

# Quantifying Urban Stressors: A Data-Driven Approach Using Sensors, Modelling, and Citizen Science

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Urban environments expose individuals to a complex mix of environmental stressors, including air pollution and noise. Understanding how these stressors are experienced and their impacts on daily life is essential for designing healthier, more liveable cities. Advancements in miniaturized personal sensors allow for the collection of high-resolution, individual-level data, offering new ways to quantify exposure to urban stressors in real-world settings. However, to ensure meaningful insights, data from these sensors require careful validation, collocation, and calibration against reference instruments. The integration of large datasets from diverse sources demands harmonization techniques to produce reliable, comparable, and actionable outputs, including personalized exposure reports for citizens in citizen science activities. These detailed datasets serve as a foundation for further analysis using spatial modelling and agent-based simulations, providing deeper insights into exposure dynamics and behavioural adaptations in urban environments. By incorporating participatory research approaches, public engagement in data collection and co-analysis enhances both scientific understanding and urban planning. When combined with agent-based modelling (ABM), these data-driven approaches allow for scenario testing, helping to design interventions that reduce exposure, optimize mobility patterns, and improve overall urban resilience to environmental stressors.