

Notes on 1D models for southern California (Table 1)

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Overview

See Table 1. Attenuation values (e.g., Q_α and Q_β or Q_κ and Q_μ) are needed for generating Green’s functions, such as with a frequency-wavenumber code (e.g., *Zhu and Rivera*, 2002). I have not seen any Q values listed in the papers cited here. Doug Dreger used $Q_\beta = 300$ and $Q_\alpha = 600$ in his 1990s research in socal (e-mail communication, 2018-08-24).

Table 1: Various published versions of “the” southern California 1D model (SoCal). Here we take the bottom of the domain to be 60 km. (This is the depth used in the 3D wavefield simulations of *Tape et al.* (2009).) *Wald et al.* (1995); *Hutton et al.* (2010) attribute the SoCal1D model to *Hadley and Kanamori* (1977), but I don’t see any 1D model listed in that paper. The velocity values almost match those listed in *Kanamori and Hadley* (1975) (6700 vs 6800), but the depths are different (see below). The study of *Tape et al.* (2009, Tab. S5) used the values from *Dreger and Helmberger* (1990), but with the Moho depth of 32 km (not 37 km).

layer	top m	bottom m	thickness m	α m s ⁻¹	β m s ⁻¹	ρ kg m ⁻³	Reference
1	0	5500	5500	5500	3180	2400	<i>Dreger and Helmberger</i> (1990, Tab. 1)
2	5500	16000	10500	6300	3640	2670	<i>Dreger and Helmberger</i> (1990, Tab. 1)
3	16000	32000	16000	6700	3870	2800	<i>Dreger and Helmberger</i> (1990, Tab. 1)
4	[†] 37000	60000	28000	7800	4500	3000	<i>Dreger and Helmberger</i> (1990, Tab. 1)
1	0	5500	5500	5500	—	—	<i>Wald et al.</i> (1995, Tab. 1)
2	5500	16000	10500	6300	—	—	<i>Wald et al.</i> (1995, Tab. 1)
3	16000	32000	16000	6700	—	—	<i>Wald et al.</i> (1995, Tab. 1)
4	[†] 32000	60000	28000	7800	—	—	<i>Wald et al.</i> (1995, Tab. 1)
1	0	4000	4000	5500	—	—	<i>Kanamori and Hadley</i> (1975, Fig. 3)
2	4000	27400	23400	6300	—	—	<i>Kanamori and Hadley</i> (1975, Fig. 3)
3	27400	32400	5000	6800	—	—	<i>Kanamori and Hadley</i> (1975, Fig. 3)
4	32400	60000	27600	7800	—	—	<i>Kanamori and Hadley</i> (1975, Fig. 3)

[†]See Latex notes on Moho. The depth for the Moho was listed as 37 km in *Dreger and Helmberger* (1990, 1991a), 35 km in *Dreger and Helmberger* (1991b, 1993), and 32 km in *Wald et al.* (1995). *Wald et al.* (1995) writes: “The crustal model used in the routine processing of all southern California events, the Hadley–Kanamori model (*Hadley and Kanamori*, 1977), has knowingly been in error since 1977. It has had an incorrect Moho depth of 37 km instead of 32 km. The standard model was changed on February 24, 1993 to correct the Moho depth to 32 km.” *Hadley and Kanamori* (1977) wrote: “The crustal thickness of about 32 km derived from these profiles is similar to that derived in earlier work (*Kanamori and Hadley*, 1975).”

References

- Dreger, D. S., and D. V. Helmberger (1990), Broadband modeling of local earthquakes, *Bull. Seismol. Soc. Am.*, *80*(5), 1162–1179.
- Dreger, D. S., and D. V. Helmberger (1991a), Complex faulting deduced from broadband modeling of the 28 February 1990 Upland earthquake ($M_L = 5.2$), *Bull. Seismol. Soc. Am.*, *81*(4), 1129–1144.
- Dreger, D. S., and D. V. Helmberger (1991b), Source parameters of the Sierra Madre earthquake from regional and local body waves, *Geophys. Res. Lett.*, *18*(11), 2015–2018.
- Dreger, D. S., and D. V. Helmberger (1993), Determination of source parameters at regional distances with three-component sparse network data, *J. Geophys. Res.*, *98*(B5), 8107–8125.
- Hadley, D., and H. Kanamori (1977), Seismic structure of the Transverse Ranges, California, *Geol. Soc. Am. Bull.*, *88*, 1469–1478.
- Hutton, K., J. Woessner, and E. Hauksson (2010), Earthquake monitoring in southern California for seventy-seven years (1932–2008), *Bull. Seismol. Soc. Am.*, *100*(2), 423–446.
- Kanamori, H., and D. Hadley (1975), Crustal structure and temporal velocity change in southern California, *Pure App. Geophys.*, *113*, 257–280.
- Tape, C., Q. Liu, A. Maggi, and J. Tromp (2009), Adjoint tomography of the southern California crust, *Science*, *325*, 988–992, doi:10.1126/science.1175298.
- Wald, L. A., L. K. Hutton, and D. D. Given (1995), The Southern California Network Bulletin: 1990–1993 summary, *Seismol. Res. Lett.*, *66*(1), 9–19.
- Zhu, L., and L. A. Rivera (2002), A note on the dynamic and static displacements from a point source in multilayered media, *Geophys. J. Int.*, *148*, 619–627, doi:10.1046/j.1365-246X.2002.01610.x.