Main field: Earth Science & Environments

Dr. Maher Sahyoun, PostDoc Researcher at the section for the Physics of Ice, Climate and Earth (PICE) – Niels Bohr Institute (NBI) – Copenhagen University (KU), Copenhagen, Denmark

"Integrated systems and analysis of urban mobility for climate-neutral and sustainable cities in Europe"

Our research focuses mainly on urban air quality in some European cities, aiming to provide tools and case studies to optimize multimodal traffic management, enhance urban mobility, reduce traffic emissions, improve air quality, foster greener mobility practices to further support climate neutrality. This can be achieved by utilizing big data, smart traffic management technologies, various modelling tools, and interdisciplinary approaches to develop an Integrated Urban System (IUS)[1,2,3,4] along with key performance indicators (KPIs) tailored to each city. This would enhance our understanding of the interactions among urban multimodal mobility, traffic emissions, air quality, and thus, climate change in those cities. By conducting multi-scenario simulations, we propose multi-mode transport schemes conducive to sustainable development, with emissions reduction and mitigation of health and climate risks. The outcomes will establish a strategic model for constructing smart cities, and cooperation, to further facilitate joint exploration of climate neutrality pathways amidst ongoing urbanization processes. Within our research activities, we combine various types of atmospheric and chemistry modelling tools, e.g., Enviro-HIRLAM (High Resolution Limited Area Model)[5], to conduct these multi-scenarios simulations, where the modeling platform provided by The Pan-Eurasian Experiment Modelling Platform (PEEX-MP)[6] as well as the services from CSC is essential and highly required.

Scientific Background:

Cities are major contributors to air pollution and up to 70% of Greenhouse Gas (GHG) emissions[7]. Addressing these challenges requires urban road planning that considers diverse mobility needs and evolving travel patterns[8]. Growing urbanization in the past few decades have resulted in a sharp rise in motor vehicle ownership and longer travel distances, leading to concentrated commuting peaks and increased environmental impacts, including pollutant emissions[9]. Despite advancements in technology, smart city construction has not fully utilized these innovations. Although significant emission data have been collected, more effective pollution control measures are needed [10,11]. Existing data resources remain underutilized, and simulation analyses for urban planning are lacking[12], highlighting the need for indices reflecting impacts on health and urban climate. Thus, it's crucial to propose multimodal mobility solutions tailored to local contexts without creating disparities in urban access[13]. Smart devices have expanded multimodal mobility options, incorporating public transport, private driving, shared services, and carbon-free modes like cycling and walking. While promoting active transportation can improve public health, it's important to address associated hazards such as air pollution[14]. Addressing these hazards together with understanding the impacts of societal travel evolution requires interdisciplinary modeling tools for better evaluating multimodal mobility scenarios[15], and such modeling tools can be provided by PEEX.

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