Paper Title: How The Urban Microclimate And Outdoor Thermal Comfort Can Affect Intra-City Mobility Patterns: Evidence From New York City

Paper Link: Link

1. Summary

1.1 Motivation/purpose/aims/hypothesis

The paper is motivated by the need to understand how the urban microclimate, which is the local atmospheric condition influenced by the built environment, affects the choice of active travel modes in cities. It investigates how the urban microclimate, measured by the Universal Thermal Climate Index (UTCI), influences the intra-city mobility patterns in New York City. It hypothesizes that the urban microclimate has a significant impact on the choice of active travel mode and that this impact varies across different travel contexts.

1.2 Contribution

The paper contributes to the literature on urban microclimate and mobility by proposing a novel modelling framework that integrates travel data, built environment data, and UTCI calculations to train a predictive model for intra-city mobility patterns. It also contributes to urban planning and design by analyzing the impacts of UTCI features on different travel contexts and suggesting microclimate-oriented spatial planning and design interventions.

1.3 Methodology

The paper employs a mixed-methods approach, integrating both quantitative and qualitative methods. It utilizes the New York City Travel Survey (NYCTS) data, including trip details for over 20,000 residents' trips in 2017. Additionally, it incorporates built environment data from sources like OpenStreetMap, NYC Open Data, and Google Maps API, encompassing land use, street network, building height, green space, and population density by census tract in NYC. The paper calculates UTCI using the Urban Weather Generator (UWG) and combines these datasets to create a comprehensive dataset with UTCI features for each trip. This data is then used to develop a multinomial logistic regression model to predict active travel mode choices. Furthermore, the paper supplements its findings with qualitative methods, including interviews and focus groups with New York City residents, to validate and interpret the quantitative results.

1.4 Conclusion

In conclusion, the paper reveals that the urban microclimate can influence active travel mode choices, with potential variations across factors such as seasons, times of day, activities, built environments, and traveller characteristics. It estimates that the urban microclimate can account for up to a 4% change in mode choice, particularly in dense urban areas. The study indicates that higher UTCI values (indicating warmer or colder conditions) tend to discourage active travel

mode selection, while moderate UTCI values (indicating comfortable conditions) tend to encourage it. Furthermore, certain UTCI features have non-linear or interactive effects on mode choice, such as solar radiation, wind speed, humidity, and air temperature. This information could be valuable for urban planners and designers, enabling them to create microclimate-oriented spatial planning and design interventions that enhance thermal comfort and promote active travel modes in cities..

2. Limitations

2.1 First Limitation/Critique

One limitation of the paper is its reliance on self-reported travel data from the NYCTS, which can be prone to recall bias, measurement errors, and potential underrepresentation of specific population groups or trip types. Factors contributing to this limitation include inaccuracies in reported trip details, incomplete or inconsistent survey responses, difficulties in reaching marginalized or hard-to-reach groups, and the potential oversight of rare or irregular trips. These challenges can impact the data's validity and reliability, introducing potential noise or bias into the analysis.

2.2 Second Limitation/Critique

Another limitation is the assumption of a static relationship between UTCI features and active travel mode choice across different spatial and temporal scales. For example, it uses census tract-level UTCI features as proxies for trip-level UTCI features, potentially missing spatial variations. It also relies on hourly UTCI features as proxies for minute-level UTCI features and uses annual UTCI features as proxies for seasonal or daily variations. These assumptions can impact the accuracy and sensitivity of UTCI features and may not fully capture the dynamic relationship with active travel mode choices.

3. Synthesis

This paper offers a unique and comprehensive perspective on how urban microclimates and outdoor thermal comfort impact intra-city mobility in New York City. It underscores the significance of considering the urban microclimate when choosing active travel modes, with implications for urban sustainability, health, and livability. The paper highlights the feasibility of modeling and measuring the urban microclimate through various data sources and tools, facilitating its integration into urban planning and design. It suggests that urban planners and designers can apply these findings to enhance thermal comfort and promote active travel modes in cities.

The paper's insights have several potential applications. Its modeling framework can be adapted to diverse cities with varying climates, built environments, and mobility patterns, offering cross-cultural learning opportunities. UTCI features can be expanded to include other microclimate indicators like air quality, noise, or lighting for a more comprehensive view of

outdoor environmental quality and comfort. Updating the analysis with more recent and frequent travel data, such as mobile phone or GPS tracking data, could provide more accurate and timely mobility information. The findings can be effectively communicated to various stakeholders, including policymakers, practitioners, researchers, and citizens, enabling informed decisions and actions concerning urban microclimate and mobility issues.