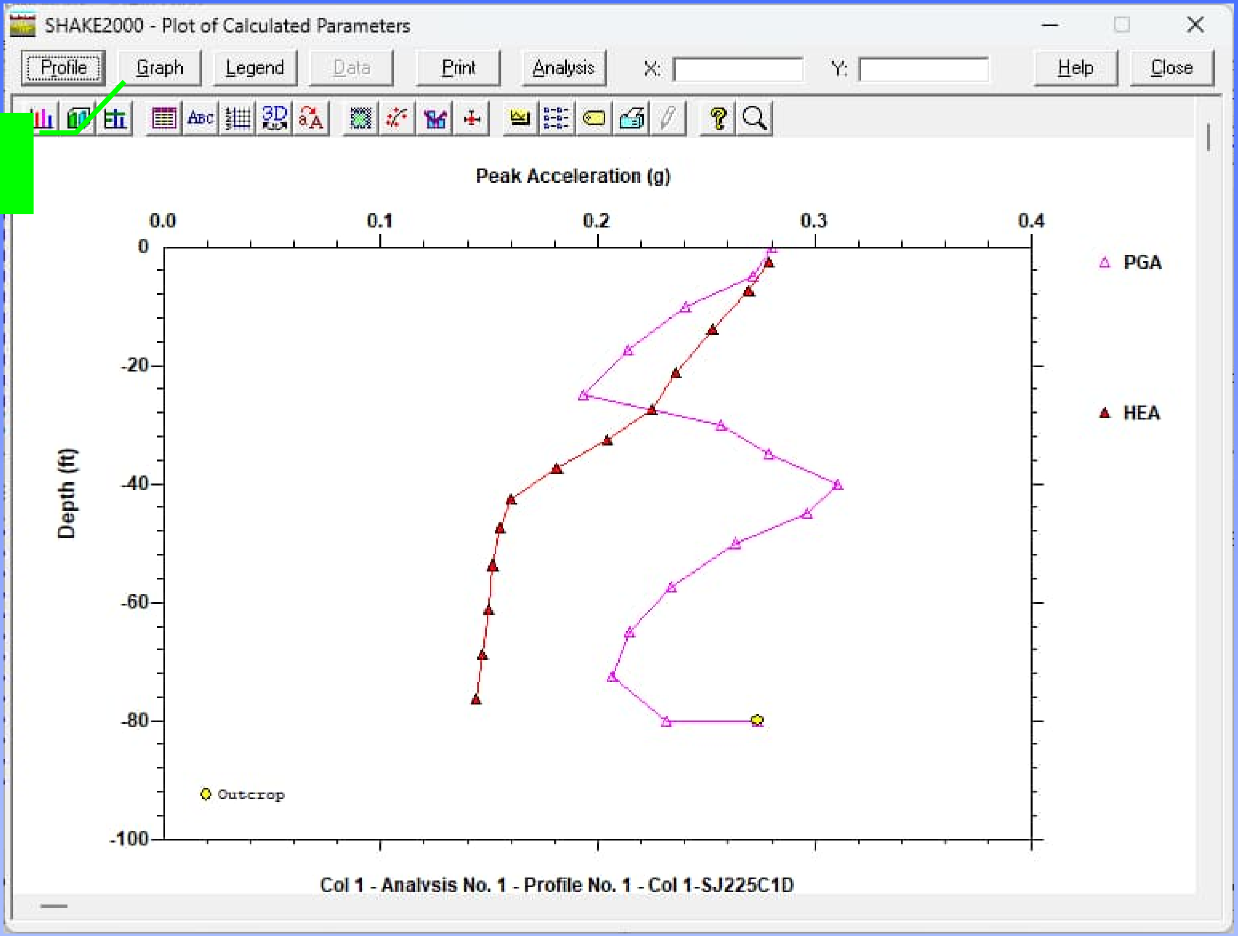
GeoMotions

Site Specific Response Analysis

Plot Results



Plot Acceleration and Strain for Column No. 1



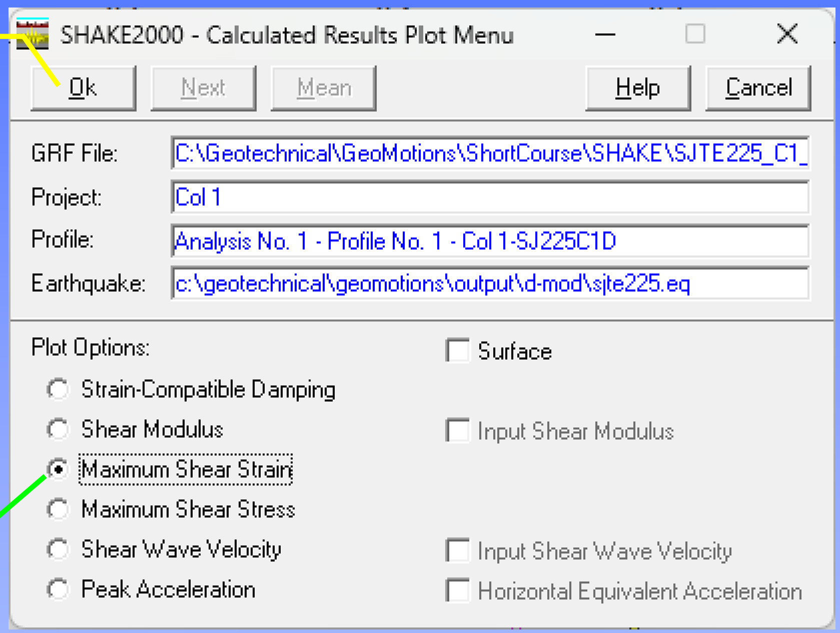
1. Click on "Graph"

If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

GeoMotions

Plot Acceleration and Strain for Column No. 1

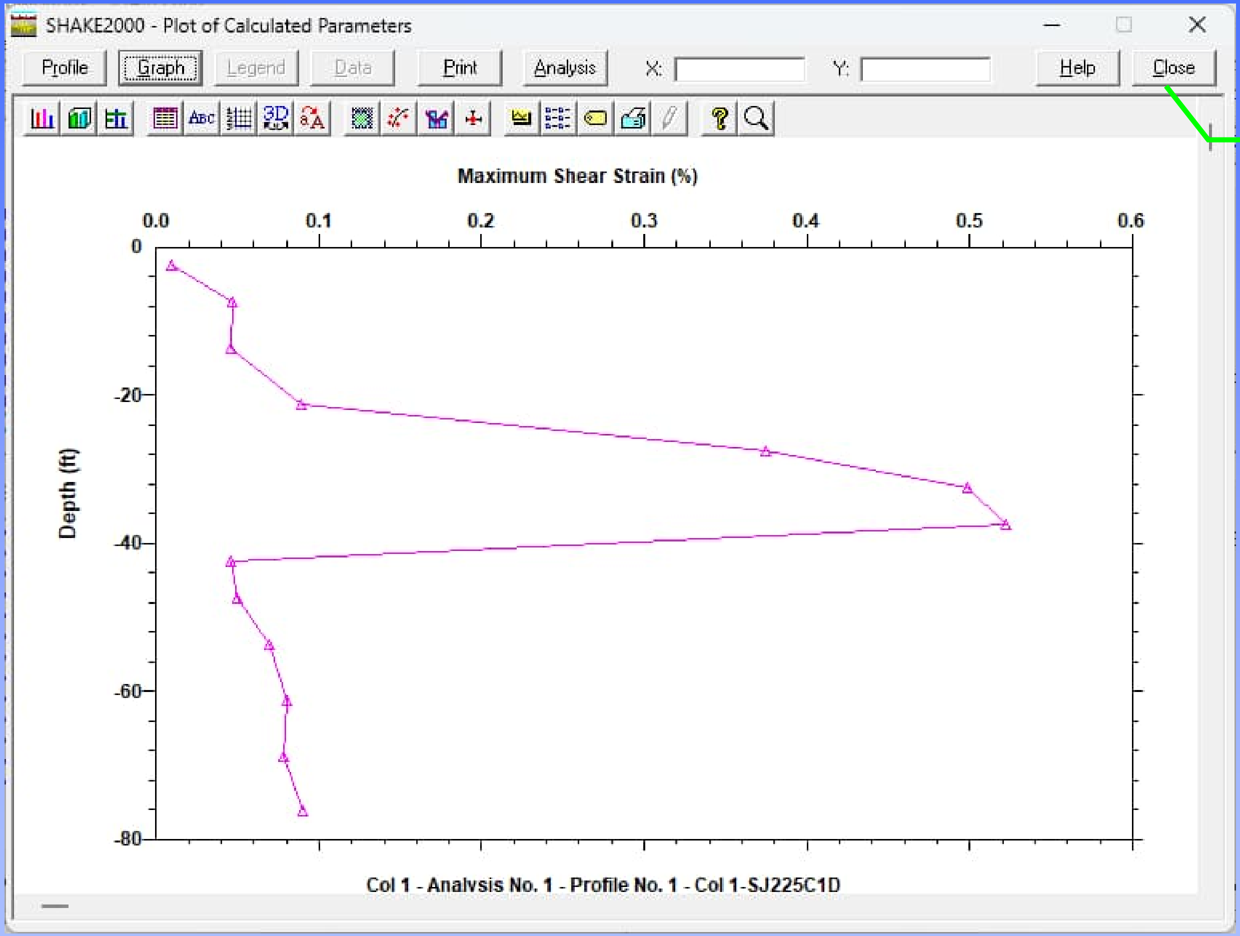
2. Click on “Ok”



1. Select “Maximum … “

GeoMotions

Plot Acceleration and Strain for Column No. 1

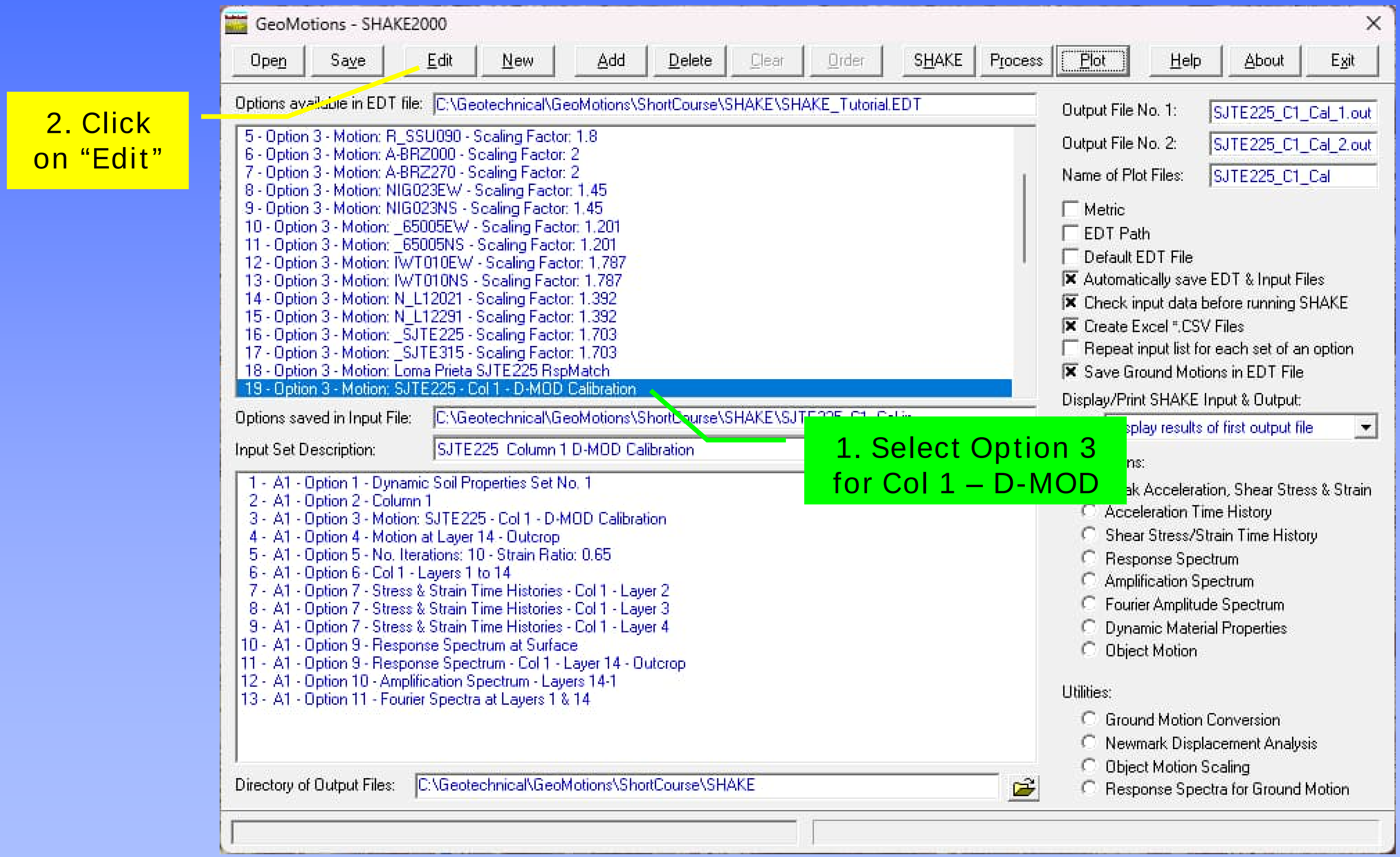


1. Click on "Close"

If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Site Specific Response Analysis

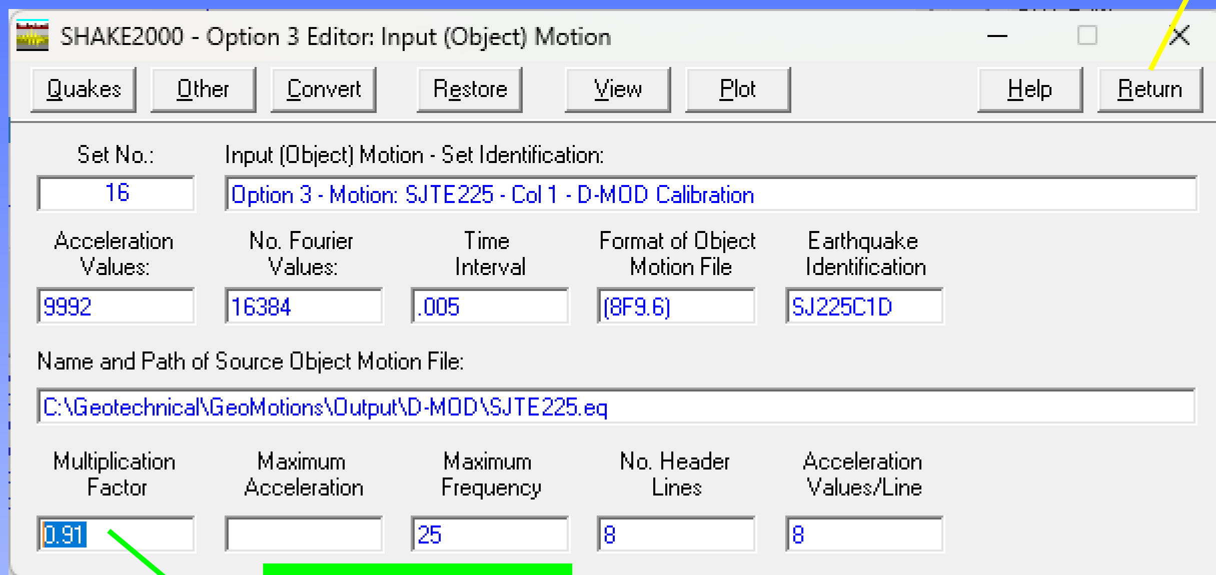
Modify Scaling Factor



Site Specific Response Analysis

Option 3: Input Motion for D-MOD Calibration of Column 1

Modify Scaling Factor



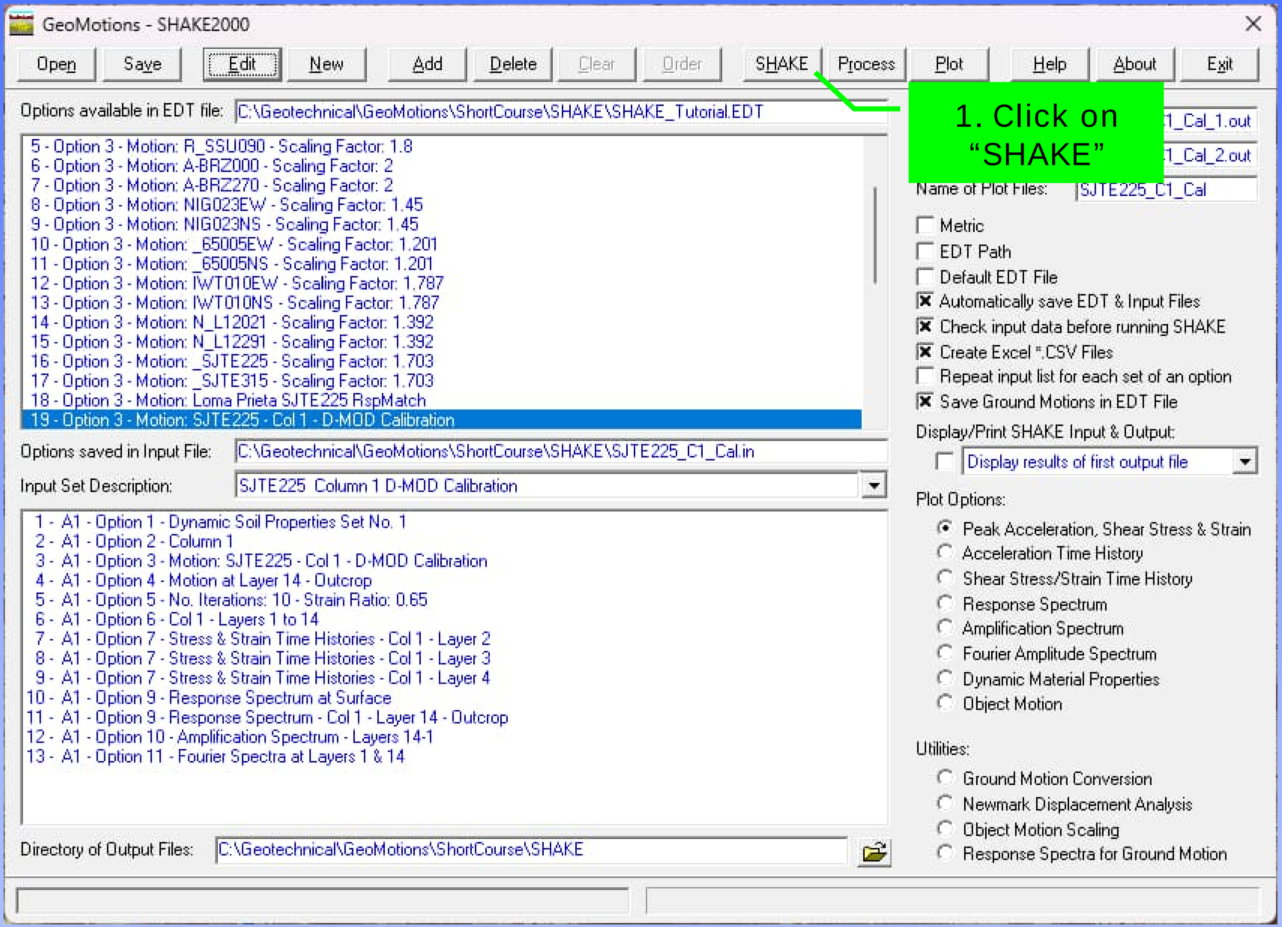
2. Click on “Return”

1. Enter “0.91”

GeoMotions

Site Specific Response Analysis

Execute SHAKE



GeoMotions

Site Specific Response Analysis

Execute SHAKE

C:\Geotechnical\GeoMotions\

```
***********************************************************
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*     LAYERED SITES by Per Schnable & John Lysmer - 1970  *
* ------------------------------------------------------- *
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* ------------------------------------------------------- *
* SHAKE88 :New modulus reduction curves for clays added   *
*      using results from Sun et al (1988) by J. I. Sun   *
*      & Ramin Golesorkhi February 26, 1988               *
*  -------------------------------------------------------*
* SHAKE90/91: Adjust last iteration; Input now is either  *
*      Gmax or max Vs; up to 13 materials can be specified*
*      by user; up to 50 Layers can be specified; object  *
*      motion can be read in from a separate file and can *
*      user specified format; Different periods for res-  *
*      ponse spectral calculations;options are renumbered;*
*      and general cleanup by: J. I. Sun, I. M. Idriss &  *
*      P. Dirrim June 1990 - February 1991                *
*  ------------------------------------------------------ *
* SHAKE91: General cleanup and finalization of input out- *
*      output format, etc. by: I. M. Idriss December 1991 *
*  ------------------------------------------------------ *
* SHAKE2000: Fix incorrect output of total stress in      *
* option 2, changed path to ground motion file in         *
* SHAKE91, input file, increased motion to 30,000 values  *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020   *
*         RUN DATE  3/15/2025                             *
*         RUN TIME 16:40                                  *
***********************************************************
```
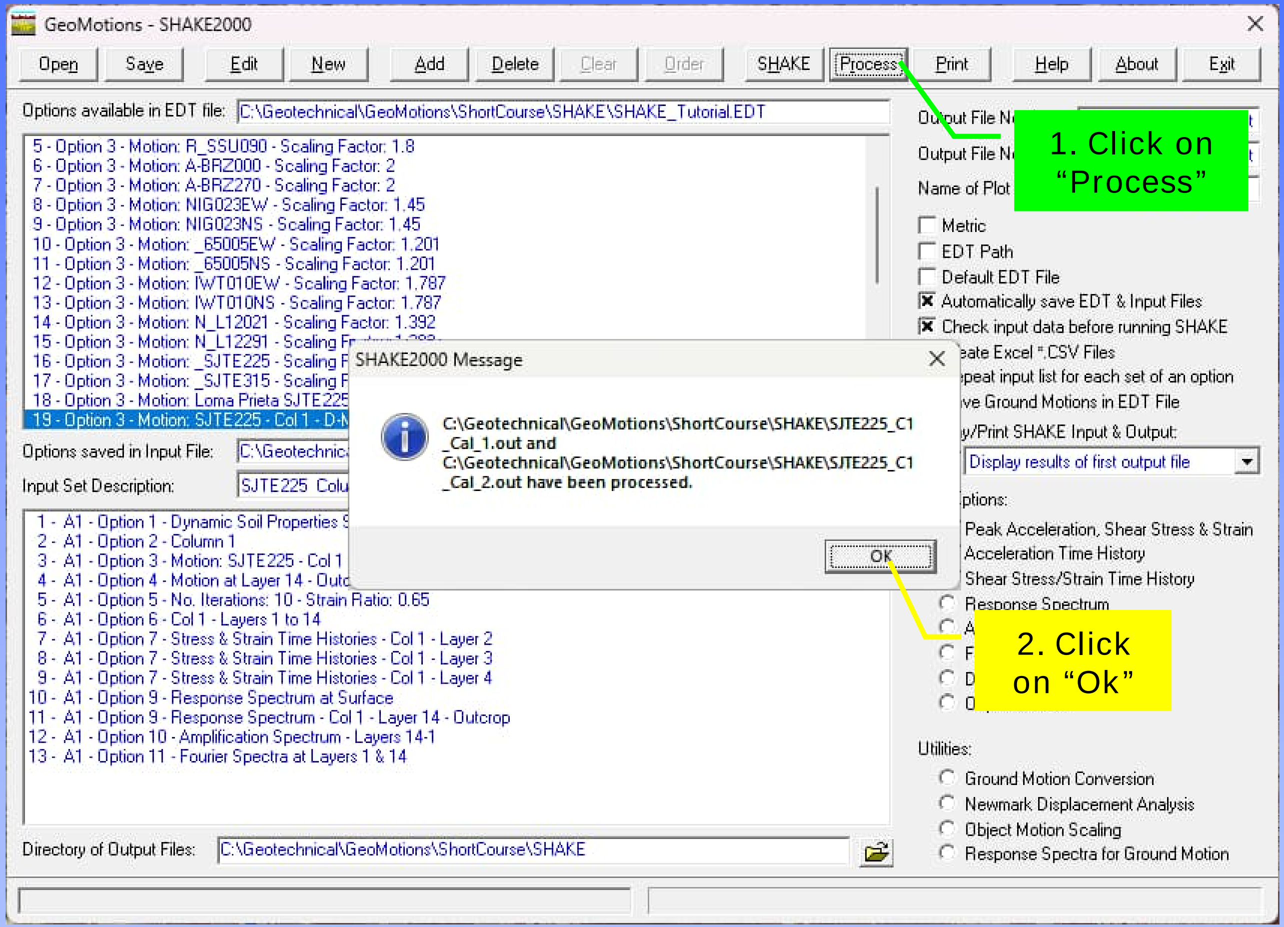


GeoMotions

Site Specific Response Analysis

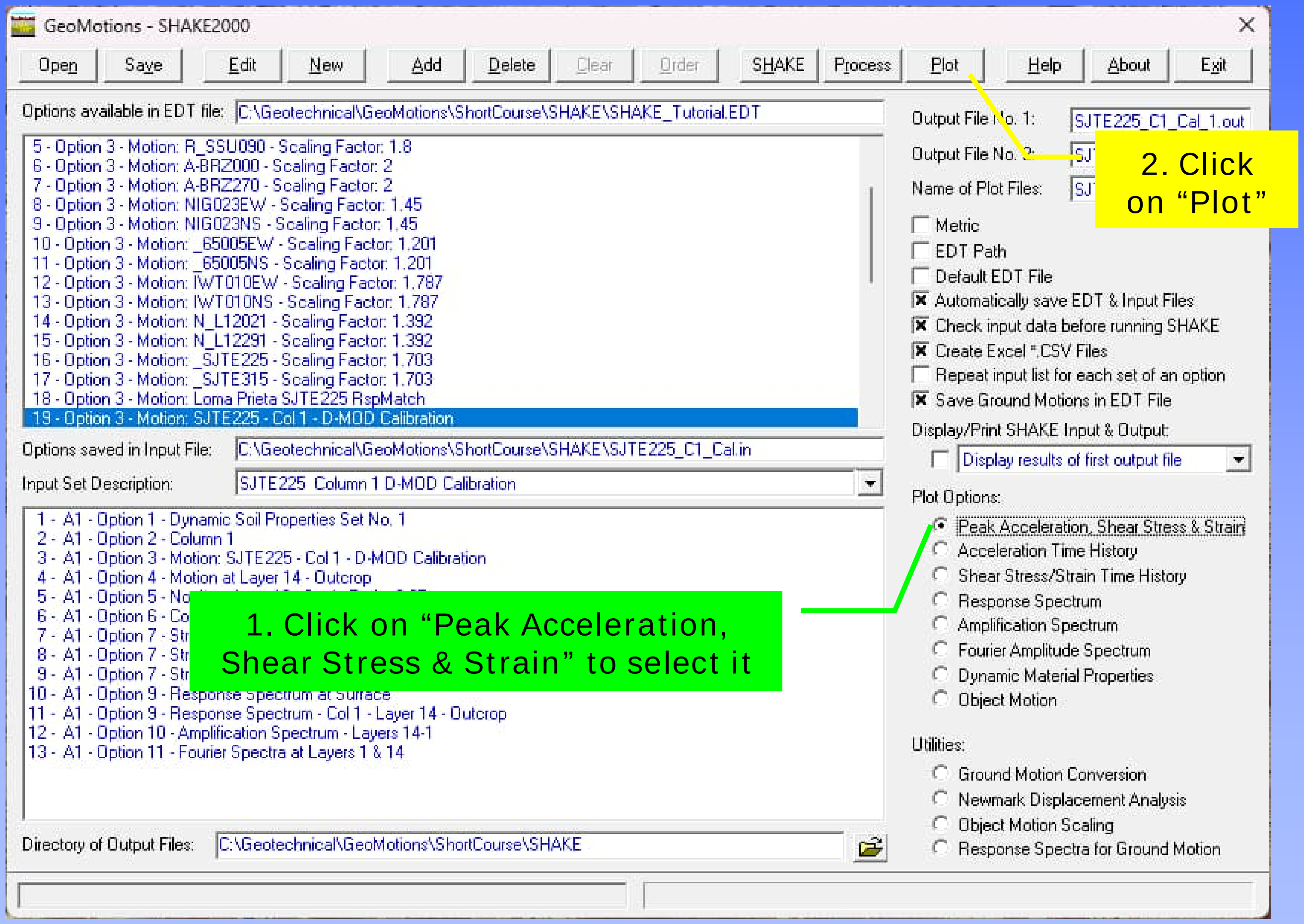
Process SHAKE's Output Files



GeoMotions

Site Specific Response Analysis

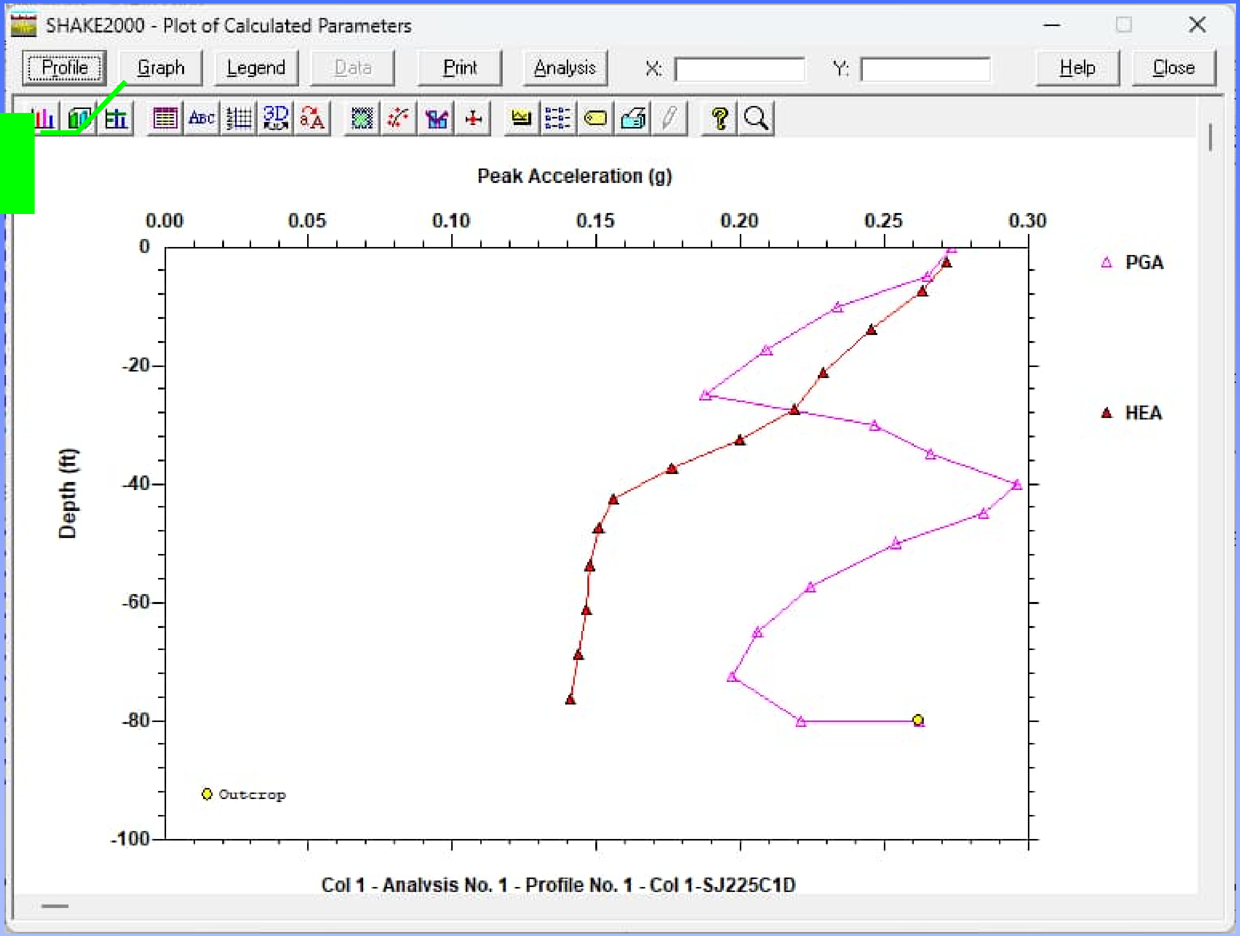
Plot Results



GeoMotions

Plot Acceleration and Strain for Column No. 1

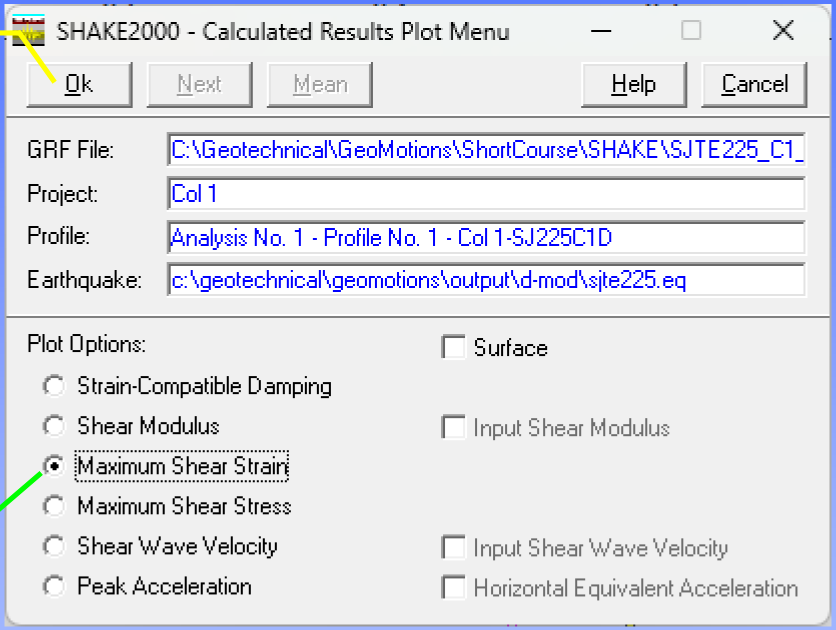
1. Click on "Graph"



If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

Plot Acceleration and Strain for Column No. 1

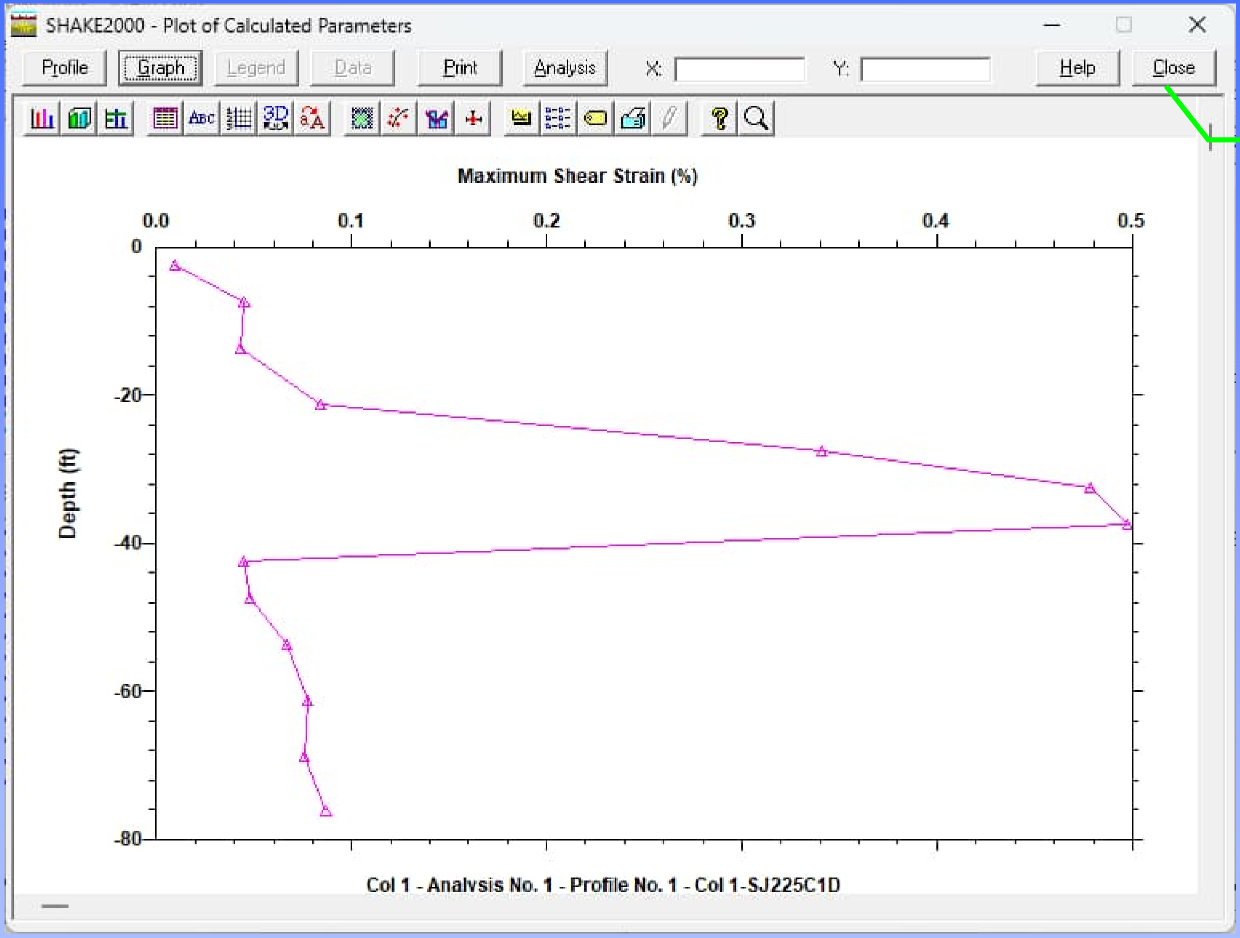
2. Click on “Ok”



1. Select “Maximum … “

GeoMotions

Plot Acceleration and Strain for Column No. 1



1. Click on "Close"

If PGA at surface > 0.40 g's or Strain in the profile > 0.5% then use a different scaling factor in Option 3 to decrease either one or both.

GeoMotions

SHAKE Calibration for D-MOD Analysis

A second approach to estimate viscous damping parameters is by calibrating the D-MOD analysis against a linear SHAKE, analysis for small strain conditions (i.e., use G_{max} and a constant value of 5% damping for all soil layers). More detailed information on this procedure is presented by Stewart et al (2008).

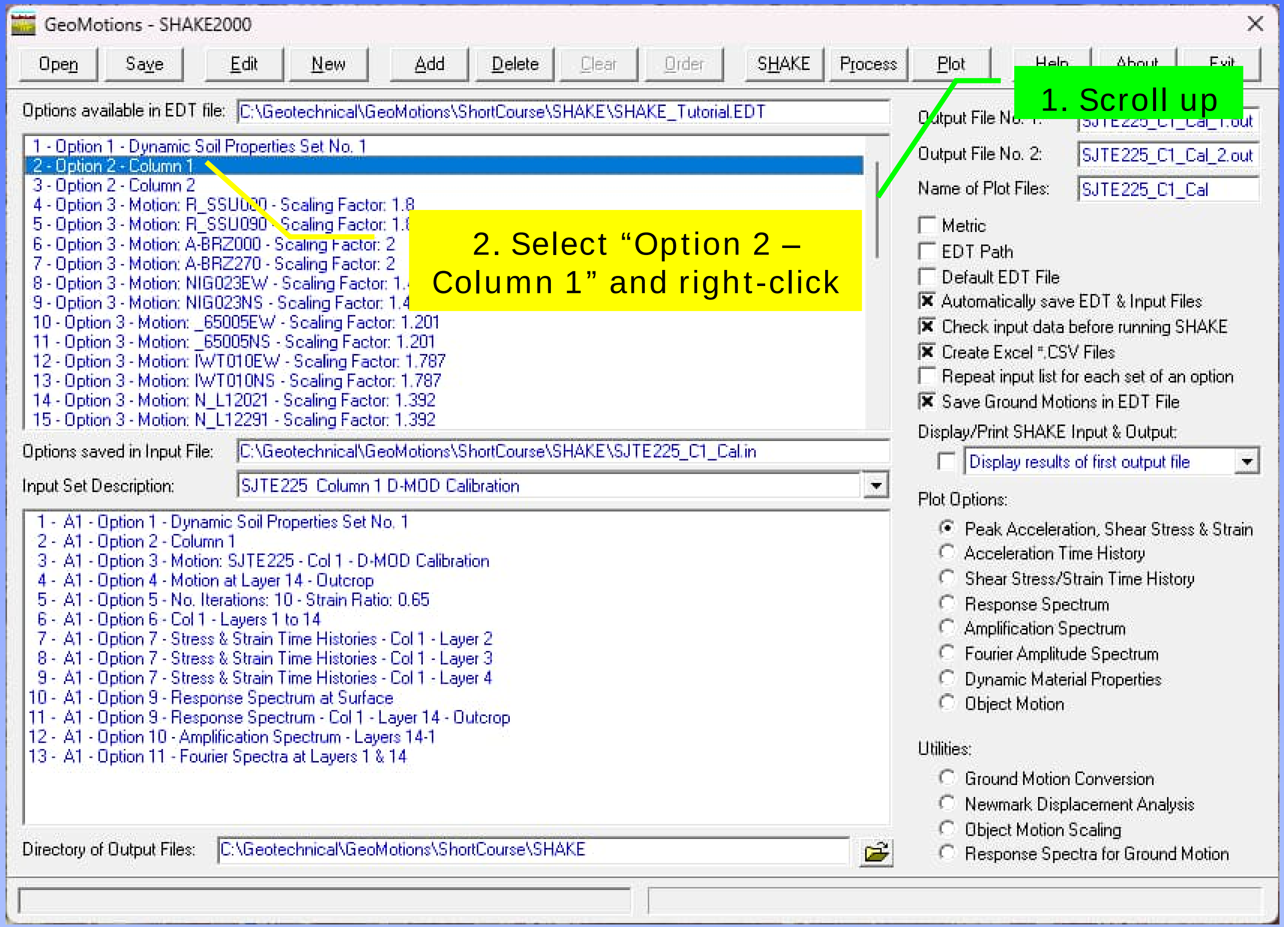
1. Develop a SHAKE column and perform a small strain linear SHAKE analysis to obtain the acceleration time history at the surface level. Use G_{max} and 5% damping for all soil layers (i.e., use "zero" type soils in Option 2). (This tutorial).
2. Develop the D-MOD column to match the SHAKE column as close as possible; use $n = 0$ and $\xi = 5$ for first iteration.
3. Perform a Total-Stress\Linear-Elastic analysis with D-MOD.
4. Compare the surface response spectrum from SHAKE to the response spectrum from D-MOD.
5. Adjust n and ξ and repeat from step 3 until a match between the SHAKE and D-MOD spectra is obtained within a reasonable degree of tolerance. Also, compare peak acceleration & Shear Strain vs. depth obtained from SHAKE and D-MOD.

Stewart, Jonathan P., Annie On-Lei Kwok, Youssef M.A. Hashash, Neven Matasovic, Robert Pyke, Zhiliang Wang, Zhaohui Yang (2008). *Benchmarking of Nonlinear Geotechnical Ground Response Analysis Procedures.* PEER Report 2008/04, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, Berkeley. August 2008.

GeoMotions

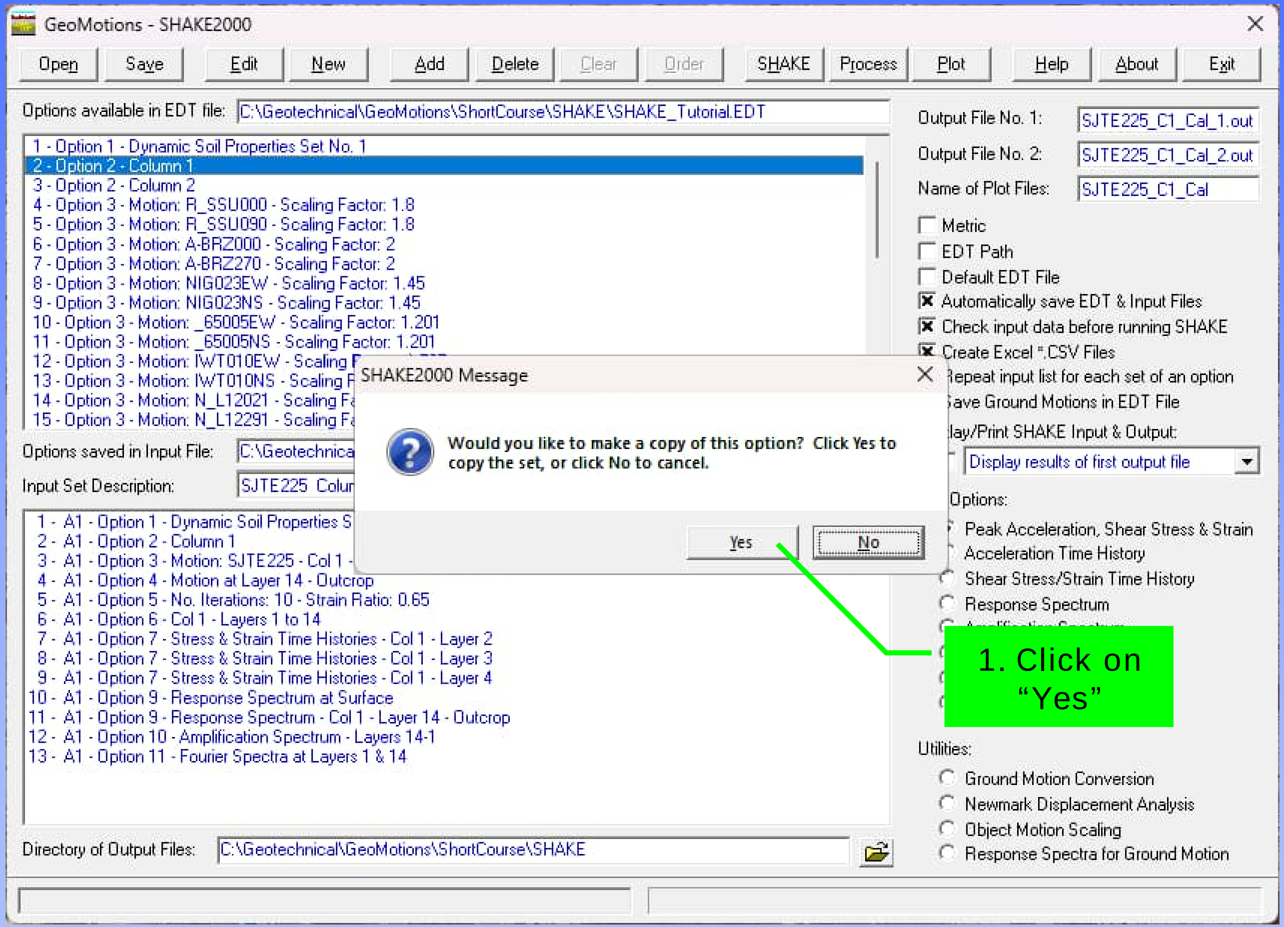
D-MOD Calibration

Small Strain Linear Analysis



D-MOD Calibration

Small Strain Linear Analysis

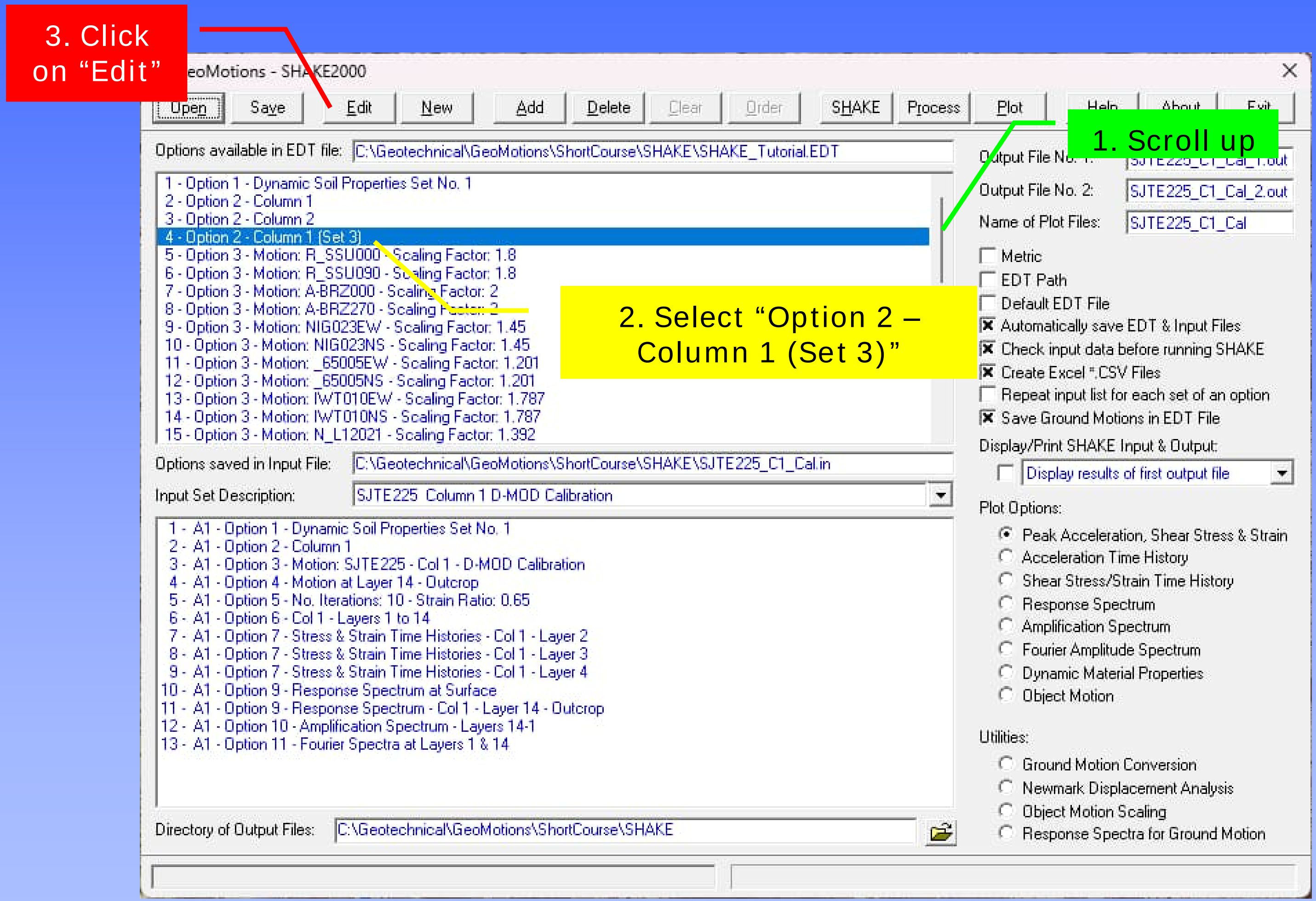


1. Click on "Yes"

GeoMotions

D-MOD Calibration

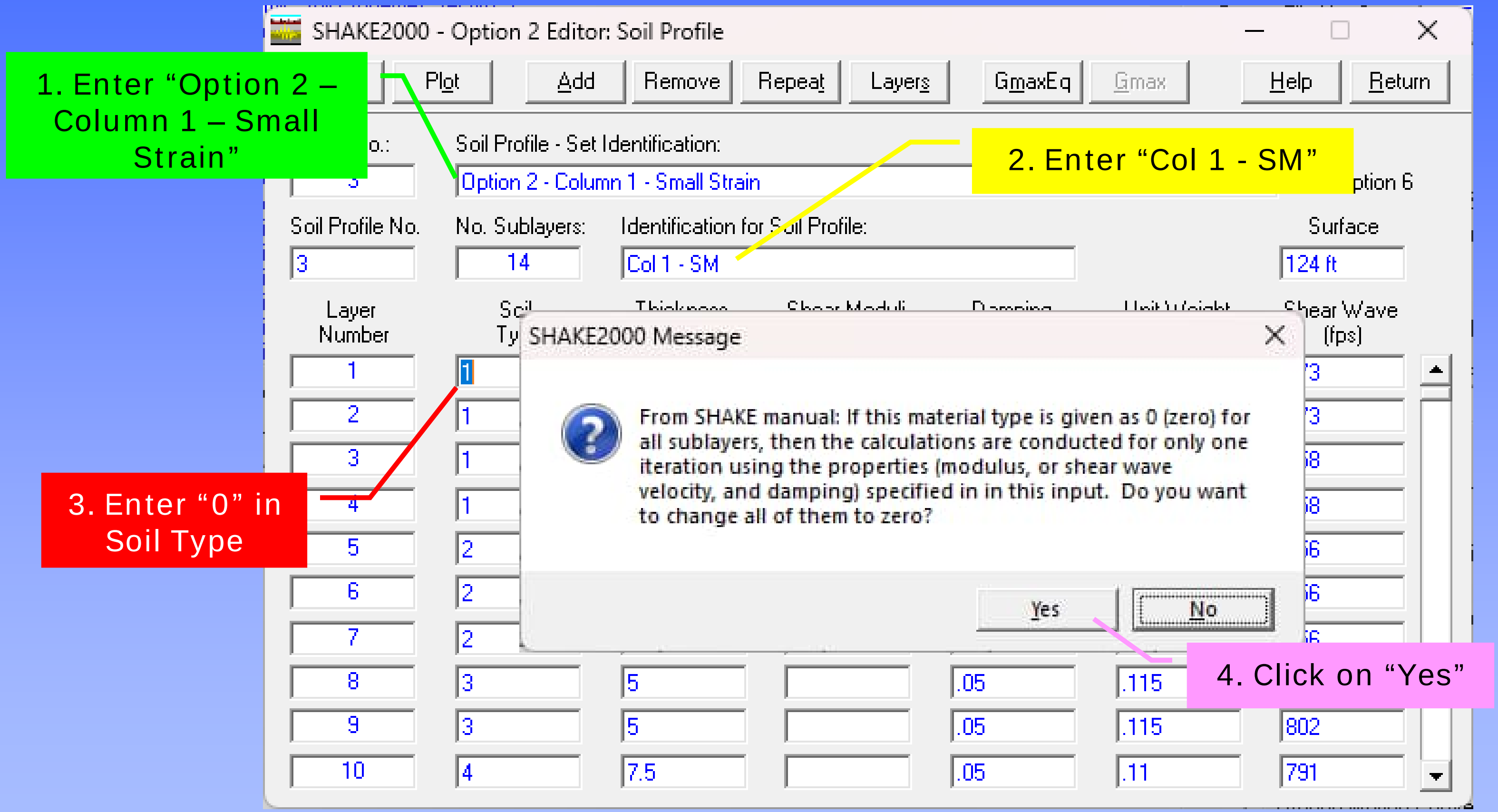
Small Strain Linear Analysis



GeoMotions

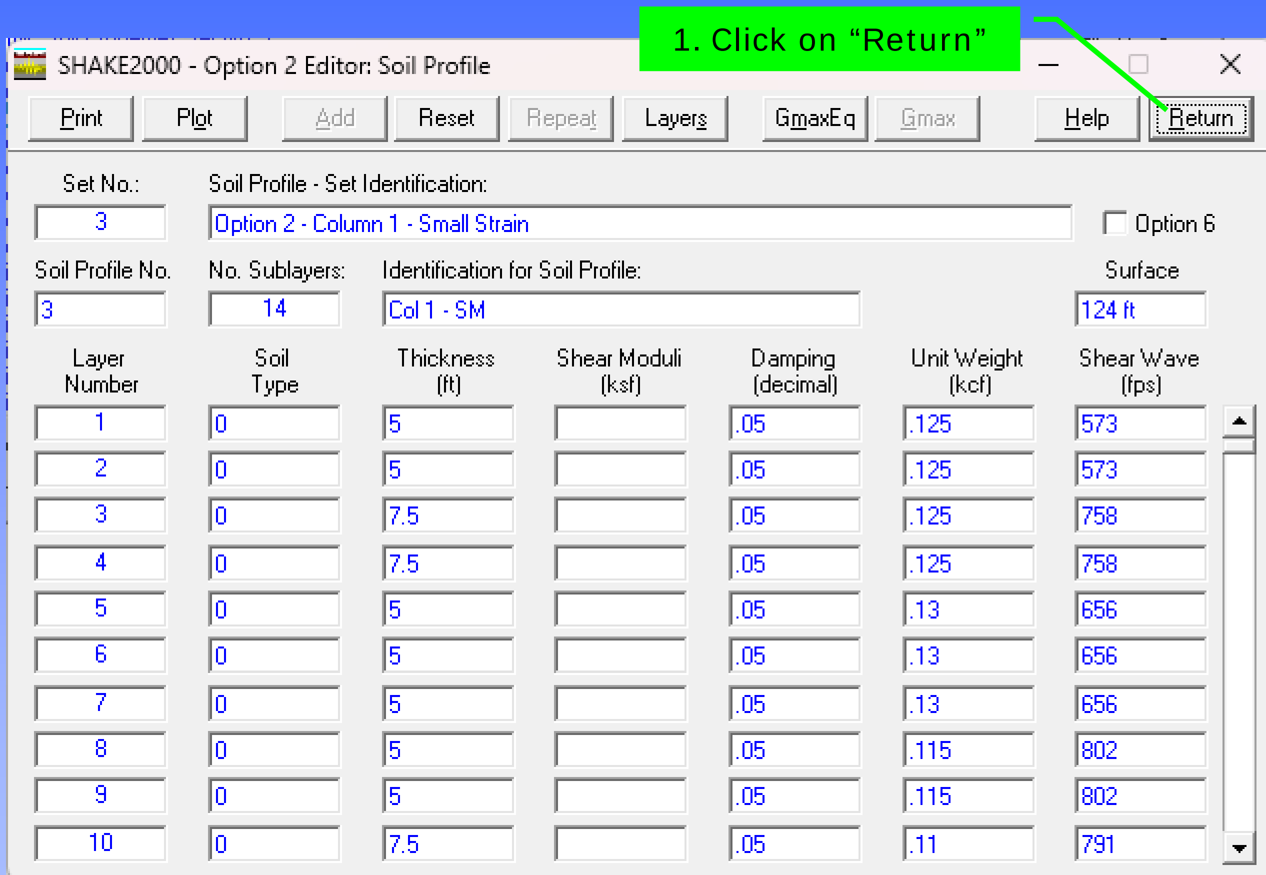
Site Specific Response Analysis

Create Input Data – Option 2: Soil Profile



Site Specific Response Analysis

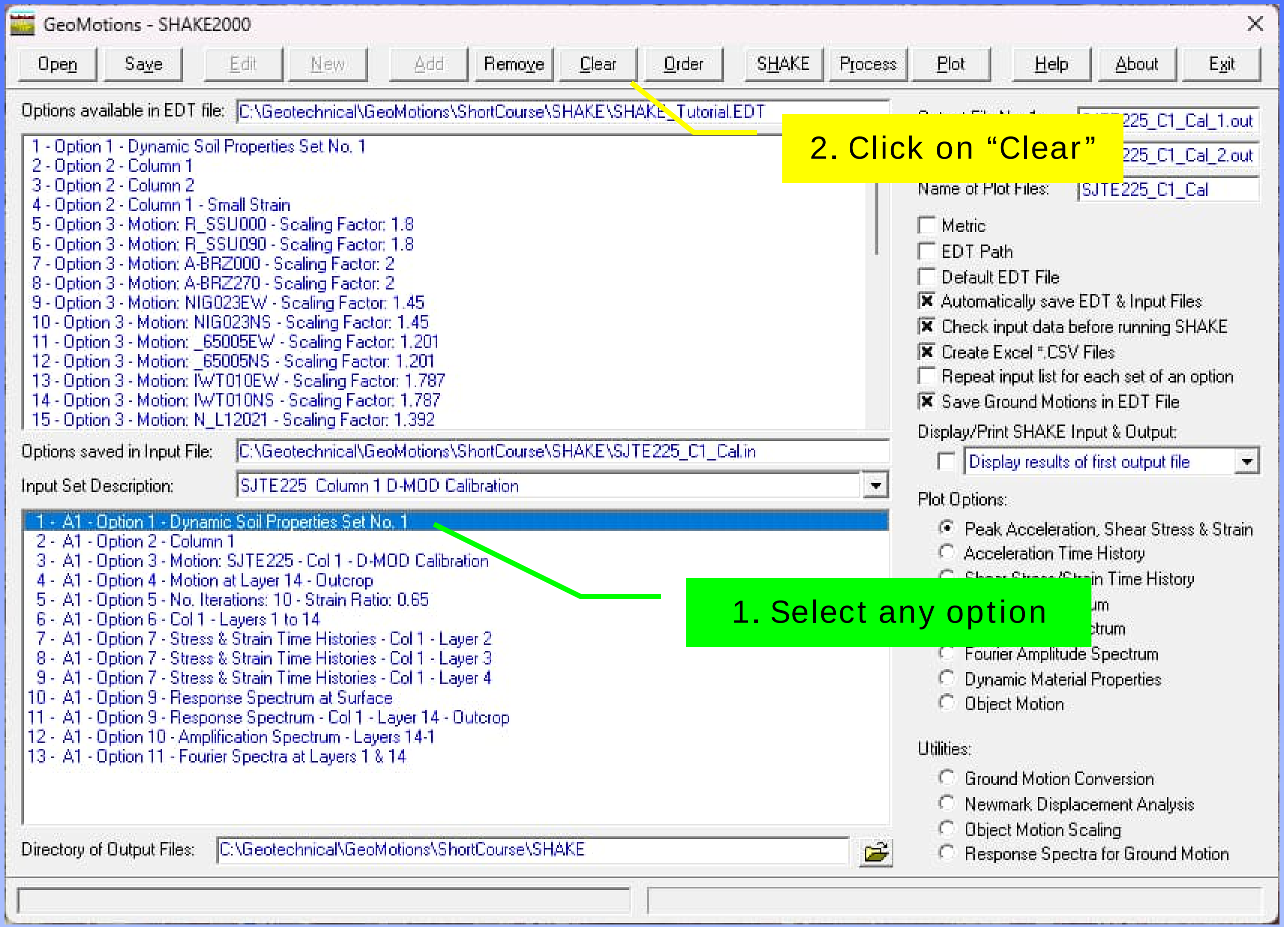
Create Input Data – Option 2: Soil Profile



GeoMotions

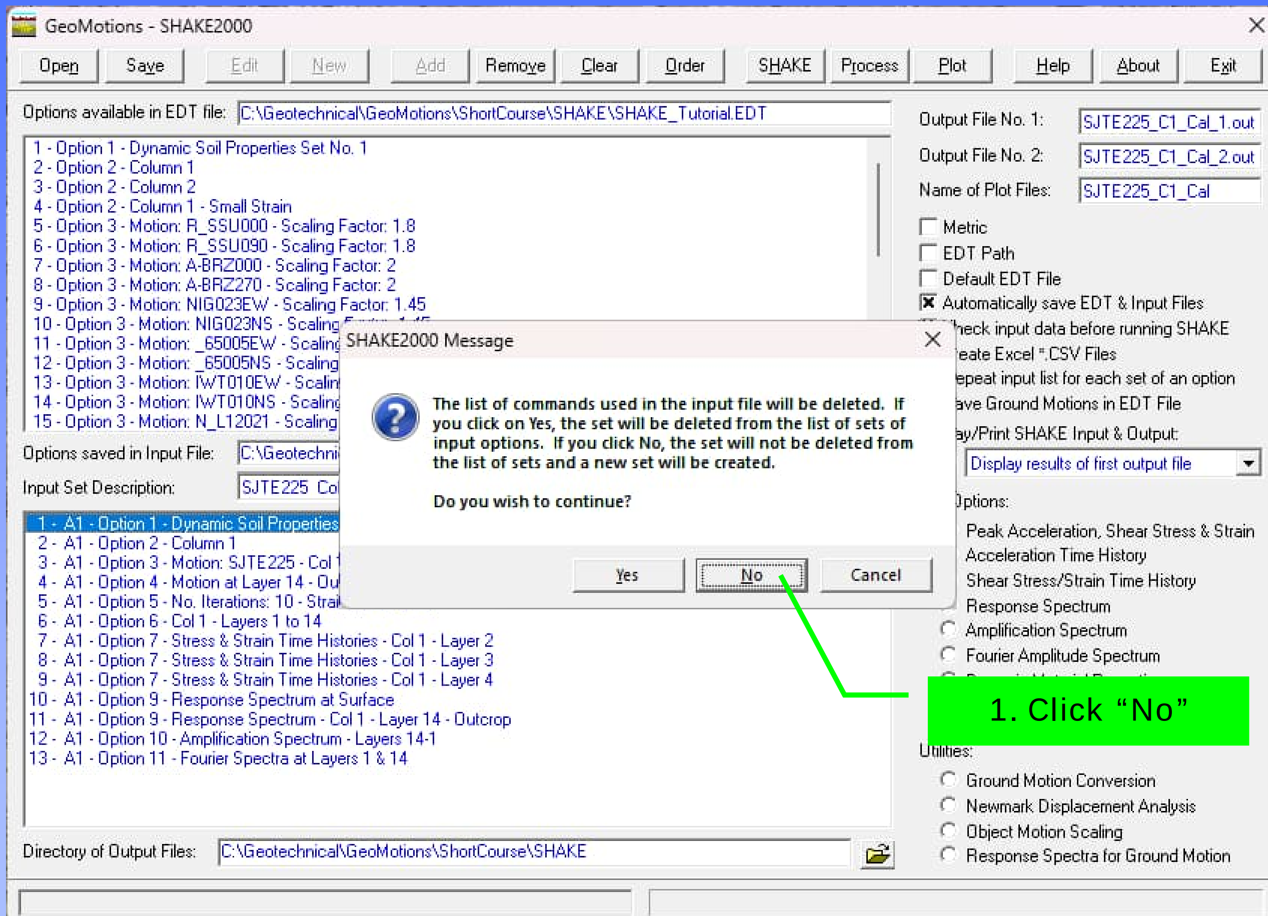
D-MOD Calibration

Small Strain Linear Analysis



D-MOD Calibration

Small Strain Linear Analysis



GeoMotions

Site Specific Response Analysis

List of Input Options for D-MOD Calibration

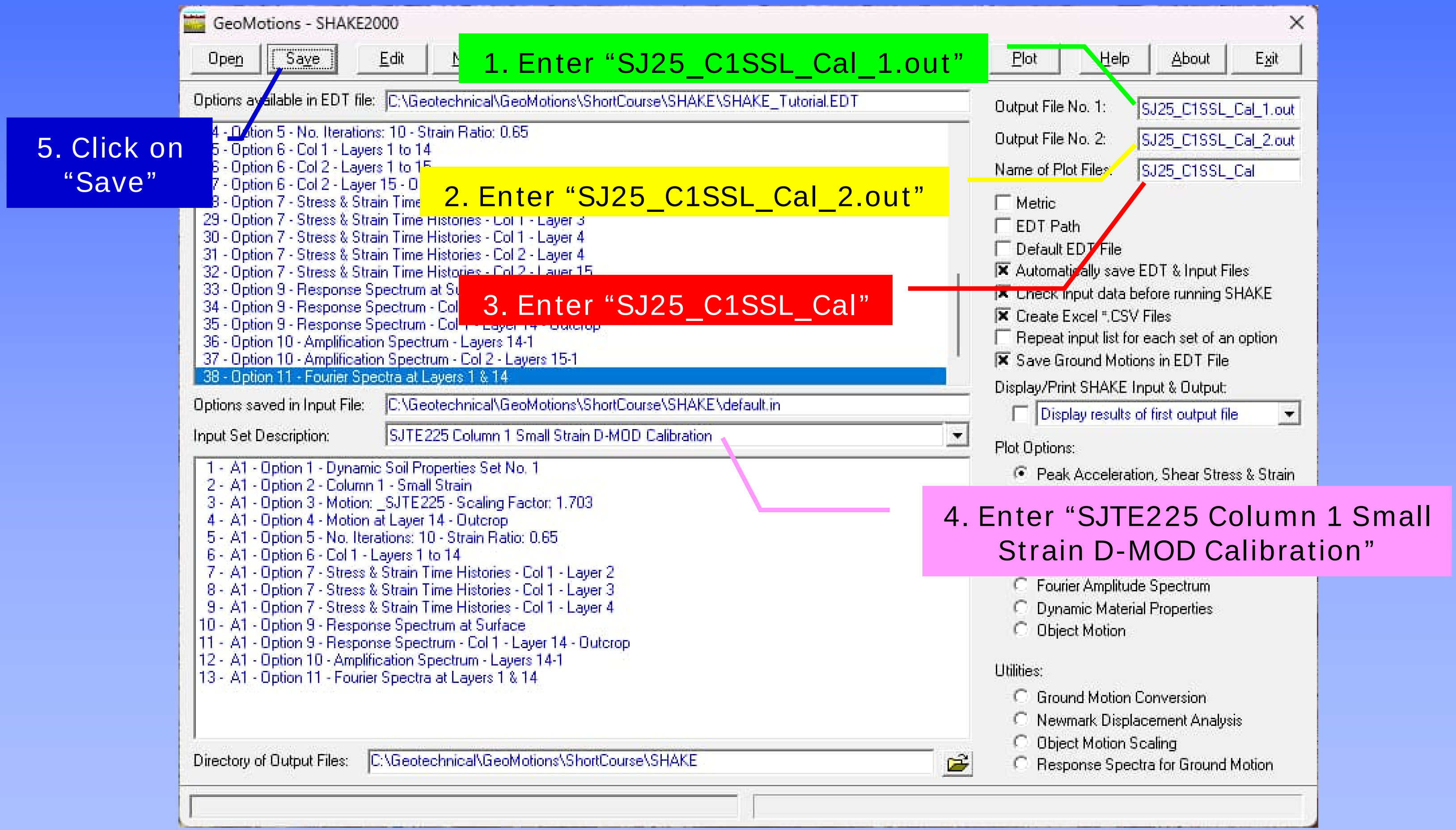
Add the following options to input file list:

Set	Description
1	Option 1 – Dynamic Soil Properties Set No. 1
3	Option 2 – Column 1 – Small Strain
17	Option 3 – Motion: _SJTE225 – Scaling Factor: 1.703
22	Option 4 – Motion at Layer 14 - Outcrop
24	Option 5 – No. of Iterations: 10 – Strain Ration: 0.65
25	Option 6 – Col 1 – Layers 1 to 14
28	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 2
29	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 3
30	Option 7 – Stress & Strain Time Histories – Col 1 – Layer 4
33	Option 9 – Response Spectrum at Surface
35	Option 9 – Response Spectrum – Col 1 – Layer 14 – Outcrop
36	Option 10 – Amplification Spectrum – Layers 14-1
38	Option 11 – Fourier Spectra at Layers 1 & 14

GeoMotions

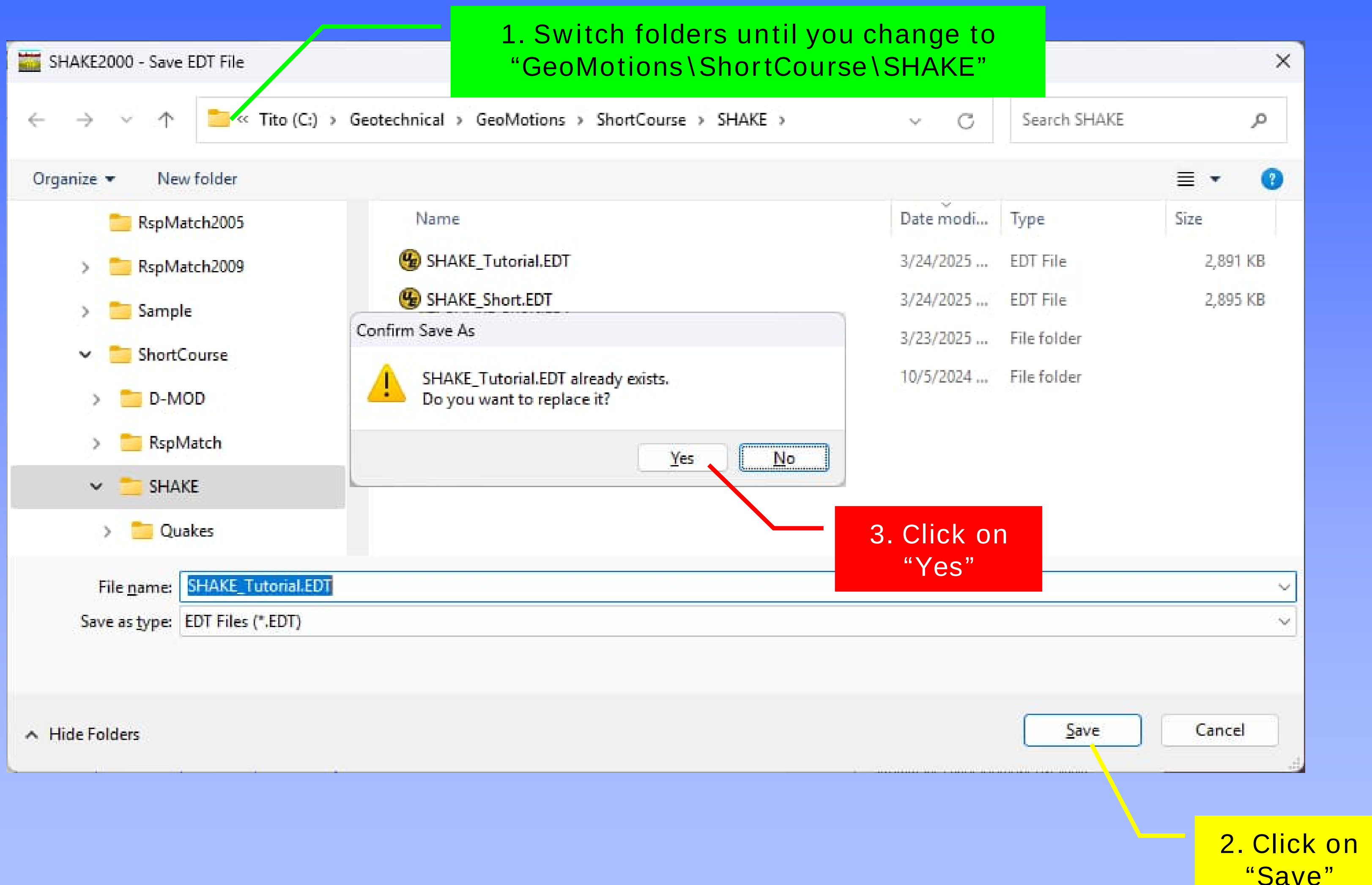
D-MOD Calibration

Rename SHAKE's Output and Plot Files



GeoMotions

Save EDT File

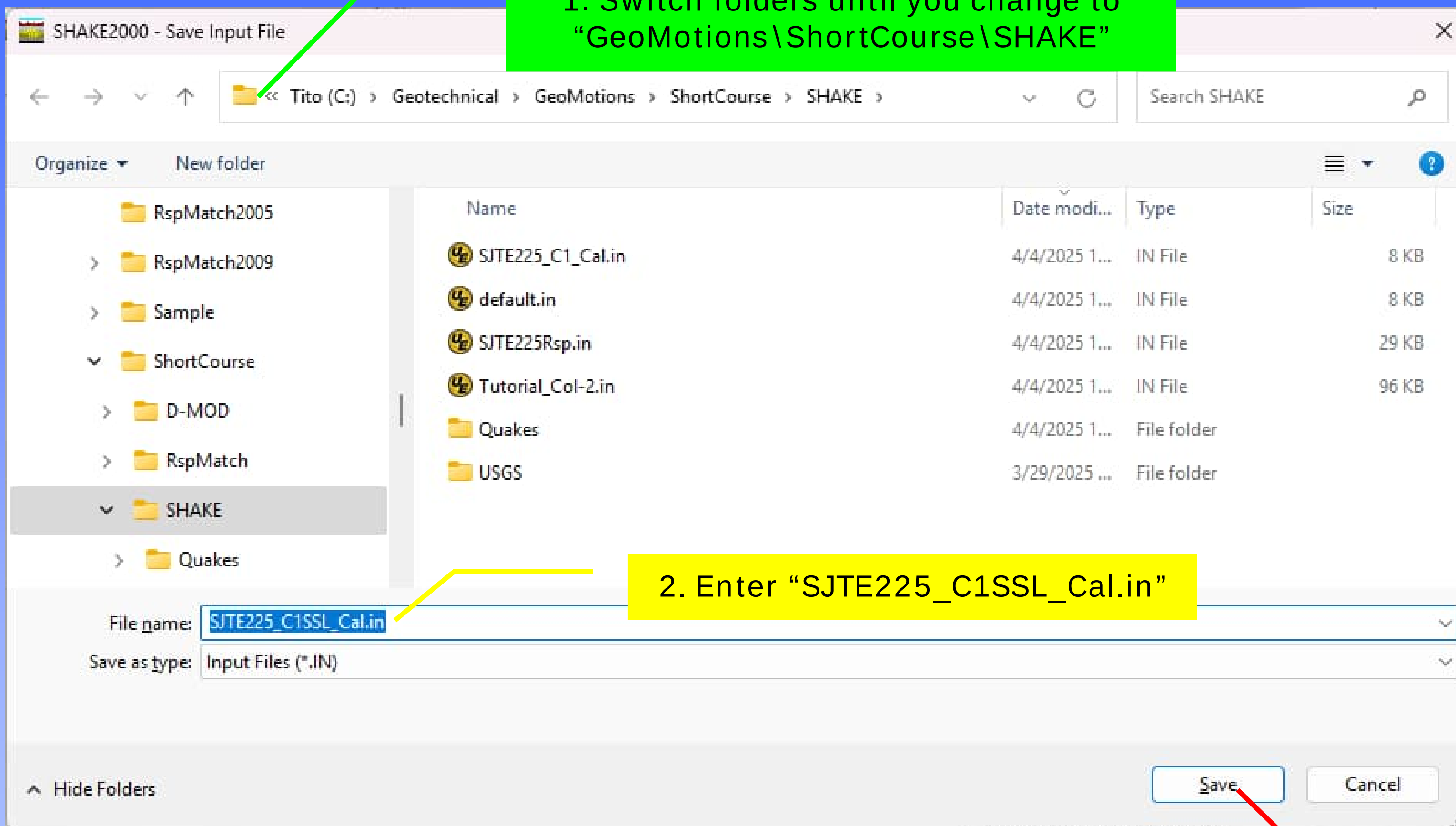


Save Input File

1. Switch folders until you change to “GeoMotions\ShortCourse\SHAKE”

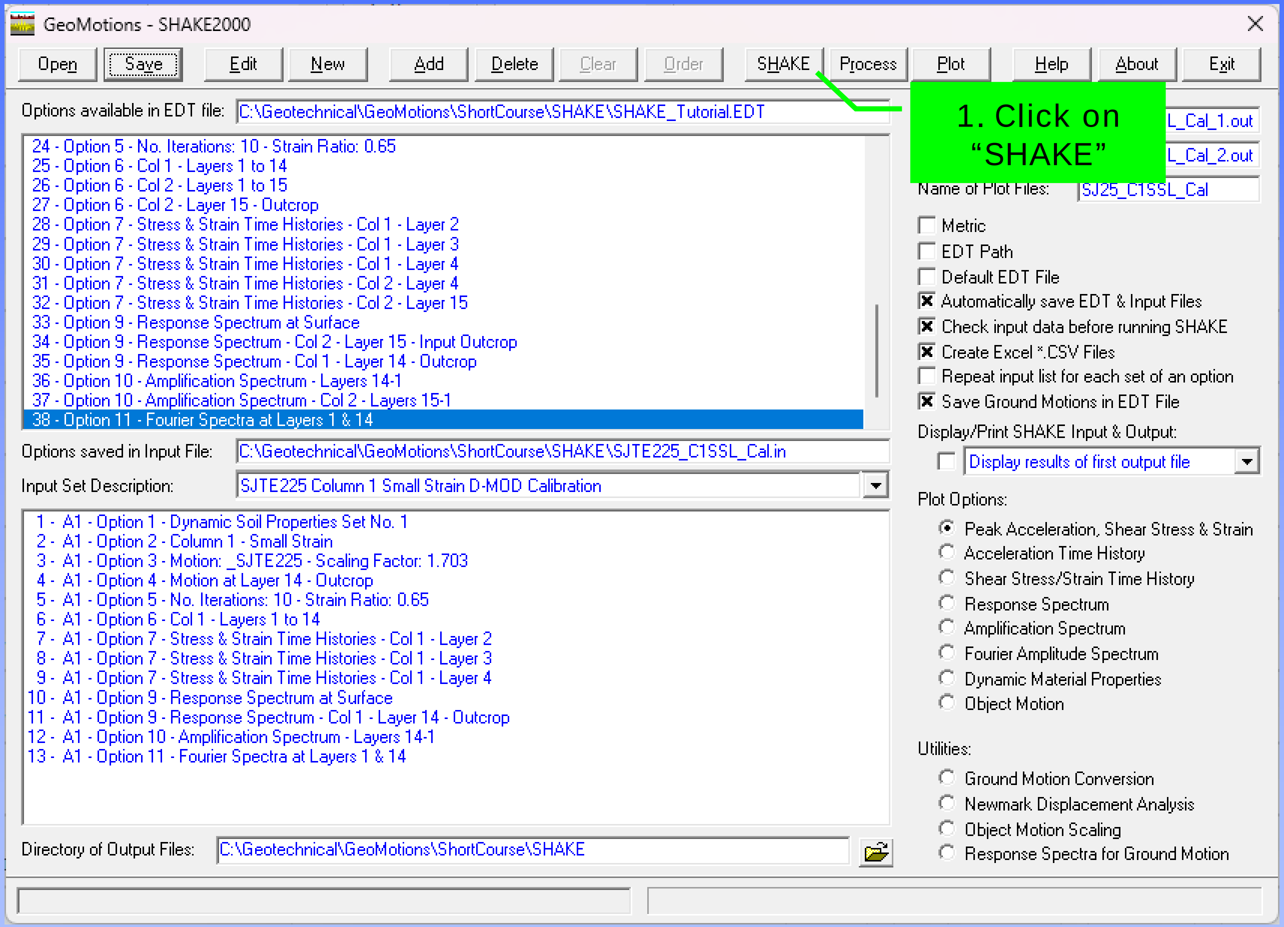
2. Enter “SJTE225_C1SSL_Cal.in”

3. Click on “Save”



D-MOD Calibration

Execute SHAKE



D-MOD Calibration

Execute SHAKE

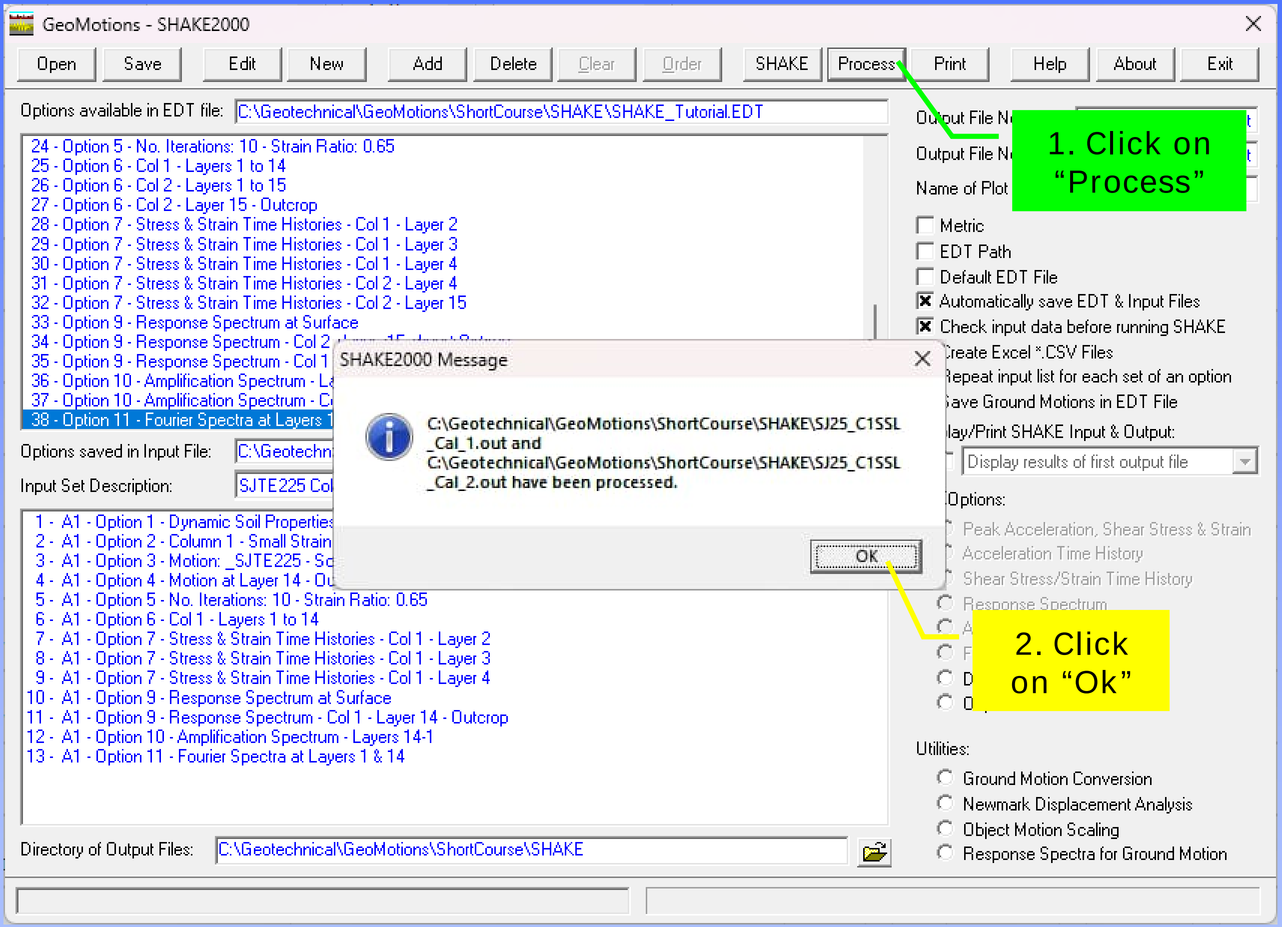
C:\Geotechnical\GeoMotions\

```
**************************************************************
* SHAKE: PROGRAM FOR EARTHQUAKE RESPONSE ANAL. HORIZONTAL *
*     LAYERED SITES by Per Schnable & John Lysmer - 1970  *
* ------------------------------------------------------- *
* SHAKE85: IBM PC SHAKE VERSION S.S.(Willie) Lai,Jan 1985 *
* ------------------------------------------------------- *
* SHAKE88 :New modulus reduction curves for clays added   *
*      using results from Sun et al (1988) by J. I. Sun   *
*      & Ramin Golesorkhi February 26, 1988               *
*  -------------------------------------------------------*
* SHAKE90/91: Adjust last iteration; Input now is either  *
*      Gmax or max Vs; up to 13 materials can be specified*
*      by user; up to 50 Layers can be specified; object  *
*      motion can be read in from a separate file and can *
*      user specified format; Different periods for res-  *
*      ponse spectral calculations;options are renumbered;*
*      and general cleanup by: J. I. Sun, I. M. Idriss &  *
*      P. Dirrim June 1990 - February 1991                *
*  ------------------------------------------------------ *
* SHAKE91: General cleanup and finalization of input out- *
*      output format, etc. by: I. M. Idriss December 1991 *
*  ------------------------------------------------------ *
* SHAKE2000: Fix incorrect output of total stress in      *
* option 2, changed path to ground motion file in         *
* SHAKE91, input file, increased motion to 30,000 values  *
* Jerald LaVassar (RIP) & Gustavo Ordonez - August 2020   *
*          RUN DATE  3/15/2025                            *
*          RUN TIME 16:40                                 *
**************************************************************
```


GeoMotions

D-MOD Calibration

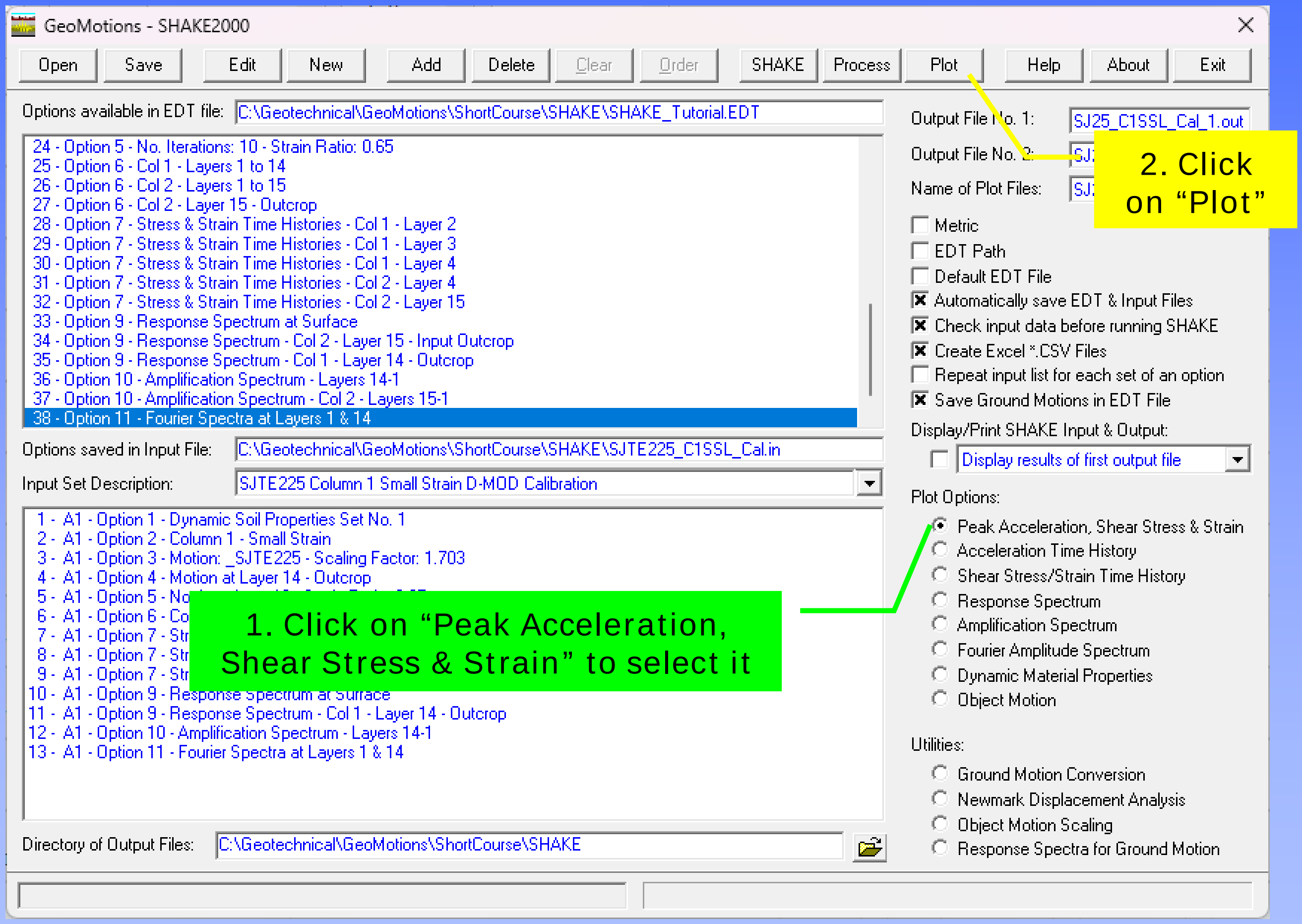
Process SHAKE’s Output Files



GeoMotions

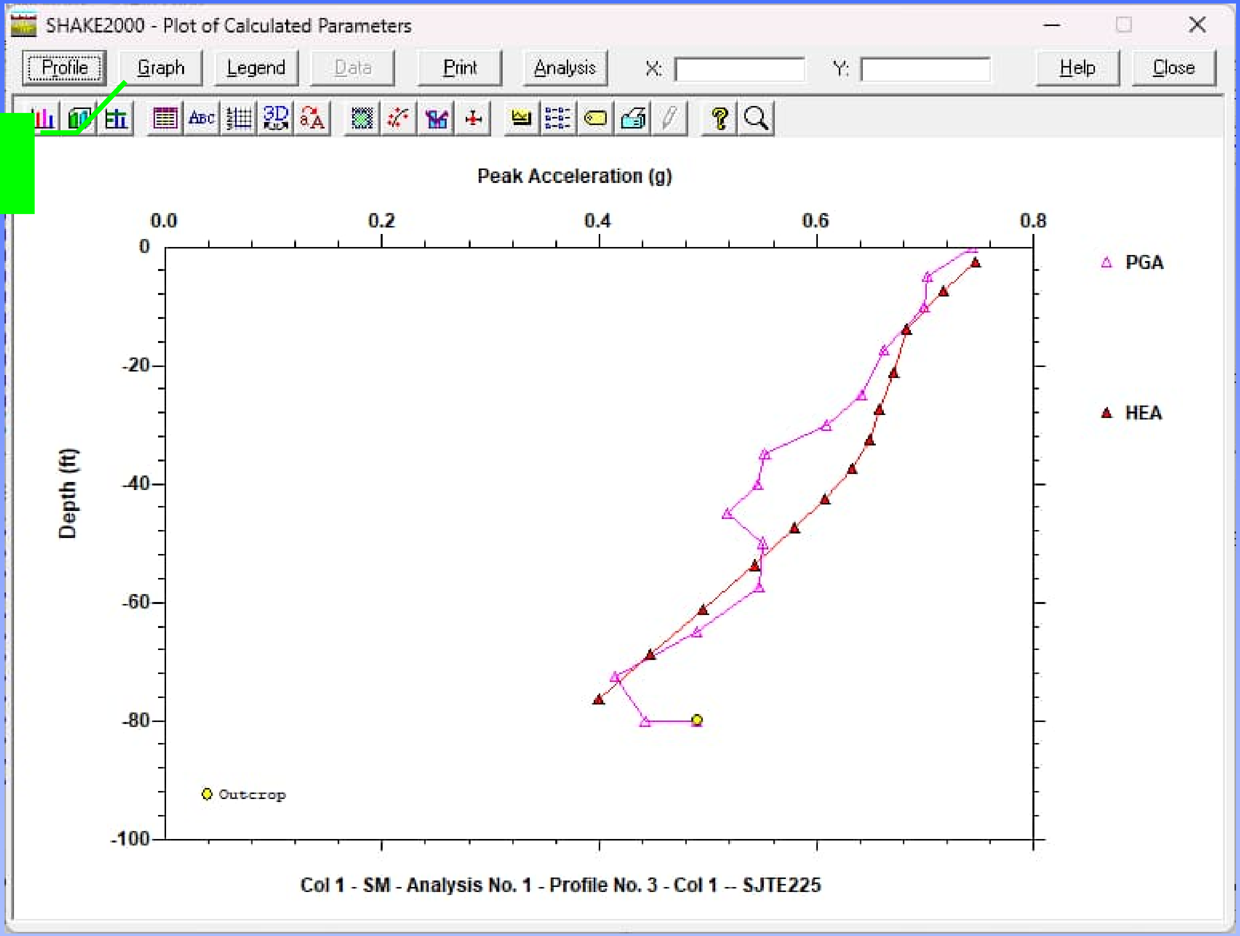
D-MOD Calibration

Plot Results



Plot Acceleration and Strain for Column No. 1

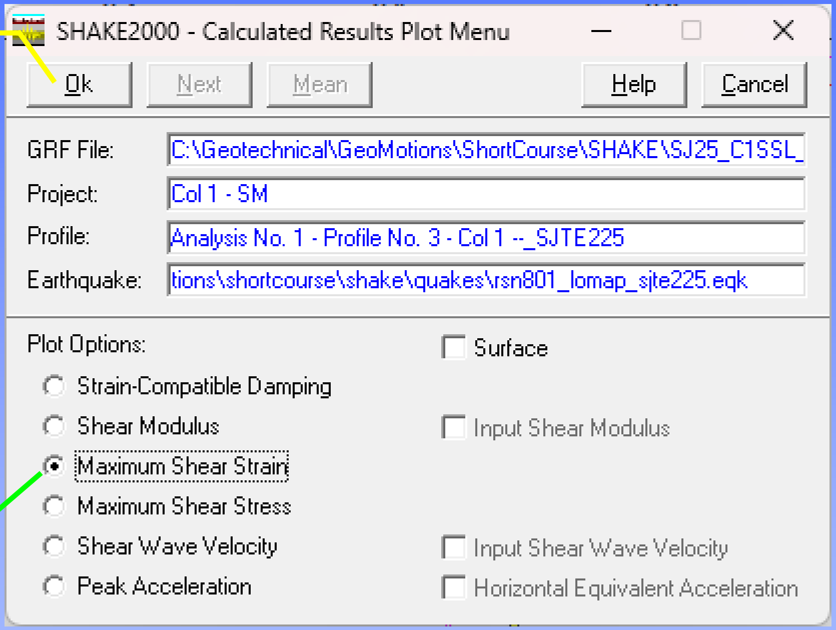
1. Click on "Graph"



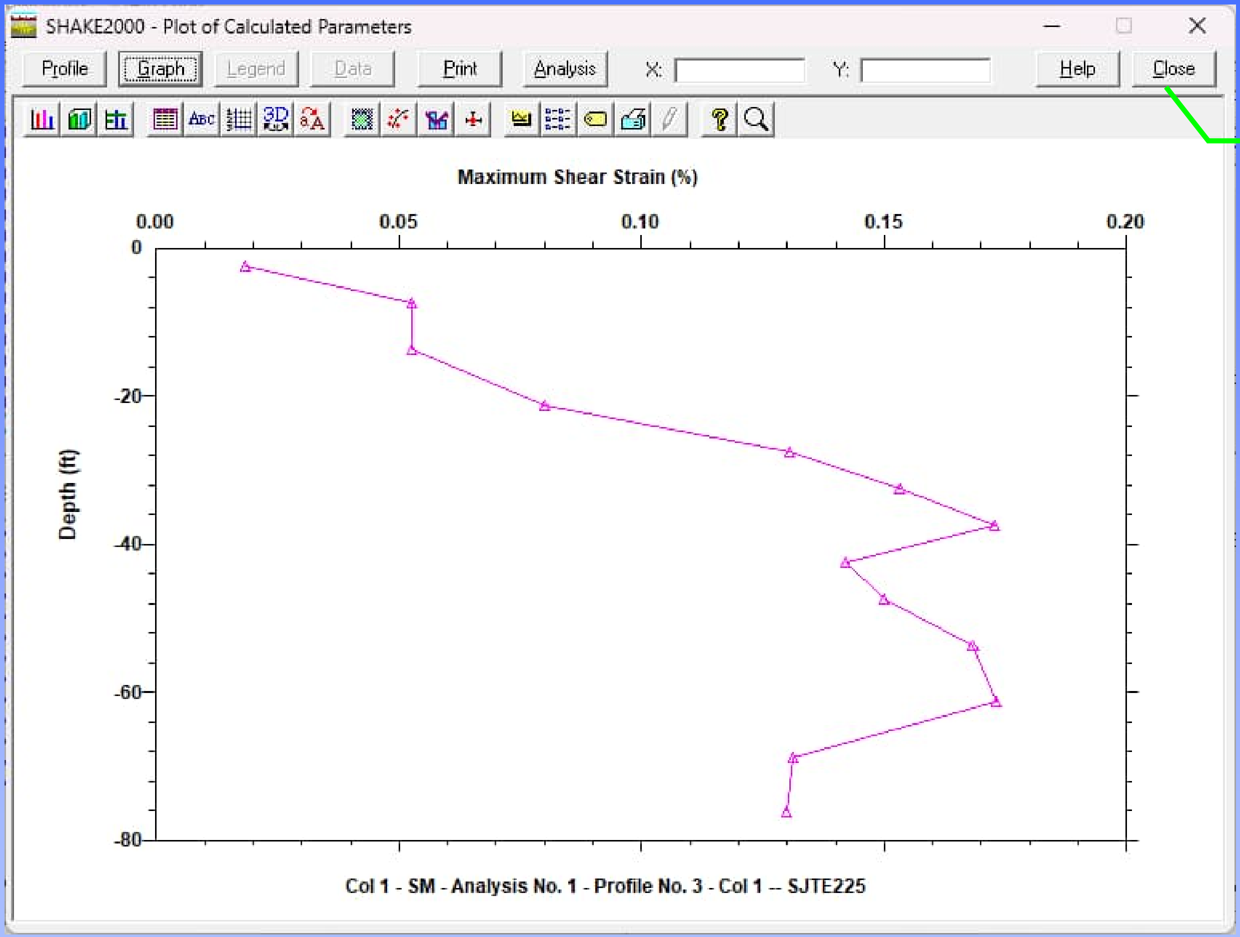
Plot Acceleration and Strain for Column No. 1

2. Click on “Ok”

1. Select “Maximum … “

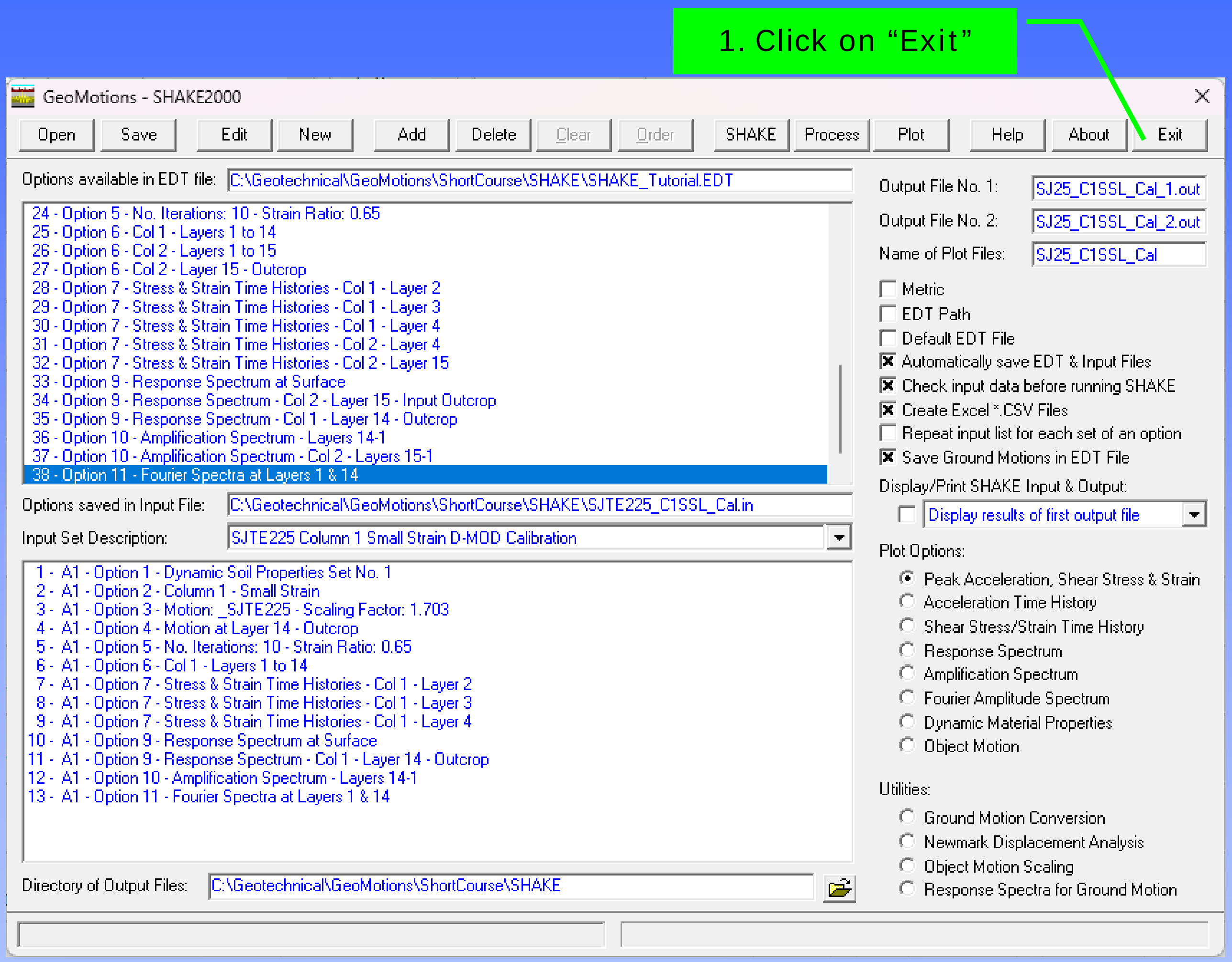


Plot Acceleration and Strain for Column No. 1



1. Click on “Close”

SHAKE2000



1. Click on "Exit"
GeoMotions - SHAKE2000
Open
Save
Edit
New
Add
Delete
Clear
Order
SHAKE
Process
Plot
Help
About
Exit
Options available in EDT file:
C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SHAKE_Tutorial.EDT
24 - Option 5 - No. Iterations: 10 - Strain Ratio: 0.65
25 - Option 6 - Col 1 - Layers 1 to 14
26 - Option 6 - Col 2 - Layers 1 to 15
27 - Option 6 - Col 2 - Layer 15 - Outcrop
28 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 2
29 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 3
30 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 4
31 - Option 7 - Stress & Strain Time Histories - Col 2 - Layer 4
32 - Option 7 - Stress & Strain Time Histories - Col 2 - Layer 15
33 - Option 9 - Response Spectrum at Surface
34 - Option 9 - Response Spectrum - Col 2 - Layer 15 - Input Outcrop
35 - Option 9 - Response Spectrum - Col 1 - Layer 14 - Outcrop
36 - Option 10 - Amplification Spectrum - Layers 14-1
37 - Option 10 - Amplification Spectrum - Col 2 - Layers 15-1
38 - Option 11 - Fourier Spectra at Layers 1 & 14
Options saved in Input File:
C:\Geotechnical\GeoMotions\ShortCourse\SHAKE\SJTE225_C1SSL_Cal.in
Input Set Description:
SJTE225 Column 1 Small Strain D-MOD Calibration
1 - A1 - Option 1 - Dynamic Soil Properties Set No. 1
2 - A1 - Option 2 - Column 1 - Small Strain
3 - A1 - Option 3 - Motion: _SJTE225 - Scaling Factor: 1.703
4 - A1 - Option 4 - Motion at Layer 14 - Outcrop
5 - A1 - Option 5 - No. Iterations: 10 - Strain Ratio: 0.65
6 - A1 - Option 6 - Col 1 - Layers 1 to 14
7 - A1 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 2
8 - A1 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 3
9 - A1 - Option 7 - Stress & Strain Time Histories - Col 1 - Layer 4
10 - A1 - Option 9 - Response Spectrum at Surface
11 - A1 - Option 9 - Response Spectrum - Col 1 - Layer 14 - Outcrop
12 - A1 - Option 10 - Amplification Spectrum - Layers 14-1
13 - A1 - Option 11 - Fourier Spectra at Layers 1 & 14
Directory of Output Files:
C:\Geotechnical\GeoMotions\ShortCourse\SHAKE
Output File No. 1:
SJ25_C1SSL_Cal_1.out
Output File No. 2:
SJ25_C1SSL_Cal_2.out
Name of Plot Files:
SJ25_C1SSL_Cal
Metric
EDT Path
Default EDT File
Automatically save EDT & Input Files
Check input data before running SHAKE
Create Excel *.CSV Files
Repeat input list for each set of an option
Save Ground Motions in EDT File
Display/Print SHAKE Input & Output:
Display results of first output file
Plot Options:
Peak Acceleration, Shear Stress & Strain
Acceleration Time History
Shear Stress/Strain Time History
Response Spectrum
Amplification Spectrum
Fourier Amplitude Spectrum
Dynamic Material Properties
Object Motion
Utilities:
Ground Motion Conversion
Newmark Displacement Analysis
Object Motion Scaling
Response Spectra for Ground Motion