Abstract

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The impact of urban form on outdoor thermal comfort in hot arid environments during daylight hours, case study: New Aswan

Although the geometry of urban settlements can significantly affect local microclimates, planning of new urban communities in Upper Egypt largely ignores opportunities to design for improved thermal environments. Significant expansion of urban areas in Upper Egypt is expected to take place in the coming decades. To inform the design process, this study uses the complex geometric configurations of older planned communities in the Greater Cairo Region (GCR) to explore key urban form variables that affect outdoor thermal comfort in arid climates. The study uses a calibrated microscale atmospheric model to simulate the microclimate of four quarters from GCR and one quarter from New Aswan (an Egyptian city 700 km to the south of Cairo). The simulations were conducted under Aswan's summer conditions for July 2018. The quarter from New Aswan had the highest pedestrian level Physiological Equivalent Temperature (PET) amongst the simulated quarters. Urban geometry variations affected average PET by up to 9 °C at the scale of individual streets, with prevalence of shade being the most important parameter. Multiple regression analysis showed that urban form variables explain more than half of the variation in PET. Extent of enclosure and Floor Area Ratio were most important at the block scale, while aspect ratio and orientation were the most impactful at the street scale. The results of this study are intended to guide planners of new urban communities in arid climates.