The Application of Green Technology to Micro-topography and Ecological Environment in Henglang Mountain Area

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Abstract. The natural ventilation environment of the scenic spot has been paid more and more attention by planners and designers of scenic spots. By finding out the relationship between different seasonal wind environments in scenic spots, the influence of unfavorable outdoor wind environment is reduced, and people’s quality of life and environmental quality are improved. Reducing energy consumption makes people and nature coexist in harmony. This article uses fluent software to simulate wind environment in the mountains. By simulating and analyzing the flow field when the wind circumnavigates the mountainous area of the scenic area, it illustrates the superiority of the computer simulation software combined with the scenic area planning. Through the simulation analysis of the scenic area examples, the relevant suggestions on the outdoor environment layout of the scenic area in the early planning period are given.

1.Introduction
With the massive use of fossil fuels and the large emission of greenhouse gases, the global climate becomes more and more harsh and the living environment is not optimistic. The mountain areas are generally far away from the cities and are a good place for people to relax and study. Creating a livable living environment is very important[1-3]. Due to the complexity of mountain topography and the influence of altitude and mountain topography, mountain climate is often characterized by a small scale of local climate, so the research on mountain climate is more complicated[4].

For the micro-topography climate, the importance of wind environment for the comfort of human lives is self-evident, especially in the Henglang area located in the south, in the summer air humidity, high temperature, the merits of the wind environment is very large Based on the current rapid development of green ecological technology and numerical simulation technology, this paper uses the latest numerical simulation technology to apply the concept of green ecology to the ecological simulation of Henglang Mountain[5-7].

In this paper, Henglang Mountain Scenic Area and the surrounding mountains are set as research objects, to explore the application of CFD technology to the landscape area of the wind environment for digital analysis[6]. Honing Lang Mountain is located in Wuhu County, West River Town, only 25 kilometers from Wuhu City, north and south Henglang mountain, 301.4 meters above sea level, is the highest peak in Wuhu County, summer or winter is more suitable for play, summer summertime, this article will wind Environment for CFD technical analysis[7-9].
2. Wind environment analysis
Simulating the wind environment on complex mountain has always been an important issue in the atmospheric sciences. Many scholars have conducted research from different perspectives for different aspects such as atmospheric environment assessment and wind energy assessment, and have achieved rich results. These studies are mainly based on the mesoscale mode[10]. Usually, the terrain follows the coordinates, and the complex terrain is described by the coordinate transformation of the equations. The difference method is mainly used in the numerical method. The mesoscale mode has a spatial resolution of up to 100m and requires smoothing of the terrain to varying degrees in the pre-processing phase of the simulation for computational stability. For mesoscale modes, there is a risk of overflowing points when encountering very steep terrain[11-13]. In recent years, the application of Computational Fluid Dynamics (CFD) model in the field of meteorology is receiving more and more attention. Especially, it has been widely used in the study of urban micro-scale wind field and pollution spread. The ability of the CFD-based model to handle complex geometries has drawn the attention of some meteorologists and gradually tried to apply it to complex wind field simulation. Compared to mesoscale mode, CFD mode has a higher spatial resolution (horizontal grid spacing can be as small as 10m), which can describe the real terrain more precisely. However, academic research in this area is still relatively small. To further strengthen this research, this paper uses the commercial CFD software FLUENT to study the wind field simulation in Henglang Scenic Area[14].

3. Simulation analysis

3.1 External environment
As shown in Figure 8, the annual maximum wind speed in this area is about 55km/h, which is about 15.2m/s. The different colors in the figure represent the total duration of wind speeds at all levels throughout the year. The meteorological conditions in Anhui area can be obtained through the analysis of meteorological data. Anhui is located in a region where the northern subtropical East Asian monsoon is prevalent, with mild climate, moderate rainfall, four seasons and annual average temperature of 15-16 °C. The annual average sunshine duration is 2000 hours, the average annual relative humidity of 77% to 83%. The average annual wind speed is 3.0m/s. From November to February next year, the northerly winds prevail from March to August. Most of the winds are north and northwest winds from September to October. In this experiment, Northeast wind and winter southwest wind two typical conditions were simulated.

3.2 Model simplification

Fig. 1. Digital model construction process
Use Gambit modeling tools. The model of Henglang Mountain simulation was established (Figure 1, left side is northwest side, right side is southwest side). At the same time, the plane simulation results at 70m above the ground is selected for analysis, mainly analyzing the wind environment of tourists in the main activity plane at the time of scenic rest [8]. Figure 1 shows a simplified model of cell CFD simulation. The main object of the analysis taking into account the modeling process is the wind environment around the scenic area. Figure 1: Model boundary size: 2400m × 1350m × 300m; model ratio is 1:1, the foundation is located at 0m.

3.3 Boundary conditions and meshing

After the mathematical model and control equations are established, it is necessary to determine the reasonable boundary conditions so that the simulation experiment is close to the real situation. Analyze the wind speed and direction of the location of the hualian mountain scenery. Using the above-mentioned wind speed and direction frequency map, wind direction and wind speed are determined as the input conditions for the simulation area. In the calculation of this paper, the inlet velocity is defined as velocity-inlet in Fluent. Typical conditions (northeast wind, wind speed 3 m/s) and winter typical conditions (southwest wind, wind speed 3.8 m/s) Calculate. In this calculation, the outlet is defined as the Outflow free-flow boundary strip. Assuming that the flow on the outflow surface has been fully developed, the flow has been restored to the normal flow without building obstruction, ie, the outlet relative pressure is zero [9]. The building's surface and ground are stationary and immobile, so slip-free walls are used as a boundary condition for fluid and solid areas. For viscous fluids, the condition of adhesion is considered that the fluid velocity at the wall surface is the same as the velocity at the wall surface, the velocity at the non-slip wall surface is zero and the fluid velocity at the wall surface is zero.

Gambit software with grid generation (pre-processing) and flow display (post-processing) module, the grid is divided into two types of structural and unstructured. The quality of grid generation has great influence on the accuracy and stability of the calculation. The strength of grid generation is also an important factor to measure the performance of CFD general software [10]. In this study, when using Fluent to simulate, the unstructured grid technique is used to mesh the meshes. The meshed grids include many shapes, so as to maximize the complex underlying surface shape, Effect (see Figure 10). The unstructured grid (Tgrid) is not constrained by the topological structure and boundary shape of the solvable domain, so it is convenient to construct and adaptively generate the adaptive grid. It can automatically adjust the grid density according to the characteristics of the flow field, Very favorable.

3.4 simulation results and analysis

Figure 2 Figure 3 is a plan view of the wind speed at 70 meters in summer and winter in the Henglang Scenic Area. From the figure, we can see that even if the topography in the simulation area is extremely steep, FLUENT can reasonably give a wind field structure near the ground. From the wind speed distribution, the wind speed is relatively small on the lee side of the mountain and the bottom of the canyon. It is suitable to build a rest area for visitors to rest here, but relatively high summer temperatures are not conducive to the distribution of pollutants. Traversing higher altitude ridges tends to have higher wind speeds. The wind will separate and generate vortices on the leeward surface, and the greater the slope of the mountains, the closer to the lee surface near the ground wind field.
Fig. 2. 70 meters high wind velocity plan in summer

Fig. 3. 70 meters high wind velocity plan in winter

Fig. 4. 70 meters high wind pressure plan in summer

The louder the ring, the larger leeward areas are formed near the strata in the leeward side of the mountains, resulting in lower wind speeds in the northeastern region near the ground. Figure 4-5 is a 70-m height wind pressure plan for the summer and winter seasons in the Henglang Scenic Area. It can be seen from the comparison that the wind pressure at the mountain gorge is greater, and the location of the house on the mountain is affected by the wind pressure. Especially at the top of the mountain, the houses are located in the negative pressure zone on the top of the mountain, and the body shape coefficient changes greatly, which is unfavorable to the wind. The influence of the mountain on the wind load of the low-rise building cannot be ignored.
Fig. 5. 70 meters high wind pressure plan in winter

Fig. 6. 70 meters high wind age contribution in summer

Fig. 7. 70 meters high wind age contribution in winter

Fig. 6 to Fig. 7 are the wind direction plans of the 70-meter altitude in the summer and winter seasons in Henglang Scenic Area. As can be seen from the figure, acceleration phenomena occur at high altitudes. The wind speed on the lee side of the large mountain range decreased significantly, while the lee side on the small mountain did not show a significant speed decay. The reason for this is related to the slope of the mountain. The lee surface of a hill with a small slope does not exhibit flow field separation. The wind speed and wind direction change more regularly and distribute symmetrically along the vertical line on the top of the slope. In a mountain with a large slope, the flow field on the leeward surface will separate and even cause vortex flow. appear. The greater the slope of the mountain, the greater the eddy current intensity at the leeward and the closer the center of the vortex to the top of the slope, resulting in obvious attenuation of the wind speed.

In the more complicated mountainous cities, the annual static wind rate is high and the average annual wind speed is low, and the background wind speed in some areas is even smaller than the air
velocity caused by the local thermal circulation. In this case, The most important factor in regional air circulation needs to be given careful consideration in planning and design.

4. Conclusion
Under the contemporary concept of green ecology, the comfort of mountain climate is very important for the research of microtopography. In this paper, the Henglang Mountain Scenic Area is taken as the engineering background. CFD software FLUENT is used to study the fine simulation of complex terrain wind field. Due to the CAD modeling, unstructured grid and finite volume method used in general mesoscale mode, FLUENT can simulate the wind field on extremely complicated (steep) topography, and it is difficult to complete normal mesoscale mode Completed mission. The results of two numerical experiments show that FLUENT can be used to finely simulate the wind field on a small scale and complex terrain, and it has an incomparable advantage in mesoscale models in accurately characterizing small terrains. The simulation found that on the lee side of the mountain, at the bottom of the canyon, the wind speed is relatively small and the wind speed is only 1.5m / s. It is suitable to construct a rest area for the rest of the tourists here. However, in summer, the temperature is relatively high and unfavorable to the pollutant discharge Scattered In the aspect of wind pressure, especially at the top of the mountain, the house is in the negative pressure zone at the top of the hill, and the body factor varies greatly, which is very unfavorable to the wind resistance. The influence of the mountain on the wind load of low buildings can not be neglected in the design planning. The research results of this paper provide a reference for the construction of mountainous terrain, which is of great reference significance.

Acknowledgment
This paper is supported by National Natural Science Foundation of China 51378365

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