Indiana University-Purdue University Indianapolis
Department of Mathematical Sciences

STATISTICS SEMINAR

12:15pm—1:15pm, Tuesday,January 16, 2024
Zoom Meeting: Meeting ID: 845 0989 4694

Speaker: **Pulong Ma**
Department of Statistics, Iowa State University

Title: **Uncertainty Quantification for Storm Surge**

Abstract:

Hurricane-driven storm surge is one of the most severe natural hazards that can lead to significant flooding in coastal areas and severe damages to the life and property. To assess storm surge hazards, current coastal flood hazard studies are often performed through a synthesis of computer modeling, statistical modeling, and extreme-event probability computation, where computer modeling is used to predict the storm surge hazard initialized by hurricanes, statistical modeling is used to determine the distribution of hurricane characteristics, and extreme-event probability is used to assess the flood hazard. Since post-Katrina coastal flood hazard studies, a key technique called Joint Probability Method (JPM) with its improvements has become the gold standard to compute annual exceedance probabilities (AEP) levels at certain frequencies by federal agencies such as Federal Emergency Management Agency (FEMA) and US Army Corps of Engineers (USACE), private sectors, and academic researchers in coastal engineering. State-of-the-art computer models (or simulators) of storm surge have often been implemented with a wide range of fidelity levels, with computational burdens varying by several orders of magnitude due to the complex nature of the physical system. Consequently, the JPM suffers from several shortcomings, including excessive use of computing resources and inappropriate uncertainty quantification, which makes it cost-prohibitive and impractical for coastal flood hazard studies. To address these issues, we propose statistical emulators - fast approximations to computer models to predict highly accurate storm surges in a computationally efficient way over large spatial domains and illustrate their performance in two case studies including Cape Coral and the entire Southwest Florida (SWFL), thereby providing the capability to facilitate efficient computation of AEP over massive number of spatial locations for risk assessment of storm surges.

Bio:
Dr. Pulong Ma is an Assistant Professor in the Department of Statistics at Iowa State University starting on June 2023. Before joining Iowa State, he was Assistant Professor in the School of Mathematical and Statistical Sciences at Clemson University during 2021-2023. During 2018-2021, he was a postdoctoral fellow at the Statistical and Applied Mathematical Sciences Institute (SAMSI) and Duke University mentored by Prof. Jim Berger and Prof. Li Ma. In 2018, he received his Ph.D. in statistics from University of Cincinnati. His statistical research is stimulated by real-world challenges and aims at addressing real-world problems in physical sciences including remote sensing science and climate science, engineering, and medical science. His research interest is focused on developing statistical methods for understanding physical and environmental processes. It includes Uncertainty Quantification (UQ), Bayesian Statistics and Spatial and Spatio-Temporal Statistics. He recently focus on developing statistical methods that allow flexible model structures and scalable computations for analyzing big and complex data with spatial dependence and understanding their use in complex real-world applications including environmental mapping, probabilistic assessment of remote sensing retrievals, and risk assessment of storm surges.