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Retraction

Retracted: Modeling of Energy Saving and Comfort of Building Layout in Extreme Weather Urban Residential Area under the Background of Spatial Structure and Form Evolution: Taking Yichun as an Example

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] M. Lu, G. Sun, E. Wang, and Z. He, "Modeling of Energy Saving and Comfort of Building Layout in Extreme Weather Urban Residential Area under the Background of Spatial Structure and Form Evolution: Taking Yichun as an Example," *Journal of Function Spaces*, vol. 2022, Article ID 6892035, 11 pages, 2022.

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Research Article

Modeling of Energy Saving and Comfort of Building Layout in Extreme Weather Urban Residential Area under the Background of Spatial Structure and Form Evolution: Taking Yichun as an Example

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After the founding of the People's Republic of China, the state formulated the first five-year plan for national economic development with the development of heavy industry as the core. The assistance of the Soviet Union completely opened the prelude to China's large-scale industrial construction. With the continuous increase of urban energy consumption in China and the huge pressure it brings to the environment, urban planning and design aiming at energy conservation and climate adaptability has attracted more and more attention. Residential building layout is an important part of urban planning and design, which is closely related to building environmental energy consumption and urban microclimate. Therefore, it is necessary to study the energy saving and climate adaptive design strategy of residential building layout. Yichun is a cold city, located in the northernmost part of the three northeastern provinces, with a population of about 1 million. Its climate is characterized by continuous low temperature in winter, and the extreme value of daily lowest air temperature in Yichun City since 1981 is -42.2°C. The highest temperature in summer is 35°C. The unique geographical location and climate have created Yichun's unique urban quality, and outdoor cultural activities are also unique. Yichun is a place with four distinct seasons, and each season has its own characteristics. The beauty of the four seasons contrasts greatly. The best travel time in Yichun is from June to September. In this study, the scientific nature of environment numerical simulation software is verified. Taking the surrounding residential open space as the research object, reasonable grid simulation size and initial boundary conditions are set. The quantitative relationship between design elements and thermal comfort level is established through software simulation. After repeated and a large number of hourly simulation verification, combined with the spatial distribution map and numerical distribution map of thermal comfort, the design elements and open space are established. On this basis, the optimization strategies of open space in residential areas in extreme weather areas are put forward, including the reasonable layout of activity areas, careful selection of open positions, attention to the proportion of open space, attention to plane enclosure and corner units, encouragement of secondary restrictions of activity space, reasonable selection of underlying surface materials, and reasonable layout of water bodies. This paper mainly studies the design of outdoor communication space in Yichun residential area in winter. The average temperature in winter is -14°C ~ -2°C. Through the study of design methods and countermeasures, an operable Yichun residential area design method is found.

1. Introduction

According to the statistics of the International Cold Region Association, more than 600 million people in the world have lived in cold regions [1]. However, China has a vast land area under the background of severe cold climate. The winter is long and cold. Every year from November to the next April, the city will face the attack of severe cold, ice, and cold wind [2]. At the same time, because winter is often affected by cold air from Siberia, compared with other countries at the same latitude in the world, the winter temperature in cold cities in my country is much lower, and the average temperature in January is often below -18°C [3]. In the research of building layout energy-saving and comfort modeling in cold regions, through numerical analysis and modeling design, the quantitative characteristics of influencing factors such as solar energy, illumination, cold wind avoidance, energy, building materials, and heating are analyzed, and the influence and contribution of the above factors on building layout energy saving are analyzed. By making full use of sunlight, energy is saved, and comfort of communities is improved, which provides an accurate model and data basis for the design and evaluation of building layout energy-saving and comfort modeling in cold regions [4]. As building energy consumption accounts for a large proportion of the total social energy consumption, building energy conservation has become one of the mainstreams of the world energy conservation wave [5].

Due to air pollution, global greenhouse effect, urban heat island effect, and ecological environment deterioration caused by massive energy consumption, energy consumption has become a serious problem that human beings have to face up to [6]. The concept of sustainable development has made people increasingly aware of energy, environment, and ecological affairs. Issues related to energy use and energy supply are the main factors considered in architectural design and planning and design [7]. For a long time, the design standards and planning control indicators of open space in residential areas are limited to the hard indicators such as sunshine time, greening rate, and floor area ratio, and no effective method to improve the thermal comfort of open space in residential areas has been put forward [8]. From the perspective of fitness for people's physical and mental health, people's physical health is to strengthen their physical quality through exercise, which belongs to physical hardware; people's psychological health refers to people's psychological feelings. A bad environment will give people feelings of depression, boredom, rigidity, etc., and make people feel uncomfortable, so they lose interest in it or even stay away from it. Generally, through the treatment of the physical form, color, texture, and other aspects existing in the space environment, it will dye a certain cultural atmosphere, alleviate people's inner discomfort and insecurity, and enhance neighborhood communication [9]. Due to the special climatic conditions, the open space in cold regions faces the problem of low utilization rate. However, residents in cold regions also long for public activities and comfortable open spaces in residential areas. Therefore, the overall climate in cold regions cannot be changed. Under the objective facts of the environment, in a limited season or time period, select a certain type of representative open space in the cold area and use the existing operational design methods and technical conditions to improve the cold area. The thermal comfort of the open space in the residential area, so as to improve the utilization rate of the open space in the cold area, is the main purpose of this study [10]. Compared with the general building layout, buildings in cold environment adopt small shape coefficient to reduce the area facing the cold, so as to reduce the loss caused by heat exchange. Good thermal insulation materials can greatly improve the quality of buildings against cold. Usually, buildings in severe cold areas have large windows on the south side, small windows on the north side, or even no windows. Reasonably arranged heating equipment will greatly improve the comfort of buildings in cold areas.

In this paper, Yichun, a cold city, is taken as the research object, and the microclimate environment of public space in typical residential areas in transition season and the use of interviewees are investigated and analyzed within the range of transition season determined in previous studies. Some planning suggestions are put forward to prolong the outdoor season of cold cities, so as to provide reference for the construction of livable cold cities in China.

2. Related Work

From 1961 to 2020, China's annual average precipitation showed an increasing trend, the annual average precipitation days showed a significant decreasing trend, and the annual cumulative number of rainstorm station days showed an increasing trend. In 2020, the cumulative number of rainstorm station days in China was the second since 1961. Extreme heavy rainfall events in China are increasing, extreme low temperature events are decreasing, and extreme high temperature events have increased significantly since the mid-1990s. Since the late 1990s, the average intensity fluctuation of typhoons landing in China has increased. The average number of sand dust days in northern China shows a significant decreasing trend, reaching the lowest value in recent years and rising slightly. China's climate risk index is on the rise. In 2020, China's climate risk index was the third highest since 1961. From the perspective of annual climate change, in the past 30 years, most parts of the country have shown a warming trend, except that most of the Sichuan Basin, a small part of the Yunnan Guizhou Plateau and a small part of the Northeast Qinghai Tibet Plateau have shown a cooling trend. The national average temperature tendency rate is 0.24810 a, and the average precipitation tendency rate is 9.207 mm/10 a. In the whole country, the area showing a warm and wet trend is the most extensive. It includes most of the northeast, Inner Mongolia, Xinjiang, Qinghai Tibet Plateau, the middle and lower reaches of the Yangtze River, and the southern part of the North China Plain. Peng et al. [11] have established a certain research foundation for the research on the wind and heat environment of open space in cold residential areas, and the microclimate of urban open space has gradually attracted the attention of planners and designers and has successively carried out relevant theoretical and practical research. Communication is a unique way of life for people. Communication is ubiquitous. From the ancient times to the present, at home and abroad, as long as there are people, communication is easy to occur. Wang and Sunaga [12] pointed out that the design of outdoor communication space in urban residential areas is more seriously affected by topography and regional climate compared with southern cities in cold cities like

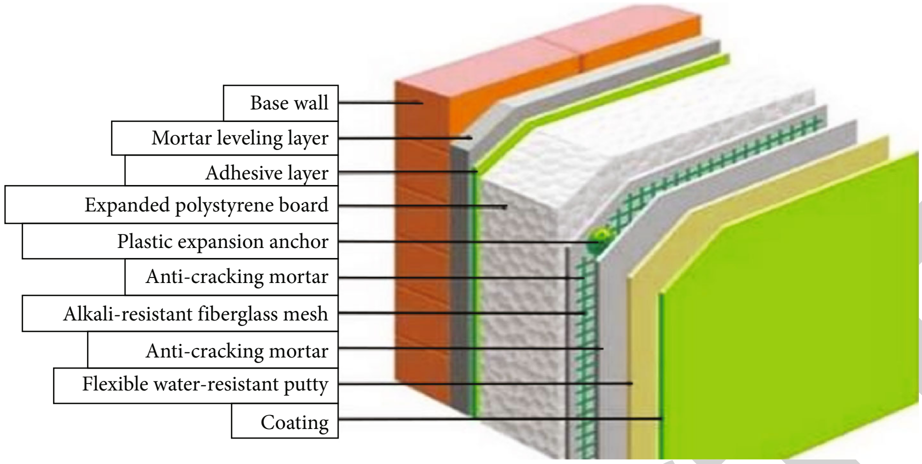
Yichun. Ascione et al. [13] put forward a series of planning countermeasures, such as creating semi-indoor space, paying attention to the demand of pedestrians in winter, improving the activity support of open space, and improving the monotonous landscape environment, in view of the planning and design of public space in cold regions. In the study on livability of urban environment in cold regions and the design countermeasures of urban squares in cold regions, Lah et al., starting from the seasonal characteristics of urban squares in cold regions, put forward countermeasures for climate protection and improving thermal comfort in terms of location selection, scale, spatial level, landscape type, and detail design of squares [14]. In reality, the quality of communication space does not affect residents' outdoor leisure activities, and the lack of design considerations has brought serious problems. For example, many facilities are scattered and seldom used. The outdoor environment of residential areas is not a simple patchwork and accumulation. Simões and Pierce [15] pointed out that the spatial pattern of a residential area refers to the objective expression of the regional characteristics in the urban style, which includes the location setting, functional layout, building arrangement, road system, and surrounding environment of the residential area. According to the five elements of urban design, such as path, area, edge, node, and landmark, Arán-Ais et al. [16] put forward the design countermeasures of outdoor public space in cold cities, such as adopting closed or semiclosed trail system and adopting asymmetric sidewalk design to improve safety and thermal comfort. Based on the software, Davies et al. [17] have made a lot of simulations on the microclimate environment of the block layer gorge; quantitatively analyzed the different plane, section, trend characteristics, and the influences of the underlying surface, green plants, and water bodies on the wind environment of the block; and put forward the corresponding technical countermeasures with the improvement of thermal comfort as the measurement standard. The relevant theories of outdoor thermal comfort are summarized. From the root of the formation mechanism of human thermal sensation, the various elements affecting the thermal environment are explored and summarized. At the same time, the outdoor thermal comfort evaluation software is launched by programming with VB software on the computer. Zhao et al. [18] put forward the concept of outdoor season based on this and believed that in the late spring to early autumn seasons of cold cities, people can achieve a comfortable state by increasing or decreasing clothes under natural conditions. Zhang et al. [19] put forward the concept of transition season on this basis. They believe that there is a transition season between winter and outdoor season in cold cities. Although the temperature is low, there are still a considerable number of citizens in sunny and windless weather conditions. Méndez-Abreu et al. [20] put forward a modeling method of building layout energy saving and comfort in cold areas based on greenhouse effect analysis and built a microclimate living environment under the building layout of cold areas. The indoor space greenhouse effect analysis method was adopted to improve the comfort experience of cold areas through energy saving and thermal insulation design, which has a good guidance. Kapsalis et al. [21] studied the interaction between ecosystem service function principles and circular economy from the perspective of interorganizational systems. Kanteraki et al. [22] explored how modern architectural designs can be applied to construction and domestication while following traditional construction methods and compared with buildings built and domesticated under bioclimatic architecture.

From March 2021 to July 2022, the author conducted research on the paper, taking Yichun as a representative of cold cities to investigate the residential area. The research methods include observation of outdoor activities of residents in the residential area, field survey of the site, visit survey of residents, and field photos. Through this research work, a large number of data about outdoor communication of residents in residential areas have been collected as the basis of this paper.

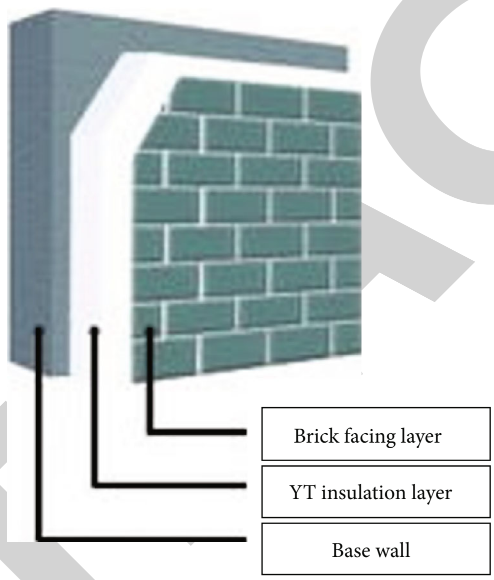
3. Methodology

3.1. Constrained Parameter Model and Energy-Saving Objective Function Construction. Through the optimized energy-saving design of building residential areas, carbon dioxide emissions are reduced, costs are reduced, and benefits are improved. The energy-saving and comfort modeling of building layout in cold residential areas analyzed in this paper mainly includes the following aspects: (1) sunlight and sunlight collection [23]: in the layout of buildings in cold regions, the indoor light environment of buildings is an important condition to ensure the constant temperature in the buildings, and a good light environment can also protect human health and improve comfort. Therefore, in the building layout energy-saving and comfort modeling of cold regions, it is necessary to optimize the brightness distribution to avoid damp and cold. (2) Selection of building insulation materials [24]: the thermal insulation material can collect excess heat and release it in a timely and stable manner to avoid condensation, mildew, and peeling of the building. In the selection of building thermal insulation materials, the building thermal insulation materials designed in this paper select organic matter as the base of the main wall, which has excellent adhesion [25]. (3) Temperature problem: in the living environment, in cold regions, temperature is an important indicator that affects human comfort in buildings. Building layout in cold regions requires energy conservation and comfort modeling to achieve energy conservation and environmental protection in addition to ensuring the overall thermal balance of the human body. The selection of thermal insulation materials and the description of thermal insulation wall design for the energy-saving model of building layout in cold regions designed in this paper are shown in Figure 1.

Parametric design is an important method of serialized product design, which is one of the key technologies of the new generation CAD system. Many scholars have done a lot of exploration work in theory and practice and achieved a lot of results. At present, the main research methods are variable geometry method and knowledge-based reasoning method. Based on process construction method and



(a) Insulation material structure



(b) Thermal insulation wall

Figure 1: Selection of thermal insulation materials and design of thermal insulation walls in building energy-saving models in cold regions.

constraint propagation solution method, these methods focus on the representation and solution of constraints. Although the implementation of the constraint model is also described, it is not unified with the constraint representation model, and a constraint representation model in line with the programming theory is given. And these parametric design methods are general methods for general fields. Finding a parametric design method that can be applied to all industries, even if it is possible, requires long-term research. This paper uses object-oriented theory to analyze geometric constraint system and uses classes to represent primitives and constraints. The class hierarchy of the system is established, and an object-oriented parametric representation model of directed hypergraph is proposed. This model has the advantage of directed hypergraph, and it is easy to implement with object-oriented programming method. This method applies object-oriented technology throughout the whole process of system analysis, modeling, and implementation and has the characteristics of high efficiency and reliability. And the system is easy to expand and modify, especially suitable for parametric CAD system modeling and program implementation of serial products in a specific industry. The implementation scope of economic energy conservation is oriented to the whole society, and the implementation objects are industries. This paper mainly studies and discusses the methods of building energy-saving target system in the macro field from the perspective of economic energy conservation. It provides calculation methods and analysis tools for scientifically and reasonably decomposing the target of reducing energy consumption per unit of GDP to relevant departments.

In the modeling of energy saving and comfort of building layout in cold area, given the multilayer quantitative information level of building layout in cold area, such as illumination, temperature, humidity, green vegetation, and heating, they are, respectively, recorded as $U_1, U_2, \cdots, U_n$.

Use $P(s_1), P(s_2), \cdots, P(s_n)$ to describe the light intensity fluctuation data of buildings in cold regions. When the judgment conditions are $h_1 > 0, h_2 > 0, \mu_1$ and μ, the correlation of evaluation indicators such as light intensity and humidity of buildings in cold regions can be calculated by $(a_1, a_2, \cdots, a_n)$ and $(t_1, t_2, \cdots, t_3)$; the modeling parameters $d_1(t)$ and $d_2(t)$ for building layout energy saving and comfort in cold regions have accompanying characteristic stability, and the multidimensional search iterative equation of the information parameter is described as follows:

$$\begin{aligned} u^{(n+1)}(x, y) &= u^{(n)}(x, y) + \delta u_1^{(n)}(x, y), \\ u_1^{(n)}(x, y) &= M\Delta_s u^{(n)}(x, y) + N\Delta_t u^{(n)}(x, y ; d). \end{aligned} \tag{1}$$

There are Ω matching pairs of light intensity in residential areas, and the oxygen release of green vegetation is $E \in \gamma(s)$, which forms a vector space in building zoning [26]. The heating quantity $AB = V$ of buildings in cold residential areas is a unilateral detection function. When $AB = V$, $AB =$, the heating edge set A converges in a finite field, and we get

$$\begin{aligned} D(C_1, C_2) &= \begin{cases} \text{true if } D\,\text{if}\,(C_1, C_2) > M\text{Int}(C_1, C_2), \\ \text{false otherwise}, \end{cases} \\ M\text{Int}(C_1, C_2) &= \min\,(\text{Int}(C_1) + \tau(C_1), \text{Int}(C_2) + \tau(C_1). \end{aligned} \tag{2}$$

Based on multiparameter autoregressive analysis, the characteristic function of heat distribution of building layout in cold area is calculated, which satisfies

$$\varphi(\omega) = E\left[e^{j\omega X}\right] = \begin{cases} \exp\left\{j\mu\omega - |a\left[1 - j\beta\,\text{sgn}\,(\omega)\,\tan\left(\dfrac{\pi a}{2}\right)\right]\right\}, a \neq 1, \\ \exp\left\{j\mu\omega - |a\left[1 + j\beta\,\text{sgn}\,(\omega)\dfrac{2}{\pi}\,1n|\omega|\right]\right\}, a = 1, \end{cases} \tag{3}$$

where $n = 1, 2, T$ represents the area number of residential buildings and $\text{VI}\,(x)$ is a k-dimensional lighting intensity state matrix. Through the above analysis, the energy-saving objective function is constructed, and the comfort modeling is realized by seeking the optimal solution of the objective function.

3.2. Comfort Simulation of Open Space in Cold Residential Area. In the above-mentioned parametric model analysis, through the optimal design of the buildings in the cold area, the comfortable experience and feeling of the residents in the severe cold area are increased, and the concept of energy saving, environmental protection, and green buildings is effectively advocated. Aiming at the disadvantages of the traditional model, this paper puts forward a design method and modeling scheme of building energy-saving layout in cold residential areas based on hierarchical integration of building divisions and feature extraction of energy-saving contribution parameters [27]. This paper analyzes the influencing factors of building energy conservation in cold areas, such as solar energy, heating, thermal insulation effect of thermal insulation wall, and temperature and humidity [28]. In the existing research on the design of building energy-saving system, most of them focus on the analysis of the effect of a single factor [29]. There is no comparative analysis of the importance of various factors on residential energy consumption [30]. There is no research on the effect of energy-saving design based on residential system in combination with the existing actual situation in China, especially the meteorological conditions. It has little guiding significance for residential energy conservation in China. Therefore, in this study, the energy-saving characteristics of various factors in the residential system are different [31]. Therefore, by comparing the energy consumption of residential buildings with different characteristics, we hope to find the relevant factors affecting residential energy consumption and their importance and their overall impact, that is, the energy-saving effect [32]. According to the carbon dioxide emission of energy consumption as the test target parameter, the contribution weight function of building optimization and energy conservation in cold areas is constructed as follows:

$$S(x) = \sum_{i=1}^{N} v_i(x)\nabla^2 v_i(x), \tag{4}$$

where $n = 1, 2, \times n$, $\text{VI}\,(x)$ is a k-dimensional random variable, and the influence weight factor matrix of light, temperature, and humidity $Q_1 \geq Q_1 \geq 0$, $p > 0$, $R_1 \geq R_1 \geq 0$, $Z_1 \geq Z\,\Lambda > 0$, and $Z_3 > 0$. According to the above analysis, in the architectural design, the contribution weight coefficient matrix of thermal insulation materials to building energy conservation is obtained by using the thermal insulation materials of the platform, female wall, and wall surface of the main building as follows:

$$\begin{aligned} K &= \left[K_1^T K_2^T K_3^T K_4^T K_5^T\right]^T, \\ P\left(\gamma_{w3}|x_{w3}, \theta, \beta\right) &= \frac{1}{Z(\beta_i)} P(\gamma_{w3}|x_{w3}, \theta)(\gamma_{w3}|\beta_i), \end{aligned} \tag{5}$$

where $Z(\beta_i) = \sum_{\gamma_{w_3}} P(\gamma_{w_{w_3}}|x_{w_3}, \theta(\gamma_{w3}|\beta_i)$ is the gray statistic value of building energy-saving and comfort modeling indicators for building layout in cold regions. The fitness evaluation formula for building layout energy-saving and comfort modeling in cold regions is

$$P\left(x_{w_3}, \gamma_{w_3}|\Theta\right) = \prod_{x_i \in w_3} \prod_{k=1}^{K} a_k g\left(x_{ij}, \gamma_{ij}|\mu_k, \sigma_k^2\right). \tag{6}$$

In the above formula, θ is the lighting characteristics of sunlight, μk is the adsorption amount of carbon dioxide by building layout energy-saving and comfort modeling in cold regions in different time periods, and αk is the control coefficient of sunlight lighting in the planning and design of communities. Through the design, this paper optimizes the architectural layout of cold residential areas and improves the energy saving and comfort of residential areas, as shown in Figure 2.

The test site is located on the east side of Shenzhen Road and on the north side of Xing'an Street, with a total construction area of 210,946 square meters and a plot ratio of 1.70. There are 7 six-storey residences and 5 18-storey residences, which were delivered on 2017-01-01. The overall plan of the community planning is shown in Figure 3.

The field test needs to measure the hourly temperature, humidity, and wind speed of each measuring point within 3 days, so the measuring instruments are mainly those that measure microclimate data. The purpose and measurement accuracy of the instruments used in the experiment are shown in Table 1.

This experiment adopts the method of flow observation and records the air temperature, relative humidity, and wind speed at the pedestrian height (1.5 m above the ground) of each measuring point every half hour at different positions of the open space, including the center of the open space, the entrance and exit positions, the shadow areas of buildings, near the water surface, and near the structures. Explore the influence of main building height, D/H ratio, open space scale, underlying materials, entrance and exit orientation, and other factors on the thermal comfort of open space.

4. Result Analysis

A total of 11 test points were arranged in the test site to explore the impact of building height, d/h ratio, open space scale, entrance and exit orientation, and other factors on the thermal comfort of open space. In addition, the observation data from the satellite ground station of Yichun Meteorological Bureau are obtained, which can be used as the comparative data of experimental tests. The weather station is located at 45.75° north latitude, 126.46° east longitude, 1264.6 meters above sea level, and about 10.1 kilometers east-south of the experimental plot. The location of the weather station is in line with the regulations of the International Meteorological Organization, and its observation data can represent the macrometeorological conditions of Yichun City. The temperature of the testing place is recorded every half hour by a multifunctional environmental tester. Here, the temperature test results of representative measuring points 2, 4, 5, 6, 7, 9, and 10 at different times are compared and analyzed by a line chart, and the test results are shown in Figure 4.

It can also be seen from the figure that the highest temperature in three days occurred at 11 : 30 on April 12th, measuring point 9, and the temperature value of measuring point 9 was almost the highest among the measuring points. It may be because measuring point 9 is located outside the shadow area of the building, and it is wrapped by a large area of evergreen coniferous trees, which has a certain advantage over other measuring points in resisting the cold wind. This may also be the reason why the temperature curve of measuring point 9 changes more gently than other curves. In contrast, the curve with the temperature test value at a lower level is that of test point 7 and test point 10. Compared with the temperature test values of test point 6 and test point 9 in the nonshaded area, the temperature difference is about 1°C, and the higher the average temperature is, the closer the time is to noon, the greater the temperature difference is. The shadow of the visible building affects the absorption of solar radiation at the measuring point and causes the temperature value to be lower than the average level of the open space. The manual observation results of each measurement point at the test site are shown in Figure 5. The wind speed value of each measurement point does not have strong regularity like temperature and humidity but shows strong randomness.

The determination of initial boundary conditions is divided into two parts. In the first part, the meteorological data of local meteorological stations are used as the simulated comfortable boundary conditions. The meteorological data include air temperature, wind speed 10 meters above the ground, wind direction, relative humidity, and absolute humidity. The meteorological data comes from the data of Yichun Meteorological Data Platform on April 12, 2021. In the second part, the modified microclimate data of the actual open space is used as the secondary boundary condition. The second boundary condition is modified because the data of macrometeorological station cannot fully represent the simulated microclimate data in open space. After the initial simulation test and the wind direction frequency in the hot and cold alternate seasons, the initial boundary conditions of the simulation are determined. After the verification of the onsite measurement, the initial simulation conditions are consistent with the actual situation, so the initial air temperature is further determined to be 276.15 K (the average measured in three days), and the wind speed 10 meters above the ground is 4.05 m/s (the average speed of the meteorological station in three days), the wind direction is 315° (that is, the northwest wind direction, combined with the specific wind direction of the day and the prevailing wind direction in spring), the relative humidity is 40.5% (the average air relative humidity at 8 : 00 in the morning within three days), and the heat transfer coefficient of the building exterior wall is 1.7 W/㎡ K; the albedo is 0.3, the heat transfer coefficient of the building roof is 2.2 W/㎡ K, the albedo is 0.15 (gray hard pavement), and the indoor temperature is set to 20°C (the average room temperature in Yichun). After the simulation test, it should be verified and corrected according to the comparison between the simulation results and the measured results, so as to obtain the secondary boundary conditions used in the actual simulation. After the initial simulation test and the wind direction frequency in alternate hot and cold seasons, as shown in Table 2, the initial boundary conditions of simulation are determined.

The initial wind speed and wind direction are fixed; that is, the wind speed and wind direction entering the open space from the external environment are constant; while the actual measured wind speed has certain transient and contingency, the record of the wind speed takes the maximum wind speed within one minute, and the wind speed and wind direction are gradually changed. And there are instantaneous maximum wind speeds that are much higher than the average wind speed. Even so, from the practical significance of scientific research application and simulation, hourly simulation of the instantaneous wind environment

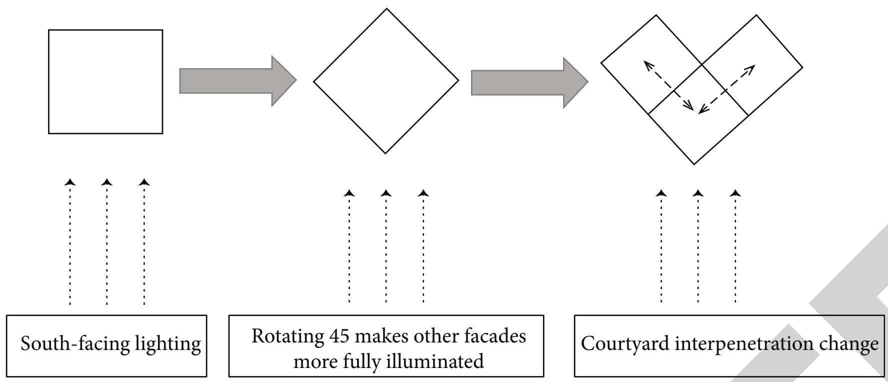


Figure 2: The building layout of the improved cold area.

Figure 3: Floor plan of Songyun City community at the test site.

Table 1: Instruments and accuracy used for on-site testing.

Measuring instrument	Instrument accuracy	Measurement parameters
American TSI9555-P multifunctional environmental tester	Temperature 0.1°C, wind speed reading ± 1%, humidity ± 3% RH	Humidity, temperature, wind speed
KANOMAX 6004 handheld digital anemometer	±(Indication value 5% + 0.1) m/s	Wind speed
Testosterone415 anemometer	Temperature 0.1°C, wind speed ± (0.05 m/s)	Wind speed, temperature
Laser rangefinder	0.05 m-60 mI ± 1.5 mm	Distance
WBGT2006 wet bulb black bulb temperature index meter	20-40°CI ± 0.5°C	Mean radiant temperature

in open space is of little significance for optimizing the thermal comfort of open space, and simulation of the average wind speed in open space is more beneficial for optimizing design.

5. Discussion

This paper will creatively expand the "current situation" mentioned in its analysis and put forward its own suggestions, design, and manufacturing measures to enhance the novel features of its analysis. And make its research results more widely applicable to similar weather and geographical morphological characteristics around the world. This kind of question involves the construction industry, which has two aspects:

(a) One dimension refers to the improvement of building materials, which belongs to bioclimatic building design, gypsum mixture and natural agricultural biomass residue (fiber) and/or mortar of gypsum and aerosol film, so as to reduce the loss of thermal bridge; improve the performance of heat insulation, sound insulation, and waterproof; and avoid the

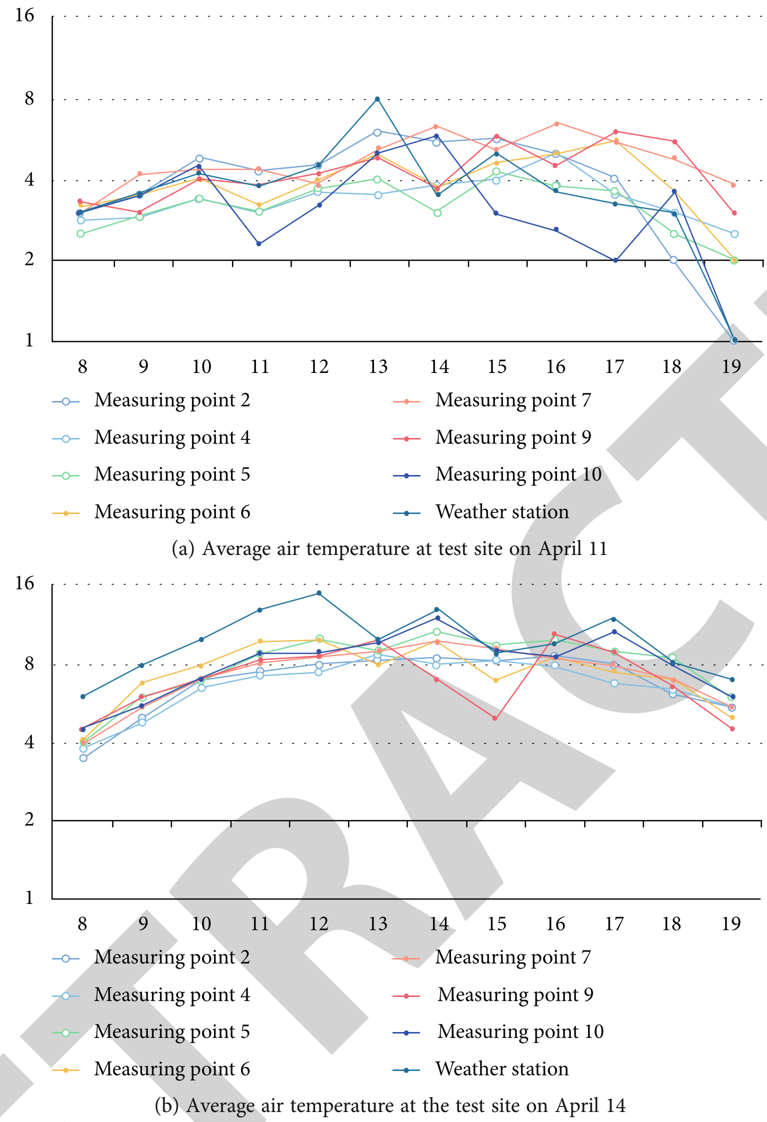


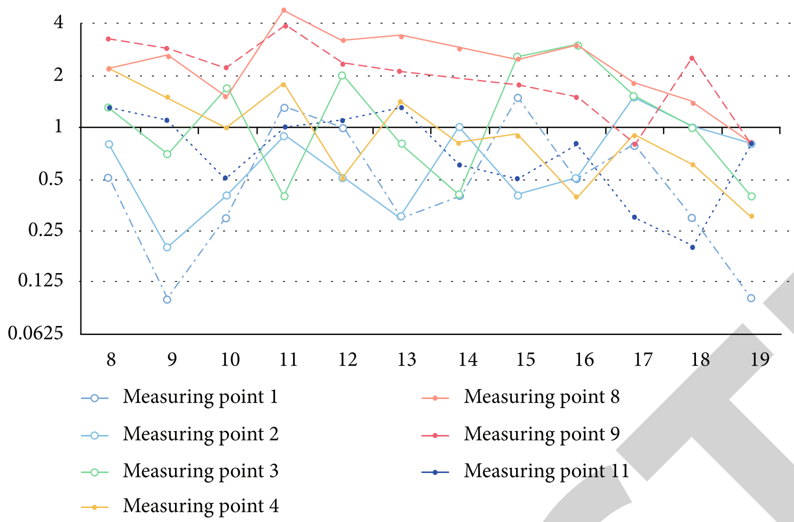
Figure 4: Average air temperature of each measuring point at the test site.

infiltration of water in its fractal structure. Other advantageous properties include higher resistance to temperature fluctuations and fracture, as well as better mechanical, hydrogen, and physical behavior (tensile and compressive stress) through solar radiation aging and humidity events

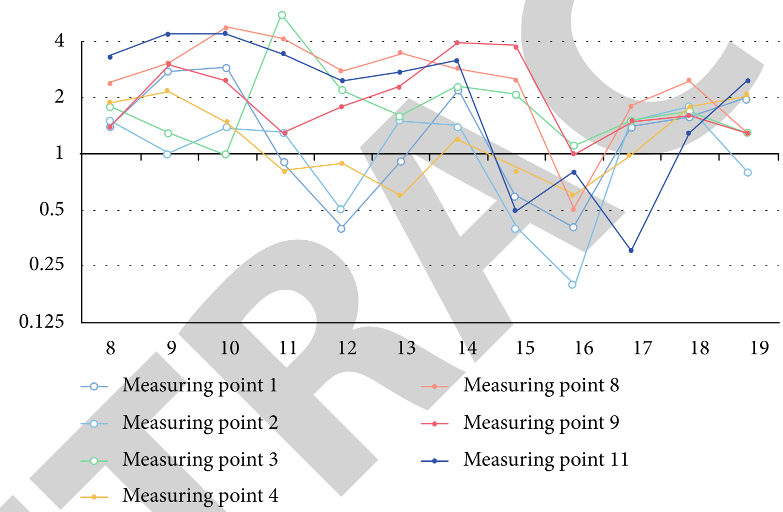
(b) Another aspect is the improvement made in the principle of circular economy, that is, recycling and reusing, rather than disposal of building demolition degradation substances, for the second round of use (to avoid the direct retirement of debris substances for natural and water resources, so as to make the local environment bear the burden of environmental pollutants)

6. Regional Studies

The annual average temperature in Yichun is -4-9°C. The average temperature during the day is 9°C. It is recommended to wear suits, jackets, windbreakers, casual wear, jackets, suits, thin sweaters, and other warm clothes. At night, the average temperature is -4°C. It is recommended to wear cotton padded clothes, winter coats, leather jackets, tweed coats, woolen hats, gloves, down jackets, leather jackets, and other heavy warm clothes. The cities with the highest annual average temperature in Yichun are Tieli (9°C), Wuying (8°C), Wuyiling (7°C), and Jiayin (7°C). The cities with the lowest annual average temperature in Yichun are Wuyiling (-7°C), Yichun (-7°C), Wuying (-δ°C), and Jiayin (-6°C). Yichun is located in the Tangwang River Basin in the hinterland of Xiaoxing'an Mountains in the northeast of Heilongjiang Province, China, from 46° 28′ to 49° 21′ north latitude and 127° 42′ to 130° 14′ east longitude. It is adjacent to Hegang and Tangyuan in the east, Qing'an and Suiling in the west, Yilan and Tonghe in the south, and Xunke across the river from Russia in the north. Yichun, with a cold temperate continental monsoon climate and cool summer, is a good place for summer vacation. In winter, the



(a) Average wind speed at each measuring point on April 11



(b) Average wind speed of each measuring point on April 14

Figure 5: Average air temperature of each measuring point at the test site.

Table 2: Meteorological data of Yichun City from 7 : 00 to 8 : 00 on April 12, 2021.

	8 : 00	9 : 00	10 : 00	11 : 00	12 : 00	13 : 00	14 : 00	15 : 00	16 : 00	17 : 00	18 : 00
Air temperature (°C)	3.2	5.1	6.8	6.5	8.9	6.8	9.5	8.5	9.3	8.1	7.5
Wind direction	338	310	286	336	360	286	350	256	214	362	265
Wind speed (m/s)	64	50	45	46	52	32	33	38	35	32	56

world wrapped in silver will definitely make you feel worthwhile. Yichun is rich in forest tourism resources, with a forest coverage rate of 82.2%. It has the largest and best preserved Korean pine virgin forest in Asia. Wuying Fenglin Nature Reserve and dailing Liangshui Nature Reserve have been approved by UNESCO to be included in the world network of man and biosphere reserves. Wuying National Forest Park has been rated as a national AAAA tourist area. In the forest sea of Xiaoxing'an Mountains, the biological community is rich and diverse, with more than 1000 kinds of wild animals and plants distributed, and Taoshan Forestry Bureau has built the first open wild animal breeding and hunting ground in China. Landscape: Fenglin national Korean pine primeval forest nature reserve, Taoshan International Hunting Ground, Wuying National Forest Park, Tangwanghe Stone Forest, Jiayin Maolan valley scenic spot, dragon bone mountain dinosaur fossils, Meixi Huilong Bay, Anti-Japanese Alliance site, etc.

This section focuses on the microclimate simulation analysis of the residential open space. The development of urban high-rise buildings is in a blowout mode. The development and construction of high-rise buildings are closely related to urban landscape and urban space. High-rise buildings internalize and privatize urban space. The three-dimensional and compressed urban space changes the sunshine, wind direction, and humidity of the surrounding environment, forming a unique microclimate in the interior of high-rise buildings. Firstly, the scientificity of the environment numerical simulation software is verified. The peripheral residential open space is taken as the research object, and the reasonable grid simulation size and initial boundary conditions are set. Then, the design factors such as d/h, east-west building length, opening position, underlying surface materials, and water distribution are quantitatively simulated. The relationship between the design factors and the proportion of open space is obtained. On this basis, the optimization strategy of active area, opening position, space proportion, plane enclosure, underlying surface, and water layout is put forward.

7. Conclusions

This paper takes the residential area of Yichun City as the research object, finds the problems existing in the communication space through investigation, and studies the outdoor communication space in the residential area suitable for the cold city of Yichun. The results of the investigation and analysis on the public open spaces of typical residential areas in Yichun City show that the outdoor activities of the respondents in the transition season are closely related to the microclimate environment. This paper gets some planning enlightenment from the survey results of climate comfort in transition season, which is used to improve the climate comfort of cities in cold regions in transition season and promote the livable construction of cities in cold regions. Through the optimization design of building layout in cold residential areas, the energy saving and comfort of living environment are improved, the satisfaction evaluation of building layout energy-saving and comfort modeling in cold residential areas is improved, the resource conservation and utilization are realized, and the living comfort experience is improved. The outdoor communication space in urban residential areas does not simply refer to the space for communication and exchange but builds a comfortable and pleasant outdoor communication platform for people through outdoor exercise, leisure, entertainment, recreation, consumption, and other activity spaces; provides people with more opportunities for outdoor diplomacy; and extends the time of outdoor communication. First of all, the research of this paper is based on the field investigation and research on more than a dozen different distribution and different scale settlements in Yichun, on the basis of interviewing and analyzing the behaviors, preferences, and needs of different groups of people, combined with the corresponding domestic and foreign theoretical knowledge. Through the research, the design theory of the outdoor communication space in the residential area of Yichun cold land is obtained. Through the research of design principles, design strategies, and design methods, the theory of outdoor communication space design in urban residential areas in cold areas of Yichun can be actively and beneficially applied to practice reflecting certain operability, not just staying on the surface of words, which is beneficial to the overall improvement of the living quality of residential areas in Yichun.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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