Auxiliary material for Paper 2011JB008501R

Locating Earthquakes with Surface Waves and Centroid Moment Tensor Estimation

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Introduction

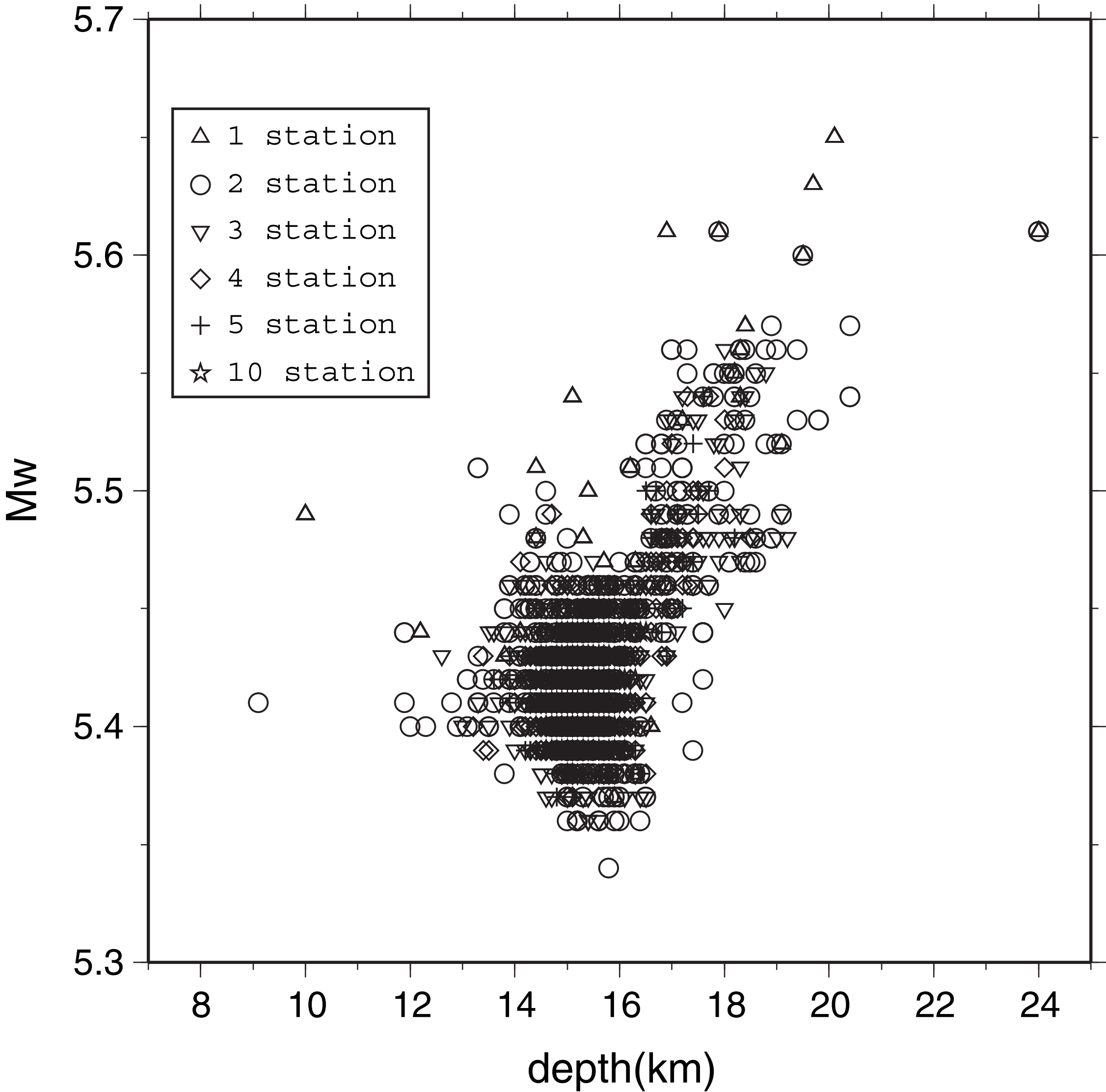
The electronic supplement consists of four supplementary figures.

1. figS1_Mw_dep.pdf
Depth and moment magnitude of the Chino Hills earthquake determined by different number of stations, selected randomly from the 42 hard rock stations. For each number the selection is performed 500 times.

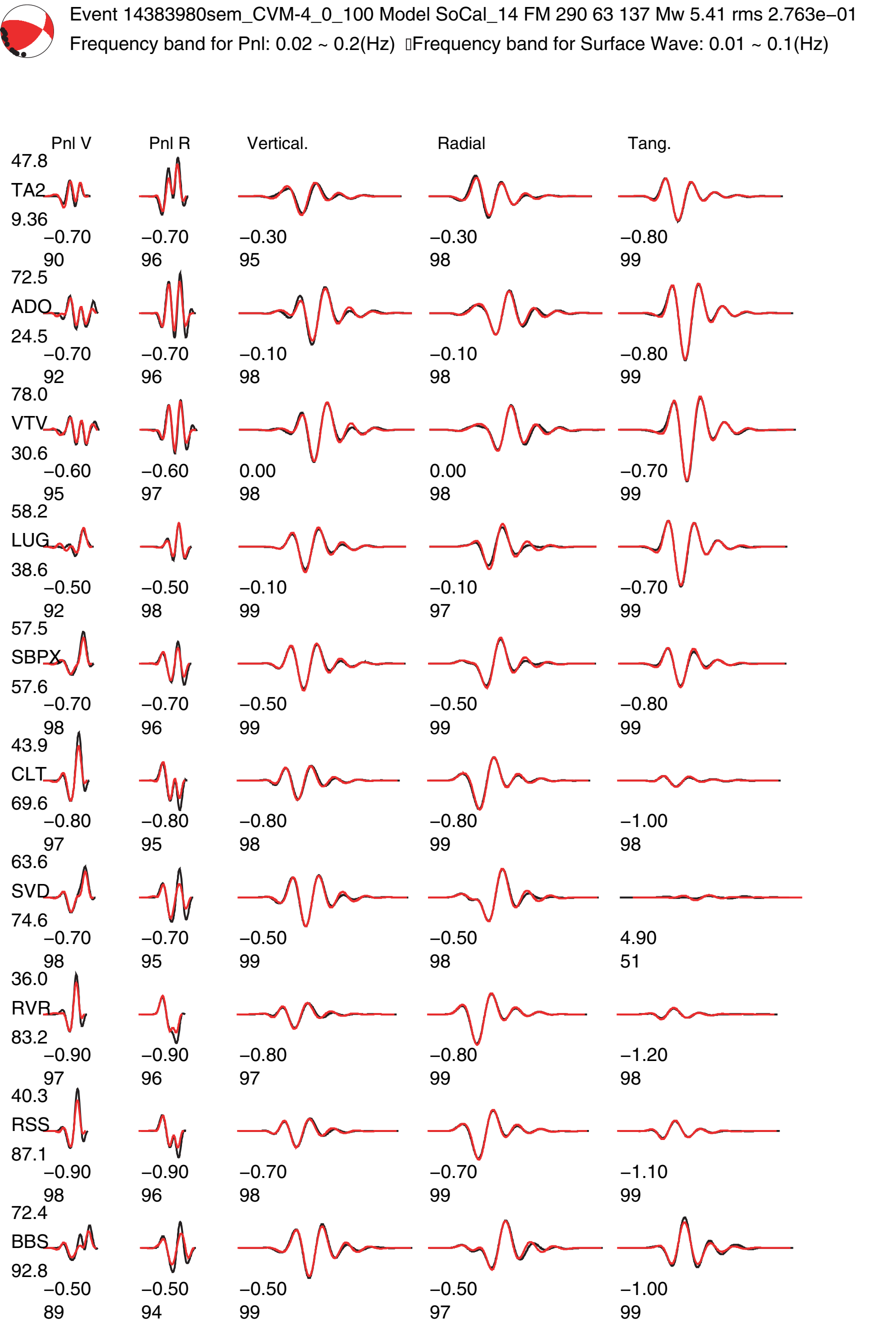
2. figS2_cap_m00m12.pdf
CAP results from processing the 3D SEM synthetic data for CVM-4 (left) and CVM-H (right), assuming SCEC location and mechanism. Refer to Fig.4 for details of numbers and characters.

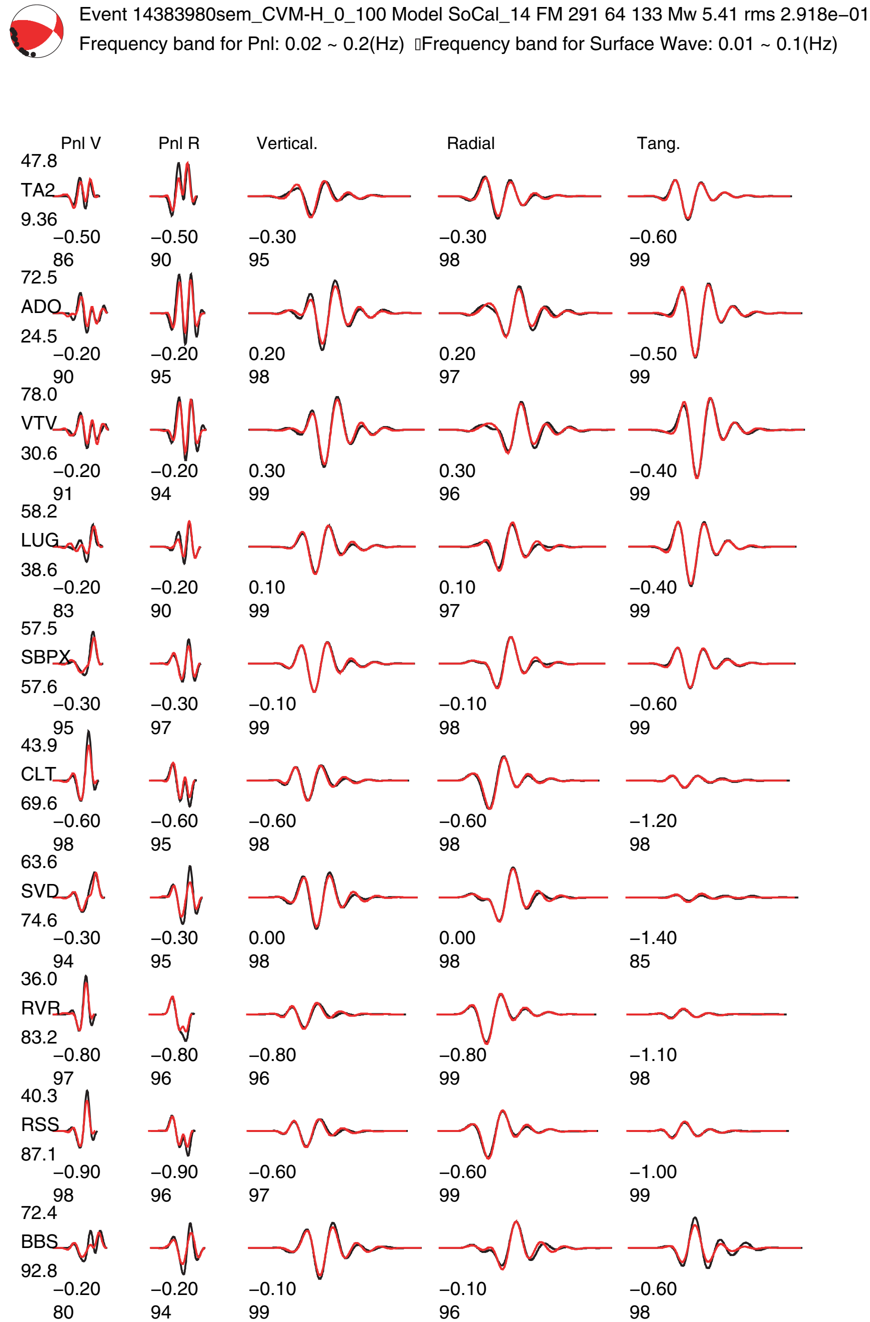
3. figS3_cap_badfits.pdf
Waveform fits of CAP inversion results for station within a specific azimuth range (around 270degree). All the red seismograms are 1D synthetics, the black traces are the real data (left), 3D synthetics data generated by CVM-4 (middle) and 3D synthetics data generated by CVM-H (right).

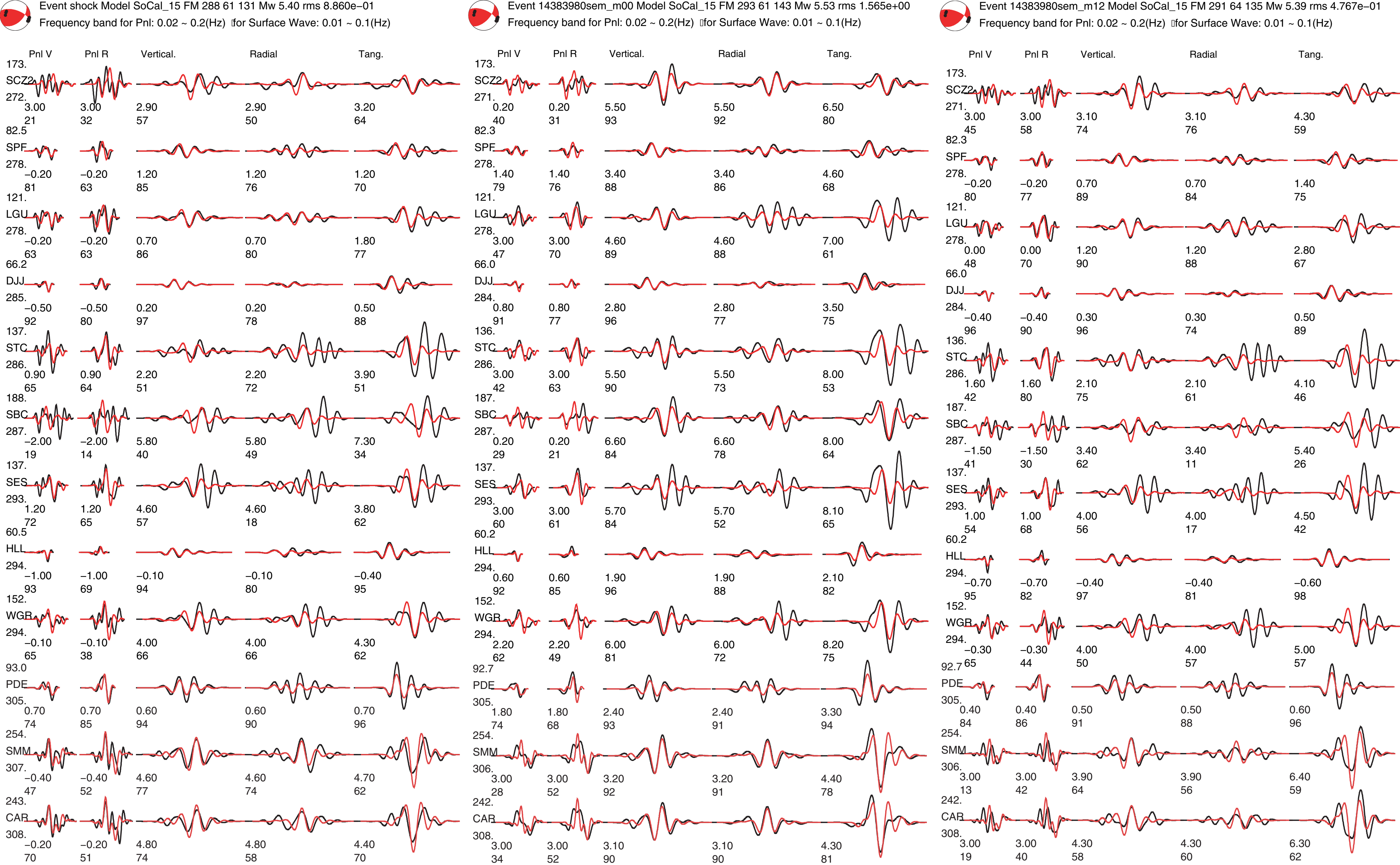
4. figS4_noise_dist.pdf
Cross Correlation Functions (CCFs) between BHZ component of ASN (Ambient Seismic Noise) recorded at one of 3 stations nearest the epicenter and other stations shown as circles in the map (Fig.1). The CCFs (black lines) are shifted to obtain maximum Cross-correlation Coefficients (CC) with single force Green's function (gray lines) between the two stations from the same 1D SC model (1D Standard South California crustal model) as used in CAP. The resulting time delays and CCs are shown on the right side of the seismograms. Over 95% of the station pairs have CCs larger than 0.7. Both the CCFs and the Green's functions have been filtered between 10s and 100s as in the earthquake modeling.



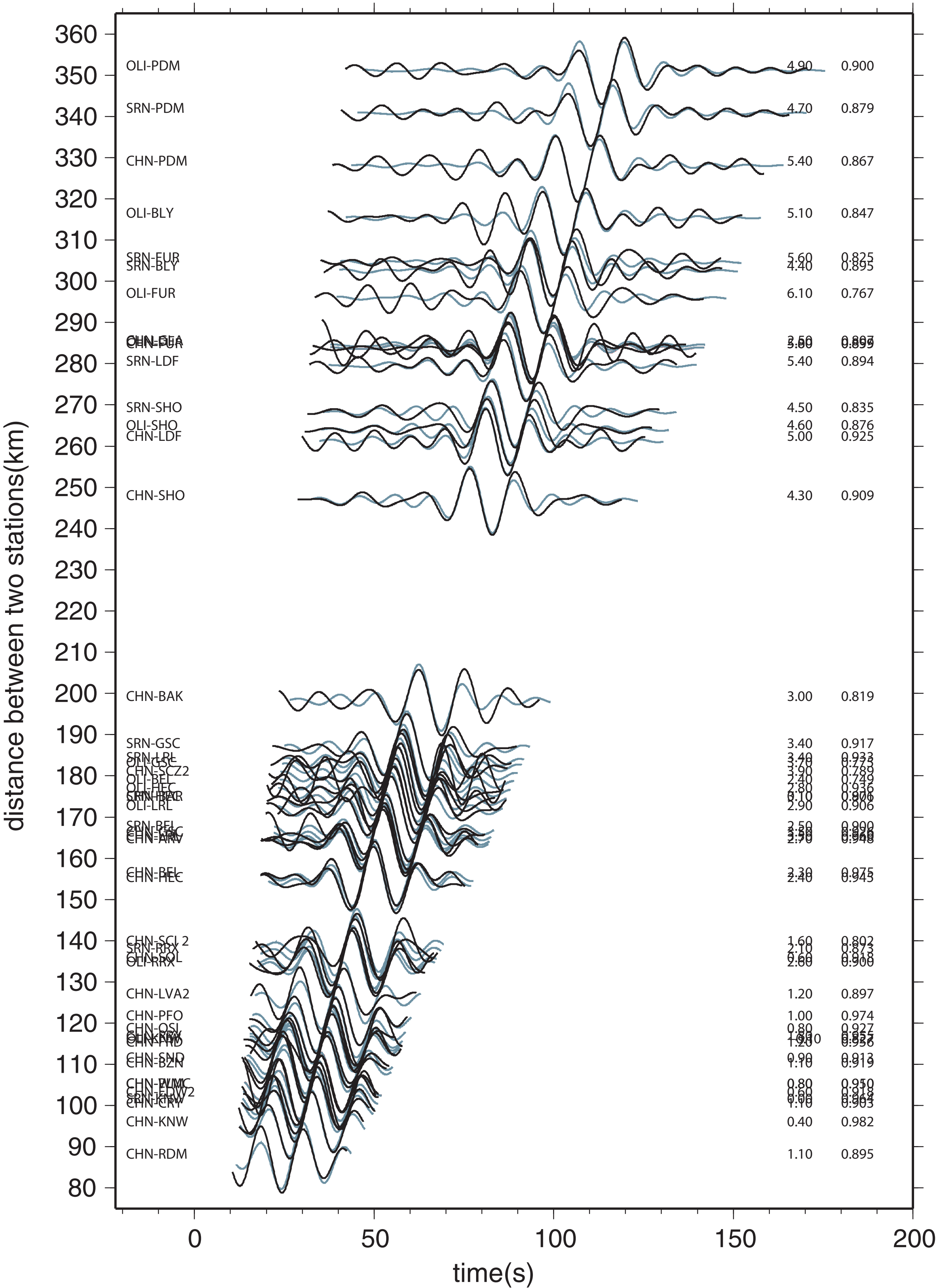
1 station
2 station
3 station
4 station
5 station
10 station
Mw
5.7
5.6
5.5
5.4
5.3
8
10
12
14
16
18
20
22
24
depth(km)


Event 14383980sem_CVM-4_0_100 Model SoCal_14 FM 290 63 137 Mw 5.41 rms 2.763e−01
Frequency band for Pnl: 0.02 ~ 0.2(Hz) Frequency band for Surface Wave: 0.01 ~ 0.1(Hz)
Pnl V
Pnl R
Vertical.
Radial
Tang.
47.8 TA2 9.36
−0.70 90
−0.70 96
−0.30 95
−0.30 98
−0.80 99
72.5 ADO 24.5
−0.70 92
−0.70 96
−0.10 98
−0.10 98
−0.80 99
78.0 VTV 30.6
−0.60 95
−0.60 97
0.00 98
0.00 98
−0.70 99
58.2 LUG 38.6
−0.50 92
−0.50 98
−0.10 99
−0.10 97
−0.70 99
57.5 SBPX 57.6
−0.70 98
−0.70 96
−0.50 99
−0.50 99
−0.80 99
43.9 CLT 69.6
−0.80 97
−0.80 95
−0.80 98
−0.80 99
−1.00 98
63.6 SVD 74.6
−0.70 98
−0.70 95
−0.50 99
−0.50 98
4.90 51
36.0 RVR 83.2
−0.90 97
−0.90 96
−0.80 97
−0.80 99
−1.20 98
40.3 RSS 87.1
−0.90 98
−0.90 96
−0.70 98
−0.70 99
−1.10 99
72.4 BBS 92.8
−0.50 89
−0.50 94
−0.50 99
−0.50 97
−1.00 99


Event 14383980sem_CVM-H_0_100 Model SoCal_14 FM 291 64 133 Mw 5.41 rms 2.918e−01
Frequency band for Pnl: 0.02 ~ 0.2(Hz) Frequency band for Surface Wave: 0.01 ~ 0.1(Hz)
Pnl V
Pnl R
Vertical.
Radial
Tang.
47.8 TA2 9.36
−0.50 86
−0.50 90
−0.30 95
−0.30 98
−0.60 99
72.5 ADO 24.5
−0.20 90
−0.20 95
0.20 98
0.20 97
−0.50 99
78.0 VTV 30.6
−0.20 91
−0.20 94
0.30 99
0.30 96
−0.40 99
58.2 LUG 38.6
−0.20 83
−0.20 90
0.10 99
0.10 97
−0.40 99
57.5 SBPX 57.6
−0.30 95
−0.30 97
−0.10 99
−0.10 98
−0.60 99
43.9 CLT 69.6
−0.60 98
−0.60 95
−0.60 98
−0.60 98
−1.20 98
63.6 SVD 74.6
−0.30 94
−0.30 95
0.00 98
0.00 98
−1.40 85
36.0 RVR 83.2
−0.80 97
−0.80 96
−0.80 96
−0.80 99
−1.10 98
40.3 RSS 87.1
−0.90 98
−0.90 96
−0.60 97
−0.60 99
−1.00 99
72.4 BBS 92.8
−0.20 80
−0.20 94
−0.10 99
−0.10 96
−0.60 98



Event shock Model SoCal_15 FM 288 61 131 Mw 5.40 rms 8.860e−01
Frequency band for Pnl: 0.02 ~ 0.2(Hz) for Surface Wave: 0.01 ~ 0.1(Hz)
Event 14383980sem_m00 Model SoCal_15 FM 293 61 143 Mw 5.53 rms 1.565e+00
Frequency band for Pnl: 0.02 ~ 0.2(Hz) for Surface Wave: 0.01 ~ 0.1(Hz)
Event 14383980sem_m12 Model SoCal_15 FM 291 64 135 Mw 5.39 rms 4.767e−01
Frequency band for Pnl: 0.02 ~ 0.2(Hz) for Surface Wave: 0.01 ~ 0.1(Hz)
Pnl V
Pnl R
Vertical.
Radial
Tang.
SCZ2
SPF
LGU
DJJ
STC
SBC
SES
HLL
WGR
PDE
SMM
CAR



distance between two stations(km)
time(s)
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
0
50
100
150
200
OLI-PDM 4.90 0.900
SRN-PDM 4.70 0.879
CHN-PDM 5.40 0.867
OLI-BLY 5.10 0.847
SRN-FUR 5.60 0.825
SRN-BLY 4.40 0.895
OLI-FUR 6.10 0.767
SRN-LDF 5.40 0.894
SRN-SHO 4.50 0.835
OLI-SHO 4.60 0.876
CHN-LDF 5.00 0.925
CHN-SHO 4.30 0.909
CHN-BAK 3.00 0.819
SRN-GSC 3.40 0.917
CHN-LVA2 1.20 0.897
CHN-PFO 1.00 0.974
CHN-KNW 0.40 0.982
CHN-RDM 1.10 0.895