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Investigating the synergistic cooling effect of urban blue and green spaces via an advanced urban canopy model

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Urban overheating is becoming an increasingly pressing concern under the dual challenges of global warming and urban heat island effect. One effective way to mitigate urban overheating problems is to create urban cool spots via urban blue-green spaces (BGS). To investigate the synergistic cooling effect of urban BGS, we proposed a new urban BGS coupling system by integrating a new urban water module with the state-of-the-art urban vegetation module in the framework of an urban canopy model (UCM). This coupled BGS system can represent complicated radiative exchanges between building, tree, and water, and simulate dynamic variations of shadow length, temperature, humidity, as well as energy and water fluxes within the urban street canyon. The new urban BGS model has been evaluated in typical neighborhoods with building and trees siting along rivers (also named ‘water towns’) in two Chinese megacities, i.e., Shanghai and Hong Kong. Based on this model, we investigated the synergistic cooling effect of BGS in different ‘water town’ design scenarios with different combinations of BGS characteristics (e.g., tree crown radius and height, river width, the distance between tree and river) and street canyon characteristics (e.g., geometries and orientations). Our study emphasizes the importance of optimizing 'water town' design to offer more effective cool spots for urban citizens facing escalating heat stress.