

## **Spatio-temporal variability of land surface temperature and vegetation indices within Local Climate Zone classes in Cardiff, Wales**

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This study explores the spatiotemporal variations in Land Surface Temperature (LST) and vegetation indices in relation to Local Climate Zone (LCZ) classification in a coastal, temperate climate city across multiple seasons. The study focuses on Cardiff, the capital and largest city of Wales, located only 2.4 km from the sea. The findings of this study extend our scientific understanding of the interrelations between LST and morphological and surface properties of the built environment and urban vegetation for various LCZ classes in Cardiff. Results showed a significant variation in Surface Urban Heat Island (SUHI) intensity in spring, summer, and winter. LST and Normalised Difference Vegetation Index (NDVI) were found to vary significantly across the LCZ classes demonstrating their association with the local urban form and morphology. For built-up areas, LCZ classes with lower vegetation cover and higher building density showed higher LST. For natural areas, LCZ F (Bare soil or sand) had higher LST than LCZ A (Dense trees). The high-density, built-up LCZ classes have a greater UHI compared to the natural classes. In addition, the results showed that LST and NDVI are significantly affected by the morphological and surface properties for each LCZ classes. Building surface fraction, impervious surface fraction and surface admittance were found to have a positive correlation with LST. Sky View Factor, surface albedo and pervious surface fraction, on the other hand, showed a negative correlation with LST. Opposite associations were found with the NDVI. Urban planners and designers will find the study useful to develop heat mitigation strategies while planning, designing, or improvising the new and existing urban areas in Cardiff. In addition, the LCZ map produced in this study for Cardiff using local expert knowledge will enable international comparison and testing of proven climate change adaptation and mitigation techniques for similar urban areas.