Bharat Sharma

Postdoctoral Research Associate
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https://sharma-bharat.github.io/

EDUCATION

Northeastern University — Boston, MA
Ph.D., Interdisciplinary Engineering — 2016 - 2022
Dissertation: Analysis Of Global Carbon Cycle Extremes, Their Compound Climate Drivers, And Implications For Terrestrial Carbon Cycle. — GPA 4.0

Technische Universität München — Munich, Germany
MS, Transportation Systems — 2013 - 2016

National Institute of Technology — Hamirpur, India
B.Tech, Civil Engineering — 2008 - 2012

DOCTORAL RESEARCH

Ph.D. Advisor: Prof. Auroop R. Ganguly

Topic 1: **Quantifying Carbon Cycle Extremes and Attributing Their Causes Under Climate and Land Use & Land Cover Change from 1850 to 2300**. JGR Biogeosciences, 2022, doi:10.1029/2021JG006738
Collaborators: Kumar, J., Collier, N., Hoffman, F. M. from **Oak Ridge National Laboratory, TN**

- Analysis of the impact of human activities through fossil fuel emissions and Land Use and Land Cover Change (LULCC) on carbon cycle are crucial for forecasting the changes in carbon uptake.
- Developed a new systematic method for analyzing temporally contiguous extremes in gross primary productivity (GPP) in Earth system modeling studies under changing atmospheric CO_2, climate and LULCC.
- This work involved processing of large geospatiotemporal datasets in an HPC environment.

Topic 2: **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.*
Collaborators: Kumar, J., Hoffman, F. M. from **Oak Ridge National Laboratory, TN**

- Investigated the agreement among GPP and extreme anomalies using upscalled remote sensing GPP and latest generation of Earth System Model simulations.
- Developed set of codes that help a user in data preparation, calculation of anomalies, interannual variability, and extremes and perform attribution to compound climate drivers across common grid resolution.
- Work presented at American Geophysical Union Fall Meeting, December 2021, New Orleans, LA.

Topic 3: **Increased Occurrence of Climate-Induced Extremes in Biomass Productivity in the 21st Century**. *Manuscript in review.* Biogeosciences, doi:10.5194/bg-2022-178
Collaborators: Kumar, J., Hoffman, F. M. from **Oak Ridge National Laboratory, TN**

- Performed regional analysis of successive spatio-temporal extremes in net biomass productivity and attribution to compound climate drivers using Community Earth System Model v2.

PROGRAMMING/SOFTWARE SKILLS

- **Languages**: English (Fluent), Hindi (Fluent); German (Intermediate)
- **Programming**: Python, bash scripting, R, MATLAB, Octave
- **Toolkits/Software**: NCO, CDO, NCL, ILAMB, MPI, Dask, ArcGIS, VISSIM, AutoCAD
- **Machine Learning/Deep learning Frameworks**: scikit-learn
- **Version Control**: Git, Mercurial
- **Document/Web Preparation Software**: LaTeX, MS office, Markdown, HTML

PUBLICATIONS

PEER-REVIEWED JOURNALS

Sharma, Bharat, Kumar, J., Collier, N., Ganguly, A. R., & 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.

Sharma, Bharat, Kumar, J., Ganguly, A. R., & 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.

Sharma, Bharat, Kumar, J., Ganguly, A. R., & Hoffman, F. M. (2022). Carbon Cycle Extremes Accelerate Weakening of the Land Carbon Sink in the Late 21st Century Biogeosciences Discuss. [preprint], *in review*, 2022, doi.org/10.5194/bg-2022-178.

Sharma, Bharat, Jitendra Kumar, Nate Collier, Auroop R. Ganguly, and Forrest M. Hoffman. 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. (2022). *Manuscript in Preparation*

Sharma R. K., Khandelwal, T. and **Sharma, Bharat**[1]. (2013). Compaction and Subgrade Characteristics of Clay Soil Modified with Beas Sand, Fly Ash, and Waste Ceramic. Recent Trends in Civil Engineering & Technology. STM Journals. Volume 3, Issue 2, ISSN: 2249–8753.

Khandelwal, T., **Sharma, Bharat**[1], Thareja, P. and Sharma R. K. (2013). Comparative Study of various Commercially Available Programs in Slope Stability and Simulation of Dynamic Loading. Recent Trends in Civil Engineering & Technology. STM Journals. Volume 3, Issue 2, ISSN: 2249–8753.

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 JC., 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

DATA/SOFTWARE PUBLICATION

Codes/programs for the paper "Quantifying Carbon Cycle Extremes and Attributing Their Causes Under Climate and Land Use & Land Cover Change from 1850 to 2300", 2022, https://zenodo.org/badge/latestdoi/413554760

PH.D. DISSERTATION

Sharma, Bharat. (2022). Analysis of Global Carbon Cycle Extremes, Their Compound Climate Drivers, and Implications for Terrestrial Carbon Cycle. Northeastern University. Civil and Environmental Engineering.

MASTER THESIS

Sharma, Bharat. (2016). Resilience in Urban Citie: An approach to study interaction between evacuation and land use & transportation infrastructure. Technical University of Munich, Germany. Chair of Urban Structure and Transport Planning.

CERTIFICATIONS

- **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
- **Introduction to Machine Learning**, North Carolina State University May 2019

AWARDS/ACHIEVEMENTS

[1]Name changed in 2016.

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

Scholarship for 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 2008
conducted (in Physics, Chemistry and Math) for undergraduate admissions in India

PRESENTATIONS

INVITED PRESENTATIONS

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

CONFERENCE PRESENTATIONS

Sharma, Bharat, Jitendra Kumar, Nathan Collier, Auroop R. Ganguly, and Forrest M. Hoffman. "Increased Intensity of Carbon Cycle Extremes Driven by Land Use and Land Cover Change" (Poster ID 45), Land Use and Land Cover Change—Interactions with Weather and Climate. January 9, 2023. American Meteorological Society's 36th Conference on Climate Variability and Change. Denver, CO, USA. AMS-poster.

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. AGU-iposter. AGU-poster.

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). View Presentation

Sharma, Bharat, Jitendra Kumar, Forrest M. Hoffman, and Auroop R. Ganguly. December 17, 2021. "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." Improving Earth System Predictability (B041), American Geophysical Union Fall Meeting. New Orleans, LA. AGU-iposter

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, Jitendra Kumar, Forrest M. Hoffman, and Auroop R. Ganguly. December 12, 2020. "Detection and Attribution of Climate-Driven Extremes in Net Biome Productivity from 1850 through 2100." Abstrat B019-0009 presented at American Geophysical Union (AGU) Fall Meeting (December 1–17, 2020).

Sharma, Bharat, Forrest M. Hoffman, Jitendra Kumar, and Auroop R. Ganguly. December 13, 2018. "Cumulative Impacts of Human-Induced Changes on Carbon Cycle Extremes." Abstract 368411 presented at the 100th American Meteorological Society (AMS) Annual Meeting, In Robert Dickinson Symposium (January 12–16, 2020), Boston, Massachusetts, USA.

Sharma, Bharat, Forrest M. Hoffman, Jitendra Kumar, Nathan Collier, and Auroop R. Ganguly. December 13, 2018. "Impact of Changes in Anthropogenic Forcing on the Terrestrial Carbon Budget through the Year 2300." Abstract B41I-2830 presented at the 2018 American Geophysical Union (AGU) Fall Meeting (December 10–14, 2018), Washington, District of Columbia, USA.

Sharma, Bharat, Forrest M. Hoffman, Jitendra Kumar, Nathan Collier, and Auroop Ganguly. June 7, 2018. "Quantifying the Effect of Changes in Climate-Driven Carbon Cycle Extremes on the Terrestrial Carbon Budget through Year 2300." 15th Annual Meeting of the Asia Oceania Geosciences Society (AOGS) (June 3–8, 2018), Hawai'i Convention Center, Honolulu, Hawai'i, USA.

Sharma, Bharat, Forrest M. Hoffman, Jitendra Kumar, Nathan Collier, and Auroop Ganguly. April 11, 2018. "Identification of Spatio-temporal Contiguous Carbon Cycle Extreme Events." 2018 U.S.-International Association for Landscape Ecology (US-IALE) Annual Meeting (April 8–12, 2018), Chicago, Illinois, USA.

Sharma, Bharat, Forrest M. Hoffman, Jitendra Kumar, and Auroop R. Ganguly. December 15, 2017. "Carbon Cycle Extremes in the 22nd and 23rd Century and Attribution to Climate Drivers." Abstract B53J-02 presented at the 2017 American Geophysical Union (AGU) Fall Meeting (December 11–15, 2017), New Orleans, Louisiana, USA.

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.

WORK EXPERIENCE

Technical University of Munich (TUM), Germany Mar'16 - Aug'16
Master Thesis at Department of Urban Structure & Transport Planning.
An approach to study interaction between evacuation and land use & transportation structures.

Obermeyer Planen + Beraten GmbH, Munich, Germany Mar'15 - Aug'16
Intern + Part-time employee (*Werkstudent*), Department of Rail Design and Engineering.
Project 'High-speed railway between Košice and the Twin-City region Vienna-Bratislava http://www.breitspur.com/', creating high performance transportation from Russia, China and Asian countries to Central Europe.
Supported Phase 1 System Development, analysis of the pre-feasibility studies, selection of suitable rail corridor and terminal locations.

Technical University of Munich (TUM), Germany Jun'14 - Jul'15
Graduate Research Assistant, Department of Urban Structure & Transport Planning.
Project 'MOR€CO', aims to improve accessibility and to foster sustainable mobility by an optimized polycentric settlement development in the Alpine Space.
Estimated the mobility costs in the metropolitan region of Munich.

Project 'WAM', aims to better understand the dynamics of residential location, workplace and mobility of households and highlight the reciprocal spatial dependence of these decisions.
Created the travel time matrix for the metropolitan region of Munich.

Oct 14 – Mar 15 Technical University of Munich (TUM), Germany Oct'14 - Mar'15
Project with TUM, 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.

GMR Airport Developers Limited, New Delhi, India Jul'12 - Sep'13
Executive Civil Engineer, Terminal 3, New Delhi International Airport
Supported civil engineering projects and maintenance, preparation and analysis of BOQ, SAP. In charge of quality control for relaying of runway 29/11 and taxiways with Larsen Tubro Ltd. (ECC).

POSITIONS OF RESPONSIBILITY

ORGANISATION ROLES

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

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

MENTORSHIP ROLES (2 Male, 3 Female Students)

Pragya Kandel **2021 - present**
University of Knoxville, Tennessee

Russ Limber **2021 - present**
University of Knoxville, Tennessee

Shamik Bhattacharya **2022 - present**
North Carolina State University, Raleigh, North Carolina

Morgan Steckler **2020 - 22**
University of Knoxville, Tennessee

Sophia Bailey **2020 - 21**
Northeastern University, Massachusetts

CIVE 5363 **Spring 2021**
Co-mentored the class project of 30 graduate and undergraduate students.

TEACHING ROLES

Teaching (Shared), CIVE 5363 Climate Science, Engineering Adaptation, and 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 **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 **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 **Spring 2018**
Designed and taught tutorials, graded assignments and conducted tutorial sessions and held office hours for answering queries of 56 students.

HOBBIES/INTERESTS

Enjoy cooking, reading, hiking, and spending time with friends and family.

CONNECT VIA

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: 0000-0002-6698-2487
: sharma-bharat
: Bharat-Sharma-19

REFERENCES

- **Dr. Anthony Walker**
  Research Scientist, ORNL
  walkerap@ornl.gov, 865.576.9365
- **Prof. Auroop R. Ganguly**,
  Professor, Civil and Environmental Engineering, Northeastern University
  a.ganguly@northeastern.edu, 617-373-6005
- **Dr. Forrest M. Hoffman**,
  Distinguished Scientist, ORNL
  hoffmanfm@ornl.gov, 865-576-7680
- **Dr. Jitendra Kumar**,
  Research Scientist, ORNL
  kumarj@ornl.gov, 865-574-9467