Urban Heat Islands Effect in Micro Scale Area by Using VHR RS-based Mobile Surveying: An Empirical Study of a University Campus

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1. Introduction

Even in a small area (such as a campus area), because of the difference in land cover and land use, the surface thermal environment exists in a huge difference between each area.

To understand atmospheric processes between surface condition and lower atmosphere, and to improve the accuracy of the approach, a fully coupled models system is required.

2. Data and Methods

With the very high-resolution remote sensing (VHR-RS) and mobile temperature surveying (Fig.1), we can analyze the surface thermal environment based on a highly accurate land cover classification result, which helps understanding the interaction in the surface condition and lower atmosphere.
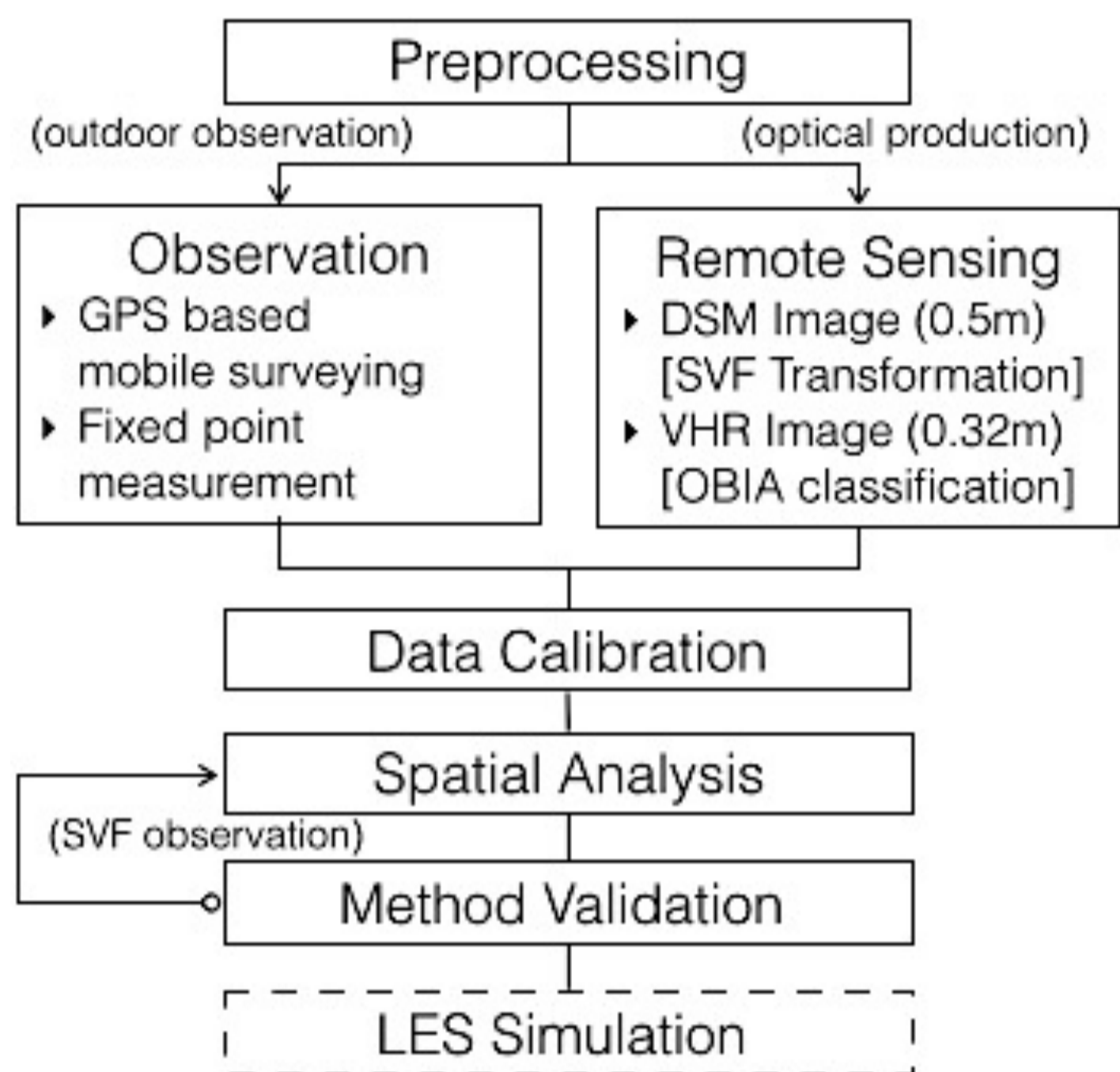

Fig.1 Workflow

Remote Sensing: In order to get an exact surface condition, Digital Surface Model (DSM; 0.5m) and airborne (0.32m) imagery were classified by object-based image analysis (OBIA) (Fig.2).
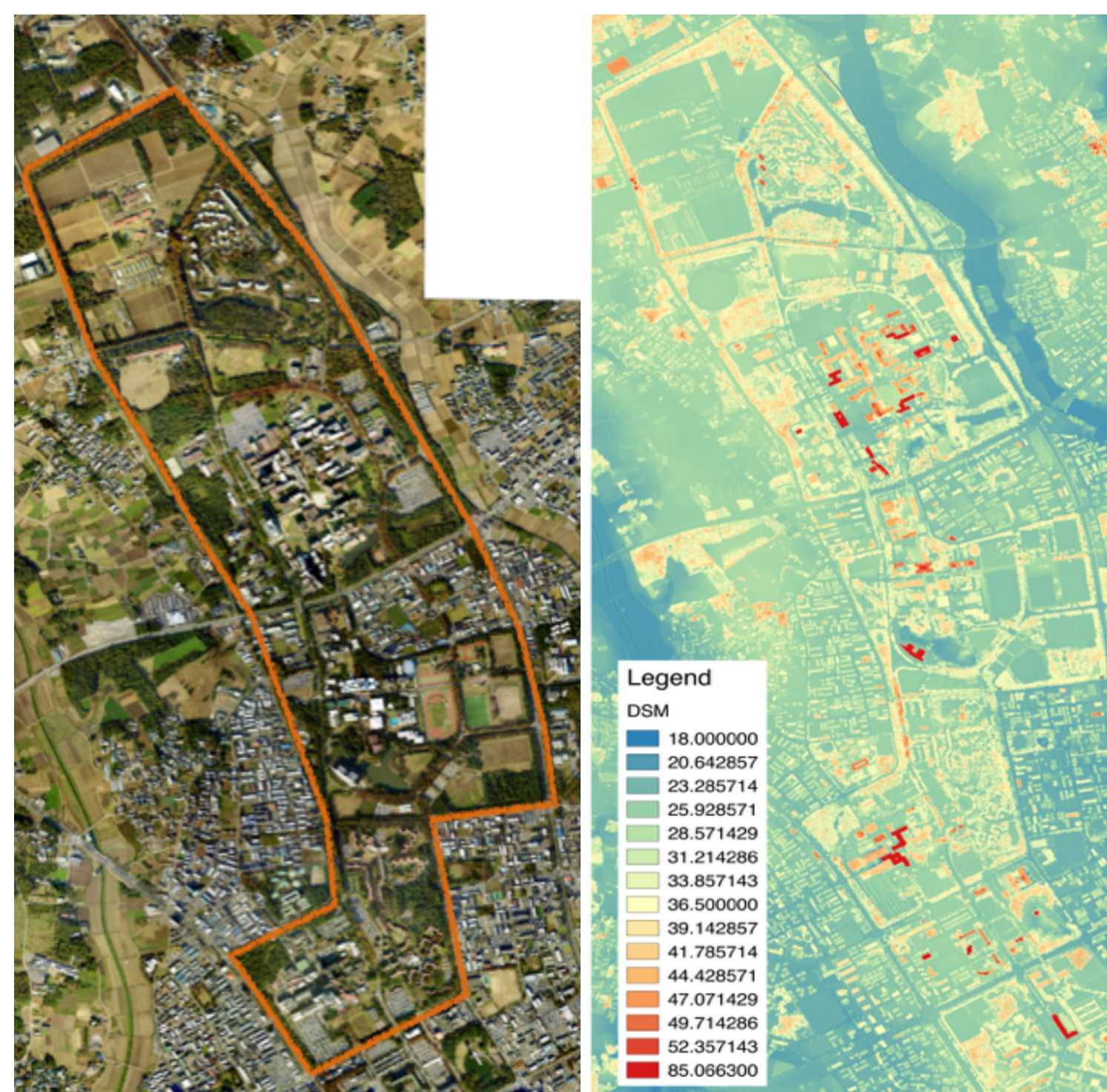

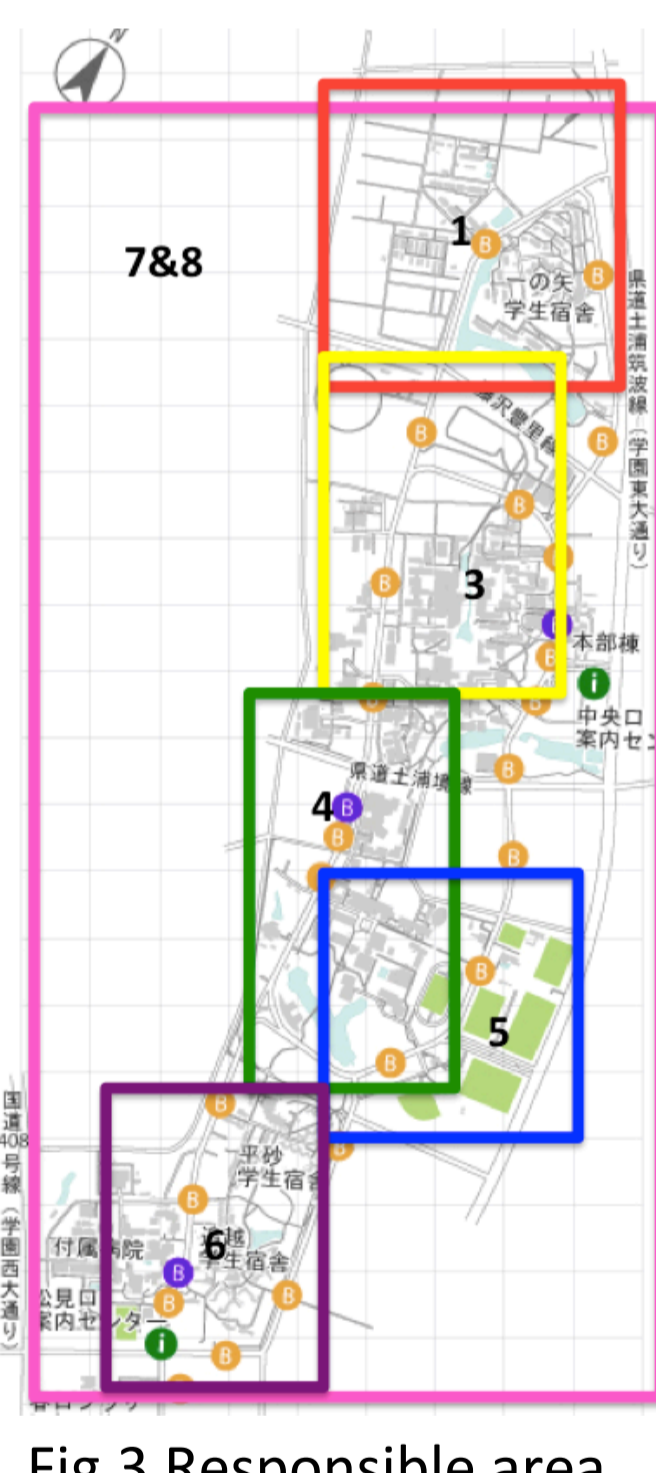Fig.2 (left) VHR airborne 0.32m, (right) DSM 0.5m

Fig.3 Responsible area for mobile surveying

Observation: Two kinds of observations (mobile surveying and fixed point observation) were conducted in 2013/12/22–12/23.

For the mobile surveying, eight groups cycled around at each responsible area by using a GPS and temperature sensor loaded bicycle. A 30-minutes mobile surveying was conducted for three times: first day 14:30, 20:30 and the next day 5:30 (Fig.3).

For fixed point observation, 14 points were set around the study area (Fig.4).

Fig.4 Equipment for fixed points temperature observation

3. Results

This empirical study was successful. A maximum temperature difference of 6℃ was observed, which means that the UHI phenomena obviously appeared. With the OBIA classification (Fig.5), we can classify the higher and lower buit-up area. Based on the classification results, third time mobile surveying showed a typical UHI phenomena (Fig.6).

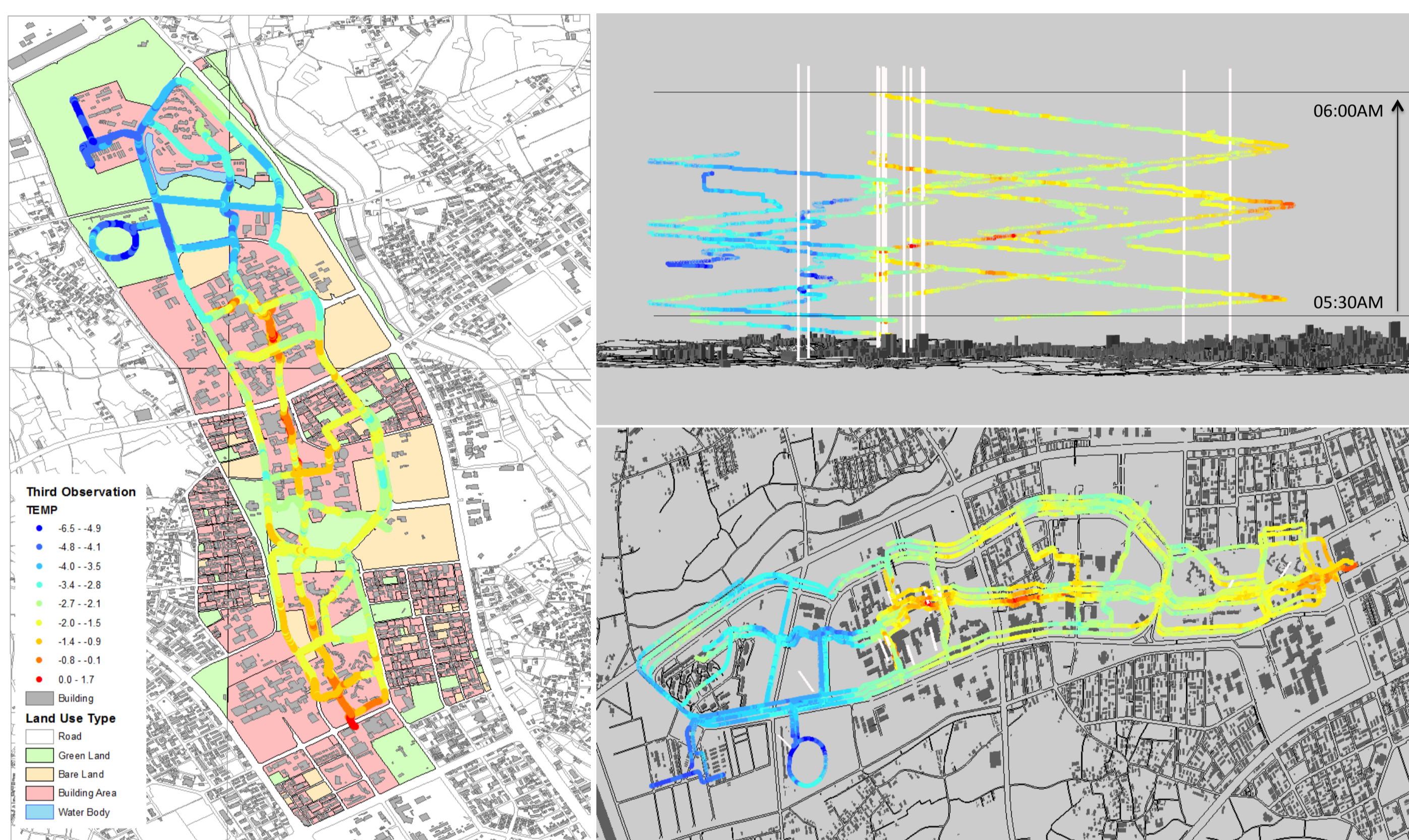Fig 5. Classification results for airborne (0.32m) by using object-based image analysis

Fig.6 (left) The 3rd mobile temperature surveying results, (up and down) time slice map for 3rd observation

4. Conclusion

As the simulated boundary layer shows (Fig.7), the study area can be divided into three parts as the land cover classification results. The thermal environment of each area has its own characteristics. This successful empirical study helps us to understand and evaluate the impact factors of the surface environment.
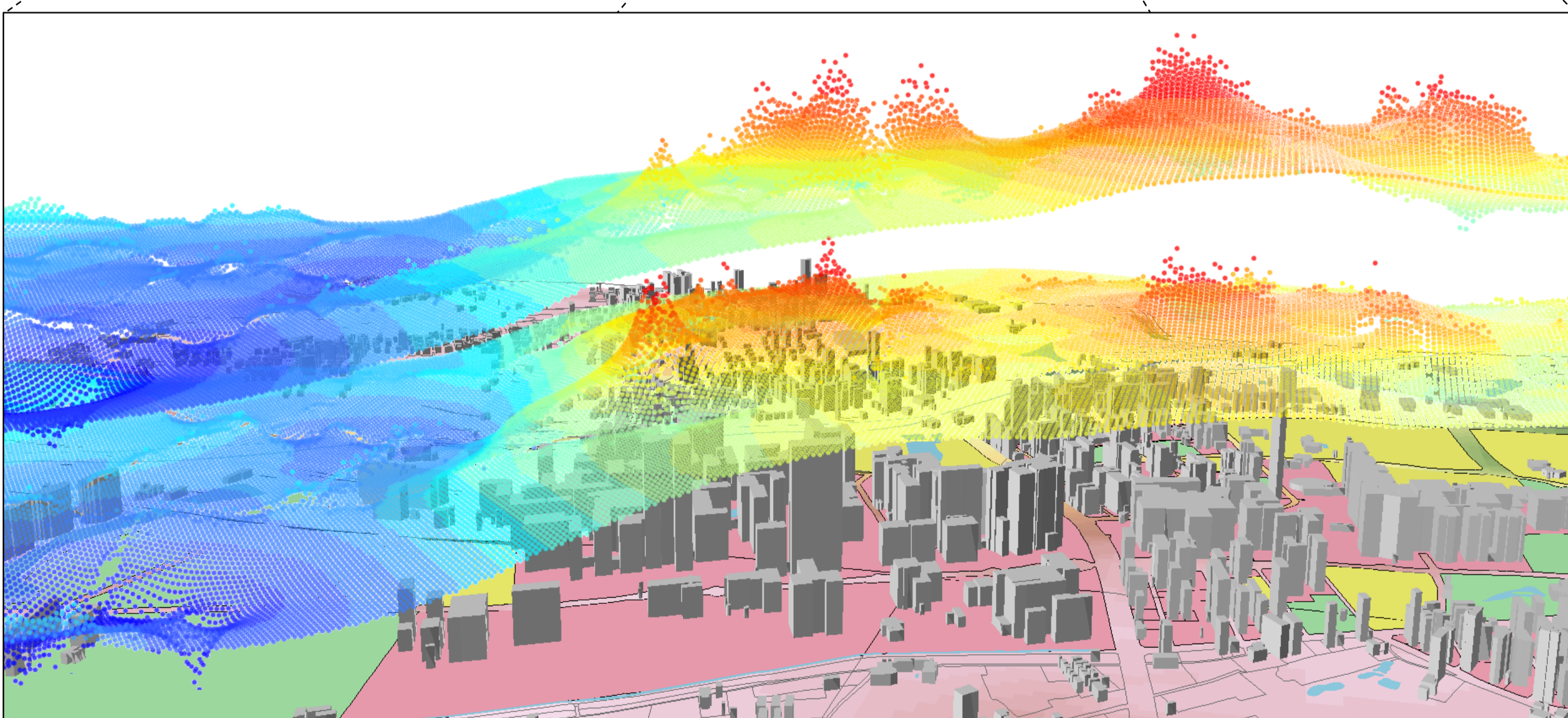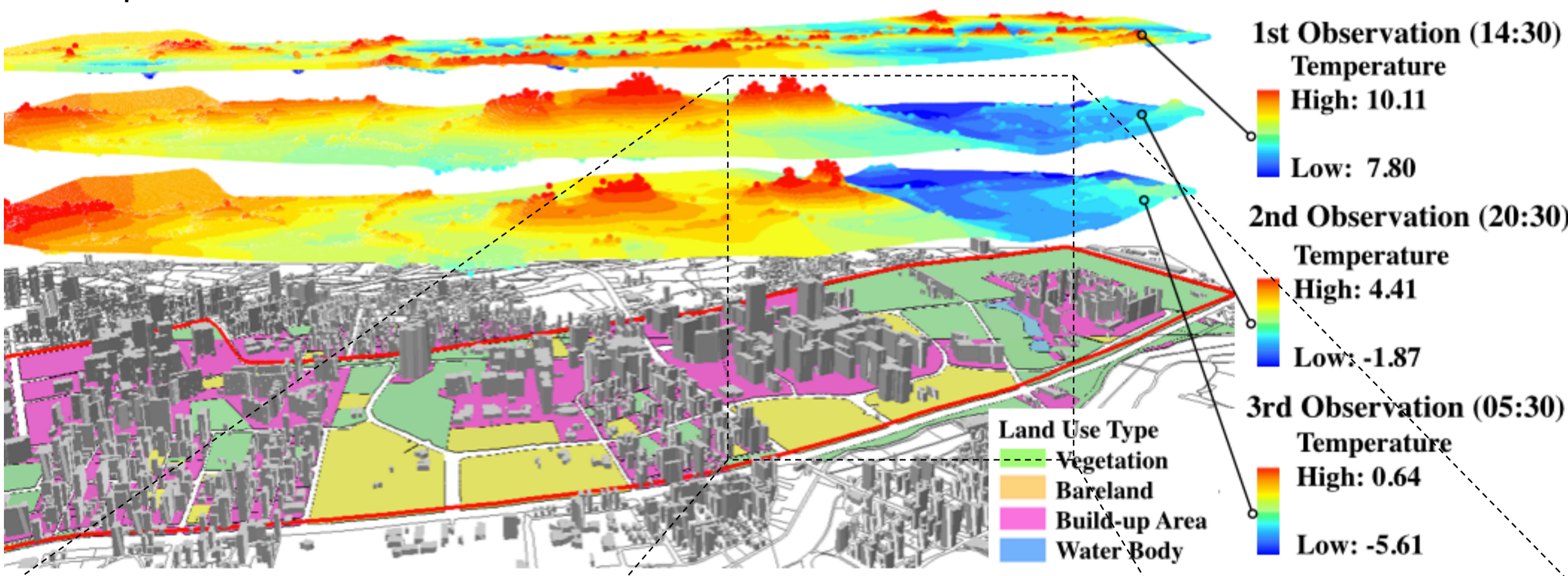

Fig.7 Simulated boundary layer of the surface temperature for the study area

5. Acknowledgement