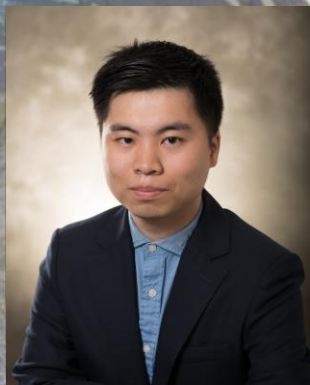# Coupling Data Science and Numerical Simulations to Empower Atmospheric and Environmental Research

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**9:00 a.m.**

**Conference Room, 3/F, Mong Man Wai Building**

**Zoom Link (Mixed-mode)**

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We have entered the age of *Data Science*. Massive amounts of data from *numerical simulations* of the Earth system are now common in atmospheric and environmental research. However, state-of-the-art Earth System Models (ESMs) are subject to limitations because of the multiscale nature of the Earth system, where processes on scales smaller than the computational grid resolution remain unresolved and can only rely on simplified representations. These simplified representations introduce large yet frequently poorly characterized uncertainties in climate simulations. Therefore, making sense and making use of these simulation data remains a fundamental challenge.

In this talk, I will share my vision of coupling Data Science and numerical simulations to create a suite of tools for addressing and overcoming the limitations induced by the model representations, focusing on two high-impact applications areas: (I) representation of urban environments in ESMs to predict climate extremes, and (II) representation of aerosol particles in the atmosphere as important players that modulate climate and impact human health. I will then introduce the framework of evaluating the information content of satellite data for $PM_{2.5}$ (air quality) estimates using the simulations from a chemical transport model and automated machine learning (AutoML). Finally, I will envision the use of Data Science (machine learning) and numerical simulations to improve urban climate modeling and optimize urban engineering for climate and environmental co-benefits. These efforts culminate in an improved understanding of the role of Data Science in atmospheric and environmental research.

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