Bharat Sharma (he/him)

Research Scientist - Computational Urban Sciences,
Computational Sciences and Engineering Division,
Oak Ridge National Laboratory, TN, USA

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Knoxville, TN, USA
https://sharma-bharat.github.io/

EDUCATION

Northeastern University — Boston, MA
PhD, Interdisciplinary Engineering — Sep 2022
Dissertation: Analysis of Global Carbon Cycle Extremes, their Compound Climate Drivers, and Implications for Terrestrial Carbon Cycle — GPA 4.0

Technical University of Munich — Munich, Germany
MS, Transportation Systems — Aug 2016
Thesis: Resilience in Urban Cities: An approach to study the interaction between evacuation and land use & transportation infrastructure. — WES iGPA 4.0

National Institute of Technology — Hamirpur, India
B.Tech, Civil Engineering — Jun 2012
Thesis: Characteristics Of Soil, Sand, Fly Ash And Ceramics Mix For Use As Subgrade Material. — WES iGPA 4.0

PROFESSIONAL APPOINTMENTS

Oak Ridge National Laboratory (ORNL), Tennessee, USA — May 2025 – present
Research Scientist - Computational Urban Sciences

- Applied research at the intersection of computing and complex urban systems in the emerging environment of smart cities, energy infrastructures, smart grids, smarter mobility, smart buildings, emergency response, and urban resiliency.
- Investigating the resilience of freight systems against climate and manual disruptions.

Oak Ridge National Laboratory (ORNL), Tennessee, USA — Oct 2022 – Apr 2025
Postdoctoral Research Associate - Terrestrial Ecosystem Ecology

- Modeling forest-CO_2 interactions with nutrients using vegetation demography model, FATES (Functionally Assembled Terrestrial Ecosystem Simulator) coupled with Energy Exascale Earth System Model (E3SM) Land Model (ELM) to improve plant response to elevated CO_2 observed in the Free Air CO_2 Enrichment experiments.
- Created tools for preprocessing input data for Earth System Models (ESMs).
- Serving as co-advisor for a PhD student on analysis of carbon extremes under geoengineering scenarios, providing guidance on advanced statistical methodologies and climate model interpretation.

ORNL and University of Tennessee, Knoxville, USA — Feb 2024 – present
Research Scientist, Advisor - ARPA-E RECOIL

- Investigated the resilience of intermodal US freight systems against climate extremes and disruptions, identifying critical nodes that could potentially diminish system functionality by 30%, proposing effective recovery strategies to enhance operational stability.
- Mentoring a PhD student of UT Knoxville to learn, develop, and contribute to RECOIL (Resiliency and Emission Control through Optimizing Intermodal Logistics) project's goal of enhancing freight resilience to disruptions.

ORNL, Tennessee, USA — May 2018 – Sep 2022
Graduate Research Assistant

- Investigated the extremes in carbon cycle using observations, CMIP5 and CMIP6 Earth System Models, attribution to climate drivers.
- Co-instructor of graduate course CIVE 5363 Climate Science, Engineering Adaptation, & Policy, Northeastern University (NEU); enabling students to analyze, define climate change induced issues and suggest policy for mitigation/adaptation.
- Taught tutorials for ENVE 691 Global Ecohydrology & Biogeochemistry, UTK encompassing analysis of the CMIP6 data using interactive Python notebooks.

Northeastern University, Boston, MA, USA — Sep 2016 – Apr 2018
Graduate Research and Teaching Assistant

- Investigated resilience of urban systems to external disruptions, e.g. robustness of US Airline network.
- Served as Teaching Assistant and co-instructor for graduate and undergraduate courses withing the department of Civil and Environmental Engineering.

Obermeyer Planen + Beraten GmbH, Munich, Germany Mar 2015 – Aug 2016
Intern + Part-time employee (*Werkstudent*), Department of Rail Design and Engineering.

- Analysis of the pre-feasibility studies including Environmental Impact Assessment (EIA) and Cost-Benefit Analysis for selection of suitable rail corridor and terminal locations of High-speed railway project between Košice and the Twin-City region Vienna-Bratislava.

Technical University of Munich, Munich, Germany Jun 2014 – Jul 2015
Graduate Research Assistant (*Werkstudent*), Department of Urban Structure & Transport Planning.

- Calculated the mobility costs in the metropolitan region of Munich for the "MOR€CO", Mobility and Residential Costs, project to investigate accessibility and foster sustainable mobility by optimized poly-centric settlement.
- Produced a travel time matrix for Munich's metropolitan area (Project "WAM",Wohnen Arbeiten Mobilität) that analyzed commuting patterns, directly aiding in the optimization of transportation routes and enhancing mobility for 30,000+ residents in the region.

GMR Airport Developers Limited, New Delhi, India Jul 2012 – Sep 2013
Executive Civil Engineer, Terminal 3, New Delhi International Airport

- In charge of quality control for relaying of runway 29/11 and taxiways with Larsen & Tubro Limited and helped finish the project 10% a head of schedule.
- Supervised civil engineering projects; preparation of Kaizen reports, and audits of contractors bill of quantities.

PUBLICATIONS

PEER-REVIEWED JOURNALS

Massoud, E. C., Collier, N., **Sharma, Bharat**, and Hoffman, F. M. Enhancing Photosynthesis Simulation Performance in ESMs with Machine Learning-Assisted Solvers (2024). 2024 IEEE International Conference on Big Data (BigData), Washington, DC, USA, 2024, pp. 4351 - 4356. https://doi.org/10.1109/BigData62323.2024.10825207.

Sharma, Bharat, Kumar, J., Ganguly, A. R., and Hoffman, F. M. (2023). Carbon Cycle Extremes Accelerate Weakening of the Land Carbon Sink in the Late 21st Century. Biogeosciences, 20, 1829 - 1841, doi.org/10.5194/bg-20-1829-2023. Highlighted in NewScientist and ORNL News.

Sharma, Bharat, Kumar, J., Collier, N., Ganguly, A. R., and Hoffman, F. M. (2022). Quantifying Carbon Cycle Extremes and Attributing Their Causes Under Climate and Land Use & Land Cover Change from 1850 to 2300. Journal of Geophysical Research: Biogeosciences, 127, e2021JG006738, doi.org/10.1029/2021JG006738. Codes: https://zenodo.org/badge/latestdoi/413554760. Awarded Wiley Top Downloaded Article.

Sharma, Bharat, Kumar, J., Ganguly, A. R., and Hoffman, F. M. (2022). Using Image Processing Techniques to Identify and Quantify Spatiotemporal Carbon Cycle Extremes. 2022 IEEE International Conference on Data Mining Workshops (ICDMW), Orlando, FL, USA, 2022, pp. 1136-1143, doi.org/10.1109/ICDMW58026.2022.00148.

Rahimitouranposhti, M., **Sharma, Bharat**, Camur, M. C., Omitaomu, F., and Li, X. Investigating Resiliency of Transportation Network Under Targeted and Potential Climate Change Disruptions (2024). *Manuscript in Review for TRR.* Accepted for 104th Transportation Research Board (TRB) Annual Meeting.

Sharma, Bharat, Kumar, J., Ganguly, A. R., and Hoffman, F. M. Investigating Variability in the Intensity, Direction, and Spatial Distribution of Carbon Cycle Extremes and Attribution to Climate Drivers Using Observations and CMIP6 Earth System Models. *Manuscript in Preparation for Nature Climate Change.*

BOOK CHAPTERS

Warner, M., **Sharma, Bharat**, Bhatia, U., and Ganguly, A. (2019). Evaluation of Cascading Infrastructure Failures and Optimal Recovery from a Network Science Perspective. In: Ghanbarnejad F., Saha Roy R., Karimi F., Delvenne J. C., Mitra B. (eds) Dynamics On and Of Complex Networks III. DOOCN 2017. Springer Proceedings in Complexity. Springer, Cham. URL: https://doi.org/10.1007/978-3-030-14683-2_3

PROGRAMMING/SOFTWARE SKILLS

- Experience in handling multi-dimensional coarse to high resolution observational and climate data in netCDF, GeoTIFF formats in Python, R, and MATLAB.
- **Running ESM Land Models**: ELM, CLM, ELM–FATES, OLMT
- **Programming**: Python, Bash, Fortran, R, MATLAB, Octave
- **Toolkits/Software**: NCO, CDO, NCL, ILAMB, MPI, Dask, ArcGIS, VISSIM, AutoCAD
- **Machine Learning/Deep Learning Frameworks**: scikit-learn, xgboost
- **Version Control**: Git, Mercurial
- **Document/Web Preparation Software**: LaTeX, MS Office, Markdown, HTML

CERTIFICATIONS

- **Introduction to Fortran**, LinkedIn Learning — Jun 2023
- **Machine Learning by Stanford University**, Coursera — May 2022
- **Machine Learning, Data Science and Deep Learning with Python**, Udemy — Mar 2021
- **New Advances in Land Carbon Cycle Modeling**, Center for Ecosystem Science and Society, Northern Arizona University — July 2020

PROFESSIONAL AFFILIATIONS

Transportation Research Board (TRB) Individual Affiliate	2024 – Present
American Geophysical Union (AGU)	2018 – Present
Asia Oceania Geosciences Society (AOGS)	2018 – Present
American Meteorological Society (AMS)	2020 – 2021
American Association of Geographers (AAG)	2016 – 2017
mobil.TUM - International Scientific Conference on Mobility and Transport, Germany	2015 – 2016

AWARDS/ACHIEVEMENTS

NewScientist Article — 2024
Interviewed by NewScientist and paper highlighted in NewScientist article.

Wiley Top Downloaded Article — 2023
My JGR-B paper was among the most downloaded article that published between 1-Jan and 31-Dec 2022.

Most Attended Biogeosciences Session — 2023
My 2023 AOGS Biogeosciences session received award for most attended and best organized session.

ORNL News — 2023
My 2023 paper was highlighted in ORNL news Modeling Climate Extremes.

Distinguished Dean's Fellowship — 2016–17
College of Engineering, Northeastern University

Scholarship for Outstanding Foreign Students — 2014–16
Bavarian State Ministry of Sciences, Research and the Arts, Munich, Germany

Brilliant Scholarship, HP, India — 2008–12
Director, Vocational & Industrial Training, Himachal Pradesh, India

Ranked among top 2% of the students, All India Engineering Entrance Examination conducted (in Physics, Chemistry and Math) for undergraduate admissions in India — 2008

POSITIONS OF RESPONSIBILITY

MENTORSHIP ROLES

Maedeh Rahimitouranposhti 2024 – present
Graduate Student, University of Knoxville, Tennessee

Pragya Kandel 2021 – present
Graduate Student, University of Knoxville, Tennessee

Shamik Bhattacharya 2022 – 2024
Undergraduate Student, NC State University, North Carolina

Russell Limber 2021 – 2022
Graduate Student, University of Knoxville, Tennessee

Morgan Steckler 2020 – 2022
Graduate Student, University of Knoxville, Tennessee

Sophia Bailey 2020 – 2021
Undergraduate Student, Northeastern University, Massachusetts

TEACHING ROLES

ENVE 691 Global Ecohydrology & Biogeochemistry, UTK Spring 2023
Taught tutorial on accessing the CMIP6 data and using Python to analyze the simulation outputs.

Teaching (Shared), CIVE 5363 Climate Science, Engineering Adaptation, & Policy, NEU Spring 2021
Taught lectures, created study material, designed and graded assignments and conducted tutorial sessions and mentored projects for 30 graduate students. Received excellent reviews.

CIVE 2260 Materials for the Built Environment, NEU Spring 2018
Graded assignments and quizzes and held office hours for answering queries of 58 students.

CIVE 2261 Lab for Materials for the Built Environment, NEU Spring 2018
Supervised field visits for surveying lab, graded lab reports and quizzes and held office hours for answering queries of 58 students.

CIVE 3464 Probability and Engineering Economy for Civil Engineering, NEU Spring 2018
Designed and taught tutorials, graded assignments and conducted tutorial sessions and held office hours for answering queries of 56 students.

COMMUNITY SERVICE

JOURNAL REVIEWER

Environmental Research Letters

Journal of Geophysical Research, Biogeosciences

Biogeosciences (EGU)

Geoscientific Model Development

Workshop on Data Mining in Earth System Science, IEEE International Conference on Data Mining

ORGANIZATION ROLES

Co-convener, AGU 2024 Dec 2024
Biogeosciences Session B106: The Global Carbon Cycle and Its Feedbacks with Anthropogenic Change.

Co-convener, AOGS 2024 Jun 2023
Biogeosciences Session BG05: Integrated Understanding of Global Carbon, Water, and Other Biogeochemical Cycles and Their Feedbacks.

Co-convener, AGU 2023 Dec 2023
Biogeosciences Session B33G: New Mechanisms, Feedbacks, and Approaches for Predicting Global Biogeochemical Cycles Under Climate Change and Intervention.

Co-convener, AOGS 2023 Aug 2023
Biogeosciences Session BG06: Integrated Understanding of Global Carbon and Other Biogeochemical Cycles and Their Feedbacks.

Program Committee, IEEE 2022 Nov 202
Workshop on Data Mining in Earth System Science (DMESS): Held in conjunction with the IEEE International Conference on Data Mining (ICDM 2022).

Organizer, Climate Change Science Institute (ORNL) Journal Club Summer 2018
In-charge of scheduling and coordinating the paper presentations, and maintaining the website.

SELECTED PROJECTS

Technical University of Munich, Munich, Germany Jun 2014 – Jul 2015
Graduate Research Assistant (*Werkstudent*), Department of Urban Structure & Transport Planning.

- Calculated the mobility costs in the metropolitan region of Munich for the "MOR€CO", Mobility and Residential Costs, project to investigate accessibility and foster sustainable mobility by optimized poly-centric settlement.
- Produced a travel time matrix for Munich's metropolitan area (Project "WAM", Wohnen Arbeiten Mobilität) that analyzed commuting patterns, directly aiding in the optimization of transportation routes and enhancing mobility for 30,000+ residents in the region.

Technical University of Munich, Munich, Germany Oct 2014 – Mar 2015
Industry Partnership Project, Department of Urban Structure & Transport Planning.

- Project with BMW Automobiles, MVV (Public Transport Company) and City of Munich.
- Examined whether the new BMW Innovation and Research Center successfully fitted into the Northern Munich by analyzing spatial strategies, current development projects and the inter-action of non-motorized mobility, and provided measures like location of transit station, convenient stores and bike paths among other steps to plan better transit.

PRESENTATIONS

INVITED TALKS

Sharma, Bharat, Jitendra Kumar, Nate Collier, Auroop R. Ganguly, and Forrest M. Hoffman, "Quantifying the Changes in Carbon Cycle Extremes Due to Land Use Change and Attribution to Climate Drivers Through Year 2300." Reducing Uncertainties in Biogeochemical Interactions through Synthesis and Computation. Feb 19, 2021. URL: https://www.bgc-feedbacks.org/research/presentations/Sharma_RUBISCO-SFA_20210219.pdf

SELECTED CONFERENCE PRESENTATIONS

Sharma, Bharat, R. Knox, C. Koven, R. Oren, R. Norby, D. Ricciuto, X. Wei, X. Yang, and A. Walker. April 17, 2024 "Simulating CO_2 Responses of Secondary-Succession Forests at Duke and Oak Ridge FACE Experiments with ELM-FATES-CNP". 2024 Environmental System Science PI Meeting, Washington DC, USA.

Sharma, Bharat, A. Walker, R. Knox, C. Koven, E. Agee, R. Fisher, R. Oren, R. Norby, D. Ricciuto, X. Wei, and X. Yang. December 15, 2023 "Investigating the CO_2 Response of Secondary-Succession Forests at Duke and Oak Ridge FACE Experiments Simulated with ELM-FATES-CNP". 2023 American Geophysical Union Fall Meeting, San Francisco, CA, USA.

Sharma, Bharat, Forrest M. Hoffman, Jitendra Kumar, and Auroop Ganguly. August 2, 2023. "Comparative Analysis of Climate-driven Carbon Cycle Extremes Using Observations and CMIP6 Earth System Models". Annual Meeting of the Asia Oceania Geosciences Society (AOGS), 30 July−4 Aug 2023, SUNTEC, Singapore.

Sharma, Bharat, Jitendra Kumar, Forrest M. Hoffman, and Auroop R. Ganguly. December 15, 2022. "Quantifying Extremes in Net Biospheric Production and Attribution to Compound Climate Drivers" (B42H-1732). New Mechanisms, Feedbacks, and Approaches for Predicting Global Biogeochemical Cycles Under Climate Change and Intervention (B42H), American Geophysical Union Fall Meeting. Chicago, IL, USA.

Pragya Kandel, **Sharma, Bharat**, Jitendra Kumar, and Forrest M. Hoffman. December 16, 2022. "Drought Susceptibility and Response Across Different Vegetation Types in California" (H55A-04). Evapotranspiration (ET): Advances in in Situ ET Measurements and Remote-Sensing-Based ET Estimation, Mapping, and Evaluation (H55A), American Geophysical Union Fall Meeting. Chicago, IL, USA. AGU-iposter. **Received Best Student Presentation Award.**

Shamik Bhattacharya, Forrest M. Hoffman, **Sharma, Bharat**, Nathan Collier, and Min Xu. December 15, 2022. "Using Statistical Learning Methods to Accelerate Model Parameter Sensitivity Experiments" (B42H-1731). New Mechanisms, Feedbacks, and Approaches for Predicting Global Biogeochemical Cycles Under Climate Change and Intervention (B42H), American Geophysical Union Fall Meeting. Chicago, IL, USA. AGU-poster

Sharma, Bharat, Jitendra Kumar, Auroop R. Ganguly, and Forrest M. Hoffman. November 28, 2022. "Using Image Processing Techniques to Identify and Quantify Spatiotemporal Carbon Cycle Extremes (S10106)." 10th Workshop on Data Mining in Earth System Science (DMESS 2022). IEEE International Conference on Data Mining Workshops (ICDMW 2022). Orlando, FL, USA. Proceedings of the 2019 IEEE International Conference on Data Mining Workshops (ICDMW 2022).

Morgan Steckler, **Sharma, Bharat**, Forrest M. Hoffman, William W. Hargrove and Jitendra Kumar. December 14, 2021. "Effects of meteorological and ecological disturbances on tropical vegetation phenology." Understanding Phenological Responses and Feedbacks in Terrestrial Vegetation: Patterns, Mechanisms, and Consequences (B33D), American Geophysical Union Fall Meeting. New Orleans, LA.

Sharma, Bharat, Mary E. Warner, Udit Bhatia, and Auroop R. Ganguly. December 15, 2017. "Cascading Interdependencies of Built and Societal Systems." In: Symposium on Human Dynamics in Smart and Connected Communities: Spatial-Social Networks in GIS. 2017 American Association of Geographers (AAG) Annual Meeting (April 5–9, 2017), Boston, Massachusetts, USA.

CONNECT VIA

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