



Northeastern

Department of Civil and Environmental Engineering

Climate Adaptation and Hazards Resilience with Big Data and Bigger Models

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12pm-1pm

458 Richards Hall

Abstract

Predictive insights on climate variability, extremes and uncertainty, especially at local to regional scales, may provide useful information for adaptation. However, while physics-based models may lose their ability to generalize with greater parameterization, especially when the parameters cannot be directly or indirectly estimated from data, insights obtained by mining massive volumes of observed and model-simulated data may have limited interpretability, particularly when explanations are attempted based on simple physical intuition. The latter may even yield spurious results when complex dependence patterns are ignored. Another major set of challenges stem from the fact that the climate system is nonlinear and dynamical, even chaotic, but contaminated with random noise, which may include low-frequency, and even $1/f$, components. While arguments and frameworks have been advanced to change the null hypothesis in adaptation decisions from stationary climate to warming environments, fundamental and achievable limits to predictability may need to be considered. This presentation discusses new findings and old perspectives, as well as prevailing beliefs in the scientific and adaptation communities, and suggests the need to consider both non-traditional tools and non-intuitive insights while being mindful of their potential pitfalls. The water sustainability case studies discuss water availability and warming, as well as floods and droughts, and the nexus with energy and marine ecosystems. The national security cases discuss sensor-based monitoring for transportation security, climate related threat multipliers and design of early warning and intervention strategies.

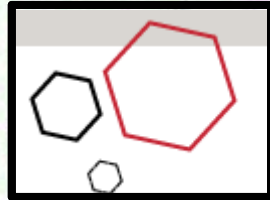
Bio

Auroop R. Ganguly is an avid enthusiast of ancient history (the distant past), science fiction (the faraway future) and comparative religion (including the myths). He also loves the present and the outdoors, but rarely gets time to be then or there. As part of his day job, he teaches courses in civil and environmental engineering (CEE), including climate change and applied data science. His evenings and weekends are spent doing research in areas such as extreme weather and climate, water resources and hazards resilience, as well as applied statistics, data mining and nonlinear dynamics. Currently at Northeastern University, he may well be the only CEE faculty in a major US research university with significant experience in the private industry, including a large corporation and a semi-startup, a government-owned national laboratory and academia. To avoid getting tagged to a specific sub-discipline, he has consistently surprised his own disciplinary expectations by publishing in climate, geophysics, water, computer science, data mining, electrical engineering, transportation, physics, operational research and information technology journals, besides a few high-impact, interdisciplinary journals, and selective computer science conferences. In addition to being associate editor of one water resources and one civil engineering journal, and guest editor of one nonlinear geophysics and one data analysis journal, he has organized workshops and authored books or chapters in sensor based data mining, climate data analysis, and agent-based models. His work has been highlighted in top scientific venues and by major funding agencies as well as by the mainstream national and international media, and by international scientific bodies. He has the dubious honor of getting his work cited by both the famous United Nations Intergovernmental Panel on Climate Change (IPCC), and rather incredulously, by the infamous Nongovernmental International Panel on Climate Change. He has bachelor and doctorate degrees from two institutes of technology, one in Kharagpur, India, and another in Cambridge, Massachusetts.



Auroop Ganguly, PhD

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Education

- **PhD, Civil & Environmental Engineering, *MASSACHUSETTS INSTITUTE OF TECHNOLOGY***
- **MS, Civil Engineering, *UNIVERSITY OF TOLEDO***
- **B.Tech., Civil Engineering, *INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR, INDIA***

Research Interests

- **Climate change**
- **Water sustainability**
- **Complex systems analysis**
- **Applied data mining**
- **Extreme events**

Selected Service, Honors, Awards

- **PI of the Sustainable and Data Sciences Laboratory**
- **Cited in international media (*USA Today, Boston Globe, MSNBC*)**
- **Assoc. editor *Water Resources Research* and *Journal of Computing in Civil Engineering***