SCEC

SCEC Unified Community Velocity Model (UCVM) Software Framework: Motivation and Overview

Philip Maechling
SCEC Open-Source Software and Data Access Workshop
8 August 2018
Palm Springs, California

Demonstration 1:

Basic UCVM command line query:

Key Starting conditions:

- Properly installed software
- Models of interest Installed (only CVM-S4, and CVM-H included in workshop VirtualBox image)
- User specified configuration of models in ucvm.conf (GTL and/or Background model)

Key Take-Aways:

- Specification of model of interest
- Input format for lat,lon,depth (and multiple lines) and CTRL-D
- Option to query by elevation or query by depth
- Specification of model, and model order
- Return result format with many columns
- Similar results using API

Demonstration 1:

Model Name	Description	UCVM Abbreviation
CVM-H	Southern California Velocity Model developed by Harvard Structural Geology Group with optional geotechnical layer	cvmh
CVM-S4	Southern California Velocity Model developed by SCEC, Caltech, USGS Group with geotechnical layer	cvms
CVM-S4.26	Tomography improved version of CVM-S4 with no geotechnical layer but has an optional Ely-Jordan GTL	cvms5
CVM-S4.26.M01	CVM-S4.26 with added geotechnical layer	cvmsi
USGS Bay Area	USGS developed San Francisco and Central California velocity model	cencal
CCA06	Central California Area Velocity Model at iteration 6 with added optional Ely-Jordan GTL (UCVMC18.5)	cca
CS17.3	CyberShake Study 17.3 Central California Velocity Model with added optional Ely-Jordan GTL (UCVMC18.5)	cs173
CS17.3-H	CyberShake Study 17.3 Central California Velocity Model integrated with Harvard group's Santa Maria and San Joaquin Basin Models with added optional Ely-Jordan GTL (UCVMC18.5)	cs173h
Modified Hadley Kanamori 1D	Southern California regional 1D model based on Hadley-Kanamori model	1d
Northridge Region 1D	Los Angeles Region 1D model used in SCEC Broadband Platform	bbp1d

	ucvm_query		Input/Output		
Column Number	Parameter	Description	Input 1	Input 2	Input 3
	Longitude	Coordinates provided as input parameters to the ucvm_query program	−118.286	118.286	−122.000
	Latitude	Coordinates provided as input parameters to the ucvm_query program	34.033	34.033	34.033
	Depth	Coordinates provided as input parameters to the ucvm_query program	100.0	1000.0	10,000.0
			Output 1	**Output 2**	**Output 3**
1	Longitude	Input longitude in decimal degrees	−118.2860	−118.2860	122.0000
2	Latitude	Input latitude in decimal degree	34.0330	34.0330	34.0330
3	Z	Input depth (or elevation) in meters	100.000	1000.000	10,000.000
4	Elevation	Returned elevation (m) from UCVM digital elevation model	60.386	60.386	−3,791.911
5	V_{S30}	Returned V_{S30} (m/s) from a Wills–Wald site type to V_{S30} relationship (for points in California), or from Wald topography relation (outside of California)	280.000	280.000	180.000
6	CVM Abbreviation	CVM abbreviation identifying which CVM from the input CVM list provided the returned material properties	cvmh	cvmh	cvms
7	V_P	Returned P-wave velocity (m/s) from the CVM in column 6	1935.708	2533.139	6,300.000
8	V_S	Returned S-wave (m/s) from the CVM in column 6	496.300	1011.327	3,637.307
9	ρ	Returned density (kg/m^3) from the CVM in column 6	1875.844	2103.371	2,859.770
10	GTL name	GTL algorithm used to modify V_P, V_S, and ρ values in the GTL depth range	elygtl	None	None
11	GTL V_P	Returned GTL V_P (m/s) at input point	0.000	0.000	0.000
12	GTL V_S	Returned GTL V_S (m/s) at input point	280.000	0.000	0.000
13	GTL ρ	Returned GTL ρ (kg/m^3) at input point	0.000	0.000	0.000
14	Combining algorithm	Name of algorithm used to combine base model V_P, V_S, and ρ with returned GTL values for V_P, V_S, and ρ	ely	crust	crust
15	Combined V_P	Returned V_P based on combined base model and GTL values	1987.721	2533.139	6,300.000
16	Combined V_P	Returned V_S based on combined base model and GTL values	432.608	1011.327	3,637.307
17	Combined ρ	Returned ρ based on combined base model and GTL values	1899.856	2103.371	2,859.770

Demonstration 2:

Plot Horizontal regional Vs map at selected depth:

Key Starting conditions:

- Specification of points, using corners
- Specification of parameter to plot (vp, vs, rho, poisson)
- Specification of model, or models, to query
- Output file names or it plots to the screen

Key Take Aways:

- Simple method to example existing models
- Resolution and region of plots significantly impacts script run-time
- Setup to run plotting scripts from UCVM/utilities directory

Demonstration 3:

Plot Vs Cross Section:

Key Starting conditions:

- Specification of points, using corners
- Specification of parameter to plot (vp, vs, rho, poisson)
- Color scale required
- Output file names or it plots to the screen

Key Take Aways:

- Resolution of plots important

Demonstration 4:

Create ground motion simulation regular mesh Using Cluster:

Key Starting conditions:

- MPI libraries must be available when ucvm is built to get the mpi executables
- User must define desired mesh in Ucvm2mesh.conf

Key Take Aways:

- Ucvm2mesh and ucvm2mesh_mpi produce same results. MPI version intended for very large meshes.
- UCVM supported output mesh output formats (IJK-12,IJK-20,IJK-32) vary by whether then include I,j,k and whether they include qp and qs for each point.
- Ucvm2mesh_mpi outputs both a grid file (lat/lon/depths) and a mesh file (includes material properties for each point).
- Researcher can discretize their volume can use the C-API to query UCVM for properties at their points of interest, if they need large, irregular meshes.

SCEC

AN NSF+USGS CENTER

Southern California Earthquake Center

www.SCEC.org