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Lawrence Berkeley National Laboratory
University of California
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Education

B. Sc., University of Texas at Austin, May 1981.
PhD., University of California at Berkeley, 1987, Dissertation: Inversion of Static Displacement of the Earth's Surface.

Professional Experience

1986-1987 Associate Research Scientist, Berkeley Laboratory
1987-1989 Post-Doctoral Scientist, Phillips Geophysics Laboratory
1989-1991 Post-Doctoral Scientist, Seismographic Station, University of California at Berkeley.
1991-1992 Visiting Fellow, Research School of Earth Sciences, Australian National University.
1992-2011 Staff Scientist, Berkeley Laboratory
2011-Present Senior Scientist, Berkeley Laboratory

Current Research Interests and Experience

Geophysical inversion and non-linear inverse problems; Seismic tomographic imaging; Use of geodetic observations to constrain subsurface fluid flow; Waveform inversion; Analysis and modeling of hydrological pressure, tracer, and multi-phase flow data; Combined inversion of geophysical and hydrological data;

Awards

Cedric K. Ferguson Certificate, for the best peer reviewed paper published by an SPE journal in 1999.

Award for Outstanding Contributions in Geoscience Research, given at the Geosciences Research Symposium on Basic Research Relevant to CO₂ Sequestration, Gaithersburg, Maryland, 2008.

Member

American Geophysical Union;
Society of Exploration Geophysicists;

Publications

Journal Articles

Vasco, D.W. and L.R. Johnson, 1985. Extremal inversion of static earth displacements due to volume sources, *Geophys. J. R. astr. Soc.*, **80**, 223-239.

Vasco, D. W., 1985. Extremal inversion of vertical displacements, Long Valley caldera 1982/1983, *J. of Geophysics*, **57**, 178-183.

Vasco, D. W., 1986. Extremal inversion of travel time residuals, *Bull. Seis. Soc. Am.*, **76**, 1323-1345.

Vasco, D. W. and L. R. Johnson, 1986. The correspondence between gravitational attraction and surface displacement due to volume expansion, *Geophys. J. of the Royal astr. Soc.*, **89**, 749-754.

Vasco, D. W., L. R. Johnson, and N. E. Goldstein, 1988. Using surface displacement and strain observations to constrain deformation at depth, with an application to Long Valley caldera, CA, *J. of Geophys. Res.*, **93**, 3232-3242.

Vasco, D. W., L. R. Johnson, 1989. Inversion of waveforms for extreme source models with an application to the isotropic moment tensor component, *Geophys. J. Royal astr. Soc.*, **97**, 1-18.

Vasco, D. W., 1989. Deriving source-time functions using principal component analysis, *Bull. Seis. Soc. Am*, **79**, 711-730.

Vasco, D. W., 1989. Resolution and variance operators of gravity and gravity gradiometry, *Geophysics*, **54**, 889-899.

Vasco, D. W., 1990. Moment tensor invariants: Searching for non-double-couple earthquakes, *Bull. Seis. Soc. Am.*, **80**, 354-371.

Vasco, D. W., 1990. Seismic source representation in orthogonal functions, *Geophys. Jour. Int.*, **102**, 531-535.

Vasco, D. W., Smith, R. B., and Taylor, C. L., 1990. Inversion for sources of crustal deformation and gravity change at the Yellowstone Caldera, *J. Geophys. Res.*, **95**, 19,839-19,856.

Vasco, D. W. and Taylor, C., 1991. Inversion of airborne gravity gradient data, Southwestern, Oklahoma, *Geophysics*, **56**, 90-101.

Vasco, D. W., 1991. Bounding seismic velocities using a tomographic method, *Geophysics*, **56**, 472-482.

Pulliam, R. J., Vasco, D. W., and Johnson, L. R., 1993. Tomographic inversions for mantle P-wave velocity structure based on the minimization of l2 and l1 norms of International Seismological Centre travel time residuals, *J. Geophys. Res.*, **98**, 699-734.

Vasco, D. W., 1993. Degeneracy, singularity, and multiple solutions in geophysical inversion, *Geophys. Jour. Int.*, **113**, 434-448.

Vasco, D. W., Pulliam, R. J., and Johnson, L. R., 1993. Formal inversion of ISC arrival times for Mantle P-velocity structure, *Geophys. Jour. Int.*, **113**, 586-606.

Vasco, D. W., Majer, E. L, and Johnson, L. R., 1993. Ensemble inference in geophysical inverse problems, *Geophys. Jour. Int.*, **115**, 711-728.

Vasco, D. W., and Majer, E. L, 1993. Wave-path traveltime tomography, *Geophys. Jour. Int.*, **115**, 1055-1069.

Vasco, D. W., Pulliam, R. J., Earle, P. S., and Johnson, L. R., 1994. Robust inversion of ISC arrival times for Mantle P and S wave velocity structure, earthquake mislocation, and station corrections, *J. Geophys. Res.*, **99**, 13727-13755.

Vasco, D. W., 1994. Singularity and branching: A path following formalism for geophysical inverse problems, *Geophys. Jour. Int.*, **119**, 809-830.

Vasco, D. W., 1995. A transformational approach to geophysical inverse problems, *Geophys. Jour. Int.*, **123**, 183-212.

Vasco, D. W., Pulliam, R. J., and Johnson, L. R., 1995. Lateral variations in mantle velocity structure and discontinuities determined from P, PP, S, SS, and SS-SdS traveltime residuals, *J. Geophys. Res.*, **100**, 24,037-24,059.

Vasco, D. W., Majer, E. L., and Peterson, J. E., 1995. Beyond ray tomography: Wavepaths and Fresnel volumes, *Geophysics*, **60**, 1790-1804.

Romero, A. E., McEvelly, T. V., Majer, E. L., and Vasco, D. W., 1995. Characterization of the geothermal system beneath the Northwest Geysers steam field, California, from seismicity and velocity patterns, *Geothermics*, **24**, 471-487.

Datta Gupta, A., Vasco, D. W., and Long, J. C. S., 1995. Detailed characterization of a fractured limestone formation using stochastic inverse approaches, *SPE Form. Eval.*, September, 133-140.

Vasco, D. W., Peterson, J. E., Jr., and Majer, E. L., 1996. Nonuniqueness in traveltime tomography: Ensemble inference and cluster analysis, *Geophysics*, **61**, 1209-1227.

Vasco, D. W., Peterson, J. E., and Majer, E. L., 1996. A simultaneous inversion of seismic traveltimes and amplitudes for velocity and attenuation, *Geophysics*, **61**, 1738-1757.

Majer, E. L., Datta-Gupta, A., Peterson, J. E., Vasco, D. W., Myer, L. R., Daley, T. M., Kalen, B., Queen, J., D'Onfro, P. S., Rizer, W. D., Cox, D., and Sinton, J., 1996. Utilizing crosswell, single well and pressure transient test for characterizing fractured gas reservoirs, *The Leading Edge*, **15**, 951-956.

Vasco, D. W., Datta-Gupta, A., and Long, J. C. S., 1997. Resolution and uncertainty in hydrologic characterization, *Water Resour. Res.*, **33**, 379-397.

Vasco, D. W., 1997. Groups, algebras and the nonlinearity of geophysical inverse problems, *Geophys. J. Int.*, **131**, 9-23.

Vasco, D. W., Peterson, J. E., and Lee, K., 1997. Ground penetrating radar velocity tomography in inhomogeneous and anisotropic media, *Geophysics*, **62**, 1758-1773.

Vasco, D. W., and Datta-Gupta, A., 1997. Integrating field production history in stochastic reservoir characterization, *SPE Form. Eval.*, September, 149-156.

Datta-Gupta, A., Vasco, D. W., and Long, J. C. S., 1997. On the sensitivity and spatial resolution of transient pressure and tracer data for heterogeneity characterization, *SPE Form. Eval.*, June, 137-144.

Long, J. C. S., Doughty, C., Datta-Gupta, A., Hestir, K., and Vasco, D., 1997. Component characterization: An approach to fracture hydrology, in *Subsurface Flow and Transport: A stochastic Approach*, Dagan, G., and Neuman, S. P. (Eds.), Cambridge University Press.

Vasco, D. W., Karasaki, K., and Myer, L., 1998. Inversion of surface tilt caused by fluid migration, *J. of Geotech. and Geoenv. Eng.*, **124**, 29-37 .

Vasco, D. W., and Johnson, L. R., 1998. Whole Earth structure estimated from seismic arrival times, *J. Geophys. Res.*, **103**, 2633-2671.

Vasco, D. W., Peterson, J. E., and Majer, E. L., 1998. Resolving seismic anisotropy: Sparse matrix methods for geophysical inverse problems, *Geophysics*, **63**, 970-983.

Vasco, D. W., 1998. Regularization and trade-off associated with nonlinear geophysical inverse problems, *Inverse Problems*, **18**, 1033-1052.

D'Onfro, P. S., Rizer, W. D., Queen, J. H., Majer, E. L., Peterson, J. E., Daley, T. M., Vasco, D. W., Datta-Gupta, A., and Long, J. C. S., 1998 An integrated approach for characterizing fractured reservoirs, in *Faulting, Fault Sealing, and Fluid Flow in Hydrocarbon Reservoirs*, Jones, G., Fisher, Q., J., and Knipe, R. J. (Eds), 193-208.

Datta-Gupta, A., Yoon, S., Barman, I., and Vasco, D. W., 1998. Streamline-based production data integration, *J. of Petrol. Tech.*, December, 72-76.

Vasco, D. W., and Datta-Gupta, A., 1999. Asymptotic solutions for solute transport: A formalism for tracer tomography, *Water Resour. Res.*, **35**, 1-16.

Vasco, D. W., Johnson, L. R., and Marques, O., 1999. Global Earth structure: Inference and assessment, *Geophys. J. Int.* **137**, 381-407.

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Vasco, D. W., Yoon, S., and Datta-Gupta, A., 1999. Integrating dynamic data into high-resolution reservoir models using streamline-based analytic sensitivity coefficients, *Soc. Petr. Eng. Journal*, **4**, (4) .

Vasco, D. W., Karasaki, K., and Doughty, C., 2000. Using surface deformation to image reservoir dynamics, *Geophysics*, **65**, 132-147.

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Karasaki, K., Freifeld, B., Cohen, A., Grossenbacher, K., Cook, P., and Vasco, D., 2000. A Multidisciplinary Fractured Rock Characterization Study at Raymond Field Site, Raymond, California, *J. of Hydrology*, **236**, 17-34.

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Kulkarni, K. N., Datta-Gupta, A. and Vasco, D. W., 2001. A Streamline Approach to Integrating Transient Pressure Data into High Resolution Reservoir Models, *Soc. Petr. Eng. Journal*, **6**.

Vasco, D. W., and Datta-Gupta, A., 2001. Asymptotics, streamlines, and reservoir modeling: A pathway to production tomography, *The Leading Edge*, **20**, 1164-1171.

Vasco, D. W., Karasaki, K. and Kishida, K., 2001. A coupled inversion of pressure and surface displacement, *Water Resour. Res.*, **37**, 3071-3089.

Vasco, D. W., Wicks, C., and Karasaki, K., 2002. Geodetic imaging: High resolution reservoir monitoring using satellite interferometry, *Geophys. J. Int.*, **149**, 555-571.

Vasco, D. W., Karasaki, K. and Nakagome, O., 2002. Monitoring reservoir production using surface deformation at the Hijiori test site and the Okuaizu geothermal field, Japan, *Geothermics*, **31**, 303-342.

Datta-Gupta, A., Yoon, S., Vasco, D. W., and Pope, G. A., 2002. Inverse modeling of partitioning interwell tracer tests: A streamline approach, *Water Resour. Res.*, **38** (6), 10.1029.

Iliassov, P. A., Datta-Gupta, A., and Vasco, D. W., 2002. Field-scale characterization of permeability and saturation distributions using partitioning tracer tests: The Ranger Field, Texas, *SPE J.*, **7** (4), 409-423, December.

Vasco, D. W., Johnson, L. R., and Marques, O., 2003. Resolution, uncertainty, and whole Earth tomography, *J. Geophys. Res.*, **108** (B1), 2022.

Vasco, D. W., Keers, H., Peterson, J., and Majer, E. L., 2003. Zeroth order asymptotics: Waveform inversion of the lowest degree, *Geophysics*, **68**, 614-628.

Vasco, D. W., and Finsterle, S., 2004. Numerical trajectory calculations for the efficient inversion of flow and tracer observations, *Water Resour. Res.*, **40**, (1) 10.1029.

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He, Z., Datta-Gupta, A., Al-Harbi, M., and Vasco, D. W., 2006. Rapid inverse modeling of pressure interference tests using trajectory-based travel time and amplitude matching, *Water Resources Research*, bf 42, W03419, 1-15.

Hoversten, G. M., Cassasuce, F., Gasperikova, E., Newman, G. A., Chen, J., Rubin, Y., Hou, Z., and Vasco, D., 2006. Direct reservoir parameter estimation using joint inversion of seismic AVA and marine CSEM data, *Geophysics*, **71**, C1-C13.

Amodei, D., Keers, H., Vasco, D., and Johnson, L., 2006. Computation of uniform wave forms using complex rays, *Physical Review E*, **73**, 36704/1-14.

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Battaglia, M., and Vasco, D. W., 2006. The search for magma reservoirs in Long Valley Caldera: Single versus distributed sources, in *Mechanisms of Activity and Unrest at Large Calderas*, Troise, C., De Natle, G. and Kilburn, C. R. J. (eds) Geological Society of London Publication **269**, 173-180.

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Chen, J., Hoversten, M., Vasco, D., Rubin, Y., and Hou, Z., 2007. A Bayesian model for gas saturation estimation using marine seismic AVA and marine CSEM data, *Geophysics*, **72**, WA85-WA95.

Vasco, D. W., 2007. Invariance, groups, and non-uniqueness: The discrete case, *Geophysical Journal International*, **168**, 473-490.

Vasco, D. W., 2007. Trajectory-based modeling of broadband electromagnetic wavefields, *Geophysical Journal International*, **168**, 949-963.

Keers, H., Johnson, L., and Vasco, D. W., 2007. Determination of porosity and saturation using seismic waveform inversion, *Studia Geophysica and Geodetica*, **51**, 119-140.

Vasco, D. W., Puskas, C. M., Smith, R. B., and Meertens, C. M., 2007. Crustal deformation and source models of the Yellowstone volcanic field from geodetic data, *J. of Geophysical Res.*, **112**, doi:10.1029/2006JB004641.

Vasco, D. W., 2008. Trajectory-based methods for modeling and characterization, in *Quantitative Information Fusion for Hydrological Sciences*, Xing, C., and Yeh, T. -C. J. (eds) Springer-Verlag, Studies in Computational Intelligence, 69-103.

Vasco, D. W., 2008. Zeroth-order inversion of transient head observations, *Inverse Problems*, **24**, 025013.

Vasco, D. W., 2008. Modeling quasi-static poroelastic propagation using an asymptotic approach, *Geophysical Journal International*, **173**, 1119-1135.

Vasco, D. W., Keers, H., Khazanehdari, J., and Cooke, A., 2008. Seismic imaging of reservoir flow properties: Resolving water influx and reservoir permeability, *Geophysics*, **73**, O1-O13.

Vasco, D. W., Ferretti, A., and Novali, F., 2008. Estimating permeability from quasi-static deformation: Temporal variations and arrival time inversion, *Geophysics*, **73**, O37-O52.

Vasco, D. W., Ferretti, A., and Novali, F., 2008. Reservoir monitoring and characterization using satellite geodetic data: Interferometric Synthetic Aperture Radar observations from the Krechba field, Algeria, *Geophysics*, **73**, WA113-WA122.

Vasco, D. W., 2009. Modeling broadband poroelastic propagation using an asymptotic approach, *Geophysical Journal International*, **179**, 299-318.

Vasco, D. W., and Minkoff, S. E., 2009. Modeling flow in a pressure-sensitive, heterogeneous medium, *Geophysical Journal International*, **179**, 972-989.

Rutqvist, J., Vasco, D. W., and Myer, L., 2009. Coupled reservoir-geomechanical analysis of CO₂ injection and ground deformations at In Salah, Algeria, *Energy Procedia, Greenhouse gas control technologies*, **1**, 1847-1854.

Vasco, D. W., Rucci, A., Ferretti, A., Novali, F., Bissell, R., Ringrose, P., Mathieson, A., and Wright I., 2010. Satellite-based measurements of surface deformation reveal flow flow associated with the geological storage of carbon dioxide, *Geophysical Research Letters*, **37**, doi:10.1029/2009GL041544, 1-5.

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Vasco, D. W., 2010. On fluid flow in a heterogeneous medium under nonisothermal conditions, *Water Resource Research*, **46**, doi:10.1029/2010WR009571.

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Vasco, D. W., and Minkoff, S. A., 2012. On the propagation of a disturbance in a heterogeneous, deformable, porous medium saturated with two fluid phases, *Geophysics*, **77**, L25-L44, 10.1190/GEO2011-0131.1.

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Vasco, D. W., Rutqvist, J., Dobson, P., Oldenburg, C., Ferretti, A., Rucci, A., Bellotti, F., Garcia, J., Walters, M., and Hartline, C., 2013. Monitoring deformation at The Geysers geothermal field, California using C-band and X-band Interferometric Synthetic Aperture Radar, *Geophysical Research Letters*, doi: 10.1002/grl.50314.

Rutqvist, J., Dobson, P. F., Garcia, J., Hartline, C., Jeanne, P., Oldenburg, C. M., Vasco, D. W., and Walters, M., 2013. The Northwest Geysers EGS Demonstration Project, California:

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Jeanne, P., Rutqvist, J., Vasco, D., Garcia, J., Dobson, P. F., Walters, M., Hartline, C., and Borgia, A., 2014. A 3D hydrological and geomechanical model of an enhanced geothermal system at The Geysers, California, *Geothermics*, **51**, 240-252. Vasco, D. W., Bakulin, A., Baek, H., and Johnson, L. R., 2015. Reservoir characterization based upon the onset of time-lapse amplitude changes, *Geophysics*, **80**, M1-M14, 10.1190/GEO2014-0076.1.

Zhang, R., Vasco, D. W., Daley, T. M., and Harbert, W., 2015. Improving thin-bed resolution: Application of a sparse-layer inversion on 3D seismic observations from the In Salah carbon dioxide storage project, *Interpretation*, **May**, SS65-SS71, doi:10.1190/INT-2014-0204.1.

Zhang, R., Vasco, D. W., Daley, T. M., and Harbert, W., 2015. Characterization of a fracture zone using seismic attributes at the InSalah CO₂ storage project, *Interpretation*, **May**, SM37-SM46, doi:10.1190/INT-2014-0141.1.

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Zhang, R., Vasco, D. W., and Daley, T. M., 2016. Study of seismic diffraction wave caused by a fracture zone at the InSalah carbon dioxide storage project, *International Journal of Greenhouse Gas Control*, **42**, 75-86, doi:10.1016/j.ijggc.2015.07.033.

Pride, S. R., Berryman, J. G., Commer, M., Nakagawa, S., Newman, G. A., and Vasco, D. W., 2016. Changes in geophysical properties caused by fluid injection into porous rocks: Analytical models, *Geophysical Prospecting*, doi: 10.1111/1365-2478.12435.

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Vasco, D. W., Ferretti, A., Rucci, A., Falorni, G., Samsonov, S. V., White, D., and Czarnogorska, M., 2017. Geodetic monitoring of the geological storage of greenhouse gas emissions, *Geophysical Monitoring of Geologic Carbon Sequestration*, AGU Monograph (in press).

Vasco, D. W., Bissell, R. C., Bohloli, B., Daley, T. M., Ferretti, A., Foxall, W., Goertz-Allmann, B. P., Korneev, V., Morris, J. P., Oye, V., Ramirez, A., Rinaldi, A. P., Rucci, A., Rutqvist, J., White, J., and Zhang, R., 2017. Monitoring and modeling caprock integrity at the In Salah carbon dioxide storage site, Algeria, *Caprock Integrity in Geological Carbon Storage*, AGU Monograph (in press).

Watanabe, W., Han, J., Datta-Gupta, A., King, M. J., and Vasco, D. W., 2017. Streamline-based time lapse seismic data integration incorporating pressure and saturation effects, *SPE Journal*, (in press).

Pride, S. R., Vasco, D. W., Flekkoy, E. G., and Holtzman, R., 2017. Dispersive transport and symmetry of the dispersion tensor in porous media, *Physical Review E*, (submitted).

Vasco, D. W., Ferretti, A., Rucci, A., Samsonov, S. V., and White, D. 2017. Monitoring the deformation associated with the geological storage of carbon dioxide, in *Geophysics and Geosequestration*, Tom Davis and Martin Landro (Eds.), Cambridge University Press, (submitted).

Books

Vasco, D. W., and Datta-Gupta, 2016. Subsurface Fluid Flow and Imaging: With Applications to Hydrology, Reservoir Engineering, and Geophysics, *Cambridge University Press*, Cambridge.

Recent Invited Talks

December 2004, American Geophysical Union Annual Meeting, San Francisco, CA. Using time-lapse geophysical estimates of pressure change to image permeability.

December 2004, American Geophysical Union Annual Meeting, San Francisco, CA. Invariance, non-uniqueness, and symmetry groups.

September 2006, Boise State University, Boise, ID, Imaging fluid flow and hydraulic conductivity using geodetic data. December 2006, American Geophysical Union Annual Meeting, San Francisco, CA. Imaging fluid flow and hydraulic conductivity using geodetic data.

March 2007, Society of Industrial and Applied Mathematics Meeting, Santa Fe, NM. Trajectory-based methods for estimating hydraulic conductivity,

June 2008, XVIII International Conference on Computational Methods in Water Resources, San Francisco. Trajectory-based methods for estimating hydraulic conductivity,

October 2008, Heiland Lecture, Colorado School of mines, Golden CO. Estimating permeability from quasi-static deformation.

November 2008, Society of Exploration Geophysicists Annual Meeting, Las Vegas, NV. Using deformation for reservoir monitoring and characterization: InSAR surveillance of CO₂ injection at the Krechba field, Algeria.

December 2009, American Geophysical Union Annual Meeting, San Francisco, CA. Satellite-based measurements of surface deformation reveal fluid flow associated with the geological storage of carbon dioxide.

September 2011, Society of Exploration Geophysicists Annual Meeting, San Antonio, TX. Trajectory-based modeling of coupled processes with applications to fluid flow and geophysics.

December 2011, American Geophysical Union Annual Meeting, San Francisco, CA. Trajectory-based modeling of coupled processes with applications to fluid flow and geophysics.

January 2013, British Geophysical Association, London, UK. Geodetic monitoring: With an application to the geologic storage of carbon dioxide.

December 2015, American Geophysical Union Annual Fall Meeting, San Francisco, CA. Estimating flow properties from the onset of time-lapse changes, in session Advances in Forward and Inverse Modeling of Coupled Thermo-Hydro-Geomechanical-Chemical Processes in Porous Media.