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Effect of water body forms on microclimate of residential district

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Abstract

Water body as one of the constituent elements of underlying surface, is an important part of urban residential environment, and plays a certain regulating effect on microclimate environment of residential district in summer. This paper taking Harbin city of China as example, through the extensive investigation of residential district, the water body configuration forms of Harbin residential area can be divided into centralized and decentralized modes. According to the characteristics of each mode, the water body is subdivided into four or five forms. It selects the typical residential district to test, so as to analyses the effect of water body on summer microclimate of residential district, and applying the ENVI-met software to simulate the urban residential district microclimate with different water body configuration forms, then concludes the best water body configuration form for regulating the residential district microclimate in summer.

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Keywords: Residential district; microclimate; water body form

1. Introduction

Along with the seriously deteriorated climatic environment and the improvement of people's living standard, urban environmental quality and comfort level are gradually given more attention, especially for the residential district which closely linked with people's living. Water body as one of the constituent elements of underlying surface, is an important part of urban residential environment, and plays a certain regulating effect on microclimate environment of residential district in summer. Existing studies about the influence of water on the microclimate have been conducted mainly using field testing and numerical simulation etc. Givoni found that the park with 0.5hm²

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could affect the 20-150m surroundings environment, besides greening the effect of water is also very important among the influence factors^[1]. B.Offerle.I found that the underlying surface's position and configuration play a decisive role to the difference between surface temperature and air temperature^[2]. Mirela Robitu found that greening and water have certain effect on the sunshine, temperature, humidity and wind speed of square in summer through the simulation analysis on two models which the difference is whether having the greening and water^[3]. Nishimura N indicated that when the surface temperature reach To the highest of 50 °C in July, the water temperature has been in the scope of around 30 °C, the water evaporation's cooling effect can affect the downwind distance of 35 m^[4]. Liu Jing combined field testing and numerical simulation to analysis the effect of Songhua River in Harbin on urban local climate^[5, 6]. Chen Hong taking Wuhan for example, carried out research into the influence of wind on the microclimate through field testing for the waterfront street on the both sides of Yangtze River^[7].Li Shuyan adopted the climate observational data to analysis the micro climate effect of urban water body^[8]. Xue Sihan conducted studies on the water effect of China traditional Lingnan garden and found that water can effectively adjust the microclimate environment of garden^[9]. Du H taking Shanghai for example found that with a fixed area of water body, the geometry of the water body should be relatively simple, the proportion of vegetation should be increased and the proportion of impervious surfaces should be reduced to realize good water cooling island effects. However, the existing studies mainly focus on the climate effect of large scale waters, and have obvious regional feature. The researches on the influence of small scale water on the residential district are few.

This paper takes Harbin city as example, which is the capital of Heilongjiang province, located in the Northeast of China. Duo to the severe cold in winter, there is almost no water in the residential district's river or pond, while in summer the water was usually used to cooling the ambient temperatures. But the arrangement and areas of water bodies is the question need to be explored. Therefore, the method of field testing and numerical simulation are adopted to analysis the water body's effect on residential district microclimate in summer, aims to find the better water form for regulating the summer microclimate. Firstly the typical residential district is selected to test, including air temperature, relative humidity and wind speed. Then the microclimate of residential district with different water body configuration is simulated by the ENVI-met software and their features are then explored.

2. Research Methods

2.1. Field testing

The field testing can reflect the actual conditions of microclimate. The residential district named “Hello, the Dutch city” in Harbin of China is selected as the site. This district covers areas of 59000 square meters, including ten slab-type apartment houses, three point block apartment house, and centralized water is located in the center. The Simple landscape design in the residential district is beneficial to reduce the effect on the accuracy of testing.

Air temperature, relative humidity and wind speed are select to test. The residential district plane and the points position as shown in Fig.1, it set up seven points in the district. Four points (NO.2, 3, 4, 5) are laid out 4m meters away from the water. In order to carry out the contrast analysis, the other three points, two (NO.1, 7) set in the open area of district and one (NO.6) in the outside of district.



Fig. 1 The residential district plane and the point's position

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