RESEARCH SEMINAR

DEPARTMENT OF GEOGRAPHY AND RESOURCE MANAGEMENT
THE CHINESE UNIVERSITY OF HONG KONG

Understanding Hydroclimate Extremes across Spatial Scales

7 June 2024 (Fri)
10:00 – 11:30 am (UTC+8)
Rm 221, Chen Kou Bun Building, CUHK

This seminar will be focusing on understanding weather and climate extremes by focusing on processes across spatial scales that range from the urban scale (~km) to the synoptic scale (~1000km) using numerical models, observations and statistics. At the synoptic scale, atmospheric rivers (ARs) have major socioeconomic repercussions along the US West Coast due to heavy rainfall, flooding, strong winds, and storm surge. However, our understanding of the physical drivers responsible for their interannual variability is still limited, with different climate modes identified as possible mechanisms. We find that the Pacific-Japan teleconnections/patterns and the East Asian subtropical jet exhibit the strongest linkage with the total frequency of landfalling ARs affecting the western United States, much stronger than the other potential climate modes previously considered. We also uncover heterogeneities in AR tracks; specifically, not all ARs making landfall along the US West Coast come from a single population, but rather it is possible to stratify them into three main clusters. We have also examined the role of weather regimes in modulating droughts in the western United States and how the weather regimes can be used to improve seasonal forecasts. Category 4 landfalling hurricane Harvey poured more than a meter of rainfall across the heavily populated Houston area, leading to unprecedented flooding and damage. We find that urbanization exacerbated not only the flood response but also the storm total rainfall. Using the Weather Research and Forecast model for simulating weather and climate at regional scales—and statistical models, we quantify the contribution of urbanization to rainfall and flooding. Overall, we find that the probability of such extreme flood events across the studied basins increased on average by about 21 times in the period 25–30 August 2017 because of urbanization.

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Dr. Wei Zhang is an assistant professor at Department of Plants, Soils and Climate at Utah State University since 2021. He received his PhD in 2011 in Geography and Resource Management from CUHK where he focused on understanding tropical cyclone dynamics through data mining and numerical models. Prior to moving to Utah State University, he worked as a research scientist at IIHR-Hydroscience & Engineering, University of Iowa during 2016-2020 and worked as a scientist at Princeton University and NOAA/GFDL during 2014-2016. He was a visiting scholar at University of Cambridge and Institute of Atmospheric Physics, Chinese Academy of Sciences. His current research is focused on hydroclimate in the United States by harnessing observations, numerical models, statistics, and theories. He has published more than 100 peer-review articles including those in Nature, Nature Climate Change, Nature Communications, Science Advances, PNAS, Nature Climate and Atmospheric Science, Geophysical Research Letters, Journal of Climate, Climate Dynamics etc. His research has received financial support from internal and external sources such as NSF, NOAA, NASA, USDA, USGS and Bureau of Reclamation (over $2.5 million).

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