

Bibliography

- Aagaard, B. T., T. M. Brocher, D. Dolenc, D. Dreger, R. W. Graves, S. Harmsen, S. Hartzell, S. Larsen, and M. L. Zoback, Ground-motion modeling of the 1906 San Francisco earthquake, part I: Validation using the 1989 Loma Prieta earthquake, *Bull. Seismol. Soc. Am.*, **98**, 989–1011, 2008a.
- Aagaard, B. T., et al., Ground-motion modeling of the 1906 San Francisco earthquake, part II: Ground-motion estimates for the 1906 earthquake and scenario events, *Bull. Seismol. Soc. Am.*, **98**, 1012–1046, 2008b.
- Akçelik, V., G. Biros, and O. Ghattas, Parallel multiscale Gauss–Newton–Krylov methods for inverse wave propagation, *Proc. ACM/IEEE Supercomputing SC’2002 conference*, 2002, published on CD-ROM and at www.sc-conference.org/sc2002.
- Akçelik, V., et al., High resolution forward and inverse earthquake modeling on terascale computers, *Proc. ACM/IEEE Supercomputing SC’2003 conference*, 2003, published on CD-ROM and at www.sc-conference.org/sc2003.
- Allen, R. V., Automatic earthquake recognition and timing from single traces, *Bull. Seismol. Soc. Am.*, **68**, 1521–1532, 1978.
- Amante, C., and B. W. Eakins,ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis, National Geophysical Data Center, NESDIS, NOAA, U.S. Department of Commerce, Boulder, CO, 2008.
- Bijwaard, H., and W. Spakman, Nonlinear global P-wave tomography by iterated linearized inversion, *Geophys. J. Int.*, **141**, 71–82, 2000.
- Bleibinhaus, F., J. A. Hole, T. Ryberg, and G. S. Fuis, Structure of the California Coast Ranges and San Andreas Fault at SAFOD from seismic waveform inversion and reflection imaging, *J. Geophys. Res.*, **112**, 2007.
- Bonner, J. L., D. D. Blackwell, and E. T. Herrin, Thermal constraints on earthquake depths in California, *Bull. Seismol. Soc. Am.*, **93**, 2333–2354, 2003.
- Boschi, L., G. Ekström, and B. Kustowski, Multiple resolution surface wave tomography: the Mediterranean basin, *Geophys. J. Int.*, **157**, 293–304, 2004.
- Brocher, T. M., Empirical relations between elastic wavespeeds and density in the Earth’s crust, *Bull. Seismol. Soc. Am.*, **95**, 2081–2092, 2005.
- Bunks, C., F. M. Saleck, S. Zaleski, and G. Chavent, Multiscale seismic waveform inversion, *Geophysics*, **60**, 1457–1473, 1995.

- Capdeville, Y., E. Chaljub, J. P. Vilotte, and J. P. Montagner, Coupling the spectral element method with a modal solution for elastic wave propagation in global earth models, *Geophys. J. Int.*, **152**, 34–67, 2003.
- Capdeville, Y., Y. Gung, and B. Romanowicz, Towards global earth tomography using the spectral element method: a technique based on source stacking, *Geophys. J. Int.*, **162**, 541–554, 2005.
- Chen, P., L. Zhao, and T. H. Jordan, Full 3D tomography for the crustal structure of the Los Angeles region, *Bull. Seismol. Soc. Am.*, **97**, 1094–1120, 2007.
- Christensen, N. I., Poisson's ratio and crustal seismology, *J. Geophys. Res.*, **101**, 3139–3156, 1996.
- Christensen, N. I., and W. D. Mooney, Seismic velocity structure and composition of the continental crust: A global view, *J. Geophys. Res.*, **100**, 9761–9788, 1995.
- Claerbout, J. F., Toward a unified theory of reflector mapping, *Geophysics*, **36**, 467–481, 1971.
- Clinton, J. F., E. Hauksson, and K. Solanki, An evaluation of the SCSN moment tensor solutions: Robustness of the M_w magnitude scale, style of faulting, and automation of the method, *Bull. Seismol. Soc. Am.*, **96**, 1689–1705, 2006.
- Courtier, P., and O. Talagrand, Variational assimilation of meteorological observations with the adjoint vorticity equation. II: Numerical results, *Q. J. R. Meteorol. Soc.*, **113**, 1329–1347, 1987.
- Custódio, S., P. Liu, and R. J. Archuleta, The 2004 M_w 6.0 Parkfield, California, earthquake: Inversion of near-source ground motion using multiple data sets, *Geophys. Res. Lett.*, **32**, 2005.
- Dahlen, F. A., Finite-frequency sensitivity kernels for boundary topography perturbations, *Geophys. J. Int.*, **162**, 525–540, 2005.
- Dahlen, F. A., and A. M. Baig, Fréchet kernels for body-wave amplitudes, *Geophys. J. Int.*, **150**, 440–446, 2002.
- Dahlen, F. A., and J. Tromp, *Theoretical Global Seismology*, Princeton U. Press, New Jersey, 1998.
- Dahlen, F. A., S.-H. Hung, and G. Nolet, Fréchet kernels for finite-frequency traveltimes—I. Theory, *Geophys. J. Int.*, **141**, 157–174, 2000.
- Dreger, D., R. Uhrhammer, M. Pasmanos, J. Franck, and B. Romanowicz, Regional and far-regional earthquake locations and source parameters using sparse broadband networks: A test on the Ridgecrest sequence, *Bull. Seismol. Soc. Am.*, **88**, 1353–1362, 1998.
- Dreger, D. S., and D. V. Helmberger, Broadband modeling of local earthquakes, *Bull. Seismol. Soc. Am.*, **80**, 1162–1179, 1990.
- Dziewonski, A., and D. Anderson, Preliminary reference Earth model, *Phys. Earth Planet. Inter.*, **25**, 297–356, 1981.

- Ekström, G., J. Tromp, and E. W. F. Larson, Measurements and global models of surface wave propagation, *J. Geophys. Res.*, **102**, 8137–8157, 1997.
- Fichtner, A., H.-P. Bunge, and H. Igel, The adjoint method in seismology—I. Theory, *Phys. Earth Planet. Inter.*, **157**, 86–104, 2006.
- Fichtner, A., B. L. N. Kennett, H. Igel, and H.-P. Bunge, Full seismic waveform tomography for upper-mantle structure in the Australasian region using adjoint methods, *Geophys. J. Int.* (*in review*), 2009.
- Fink, M., Time reversal of ultrasonic fields—Part I: Basic principles, *IEEE Trans. Ultras. Ferroelec. Freq. Contr.*, **39**, 555–566, 1992.
- Fink, M., Time reversed acoustics, *Phys. Today*, **50**, 34–40, 1997.
- Fink, M., C. Prada, F. Wu, and D. Cassereau, Self focusing in inhomogeneous media with “time reversal” acoustic mirrors, in *Proc. IEEE Ultrasonic Symp. 1989*, vol. 2, pp. 681–686, 1989.
- Fletcher, R., and C. M. Reeves, Function minimization by conjugate gradients, *Comp. J.*, **7**, 149–154, 1964.
- Fuis, G. S., and W. M. Kohler, Crustal structure and tectonics of the Imperial Valley region, California, in *The Imperial Basin—Tectonics, Sedimentation, and Thermal Aspects*, edited by C. A. Rigsby, pp. 1–13, Pacific Section S.E.P.M, Los Angeles, Calif., USA, 1984.
- Fuis, G. S., et al., Fault systems of the 1971 San Fernando and 1994 Northridge earthquakes, southern California: Relocated aftershocks and seismic images from LARSE II, *Geology*, **31**, 171–174, 2003.
- Gauthier, O., J. Virieux, and A. Tarantola, Two-dimensional nonlinear inversion of seismic waveforms: Numerical results, *Geophysics*, **51**, 1387–1403, 1986.
- Goodman, E. D., and P. E. Malin, Evolution of the southern San Joaquin basin and mid-Tertiary “transitional” tectonics, central California, *Tectonics*, **11**, 478–498, 1992.
- Grand, S. P., R. D. van der Hilst, and S. Widjiantoro, Global seismic tomography: A snapshot of convection in the Earth, *GSA Today*, **7**, 1–7, 1997.
- Hansen, P. C., *Rank-Deficient and Discrete Ill-Posed Problems*, SIAM, Philadelphia, Penn., 1998.
- Hardebeck, J. L., and P. M. Shearer, Using S/P amplitude ratios to constrain the focal mechanisms of small earthquakes, *Bull. Seismol. Soc. Am.*, **93**, 2434–2444, 2003.
- Hauksson, E., Crustal structure and seismicity distribution adjacent to the Pacific and North America plate boundary in southern California, *J. Geophys. Res.*, **105**, 13,875–13,903, 2000.
- Hauksson, E., and J. Unruh, Regional tectonics of the Coso geothermal area along the intracontinental plate boundary in central eastern California: Three-dimensional V_p and V_p/V_s models, spatial-temporal seismicity patterns, and seismogenic deformation, *J. Geophys. Res.*, **112**, 2007.

- Humphreys, E. D., and R. W. Clayton, Tomographic image of the southern California mantle, *J. Geophys. Res.*, **95**, 19,725–19,746, 1990.
- Hung, S.-H., F. A. Dahlen, and G. Nolet, Fréchet kernels for finite-frequency traveltimes—II. Examples, *Geophys. J. Int.*, **141**, 175–203, 2000.
- Jarrard, R. D., Relations among subduction parameters, *Rev. Geophys.*, **24**, 217–284, 1986.
- Jennings, C. W., Fault activity map of California and adjacent areas, with locations and ages of recent volcanic eruptions, Calif. Div. Mines and Geology, 1994, Geologic Data Map No. 6, map scale 1:750,000.
- Kanamori, H., and D. Hadley, Crustal structure and temporal velocity change in southern California, *Pure App. Geophys.*, **113**, 257–280, 1975.
- Kennett, B. L. N., M. S. Sambridge, and P. R. Williamson, Subspace methods for large inverse problems with multiple parameter classes, *Geophys. J. Int.*, **94**, 237–247, 1988.
- Kiyashchenko, D., R.-E. Plessix, B. Kashtan, and V. Troyan, A modified imaging principle for true-amplitude wave-equation migration, *Geophys. J. Int.*, **168**, 1093–1104, 2007.
- Komatitsch, D., and J. Tromp, Introduction to the spectral element method for three-dimensional seismic wave propagation, *Geophys. J. Int.*, **139**, 806–822, 1999.
- Komatitsch, D., and J. Tromp, Spectral-element simulations of global seismic wave propagation—I. Validation, *Geophys. J. Int.*, **149**, 390–412, 2002a.
- Komatitsch, D., and J. Tromp, Spectral-element simulations of global seismic wave propagation—II. Three-dimensional models, oceans, rotation and self-gravitation, *Geophys. J. Int.*, **150**, 308–318, 2002b.
- Komatitsch, D., and J.-P. Vilotte, The spectral element method: An efficient tool to simulate the seismic response of 2D and 3D geological structures, *Bull. Seismol. Soc. Am.*, **88**, 368–392, 1998.
- Komatitsch, D., J. Ritsema, and J. Tromp, The spectral-element method, Beowulf computing, and global seismology, *Science*, **298**, 1737–1742, 2002.
- Komatitsch, D., Q. Liu, J. Tromp, P. Süß, C. Stidham, and J. H. Shaw, Simulations of ground motion in the Los Angeles basin based upon the spectral-element method, *Bull. Seismol. Soc. Am.*, **94**, 187–206, 2004.
- Laske, G., and G. Masters, Constraints on global phase velocity maps from long-period polarization data, *J. Geophys. Res.*, **101**, 16,059–16,075, 1996.
- Lee, S.-J., H.-W. Chen, Q. Liu, D. Komatitsch, B.-S. Huang, and J. Tromp, Three-dimensional simulations of seismic-wave propagation in the Taipei basin with realistic topography based upon the spectral-element method, *Bull. Seismol. Soc. Am.*, **98**, 253–264, 2008.
- Lin, G., P. Shearer, and Y. Fialko, Obtaining absolute locations for quarry seismicity using remote sensing data, *Bull. Seismol. Soc. Am.*, **96**, 722–728, 2006.

- Lin, G., P. M. Shearer, and E. Hauksson, Applying a three-dimensional velocity model, waveform cross correlation, and cluster analysis to locate southern California seismicity from 1981 to 2005, *J. Geophys. Res.*, **112**, 2007a.
- Lin, G., P. M. Shearer, E. Hauksson, and C. H. Thurber, A three-dimensional crustal seismic velocity model for southern California from a composite event method, *J. Geophys. Res.*, **112**, 2007b.
- Liu, Q., and J. Tromp, Finite-frequency kernels based on adjoint methods, *Bull. Seismol. Soc. Am.*, **96**, 2383–2397, 2006.
- Liu, Q., and J. Tromp, Finite-frequency sensitivity kernels for global seismic wave propagation based upon adjoint methods, *Geophys. J. Int.*, **174**, 265–286, 2008.
- Liu, Q., J. Polet, D. Komatitsch, and J. Tromp, Spectral-element moment tensor inversions for earthquakes in southern California, *Bull. Seismol. Soc. Am.*, **94**, 1748–1761, 2004.
- Lohman, R. B., and J. J. McGuire, Earthquake swarms driven by aseismic creep in the Salton Trough, California, *J. Geophys. Res.*, **112**, 2007, B04405, doi:10.1029/2006JB004596.
- Lovely, P., J. H. Shaw, Q. Liu, and J. Tromp, A structural V_p model of the Salton Trough, California, and its implications for seismic hazard, *Bull. Seismol. Soc. Am.*, **96**, 1882–1896, 2006.
- Luffi, P., J. B. Saleeby, C.-T. A. Lee, and M. N. Ducea, Lithospheric mantle duplex beneath the central Mojave Desert revealed by xenoliths from Dish Hill, California, *J. Geophys. Res.*, **114**, 2009.
- Luo, Y., and G. Schuster, Parsimonious staggered grid finite-differencing of the wave equation, *Geophys. Res. Lett.*, **17**, 155–158, 1990.
- Luyendyk, B. P., M. K. Kamerling, and R. Terres, Geometric model for Neogene crustal rotations in southern California, *Geol. Soc. Am. Bull.*, **91**, 211–217, 1980.
- Ma, S., R. J. Archuleta, and M. T. Page, Effects of large-scale surface topography on ground motions, as demonstrated by a study of the San Gabriel Mountains, Los Angeles, California, *Bull. Seismol. Soc. Am.*, **97**, 2066–2079, 2007.
- Maggi, A., C. Tape, M. Chen, D. Chao, and J. Tromp, An automated time-window selection algorithm for seismic tomography, *Geophys. J. Int.*, 2009, The automated algorithm FLEXWIN is available for download at www.geodynamics.org.
- Magistrale, H., S. Day, R. W. Clayton, and R. Graves, The SCEC Southern California reference three-dimensional velocity model Version 2, *Bull. Seismol. Soc. Am.*, **90**, S65–S76, 2000.
- Marquering, H., F. A. Dahlen, and G. Nolet, Three-dimensional sensitivity kernels for finite-frequency traveltimes: the banana-doughnut paradox, *Geophys. J. Int.*, **137**, 805–815, 1999.

- McLaren, M. K., J. L. Hardebeck, N. van der Elst, J. Unruh, G. W. Bawden, and J. L. Blai, Complex faulting associated with the 22 December 2003 M_W 6.5 San Simeon, California, earthquake, aftershocks, and postseismic surface deformation, *Bull. Seismol. Soc. Am.*, **98**, 1659–1680, 2008.
- McMechan, G. A., Determination of source parameters by wavefield extrapolation, *Geophys. J. R. Astron. Soc.*, **71**, 613–628, 1982.
- Montelli, R., G. Nolet, F. A. Dahlen, G. Masters, E. R. Engdahl, and S.-H. Hung, Finite-frequency tomography reveals a variety of plumes in the mantle, *Science*, **303**, 338–343, 2004.
- Mora, P., Nonlinear two-dimensional elastic inversion of multioffset seismic data, *Geophysics*, **52**, 1211–1228, 1987.
- Mori, J., and D. Helmberger, Large-amplitude Moho reflections (*Sms*) from Landers aftershocks, southern California, *Bull. Seismol. Soc. Am.*, **86**, 1845–1852, 1996.
- Nadin, E. S., and J. B. Saleeby, Quaternary reactivation of the Kern Canyon fault system, southern Sierra Nevada, California, USA (in review), *Geol. Soc. Am. Bull.*, 2009.
- Ni, S., E. Tan, M. Gurnis, and D. Helmberger, Sharp sides to the African superplume, *Science*, **296**, 1850–1852, 2002.
- Nicholson, C., C. C. Sorlien, T. Atwater, J. C. Crowell, and B. P. Luyendyk, Microplate capture, rotation of the western Transverse Ranges, and initiation of the San Andreas transform as a low-angle fault system, *Geology*, **22**, 491–495, 1994.
- Nolet, G., Waveform tomography, in *Seismic Tomography: With Applications in Global Seismology and Exploration Geophysics*, edited by G. Nolet, pp. 301–322, Reidel Publishing, Dordrecht, The Netherlands, 1987.
- Olsen, K. B., S. M. Day, J. B. Minster, Y. Cui, A. Chourasia, M. Faerman, R. Moore, P. Maechling, and T. Jordan, Strong shaking in Los Angeles expected from southern San Andreas earthquake, *Geophys. Res. Lett.*, **33**, 2006.
- Pasyanos, M. E., D. S. Dreger, and B. Romanowicz, Toward real-time estimation of regional moment tensors, *Bull. Seismol. Soc. Am.*, **86**, 1255–1269, 1996.
- Paulssen, H., Crustal anisotropy in southern California from local earthquake data, *Geophys. Res. Lett.*, **31**, 2004.
- Percival, D., and A. Walden, *Spectral Analysis for Physical Applications*, Cambridge U. Press, 1993.
- Peter, D., C. Tape, L. Boschi, and J. H. Woodhouse, Surface wave tomography: global membrane waves and adjoint methods, *Geophys. J. Int.*, **171**, 1098–1117, 2007.
- Pratt, R. G., Seismic waveform inversion in the frequency domain, Part 1: Theory and verification in a physical scale model, *Geophysics*, **64**, 888–901, 1999.
- Pratt, R. G., C. S. Shin, and G. J. Hicks, Gauss–Newton and full Newton methods in frequency–space seismic waveform inversion, *Geophys. J. Int.*, **133**, 341–362, 1998.

- Press, W. H., S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, *Numerical Recipes: The Art of Scientific Computing*, Cambridge U. Press, Cambridge, 1994.
- Rawlinson, N., G. A. Houseman, and C. D. N. Collins, Inversion of seismic refraction and wide-angle reflection traveltimes for three-dimensional layered crustal structure, *Geophys. J. Int.*, 145, 381–400, 2001.
- Ritsema, J., H. J. van Heijst, and J. H. Woodhouse, Complex shear velocity structure imaged beneath Africa and Iceland, *Science*, 286, 1925–1928, 1999.
- Rodgers, A., A. Petersson, S. Nilsson, B. Sjögren, and K. McCandless, Broadband waveform modeling of moderate earthquakes in the San Francisco Bay area and preliminary assessment of the USGS 3D seismic velocity model, *Bull. Seismol. Soc. Am.*, 98, 969–988, 2008.
- Romanowicz, B., Global mantle tomography: Progress status in the past 10 years, *Annu. Rev. Earth Planet. Sci.*, 31, 303–328, 2003.
- Ruff, L., and H. Kanamori, Seismicity and the subduction process, *Phys. Earth Planet. Inter.*, 32, 240–252, 1980.
- Sambridge, M. S., Non-linear arrival time inversion: constraining velocity anomalies by seeking smooth models in 3-D, *Geophys. J. Int.*, 102, 653–677, 1990.
- Sambridge, M. S., A. Tarantola, and B. L. N. Kennett, An alternative strategy for non-linear inversion of seismic waveforms, *Geophys. Prosp.*, 39, 723–736, 1991.
- Shapiro, N. M., M. Campillo, L. Stehly, and M. H. Ritzwoller, High-resolution surface-wave tomography from ambient seismic noise, *Science*, 307, 1615–1618, 2005.
- Sieminski, A., Q. Liu, J. Trampert, and J. Tromp, Finite-frequency sensitivity of surface waves to anisotropy based upon adjoint methods, *Geophys. J. Int.*, 168, 1153–1174, 2007.
- Slepian, D., Prolate spheroidal wave functions, Fourier analysis, and uncertainty. V: The discrete case, *Bell Syst. Tech.*, 57, 1371–1430, 1978.
- Stich, D., P. Danecek, A. Morelli, and J. Tromp, Imaging lateral heterogeneity in the northern Apennines from time reversal of reflected surface waves, *Geophys. J. Int.*, 2009.
- Süss, M. P., and J. H. Shaw, P-wave seismic velocity structure derived from sonic logs and industry reflection data in the Los Angeles basin, California, *J. Geophys. Res.*, 108, 2003.
- Takeuchi, N., and M. Kobayashi, Improvement of seismological earth models by using data weighting in waveform inversion, *Geophys. J. Int.*, 158, 681–694, 2004.
- Talagrand, O., and P. Courtier, Variational assimilation of meteorological observations with the adjoint vorticity equation. I: Theory, *Q. J. R. Meteorol. Soc.*, 113, 1311–1328, 1987.
- Tan, Y., Broadband Waveform Modeling Over a Dense Seismic Network, Ph.D. thesis, California Institute of Technology, 2006.
- Tanimoto, T., Modelling curved surface wave paths: membrane surface wave synthetics, *Geophys. J. Int.*, 102, 89–100, 1990.

- Tape, C., Q. Liu, and J. Tromp, Finite-frequency tomography using adjoint methods—Methodology and examples using membrane surface waves, *Geophys. J. Int.*, **168**, 1105–1129, 2007.
- Tape, C., P. Musé, M. Simons, D. Dong, and F. Webb, Multiscale estimation of GPS velocity fields, *Geophys. J. Int. (in review)*, 2009.
- Tarantola, A., Inversion of seismic reflection data in the acoustic approximation, *Geophysics*, **49**, 1259–1266, 1984.
- Tarantola, A., A strategy for nonlinear elastic inversion of seismic reflection data, *Geophysics*, **51**, 1893–1903, 1986.
- Tarantola, A., *Inverse Problem Theory and Methods for Model Parameter Estimation*, SIAM, Philadelphia, Penn., 2005.
- Thomson, D. J., Spectrum estimation and harmonic analysis, *IEEE Proc.*, **70**, 1055–1096, 1982.
- Thurber, C., H. Zhang, F. Waldhauser, J. Hardebec, A. Michael, and D. Eberhart-Phillips, Three-dimensional compressional wavespeed model, earthquake relocations, and focal mechanisms for the Parkfield, California, region, *Bull. Seismol. Soc. Am.*, **96**, S38–S49, 2006.
- Tromp, J., C. Tape, and Q. Liu, Seismic tomography, adjoint methods, time reversal, and banana-doughnut kernels, *Geophys. J. Int.*, **160**, 195–216, 2005.
- Wald, L. A., L. K. Hutton, and D. D. Given, The Southern California Network Bulletin: 1990–1993 summary, *Seis. Res. Lett.*, **66**, 9–19, 1995.
- Waldhauser, F., and W. L. Ellsworth, A double-difference earthquake location algorithm: Method and application to the northern Hayward Fault, California, *Bull. Seismol. Soc. Am.*, **90**, 1353–1368, 2000.
- Wang, Z., and F. A. Dahlen, Spherical-spline parameterization of three-dimensional Earth, *Geophys. Res. Lett.*, **22**, 3099–3102, 1995.
- Wang, Z., J. Tromp, and G. Ekström, Global and regional surface-wave inversion: A spherical-spline parameterization, *Geophys. Res. Lett.*, **25**, 207–210, 1998.
- Woodhouse, J. H., and A. M. Dziewonski, Mapping the upper mantle: Three-dimensional modeling of Earth structure by inversion of seismic waveforms, *J. Geophys. Res.*, **89**, 5953–5986, 1984.
- Yan, Z., and R. W. Clayton, Regional mapping of the crustal structure in southern California from receiver functions, *J. Geophys. Res.*, **112**, 2007, B05311, doi:10.1029/2006JB004622.
- Zhao, L., and T. H. Jordan, Structural sensitivities of finite-frequency seismic waves: a full-wave approach, *Geophys. J. Int.*, **165**, 981–990, 2006.
- Zhao, L., T. H. Jordan, and C. H. Chapman, Three-dimensional Fréchet differential kernels for seismic delay times, *Geophys. J. Int.*, **141**, 558–576, 2000.

- Zhao, L., T. H. Jordan, K. B. Olsen, and P. Chen, Fréchet kernels for imaging regional earth structure based on three-dimensional reference models, *Bull. Seismol. Soc. Am.*, **95**, 2066–2080, 2005.
- Zhao, L.-S., and D. V. Helmberger, Source estimation from broadband regional seismograms, *Bull. Seismol. Soc. Am.*, **84**, 91–104, 1994.
- Zhou, Y., F. A. Dahlen, and G. Nolet, Three-dimensional sensitivity kernels for surface wave observables, *Geophys. J. Int.*, **158**, 142–168, 2004.
- Zhou, Y., F. A. Dahlen, G. Nolet, and G. Laske, Finite-frequency effects in global surface-wave tomography, *Geophys. J. Int.*, **163**, 1087–1111, 2005.
- Zhu, L., and D. Helmberger, Advancement in source estimation techniques using broadband regional seismograms, *Bull. Seismol. Soc. Am.*, **86**, 1634–1641, 1996.
- Zhu, L., and H. Kanamori, Moho depth variation in southern California from teleseismic receiver functions, *J. Geophys. Res.*, **105**, 2969–2980, 2000.