

## **Xiaodong Chen, Ph.D.**

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### **Research Interests**

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- Hydroclimate Extreme Events (extreme precipitation and flooding)
- Regional Climate Modeling and Applications
- Machine Learning and Neuralhydrology
- Engineering Hydrometeorology

### **Research Experience**

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2021.2 - now	Earth Scientist Scientist III (2024-); Scientist II (2021-2023) Pacific Northwest National Laboratory, Richland, WA, USA
2018.3 - 2021.1	Postdoctoral Research Associate Pacific Northwest National Laboratory, Richland, WA, USA
2013.7 - 2013.8	Visiting Scholar National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan

### **Degrees**

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2015.3 – 2017.12	Ph.D. in Civil and Environmental Engineering <i>Dissertation: “Understanding probable maximum precipitation and safety of water management infrastructures under a changing climate”</i> Department of Civil and Environmental Engineering, University of Washington, USA
2011.9 – 2015.3	M.S. in Civil and Environmental Engineering <i>Thesis: “Model estimate of Pan-Arctic wetland methane emissions and their climate sensitivity during 1960-2006”</i> Department of Civil and Environmental Engineering, University of Washington, USA
2007.9 – 2011.7	B.E. in Hydraulic Engineering Department of Hydraulic Engineering, Tsinghua University, China

### **Honors and Awards**

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2023	EBSDBESTies Award	PNNL EBSD
2023	Silver Dollar Award for High-Impact Publication	PNNL EBSD

2021	Pathway to Excellence Award	PNNL
2020	Editor's Award ( <i>Journal of Hydrometeorology</i> )	American Meteorological Society
2019	EED Of-The-Year Award	PNNL Energy and Environment Directorate
2019	Editor's Award, <i>Advances in Atmospheric Sciences</i>	Springer Sciences+Business Media and Science Press
2015	Graduate Student Fellowship	University of Washington
2010	Friend of Tsinghua-Huang Qianheng Scholarship	Tsinghua University
2010	Second Prize in 2 <sup>nd</sup> Hydrological Innovation Competition	Tsinghua University
2009	Allen T. Chwang Award of Fluid Mechanics	Tsinghua University

## Grants

2021.9 – 2024.8	A Framework for Improving Analysis and Modeling of Earth System and Intersectoral Dynamics at Regional Scales (HyperFACETS) (co-PI), DOE
2021.11 – 2022.9	Understanding the Physics Representation of Deep Learning Models in Environmental Applications (PI, \$80,000), PNNL Seed LDRD
2019.10 – 2020.9	Approaching High-resolution Downscaling of Climate Projections with Machine Learning (PI, \$7,000), PNNL

## Teaching and Mentoring Experience

Visitor Host	Yanle Lu (Cornell University, 2023)
Mentor	Hisham Eldardiry (Ph.D. student at University of Washington, 2016-2017) Asif Mahmood (Master student at University of Washington, 2015-2016)
Guest Lecturer	MAS950, National Institute of Education/Nanyang Technological University (Singapore, February 2023) CEE599, University of Washington (Seattle, February 2023) AAG33H, National Institute of Education (Singapore, March 2022)
Teaching assistant	CEE 599 (Remote Sensing), University of Washington (Spring 2017; Spring 2015) CEE 599 (Water Resource Management), University of Washington (Spring 2016)

## Community Services

Editorial	Associate Editor: <i>Journal of Hydrometeorology</i> (2018 - present) Review Editor: <i>Frontiers in Water</i> (2021 - present) <i>Frontiers in Climate</i> (2021 – present)
Reviewer	IPCC AR6 WG I report (SOD expert reviewer)
Convener	AGU Fall Meeting 2022 (H023 - Advancing Precipitation Forecasting with Physical Models and Artificial Intelligence) AGU Fall Meeting 2021 (GC052 - Integrated investigations of hydroclimate variability)

	and extremes across multiple scales: processes and implications over complex terrains)
Referee	Advances in Atmospheric Sciences; Atmosfera; Atmosphere; Atmospheric Sciences Letters; Climate Dynamics; Climatic Change; Earth's Future; Earth Interactions; Estuarine, Coastal, and Shelf Science; Geophysical Research Letters; International Journal of Biometeorology; Journal of Applied Meteorology and Climatology; Journal of Climate; Journal of Geophysical Research: Atmosphere; Journal of Hydrologic Engineering; Journal of Hydrology; Journal of Hydrometeorology; npj Climate and Atmospheric Science; Resources, Conservation & Recycling; Water Resources Research; WIREs Water
Judge	PNNL Post Graduate Research Symposium (2018, 2021, 2022)

## Publications

\* Indicates corresponding author(s)

1. **Chen, X.\***, L. R. Leung\*, Y. Gao, Y. Liu, and M. Wigmosta (2023), Sharpening of Cold Season Storms over the Western US, *Nature Clim. Change*, 13, 167-173.
2. **Chen, X.\***, L. R. Leung\*, and L. Dong (2023), Antecedent hydrometeorological conditions of wildfire occurrence and their trends in the western U.S. during 1984-2018, *J. Geophys. Res.: Atmos.*, 128, e2023JD039136.
3. **Chen, X.\***, L., R. Leung\*, and N. Sun, Weather Systems Connecting Modes of Climate Variability to Regional Hydroclimate Extremes. *Geophys. Res. Lett.* (in press)
4. Lu, Y. et al.: Understanding the influence of urban form on the spatial pattern of precipitation, *Earth's Future* (in press)
5. Qin, H. et al. (2023), Summertime Near-Surface Temperature Biases Over the Central United States in Convection-Permitting Simulations, *J. Geophys. Res.: Atmos.* (in press)
6. Gao, Y.\*, Wu, Y., Guo, X., Kuo, W., Zhang, S., Leung, L. R., **Chen, X.** et al. (2023), More frequent and persistent heatwaves due to increased temperature skewness projected by a high-resolution Earth System Model, *Geophys. Res. Lett.*, 50, e2023GL105840.
7. Li, J.\*, Y. Qian, L. R. Leung, **X. Chen**, Z. Yang, and Z. Feng (2023), Potential weakening of the June 2012 North American derecho under future warming, *J. Geophys. Res.: Atmos.*, 128, e2022JD037494.
8. Yang, Z.\*, Qian, Y., Wang, J., Xue, P., Pringle, W., Li, J., **Chen, X.** (2023), Moisture Sources of Precipitation in the Great Lakes Region: Climatology and Recent Changes. *Geophys. Res. Lett.*, 50, e2022GL100682.
9. Zhang, J., Yang, L.\*, Yu, M., & **Chen, X.** (2023). Response of extreme rainfall to atmospheric warming and wetting: Implications for hydrologic designs under a changing climate. *J. Geophys. Res.: Atmos.*, 128, e2022JD038430.
10. Wang, Q., L. Yang\*, Y. Yang, and **X. Chen\*** (2022), Contrasting Climatic Trends of Atmospheric River Occurrences over East Asia. *Geophys. Res. Lett.*, 49, e2022GL099646.
11. Yang, Y., L. Yang\*, **X. Chen**, Q. Wang, and F. Tian (2022), Climate leads to reversed latitudinal changes in Chinese flood peak timing. *Earth's Future*, 10, e2022EF002726.
12. Fan, J.\*, et al. (2022), Contrasting responses of hailstorms to anthropogenic climate change in different synoptic weather systems. *Earth's Future*, 10, e2022EF002768.

13. **Chen, X.\***, L. R. Leung\*, Y. Gao, and Y. Liu (2021), Response of U.S. West Coast mountain snowpack to local sea surface temperature perturbations: Insights from regional climate simulations and machine learning models. *J. Hydrometeorol.*, 22, 1045-1062.
14. Dong L.\*, L. R. Leung, Y. Qian, Y. Zou, F. Song, and **X. Chen** (2021), Meteorological environments associated with California wildfires and their role in wildfire changes during 1984-2017. *J. Geophys. Res.: Atmos.*, 126, e2020JD033180.
15. Wang, L., Y. Qian\*, L.R. Leung, **X. Chen\***, et al. (2021), Multiple metrics informed projections of future precipitation in China. *Geophys. Res. Lett.*, 48, e2021GL093810.
16. **Chen, X.\*** and L. R. Leung\* (2020), Response of landfalling atmospheric rivers on the U.S. west coast to local sea surface temperature perturbations. *Geophys. Res. Lett.* 47, e2020GL089254.
17. Yan, H.\*, N. Sun, **X. Chen**, and M. Wigmosta\* (2020), Next-Generation Intensity-Duration-Frequency Curves for Climate-Resilient Infrastructure Design: Advances and Opportunities. *Frontiers in Water*, 2, 59.
18. Anderson, C.\* , et al. (2020), Soil moisture and hydrology projections of the permafrost region - A model intercomparison, *The Cryosphere*, 14, 445–459.
19. **Chen, X.\***, Z. Duan, L. R. Leung\*, and M. Wigmosta (2019), A framework to delineate precipitation-runoff regimes: Precipitation vs. snowpack in the western U.S., *Geophys. Res. Lett.*, 46, 13044–13053. [[EOS Highlight](#)]
20. Perkins, W. A.\* , et al. (2019), Parallel distributed hydrology model using global arrays, *Env. Mod. Soft.*, 122, 104533.
21. **Chen, X.\***, L. R. Leung\*, M. Wigmosta, and M. Richmond (2019), Impact of atmospheric rivers on surface hydrological processes in western U.S. watersheds, *J. Geophys. Res.: Atmos.*, 124, 8896–8916. [[EOS Highlight](#)] [[Cover Image](#)]
22. **Chen, X.** and F. Hossain\* (2019), Understanding future safety of dams in a changing climate, *B. Am. Meteorol. Soc.*, 100, 1395-1404.
23. Eldardiry, H. et al. (2019), Atmospheric river-induced precipitation and snowpack during the western United States cold season, *J. Hydrometeorol.*, 20, 613-630.
24. **Chen, X.**, L. R. Leung\*, Y. Gao, Y. Liu, M. Wigmosta, and M. Richmond (2018), Predictability of extreme precipitation in western U.S. watersheds based on atmospheric river occurrence, intensity, and duration, *Geophys. Res. Lett.*, 45, 11693–11701.
25. **Chen, X.**, and F. Hossain\* (2018), Understanding model-based probable maximum precipitation estimation as a function of location and season from atmospheric reanalysis, *J. Hydrometeorol.*, 19, 459-475.
26. **Chen, X.**, F. Hossain\*, and L. R. Leung (2017), Probable maximum precipitation in the U.S. Pacific Northwest in a changing climate, *Water Resour. Res.*, 53, 9600-9622.
27. **Chen, X.**, F. Hossain\*, and L. R. Leung (2017), Establishing a numerical modeling framework for hydrologic engineering analyses of extreme storm events, *J. Hydrol. Eng.* 22, 04017016.
28. Xia, J.\* , et al. (2017), Terrestrial ecosystem model performance in simulating net primary productivity and its vulnerability to climate change in the northern permafrost region. *J. Geophys. Res.: Biogeosciences.*, 122, 430-446.
29. **Chen, X.** and F. Hossain\* (2016), Revisiting extreme storms of the past 100 years for future safety of large water management infrastructures. *Earth's Future*, 4, 306–322.

30. Sikder, S., **X. Chen**, F. Hossain\*, J. Roberts, F. Robertson, C. Shum, and F. Turk (2016), Are general circulation models ready for operational streamflow forecasting for water management in the Ganges and Brahmaputra river basins? *J. Hydrometeor.*, 17, 195–210.
31. McGuire, A. D.\*, et al. (2016), Variability in the sensitivity among model simulations of permafrost and carbon dynamics in the permafrost region between 1960 and 2009, *Global Biogeochem. Cycles*, 30, 1015–1037.
32. Wang, W., et al. (2016), Evaluation of air–soil temperature relationships simulated by land surface models during winter across the permafrost region, *The Cryosphere*, 10, 1721-1737.
33. Peng, S.\*, et al. (2016), Simulated high-latitude soil thermal dynamics during the past 4 decades, *The Cryosphere*, 10, 179-192.
34. Bonnema, M., S. Sikder, Y. Miao, **X. Chen**, F. Hossain\*, I. Ara Pervin, S. M. Mahbubur Rahman, and H. Lee (2016), Understanding satellite-based monthly-to-seasonal reservoir outflow estimation as a function of hydrologic controls, *Water Resour. Res.*, 52, 4095–4115.
35. **Chen, X.**, Bohn, T. J.\*, and Lettenmaier, D. P. (2015), Model estimates of climate controls on pan-Arctic wetland methane emissions, *Biogeosciences*, 12, 6259-6277.
36. Rawlins, M. A.\*, et al. (2015), Assessment of model estimates of land-atmosphere CO<sub>2</sub> exchange across Northern Eurasia, *Biogeosciences*, 12, 4385-4405.
37. Koven, C. D.\*, et al. (2015), A simplified, data-constrained approach to estimate the permafrost carbon–climate feedback. *Phil. Trans. R. Soc. A*, 373: 20140423.
38. Bohn, T. J., et al. (2013), Modeling the large-scale effects of surface moisture heterogeneity on wetland carbon fluxes in the West Siberian Lowland, *Biogeosciences*, 10, 6559-6576.

#### In Progress

1. **Chen, X.\***, L. R. Leung\*, and N. Sun, Impact of ENSO and MJO on the Puget Sound Regional Hydroclimate Conditions. (under review)
2. **Chen, X.\***, E. E. McClenny, and P. A. Ullrich\*: Response of Atmospheric River Width and Intensity to Sea-Surface Temperatures in an Aquaplanet Model. (to be submitted)
3. Feng, Z., Chen, X., Leung, L. R.: How Might the May 2015 Flood in the U.S. Southern Great Plains Induced by Clustered MCSs Unfold in the Future? (in revision)
4. Guo, X. et al.: Global warming causes broader and more frequent extreme precipitation by high-resolution simulations (under review)
5. Li, Z., et al.: Characterizing the Uncertainty of CMORPH Products for Estimating Orographic Precipitation over Northern California (under review)

#### Book Chapters

1. **Chen, X.\*** (2020), Safety design of water infrastructures in a modern era, *Resilience of Large Water Management Infrastructure: Solutions from Modern Atmospheric Science*, Springer.
2. **Chen, X.**, F. Hossain, and L. R. Leung (2020), Application of numerical atmospheric models, *Resilience of Large Water Management Infrastructure: Solutions from Modern Atmospheric Science*, Springer.
3. **Chen, X.** and F. Hossain (2020), Infrastructure-relevant storms of the last century, *Resilience of Large Water Management Infrastructure: Solutions from Modern Atmospheric Science*, Springer.

### Non Peer-reviewed Articles

1. Miao, Y., X. Chen, and F. Hossain (2016), Maximizing Hydropower Generation with Numerical Modeling of the Atmosphere, *J. Hydrol. Eng.* (forum article), 21, 02516002.

### **Invited Talks**

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1. Chen, X., *Understanding the western U.S. hydroclimate with regional climate modeling and machine learning*, Department of Atmospheric Sciences, University of Utah, 2023, Salt Lake City, Utah
2. Chen, X., *Regional hydro-climate extremes of western US in a changing climate*, Nanjing University of Information Science & Technology, 2022, online
3. Chen, X., *Improved understanding of the regional hydro-climate extremes from machine learning*, College of Global Change and Earth System Science, Beijing Normal University, 2022, online
4. Chen, X., *Improved understanding of the regional hydro-climate extremes from machine learning*, School of Geographic and Oceanographic Sciences, Nanjing University, 2022, online
5. Chen, X., *Understanding the regional hydro-climate extreme events with machine learning*, National Institute of Education, Nanyang Technological University, 2022, online
6. Chen, X., *Footprint of atmospheric rivers on land and implications for managing water resources*, California Extreme Precipitation Symposium, 2020, Davis, CA
7. Chen, X., *Introduction to VIC model and its application in wetland methane emissions estimation*, National Institute of Environmental Studies workshop, 2013, Tsukuba, Japan
8. Chen, X., *Model Estimates of Pan-Arctic Lakes and Wetlands Methane Emissions*, ENVIROMIS-2012 Summer Workshop, 2012, Irkutsk, Russia

### **Conference/Workshop Presentations** (only those given by me)

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1. Chen, X., L. R. Leung, Y. Gao, Y. Liu, M. Wigmosta, *Sharpening of Cold Season Storms over the Western US*, American Geophysical Union (AGU) Fall Meeting (San Francisco, CA, 2023)
2. Chen, X., L. R. Leung, and N. Sun, *Weather Systems Connecting Modes of Climate Variability to Puget Sound Hydroclimate Extremes*, Northwest Climate Conference (online, 2023)
3. Chen, X., L. R. Leung, Y. Gao, Y. Liu, M. Wigmosta, *Future Changes of Western US Winter Storms and Implications for Design Curves*, HyperFACETS Spotlight Meeting (online, 2023)
4. Chen, X., L. R. Leung, Y. Gao, Y. Liu, M. Wigmosta, *Future Sharpening of Winter Storms in the Western United States*, PNNL-LBNL Climate Extreme Monthly Meeting (online, 2023)
5. Chen, X., L. R. Leung, Y. Gao, Y. Liu, M. Wigmosta, *Future Sharpening of Winter Storms in the Western United States*, International Workshop on Building Resilience to Water-related Hazards (online, 2023)
6. Chen, X., L. R. Leung, and N. Sun, *Quantifying the Predictability of Coastal Hydroclimate Conditions from Large-scale Climate Driver*, AGU Fall Meeting (online, 2022)
7. Chen, X., L. R. Leung, Z. Feng, and H. Hu, *Floods Produced by Sequential Mesoscale*

- Convective Systems under Future Climate*, American Meteorological Society (AMS) 102nd Annual Meeting (online, 2022)
8. Chen, X., L. R. Leung, and L. Dong, *Antecedent Hydrometeorological Conditions of Wildfire Occurrence in the Western U.S.*, AGU Fall Meeting (online, 2021)
  9. Chen, X., L. R. Leung, Y. Gao, Y. Liu, *Understanding the Response of U.S. West Coast Mountain Snowpack to Sea Surface Temperature Perturbations: A Local Perspective*, AMS 101st Annual Meeting (online, 2021)
  10. Chen, X., *Understanding the hydro-climate system of western U.S. with regional climate modeling and machine learning*, PNNL ASGC Seminar (Richland, WA, 2020)
  11. Chen, X., L. R. Leung, C. Dang, Y. Gao, and Y. Liu, *Precipitation Morphology in the Western United States: Its Relationship to Ambient Atmospheric Conditions and Future Changes*, AMS 100th Annual Meeting (Boston, MA, 2020)
  12. Chen, X., L. R. Leung, Y. Gao, Y. Liu, Z. Duan, M. Wigmosta, M. Richmond, *Atmospheric rivers, extreme precipitation, and rain-on-snow: A model-based investigation of hydroclimate extremes in the western U.S.*, PNNL ASGC Division Seminar (Richland, WA, 2019)
  13. Chen, X., Z. Duan, L. R. Leung, M. Wigmosta, *A framework to delineate precipitation-runoff regimes: Precipitation vs. snowpack in the western U.S.*, PNNL Post Graduate Research Symposium, Richland (Richland, WA, 2019)
  14. Chen, X., L. R. Leung, Y. Gao, Y. Liu, M. Wigmosta, M. Richmond, *Predictability of Extreme Precipitation in Western U.S. Watersheds Based on Atmospheric River Occurrence, Intensity, and Duration*, PNNL Post Graduate Research Symposium (Richland, WA, 2018)
  15. Chen, X., and F. Hossain, *Climate Controls on the Extreme Rainstorms in the Contiguous US: 1979-2015*, AMS 97th Annual Meeting (Seattle, WA, 2017)

## Memberships

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- American Geophysical Union (2012 - present)
- American Meteorological Society (2015 - present)
- American Society of Civil Engineers (2015 - present)  
Observer of the Task Committee “Infrastructure Impacts of Landscape-driven Weather Change”
- Chinese-American Oceanic and Atmospheric Association (2018 - present)  
President of the Northwest Chapter (2021 – present)

Revised Dec 2023