PUJA **DAS**

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Climate scientist and data science expert with PhD in extreme weather modeling and 5+ years developing AI-driven solutions for precipitation forecasting and flood risk assessment. Proven track record leading multi-institutional projects and translating academic research into practical risk management tools for diverse stakeholders.

🎓 EDUCATION

2020- 2025
PhD in Interdisciplinary Engineering within the Department of Civil and Environmental Engineering (CGPA- **4.00/4.00**)
Northeastern University, Boston, USA
Experiential Learning :
● De facto technical and programmatic lead in a multi-institute collaboration project involving Tennessee Valley Authority (TVA), Zeus AI, Oak Ridge National Laboratory (ORNL), and Research Triangle Institute (RTI).
● Research internships at NASA Ames Research Center and Capella Space Corp.
Courseworks :
● Data Science and AI : Supervised Machine Learning, Time Series and Geospatial Data Sciences, Complex Networks, Remote Sensing.
● Climate, Environmental Science and Engineering : Climate Science, Engineering Adaptation, and Policy, Critical Infrastructure Resilience, Climate and Atmospheric Change, Hydrologic & Hydraulic Design, Hydrologic Modelling, Population Dynamics.

2020-2022
MS in Civil and Environmental Engineering (Data and Systems), (CGPA : **3.97/4.00**)
Northeastern University, Boston, USA

2012-2016
B.S. in Water Resources Engineering (CGPA : **3.95/4.00**)
Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

💼 PROFESSIONAL EXPERIENCE

Feb, 2025-Present
Institute of Experiential AI, Northeastern University, PORTLAND, ME , USA
› **Postdoctoral Research Fellow**

Sep, 2020-Feb, 2025
Northeastern University, BOSTON, USA
› **Project Lead :** Served as the de facto technical and programmatic lead in "Remote sensing data driven Artificial Intelligence for precipitation Nowcasting (RAIN)" project funded by NASA Earth Science Applications. Responsibilities included :
  › Coordinating with NASA scientists, entrepreneurs (Zeus AI), national labs (ORNL), non-profits (RTI), and federal agencies (TVA) to align technical and programmatic goals.
  › Developing hybrid AI-physics-driven products to improve precipitation nowcasting.

› **Research Assistant :** Conducted independent and multidisciplinary research within the Sustainability and Data Sciences Lab, emphasizing climate and hydrological processes. Key projects include :
  › **Advancing Water Availability Projections :** Evaluated CMIP6 Earth System Models (ESMs) to assess credibility in projecting surface runoff for major rivers worldwide.
  › **Urbanization Impacts on Precipitation Extremes :** Led an analysis of reanalysis datasets and urban-rural classifications to investigate temporal and spatial shifts in precipitation intensity across the continental US.

Jun, 2022-Aug, 2022
Capella Space Corp., SAN FRANCISCO, USA
› **Data Science and Remote Sensing Intern :** Led project on estimating riverine and coastal flood depth utilizing high-resolution flood inundation maps from Synthetic Aperture Radar (SAR) imagery and topography.

May, 2021- **Aug, 2021**	**NASA Ames Research Center, MOFFETTE FIELD, USA** › **Machine Learning Intern :** Conducted preliminary studies, literature review, and dataset preparation for uncertainty-aware machine learning algorithms aimed at quantitative precipitation estimation from geostationary satellites.

Sep, 2020-
Feb, 2025
	Northeastern University, BOSTON, USA
	› **Graduate and Undergraduate Level Teaching Practicum :** Contributed extensively in teaching and academic logistics. Key responsibilities included :
	  › Delivered guest lectures on key topics in courses such as Climate Science, Engineering Adaptation, and Policy; Time Series and Geospatial Data Sciences; Probability and Engineering Economy for Civil Engineering; and Critical Infrastructure Resilience.
	  › Assisted in curriculum development by designing lecture materials, tutorials, and problem sets to enhance student understanding of complex concepts.
	  › Conducted interactive tutorials and discussion sessions, fostering student engagement and deeper comprehension of subject matter.
	  › Held office hours to provide one-on-one support, addressing student queries and guiding them through assignments and projects.
	  › Evaluated and graded assignments, projects, and presentations, providing constructive feedback to support academic growth.
	› **Dialogue of Civilizations Program Coordinator :** Fostered cross-cultural learning and provided logistical and academic support in the 2023 and 2024 Dialogue of Civilizations (undergraduate study abroad) programs. Key contributions included :
	  › Designed and delivered orientation sessions to prepare students for immersive international experiences in India and Nepal, covering cultural, logistical, and academic aspects.
	  › Developed and managed comprehensive itineraries for program activities, including travel arrangements, on-site logistics, and daily schedules, ensuring seamless execution.
	  › Facilitated interactive cultural immersion activities, enhancing students' understanding of diverse global perspectives and fostering meaningful engagement with local communities.
	  › Supported students as an Academic Advisor and Program Assistant, offering personalized guidance and fostering a collaborative and enriching learning environment.

Dec, 2017- **Aug, 2020**	**Military Institute of Science and Technology (MIST), DHAKA, Bangladesh** › **Lecturer :** Delivered theory and lab lectures in water resources engineering department. › **Junior Environmental Specialist :** Monitored and reported environmental parameters (Air Quality, Surface and Ground Water Quality, Noise) for Dhaka Mass Rapid Transit Development Project.

📊 RESEARCH PROJECTS

› **1. Dissertation Topic : Remote-sensing data driven Artificial Intelligence for Precipitation-Nowcasting (RAIN)** Exploring the challenges of intense orographic precipitation in the Appalachia region of the United States, this research delves into innovative machine learning and hybrid physics-ML methodologies. The focus lies in assessing predictive techniques, integrating multi-sensor observations, and creating metrics essential for enhanced flood and river management practices for diverse stakeholders such as infrastructure owners and operators, defense and security, private-public-government installations and facilities.

› **2. Climate and Data Sciences Project 1 : Urbanization Impacts on Precipitation Extremes Statistics and Design Curves for Hydraulic Infrastructures** This research focuses on the intensification of extreme precipitation events in urban versus non-urban regions across the continental US (CONUS). By analyzing reanalysis datasets and urban-rural classification data, this research aims to unravel temporal and spatial shifts in precipitation intensity. Through a comprehensive analysis of precipitation dynamics in diverse contexts, this work contributes to informed decision-making and risk mitigation strategies amidst evolving climate conditions.

› **3. Climate and Data Sciences Project 2 : Advancing Runoff Projections : CMIP6 Improvements Over CMIP5 through Enhanced Process Parameterization and Model Consensus** This study evaluates CMIP6 Earth System Models' (ESMs) credibility in projecting surface runoff for the world's largest rivers, addressing a critical knowledge gap in water resource planning. Assessing annual mean runoff using various metrics, it substantiates the hypothesis that CMIP6 improves projections over CMIP5.

› **4. Internship Project at NASA Ames Research Center : Uncertainty Aware Machine Learning based Quantitative Precipitation Estimation from Geostationary Satellites** I developed a machine learning framework for high-frequency Quan-

titative Precipitation Estimation (QPE) using NOAA's GOES-16/17 ABI sensors which leveraged NEXRAD MRMS data and GeoNEX L1G dataset to enhance QPE accuracy and uncertainty quantification for hydrological predictions and water resource assessments. Here, I investigated the potential of GOES-16/17 over previous satellites and explored transfer-learning across diverse sensors, addressing key challenges in hydrology and water resources.

> **5. Internship Project at Capella Space Corp. : Synthetic Aperture Radiometry (SAR) based Flood Depth Estimation and Damage Assessment** I utilized SAR imagery from Capella Space satellites to estimate flood depths during major flood events in March 2021 and March 2022 at different parts of the US and Australia. Leveraging a Python-based Floodwater Depth Estimation Tool (FwDET) and digital elevation models (DEM), I assessed flood damage using inferred flood extents.

🎙 Invited Talk and Presentations

2023-2024	Presentation at NASA Annual Water Resources Program on NASA RAIN Project on September 17, 2024 and September 28, 2023.
2024	Presented research to US Air Force Weather (US AFW) on using AI for Weather Forecasting during their visit to Northeastern University on April 26.
2024	Invited talk at CDM SMith inc. on January 4 on the topic : Precipitation Nowcasting with AI.
2023	Invited talk for Scalable Solutions for Resilience at United Nations Headquarters for Disaster Risk Resilience Program on May 17.
2023	Presented research to a delegation from the Indonesian Ministry BAPPENAS during their visit to SDS lab for discussing potential long-term collaborations and grant funding on May 1.
2023	Presented research to US Department of Transportation (DOT) on "Predictive Insights on Precipitation Nowcasting for Flooding, River, and Hydropower Management".
2023	Poster Presentation at Industry Leadership Night by Civil and Environmental Engineering Department.
2023	Presentation at Tennessee Valley Authority on Project Updates.

📄 Publications

> **Das, P**., Ganguly, A., Rabb, N., Smith, K., Islam, S." Floods, Facts, and Fictions : Numbers and Narratives Behind Bangladesh's 2024 Regional Floods." Preprint at *Earth arXiv*, 2025. (Manuscript in review)

> Mawalagedara, R., Ray, A., **Das, P**., Watson, J., Pal, A., Duffy, K., Bhatia, U., Aldrich, D., Ganguly, A." Non-linear dynamical approaches for multi-sector climate resilience under irreducible uncertainty." Preprint at *Earth arXiv*, 2025. (Manuscript in review)

> **Das, P**., Posch, A., Barber, N., Hicks, M., Vandal, T., Duffy, K., Singh, D., Werkhoven, K., Ganguly, A. "Hybrid Physics-AI Outperforms Numerical Weather Prediction for Extreme Precipitation Nowcasting." npj Climate and Atmospheric Science 7, no. 1 (2024) : 282.

> **Das, P**., Ganguly, A. R. "Finer Resolutions and Targeted Process Representations in Earth System Models Improve Hydrologic Projections and Hydroclimate Impacts." *npj Climate and Atmospheric Science*, **8**, 247 (2025).

> **Das, P**., " Enhancing Flood Resilience : Predictive Tools for Flood and Flash Flood Nowcasting." International Coalition for Sustainable Infrastructure convening the Climate Resilient Infrastructure Report : A Focus on Technology, 2024. (Launched at COP29).

> **Das, P**., " Improving Flood Emergency Management, Bangladesh and Indonesia." International Coalition for Sustainable Infrastructure convening Accelerating Implementation of Disaster Risk Reduction and Resilience in Infrastructure, United Nations Headquarters, 2023.

📑 Conferences

> **Das, P**., Posch, A., Barber, N., Duffy, K., Vandal, T., Hicks, M., Singh, D., Werkhoven, K., Ganguly, A. " Exploring Uncertainties and Post-processing for Physics-Embedded Deep Generative Precipitation Nowcasting" AGU Fall Meeting, 2024.

> Indrawati, D., **Das, P**., Ganguly, A. " Interdependence and Cascade of Variability Across Regional Projections from Earth System Models" AGU Fall Meeting, 2024.

> **Das, P**., Posch, A.,Barber, N., Duffy, K., Vandal, T., Hicks, M., Singh, D., Werkhoven, K., Ganguly, A. "Predictive Insights in Hydrology with Hybrid Physics and Data Sciences for Climate Adaptation." Science Understanding through Data Science (SUDS) Conference, 2024.

> **Das, P**., Jensen, K., De, S., Ganguly, A. "Flood Depth Estimation using Synthetic Aperture Radar (SAR) Imagery And Topography : A Case Study of the 2021 and 2022 Floods in Hawkesbury Valley, Australia." IEEE IGARSS Conference, 2023.

> **Das, P**.,Vandal, T., Duffy, K., Barber, N., Ganguly, A. " Remote-sensing data driven Artificial Intelligence for precipitation-Nowcasting ("RAIN")." AGU Fall Meeting, 2023.

> **Das, P**.,Barber, N.,Vandal, T., Posch, A., Duffy, K., Hicks, M., Singh, D., Werkhoven, K., Ganguly, A. " Hybrid Physics and Machine Learning for Precipitation Nowcasting." Statistical Hydrology (STAHY) Conference 2023.

> **Das, P**., Ganguly, A. "Evaluation of Surface Runoff Projections from Earth System Models in Major Basins of the World." Fragile Earth 2022 Workshop of the ACM SIGKDD Conference, 2022.
> Pal, A.K., **Das, P**., Yadav, N., Ganguly, A. "Robustness of Urban Coastal Rail Network Under Projected Future Floods." Fragile Earth 2022 Workshop of the ACM SIGKDD Conference, 2022.
> **Das, P**., Yadav, N., Ganguly, A. "Urbanization Impacts on Precipitation Extremes Statistics and Design Curves for Hydraulic Infrastructures." AGU Fall Meeting, 2022.
> **Das, P**., Ganguly, A. "Surface Runoff and Streamflow Projections from Earth System Models." AGU Fall Meeting, 2021.
> **Das, P**., Vandal, T., Duffy, K., Ganguly, A. "Preliminary Assessment for Enabling Machine Learning based Quantitative Precipitation Estimation with High Spatio-temporal Resolution from Geostationary Satellites." AGU Fall Meeting, 2021.

👥 Mentorship Experience with Selected Examples

2024	Assisted PhD students in conceptualizing PhD Qualifying exam presentation and supported in formalizing the presentation by developing research methodology.
2023	Mentored undergraduate students and guided them through an introduction to machine learning and its application in weather forecasting. Specifically, focused on topics such as generative AI and computer vision.
2023	Assisted high school student in researching conditional generative adversarial networks and conducting literature reviews on precipitation nowcasting and introductory earth system modeling.
2021	Mentored high school student during the summer on climate model data simulation, providing guidance on handling large datasets and conducting analysis on climate model projections.

🏆 Awards

Outstanding PhD Student Award for Teaching	Northeastern University, 2023
CEE Fellowship Award	Northeastern University, 2020
University Merit List and Deans List Award	Bangladesh University of Engineering and Technology, 2012-2016

👥 Service, Outreach and Collaboration

2023 - Present	Participated in and collaborated on regular strategic reporting to various levels of stakeholders including Northeastern University President.
2023 - Present	Topic coordinator for 'Short-term Weather Precipitation Nowcasting for Emergency Warnings and River Management' in Frontiers in Water Journal.
2023 - Present	Engaged as a stakeholder for the development of the Geospatial AI Foundation Model in collaboration with NASA Marshall Center and IBM.
2021 - Present	Collaborated with postdocs, graduate students, entrepreneurs and SDS lab alumni on research projects (Example : Climate Resilience under Irreducible Uncertainty).
2021 - Present	Membership in American Geophysical Union (AGU) and American Society for Civil Engineers (ASCE).
2024	Assisted Professor in preparing lecture materials at Northwestern University, contributing to the development of AI for Science course.
2024	Served as a reviewer for Environmental Data Science journal.
2023	Conducted tutorials on Earth System Modelling data analysis for students at Tufts University, providing valuable guidance and support to enhance their understanding of the subject matter.
2023	Rapporteur for the Neural Network session at the Artificial Intelligence for Earth System Predictability workshop.

</> Software Products

> **Pretrained Models for QPF :** Implemented machine learning-based pretrained models for Quantitative Precipitation Forecasting (QPF), leveraging advanced AI techniques to enhance predictive accuracy.
> **Satellite and Radar Observations for QPE :** Built Quantitative Precipitation Estimation (QPE) models by integrating satellite and radar observations, improving the resolution and availability of precipitation data.
> **Earth System Model Projections for Impact Assessments :** Conducted earth system model projection analysis to assess potential impacts on hydrology and infrastructure resilience under future climate scenarios.

🖵 Technical Skills

Geospatial and Network Data Analysis	ArcGIS Pro, QGIS, Gephi, Google Earth Engine
Programming Language	Python, MATLAB, R
Watershed Modelling	Hec-RAS, Hec-HMS, SWMM, VIC
Cloud Computing	Cloud storage services and High-Performance Computing (HPC) resources