

# Alex Sun

## Professional Summary

December 7, 2021

Business address: The University of Texas at Austin  
Bureau of Economic Geology  
University Station, Box X  
Austin, TX 78713-8924  
Telephone: (512) 475-6190  
E-mail address: alex.sun@beg.utexas.edu

## Professional Preparation

### Academic Background

Ph.D. Environmental Water Resources, University of California at Berkeley, May 2000

M.S. Civil and Environmental Engineering, University of California at Berkeley, May 1996

B.S. Civil and Environmental Engineering, University of California at Los Angeles, June 1995

### Professional Appointments

Senior Research Scientist, The University of Texas at Austin, Bureau of Economic Geology (September 2017-Present)

Present Position: Research Scientist, Bureau of Economic Geology, The University of Texas at Austin (March 2011 - Present). Developing theoretical and analytical tools for predicting CO<sub>2</sub> leakage into groundwater aquifers; conducting performance assessment of a proposed low-level radioactive waste repository in Texas.

Principal Research Engineer, Senior Research Engineer, Research Engineer, Southwest Research Institute, San Antonio, Texas (September 2003 - March 2011). Developed a decision support system for surface water quality management; conducted environmental impact assessment of in-situ uranium recovery operations; developed an integrated framework for calibrating regional groundwater models; conducted researches related to a potential high-level nuclear waste repository project; responsible for assessing DOE's modeling of surface and subsurface hydrologic processes through independent process-level modeling and uncertainty analyses; developed robust contaminant source identification methodologies for identifying source locations and release histories under model and data uncertainty; developed a novel grid-based ensemble Kalman filter method for continuous reduction of model and parameter uncertainty in multimodal, non-Gaussian random fields; implemented a dual-conductivity module in MODFLOW and applied it to modeling karst aquifers in Texas and Florida; modeled coupled, non-isothermal, hydrological and geochemical processes in unsaturated fractured volcanic aquifers using high-performance computing tools; led a wireless sensor project for developing miniature acoustic sensors for monitoring underwater environments; simulated a seawater intrusion scenario for a Swedish nuclear repository project.

Co-founder (part-time), SUNDA Environmental Technology, LLC, Santa Monica, California (May 2000 - March 2004). Provided litigation support for a Superfund site located in Riverside County, California; developed a three-dimensional contaminant transport model for the site and successfully reconstructed contaminant plume migration history; designed and maintained large-scale sample databases.

Environmental Engineer, Tetra Tech Inc., R&D Division, Lafayette, California (August 1999 - May 2000). Conducted feasibility study and site characterization projects for several Superfund sites in California; developed in-house tools for environmental risk assessment, geostatistical

modeling, and contaminant transport modeling.

Research Fellow, Los Alamos National Laboratory, Los Alamos, New Mexico (June 1998 - August 1999). Derived and implemented particle tracking algorithms for predicting uncertainties associated with mass transport in porous media; developed codes for solving stochastic partial differential equations for solute transport in unsaturated nonstationary random porous media.

Lab Assistant, Environmental Research Lab, UCLA, Los Angeles, California (September 1993 - September 1994). Conducted experiments to test the performance of reverse-osmosis membranes.

## Professional Registrations and Certificates

Engineer-in-Training (State of California)

Texas Board of Professional Engineers # 117339

## Theses

A Closed-Form Solution to a Multi-Rate Solute Transport Model

## Dissertations

Stochastic Analysis of Mass Transport in Unsaturated Porous Media

## Areas of Expertise

### Areas of Expertise

Application of Big Data and machine learning in geosciences

Development and application of high-performance numerical codes and data assimilation techniques for sustainable water resources management, reservoir characterization, and CO<sub>2</sub> sequestration

Development of decision support systems

Modeling of multiphase flow and multicomponent transport in porous media

Quantification of model uncertainty using Characterization of subsurface and surface water interactions through real-time monitoring and modeling

Quantification of model uncertainty using statistical and stochastic techniques

## Awards

### Awards and Honorary Societies

Center for Nonlinear Studies Research Fellowship, Los Alamos National Laboratory, 1998 - 1999

Dean's Fellowship, Department of Civil and Environmental Engineering, UC Berkeley, 1997 - 1998

Jane Lewis Fellowship, Department of Material Science and Engineering, UC Berkeley, 1995 - 1996

## Service

### External Committees Participation

Associate Editor, Water Resources Research, January 1, 2017-Present

Member, Editorial Board, Advances in Water Resources, July 1, 2016-Present

Session Convener, H44E Transforming Hydrologic Prediction and Decision Making: Intelligent Decision Making V, 2016 AGU Fall Meeting, San Francisco, Calif.

## Teaching and Advising

## Student Committee Supervision

Reader, Master's thesis committee, Behnaz Bolhassani, Model-based cost analysis for pressure and geochemical-based monitoring methods in CO<sub>2</sub>-EOR fields: application to field A, The University of Texas at Austin, Austin, Tex., 2016

## Student Committee Participation

Member, Ph.D. Dissertation Committee, Tony Perez, The University of Texas at San Antonio, 2010

Member, Ph.D. Dissertation Committee, Juliana Leung, The University of Texas at Austin, Completed, 2009

## Presentations

### Presentations

Combining Physics-Based Modeling and Machine Learning for GRACE Satellite Data Fusion and Reconstruction: presented at American Geophysical Union meeting, December 1-17, 2020.

Global Analysis of Daily and Monthly GRACE Data for Flood Prediction: presented at American Geophysical Union meeting, online, December 1-17, 2020.

Preliminary Results from GRACE/GRACE-FO 5-Day Mascon Solutions from CSR: presented at American Geophysical Union meeting, virtual, December 1-17, 2020.

Reconstruction of GRACE Total Water Storage Through Automated Machine Learning (AutoML): presented at American Geophysical Union meeting, virtual, December 1-17, 2020.

Relative Impacts of Climate Extremes and Irrigation Water Use on Water Storage in Major Aquifers Based on GRACE Satellite Data: presented at American Geophysical Union meeting, virtual, December 1-17, 2020.

Assessing Impacts of Climate Extremes and Human Water Use on GRACE Total Water Storage Trends in Major US Aquifers.: presented at GRACE/GRACE-FO Science Team Meeting, virtual, October 26-29, 2020.

Reconstruction of GRACE Total Water Storage Through Automated Machine Learning: presented at GRACE/GRACE-FO Science Team Meeting, October 26-29, 2020.

Assessing Detectability of Global Flood Occurrences using Daily and Monthly GRACE/GRACE-FO: presented at GRACE/GRACE-FO Science Team Meeting 2020, virtual, October 2020.

Assessing the Reliability of GRACE-Derived Groundwater Storage Using Ground-Based Monitoring and Regional and Global Modeling in Major U.S. Aquifers: presented at American Geophysical Union meeting, San Francisco, Calif., December 9-13, 2019.

How Reliable is GRACE-Derived Groundwater Storage Changes?: presented to GRACE science team, presented at GRACE/GRACE-FO Science Team Meeting 2019, Pasadena, Calif., October 8-10, 2019.

Quantifying rainfall and soil moisture patterns using a network approach: presented at 2017 Texas Weather Conference, Austin, Tex., March 3-4, 2017.

Interpreting detailed brine chemistry changes during early periods of in-zone CO<sub>2</sub> storage at Cranfield site, Mississippi, USA: presented at Fall meeting of American Geophysical Union, San Francisco, December 14-19, 2015.

Development of a binational geospatial decision support system to protect water quality in the Lower Rio Grande: An innovative use of open source geographic information system software: presented to Texas GIS Forum, Austin, Texas, October 26-29, 2015.

Pressure-based inversion and data assimilation system for CO<sub>2</sub> leakage detection: presented to

DOE/NETL, presented at National Energy Technology Laboratory Carbon Storage R&D Project Review Meeting, Pittsburgh, Pa., August 18-20, 2015.

Application of harmonic pulse testing for leakage detection in carbon storage formations: presented at American Geophysical Union Fall Meeting, San Francisco, California, December 15-19, 2014.

A frequency-domain diagnosis tool for early leakage detection at geologic carbon sequestration sites: presented at Greenhouse Gas Control Technologies (GHGT-12), Austin, Texas, October 5-9, 2014.

Streamflow forecasting: a data driven approach using Gaussian process regression: presented at the 6th International Workshop on Catchment Hydrological Modeling and Data Assimilation, Austin, Texas, September 8-12, 2014.

PIDAS: pressure-based inversion and data assimilation system for CO<sub>2</sub> leakage detection: presented to U.S. Department of Energy National Energy Technology Laboratory, presented at Carbon Storage R&D Project Review Meeting, Pittsburgh, Pennsylvania, August 12-14, 2014.

Estimating regional groundwater model parameters using GRACE and in situ observations: invited talk presented at Fall Meeting of AGU, San Francisco, California, December 2010.

A collaborative geospatial decision support system for managing coastal river basin water quality: presented at Hydrologic Science Conference, San Diego, California, October 2010.

Uncertainty quantification and parameter estimation in hydrogeology: presented at The University of Texas at San Antonio Environmental Seminar Series, San Antonio, Texas, April 2010.

Uncertainty quantification in surface and subsurface hydrology: presented at The University of Texas at Arlington Civil and Environmental Engineering Seminar, Arlington, Texas, March 2010.

Development of an ensemble Kalman filter and its application in geoscience applications: presented at Environmental Engineering Fall Seminar Series, Texas A&M, Kingsville, Texas, October 2009.

Toward an integrated framework for contaminant source identification: presented at California State University, Los Angeles, California, August 2008.

Contaminant source identification under model uncertainty: presented at Reservoir Characterization Workshop, The University of Texas at Austin, Austin, Texas, March 2008.

## Activities of a Professional Nature

### Professional Societies

American Geophysical Union

National Ground Water Association

### Activities of a Professional Nature

Instructor for a short course on statistical methods for environmental monitoring and sample analyses, U. S. Nuclear Regulatory Commission (2010)

Mentor for Jason Frels, student employee, BS, Geology, Trinity University, San Antonio (2009)

Session Convener, Adopting Cloud Computing for Environmental Decision Support Systems, Fall Meeting of American Geophysical Union, San Francisco, CA

Session Convener, Uncertainty in Water Management: Quantification, Sensitivity Analysis and Experimental Design. Fall Meeting of American Geophysical Union, San Francisco, CA

Teaching assistant for a graduate course in hydrogeology, UC Berkeley (1998)

Teaching assistant for an undergraduate hydrology class, UC Berkeley (1997)

## Funding

### Research Support

Principal Investigator: Development of a framework data integration, assimilation, and learning for geologic carbon sequestration projects, DOE-NETL (October 1, 2015-September 30, 2018).

Co-Investigator: Minimum data set requirement for leakage detection, Canada Petroleum Technology Research Centre (June 1, 2015-September 30, 2016).

Principal Investigator: Pressure-Based Inversion and Data Assimilation System (PIDAS) for CO<sub>2</sub> Leakage Detection, U.S. Department of Energy (October 1, 2013-September 30, 2016).

Principal Investigator: Development of a Computer-based Decision Support System for the Lower Rio Grande/Río Bravo Water Quality Initiative, Texas Commission on Environmental Quality (July 15, 2013-August 31, 2016).

## Publications

### Peer Reviewed Journal Articles

Sun, A. Y., Scanlon, B. R., Save, H., and Rateb, A., 2021, Reconstruction of GRACE total water storage through automated machine learning: *Water Resources Research*, v. 57, no. 2, article no. e2020WR028666, 20 p., <http://doi.org/10.1029/2020WR028666>.

Jeong, H., Sun, A. Y., Jeon, J., Min, B., and Jeong, D., 2020, Efficient Ensemble-Based Stochastic Gradient Methods for Optimization Under Geological Uncertainty: *Frontiers in Earth Science*, v. 8, no. 108, 14 p., <http://doi.org/10.3389/feart.2020.00108>.

Liu, M., and Sun, A. Y., 2020, A physical agricultural drought index based on root zone water availability: model development and application: *Geophysical Research Letters*, v. 47, no. e2020GL088553, 11 p., <http://doi.org/10.1029/2020GL088553>.

Pierre, J. P., Andrews, J. R., Young, M. H., Sun, A. Y., and Wolaver, B. D., 2020, Projected landscape impacts from oil and gas development scenarios in the Permian Basin, USA: *Environmental Management*, v. 66, no. 3, p. 348-363, <http://doi.org/10.1007/s00267-020-01308-2>.

Rateb, A., Scanlon, B. R., Pool, D. R., Sun, A., Zhang, Z., Chen, J., Clark, B., Faunt, C. C., Haugh, C. J., Hill, M., and nine others, 2020, Comparison of groundwater storage changes from GRACE satellites with monitoring and modeling of major U.S. aquifers: *Water Resources Research*, v. 56, no. 12, article no. e2020WR027556, 19 p., <http://doi.org/10.1029/2020WR027556>.

Sinha, S., Pires de Lima, R., Lin, Y., Sun, A. Y., Symons, N., Pawar, R., and Guthrie, G., 2020, Normal or abnormal? Machine learning for the leakage detection in carbon sequestration projects using pressure field data: *International Journal of Greenhouse Gas Control*, v. 103, no. 103189, 12 p., <http://doi.org/10.1016/j.ijggc.2020.103189>.

Sun, A. Y., 2020, Optimal carbon storage reservoir management through deep reinforcement learning: *Applied Energy*, v. 278, no. 115660, 15 p., <http://doi.org/10.1016/j.apenergy.2020.115660>.

Sun, A. Y., and Tang, G., 2020, Downscaling satellite and reanalysis precipitation products using attention-based deep convolutional neural nets: *Frontiers in Water*, v. 2, no. 536743, 22 p., <http://doi.org/10.3389/frwa.2020.536743>.

Zhong, Z., Sun, A. Y., and Wu, X., 2020, Inversion of time-lapse seismic reservoir monitoring data using CycleGAN: a deep learning-based approach for estimating dynamic reservoir property changes: *Journal of Geophysical Research: Solid Earth*, v. 125, no. e2019JB018408, 27 p., <http://doi.org/10.1029/2019JB018408>.

Zhong, Z., Sun, A. Y., Wang, Y., and Ren, B., 2020, Predicting field production rates for

waterflooding using a machine learning-based proxy model: *Journal of Petroleum Science and Engineering*, v. 194, no. 107574, 14 p., <http://doi.org/10.1016/j.petrol.2020.107574>.

Lashgari, H. R., Sun, A. Y., Zhang, T., Pope, G. A., and Lake, L. W., 2019, Evaluation of carbon dioxide storage and miscible gas EOR in shale oil reservoirs: *Fuel*, v. 241, p. 1223-1235, <http://doi.org/10.1016/j.fuel.2018.11.076>.

Scanlon, B. R., Zhang, Z., Rateb, A., Sun, A. Y., Wiese, D., Save, H., Beaudoin, H., Lo, M. H., Muller-Schmied, H., Doll, P., van Beek, R., Swenson, S., Lawrence, D., Croteau, M., and Reedy, R. C., 2019, Tracking seasonal fluctuations in land water storage using global models and GRACE satellites: *Geophysical Research Letters*, v. 46, p. 5254-5264, <http://doi.org/10.1029/2018GL081836>.

Sun, A. Y., and Scanlon, B. R., 2019, How can Big Data and machine learning benefit environment and water management: a survey of methods, applications, and future directions: *Environmental Research Letters*, v. 14, no. 7, article no. 073001, 28 p., <http://doi.org/10.1088/1748-9326/ab1b7d>.

Sun, A. Y., Scanlon, B. R., Zhang, Z., Walling, D., Bhanja, S. N., Mukherjee, A., and Zhong, Z., 2019, Combining physically-based modeling and deep learning for fusing GRACE satellite data: can we learn from mismatch?: *Water Resources Research*, v. 55, p. 1179-1195, <http://doi.org/10.1029/2018WR023333>.

Sun, A. Y., Zhong, Z., Jeong, H., and Yang, Q., 2019, Building complex event processing capability for intelligent environmental monitoring: *Environmental Modelling & Software*, v. 116, p. 1-6, <http://doi.org/10.1016/j.envsoft.2019.02.015>.

Zhong, Z., Sun, A. Y., and Jeong, H., 2019, Predicting CO<sub>2</sub> plume migration in heterogeneous formations using conditional deep convolutional generative adversarial network: *Water Resources Research*, v. 55, no. 7, p. 5830--5851, <http://doi.org/10.1029/2018WR024592>.

Zhong, Z., Sun, A. Y., Yang, Q., and Ouyang, Q., 2019, A deep learning approach to anomaly detection in geological carbon sequestration sites using pressure measurements: *Journal of Hydrology*, v. 573, p. 885-894, <http://doi.org/10.1016/j.jhydrol.2019.04.015>.

Jeong, H., Sun, A. Y., and Zhang, X., 2018, Cost-optimal design of pressure-based monitoring networks for carbon sequestration projects, with consideration of geological uncertainty: *International Journal of Greenhouse Gas Control*, v. 71, p. 278-292, <http://doi.org/10.1016/j.ijggc.2018.02.014>.

Jeong, H., Sun, A. Y., Lee, J., and Min, B., 2018, A learning-based data-driven forecast approach for predicting future reservoir performance: *Advances in Water Resources*, v. 118, p. 95-109, <http://doi.org/10.1016/j.advwatres.2018.05.015>.

Liu, M., Xu, X., and Sun, A. Y., 2018, New drought index indicates that land surface changes might have enhanced drying tendencies over the Loess Plateau: *Ecological Indicators*, v. 89, p. 716-724, <http://doi.org/10.1016/j.ecolind.2018.02.003>.

Liu, M., Xu, X., Sun, A. Y., Luo, W., and Wang, K., 2018, Why do karst catchments exhibit higher sensitivity to climate change? Evidence from a modified Budyko model: *Advances in Water Resources*, v. 122, p. 238-250, <http://doi.org/10.1016/j.advwatres.2018.10.013>.

Min, B., Sun, A. Y., Wheeler, M. F., and Jeong, H., 2018, Utilization of multiobjective optimization for pulse testing dataset from a CO<sub>2</sub>-EOR/sequestration field: *Journal of Petroleum Science and Engineering*, v. 170, p. 244-266, <http://doi.org/10.1016/j.petrol.2018.06.035>.

Scanlon, B. R., Zhang, Z., Save, H., Sun, A. Y., Mueller Schmied, H., van Beek, L. P. H., Wiese, D. N., Wada, Y., Long, D., Reedy, R. C., Longuevergne, L., Doell, P., and Bierkens, M. F. P., 2018, Global models underestimate large decadal declining and rising water storage trends relative to GRACE satellite data: *Proceedings of the National Academy of Sciences*, v. 115, no. 6, p. E1080-E1089, <http://doi.org/10.1073/pnas.1704665115>.

- Sun, A. Y., 2018, Discovering state-parameter mappings in subsurface models using generative adversarial networks: *Geophysical Research Letters*, v. 45, p. 11,137-11,146, <http://doi.org/10.1029/2018GL080404>.
- Sun, A. Y., Jeong, H., Gonzalez-Nicolas, A., and Templeton, T. C., 2018, Metamodeling-based approach for risk assessment and cost estimation: application to geological carbon sequestration planning: *Computers and Geosciences*, v. 113, p. 70-80, <http://doi.org/10.1016/j.cageo.2018.01.006>.
- Sun, A. Y., Xia, Y., Caldwell, T., and Hao, Z., 2018, Patterns of precipitation and soil moisture extremes in Texas, US: a complex network analysis: *Advances in Water Resources*, v. 112, p. 203-213, <http://doi.org/10.1016/j.advwatres.2017.12.019>.
- Islam, A., and Sun, A. Y., 2017, A theory-based simple extension of Peng-Robinson equation of state for nanopore confined fluids: *Journal of Petroleum Exploration and Production Technology*, v. 7, no. 4, p. 1197-1203, <http://doi.org/10.1007/s13202-016-0306-y>.
- Islam, A., and Sun, A. Y., 2017, Detecting CO<sub>2</sub> leakage around the wellbore by monitoring temperature profiles: a scoping analysis: *International Journal of Thermal Sciences*, v. 118, p. 367-373, <http://doi.org/10.1016/j.ijthermalsci.2017.04.030>.
- Liu, M. X., Xu, X. L., Xu, C. H., Sun, A. Y., Wang, K. L., Scanlon, B. R., and Zhang, L., 2017, A new drought index that considers the joint effects of climate and land surface change: *Water Resources Research*, v. 53, no. 3262-3278, p. 3262-3278, <http://doi.org/10.1002/2016WR020178>.
- Soltanian, M. R., Sun, A. Y., and Dai, Z., 2017, Reactive transport in the complex heterogeneous alluvial aquifer of Fortymile Wash, Nevada: *Chemosphere*, v. 179, p. 379-386, <http://doi.org/10.1016/j.chemosphere.2017.03.136>.
- Sun, A. Y., Lu, J., and Islam, A., 2017, A laboratory validation study of the time-lapse oscillatory pumping test for leakage detection in geological repositories: *Journal of Hydrology*, v. 548, p. 598-604, <http://doi.org/10.1016/j.jhydrol.2017.03.035>.
- Sun, A. Y., Scanlon, B. R., AghaKouchak, A., and Zhang, Z., 2017, Using GRACE satellite gravimetry for assessing large-scale hydrologic extremes: *Remote Sensing*, v. 9, no. 1287, 25 p., <http://doi.org/10.3390/rs9121287>.
- Sun, A. Y., Wheeler, M. F., and Islam, A., 2017, Identifying attributes of CO<sub>2</sub> leakage zones in shallow aquifers using a parametric level set method: *Greenhouse Gases: Science and Technology*, v. 7, no. 4, p. 649-664, <http://doi.org/10.1002/ghg.1665>.
- Tang, Y., Hooshyar, M., Zhu, T., Ringler, C., Sun, A. Y., Long, D., and Wang, D., 2017, Reconstructing annual groundwater storage changes in a large-scale irrigation region using GRACE data and Budyko model: *Journal of Hydrology*, v. 551, p. 397-406, <http://doi.org/10.1016/j.jhydrol.2017.06.021>.
- Zhang, X., Sun, A. Y., Duncan, I. J., and Vesselinov, V. V., 2017, Two-stage fracturing wastewater management in shale gas development: *Industrial & Engineering Chemistry Research*, v. 56, no. 6, p. 1570-1579, <http://doi.org/10.1021/acs.iecr.6b03971>.
- Gao, R. S., Sun, A. Y., and Nicot, J.-P., 2016, Identification of a representative dataset for long-term monitoring at the Weyburn CO<sub>2</sub>-injection enhanced oil recovery site, Saskatchewan, Canada: *International Journal of Greenhouse Gas Control*, v. 54, p. 454-465, <http://doi.org/10.1016/j.ijggc.2016.05.028>.
- Hao, Z., Hao, F., Singh, V. P., Sun, A. Y., and Xia, Y., 2016, Probabilistic prediction of hydrologic drought using a conditional probability approach based on the meta-Gaussian model: *Journal of Hydrology*, v. 542, p. 772-780, <http://doi.org/10.1016/j.jhydrol.2016.09.048>.
- Islam, A., and Sun, A. Y., 2016, Corrosion model of CO<sub>2</sub> injection based on non-isothermal wellbore hydraulics: *International Journal of Greenhouse Gas Control*, v. 54, p. 219-227,

<http://doi.org/10.1016/j.ijggc.2016.09.008>.

Islam, A., Meckel, T., Sun, A. Y., and Krishnamurthy, P. G., 2016, Numerical experiments of density driven CO<sub>2</sub> saturated brine migration in heterogeneous two-dimensional geologic fabric materials: *International Communications in Heat and Mass Transfer*, v. 71, p. 148-156, <http://doi.org/10.1016/j.icheatmasstransfer.2015.12.019>.

Islam, A., Sun, A. Y., and Lu, J., 2016, Simulating in-zone chemistry changes from injection time to longer periods of CO<sub>2</sub> storage: *Environmental Earth Sciences*, v. 75:1346, 11 p., <http://doi.org/10.1007/s12665-016-6153-9>.

Islam, A., Sun, A. Y., and Yang, C., 2016, Reactive transport modeling of the enhancement of density-driven CO<sub>2</sub> convective mixing in carbonate aquifers and its potential implication on geological carbon sequestration: *Scientific Reports*, v. 6, no. 24768, 9 p., <http://doi.org/10.1038/srep24768>.

Liu, M., Xu, X., Wang, D., Sun, A. Y., and Wang, K., 2016, Karst catchments exhibited higher degradation stress from climate change than the non-karst catchments in southwest China: An ecohydrological perspective: *Journal of Hydrology*, v. 535, p. 173-180, <http://doi.org/10.1016/j.jhydrol.2016.01.033>.

Sun, A. Y., Lu, J., Freifeld, B. M., Hovorka, S. D., and Islam, A., 2016, Using pulse testing for leakage detection in carbon storage reservoirs: A field demonstration: *International Journal of Greenhouse Gas Control*, v. 46, p. 215-227, <http://doi.org/10.1016/j.ijggc.2016.01.015>.

Zhang, X., Sun, A. Y., and Duncan, I. J., 2016, Shale gas wastewater management under uncertainty: *Journal of Environmental Management*, v. 165, no. 1, p. 188-198, <http://doi.org/10.1016/j.jenvman.2015.09.038>.

Islam, A., and Sun, A. Y., 2015, Quantification of CO<sub>2</sub> masses trapped through free convection process in isothermal brine saturated reservoir: *International Journal of Heat and Mass Transfer*, v. 87, p. 128-137, <http://doi.org/10.1016/j.ijheatmasstransfer.2015.03.083>.

Islam, A., Patzek, T., and Sun, A. Y., 2015, Thermodynamics phase changes of nanopore fluids: *Journal of Natural Gas Science and Engineering*, v. 25, p. 134-139, <http://doi.org/10.1016/j.jngse.2015.04.035>.

Liu, M., Xu, X., and Sun, A. Y., 2015, Decreasing spatial variability in precipitation extremes in southwestern China and the local/large-scale influencing factors: *Journal of Geophysical Research: Atmospheres*, v. 120, no. 13, p. 6480-6488, <http://doi.org/10.1002/2014JD022886>.

Liu, M., Xu, X., Sun, A. Y., Wang, K., Yue, Y., Tong, X., and Liu, W., 2015, Evaluation of high-resolution satellite rainfall products using rain gauge data over complex terrain in southwest China: *Theoretical and Applied Climatology*, v. 119, no. 1-2, p. 203-219, <http://doi.org/10.1007/s00704-014-1092-4>.

Sun, A. Y., Chen, J. L., and Donges, J., 2015, Global terrestrial water storage connectivity revealed using complex climate network analyses: *Nonlinear Processes in Geophysics*, v. 22, p. 433-446, <http://doi.org/10.5194/npg-22-433-2015>.

Sun, A. Y., Lu, J., and Hovorka, S. D., 2015, A harmonic pulse testing method for leakage detection in deep subsurface storage formations: *Water Resources Research*, v. 51, no. 6, p. 4263-4281, <http://doi.org/10.1002/2014WR016567>.

Sun, A. Y., Miranda, R. M., and Xu, X., 2015, Development of multi-metamodels to support surface water quality management and decision making: *Environmental Earth Sciences*, v. 73, no. 1, p. 423-434, <http://doi.org/10.1007/s12665-014-3448-6>.

Wolaver, B. D., Coogan, J. C., Horton, B. K., Bermudez, L. S., Sun, A. Y., Wawrzyniec, T. F., Zhang, T., Shanahan, T. M., Dunlap, D. B., Costley, R., and de la Rocha, L., 2015, Structural and hydrogeologic evolution of the Putumayo basin and adjacent fold-thrust belt, Colombia: *AAPG Bulletin*, v. 99, no. 10, p. 1893-1927, <http://doi.org/10.1306/05121514186>.



- Xu, G., Xu, X., Liu, M., Sun, A. Y., and Wang, K., 2015, Spatial downscaling of TRMM precipitation product using a combined multifractal and regression approach: demonstration for South China: *Water*, v. 7, p. 3083-3102, <http://doi.org/10.3390/w7063083>.
- Liu, M., Xu, X., Sun, A. Y., Wang, K., Liu, W., and Zhang, X., 2014, Is southwestern China experiencing more frequent precipitation extremes?: *Environmental Research Letters*, v. 9, no. 6, 14 p., <http://doi.org/10.1088/1748-9326/9/6/064002>.
- Long, D., Shen, Y., Sun, A. Y., Hong, Y., Longuevergne, L., Yang, Y., Li, B., and Chen, L., 2014, Drought and flood monitoring for a large karst plateau in Southwest China using extended GRACE data: *Remote Sensing of Environment*, v. 155, p. 145-160, <http://doi.org/10.1016/j.rse.2014.08.006>.
- Sun, A. Y., Wang, D., and Xu, X., 2014, Monthly streamflow forecasting using Gaussian Process Regression: *Journal of Hydrology*, v. 511, p. 72-81, <http://doi.org/10.1016/j.jhydrol.2014.01.023>.
- Long, D., Scanlon, B. R., Longuevergne, L., Sun, A. Y., Fernando, D. N., and Save, H., 2013, GRACE satellite monitoring of large depletion in water storage in response to the 2011 drought in Texas: *Geophysical Research Letters*, v. 40, p. 3395-3401, <http://doi.org/10.1002/grl.50655>.
- Sun, A. Y., 2013, Enabling collaborative decision-making in watershed management using cloud-computing services: *Environmental Modelling & Software*, v. 41, p. 93-97.
- Sun, A. Y., 2013, Predicting groundwater level changes using GRACE data: *Water Resources Research*, v. 29, p. 1-13.
- Sun, A. Y., Nicot, J. -P., and Zhang, Xiaodong, 2013, Optimal design of pressure-based, leakage detection monitoring networks for geologic carbon sequestration repositories: *International Journal of Greenhouse Gas Control*, v. 19, p. 251-261.
- Sun, A. Y., Zeidouni, M., Nicot, J. -P., Lu, Zhiming, and Zhang, D., 2013, Assessing leakage detectability at geologic CO<sub>2</sub> sequestration sites using the probabilistic collocation method: *Advances in Water Resources*, v. 56 (2013), p. 49-60.
- Xu, X., Scanlon, B. R., Schilling, K., and Sun, A. Y., 2013, Relative importance of climate and land surface changes on hydrologic changes in the U.S. Midwest since the 1930s: Implications for biofuel production: *Journal of Hydrology* v. 497, 110-120.
- Liu, Y., Sun, A. Y., Nelson, K., and Hipke, W. E., 2012, Cloud computing for integrated stochastic groundwater uncertainty analysis: *International Journal of Digital Earth*, v. 5, no. 5, p. 1-25. DOI:10.1080/17538947.2012.687778.
- Sun, A. Y., and Nicot, J. -P., 2012, Inversion of pressure anomaly data for detecting leakage at geologic carbon sequestration sites: *Advances in Water Resources*, v. 44, p. 20-29.
- Sun, A. Y., Green, R., Swenson, S., and Rodell, M., 2012, Toward calibration of regional groundwater models using GRACE data: *Journal of Hydrology*, v. 422-423, p. 1-9.
- Sun, A. Y., 2011, Identification of geologic fault network geometry by using a grid-based ensemble Kalman filter: *Journal of Hazardous, Toxic, and Radioactive Waste*, v. 15, no. 4, p. 228-233.
- Sun, A. Y., Green, R., Rodell, M., and Swenson, S., 2010, Inferring aquifer storage parameters using satellite and in situ measurements: estimation under uncertainty: *Geophysical Research Letters*, v. 37, L10401.
- Sun, A. Y., Morris, A., and Mohanty, S., 2009, Comparison of deterministic ensemble Kalman filters for assimilating hydrogeologic data: *Advances in Water Resources*, v. 32, no. 2, p. 280-292.
- Sun, A. Y., Morris, A., and Mohanty, S., 2009, Sequential updating of multimodal hydrogeologic parameter fields using localization and clustering techniques: *Water Resources Research*, v. 45, W07424.

Sun, A. Y., 2008, CONSID®: A toolbox for contaminant source identification: *Ground Water*, v. 46, no. 4, p. 638-641.

Sun, A. Y., Ritzi, R., and Sims, D., 2008, Characterizing and modeling a complex alluvial aquifer: implication on solute transport: *Water Resources Research*, v. 44, W04402.

Sun, A. Y., 2007, A robust maximum likelihood approach to contaminant source identification: *Water Resources Research*, v. 43, W02418.

Green, R., Painter, S., Sun, A. Y., and Worthington, S., 2006, Groundwater contaminant in karst terrains: *Water, Air, and Soil Pollution*, v. 6, nos. 1-2, p. 157-170.

Sun, A. Y., Painter, S., and Wittmeyer, G., 2006, A constrained, robust least squares approach for contaminant source release history identification: *Water Resources Research*, v. 42, W04414.

Sun, A. Y., Painter, S., and Wittmeyer, G., 2006, A robust approach for contaminant source location and release history recovery: *Journal of Contaminant Hydrology*, v. 88, p. 29-44.

Sun, A. Y., and Zhang, D., 2004, A solute flux approach to transport through bounded, unsaturated heterogeneous porous media: *Vadose Zone Journal*, v. 3, p. 513-526.

Sun, A. Y., and Zhang, D., 2000, Prediction of solute spreading during vertical infiltration in unsaturated, bounded heterogeneous porous media: *Water Resources Research*, v. 36, no. 3, p. 715-723.

Zhang, D., and Sun, A. Y., 2000, Stochastic analysis of transient saturated flow through heterogeneous fractured porous media: a double-permeability approach: *Water Resources Research*, v. 36, no. 4, p. 865-874.

Zhang, D., Andricevic, R., Sun, A. Y., Hu, X., and He, G., 2000, Solute-flux approach to transport through spatially nonstationary flow in porous media: *Water Resources Research*, v. 36, no. 7, p. 2107-2120.

Rubin, Y., Sun, A. Y., Maxwell, R., and Bellin, A., 1999, The concept of block effective macrodispersivity and a unified approach for grid-scale and plume-scale dependent transport: *Journal of Fluid Mechanics*, v. 395, p. 161-180.

Sun, A. Y., and Rubin, Y., 1998, Temporal moments of reactive and conservative solute transport in the unsaturated zone: *Journal of Hydraulic Research*, v. 36, no. 6.

### Peer Reviewed Book Chapters

Hosseini, S. A., Shakiba, M., Sun, A. Y., and Hovorka, S. D., 2018, In-zone and above-zone pressure monitoring methods for CO<sub>2</sub> geologic storage, in Vialle, S., Ajo-Franklin, J., Carey, J. W., eds., *Geological carbon storage: subsurface seals and caprock integrity*: American Geophysical Union, *Geophysical Monograph Series*, v. 238, p. 227-241, <http://doi.org/10.1002/9781119118657>.

Sun, N.-Z., and Sun, A. Y., 2005, Inverse methods for parameter estimation, in Anderson, M. G., and McDonnell, J. J., eds., *Encyclopedia of hydrological sciences*: United Kingdom, John Wiley and Sons, v. 4,

Sun, N.-Z., and Sun, A. Y., 2002, Chapter 8. Parameter identification of environmental systems, in Shen, H., et al., *Environmental fluid mechanics*: American Society of Civil Engineers,

### Non Peer Reviewed Authored Books

Sun, N.-Z., and Sun, A. Y., 2015, *Model calibration and parameter estimation for environmental and water resources systems*: New York, Springer-Verlag, 621 p., ISBN 978-1-4939-2322-9, <http://doi.org/10.1007/978-1-4939-2323-6>.

### Non Peer Reviewed Journal Articles

Nicot, J.-P., Sun, A. Y., Gao, R. S., and Lashgari, H., 2017, Identification of a minimum dataset for CO<sub>2</sub>-EOR monitoring at Weyburn, Canada: Energy Procedia, Proceedings of 13th International Conference on Greenhouse Gas Control Technologies GHGT-13, 14-18 November 2016, Lausanne, Switzerland, v. 114, p. 7033-7041, <http://doi.org/10.1016/j.egypro.2017.03.1844>.

Sun, A. Y., 2013, Predicting groundwater level changes using GRACE data: Water Resources Research, v. 49, p. 1-13, <http://doi.org/10.1002/wrcr.20421>.

Porras, A., Yang, C., Tu, K., Broussard, B., and Sun, A. Y., 2012, Numerical modeling of groundwater flux through a low-level radioactive waste repository for performance assessment: Gulf Coast Association of Geological Societies Transactions, v. 62, p. 343-350.

Sun, A. Y., Painter, S., and Wittmeyer, G., 2006, A robust framework for contaminant source identification using MODFLOW/MT3DMS, in Poeter et al., eds., Proceedings of MODFLOW and MORE, Golden, Colorado.

Sun, A. Y., Painter, S., and Green, R., 2005, Modeling Barton Springs segment of the Edwards Aquifer using MODFLOW-DCM, in Schindel, G., ed., Proceedings of the 10th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst, San Antonio.

Zhang, D., and Sun, A. Y., 1999, Stochastic analysis of groundwater flow in fractured porous media, in Faybishenko, B., ed., Proceedings of the International Symposium on Dynamics of Fluids in Fractured Rocks-Concepts and Recent Advances.

## Non Peer Reviewed Book Chapters

Long, D., Shen, Y., Sun, A. Y., Hong, Y., Longuevergne, L., Yang, Y., Li, B., and Chen, L., 2016, Drought and flood monitoring for a large karst plateau in southwest China using extended GRACE data, in Yang, H., Yu, Z., Ibrahim, K. S., eds., Hydrologic Remote Sensing -- Capacity Building for Sustainability and Resilience: CRC Press, p. 73-102, <http://doi.org/10.1201/9781315370392-6>.

## Conference Proceedings

Wang, L., Gale, J. F. W., and Sun, A. Y., 2020, Development of a machine-learning-based workflow for well completion optimization in Permian Basin, Unconventional Resources Technology Conference (URTeC), Annual Meeting, 13 p.

## Contract Reports

Wolaver, B. D., Sun, A. Y., Caldwell, T., Smyth, R. C., Mickler, P., Bongiovanni, T., Pierre, J. P., Sharp, J. M., Jr., Uliana, M., and Breton, C., 2019, Report on year one preliminary results: hydrogeologic evaluation and vulnerability analysis for Balmorhea-area springs: Bureau of Economic Geology, The University of Texas at Austin, Annual Report prepared for Apache Corporation, 52 p.

Hosseini, S. A., Nicot, J.-P., Darvari, R., Costley, R., Lu, J., Sava, D., Goudarzi, A., Mickler, P., Banerji, D., Uhlman, K., Walden, S., Hentz, T. F., Hamlin, H. S., Ganjdanesh, R., Sun, A. Y., Hovorka, S. D., and Scanlon, B. R., 2016, Pressure management and plume control strategies through a brine extraction storage test at the Devine Test Site in Texas, Phase I: Bureau of Economic Geology, The University of Texas at Austin, Topical Report prepared for DOE NETL, under contract no. DE-FE0026137, 157 p.

Nicot, J.-P., Gao, S. R., Sun, A. Y., Meckel, T., Lashgari, H. R., and Trevisan, L., 2015, Minimum dataset requirements and development of a modeling workflow for CO<sub>2</sub> migration during post-EOR storage: Case of Weyburn, SK: The University of Texas at Austin, Bureau of Economic Geology, Contract Report prepared for Petroleum Technology Research Centre (PTRC), Regina, Saskatchewan, 87 p.

Hovorka, S. D., Nicot, J. -P., Zeidouni, M., Sava, Diana, Yang, Changbing, Sun, A. Y., and

Remington, R. L., 2014, Workbook for developing a monitoring plan to ensure storage permanence in a geologic storage project, including site-specific tool selection: Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, contract report conducted under Funding Opportunity Number: EPA-G2008-STAR-H1, Integrated Design, Modeling, and Monitoring of Geologic Sequestration of Anthropogenic Carbon Dioxide to Safeguard Sources of Drinking Water and with funding from the Carbon Capture Project, 65 p.

Hovorka, S. D., Nicot, J. -P., Zeidouni, M., Sun, A. Y., Yang, C., Sava, D., Mickler, P., and Remington, R. L., 2014, Expert-based development of a standard in CO<sub>2</sub> sequestration monitoring technology: Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, final report prepared for Project STAR#R834384, under Funding Opportunity Number EPA-G2008-STAR-H1: Integrated Design, Modeling, and Monitoring of Geologic Sequestration of Anthropogenic Carbon Dioxide to Safeguard Sources of Drinking Water, 52 p.

Hovorka, S. D., Nicot, J. -P., Zeidouni, M., Sun, A. Y., Yang, Changbing, Sava, Diana, Mickler, P., Remington, R. L., 2014, Expert-based development of a standard in CO<sub>2</sub> sequestration monitoring technology: Gulf Coast Carbon Center, Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, Project STAR#R834384 conducted under Funding Opportunity Number EPA-G2008-STAR-H1: Integrated Design, Modeling, and Monitoring of Geologic Sequestration of Anthropogenic Carbon Dioxide to Safeguard Sources of Drinking Water.

Núñez-López, V., Hovorka, S. D., Carr, D. L., Sun, A. Y., and Smyth, R. C., 2014, Above-zone monitoring plan report for the West Ranch CO<sub>2</sub> EOR oilfield: Final Report prepared for NRG Energy Company, Petra Nova LLC, under contract no. 4501477652, 17 p.

Smyth, R. C., Núñez López, Vanessa, Hovorka, S. D., Wolaver, B. D., Hosseini, S. A., Ambrose, W. A., Lu, Jiemin, Mickler, P., Zahid, K., Zeidouni, M., and Sun, A. Y., 2013, Draft final monitoring plan report, Phase I at West Ranch Field: The University of Texas at Austin, Bureau of Economic Geology, final report prepared for NRG Energy Company, Petra Nova LLC, DOE Award Number: DE-FE-0003311.

Smyth, R. C., Núñez, Vanessa, Hovorka, S. D., Wolaver, B. D., Hosseini, S. A., Ambrose, W. A., Lu, Jiemin, Mickler, P., Zahid, K., Zeidouni, M., Sun, A. Y., 2013, Monitoring Plan Report: Phase I at West Ranch Field, Gulf Coast Carbon Center at the Bureau of Economic Geology, a unit of The University of Texas at Austin, draft final report, prepared for NRG Energy Inc., Petra Nova LLC, DOE award number DE-FE-0003311.

Núñez López, Vanessa, Hovorka, S. D., Wolaver, B. D., Zahid, K., Sun, A. Y., Hosseini, S. A., and Romanak, K. D., 2011, Phase 2A at West Hastings field: The University of Texas at Austin, Bureau of Economic Geology, Gulf Coast Carbon Center, final report for the MVA Design Phase prepared for Denbury Onshore, LLC, 126 p.

Núñez-López, V., Hovorka, S. D., Wolaver, B. D., Zahid, K. M., Sun, A. Y., Hosseini, S. A., and Romanak, K. D., 2011, Monitoring verification and accounting for demonstration of CO<sub>2</sub> capture & sequestration for steam methane reforming gas for large-scale production: The University of Texas at Austin, Bureau of Economic Geology, final report prepared for U.S. Department of Energy, under DOE Award Number: DE-FE-0002381.

Núñez-López, V., Hovorka, S. D., Wolaver, B. D., Zahid, K., Sun, A. Y., Hosseini, S. A., and Romanak, K. D., 2011, Monitoring verification and accounting subcontracted work for the "Lake Charles CCS Project": The University of Texas at Austin, Bureau of Economic Geology, Gulf Coast Carbon Center, final report, prepared for Denbury Onshore, LLC, under DOE Award Number: DE-FE-0002314, 126 p.

Sun, A. Y., 2008, Review of state-of-the-art multiscale approaches for modeling flow and transport in porous media: Southwest Research Institute, report prepared for Nuclear Regulatory

Commission.

Sun, A. Y., and Bertetti, P. F., 2007, Evaluation of the effects of physical and chemical heterogeneities on flow and transport in the saturated alluvium of Fortymile Wash, Nevada: Southwest Research Institute, report prepared for Nuclear Regulatory Commission.

Colton, S., Sun, A. Y., Stamatakos, J., and Sims, D. W., 2006, Three-dimensional structural model of the Amargosa Desert, Nevada, Version 2.0: Southwest Research Institute, report prepared for Nuclear Regulatory Commission.

Painter, S., Sun, A. Y., and Green, R., 2006, Evaluation of the effects of physical and chemical heterogeneities on flow and transport in the saturated alluvium of Fortymile Wash, Nevada: Southwest Research Institute, report prepared for American Water Works Association.

Sun, A. Y., Ritzi, R., and Sims, D. W., 2006, Characterization and modeling of alluvium beneath Fortymile Wash, Nevada: Southwest Research Institute, report prepared for Nuclear Regulatory Commission.

Painter, S., and Sun, A. Y., 2005, Representation of an open repository in groundwater flow models: Southwest Research Institute, report prepared for Swedish Nuclear Fuel and Waste Management Co..

Manepally, C., Sun, A. Y., Fedors, R., and Farrell, D., 2004, Drift-scale thermohydrologic process modeling: in-drift heat transfer and drift degradation: Southwest Research Institute, report prepared for Nuclear Regulatory Commission.

## Published Abstracts

Scanlon, B. R., Rateb, A., Pool, D. R., and Sun, A. Y., 2020, Relative impacts of climate extremes and irrigation water use on water storage in major aquifers based on GRACE satellite data (abs.): AGU Fall Meeting 2020, no. h079-08.

Islam, A., Sun, A. Y., and Wheeler, M., 2016, Identifying attributes of CO<sub>2</sub> leakage zones in shallow aquifers using a parametric level set method, H31F-1457, 2016 AGU Fall Meeting, San Francisco, Calif. (abs.).

Min, B., Wheeler, M., and Sun, A. Y., 2016, Multi-objective optimization of pulse testing results using parallel compositional simulations for reservoir characterization of a CO<sub>2</sub>-EOR field in Mississippi, no. GC41C-1103, 2016 AGU Fall Meeting, San Francisco, Calif. (abs.).

Scanlon, B. R., Zhang, Z., Sun, A. Y., Save, H., Schmied, H. M., Wada, Y., Doll, P. M., and Eisner, S., 2016, Comparison of total water storage anomalies from global hydrologic and land surface models and new GRACE satellite solutions (abs.): AGU Fall Meeting, no. H51P-04.

Sun, A. Y., Jeong, H., Hovorka, S. D., Templeton, T., Arctur, D., Zhu, T., and Xu, W., 2016, Development of an intelligent monitoring system for geological carbon sequestration (GCS) systems, no. H44E-06, 2016 AGU Fall Meeting, San Francisco, Calif. (abs.).

Islam, A., Sun, A. Y., and Lu, J., 2015, Interpreting detailed brine chemistry changes during early periods of in-zone CO<sub>2</sub> storage at Cranfield site, Mississippi, USA (abs.): AGU Fall Meeting Abstracts.

Sun, A. Y., Lu, J., Freifeld, B., Hovorka, S. D., and Islam, A., 2015, Hydrogeology from 10,000 ft below: lessons learned in applying pulse testing for leakage detection in a carbon sequestration formation (abs.): AGU Fall Meeting Abstracts.

Sun, A. Y., and Nicot, J. -P., 2012, Inversion of pressure anomaly data for CO<sub>2</sub> leakage detection at geologic carbon sequestration sites (abs.), in American Geophysical Union Fall Meeting, San Francisco, December 3-7, Abstract H44B-07.

Yang, Changbing, Tu, K., Porras, A., Broussard, B., Sun, A. Y., Nicot, J. -P., and Scanlon, B. R., 2012, Sensitivity analysis of radonucleide downward migration for a low-level radioactive waste repository: an analytical approach for performance assessment (abs.): Gulf Coast Association of

Geological Societies Transactions, v. 62, p. 817.

Strassberg, Gil, Scanlon, B. R., Longuevergne, Laurent, Wilson, C. R., Sun, A. Y., and Long, D., 2011, Difficulties in assessing reliability of groundwater storage changes from GRACE satellite data (abs.), in American Geophysical Union Fall Meeting, San Francisco, Abstract H14B-05.

Sun, A. Y., Yang, C., Porras, A., Tu, K., Broussard, B., Scanlon, B. R., Nicot, J. -P., and Council, L., 2011, Performance assessment of a low-level radioactive waste disposal facility in Texas (abs.), in AGU Meeting, San Francisco, December 5-9, Abstract #H531-1528.

Wolaver, B. D., Sun, A. Y., Nicot, J. -P., Hovorka, S. D., Nuñez López, Vanessa, and Young, M. H., 2011, The effects of subsurface heterogeneity on detectability of CO<sub>2</sub> leakage to shallow groundwater aquifers (abs.): presented at the AGU Meeting, San Francisco, California, December 5-9, 2011, no. H33B-1110.

Wolaver, B. D., Sun, A. Y., Nicot, J.-P., Hovorka, S. D., and Nuñez-López, V., 2011, The effects of subsurface heterogeneity on detectability of CO<sub>2</sub> leakage to shallow groundwater aquifers (abs.): American Geophysical Union, Fall Meeting 2011, ID: H33B-1323.