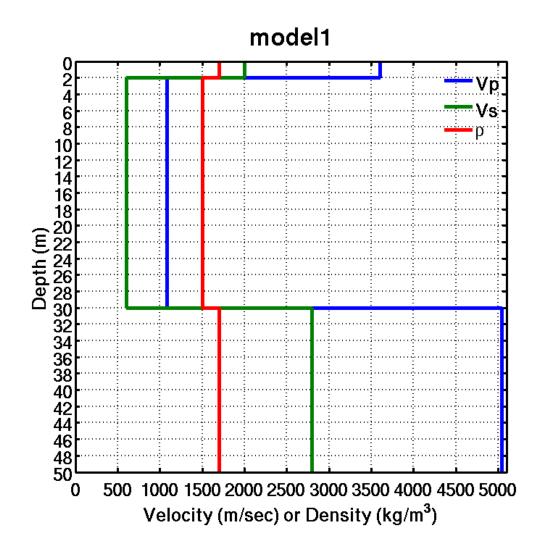# Synthetics Comparison of CPS-modal-summation and E3D Finite Difference Codes

1. Input model:

A two layer + Half space model with the presence of a low velocity layer.

model1

2. Parameter setup in CPS-modal-summation codes:

(1) Total number of modes included in the calculation: **-NMOD 30**;

(2) Source-Receiver configuration:

      [1] Source: a vertical force applied on the free surface (to mimic the effect of a sledge hammer

impact): **HS 0.0**

        [2] Receiver: The minimum source-to-receiver offset equals to zero so as to capture the source time function. A regularly spaced linear array is the modeling target, which has 48 receivers laying out with 1.1 meters of inter-receiver spacing. Part of the distance file used in the calculation is posted here: (Column 1: source-to-receiver distance (km); Column 2: sampling rate dt (second); Column 3: total number of points (unitless; must be power of 2; Column 4: t0 (second); Column 5: Reduction Velocity(km/sec))) **HR 0.0**

Part of the distance file used in the calculation is shown below:

```
0       6.20e-05     8192   0.0     10000.0
0.0011  6.20e-05     8192   0.0     10000.0
0.0022  6.20e-05     8192   0.0     10000.0
0.0033  6.20e-05     8192   0.0     10000.0
0.0044  6.20e-05     8192   0.0     10000.0
0.0055  6.20e-05     8192   0.0     10000.0
0.0066  6.20e-05     8192   0.0     10000.0
...
0.0506  6.20e-05     8192   0.0     10000.0
0.0517  6.20e-05     8192   0.0     10000.0
```

        [3] Source time function: A parabolic pulse with the base duration time of 0.01 seconds. L parameter in dt = 4 * L * dt equals to 0.01/4/6.20e-05 = 40.

        The associated spulse96 run is:

spulse96 -d dfile -p -l 40 -EXF -LOCK

3. Comparison of synthetics (CPS vs. E3D):

        !!! A couple of things that are standing out in CPS results --

        a. The high frequency "glitches" that are superimposed on the longer period signal: **(Q1: What causes these series of glitches?)**

        b. The very long period signal that are present before the first-P arrivals, which make the time series appear to be acausa; **(Q2: What are the causes of these arrivals? Could inadequate amount of summed modes be the lead cause?)**

        c. Long period signals are also quite strong in later portion of the synthetic seismograms. Would this be caused by inadequate amount of summed modes as well?

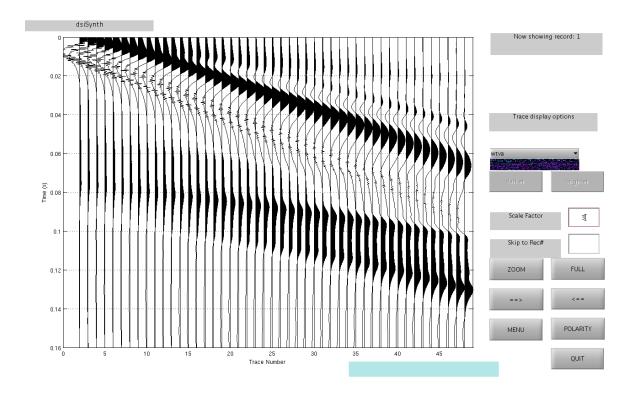**Figure 1:** CPS-modal-summation output (The vertical component velocity for a vertical single force):

Figure 2: E3D output:
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