

Lehua Pan
Earth Sciences Division
Lawrence Berkeley National Laboratory
Tel: (510) 495-2360, Email: lpan@lbl.gov

CHRONOLOGY OF EDUCATION

Zhejiang University, Hangzhou, B.S. Geology, Feb. 1982.
Zhejiang Agricultural University, Hangzhou, M.S. Soil Physics, July 1986.
University of Arizona, Tucson, Ph.D., Soil, Water, and Environmental
Sciences/Hydrology, Dec. 1995.

EMPLOYMENT

09/2012-present Geological Research Scientist, Earth Science Division, Lawrence
Berkeley National Laboratory

10/2004-09/2012 Sr. Scientific Engr. Assoc., Earth Science Division, Lawrence
Berkeley National Laboratory

12/1997-10/2004 Geological Scientist, Earth Science Division, Lawrence Berkeley
National Laboratory

01/1996-12/1997 Postdoctoral Fellow, Department of Soil & Environmental Sciences,
UC Riverside

01/1992-12/1995 Research Associate, Department of Soil & Water Science,
University of Arizona, Tucson

08/1986-12/1991 Assistant Research Scientist, Institute of Mountainous Disaster and
Environment, Chinese Academy of Science, Chengdu

02/1982-07/1983 Faculty (Teaching Assistant), Department of Hydraulic
Engineering, Tianjin University, Tianjin

HONORS AND AWARD

2012 Director's Award for Exceptional Tech Transfer Achievement, Lawrence
Berkeley National Laboratory

The Secretary's Achievement Award, United States Dept. of Energy, 2011.

Award of (Youth) Excellent Paper, Science & Technology Association of Sichuan Province, 1988.

PUBLICATIONS

Peer Reviewed Journal

55. Reagan, M.T., G.J. Moridis, J.N. Johnson, L. Pan, C.M. Freeman, K.L. Boyle, N.D. Keen and J. Husebo, Field-Scale Simulation of Production from Oceanic Gas Hydrate Deposits, Transport In Porous Media, In Press (doi: 10.1007/s11242-014-0330-7).
54. Weng, Huan-Xin, Hui-Ping Liu, De-Wang Li, Mingli Ye, Lehua Pan, Tian-Hong Xia (2014), An innovative approach for iodine supplementation using iodine-rich phytogetic food. Environmental Geochemistry and Health. 02/2014; DOI:10.1007/s10653-014-9597-4
53. Pan, Lehua, and Curtis M Oldenburg (2014) T2Well—An integrated wellbore-reservoir simulator. Computers & Geosciences 65 (2014) 46–55, available online 29 June 2013, <http://www.sciencedirect.com/science/article/pii/S0098300413001696>).
52. Finsterle Stefan, Yingqi Zhang, Lehua Pan, Patrick Dobson, Ken Oglesby (2013). Microhole arrays for improved heat mining from enhanced geothermal systems. Geothermics 47 (2013) 104–115.
51. Oldenburg, Curtis M., and Lehua Pan (2013) Utilization of CO₂ as cushion gas for porous media compressed air energy storage. Greenhouse Gas Sci Technol. 3:1–12 (2013); DOI: 10.1002/ghg.
50. Oldenburg, Curtis M., and Lehua Pan (2013) Porous Media Compressed-Air Energy Storage (PM-CAES): Theory and Simulation of the Coupled Wellbore–Reservoir System. Transp. Porous Med; DOI 10.1007/s11242-012-0118-6.
49. Andrea Borgia, Karsten Pruess, Timothy J. Kneafsey, Curtis M. Oldenburg, Lehua Pan (2012), Numerical simulation of salt precipitation in the fractures of a CO₂-enhanced geothermal system Geothermics 44 (2012) 13– 22.
48. Litang Hu, Lehua Pan, Keni Zhang (2012), Modeling brine leakage to shallow aquifer through an open wellbore using T2WELL/ECO2N. International Journal of Greenhouse Gas Control 9 (2012) 393–401.
47. Pan, Lehua, Curtis M. Oldenburg, and Karsten Pruess, Yu-Shu Wu (2011), Transient CO₂ leakage and injection in wellbore-reservoir systems for geologic carbon sequestration. Greenhouse Gas Sci Technol. 1:335–350 (2011); DOI: 10.1002/ghg.

46. Pan, Lehua, Stephen W. Webb, and Curtis M. Oldenburg (2011), Analytical solution for two-phase flow in a wellbore using the drift-flux model. *Advances in Water Resources*. 34 (2011) 1656–1665. doi:10.1016/j.advwatres.2011.08.009.
45. Ma, Xue-wen, Huan-xin Weng, Min-hua Su and Lehua Pan, 2011. Drying sewage sludge using flue gas from power plants in China. *Environmental Earth Sciences*, DOI: 10.1007/s12665-011-1166-x.
44. Curtis M. Oldenburg, Barry M. Freifeld, Karsten Pruess, Lehua Pan, Stefan Finsterle, and George J. Moridis, 2011. Numerical simulations of the Macondo well blowout reveal strong control of oil flow by reservoir permeability and exsolution of gas. doi: 10.1073/pnas.1105165108.
43. Yingqi Zhang, Lehua Pan, Karsten Pruess, Stefan Finsterle (2011) A time-convolution approach for modeling heat exchange between a wellbore and surrounding formation. *Geothermics*. doi:10.1016/j.geothermics.2011.08.003
42. Curtis M. Oldenburg, Jennifer L. Lewicki, Lehua Pan, Laura Dobeck and Lee Spangler, 2010. Origin of the patchy emission pattern at the ZERT CO₂ release test. *Environmental Earth Sciences*, 60(2):241-250, DOI: 10.1007/s12665-009-0442-5.
41. Weng, Huan-Xin, Ai-Lan Yan, Chun-Lai Hong, Ya-Chao Qin, Lehua Pan and Ling-Li Xie, 2009. Biogeochemical transfer and dynamics of iodine in a soil–plant system. *Environmental Geochemistry and Health*, 31(3): 401-411, DOI: 10.1007/s10653-008-9193-6.
40. Lehua Pan, Jennifer L. Lewicki, Curtis M. Oldenburg, Marc L. Fischer, 2009. Time-Windows-Based Filtering Method for Near-Surface Detection of Leakage from Geologic Carbon Sequestration Sites. *Environmental Earth Sciences*. 60:359-369, DOI 10.1007/s12665-09-0436-3.
39. Curtis M. Oldenburg, Jennifer L. Lewicki, Lehua Pan, Laura Dobeck, and Lee Spangler, 2009. Origin of the Patchy Emission Pattern at the ZERT CO₂ Release Test, *EES special issue* 60:241-250, DOI 10.1007/s12665-009-0442-5.
38. Lewicki, J. L., G. E. Hilley, M. L. Fischer, L. Pan, C. M. Oldenburg, L. Dobeck, and L. Spangler. 2009. Eddy covariance observations of surface leakage during shallow subsurface CO₂ releases, *J. Geophys. Res.*, 114, D12302, doi:10.1029/2008JD011297.
37. Pan. L., J. Jin, N. Miller, Y.-S. Wu, and Gudmundur Bodvarsson , 2008. Modeling Hydraulic Responses to Meteorological Force: from Canopy to

Aquifer. *Vadose Zone Journal*, 7:325-331. LBNL-61018

36. Finsterle S., C. Doughty, M.B. Kowalsky, G.J. Moridis, L. Pan, T. Xu, Y. Zhang, and K. Pruess, 2008, *Advanced Vadose Zone Simulation Using TOUGH*. *Vadose Zone Journal* 7:601-609.
35. Weng, H.-X., C.-L. Hong, A.-L. Yan, L. Pan, Y.-Ch. Qin, L.-L. Xie, 2008. Mechanism of iodine uptake by cabbage: effects of iodine species and where it stored. *Biological Trace Element Research*, 125(1):59-71. DOI 10.1007/s12011-008-8155-2.
34. Wu, Y.-S., Lu, G., Zhang, K., Pan, L. and Bodvarsson, G. S., 2007. Analyzing flow patterns in unsaturated fractured rock of Yucca Mountain using an integrated modeling approach, *Hydrogeology Journal*. 15:553-572. LBNL-54006.
33. Zhang, K., Wu, Y.-S. and Pan, L., 2006. Temporal Damping Effect of the Yucca Mountain Fractured Unsaturated Rock on Transient Infiltration Pulses, *Journal of Hydrology*. LBNL-57539. 327 (1-2) 235-248.
32. Wu, Y.-S., and L. Pan. 2005. An Analytical Solution for Transient Unsaturated Radial Flow through fractured Porous Media. *Water Resources Research*, 41, W02029, doi:10.1029/2004WR003107. (LBNL-54587)
31. Lehua Pan, Yu-Shu Wu, and Keni Zhang, 2004. A Modeling Study of Flow Diversion and Focusing in Unsaturated Fractured Rocks. *Vadose Zone Journal*, 3(1):233-246. doi: 10.2113/3.1.233 (LBNL-49274).
30. Wu, Y.-S., L. Pan, and K. Pruess, 2004. A Physically Based Approach for Modeling Multiphase Fracture-Matrix Interaction in Fractured Porous Media. *Advances in Water Resources* 27:875-887. (LBNL- 54749)
29. Pan, L. 2004. Computational Methods in Water Resources (book review). *Vadose Zone Journal*, 3(2):731. doi: 10.2113/3.2.731.
28. Wu, Y.-S., and L. Pan, 2003, Special relative permeability functions with analytical solutions for transient flow into unsaturated rock matrix. *Water Resources Research*, 39(4):1104-1029. LBNL-50443
27. Pan, L., and G. S. Bodvarsson, 2002. Modeling transport in fractured porous media with random-walk particle method: The transient activity range and the particle transfer probability, *Water Resource Research*, 38(6):1029-1035.
26. Wu, Yu-Shu; Zhang, Winnie; Pan, Lehua; Hinds, Jennifer; Bodvarsson,

- Gudmundur S. 2002. Modeling capillary barriers in unsaturated fractured rock. *Water Resources Research*, 38(11):1253-1265. (LBNL-46876).
25. Wu, Yu-Shu; Pan, Lehua; Zhang, Winnie; Bodvarsson, Gudmundur S. 2002. Characterization of flow and transport processes within the unsaturated zone of Yucca Mountain, Nevada, under current and future climates. *J. of Contaminant Hydrology* 54:215-247. (LBNL-46572).
 24. Liu, H.H., Bodvarsson, G.S., and Pan, L. 2002. Reply. *Water Resources Research*, 38(11), published 2003, LBNL-49008
 23. Liu, H.H., G.S. Bodvarsson, and L. Pan, Determination of particle transfer probability in random walk algorithms for fractured porous media, *Water Resources Research*, 36 (3), pp. 707-713, 2000.
 22. Wu, L., L. Pan, J. Mitchell, and B. Sanden, Measuring Saturated Hydraulic Conductivity using a generalized solution for Single-Ring Infiltrometers, *Soil Science Society of America Journal*, 63, pp. 788-792, 1999.
 21. Pan, L., and L. Wu. 1998. A hybrid global optimization method for inverse estimation of hydraulic parameters: Annealing-simplex method. *Water Resource Research*. 34(9):2261-2269.
 20. Pan, L., and P. J. Wierenga. 1997. Improving numerical modeling of 2-D water flow in variably saturated and heterogenous porous media. *Soil Science Society of America Journal*. 61(2):335-346.
 19. Pan, L., A.W. Warrick, and P.J. Wierenga. 1997. Downward water flow through sloping layers in the vadose zone: Time-dependence and effect of slope length. *Journal of Hydrology*. 199:36-52.
 18. Wu, L., L. Pan, M. Roberson, and P.J. Shouse. 1997. Numerical evaluation of ring-infiltrometers under various soil conditions. *Soil Sci*. 162:771-777.
 17. Wu, L., and L. Pan, 1997. A Generalized Solution to Infiltration from Single-ring Infiltrometers by Scaling. *Soil Science Society of America Journal*. 61(5)1318-1322.
 16. Warrick, A.W., P.J. Wierenga, and L. Pan. 1997. Downward water flow through sloping layers in the vadose zone: steady-state analytical solutions. *Journal of Hydrology*. 192:321-337.
 15. B Sanden, L Wu, JP Mitchell, L Pan, R Strohman, 1997. Effects of Irrigation Nonuniformity on Nitrogen and Water Use Efficiencies in Shallow-rooted

14. Pan, L., A. W. Warrick, and P. J. Wierenga. 1996. Finite element methods for modeling water flow in variably saturated porous media: numerical oscillation and mass distributed scheme. *Water Resource Research*. 32(6):1883-1889.
13. Pan, L. and P. J. Wierenga. 1995. A transformed pressure head based approach to solve Richards' equation for variably saturated soils. *Water Resource Research*. 31(4):925-931.
12. Dan, L. and L. Pan. 1992. Adsorption characteristics of phosphorus to calcareous purple soils and a bi-mechanism model. *Mountainous Region Research*, Vol.5(4).
11. Li, Z. and L. Pan. 1991. Pathways of sustained and stable development of agriculture in Southwest China. *Soft Sciences*. 1991-03.
10. Li, Z. and L. Pan. 1991. On sustainable agriculture development in Southwest China. *Journal of Soil Science and Agrochemistry*, 6(1-2):1-4.
9. Pan, L. and J. Yu. 1990. In-situ estimation of dynamical distribution of solute in perched soils – A Kalman filter approach. *Journal of Southwest China Agricultural University*, Special issue of the national soil physics symposium.
8. Pan, L. 1990. Spectral analysis method to estimate the apparent thermal diffusivity of soil. *Journal of Southwest China Agricultural University*, Special issue of the national soil physics symposium.
7. He, Y., F. Zhang, L. Pan, and A. Bang. 1990. Research on the degradation of purple soils in hilly area of Sichuan Basin: I. Physical properties of purple soils and characteristics of its degradations. *Resource Exploitation and Protection*, 6(1):3-7.
6. He, Y., L. Pan, and A. Bang. 1990. Research on the degradation of purple soils in hilly area of Sichuan Basin: II. Micromorphology of purple soils and characteristics of its degradations. *Resource Exploitation and Protection*, 6(2):67-70.
5. Pan, L. 1989. The position and direction of agricultural development in Guizhou Province, China. *Regional Economy Research*, 1989-2:21-25.
4. Pan, L. and J. Yu. 1988. Systematically modeling the movement of NO_3^- in perched soils. (Chinese) *Soil Science* 19(3):100-103.
3. Pan, L. 1988. Dynamical analysis and prediction of grain production in Yunnan

province, China – A time series model. *Journal of Soil Science and Agrochemistry*, 3(3-4):85-90.

2. He, Y., X. Zhao, L. Tian, and L. Pan. 1987. Mineral composition of purple soils and its effects on soil fertility. *Journal of Soil Science and Agrochemistry*, 2(1-2):44-46.
1. Pan, L. 1987. Systematic analysis and development strategy of agriculture –Principles and methodology. *Journal of Soil Science and Agrochemistry*, 2(1-2):151-154.

Chapters, Proceedings, and Reports:

Lehua Pan, Curtis M. Oldenburg (2012), T2Well—An Integrated Wellbore-Reservoir Simulator. PROCEEDINGS, TOUGH Symposium 2012 Lawrence Berkeley National Laboratory, Berkeley, California, September 17-19, 2012.

Yingqi Zhang, Lehua Pan, Patrick Dobson, Ken Oglesby, Stefan Finsterle (2012), Simulating Microhole-Based Heat Mining from Enhanced Geothermal System. PROCEEDINGS, TOUGH Symposium 2012 Lawrence Berkeley National Laboratory, Berkeley, California, September 17-19, 2012.

Matthew T. Reagan, George J. Moridis, Katie L. Boyle, C. Matthew Freeman, Lehua Pan, Noel D. Keen, Jarle Husebo (2012). Massively Parallel Simulation of Production from Field-Scale Oceanic Gas Hydrate Deposits. PROCEEDINGS, TOUGH Symposium 2012 Lawrence Berkeley National Laboratory, Berkeley, California, September 17-19, 2012.

Yingqi Zhang, Lehua Pan, Patrick Dobson, Ken Oglesby, and Stefan Finsterle (2012) Initial Evaluation of Microholes for Improved Heat Extraction from EGS Reservoirs. GRC 2012 Annual Meeting.

Yingqi Zhang, Lehua Pan, Patrick Dobson, Ken Oglesby, and Stefan Finsterle (2012) Microholes for Improved heat extraction from EGS Reservoirs: Numerical Evaluation. PROCEEDINGS, Thirty-Seventh Workshop on Geothermal Reservoir Engineering Stanford University, Stanford, California, January 30 - February 1, 2012. SGP-TR-194

Jonny Rutqvist, Hui-Hai Liu, Donald W. Vasco, Lehua Pan, Karl Kappler, Ernie Majer, 2011. Coupled non-isothermal, multiphase fluid flow, and geomechanical modeling of ground surface deformations and potential for induced micro-seismicity at the In Salah CO₂ storage operation. *Energy Procedia* 4: 3542-3549.

Pan, L., Yu-Shu Wu, Curtis M. Oldenburg, and Karsten Pruess, 2011. T2Well/ECO2N Version 1.0: Multiphase and Non-Isothermal Model for Coupled Wellbore-Reservoir Flow of Carbon Dioxide and Variable Salinity Water. LBNL-4291E.

Quanlin Zhou, Stefan Finsterle, Lehua Pan and Yingqi Zhang, 2010. Mobility of Tritium in Engineered and Earth Materials at the NuMI Facility, Fermilab. LBNL Report.

Curtis M. Oldenburg, Steven L. Bryant, Jean-Philippe Nicot, Navanit Kumar, Yingqi Zhang, Preston Jordan, Lehua Pan, Patrick Granvold, Fotini K. Chow, 2009., Chapter 1: MODEL COMPONENTS OF THE CERTIFICATION FRAMEWORK FOR GEOLOGIC CARBON SEQUESTRATION RISK ASSESSMENT, Carbon Dioxide Capture for Storage in Deep Geological Formations, Volume 3, D.C. Thomas and S.M. Benson (Eds.) © 2009 CPL Press and BP.

Pan, L. Curtis M. Oldenburg, Yu-Shu Wu, Karsten Pruess. 2009. Wellbore flow model for carbon dioxide and brine. Energy Procedia 1(1):71-78.

Jennifer L. Lewickia, George E. Hilley, Marc L. Fischer, Lehua Pan, Curtis M. Oldenburg, Laura Dobeck, Lee Spangler, 2009. Detection of CO₂ leakage by eddy covariance during the ZERT project's CO₂ release experiments. Energy Procedia 1(1):2301-2306.

Pan, L., 2008, User's Information for WinGridder V3.0. LBNL-273E

Pan, L., C. M. Oldenburg, Y.-S. Wu, and K. Pruess (2008), Wellbore flow model for carbon dioxide and brine leakage. GHGT-9, Energy Procedia.

Pan, L., J. L. Lewicki, and C. M. Oldenburg, 2008. Exploiting temporal features of ecological CO₂ flux variations for near surface detection of leakage from geologic CO₂ storage sites. The 7th Annual Conference on Carbon Capture & Sequestration, May 5-8, 2008, Pittsburgh, PA, USA.

Pan, L. and Y. Seal, 2007. Geothermal evolution of geothermal aquifer and the potential effects of geothermal heat pumping. Technical report.

Pan, L., 2006., CLMT2 user's guide: A Coupled Model for Simulation of Hydraulic Processes from Canopy to Aquifer, Version 1.0. Technical Report (LBNL-60857). Lawrence Berkeley National Laboratory, July 2006.

Pan, L., J. Jin, N. Miller, Y.-S. Wu, and G. S. Bodvarsson, 2006. Coupling Tough2 With Clm3: Developing A Coupled Land Surface And Subsurface Model. Proceedings of TOUGH Symposium 2006, Lawrence Berkeley National Laboratory, Berkeley,

California, May 15–17, 2006. LBNL-60211.

Pan, L. , 2004, Analysis of Hydrologic Properties Data, ANL-NBS-HS_0000 42 REV 00, SBC, Las Vegas, Nevada. LBID-2525

Pan, L., K. Zhang, Y.S. Wu, and G.S. Bodvarsson, 2004. Percolation through heterogeneous fractured porous media under transient infiltration: Reconciling measured and predicted seepage into a mined opening. The 68th Annual Meeting for Soil Science Society of America, Seattle, Washington, Oct. 31-Nov. 4, 2004. Agronomy Abstracts. American Society of Agronomy. Madison. WI.

Pan, L., Y. Seol, and G. S. Bodvarsson. 2004. Improved Scheme for Modeling Mass Transfer between Fracture and Matrix Continua with Particle Tracking Method. LBNL Report. DOI 10.2172/837504

Pan, L., Y. Seol, and G. S. Bodvarsson. 2004. Improved estimation of the activity range of particles: The influence of water flow through fracture-matrix interface. Proceedings of the Second International Symposium on Dynamics of Fluids in Fractured Rocks, Edited by B. Faybishenko and P. A. Witherspoon, Lawrence Berkeley National Laboratory, University of California, Berkeley, California, USA, 360-366, February 10-12. (LBNL-55662 Ext. Abs.) Permalink: <http://escholarship.org/uc/item/8jf4z723>.

Wu, Y.S. and Pan L., 2004. Analytical solutions for transient flow through unsaturated fractured porous media, Proceedings of the Second International Symposium on Dynamics of Fluids in Fractured Rocks, Edited by B. Faybishenko and P. A. Witherspoon, Lawrence Berkeley National Laboratory, University of California, Berkeley, California, USA, 360-366, February 10-12. (LBNL-)

Wu, Y.-S., Lu, G., Zhang, K., Pan, L., and Bodvarsson, G. S. 2003. Analyzing flow patterns in unsaturated fractured rock of Yucca Mountain using an integrated modeling approach. LBNL-54006.

Pan, L., 2003. WinGridder - An interactive Grid Generator for TOUGH2. Proceedings, TOUGH Symposium 2003. Berkeley, CA: pp. 6 LBNL-52422.

Pan, L., J. Hinds, C. Haukwa, Y. S. Wu, and G. S. Bodvarsson, 2001. WinGridder: a user manual (version 1.0). LBNL-42957, Lawrence Berkeley National Laboratory, Berkeley, California, 2001.

Pan, L., H.H. Liu, M. Cushey, and G.S. Bodvarsson, 2001. DCPT: A new random walk particle tracker for dual-continua, LBNL-42958, Lawrence Berkeley National Laboratory, Calif., 2001.

Pan, L., and C. Ho. 2000. Analysis Comparing advective-dispersive transport solution to particle tracking. Analysis/Modeling Report to Office of Civilian Radioactive Waste Management. ANL-NBS-HS-000001, Rev. 00.

Hinds, J., and L. Pan. 1999. Development of numerical grids for UZ flow and transport modeling. Analysis/Modeling Report to Office of Civilian Radioactive Waste Management. ANL-NBS-HS-000015, Rev. 00.

Warrick, A.W., L. Pan, and P.J. Wierenga. 1999. Water flow in desert soils near buried waste repositories. In *Vadose Zone Hydrology, Cutting across Disciplines*. (Parlange & Hopkins ed.), Oxford University Press, New York, pp.374-395.

Pan, L. and L. Wu, 1999. Inverse estimation of hydraulic parameters by using simulated annealing and downhill simplex method, In *Characterization and measurement of the hydraulic properties of unsaturated porous media*, van Genuchten, Leji, and Wu ed., pp. 769-782, 1999.

Pan, L., L. Wu, and W. A. Jury. 1996. Conditional stochastic analysis of Nitrate Leaching potential for agricultural field. The 88th Annual Meeting for Soil Science Society of America, Indianapolis, Indiana, November 3-7. *Agronomy Abstracts*. American Society of Agronomy. Madison. WI.

Wu, L., L. Pan, M.J. Roberson, J. Letey. 1996. Numerical evaluation on the performance of ring-infiltrometer under different soil conditions. The 88th Annual Meeting for Soil Science Society of America, Indianapolis, Indiana, November 3-7. *Agronomy Abstracts*. American Society of Agronomy. Madison. WI.

Wu, L., J.D. Oster, and L. Pan. 1996. Effect of Gypsum slotting and mole drain on the movement of water and salts. The 88th Annual Meeting for Soil Science Society of America, Indianapolis, Indiana, November 3-7. *Agronomy Abstracts*. American Society of Agronomy. Madison. WI.

Pan, L., and P. J. Wierenga, 1996. Globally optimized estimator of hydraulic properties based on upward infiltration data. *Western Soil Physics Annual Meeting*. Las Vegas, NV, January 1996.

Warrick, A.W., L. Pan, and P.J. Wierenga. 1995. Water flow in desert soils near buried waste repositories (invited). *Vadose Zone Hydrology Conference: Cutting Across Disciplines*. UC Davis, September, 1995.

Pan, L., H. Wyckoff, M. H. Young, and P. J. Wierenga, 1995. Inverse method for determination of saturated and unsaturated hydraulic properties from upward infiltration data. The 87th Annual Meeting for Soil Science Society of America. St. Louis, Missouri, October 19-November 3.

Pan, L. 1995. Techniques for improving numerical modeling of water flow in variably saturated, heterogenous media. Ph.D. Dissertation. The University of Arizona.

Pan L., and P. J. Wierenga, 1995. An efficient and simple solver to Richards' equation. Western Soil Physics Annual Meeting. Las Vagas, NV, January 8-11, 1995.

Pan L., and P. J. Wierenga, 1994. An efficient algorithm to solve Richards' equation for variably saturated soils(2D). The 86th Annual Meeting for Soil Science Society of America. Seattle, Washington, Novermber 13-18.

Dan, L., and L. Pan. 1992. Phosphorus in calcareous purple soils: II adsorption characteristics. Proceedings of the 4th national conference of young soil scientists, Page 183-188. Beijing Agriculture University Press.

Li, Z., L. Pan, and Y. Li, 1990, Agricultural development and strategy of Southwest China. Academic Press, Beijing.

Pan, L., 1990, Chapter 10. Temporal and spatial variations of the temperature in purple soils. In Purple Soils in China (edited by Li et al.), Chinese Academic Press, Beijing.

Pan L., 1990. Spatial and temporal structure of soil temperature variation in Sichuan Basin – A spectral analysis approach. The 3rd national conference of young soil scientists, Hangzhou, China.

He, Y., L. Pan, and A. Bang, 1990. Fertility degradation of purple soils in a hilly area of Sichuan Basin and its recovery. Proceddings of the 1st national conference of land degradation and its recovery. Xiameng. Chinese Scientific and Technological Literature Press, Beijing.

Pan, L., and J. Yu, 1986. Modeling solute transport and transformation in rice soils. The 1st national conference of young scientists, Nanjing.

Pan, L., and J. Yu, 1985. The observability and the controllability of soil-solute system. The 3rd national conference of soil physics. Shanghai.

Softwares:

T2Well/ECO2N V1.0 – a coupled wellbore-reservoir simulator of nonisothermal, two phase, CO2-Brine flow

T2Well/EOS3 (beta) – a coupled wellbore-reservoir simulator of nonisothermal, two phase, Air-Water flow

T2Well/Eoil3 (beta) – a coupled wellbore-reservoir simulator of nonisothermal, two phase, Gas-oil flow

T2Well/EOS1 (beta) – a coupled wellbore-reservoir simulator of nonisothermal, two phase, one component (H2O) flow

T2Well/EOS7cma (beta) – a coupled wellbore-reservoir simulator of nonisothermal, two phase, 5 components flow

T2Well/ECO2H (beta) – a coupled wellbore-reservoir simulator of nonisothermal, two phase, CO2-Brine flow (T beyond 110 C)

CLMT2/CO2 (beta) -- a coupled land surface-subsurface model with capability to simulating net CO2 flux from a terrestrial ecosystem as response to climate change, groundwater variations, and land management practices

WinGridder Version 1.0, 2.0, & 3.0 -- A visual grid generator for control volume based numerical simulators

DCPT Version 1.0, 2.0, & 3.0 -- Dual-continuum particle tracker

SimAnneal Version 1.0 -- A global optimization program for inverse parameter estimation based on Annealing-Simplex method

Cylinder Version 1.0 --Unsaturated flow and transport simulator for lab column

CLMT2 V1.0 --A Coupled surface-subsurface hydraulic model

ToolBox of some analytical solutions --Java codes for several analytical solutions of water flow and transport problem through (fractured) porous media.