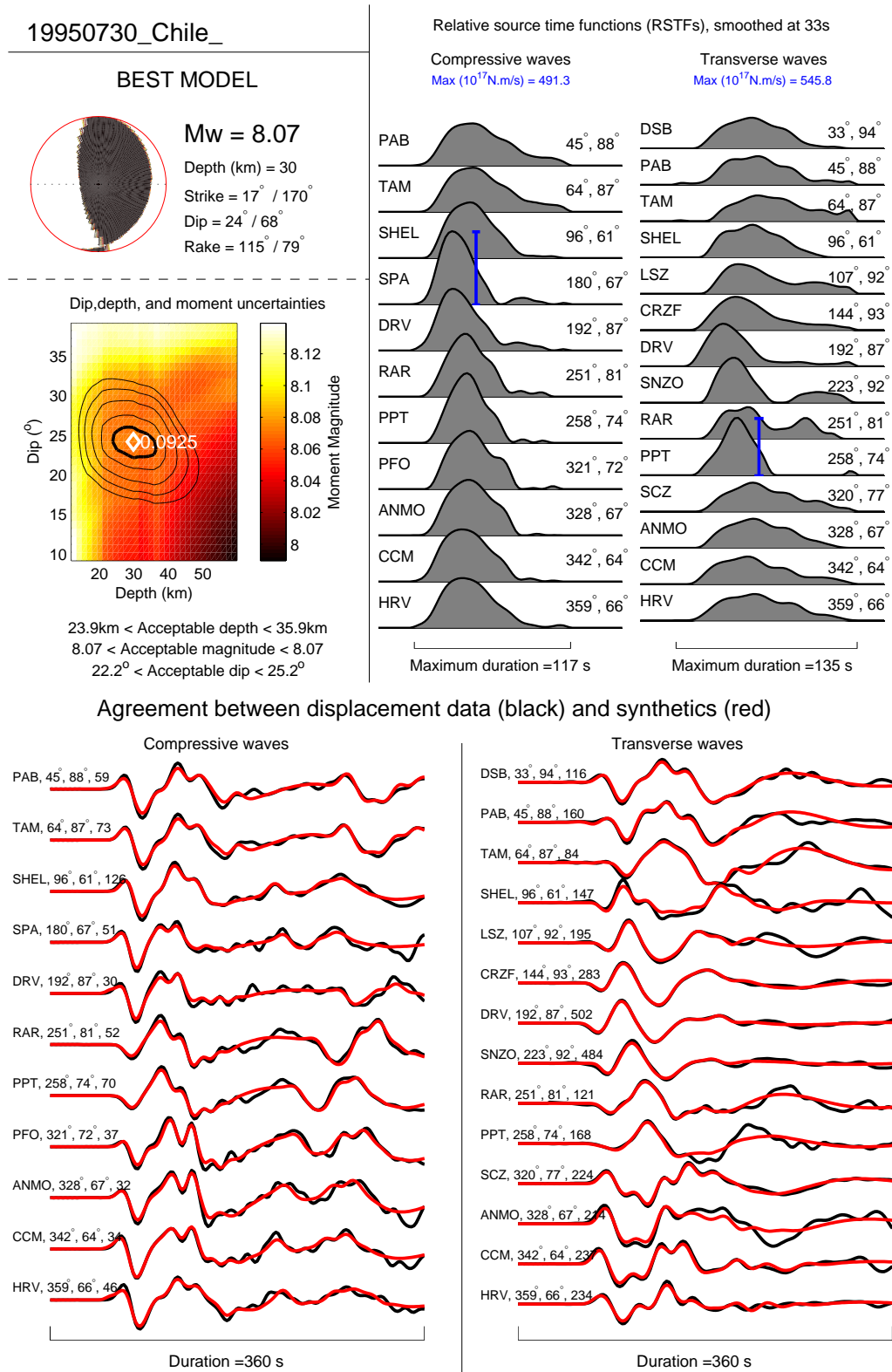
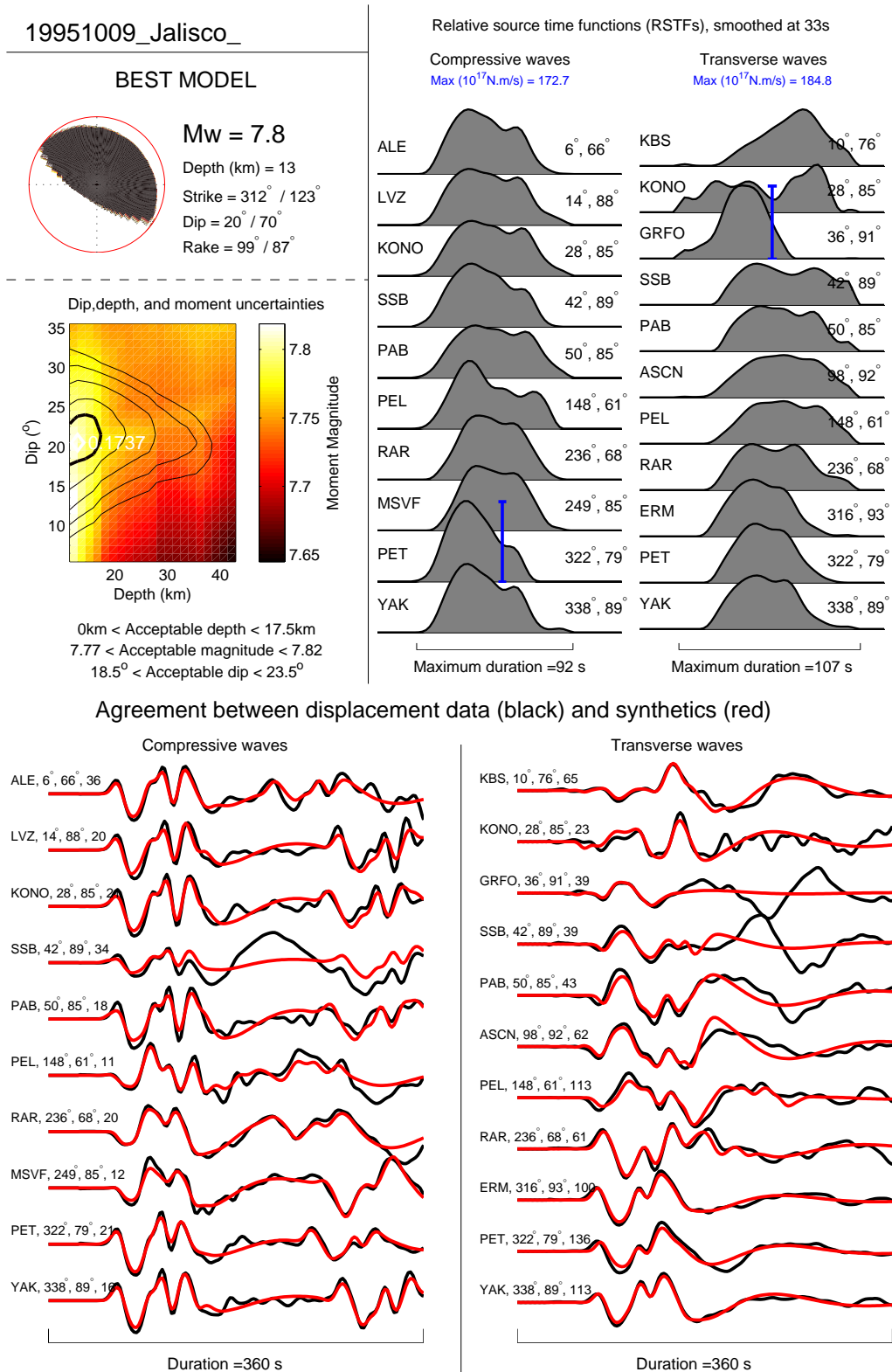


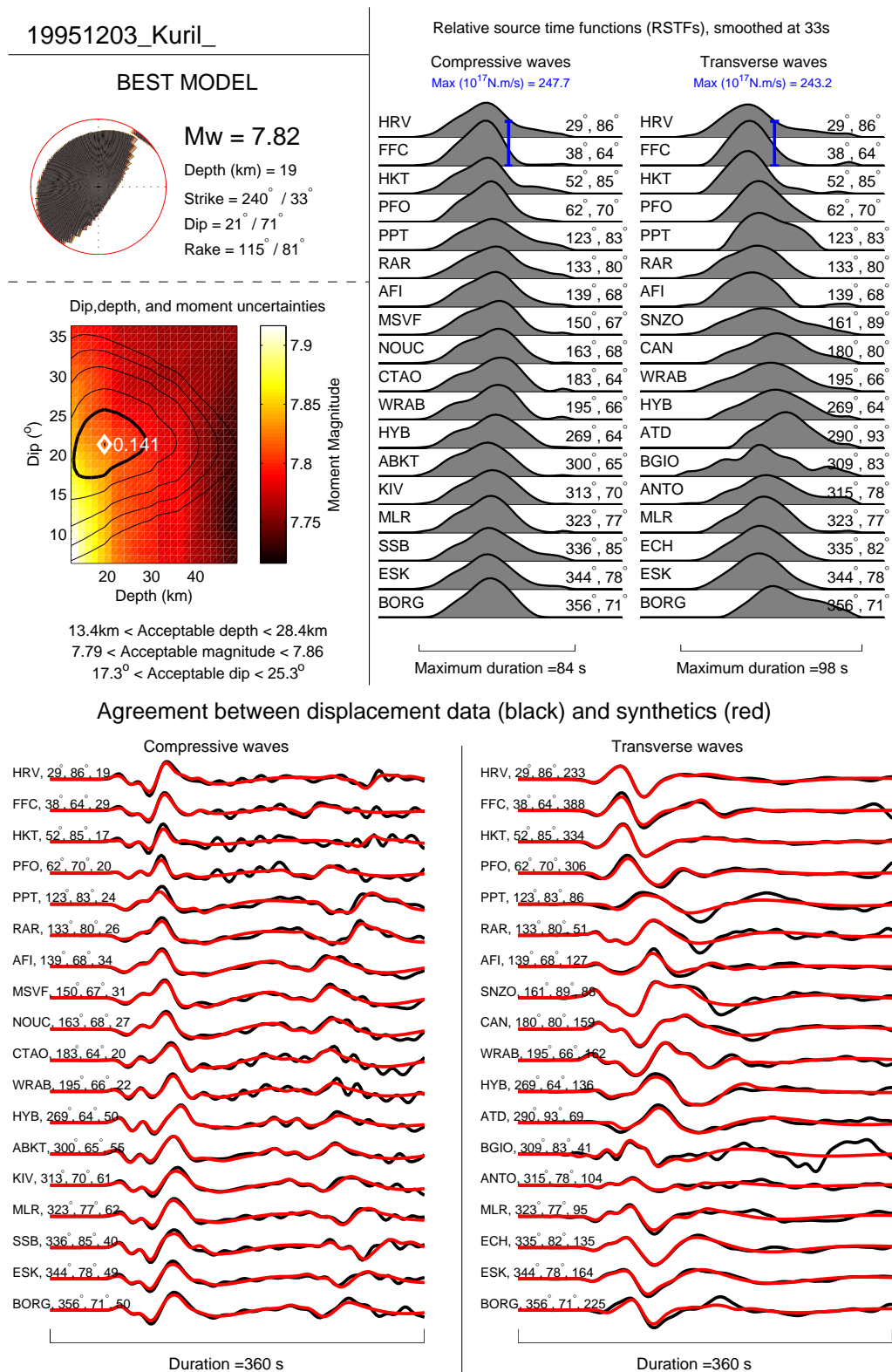
**Supplementary Figure 1** : Results for the 1994 Java earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



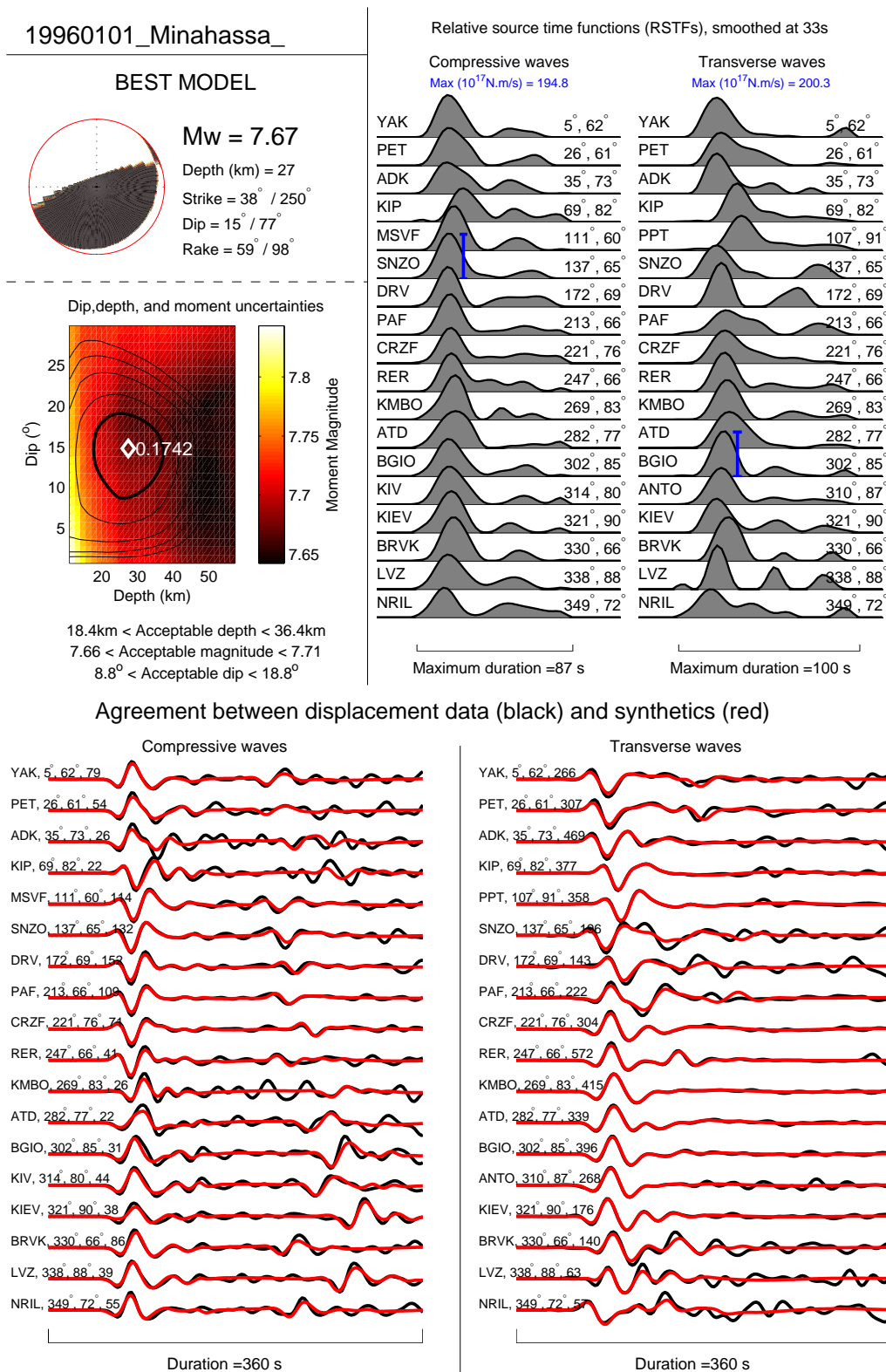
**Supplementary Figure 2** : Results for the 1995 Chile earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



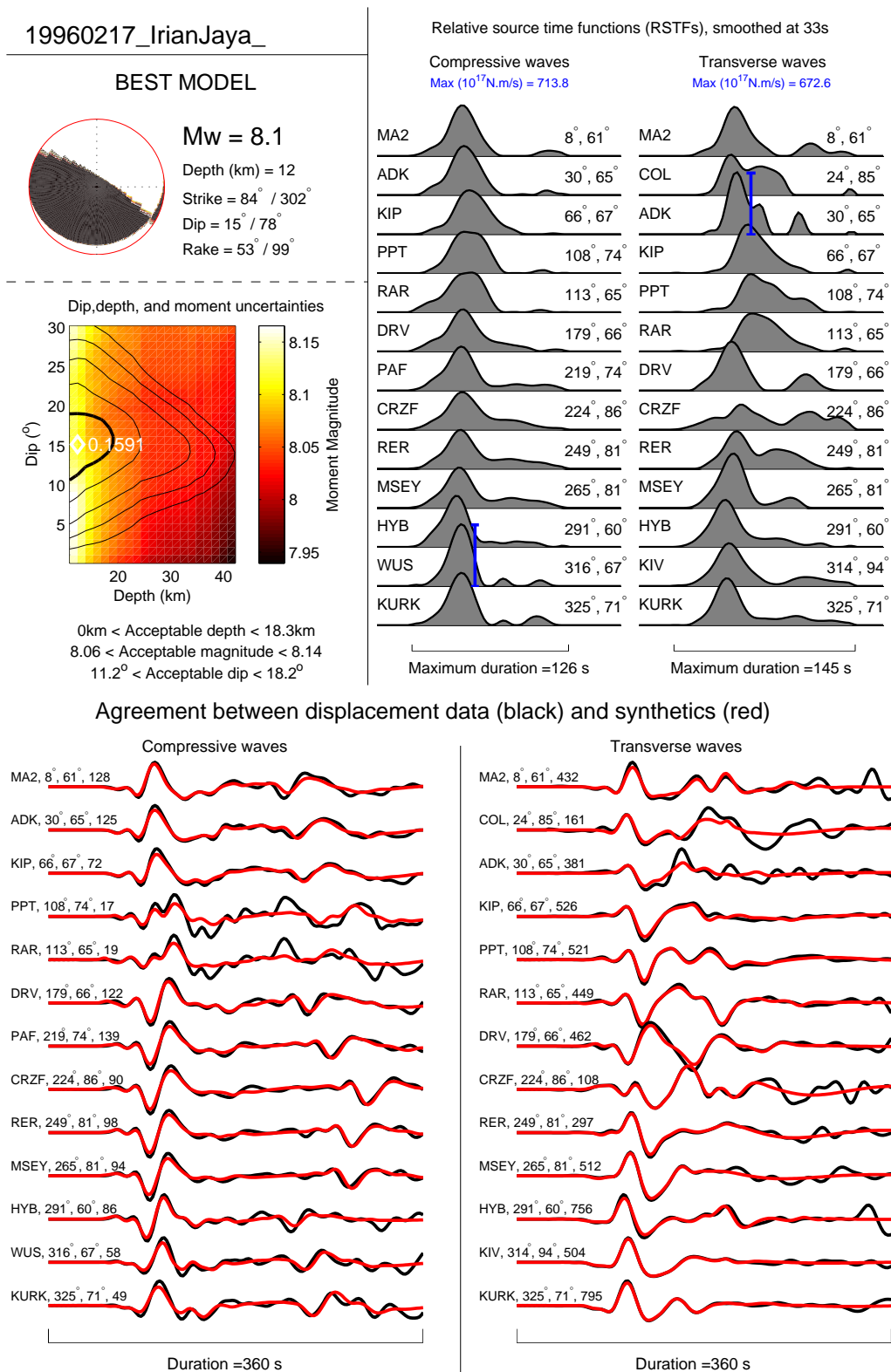
**Supplementary Figure 3** : Results for the 1995 Jalisco earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



**Supplementary Figure 4** : Results for the 1995 Kuril earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.

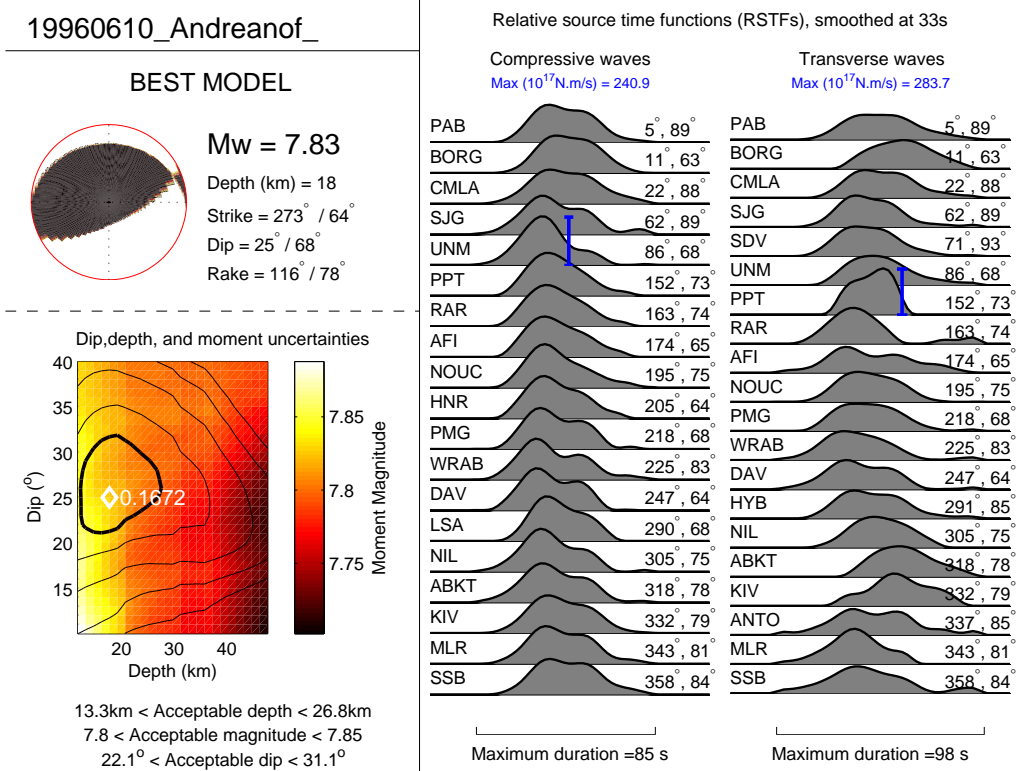


**Supplementary Figure 5** : Results for the 1996 Minahassa earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.

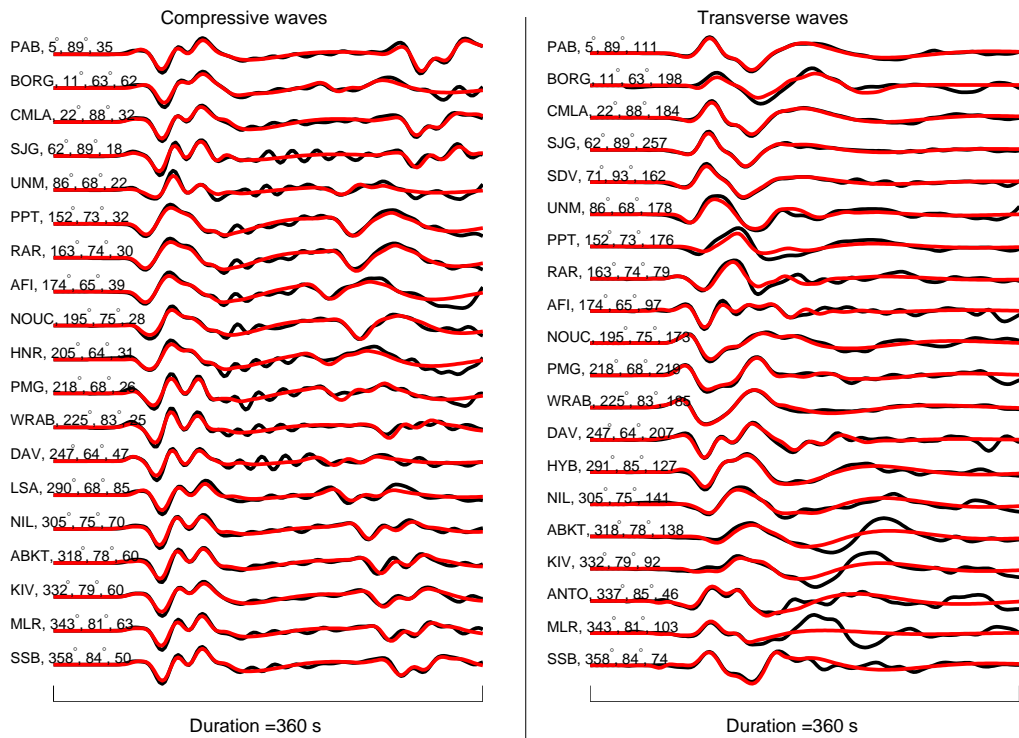


**Supplementary Figure 6** : Results for the 1996 Irian-Jaya earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.

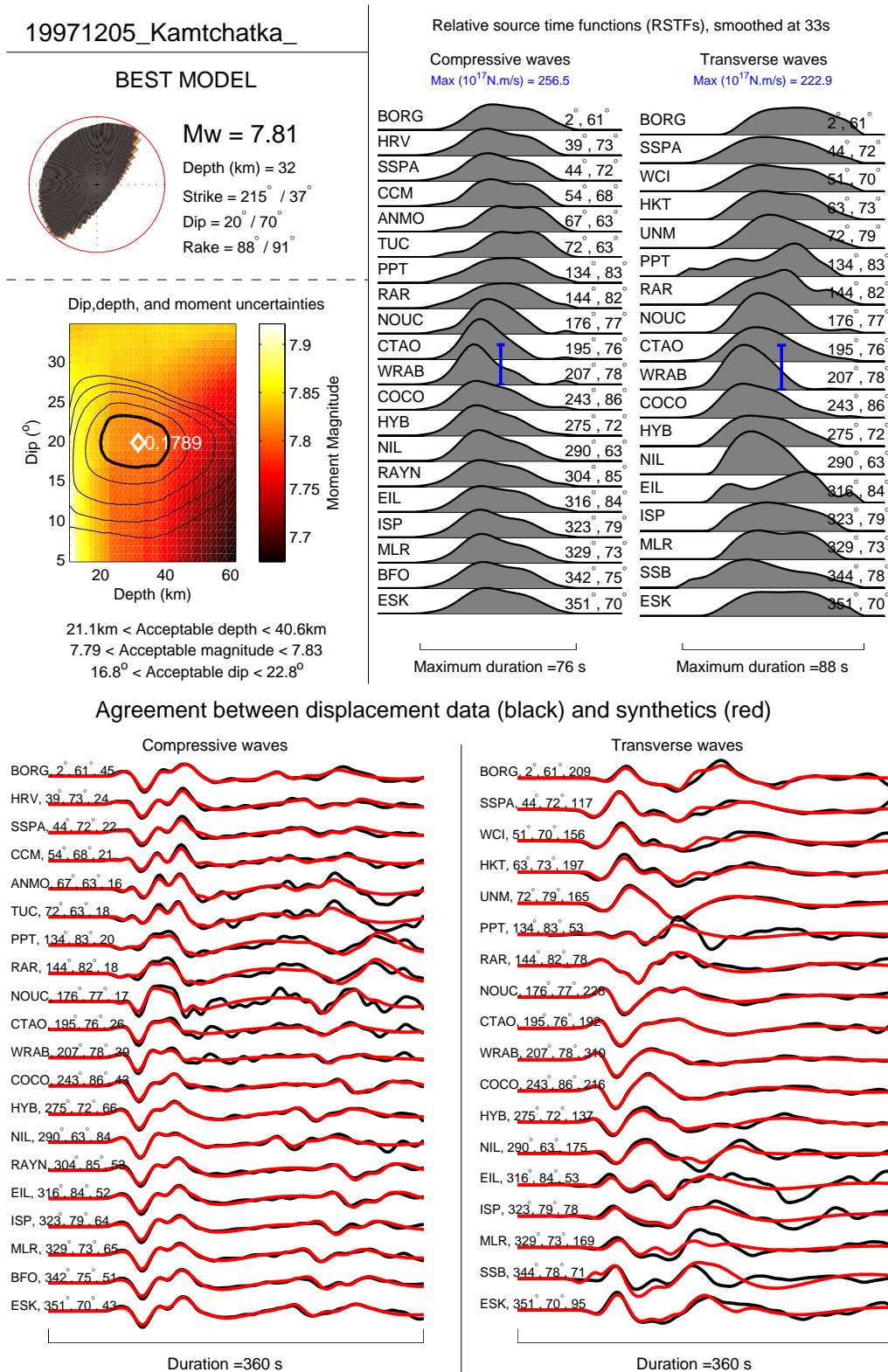




**Agreement between displacement data (black) and synthetics (red)**



**Supplementary Figure 7** : Results for the 1996 Andreanof earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.

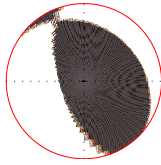


**Supplementary Figure 8** : Results for the 1997 Kamtchatka earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



20010623\_Peru\_

**BEST MODEL**



**Mw = 8.36**

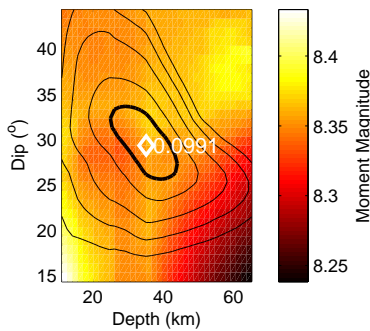
Depth (km) = 35

Strike = 307° / 162°

Dip = 29° / 65°

Rake = 59° / 106°

Dip, depth, and moment uncertainties



26.2km < Acceptable depth < 42.7km

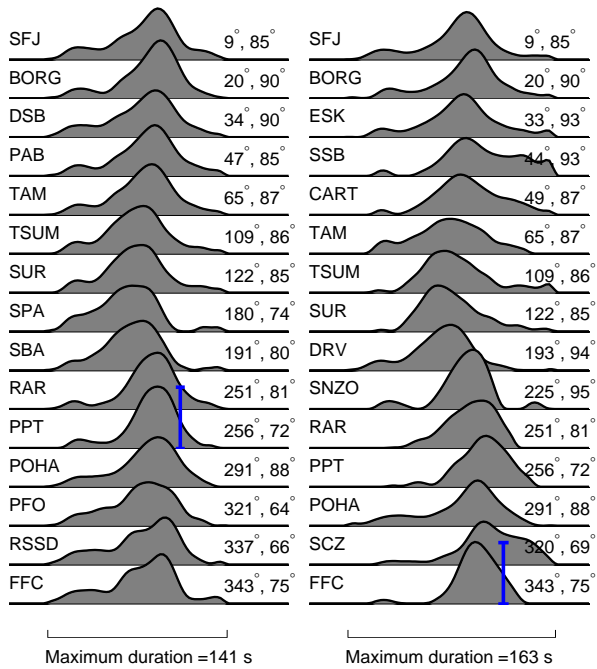
8.34 < Acceptable magnitude < 8.37

26.3° < Acceptable dip < 33.3°

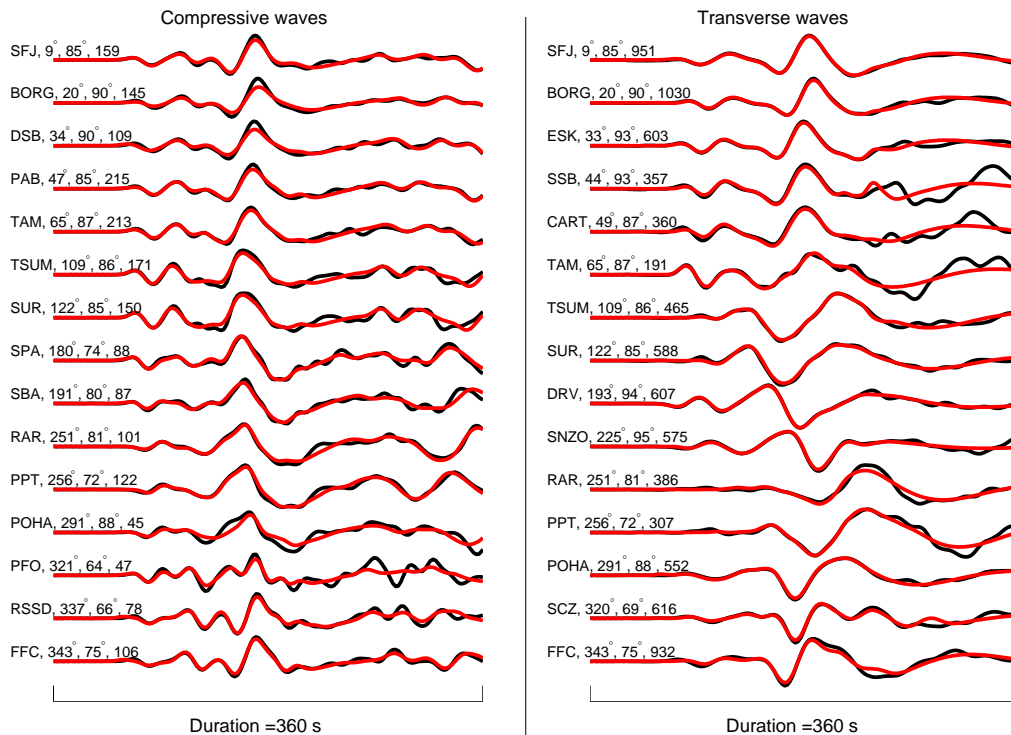
Relative source time functions (RSTFs), smoothed at 33s

Compressive waves  
Max ( $10^{17}$ N.m/s) = 1025.8

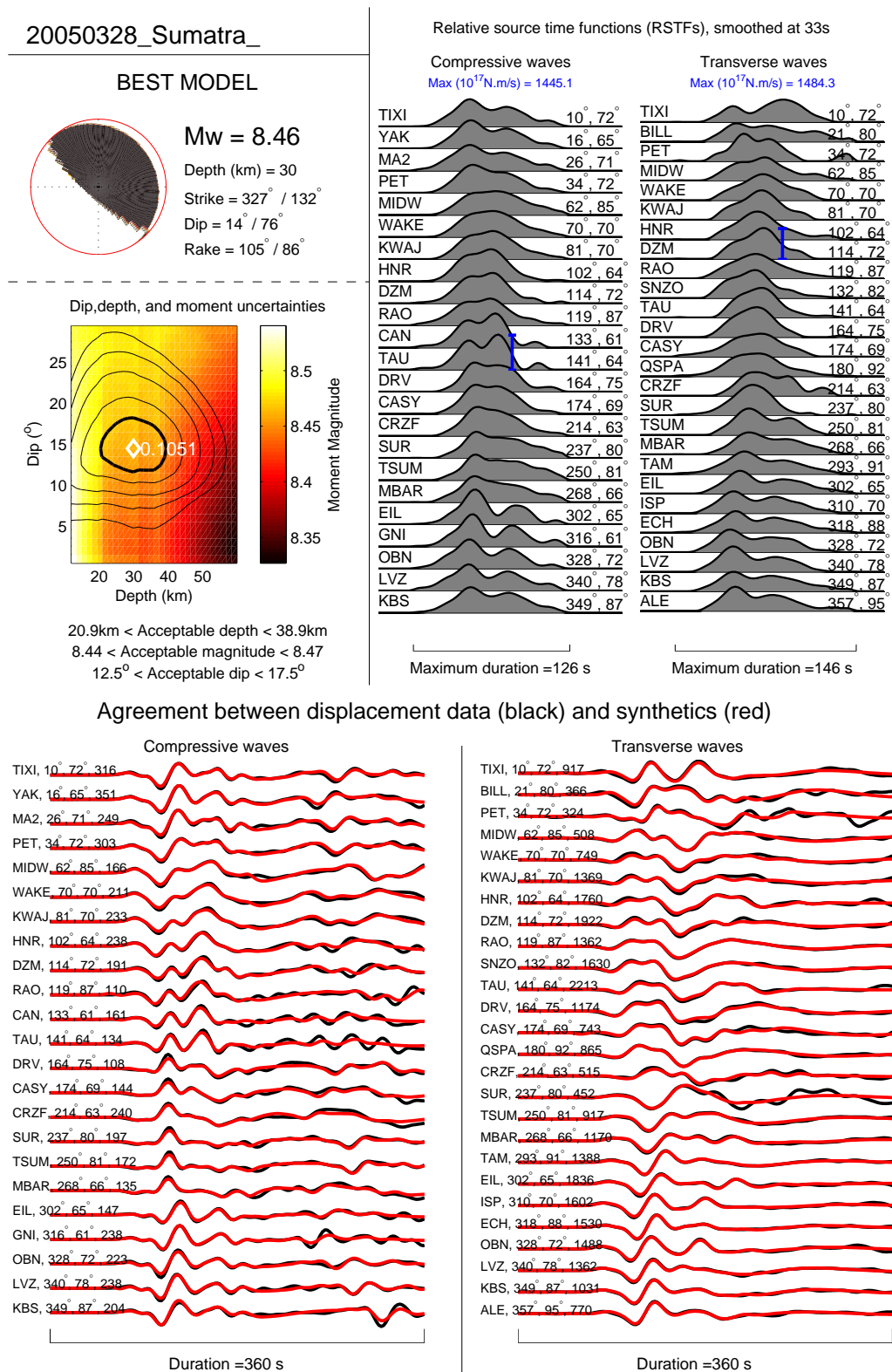
Transverse waves  
Max ( $10^{17}$ N.m/s) = 1146.8



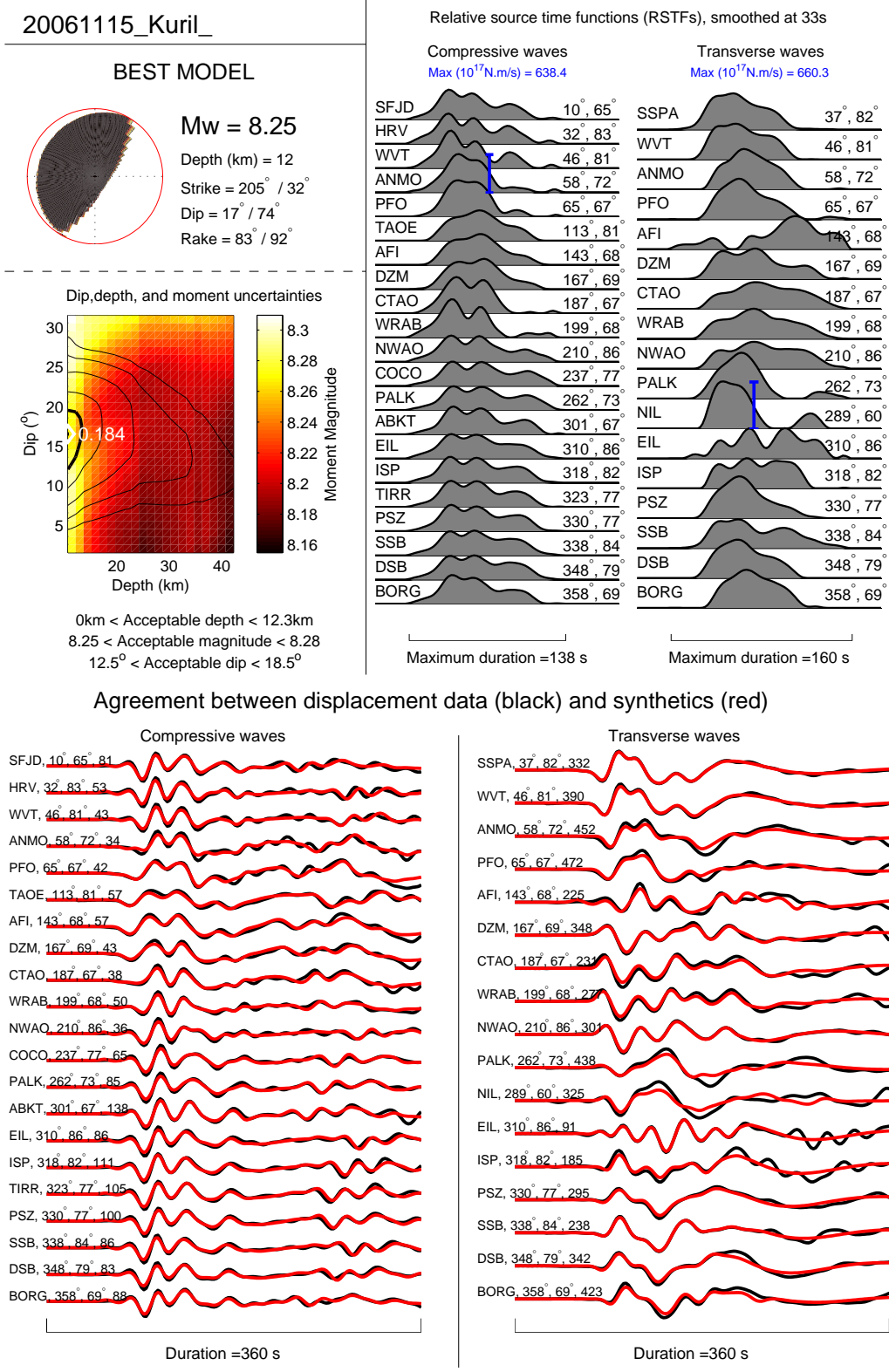
**Agreement between displacement data (black) and synthetics (red)**



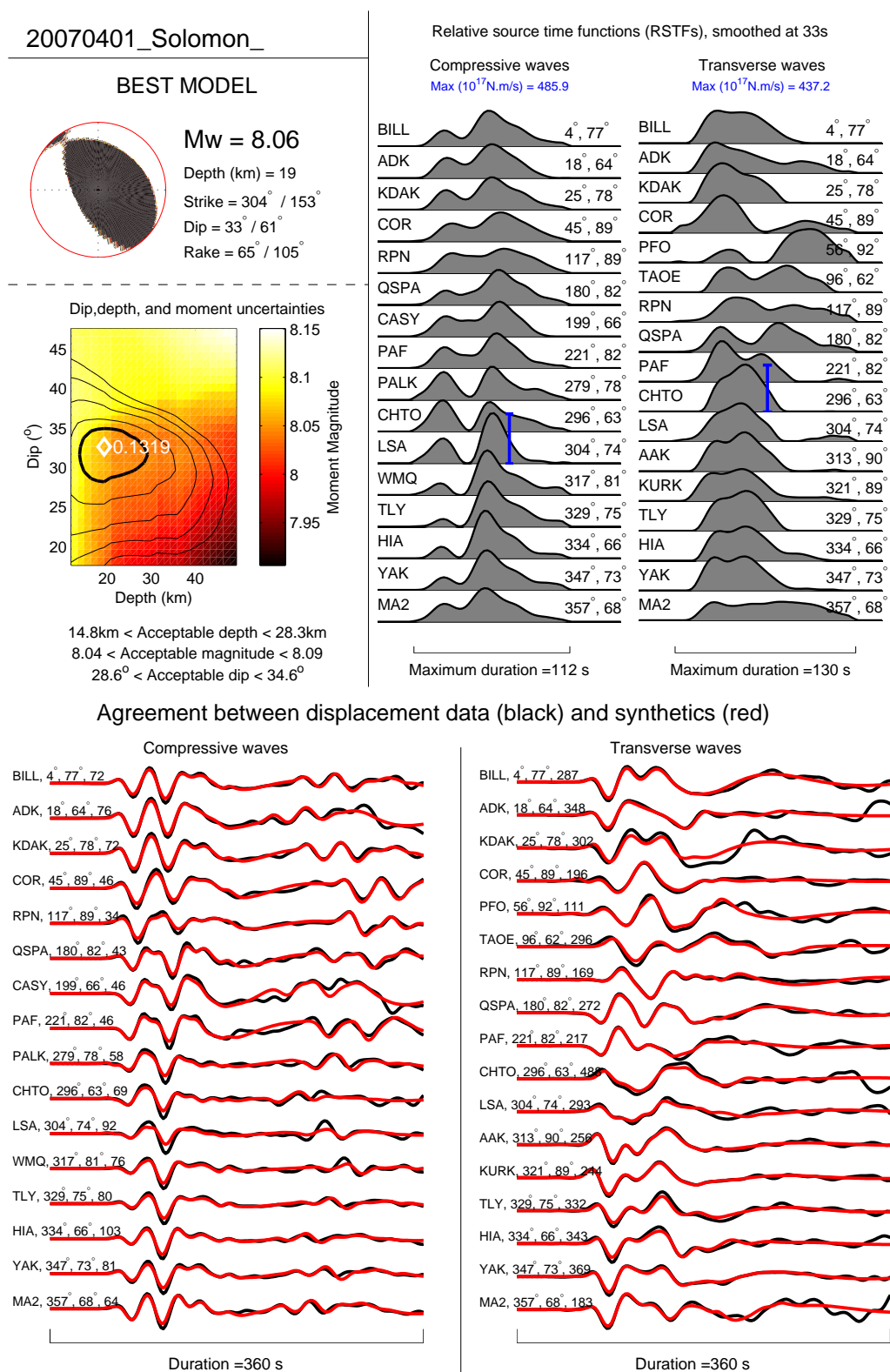
**Supplementary Figure 9** : Results for the 2001 Peru earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



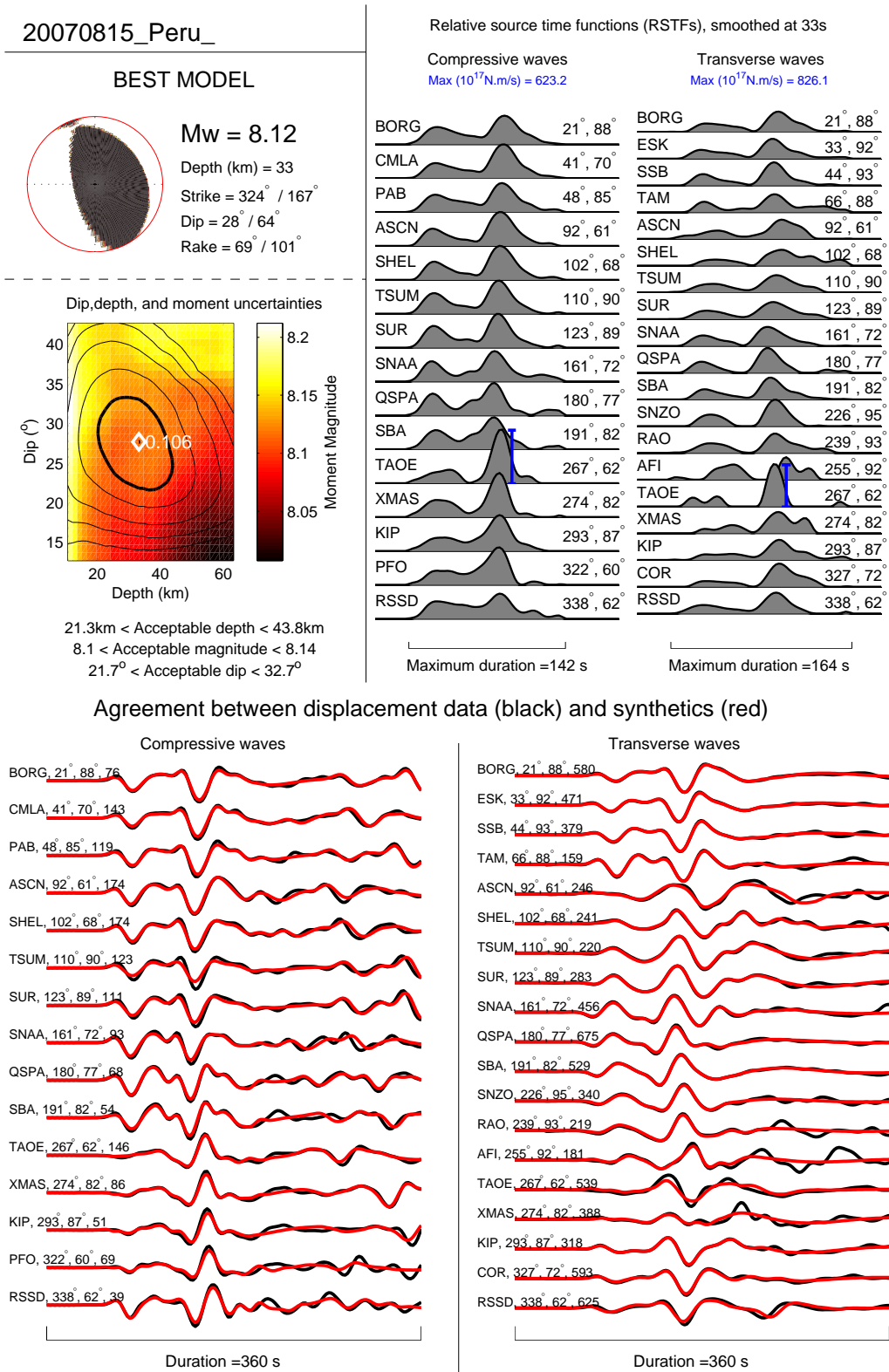
**Supplementary Figure 10** : Results for the 2005 Sumatra earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



**Supplementary Figure 11** : Results for the 2006 Kuril earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.

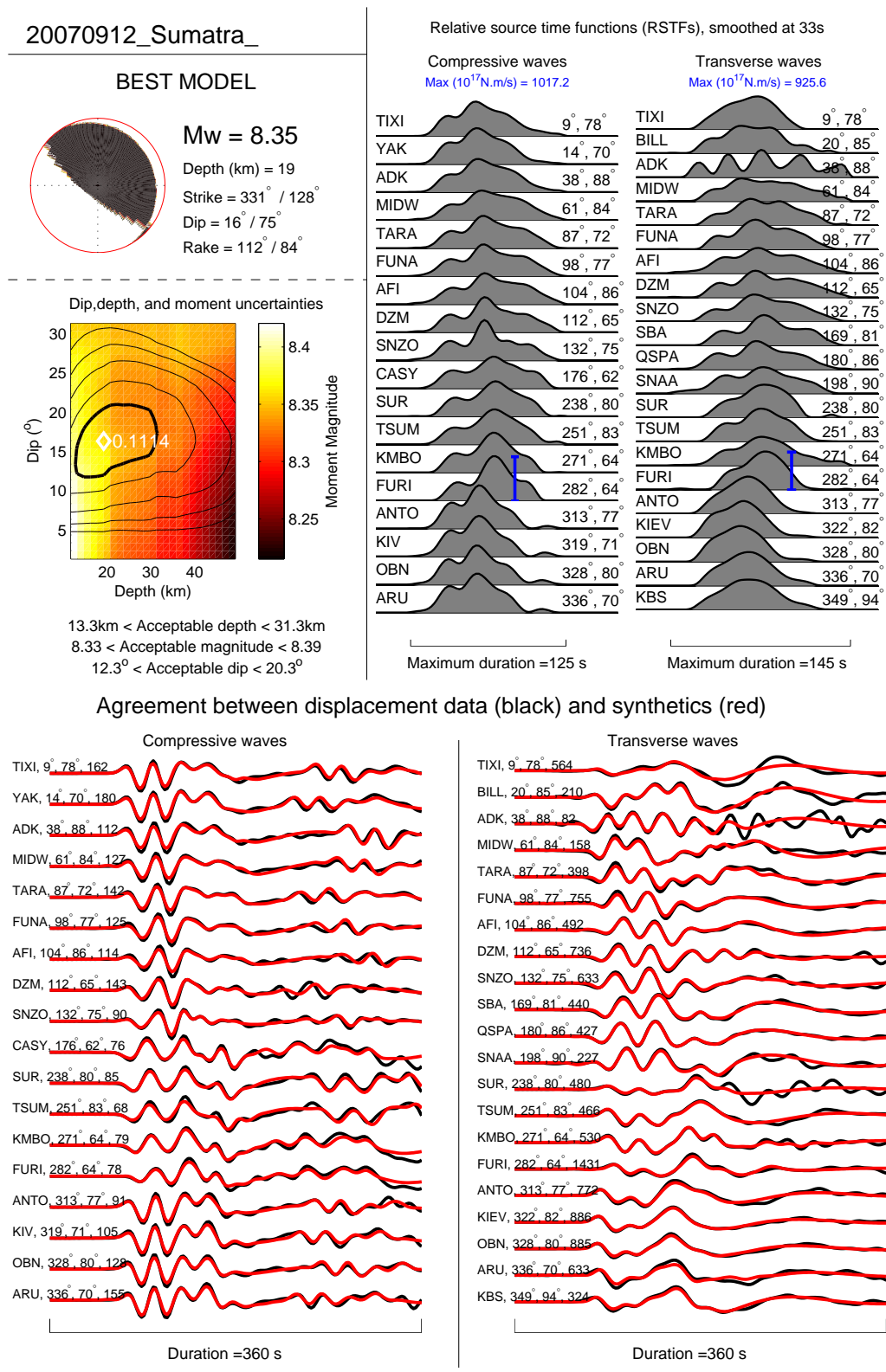


**Supplementary Figure 12** : Results for the 2007 Solomon earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



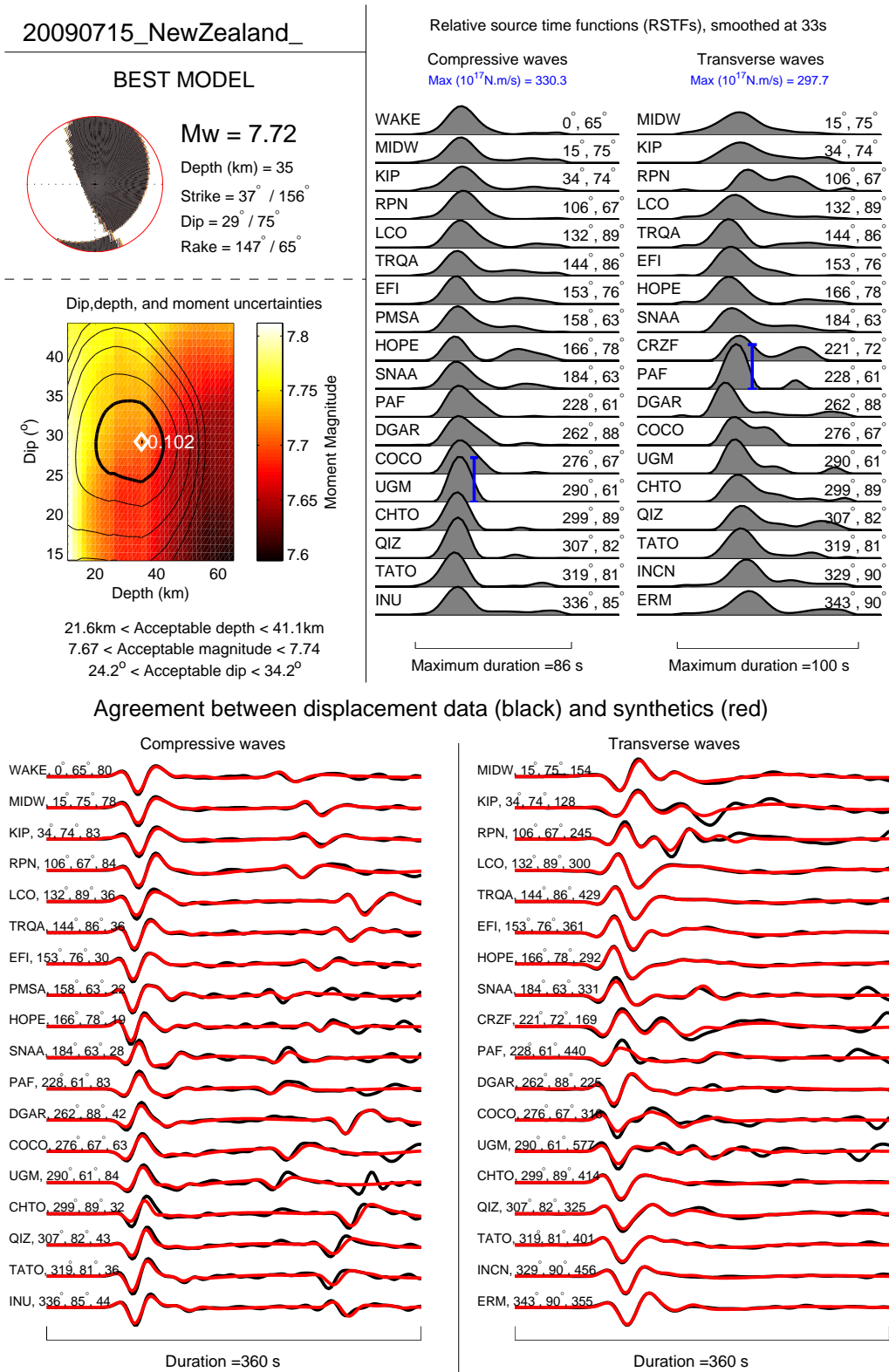
**Supplementary Figure 13** : Results for the 2007 Peru earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



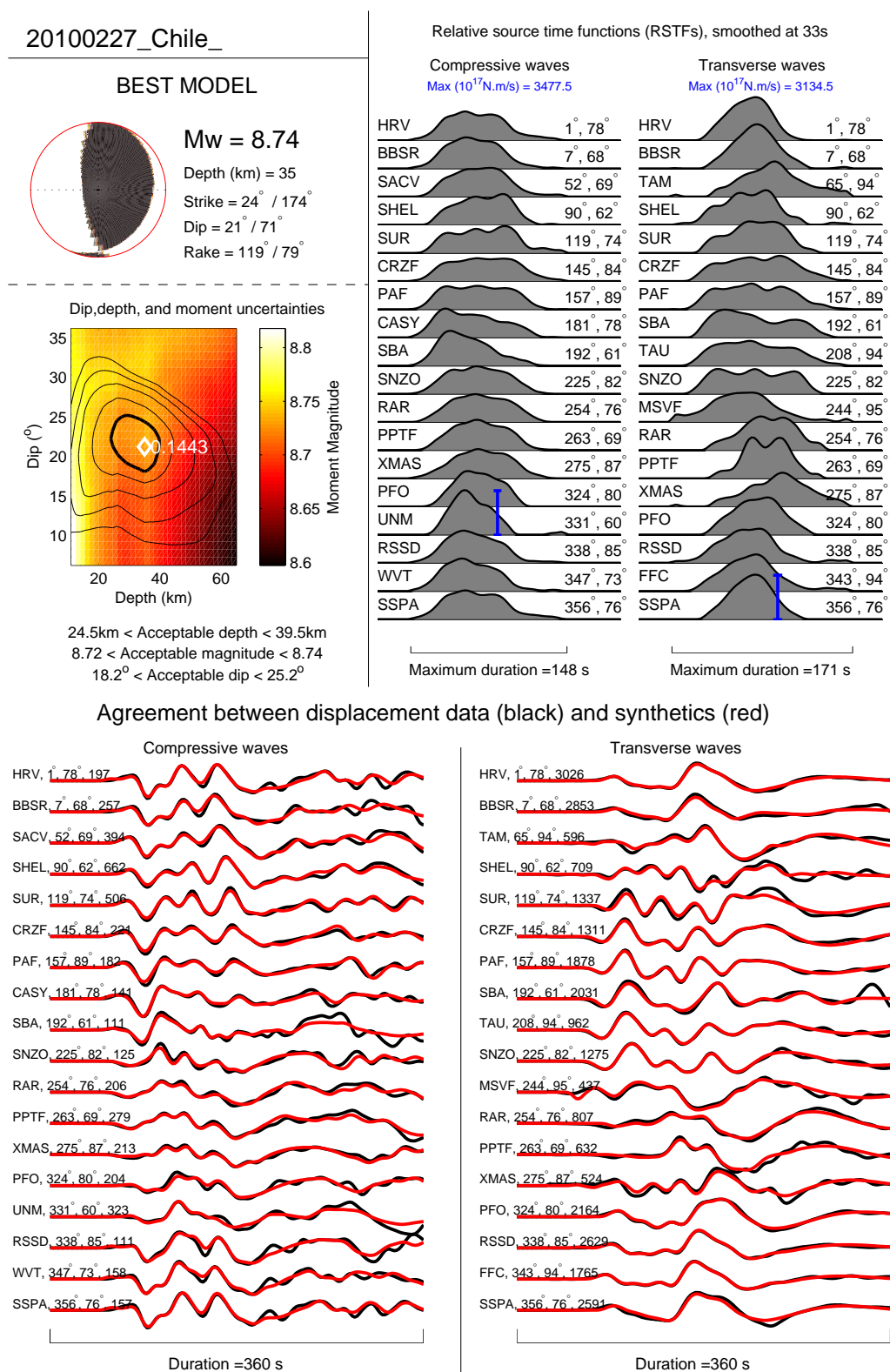


**Supplementary Figure 14** : Results for the 2007 Sumatra earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.

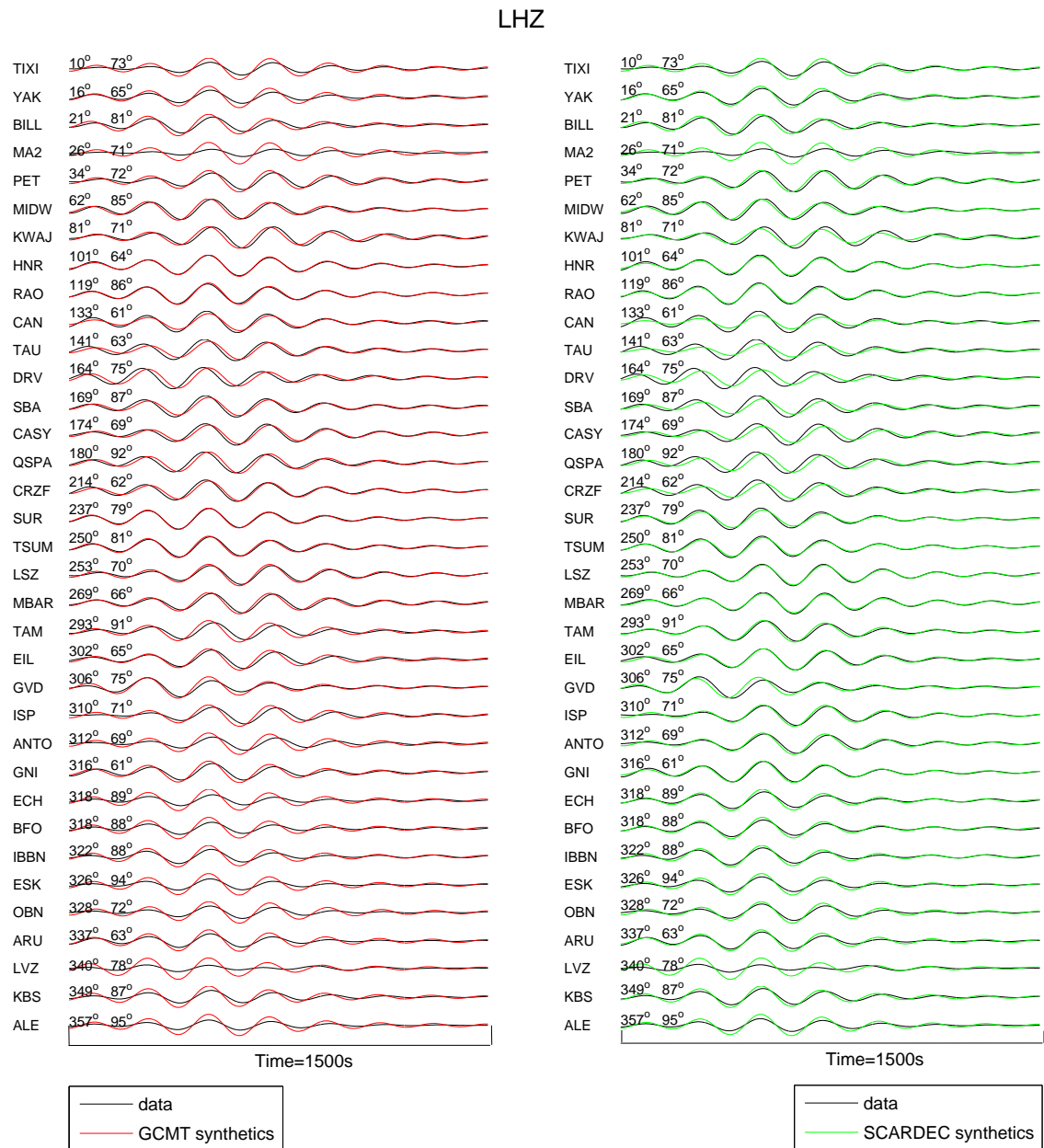




**Supplementary Figure 15** : Results for the 2009 New-Zealand earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.

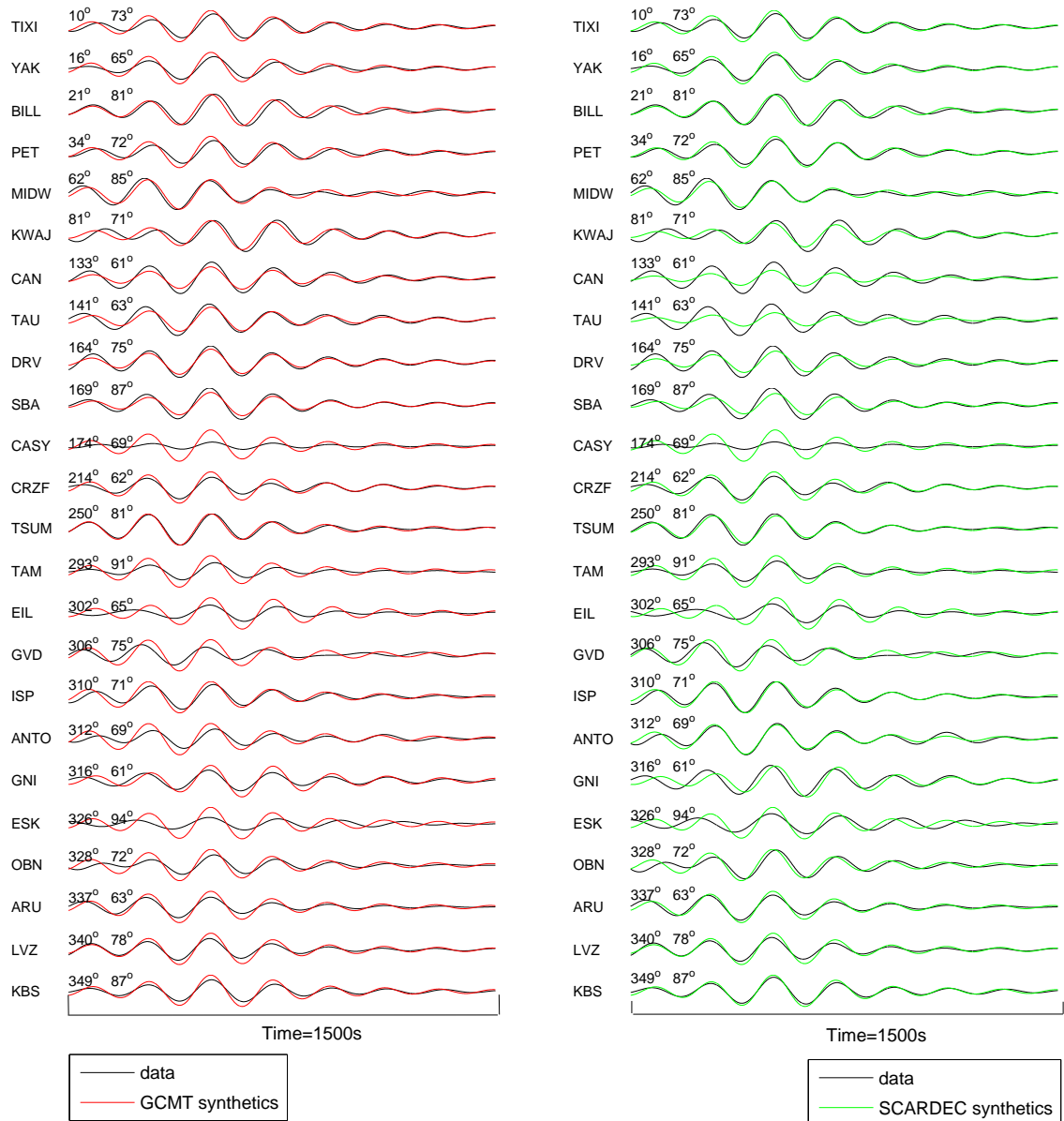


**Supplementary Figure 16** : Results for the 2010 Chile earthquake. (Top) Focal mechanism, depth, magnitude, uncertainties and RSTFs. See Figure 5 for more details. (Bottom) Agreement between data and synthetics, see Figure 6 for more details.



**Supplementary Figure 17** : Comparison of vertical component observed Rayleigh waves (black) with theoretical seismograms (red, green) at various stations of the FDSN, following the 2005 March 28 Sumatra earthquake. The name of each station is shown in the left of the waveforms and the corresponding source-receiver azimuth and epicentral distance are shown in the top, respectively. The synthetic seismograms are calculated for the earthquake source parameters in the GCMT catalogue (red) and for the parameters in the SCARDEC model (green; see main text for details). All traces have been low-pass cosine tapered around  $T=200$  s.

## LHT



**Supplementary Figure 18** : Same as in Supplementary Figure 17, but for transverse component  
Love waves.