

# Anamitra Saha

✉ saha@anamitra.me | 🌐 <https://anamitra.me>

## Research Profile

---

Climate extremes; Downscaling; Physics-guided machine learning; Flood modelling; Indian monsoon system; Climate change impact assessment.

## Education

---

### Indian Institute of Technology Bombay

2012-2020

M.TECH. + PH.D. DUAL DEGREE

ADVISORS: PROF. SUBIMAL GHOSH AND PROF. E. P. RAO

- **M.Tech.** Remote Sensing, Civil Engineering Department
- **Ph.D.** Water Resources Engineering, Civil Engineering Department

### Jadavpur University

2008-2012

B.E. IN CIVIL ENGINEERING

## Work Experience

---

### Massachusetts Institute of Technology

2021-Present

POSTDOCTORAL ASSOCIATE AT DEPARTMENT OF EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

MENTOR: DR. SAI RAVELA

### Indian Institute of Technology Bombay

2020

RESEARCH ASSOCIATE AT DEPARTMENT OF CIVIL ENGINEERING

MENTOR: PROF. SUBIMAL GHOSH

## Research Experience

---

### Massachusetts Institute of Technology

2021-Present

PHYSICS-GUIDED DATA-DRIVEN DOWNSCALING MODEL FOR CLIMATE RISK ASSESSMENT

(MENTOR: DR. SAI RAVELA)

- **Downscaling:** Developing downscaling model for extreme precipitation, wind and other climatic variables using physics-guided data-driven approach.
- **Risk of Extremes:** Modelling risk of extremes such as floods and extratropical cyclones.
- **Flood Modelling:** Hydrodynamic simulation and surrogate modelling of floods.

### Indian Institute of Technology Bombay

2012-2020

PH.D. THESIS: HYDRO-METEOROLOGICAL PROJECTIONS AND SIMULATIONS UNDER CHANGING ENVIRONMENT

(ADVISORS: PROF. SUBIMAL GHOSH AND PROF. E. P. RAO)

- **Anthropogenic Impacts on Indian Monsoon:** Investigated the impacts of anthropogenic forcing, especially anthropogenic aerosols, on multi-decadal trend and spatio-temporal distribution of Indian monsoon rainfall, using statistical methods. Examined weakening of Indian monsoon and geophysical processes associated with it.
- **Seasonal Prediction of Indian monsoon:** Contributed in development of a data-driven model for seasonal prediction of Indian monsoon rainfall distribution.
- **Hydro-meteorological projections:** Performed hydro-meteorological projections of Ganga basin region, using statistical downscaling, process-based hydrological model simulations and conceptual frameworks. Estimated relative contributions of climate and land use changes in the projected hydrological changes based on climate mitigation and socio-economic development pathways.

### Scripps Institute of Oceanography, University of California, San Diego

2016-2017

INTERACTIVE VS PRESCRIBED AEROSOLS IN COMMUNITY EARTH SYSTEM MODEL

(ADVISOR: PROF. ART MILLER)

- Investigated the characteristics of Indian monsoon in CESM simulations and how they change between interactive vs prescribed aerosol runs, using statistical methods.

# Publications

---

## Journal

- **Saha, A.** and Ravela, S. (2024). **Statistical-Physical Adversarial Learning from Data and Models for Downscaling Rainfall Extremes** In Review: Journal of Advances in Modeling Earth Systems. Preprint: arXiv:2212.01446.
- Salas, J., **Saha, A.** and Ravela, S. (2023). **Learning inter-annual flood loss risk models from historical flood insurance claims** Journal of Environmental Management, 347, 118862.
- Mehmood, S., Ashfaq, M., Kapnick, S., Gosh, S., Abid, M. A., Kucharski, F., Batibeniz, F., **Saha, A.**, Evans, K. and Hsu, H. (2022). **Dominant controls of cold-season precipitation variability over the high mountains of Asia** npj Climate and Atmospheric Science, 5(1), 65.
- **Saha, A.**, Joseph, J., and Ghosh, S. (2020). **Climate Controls on the Terrestrial Water Balance: Influence of Aridity on the Basin Characteristics Parameter in the Budyko Framework.** Science of The Total Environment, 739, 139863.
- **Saha, A.**, and Ghosh, S. (2020). **Relative Impacts of Projected Climate and Land Use Changes on Terrestrial Water Balance: A Case Study on the Ganga River Basin.** Frontiers in Water, 2, 12.
- Ghosh, S., Karmakar, S., **Saha, A.**, Mohanty, M. P., Ali, S., Raju, S. K., ... and Murty, P. L. N. (2019). **Development of India's first integrated expert urban flood forecasting system for Chennai.** Current Science, 117(5), 741-745.
- **Saha, A.**, and Ghosh, S. (2019). **Can the weakening of Indian Monsoon be attributed to anthropogenic aerosols?** Environmental Research Communications, 1(6), 061006.
- Sahastrabuddhe, R., Ghosh, S., **Saha, A.**, and Murtugudde, R. (2019). **A minimalistic seasonal prediction model for Indian monsoon based on spatial patterns of rainfall anomalies.** Climate Dynamics, 52(5-6), 3661-3681.
- Rastogi, D., Ashfaq, M., Leung, L. R., Ghosh, S., **Saha, A.**, Hodges, K., and Evans, K. (2018). **Characteristics of Bay of Bengal Monsoon Depressions in the 21st Century.** Geophysical Research Letters, 45(13), 6637-6645.
- **Saha, A.**, Ghosh, S., Sahana, A. S., and Rao, E. P. (2014). **Failure of CMIP5 climate models in simulating post-1950 decreasing trend of Indian monsoon.** Geophysical Research Letters, 41(20), 7323-7330.

## Book Chapter

- **Saha, A.**, Shashikanth, K. and Ghosh, S. (2018), **Changing Monsoon Behaviour with the Evaluation of CMIP5 Climate Models.** Sustainable Holistic Water Resources Management in a Changing Climate (Pub: Jain Brothers)

## Conference

- **Saha, A.**, and Ravela, S. (2023). **Downscaling Precipitation Extremes Using Physics-coupled Dynamic Data Driven Adversarial Learning** EGU23-10931, EGU General Assembly, Vienna, Austria.
- **Saha, A.**, Salas, J. and Ravela, S. (2022). **Dynamic Data Driven Downscaling: Using Physics-Machine Learning to quantify Extreme Rainfall and Flood Loss Risk.** 4th International Conference on Dynamic Data Driven Applications Systems, DDDAS 2022, Cambridge, MA, USA.
- **Saha, A.**, Joseph, J., and Ghosh, S. (2019). **Influence of Aridity on the Basin Characteristics in the Budyko Framework: A Case Study on the Ganga River Basin.** Water Future International Conference, Bengaluru, India.
- Mohanty, M. P., Gusain, A., Ghosh, M., **Saha, A.**, Karmakar, S., and Ghosh, S. (2019). **Flood Disaster Management: Present Challenges and Future Perspectives.** World Conference on Disaster Management, Mumbai, India.
- Sahastrabuddhe, R., Ghosh, S., **Saha, A.**, and Murtugudde, R. (2018). **Improvement of Seasonal Prediction for Indian Monsoon based on Spatial Patterns using Deep Learning Techniques.** AGU Fall Meeting, San Francisco, USA.
- **Saha, A.**, Joseph, J., and Ghosh, S. (2018). **Impact of climate change on terrestrial water cycle at Ganga river basin: 1.5° and 2° scenario.** International Conference of the National Hydrology Project, Chandigarh, India.
- **Saha, A.**, Sahana, A. S., Ghosh, S. and Rao, E. P. (2015). **Evaluation of CMIP5 Models for post-1950 Weakening of Indian Monsoon.** EGU2015-338, EGU General Assembly, Vienna, Austria.

# Projects

---

## Downscaling, MIT Climate Grand Challenges: Preparing for a New World of Weather and Climate Extremes

2022-Present

MIT CLIMATE GRAND CHALLENGES (PI: DR. SAI RAVELA, AND PROF. KERRY EMANUEL)

- As a postdoctoral associate, contributed in developing downscaling model for extreme precipitation and wind in midlatitudes, and estimating risk of extratropical storms.

## Cyclone Forecasting, MIT Climate Grand Challenges: Jameel Observatory Climate Resilience Early Warning System (JO-CREWSnet)

2022-Present

MIT CLIMATE GRAND CHALLENGES (PI: DR. SAI RAVELA)

- As a postdoctoral associate, contributed in developing downscaling model for extreme precipitation risk assessment in Bangladesh.

## Urban Flood Risk Assessment

2021-Present

PROJECT FROM LIBERTY MUTUAL INSURANCE (PI: DR. SAI RAVELA)

- As a postdoctoral associate, contributed in extreme rainfall downscaling, hydrodynamic urban flood simulations, and surrogate modelling of flood.

## **Coupled Human And Natural Systems Environment (CHANSE) for water management under uncertainty in the Indo-Gangetic Plain**

2017-2019

NEWTON BHABA PROJECT (PI: PROF. SUBIMAL GHOSH)

- As a research scholar, performed hydro-meteorological projections for Ganga river basin

## **Design of an Expert System for Flood Forecasting and Management for the city of Chennai**

2017-2018

PROJECT FROM SCIENTIFIC ADVISOR TO THE GOVT OF INDIA (PI: PROF. SUBIMAL GHOSH)

- As a research scholar, contributed in developing the probabilistic rainfall forecasting module, and integrating multiple modules of the system

## **Awards and Recognitions**

---

### **Fulbright-Nehru Doctoral Research Fellowship**

2016-2017

- Visited Scripps Institute of Oceanography, University of California, San Diego as a visiting research Scholar

## **References**

---

### **Dr. Sai Ravela**

Department of Earth, Atmospheric  
and Planetary Sciences  
Massachusetts Institute of Technology

✉ ravela@mit.edu

### **Prof. Subimal Ghosh**

Civil Engineering Department  
Indian Institute of Technology Bombay

✉ subimal@civil.iitb.ac.in

### **Prof. E. P. Rao**

Civil Engineering Department  
Indian Institute of Technology Bombay

✉ ceepria@iitb.ac.in