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The Green Ecological Environment in Shanghai Free Trade Area

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ABSTRACT

As one of the key cities in the largest developing country, Shanghai has already been an international city around the world, and its economy has increased at two-digit speed for thirteen years consecutively. The construction of Shanghai Free Trade Zone has the ability to promote the opening of service industry, to accelerate financial reform, to update foreign trade, to simplify administration as well as to promote China's economic structure transformation. However, the rapid economic development has brought about great challenges to the ecological environment, therefore, to create a good urban ecological environment is not only a pursuit of human beings, but also an important part that is related to human existence, social development and economic system reform, and which is the most direct embodiment of the principle of "people-oriented". This paper aims to provide reference for the development of Shanghai Free Trade Zone and the creation of urban ecological environment.

INTRODUCTION

China's free trade test area is located in Shanghai. It was set up by the Chinese government as a regional free trade zone belonging to the scope of China's Free Trade Areas (Fig. 1). The State Council approved the test area on August 22, 2013, and at 10:00 am on September 29 it officially opened. The government hopes that the Shanghai FTA will allow it to become a testing ground for a new era of the Chinese economy. It includes the implementation of changes to government functions, financial systems, trade services, foreign investment and taxation policies, as well as a number of reform measures. It also vigorously promotes Shanghai transit from shore development business.

The test area is 28.78 square kilometres, equivalent to 1/226 of Shanghai's total area. It covers the Shanghai Waigaoqiao Free Trade Zone (core), Waigaoqiao Bonded Logistics Park, Yangshan Bonded Port and Shanghai Pudong Airport Comprehensive Bonded Zone, as well as four other customs supervisions, known as the "four zone three harbour" FTA pattern.

Waigaoqiao Free Trade Zone and Waigaoqiao Logistics Park are located on the Yangtze River Estuary, adjacent to the first town of Gaoqiao Yangtze River. This location is across the Yang High Road less than 10 km from the city centre of Wujiaochang. A 15 km drive along Zhangyanglu provides direct access to the Lujiazui financial district, and the Bund in about 25 minutes.

Shanghai Pudong Airport Comprehensive Bonded Zone is adjacent to the Pudong International Airport and Shanghai Disneyland to be built about 10 to 15 kilometres away, and about 50 kilometres from the Shanghai area. The S20 switch from the outer ring into the city can be used to reach the city centre.

This is not only a free trade zone located in Shanghai, but is also China's first free trade zone in mainland China, while Shanghai will also bring decades of development dividend to the Shanghai city into a world basis.

Shanghai Urban Construction as the Condition of the World Analysis

The focus shifted to the world economic growth in East Asia: In the fourth long wave in Japan and the East Asian "tigers" of economic take-off has become one of the world's new economic centres. Currently, countries and regions are being affected by the continuous appreciation of the yen, and the impact of rising labour costs, among other factors that are being implemented in the industrial structure adjustment and transfer. This has brought rare opportunities for China's economic development, providing China with the largest economic growth as one of the highest in the world. Therefore, Shanghai's development has provided a powerful stimulus to China becoming an international economic hub.

Shanghai has a long history of opening: The rise of Shanghai as a port city and opening economy began 700 years ago. After the Opium War, Shanghai was the first city in China to open to the world and is also the fastest growing. Many scholars aim to explore the relationship between East Asian countries and regional economic development with historical background and culture. Hong Kong and Singapore, which are the city's development context of the emerging world to see, integrate Eastern culture and Western culture in many ways. Shanghai also has this feature, along with its unique culture. In the course of Shanghai's international market development, the traditional and cultural characteristics may have a potential impact that cannot be ignored.

Shanghai has a multi-level hinterland, other cities do not have: The formation and development of the world economy in the hinterland of the city has a close relationship, and is often multi-layered. In the hinterland of the multi-level aspects, Shanghai has unique advantages that other cities do not have. Shanghai is the first level in the hinterland of the Yangtze River Delta. Shanghai and Jiangsu and Zhejiang with 13 cities compose the whole area of nearly 100,000 square kilometres, with a population of 72.4 million (1992), the equivalent of the population of Germany. The second level is the heart of Shanghai, Jiangsu, Zhejiang and Anhui provinces, with a total area of 340,000 square kilometres and 170 million residents. This area is close to the size and more than the population of nearly one-third of Japan. The population size has a great potential for growth and is sufficient to support the development of Shanghai as a world-class city. The third level is in the heart of Shanghai across the Yangtze River Basin, an area of 1.8 million square kilometres and a population of nearly 400 million. While in some areas upstream actively open up new foreign channels, but with Shanghai's long-standing economic ties will continue.

Shanghai industrial restructuring has been noticed: It is reported that the Shanghai FTA establishment ushered in "the age". According to market transaction data, FTA plate prices rose by almost twice the average increase of the city. The concept of the real estate market in the region has played a significant positive effect.

The first anniversary of the Free Trade Area, according to real estate market research, monitoring data shows that: As of now, by the FTA direct radiation plate (Waigaoqiao, I wish Bridge, Harbour City) transaction price was 24,992 yuan this year/sq m, the average transaction price of the FTA before the inauguration was 20,987 yuan/sq m and rose 19.1%. We can see that the city's commercial housing rose 10.7 percent and the average FTA price almost doubled.

FTA radiation from the plate, the Waigaoqiao and I wish bridge plate prices rise very significantly, were maintained at two percent, while the price of Harbour City, it was an accidental fall. Waigaoqiao to high-end residential, a collection of a lot of high-quality housing in radiation FTA, the price rose significantly, as Senlan Jiayuan name plate inside. This year's average transaction price of 28,927 yuan/sq m is an increase of 12.9% from last year. The name of the disk plate inside Senlan Villas Yanlord recorded a year contract price of 44,296 yuan/sq m, an increase of 7.9% from last year.

The FTA in Shanghai allowed for a property market boom. In this article, we study the Shanghai Free Trade Area. The simulation model of the FTA summer thermal environment was used through digital technology to provide some reference for the future of Shanghai's urban planning and spatial development layout. In this study, we use the research tools Air-pak software and Ecotect software.

Analysis of Weather Conditions in Shanghai

For the Shanghai FTA summer urban heat environment simulation, we must first study the climatic conditions of a typical summer in Shanghai and the simulation of the initial conditions. Shanghai is located at latitude 31°14' N, longitude 121° 29' E, at the forefront of the Yangtze River Delta, and East China Sea (Fig. 2). The typical characteristics are, hot summer and cold winter climates, with high humidity in warm months. Due to the high humidity, the human body has difficulty in discharging heat through sweat. This is also a major cause of summer urban poor thermal comfort. The Ecotect software analysis is according to the annual Shanghai temperature, solar radiation, thermal comfort maps (Fig. 3). From the figure, we can learn the year's most direct solar radiation. Strong values appear in May while the highest temperature was seen in June. The average temperature was the highest in July, with an average maximum temperature of 28°C. Therefore, the simulation time we chose was the highest average temperature in July in Shanghai, i.e., on July 6 at noon (10: 00-14: 00). This measured the wind, the wind frequency, and wind speed distribution. From the Fig. 4, we can see that the July afternoon has southernly wind to the southeast and southwest. The highest wind speeds were up to 50 km/h, with an average wind speed of 15 km/h. According to Ecotect statistics, in order to facilitate the simulation, we simulate the time when the wind at the south east reaches 15 km/h, at a temperature of 28°C.

The Establishment of CFD Models

After the initial conditions of the external environment are set up, the complexity of the city is transformed into a digital model where CFD software can be calculated. The city is an extremely complex object and a collection of a variety of information. To include all of the information reflected would be a very arduous task. Therefore, with the city established CFD model, we consider only the main urban thermal environment-related information. The different regions have the same attributes to consider. In accordance with the existing urban fabric, to simplify the boundaries of the city

Fig. 1: China Shanghai free trade experimental area map.

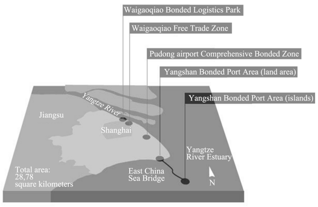

Fig. 2: Location diagram.

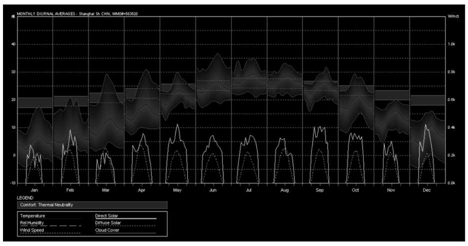

Fig. 3: Shanghai annual temperature, solar radiation, thermal comfort maps.

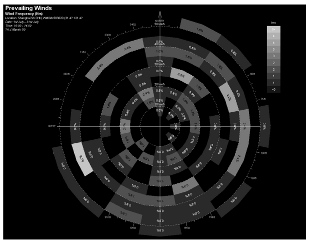

Fig. 4: Shanghai July afternoon wind direction, wind frequency, wind speed map.

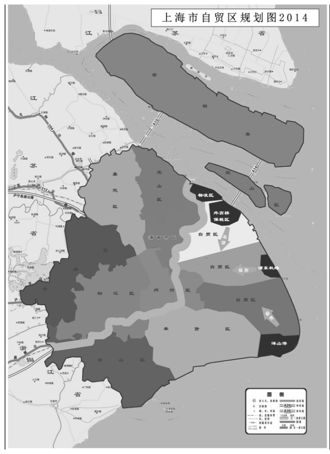

Fig. 5: Shanghai FTA function zoning map.

to the county, the city is divided into multiple zones (into blocks), and each region is according to its land property, building density, floor area ratio, and the green rate gives the corresponding attribute. Fig. 5 is a functional area of Shanghai FTA. The layout of the public space is shown as "a master of four" and "one Lord". It refers to the Free Trade Area of Shanghai. "Four" refers to the distribution of the four deputy surrounding municipal centres (including logistics area, Waigaoqiao Free Trade Zone, Pudong International Airport, Yangshan Port). This is typical of regional building density, and the volume rate flow of people-intensive. Behind the establishment of the CFD model, it will be based on characteristics to determine the appropriate attributes (Yang 2010, Christof et al. 2008).

In establishing the CFD model, according to the findings of some scholars, under normal wind speed conditions the effect of 100 m below the plenum is not obvious. Only when the ventilation channel has a width around 150 m the effect is obvious and able to achieve a more satisfactory ventilation heat effect (Yuan et al. 2007). Thus, since the Suzhou River and other rivers flow width is too narrow, they will not to be considered in modelling. In green terms, 120 m × 120 m (i.e. an area of 1.44 ha) area of green space reduces the surface temperature of the most significant ecological functions. In the city, there are various conditions, such as main roads, landscaping and water for boundaries that can be used to divide the different region plots (i.e. the model block). It is important to take into account the size of the building density in different areas, the floor area ratio, green rate, population digital model density, and other calculation factors of the simulation process that may exhibit different characteristics (Powell et al. 2007). The whole FTA is divided into five grades, followed by the regional level-primarily FTA Pudong New District, which is Nanhui District; second region - Pudong Airport; third region -Waigaoqiao Bonded Logistics Zone; fourth region- Yangshan Port; fifth region-within the city's main river (Huangpu River, the Yangtze River). The area grading process is according to the building density in the region and is closely related to the urban heat environment, floor area ratio, green rate, population density and other factors, such as the average of the parameters of this land, and mainly in the block in the region acceptance of solar radiation. Wind effect size is a standard, the whole region from the five regional levels, building density within its area, floor area ratio, population density in descending order is also important. Followed by a long green rate is high, due to the river (Huangpu River) to act as a role in an airy corridor, and the water system due to evaporation is greater than the green, it is greater than the heat absorbed by the green, so the water system ranked fifth (Lu et al. 2006, Weng et al. 2004). The level determined after the completion of the mesh, should be divided. The mesh generation for computational accuracy and stability of the quality has a great impact. The strength of the mesh generation capability is also an important factor in the commercial CFD software performance measure. This model uses unstructured grid meshing. The divided grid includes a variety of shapes, which can maximize the complexity of the urban surface shape shown to improve model simulations of the effect (Fig. 6). The unstructured mesh topology without the boundary shape restrictions domain structure is very convenient. It also helps to generate adaptive meshes that can automatically adjust the flow field characteristics according to the mesh density, and can effectively improve the accuracy of the entire region.

All levels of the area (block) provide the corresponding attributes based on the actual plot indicators. Specifically, the number of parameters to set the model throughout the simulation is the most critical step. For the area of the city in different levels, a whole block model is used for considering the extent of its influence by the size of the solar radiation and wind. Respectively, building density, floor area ratios, green rate, and population density, among others, are used in a block of attribute parameters. The fifth region (Huangpu River, the Yangtze River), and regional properties (block type) are set to a fluid (Fluid), and fluid material (Fluid material) to water (H_2O). Because of its solar radiation generated by evaporation, the above block is needed to set the same surface area of its upward exhaust outlet (opening) based on the measured data. The initial temperature of the air was set to 25°C. One of the four regions (Yangshan Port), due to the thermal radiation, is significantly less than the vegetation on building surfaces, with a relatively large heat capacity. Latent heat storage capacity is greater than thermal. To improve the urban thermal environment on the property of the hollow block (Hollow), the initial temperature was set at 26°C. For second, third regions, due to warehousing, logistics-based, compared to the regional level, the flow of people is relatively small, and generally have a higher internal greening rate, block attributes hollow, made of brick (Brick), the initial temperature was set at 30°C. For the region with the flow of people, because it is the most concentrated area, building density is the largest model using (Solid) cement material and the initial temperature is set to 40°C (Dong et al. 2014, Sugawara et al. 2011). In the specific material properties, such as reflectivity of solar radiation, heat absorption depending on the circumstances, may be further provided. After the property is set to complete, the external environment must be set up, mainly with solar radiation and wind environment. According to the wind in Shanghai in July, Ecotect software determined the wind speed, and average temperatures around the opening of our room accordingly. The settings simulate a typical July afternoon wind environment and in terms of solar radiation, the latitude and longitude in CFD are set in Shanghai. The time is set for July 15 at noon, the sun enters the coefficient set to 1.0, and

Fig. 6: Shanghai FTA CFD meshing digital models.

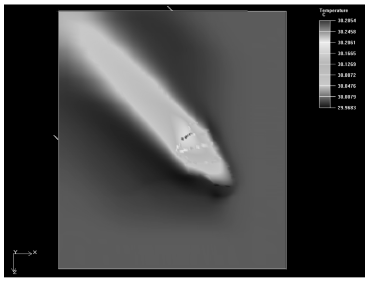

Fig. 7: Shanghai FTA over the temperature profile (8 m height).

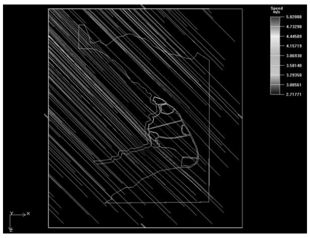

Fig. 8: Shanghai FTA wind flow over the chart (8 m height).

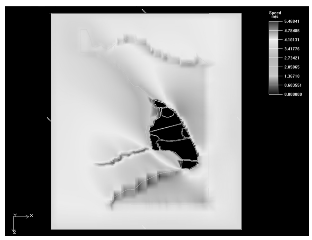

Fig. 9: Shanghai FTA wind speed plan.

the reflectivity of the ground is set to 0.2. In terms of air flow patterns, set turbulence (Turbulent) of RNG model, atmospheric pressure is set to a standard atmospheric pressure (1.013×105 Pa).

The Thermal Environment Simulation Results Shanghai FTA Analysis

Through simulation, in the Air-pak software, we can determine the FTA in Shanghai in July midday (10: 00-14: 00) under typical weather conditions, temperature, wind speed, solar radiation and air distribution. We can also analyse the results of these simulations through comprehensive comparison, and conclude a free trade area between Shanghai and the layout of urban planning and urban climate relationships. From the temperature distribution graph (see Fig. 7), we can clearly see the temperature distribution in the southeast of the dominant models urban wind effects (Wong 2013,

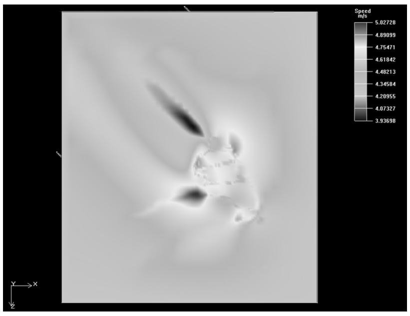

Fig. 10: Shanghai FTA wind speed plan (8 m height) over the.

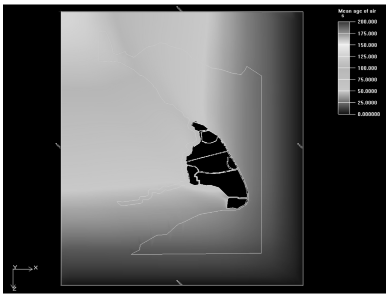

Fig. 11: Shanghai over the age of air FTA map.

Rizwan et al. 2008). In the dominant summer midday wind conditions, heat Shanghai FTA regional distribution centre constituted to FTA, the main features of polycentric urban heat regional FTA Deputy Centre supplemented. Overall, the average temperature of the FTA was significantly higher than the surrounding areas. The city formed a clear "heat island" effect in the main region, with a level significantly higher than other regions. From first to fifth region, the temperature showed a descending trend (Liu et al. 2013, Lee et al. 2013). The Huangpu River obvious urban thermal environment to form a cutting potential, the main city is divided into two. River front area temperatures were relatively low, due to the evaporation of water absorbing heat and ventilation corridors. Fig. 8 is a flow chart of wind speed over the main city. In the figure, we can clearly see changes in wind direction and wind speed, due to the influence of the city (Priyadarsini et al. 2008, Kershaw et al. 2010). The monsoon winds when passing over the city remained unchanged, but the wind speed decreased. The urban wind speed was significantly lower than the wind. Winds from the plan (Figs. 9, 10, respectively, the main city in the region, and wind speed over the cloud) and air age (Fig. 11 over the age of air FTA cloud) analysis, the higher the wind speed of wind in the city suburbs, shorter air age index, which illustrate the surrounding urban wind shorter residence time (Yang 2010, Li Yang 2013). Through the main city, due to the construction of the city, the speed is decreased while the air age index is relatively long. The leeward side of the Fengying city area was consistent with relatively short wind street air age. In Figs. 9, 10, and a longitudinal comparison chart in 12, we found that, over the city, although the building has not been obscured beneath, but also affected the city below, by reducing wind speed over the city, the air age increases. However, this effect increased with the height of the trend more and more. Through simulation experiments, we can see that the city "heat island" effect is due to changes in urban surfaces producing heat and results from changes in the underlying surface and poor ventilation (Yang et al. 2014a, Blocken et al. 2012). Because of improved ventilation, the urban heat island overall temperature distribution from bottom to top shows a decreasing trend (Yang et al. 2014b). By comparison, the measured data of CFD simulation results of the experimental situation is about the same. In the Shanghai FTA central area, the changing nature of urban surfaces, high building density, high population density, as well as by the impact of solar radiation, air flow generated heat buildup creating urban "heat island" effect. In Huangpu District, Yangtze and large urban green space areas, the relatively low temperature of the water bodies and plants regulate the surrounding microclimate and relieve the "heat island"effect (Kolokotroni et al. 2009, Nichol et al. 2005, Prakash et al. 2007).

CONCLUSION

Digital simulation is a fast, efficient and economical means of study compared with traditional methods. It not only reduces manpower and material resources, but also surpasses the traditional methods that cannot complete the experiment. It fills in previous research methods missing information by using Ecotect software in conjunction with CFD software for Shanghai FTA in a typical July midday urban thermal environment. Conditions were simulated to assess the city's "heat island" distribution, as well as better understand the causes of urban thermal environment as closely related to the wind speed, temperature, radiation, barometric pressure and a series of climatic factors. We can also use this research means to come up with better solutions for improving the urban "heat island" effect and improving thermal comfort. The future of urban planning can also be introduced in this approach through different geographical and climatic characteristics of urban development, urban climate corresponding design guidelines for urban space layout, ventilation corridors and green layout recommendations to provide a reference for urban planning and management. This will improve the urban thermal environment and create a "livable city" to contribute to China "building a resource-saving and environment-friendly society" and "low-carbon city" (Yang et al. 2014c, Marina et al. 2007, Goward et al. 2004).

From the regional perspective, the establishment of Shanghai FTA will undoubtedly bring prosperity and growth of Shanghai's economy. The FTA is located near the Shanghai Port Airport to create the conditions for cargo shipping in the sea and air transport. Special customs supervision policies improve the efficiency of logistics, thus contributing to the development of Shanghai in becoming an international transit world cargo logistics hub. Rapid development of the service industry will bring a lot of demand for local labour, easing employment pressure. Radiation effects Shanghai FTA has also delivered to the surrounding area, with the transfer of production factors, such as the development of services, promote the prosperity of the entire Yangtze River Delta.

Isochronous FTA matured gradually pushing the radiation and the establishment of a broader free trade zone, economic development and other related areas. The establishment of Shanghai FTA not only complies with the new trend of global trade and economic development, but also helps improve China's global competition, build a new platform for cooperation and development of countries, making room in the international arena of economic growth.

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