

TIAN ZHOU

Scientist

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EDUCATION

Ph.D., 2012	Water Resources Engineering , State University of New York, College of Environmental Science and Forestry (SUNY-ESF) in Association with Syracuse University, Syracuse, NY
M.S., 2007	Quaternary Geology , Lanzhou University, China
B.S., 2004	Geological Science , Lanzhou University, China

APPOINTMENT

Dec. 2021 – present	Team Leader , Land System Modeling Team, ASGC, PNNL
Oct. 2017 – present	Scientist , Atmospheric Sciences & Global Change (ASGC) Division, Pacific Northwest National Laboratory, Richland, WA
Oct. 2015 – Sep. 2017	Research Associate , Atmospheric Sciences & Global Change Division, Pacific Northwest National Laboratory, Richland, WA
Oct. 2012 – Oct. 2015	Research Associate , Dept. of Civil and Environmental Engineering, University of Washington, Seattle, WA
Aug. 2010 – Aug. 2012	Research Analyst , USDA Forest Service Northern Research Station, Syracuse, NY
Aug. 2007 – Aug. 2010	Research Assistant , Dept. of Environmental Resources Engineering, SUNY ESF, Syracuse, NY

REFEREED PUBLICATIONS (Citations: 1574, H-index: 21 as of Feb. 2023 by [Google Scholar](#))

- 41) Liao, C.; **T. Zhou**, D. Xu, M. Cooper, D. Engwirda, H. Y. Li, R. Leung (2021). Topological relationships-based flow direction modeling: Mesh-independent river networks representation. *Journal of Advances in Modeling Earth Systems* <https://doi.org/10.1029/2022MS003089>
- 40) Cooper, M., **T. Zhou**, B. Katrina, W. Bolton, E. Coon, S. Fleming, J. Rowland, J. Schwenk (2023). Detecting Permafrost Active Layer Thickness Change from Nonlinear Baseflow Recession. *Water Resources Research* <https://doi.org/10.1029/2022WR033154>
- 39) Feng, D., Z. Tan, D. Engwirda, C. Liao, D. Xu, G. Bisht, **T. Zhou**, H-Y. Li, R. Leung (2022). Investigating coastal backwater effects and flooding in the coastal zone using a global river transport model on an unstructured mesh. *Hydrology and Earth System Sciences* <https://doi.org/10.5194/hess-26-5473-2022>

- 38) Zhang, C., J. Golaz, R. Forsyth, T. Vo, S. Xie, Z. Shaheen, G. Potter, X. S. Asay-Davis, C. S. Zender, W. Lin, C. Chen, C. R. Terai, S. Mahajan, **T. Zhou**, K. Balaguru, Q. Tang, C. Tao, Y. Zhang, T. Emmenegger, and P. Ullrich (2022). The E3SM Diagnostics Package (E3SM Diags v2.6): A Python-based Diagnostics Package for Earth System Models Evaluation. *Geoscientific Model Development* <https://doi.org/10.5194/gmd-2022-38>
- 37) Golaz, C; L. P. Van Roekel; X. Zheng; A. Roberts; J. D. Wolfe; W. Lin; A. Bradley; Q. Tang; M. Maltrud; R. Forsyth; C. Zhang; **T. Zhou**; ...57 coauthors...; D. C. Bader (2022). The DOE E3SM Model Version 2: Overview of the physical model. *Journal of Advances in Modeling Earth Systems* <https://doi.org/10.1029/2022MS003156>
- 36) Xu, D.; G. Bisht, **T. Zhou**, L. R. Leung, and M. Pan (2022). Development of Land-River Two-Way Coupling in the Energy Exascale Earth System Model. *Journal of Advances in Modeling Earth Systems* <https://doi.org/10.1029/2021MS002772>
- 35) Eldardiry H.; **T. Zhou**, M. Huang, O. Chegwiddden (2022). The Role of Groundwater Withdrawals on River Regulation: Example from the Columbia River Basin. *Water Resources Research* <https://doi.org/10.1029/2020WR028955>
- 34) Zheng, X.; Q. Li, **T. Zhou**, Q. Tang, L. Van Roekel, and C. Golaz (2022). Description of historical and future projection simulations by the global coupled E3SMv1.0 model as used in ScenarioMIP and DAMIP of CMIP6. *Geoscientific Model Development* <https://doi.org/10.5194/gmd-15-3941-2022>
- 33) Sun, N.; H. Yan, M. Wigmosta, J. Lundquist, S. Dickerson-Lange, and **T. Zhou** (2022). Variability of Forest Canopy Effects on Snowpack Dynamics across the Climate Gradients of the Western United States Mountain Ranges. *Water Resources Research* <https://doi.org/10.1029/2020WR029194>
- 32) Liao, C.; **T. Zhou**, D. Xu, R. Barnes, G. Bisht, H. Y. Li, Z. Tan, T. Tesfa, Z. Duan, D. Engwirda, and R. Leung (2022). Advances in modeling flow direction on a hexagon mesh grid. *Advances in Water Resources* <https://doi.org/10.1016/j.advwatres.2021.104099>
- 31) Li, H-Y, Z. Tan, H. Ma, Z. Zhu, G. Abeshu, S. Zhu, S. Cohen, **T. Zhou**, D. Xu, and L. R. Leung (2022). A new large-scale suspended sediment model and its application over the United States. *Hydrology and Earth System Sciences* <https://doi.org/10.5194/hess-26-665-2022>
- 30) Cheng, Y; M. Huang, B. Zhu, **T. Zhou**, Y. Liu, and X. He (2021). Validation of the Version 5 of the Community Land Model over the Contiguous United States (CONUS) using in-situ and remote sensing datasets. *Geophysical Research: Atmosphere* <https://doi.org/10.1029/2020JD033539>
- 29) Burrows, S. M.; ... 13 coauthors... **T. Zhou**; ... 15 coauthors; and L. R. Leung (2020). The DOE E3SM coupled model v1.1 biogeochemistry configuration: overview and evaluation of coupled carbon-climate experiments. *Journal of Advances in Modeling Earth Systems* <https://doi.org/10.1029/2019MS001766>
- 28) **Zhou, T**; L. R. Leung; G. Leng; N. Voisin; H. Li; A. P. Craig; T. Tesfa; and Y. Mao (2020). Global irrigation characteristics and effects simulated by fully coupled land surface, river, and water management models in E3SM. *Journal of Advances in Modeling Earth Systems* <https://doi.org/10.1029/2020MS002069>
- 27) Voisin, N; A. Dyreson; T. Fu; M. O'Connell; S. Turner; **T. Zhou**; and J. Macknick (2020). Impact of climate change on water availability and its propagation through the Western US power grid. *Applied Energy* <https://doi.org/10.1016/j.apenergy.2020.115467>

- 26) **Zhou, T**; T. Endreny (2020). The Straightening of a River Meander Leads to Extensive Losses in Flow Complexity and Ecosystem Services. *Water* <https://doi.org/10.3390/w12061680>
- 25) Shah, H; **T. Zhou**; N. Sun; M. Huang, and V. Mishra (2019). Roles of irrigation and reservoir operations in modulating terrestrial water budgets in the Indian sub-continental river basins. *Journal of Geophysical Research: Atmosphere* <https://doi.org/10.1029/2019JD031059>
- 24) Caldwell, P. M.; ... 31 coauthors...; **T. Zhou** (2019). The DOE E3SM coupled model version 1: Description and results at high resolution. *Journal of Advances in Modeling Earth Systems* <https://doi.org/10.1029/2019MS001870>
- 23) Mao, Y; **T. Zhou**, L. R. Leung, T. Tesfa, H.-Y. Li, K. Wang, Z. Tan, A. Getirana (2019). Flood Inundation Generation Mechanisms and Their Changes in 1953 - 2004 in Global Major River Basins. *Journal of Geophysics Research: Atmospheres* <https://doi.org/10.1029/2019JD031381>
- 22) Golaz, C; ...80 coauthors...; **T. Zhou**; Q. Zhu (2019). The DOE E3SM coupled model version 1: Overview and evaluation at standard resolution. *Journal of Advances in Modeling Earth Systems* <https://doi.org/10.1029/2018MS001603>
- 21) Shah, H; **T. Zhou**, M. Huang, M. Vimal (2019). Strong influence of irrigation on water budget and land surface temperature in Indian sub-continental river basins. *Journal of Geophysical Research: Atmospheres* <https://doi.org/10.1029/2018JD029132>
- 20) Bao, J; **T. Zhou**; M. Huang; Z. Hou, W. Perkins, S. Harding, G. Hammond, H. Ren, P. Thorne, S. Suffield, and J. Zachara (2018) Modulating factors of hydrologic exchanges in a large-scale river reach: insights from three-dimensional computational fluid dynamics simulations. *Hydrological Processes* <https://doi.org/10.1002/hyp.13266>
- 19) **Zhou, T**; N. Voisin, T. Fu (2018) Non-stationary hydropower generation projections constrained by environmental and electricity grid operations over the western United States. *Environmental Research Letters* <https://doi.org/10.1088/1748-9326/aad19f>
- 18) Wartenburger, R; ...37 coauthors... **T. Zhou** (2018). Evapotranspiration simulations in ISIMIP2a - Evaluation of spatio-temporal characteristics with a comprehensive ensemble of independent datasets. *Environmental Research Letters* <https://doi.org/10.1088/1748-9326/aac4bb>
- 17) Sun, N; M. Wigmosta, **T. Zhou**, J. Lundquist, S. Dickerson-Lange, N. Cristea (2018). Evaluating the functionality and streamflow impacts of explicitly modeling forest-snow interactions and canopy gaps in a distributed hydrologic model. *Hydrological Processes* <https://doi.org/10.1002/hyp.13150>
- 16) **Zhou, T**; J. Bao, M. Huang, Z. Hou, E. Arntzen, R. Mackley, S. Harding, Y. Xu, X. Song, X. Chen, J. Stegen, G. Hammond, P. Thorne, and J. Zachara (2018) Riverbed hydrologic exchange dynamics in a large regulated river reach. *Water Resources Research* <https://doi.org/10.1002/2017WR020508>
- 15) **Zhou, T**; N. Voisin; G. Leng; and M. Huang (2018). Sensitivity of regulated flow regime to climate change in the Western United States. *Journal of Hydrometeorology* <https://doi.org/10.1175/JHM-D-17-0095.1>
- 14) Zhang, Y; M. Pan; J. Sheffield; A. Siemann; C. Fisher; M. Liang; H. Beck; N. Wanders; R. MacCracken; P. R. Houser; **T. Zhou**; D. P. Lettenmaier; Y. Ma; R. T. Pinker; J. Bytheway; C. D. Kummerow; and E. F. Wood. (2018). A Climate Data Record (CDR) for the global terrestrial water budget: 1984–2010. *Hydrology and Earth System Sciences*. <https://doi.org/10.5194/hess-22-241-2018>

- 13) Bisht, G; M. Huang; **T. Zhou**; X. Chen; H. Dai; G. Hammond; W. Riley; J. Downs; Y. Liu; and J. Zachara. (2017). Coupling a three-dimensional subsurface flow and transport model with a land surface model to simulate stream-aquifer-land interactions (CP v1.0). *Geoscientific Model Development* <https://doi.org/10.5194/gmd-10-4539-2017>
- 12) Yuan, X; M. Zhang; L. Wang; and **T. Zhou**. (2017). Understanding and seasonal forecasting of hydrological drought in the Anthropocene. *Hydrology and Earth System Sciences* <https://doi.org/10.5194/hess-21-5477-2017>
- 11) Voisin, N; M. Kintner-Meyer; D. Wu, R. Skaggs; T. Fu; **T. Zhou**; T. Nguyen; and I. Kraucunas. (2017). Opportunities for joint water-energy management: sensitivity of the 2010 Western U.S. electricity grid operations to climate oscillations. *Bulletin of the American Meteorological Society*. <https://doi.org/10.1175/BAMS-D-16-0253.1>
- 10) **Zhou, T**; M. Huang; J. Bao; Z. Hou; E. Arntzen; R. Mackley; A. Crump; A. E. Goldman; X. Song; Y. Xu; and J. Zachara. (2017) A New Approach to Quantify Shallow Water Hydrologic Exchanges in a Large Regulated River Reach. *Water*. <https://doi.org/10.3390/w9090703>
- 9) **Zhou, T**; B. Nijssen; H. Gao; and D.P. Lettenmaier. (2016). The contribution of reservoirs to global land surface water storage variations. *Journal of Hydrometeorology*. <https://doi.org/10.1175/JHM-D-15-0002.1>
- 8) **Zhou, T**; I. Haddeland; B. Nijssen; and D. P. Lettenmaier. (2016). Human induced changes in the global water cycle. *Terrestrial Water Cycle and Climate Change: Natural and Human-Induced Impacts; Geophysical Monograph 221*; 57. <https://doi.org/10.1002/9781118971772.ch4>
- 7) **Zhou, T**; B. Nijssen; G. J. Huffman; and D. P. Lettenmaier. (2014). Evaluation of real-time satellite precipitation data for global drought monitoring. *Journal of Hydrometeorology*. <https://doi.org/10.1175/JHM-D-13-0128.1>
- 6) Nijssen, B; S. Shukla; C. Lin; H. Gao; **T. Zhou**; J. Sheffield; E. F. Wood; and D. P. Lettenmaier. (2014). A prototype global drought information system based on multiple land surface models. *Journal of Hydrometeorology*. <https://doi.org/10.1175/JHM-D-13-090.1>
- 5) **Zhou, T**; and T. A. Endreny. (2013). Reshaping of the hyporheic zone beneath river restoration structures: flume and hydrodynamic experiments. *Water Resources Research*. <https://doi.org/10.1002/WRCR.20384>
- 4) **Zhou, T**; and T. A. Endreny. (2012). Meander hydrodynamics initiated by river restoration deflectors. *Hydrological Processes*. <https://doi.org/10.1002/hyp.8352>
- 3) **Zhou, T**; B. Pan; X. Liu; H. Su; and Z. Hu. (2008). The discovery of ice-wedge casts in Ordos Plateau; China and permafrost boundary establishment (in Chinese with English abstract). *Journal of Glaciology and Geocryology* <http://bcdt.westgis.ac.cn/CN/abstract/abstract415.shtml>
- 2) Pan, B; H. Su; X. Liu; X. Hu, **T. Zhou**; C. Hu; and J. Li; (2007). River terraces of the Yellow River and their genesis in eastern Lanzhou Basin during last 1.2 Ma (in Chinese with English abstract). *Quaternary Sciences*. <http://www.dsjy.com.cn/CN/abstract/abstract9193.shtml>
- 1) Pan, B; H. Su; C. Hu; X. Hu; **T. Zhou**; and J. Li. (2007). Discovery of a 1.0 Ma Yellow River terrace and re-dating of the fourth Yellow River terrace in Lanzhou area. *Progress in Natural Science*. <https://doi.org/10.1080/10020070612331343246>

PUBLICATIONS IN REVIEW/REVISION/PRESS

- Zhou, T**; S-C. Kao; W. Xu; S. Gangrade; and N. Voisin (in review). Impacts of Climate Change on Subannual Hydropower Generation: A Multi-model Assessment of the United States Federal Hydropower Plants. *Environmental Research Letters*
- Silva S.J., S.M. Burrows, K.V. Calvin, P.J. Cameron-Smith, X. Shi, and **T. Zhou**. (in review) Contrasting the biophysical and radiative effects of rising CO₂ concentrations on ozone dry deposition fluxes. *Journal of Geophysical Research: Atmospheres*
- Harrop, B; K. Balaguru, C. Golaz, L. R. Leung, S. Mahajan, A. Rhoades, P. Ullrich, C. Zhang, X. Zheng, **T. Zhou**, D. Bader, P. Caldwell, N. Keen, and A. Mametjanov (in review). Evaluating the water cycle over CONUS using multiple metrics for the Energy Exascale Earth System Model version 1 (E3SMv1) across resolutions. *Journal of Advances in Modeling Earth Systems*
- Tang, Q.; J-C. Golaz, L. P. Van Roekel, M. A. Taylor, W. Lin, B. R. Hillman, P. A. Ullrich, A. M. Bradley, O. Guba, J. D. Wolfe, **T. Zhou**, ...30 coauthors...; and D. C. Bader (in review). The Fully Coupled Regionally Refined Model of E3SM Version 2: Overview of the Atmosphere, Land, and River. *Geoscientific Model Development*
- Liao, C.; **T. Zhou**, D. Xu, Z. Tan, G. Bisht, M. Cooper, D. Engwirda, H. Y. Li, R. Leung, (in review). Topological relationship-based flow direction modeling stream burning and depression filling. *Journal of Advances in Modeling Earth Systems*

DATA

- Gosling, S; H. Müller Schmied; R. Betts; J. Chang; P. Ciais; R. Dankers; P. Döll; S. Eisner; M. Flörke; D. Gerten; M. Grillakis; N. Hanasaki; S. Hagemann; M. Huang; Z. Huang; S. Jerez; H. Kim; A. Koutroulis; G. Leng; X. Liu; Y. Masaki; P. Montavez; C. Morfopoulos; T. Oki; L. Papadimitriou; Y. Pokhrel; F. Portmann; R. Orth; S. Ostberg; Y. Satoh; S. Seneviratne; P. Sommer; T. Stacke; Q. Tang; I. Tsanis; Y. Wada; **T. Zhou**; M. Büchner; J. Schewe; F. Zhao (2017): ISIMIP2a Simulation Data from Water (global) Sector. GFZ Data Services. <https://doi.org/10.5880/PIK.2017.010>
- Voisin, N; A. Dyreson; T. Fu; M. O'Connell; S. Turner; **T. Zhou**; and J. Macknick (2020). Impact of climate change on water availability and its propagation through the Western US power grid: PLEXOS Inputs and outputs. <https://doi.org/10.25584/data.2020-06.1318/1635205> and <https://doi.org/10.25584/data.2020-06.1319/1635208>

NON-REFEREED PUBLICATIONS

- Nowak, David J.; R. E. Hoehn III; A. R. Bodine; E. J. Greenfield; A. Ellis; T. A. Endreny; Y. Yang; **T. Zhou**; R. Henry (2013): Assessing urban forest effects and values: Toronto's urban forest. *Resour. Bull. NRS-79*; U.S. Department of Agriculture, Forest Service, Northern Research Station. 59 p. <https://doi.org/10.2737/NRS-RB-79>.

CONFERENCE PRESENTATIONS (Selected)

- Zhou, T., R. Leung, N. Voisin, H. Li, G. Leng, T. Tesfa, **2018**. Global irrigation water withdrawal simulated by fully coupled land surface, river, and water management models. *American Geophysical Union Fall Meeting, Washington, DC*
- Zhou, T., N. Voisin, T. Fu, **2017**. Non-stationary hydropower generation projection over the western United States. *American Geophysical Union Fall Meeting, New Orleans, LA*
- Zhou, T., J. Bao, M. Huang, Z. Hou, E. Arntzen and R. Mackley, **2016**. Quantifying hyporheic exchange dynamics in a highly regulated large river reach. *American Geophysical Union Fall Meeting, San Francisco, CA*
- Zhou, T., B. Nijssen, I. Haddeland, H. Gao, and D. P. Lettenmaier. **2014**. Reservoir in Global Water Cycle: Macro Scale Hydrologic Modeling for Water Management. *American Geophysical Union Fall Meeting, San Francisco, CA*
- Zhou, T., B. Nijssen, I. Haddeland, and D. P. Lettenmaier. **2013**. Macro Scale Hydrologic Modeling for Water Management: Re-construction of Large Reservoir Storage Time Series in the Continental U.S. *American Geophysical Union Fall Meeting, San Francisco, CA*
- Lettenmaier, D. P., T. Zhou, G. J. Huffman, and B. Nijssen. **2013**. Evaluation of TMPA v7 Real-Time Precipitation for Global Hydrologic Prediction. *The 3rd International Workshop on Global Flood Monitoring & Modelling, College Park, MD, USA*
- Zhou, T., A. S. Ward, B. L. O'Connor, and T. A. Endreny. **2012**. Floodplain Hyporheic Response under Dam Release Hydrographs. *American Geophysical Union Fall Meeting, San Francisco, CA*
- Zhou, T., and T. A. Endreny. **2011**. Hydrodynamic impacts of disrupting point bar steering with river restoration structures. *American Geophysical Union Fall Meeting, San Francisco, CA*
- Zhou, T., and T. A. Endreny. **2011**. Changes of hydraulic patterns with in-channel restoration structures at a point bar. *11th Annual Meeting of the American Ecological Engineering Society, Ashville, NC*
- Zhou, T., and T. A. Endreny. **2010**. Flume analysis of in-channel restoration structures and impacts to secondary circulation flows. *World Congress of the International Commission of Agricultural and Biosystems Engineering, Quebec City, Canada*
- Zhou, T., and T. A. Endreny. **2010**. Hyporheic exchange flow around in-channel restoration structures: simulation and flume experiments. *Association of American Geographers Annual Meeting, Washington, DC*
- Zhou, T., and T. A. Endreny. **2009**. (invited talk) Hydraulic impacts of in-channel restoration structures in a meander band: simulation with CFD. *Workshop of Techniques for Evaluating Water Resources in the Finger Lakes, sponsored by United States Geological Survey, Finger Lakes - Lake Ontario Watershed Protection Alliance, and the Finger Lakes Institute, Geneva, NY*

SERVICES

- Referee for: *Water Resources Research*; *Journal of Hydrometeorology*; *Journal of Hydrology*; *Journal of Geophysical Research: Atmospheres*; *Hydrology and Earth System Sciences*; *Hydrological Processes*; *Hydrogeology Journal*; *AGU Books*; *Earth System Dynamics*; *Water Science and Technology*; *International Journal of Climatology*; *Remote Sensing*; *Estuarine, Coastal and Shelf Science*; *WIREs Water*, etc.
- Served as review panelist for 2014 US EPA National Priorities Grant
- Editorial board member of [Advances in Climate Change Research](#) (2018 – present)
- AGU 2020 session organizer

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HONORS AND AWARDS

2018	PNNL Exceptional Contribution Program (ECP) Award
2017	EBSD Best Award, Pacific Northwest National Laboratory
2011	AEES Conference Travel Grant
2007-2010	Tuition Scholarship Award, SUNY ESF, NY
2004	First Place in the 5 th "Challenge Cup" of the College Student Research Competition of Gansu Province, China
2002	Tuition Scholarship Award, Lanzhou University, China

(Last update: Feb. 2023)