CHRISTINE DOUGHTY
Energy Geosciences Division
Hydrogeology Department
E. O. Lawrence Berkeley National Laboratory

EDUCATION

Ph.D. 1995, (Material Science and Mineral Engineering), University of California, Berkeley.
Hydrologic characterization of heterogeneous geologic media using inverse methods based on iterated function systems.

M.Sc. 1991, (Material Science and Mineral Engineering), University of California, Berkeley.
Mathematical modeling of multi-phase fluid flow with heat transfer in geologic media.

B.Sc. 1978, (Engineering Physics), University of California, Berkeley.
Theoretical physics and mathematics with an emphasis on geosciences applications.

EXPERIENCE

Staff Scientist, Energy Geosciences Division, Lawrence Berkeley Laboratory, Berkeley, CA, Mathematical modeling of the hydrothermal behavior of geothermal and petroleum reservoirs, aquifer and soil thermal energy storage systems, geologic sequestration of nuclear waste and carbon dioxide, groundwater and vadose-zone contamination problems, and desert hydrologic cycle, 10/78 - Present.

Consultant, GreenFire Energy, Emeryville, CA, Advise development of TOUGH application for geothermal heat extraction with CO_2 as the working fluid, 1/16 – 4/16

Consultant, Ormat Technologies, Reno, NV, Taught short course for geothermal tracer test analysis, 6/14

Consultant, BP Exploration, Houston, TX, Petroleum resource evaluation 8/97-10/97, 6/02-9/02

Consultant, Oxbow Geothermal, Reno, NV, Geothermal resource evaluation 2/86 – 3/94

Technical Assistant, Energy and Environment Division, Lawrence Berkeley Laboratory, Berkeley, CA, Development of calculational meshes for numerical simulation of two-phase geothermal systems, 7/77 - 9/77.

HONORS

Undergraduate honors, University of California, Berkeley (1974-1978)
Achievement Rewards for College Scientists (ARCS) Foundation scholarship (1978)
Editors' citation for excellence in refereeing, Water Resources Research (1999)
LBNL award for excellence in technology transfer (2004)
LBNL award for outstanding performance (2006)
LBNL director's award for exceptional tech transfer achievement (2012)
LBNL SPOT award for TOUGH Symposium (2015)

AFFILIATIONS

Member, Phi Beta Kappa
Member, American Geophysical Union

PATENTS

Patent number 4559818, December 1985
Thermal well-test method for determination of aquifer thermal and hydraulic properties.

CURRENT RESEARCH INTERESTS

Mathematical modeling of multi-component, multi-phase fluid flow and transport in heterogeneous geologic media; development and application of techniques for analyzing well-log, well-test, and tracer data to infer the distribution of hydrologic properties in heterogeneous geologic settings, including fractured rock; analysis of watershed and groundwater-basin hydrologic cycles; coordination of modeling studies with laboratory and field work; collaboration with geophysicists, geochemists, and geologists in interdisciplinary studies.

PUBLICATIONS

Journal Articles

1. Tsang, C.-F., T.A. Buscheck, and C. Doughty, Aquifer thermal energy storage: a numerical simulation of Auburn University field experiments, Water Resour. Res., 17, 3, 647-658, 1981.
2. Doughty, C., G. Hellstrom, C.-F. Tsang, and J. Claesson, A dimensionless parameter approach to the thermal behavior of an aquifer thermal energy storage system, Water Resour. Res., 18, 3, 571-587, 1982.
3. Buscheck, T.A., C. Doughty, and C.-F. Tsang, Prediction and analysis of a field experiment on a multilayered aquifer thermal energy storage system with strong buoyancy flow, Water Resour. Res., 19, 5, 1307-1315, 1983.
4. Tsang, C.-F., D.C. Mangold, C. Doughty, and M.J. Lippmann, Prediction of reinjection effects in the Cerro Prieto geothermal system, Geothermics, 13, 1/2, 141-162, 1984.
5. Doughty, C. and C.-F. Tsang, A comparative study of a heat and fluid flow problem using three models of different levels of sophistication, Mathematical Modelling, 8, 412-418, 1987.
6. Doughty, C. and K. Pruess, A semianalytical solution for heat pipe effects near high-level nuclear waste packages buried in partially saturated geological media, Intl. Journal of Heat and Mass Transfer, 31, 1, 79-90, 1988.
7. Doughty, C. and K. Pruess, A similarity solution for two-phase fluid and heat flow near high-level nuclear waste packages emplaced in porous media, Intl. Journal of Heat and Mass Transfer, 33, 6, 1205-1222, 1990.
8. Doughty, C. and K. Pruess, A similarity solution for two-phase water, air, and heat flow near a linear heat source in a porous medium, Journal of Geophysical Res., 97 (B2), 1821-1838, 1992.
9. Nir, A., C. Doughty, and C.-F. Tsang, Validation of design procedure and performance modeling of a heat and fluid transport field experiment in the unsaturated zone, Advances in Water Resources, 15, 153-166, 1992.
10. Amistoso, A.E., B.G. Aquino, Z.P. Aunzo, O.T. Jordan, F.X.M. Sta. Ana, G.S. Bodvarsson, and C. Doughty, Reservoir analysis of the Palinpinon geothermal field, Negros Oriental, Philippines, Geothermics, 22, 5/6, 555-574, 1993.
11. Doughty, C., J.C.S. Long, K. Hestir, and S.M. Benson, Hydrologic characterization of heterogeneous geologic media with an inverse method based on iterated function systems, Water Resour. Res., 30, 6, 1721-1745, 1994.
12. Liu, H.H., C. Doughty, and G.S. Bodvarsson, An active fracture model for unsaturated flow and transport in fractured rocks, Water Resour. Res., 34, 10, 2633-2646, 1998.
13. Doughty, C., Investigation of conceptual and numerical approaches for evaluating moisture, gas, chemical, and heat transport in fractured unsaturated rock, Journal of Contaminant Hydrology, 38, 1-3, 69-106, 1999.
14. Vasco, D.W., K. Karasaki, and C. Doughty, Using surface deformation to image reservoir dynamics, Geophysics, 65, 1, 132-147, 2000.
15. Johnson, T.M., R.C. Roback, T.L. McLing, T.D. Bullen, D.J. DePaolo, C. Doughty, R.J. Hunt, R.W. Smith, L.D. Cecil, and M.T. Murrell, Groundwater “fast paths” in the Snake River Plain aquifer: Radiogenic isotope ratios as natural groundwater tracers, Geology, 28, 10, 871-874, 2000.
16. Faybishenko, B., C. Doughty, M. Steiger, J.C.S. Long, T.R. Wood, J.S. Jacobsen, J. Lore, and P.T. Zawislanski, Conceptual model of the geometry and physics of water flow in a fractured basalt vadose zone, Water Resour. Res., 36, 12, 3499-3520, 2000.

17. Doughty, C., Numerical model of water flow in a fractured basalt vadose zone, Box Canyon site, Idaho, Water Resour. Res., 36, 12, 3521-3534, 2000.

18. Salve, R., J.S.Y. Wang, and C. Doughty, Liquid-release tests in unsaturated fractured welded tuffs: I. Field investigations, Journal of Hydrology, 256, 1-2, 60-79, 2002.

19. Doughty, C., R. Salve, and J.S.Y. Wang, Liquid-release tests in unsaturated fractured welded tuffs: II. Numerical modeling, Journal of Hydrology, 256, 1-2, 80-105, 2002.

20. Doughty, C. and K. Karasaki, Flow and transport in hierarchically fractured rock, Journal of Hydrology, 263, 1-4, 1-22, 2002.

21. Myer, L.R., S.M. Benson, C. Byrer, D. Cole, C. Doughty, W. Gunter, G.M. Hoversten, S. Hovorka, J.W. Johnson, K. Knauss, A. Kovscek, D. Law, M.J. Lippmann, E.L. Majer, B. van der Meer, G. Moline, R.L. Newmark, C.M. Oldenburg, F.M. Orr, Jr., K. Pruess, C.-F. Tsang, The GEO-SEQ project; A status report, Greenhouse Gas Control Technologies, 6, II, 1625-1628, 2003.

22. Doughty, C., S.M. Benson, K. Pruess, Capacity Investigation of Brine-Bearing Sands for Geologic Sequestration of CO_2, Greenhouse Gas Control Technologies, 6, II, 1645-1648, 2003.

23. Tsang, C.-F. and C. Doughty, A particle-tracking approach to simulating transport in a complex fracture, doi:10.1029/2002WR001614, Water Resour. Res., 39, 7, 1174, 2003.

24. Tsang, C.-F. and C. Doughty, Multirate flowing fluid electric conductivity logging method, doi:10.1029/2003WR002308, Water Resour. Res., 39, 12, 1354, 2003.

25. Doughty, C. and K. Karasaki, Modeling flow and transport in saturated fractured rock to evaluate site characterization needs, IAHR Journal of Hydraulics, 42, extra issue, 33-44, 2004.

26. Doughty, C. and K. Pruess, Modeling supercritical carbon dioxide injection in heterogeneous porous media, Vadose Zone Journal, 3, 3, 837-847, 2004.

27. Doughty, C. and C.-F. Tsang, Signatures in flowing fluid electric conductivity logs, Journal of Hydrology, 310, 1-4, 157-180, 2005.

28. Doughty, C., S. Takeuchi, K. Amano, M. Shimo, and C.-F. Tsang, Application of multi-rate flowing fluid electric conductivity logging method to Well DH-2, Tono Site, Japan, doi:10.1029/2004WR003708, Water Resour. Res., 41, W1041, 2005.

29. Hovorka, S.D., C. Doughty, M.H. Holtz, Testing efficiency of storage in the subsurface: Frio brine pilot experiment, Greenhouse Gas Control Technologies 7, II, 1, 1361-1366, 2005.

30. Hovorka, S.D., S.M. Benson, C. Doughty, B.M. Freifeld, S. Sakurai, T.M. Daley, Y.K. Kharaka, M.H. Holtz, R.C. Trautz, H.S. Nance, L.R. Myer, and K.G. Knauss, Measuring permanence of CO_2 storage in saline formations: the Frio experiment, Environmental Geosciences, 13, 2, 1-17, 2006.

31. Doughty, C., Modeling geologic storage of carbon dioxide: comparison of hysteretic and non-hysteretic curves, doi:10.1016/j.enconman.2007.01.022, Energy Conversion and Management, 48, 6, 1768-1781, 2007.

32. Doughty, C., B.M. Freifeld, and R.C. Trautz, Site characterization for CO_2 geologic storage and vice versa – the Frio brine pilot, Texas, USA as a case study, doi:10.10007/s00254-007-0942-0, Environmental Geology, 54, 8, 1635-1656, 2008.

33. Finsterle, S., C. Doughty, M.B. Kowalsky, G.J. Moridis, L. Pan, T. Xu, Y. Zhang, and K. Pruess, Advanced vadose zone simulation using TOUGH, doi:10.2136/vzj2007.0059, Vadose Zone Journal, 7, 601–609, 2008.

34. Doughty, C., C.-F. Tsang, K. Hatanaka, S. Yabuuchi, and H. Kurikami, Application of direct-fitting, mass-integral, and multi-rate methods to analysis of flowing fluid electric conductivity logs from Horonobe, Japan, doi:10.1029/2007WR006441, Water Resour. Res., 44, W08403, 2008.

35. Tsang, C.-F., C. Doughty, and M. Uchida, Simple model representations of transport in a complex fracture and their effects on long-term predictions, doi:10.1029/2007WR006632, Water Resour. Res., 44, W08445, 2008.

36. Doughty, C., Estimating plume volume for geologic storage of CO_2 in saline aquifers, Ground Water, 46, 6, 810-813, 2008.

37. Ijiri, Y., H. Saegusa, A. Sawada, M. Ono, K. Watanabe, K. Karasaki, C. Doughty, M. Shimo, K. Fumimura, Evaluation of uncertainties originating from the different modeling approaches applied to analyze regional groundwater flow in the Tono area of Japan, doi:10.1016/j.jconhyd.2008.10.010, Journal of Contaminant Hydrology, 103, 168–181, 2009.

38. Doughty, C., L.R. Myer, and C.M. Oldenburg, Predictions of long-term behavior of a large-volume pilot test for CO2 geological storage in a saline formation in the Central Valley, California, doi:10.1016/j.egypro.2009.02.115, Energy Procedia, 1, 1, 3291-3298, 2009.

39. Jordan, P. and C. Doughty, Sensitivity of CO_2 migration estimation on reservoir temperature and pressure uncertainty, doi:10.1016/j.egypro.2009.02.055, Energy Procedia, 1,1, 2825-2832, 2009.

40. Doughty, C., Investigation of CO_2 plume behavior for a large-scale pilot test of geologic carbon storage in a saline formation, doi:10.1007/s11242-009-9396-z, Transport in Porous Media, 82, 1, 49-76, 2010.

41. Xu, T., Y.K Kharaka, C. Doughty, B.M. Freifeld, and T.M. Daley, Reactive transport modeling to study changes in water chemistry induced by CO_2 injection at the Frio-I brine pilot, Chemical Geology, 271, 3-4, 153-164, 2010. (LBNL-3056E)

42. Oldenburg, C.M. and C. Doughty, Injection, flow, and mixing of CO_2 in porous media with residual gas, doi:10.1007/s11242-010-9645-1, Transport in Porous Media, 90, 1, 201-218, 2011.

43. Yamamoto, H. and C. Doughty, Investigation of gridding effects for numerical simulation of CO_2 geologic sequestrations, doi:10.1016/j.ijggc.2011.02.007, Int. Journal of Greenhouse Gas Control, 5, 4, 975-985, 2011.

44. Daley, T.M., J.B. Ajo-Franklin, and C. Doughty, Constraining the reservoir model of an injected CO_2 plume with crosswell CASSM at the Frio-II Brine Pilot, doi:10.1016/j.ijggc.2011.03.002, Int. Journal of Greenhouse Gas Control, 5, 4, 1022-1030, 2011.

45. Hovorka, S.D., T.A. Meckel, R.H. Trevino, J. Lu, J.-P. Nicot, J.-W. Choi, D. Freeman, P. Cook, T.M. Daley, J.B. Ajo-Franklin, B.M. Freifeld, C. Doughty, C.R. Carrigan, D. La Brecque, Y.K. Kharaka, J.J. Thordsen, T.J. Phelps, C. Yang, K.D. Romanak, T. Zhang, R.M. Holt, J.S. Lindler, R.J. Butsch, Monitoring a large volume CO_2 injection: Year two results from SECARB project at Denbury's Cranfield, Mississippi, USA, doi:10.1016/j.egypro.2011.02.274, Energy Procedia, 4, 3478-3485, 2011.

46. Oldenburg, C.M., C. Doughty, C.A. Peters, and P.F. Dobson, Simulations of long-column flow experiments related to geologic carbon sequestration: effects of outer wall boundary condition on upward flow and formation of liquid CO_2, doi:10.1002/ghg.1294, Greenhouse Gases: Science and Technology, 2(4), 279-303, 2012.

47. Doughty, C., C.-F. Tsang, S. Yabuuchi and T. Kunimaru, Flowing Fluid Electric Conductivity Logging for a Deep Artesian Well in Fractured Rock with Regional Flow, doi:10.1016/j.jhydrol.2012.04.061, Journal of Hydrology, 482, 1-13, 2013.

48. Doetsch, J., M.B. Kowalsky, C. Doughty, S. Finsterle, J.B. Ajo-Franklin, C.R. Carrigan, X. Yang, S.D. Hovorka, and T.M. Daley, Constraining CO_2 simulations by coupled modeling and inversion of

electrical resistance and gas composition data, International Journal of Greenhouse Gas Control, 18, 510-522, 2013.

49. Larsson, M., C. Doughty, C.-F. Tsang, and A. Niemi, Understanding the effect of single fracture heterogeneity from single well injection withdrawal (SWIW) tests, doi:10.1007/s10040-013-0988-x, Hydrogeology Journal, 21: 1691–1700, 2013.

50. Oldenburg, C.M., C. Doughty, and N. Spycher, The role of CO_2 in CH_4 exsolution from deep brine: Implications for geologic carbon sequestration, doi:10.1002/ghg.1370, Greenhouse Gas Science and Technology, 3(5), 359-377, 2013.

51. Doughty, C. and B.M. Freifeld, Modeling CO_2 injection at Cranfield, Mississippi: Investigation of methane and temperature effects, doi:10.1002/ghg.1363, Greenhouse Gas Science and Technology, 3, 475-490, 2013.

52. Espinet, A.J., C.A. Shoemaker, and C. Doughty, Estimation of plume distribution for carbon sequestration using parameter estimation, optimization and monitoring data, doi: 10.1002/wrcr.20326, Water Resources Research, 49(7), 4442-4464, 2013.

53. Tran Ngoc, T.D., C. Doughty, R. Lefebvre, and M. Malo, Feasibility of CO_2 injection in deep saline aquifers: A case study in the St. Lawrence Platform, Quebec (Canada), doi:10.1002/ghg.1387, Greenhouse Gas Science and Technology, 3, 516-540, 2013.

54. Mukhopadhyay, S., Z. Hou, L. Gosink, D. Bacon, C. Doughty, J.J. Li, L. Wei, S. Gasda, G. Bacci, R. Govindan, J.-Q. Shi, H. Yamamoto, R. Ramanathan, JP Nicot, S.A. Hosseini, J.T. Birkholzer, A. Bonneville, Model comparison and uncertainty quantification for geologic carbon storage: The Sim-SEQ Initiative, Energy Procedia 37, 3867 – 3874, 2013.

55. Freifeld, B., S.Zakim, L. Pan, B. Cutright, M. Sheu, C. Doughty and T. Held, Geothermal energy production coupled with CCS: a field demonstration at the SECARB Cranfield Site, Cranfield,Mississippi, USA, Energy Procedia 37, 6595 – 6603, 2013.

56. Pan, L., B. Freifeld, C. Doughty, S. Zakem, M. Sheu, B. Cutright, and T. Terrall, Fully coupled wellbore-reservoir modeling of geothermal heat extraction using CO_2 as the working fluid, Geothermics, 53, 100-113, 2015.

57. Mukhopadhyay, S., C. Doughty, D. Bacon, J. Li, L. Wei, H. Yamamoto, S. Gasda, S.A. Hosseini, J.-P. Nicot, and J.T. Birkholzer, The Sim-SEQ Project: Comparison of Selected Flow Models for the S-3 Site, doi:10.1007/s11242-014-0361-0, Transport in Porous Media, 108, 207-2312015.

58. Karasaki, K., C. Doughty, C.T. Onishi, and J. Goto, Development of geohydrologic model of the Wildcat Fault Zone, doi:10.1007/s11242-014-0348-x, Transport in Porous Media, 108, 3-222015.

59. Pan, L., N. Spycher, C. Doughty, and K. Pruess, ECO2N V2.0: A TOUGH2 fluid property module for modeling CO2-H2O-NaCl systems to elevated temperatures of up to 300^{o}C, doi:10.1002/ghg.1617, Greenhouse Gas Science and Technology, published online 1 August 2016.

60. Blanco-Martin, L., J. Rutqvist, C. Doughty, Y. Zhang, S. Finsterle, and C.M. Oldenburg, Coupled geomechanics and flow modeling of thermally induced compaction in heavy oil diatomite reservoirs under cyclic steaming, doi:10.1016/j.petrol.2016.09.002, Journal of Petroleum Science and Engineering, 147, 474-484, 2016.

61. Doughty, C., C.-F. Tsang, J.-E. Rosberg, C. Juhlin, P.F. Dobson, and J.T. Birkholzer, Flowing fluid electrical conductivity logging of a deep borehole during and following drilling: estimation of transmissivity, water salinity and hydraulic head of conductive zones, doi:10.1007/s10040-016-1497-5, Hydrogeology Journal, published online 30 November 2016.

62. Doughty, C., Generating one-column grids with fractal flow dimension, doi:/10.1016/j.cageo.2016.11.010, Computers and Geosciences, available online 22 November 2016.
63. Patterson, C., R.W. Falta, and C. Doughty, A history-dependent nonwetting phase trapping model for multiphase flow characteristic curves, submitted to Computational Geosciences, May 2016.

Books and Book Chapters

1. Javandel, I., C. Doughty, and C.-F. Tsang, Groundwater Transport: handbook of mathematical models, 228 pp., Water Resources Monograph 10, American Geophysical Union, Washington D.C., 1984.
2. Long, J.C.S., C. Doughty, K. Hestir, and S. Martel, Modeling heterogeneous and fractured reservoirs with inverse methods based on Iterated Function Systems, in Reservoir characterization III, Bill Linville, Editor, PennWell Books, Tulsa, Oklahoma, 1993.
3. Long, J.C.S., C. Doughty, A. Datta-Gupta, K. Hestir, and D.W. Vasco, Component characterization: An approach to fracture hydrogeology, in Subsurface flow and transport: a stochastic approach, G. Dagan and S.P. Neuman, Editors, Cambridge University Press, New York, 1997.
4. Benito, P.H., P.J. Cook, B. Fayishenko, B. Freifeld, and C. Doughty, Cross-well air-injection parcker tests for the assessment of pneumatic connectivity in fractured, unsaturated basalt, in Rock mechanics for industry, Proceedings of the 37th U.S. Rock Mechanics Symposium, Vail, Colorado, USA, June 6-9, 1999, B. Amadei, R.L. Kranz, G.A. Scott and P.H. Smealie, Editors, 843-851, A.A. Balkema, Rotterdam, 1999.
5. Doughty, C. and B. Faybishenko, Modeling of water flow and tracer breakthrough curves in fractured basalt (lessons learned and future investigations), in Vadose zone science and technology solutions, B.B. Looney and R.W. Falta, Editors, Battelle Memorial Institute, Columbus, Ohio, 2000.
6. Faybishenko, B., P. A. Witherspoon, C. Doughty, J.T. Geller, T.R. Wood, and R.K. Podgorney, Multi-scale investigations of liquid flow in a fractured basalt vadose zone, in Flow and transport through unsaturated fractured rock, second edition, D.D. Evans, T.J. Nicholson, and T.C. Rasmussen, Editors, Geophysical Monograph 42, 161-182, American Geophysical Union, Washington D.C., 2001.
7. Hovorka, S.D., C. Doughty, S.M. Benson, K. Pruess, and P.R. Knox, The impact of geological heterogeneity on CO2 storage in brine formations: a case study from the Texas Gulf Coast, In Geological storage of carbon dioxide, S.J. Baines and R.H. Worden, Editors, Special Publication 233, 147-163, Geological Society, London, 2004.
8. Tsang, C.-F., C. Doughty, J. Rutqvist, and T. Xu, Modeling to understand and simulate physico-chemical processes of CO2 geological storage, In Carbon capture and geologic sequestration: Integrating technology, monitoring, and regulation, E.J. Wilson and D. Gerard, Editors, Blackwell Publishing, Ames, Iowa, 2007.
9. Doughty, C. and L.R. Myer, Scoping calculations on leakage of CO_2 in geologic storage: the impact of overburden permeability, phase trapping, and dissolution. In: Carbon Sequestration and its role in the global carbon cycle, Brian J. McPherson and Eric T. Sundquist, Editors, Geophysical Monograph Series, Volume 183, 350 pp., American Geophysical Union, Washington DC, 2009.
10. Sharma, P., C.-F. Tsang, C. Doughty, A. Niemi, and J. Bensabat, Feasibility of long-term passive monitoring with Flowing Fluid Electric Conductivity Method. Fluids dynamics in complex fractured-porous systems, B. Faybishenko, S.M. Benson, J.E. Gale, Editors, Geophysical Monograph Series, Vol. 210, Ch. 4, American Geophysical Union, Washington DC, Published online: 12 June, 2015.

Thesis and Dissertation

Doughty, C., Two phase fluid and heat flow in fractured/porous media: a similarity solution, M.Sc. Thesis, Department of Materials Science and Mineral Engineering, University of California, Berkeley, 1991.

Doughty, C., Estimation of hydrologic properties of heterogeneous geologic media with an inverse method based on iterated function systems, Ph.D. Dissertation, Department of Materials Science and Mineral Engineering, University of California, Berkeley, 1995 (LBL-38136).

Editor

Moridis, G., C. Doughty, S. Finsterle, and E. Sonnenthal (eds.), Proceedings of the TOUGH Symposium 2009, September 14–16, 2009, Rep. LBNL-2790E, Lawrence Berkeley National Lab., Berkeley CA, 2009.

Moridis, G.J. and C. Doughty, Computers and Geosciences, Special issue 2009 TOUGH Symposium, 37(6), 713-790, June 2011.

Blanco-Martin, L., C. Doughty, S. Finsterle, M. Reagan, J. Rutqvist, C. Valladao, and L. Zheng, Proceedings of the TOUGH Symposium 2015, Rep. LBNL-190559, Lawrence Berkeley National Lab., Berkeley, CA, September 2015.

Conference Papers and Presentations

1. Tsang, C.-F., T.A. Buscheck, and C. Doughty, Aquifer thermal energy storage - recent parameter and site-specific studies, International Conference: Seasonal Thermal and Compressed Air Energy Storage, Seattle, Washington, October 19-21, 1981.
2. Tsang, C.-F., D.C. Mangold, C. Doughty, and M.J. Lippmann, The Cerro Prieto reinjection tests: studies of a multilayer system, Third Symposium on the Cerro Prieto Geothermal Field, San Francisco, March 24-26, 1981.
3. Tsang, C.-F. and C. Doughty, A non-isothermal well test analysis method, ASME-JSME Thermal Engineering Conference, Honolulu, Hawaii, March 20-24, 1983.
4. Doughty, C. and C.-F. Tsang, Control of the movement of a fluid plume by injection and production procedures ASME-JSME Thermal Engineering Conference, Honolulu, Hawaii, March 20-24, 1983.
5. Tsang, C.-F., D.C. Mangold, C. Doughty, and I. Javandel, A study of contaminant plume control in fractured-porous media, National Water Well Convention, Columbus, Ohio, May 22, 1983.
6. Doughty, C., A. Nir, C.-F. Tsang, and G.S. Bodvarsson, Heat storage in unsaturated soils - initial theoretical analysis of storage design and operational methods, International Conference on Subsurface Heat Storage in Theory and Practice, Stockholm, Sweden, June 6-8, 1983.
7. Tsang, C.-F. and C. Doughty, Detailed validation of a liquid and heat flow code against field performance, SPE-13503, Eighth SPE Symposium on Reservoir Simulation, Dallas, Texas, Feb. 10-13, 1985.
8. Doughty, C. and C.-F. Tsang, Investigation of the vertical-flow aquifer thermal energy storage concept and numerical simulation of the Dorigny field experiment, Third International Conference on Energy Storage for Building Heating and Cooling, Toronto, Canada, Sept. 22-26, 1985.
9. Nir, A., C. Doughty, and C.-F. Tsang, Seasonal heat storage in unsaturated soils: example of design study, 21st Intersociety Energy Conversion Engineering Conference, San Diego, August 25-29, 1986.

10. Bensabat, J., C. Doughty, E. Korin, A. Nir, and C.-F. Tsang, Validation experiments of seasonal thermal energy storage models in unsaturated soils, Jigastock 88, Journees internationales sur le stockage de l'energie thermique et la geothermie appliquee, Versailles, France, October 17-20, 1988.

11. Doughty, C. and K. Pruess, A similarity solution for two-phase fluid and heat flow near high-level nuclear waste packages emplaced in porous media, Fall AGU Meeting, San Francisco, December, 1988.

12. Doughty, C. and K. Pruess, Verification of TOUGH2 against a semianalytical solution for transient two-phase fluid and heat flow in porous media, TOUGH Workshop, Lawrence Berkeley Lab., Berkeley, CA, September 13-14, 1990.

13. Doughty, C., C.-F. Tsang, E. Korin, and A. Nir, Seasonal storage of thermal energy in unsaturated soils: modeling, simulation, and field validation, Thermastock '91, Fifth International Congress on Thermal Energy Storage, Scheveningen, The Netherlands, May 13-16, 1991.

14. Doughty, C. and K. Pruess, A mathematical model for two-phase water, air, and heat flow around a linear heat source emplaced in a permeable medium, 1991 ASME/AIChE National Heat Transfer Conference, Minneapolis, Minnesota, July 28-31, 1991, Rep. LBL-30050, Lawrence Berkeley Lab., Berkeley, CA, 1991.

15. Doughty, C., J.C.S. Long, and K. Hestir, Characterization of heterogeneous geologic media using inverse methods on models with hierarchical structure, AGU Fall Meeting, San Francisco, December, 1991.

16. Doughty, C., Hydrological inversions using Iterated Function Systems, Invited talk, SIAM Conference on Mathematical and Computational Issues in the Geosciences, Houston, Texas, April 19-21, 1993.

17. Doughty, C., J.C.S. Long, E.L. Majer, T.M. Daley, J.E. Peterson Jr., and L.R. Myer, LBL/Industry heterogeneous reservoir performance definition project - Gypsy site, BPO Contractor Review Conference, Fountainhead, Oklahoma, July 18-22, 1993.

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