

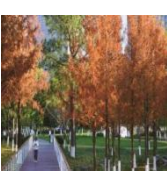
Table S1. Data source

Element	Data Source	Used for (ENVI-met)
Building	OpenStreetMap+Field survey	Define built-up areas and 3D massing
Vegetation	Field survey	Input tree
Pavement	High-resolution satellite image	Assign surface material
Water	High-resolution satellite image	Define water surfaces

**Table S2.** Summary of indicator sources

Abbreviation	Source	Calculation Method
GCR	[86–88]	Green areas were identified using NDVI derived from 0.5 m resolution imagery. Greening coverage ratio was calculated within each 8 m × 8 m spatial unit.
CCR	[89]	Green areas were identified using NDVI derived from 0.5 m resolution imagery. Greening coverage ratio was calculated within each 8 m × 8 m spatial unit.
GSSI	[90]	Green patch shape index was calculated within 8 m × 8 m units using ArcGIS Patch Analyst based on the perimeter and area of connected green cells.
ELGS	[91,92]	The total edge length of green patches within each 8 m × 8 m unit was extracted through GIS-based vectorization, indicating ventilation and dissipation potential.
ISCR	[93,94]	Impervious surfaces were identified via remote sensing and field-verified data. The coverage ratio was computed per 8 m × 8 m spatial unit.
WBCR	[95]	Waterbody areas were extracted from imagery and rasterized to calculate coverage ratio per 8 m × 8 m grid cell.
DWBx	[96]	Euclidean distance from the center of each 8 m × 8 m unit to the waterbody centroid was calculated along X and Y axes, respectively.
DWBy	[97]	
OSR	[98]	Defined as areas without buildings, vegetation, water, or paving; open space ratio was computed for each 8 m × 8 m unit.
BCR	[99]	Building footprints and heights were extracted from GIS and survey data, and the building coverage ratio was calculated per 8 m × 8 m unit.

Table S3. Plant Classification Table of Wangcheng Park

Arbor						
Number	Species Name	Scientific/ Genus	Photo	Height(m)	Diameter at Breast Height (cm)	Configuration Method
1	Cedar	Pinaceae/ Cedrus atlantica		30	150-300	Isolated planting、Avenue system
2	Chinese pine	Pinaceae/ Pinus		25-30	100	Avenue system、Group planting
3	Platycladus orientalis	Cupressaceae/ Platycladus		20	100	Isolated planting
4	Dragon juniper	Cupressaceae/ Sabina		20	350	Isolated planting
5	Pinus massoniana	Pinaceae/ Pinus		45	100-150	Isolated planting、Planting in rows
6	Plam	Palmae/ Trachycarpus		3-15	15-30	Planting in rows、Avenue system
7	Southern magnolia	Magnoliaceae/ Magnolia		3	8-16	Isolated planting、Opposite planting、Group planting
8	Loquat	Rosaceae/ Eriobotrya		2.6-5	7	Isolated planting
9	Metasequoia	Taxodiaceae/ Metasequoia		35	250	Isolated planting

10	Plane tree	Platanaceae/ Platanus		35	100	Isolated planting
11	Ginkgo	Ginkgoaceae/ Ginkgo		40	400	Isolated planting、Avenue system
12	Chinese catalpa	Bignoniaceae/ Catalpa		15-20	15-25	Isolated planting
13	Corylus avellana	Elaeocarpaceae/Elaeocarpus		10	80	Isolated planting、Avenue system
14	Midget crabapple	Rosaceae/ Malus		2.5-5	3-18	Isolated planting
15	Pterocarya stenoptera	Juglandaceae/ Pterocarya		30	80-100	Isolated planting
16	Buerger maple	Aceraceae/ Acer		8-12	30-45	Isolated planting
17	Bischofia polycarpa	Euphorbiaceae/Bischofia		15	100	Isolated planting
18	Ailanthus	Simarubaceae/ Ailanthus		20	100	Isolated planting、Group planting
19	Chinese scholartree	Leguminosae/ Sophora		12	100	Isolated planting、Avenue system、Opposite planting
20	Koelreuteria integrifoliola	Sapindaceae/ Koelreuteria		6.5	21	Isolated planting

21	Silk tree	Mimosoideae/ Acacia		16	40-80	Isolated planting
22	Purple-leaf plum	Rosaceae/ Prunus		4-8	10-19	Isolated planting、Planting in rows
23	Chinese pagoda tree	Leguminosae/ Sophora		1.6	3-10	Isolated planting、Avenue system、Opposite planting
24	Magnolia denudata	Magnoliaceae/ Magnolia		17	50	Isolated planting、Opposite planting、Group planting
25	Lannesiana	Rosaceae/ Cerasus		3-8	8-15	Group planting、Group planting、Avenue system
26	Flowering peach	Rosaceae/ Prunus		8	5-15	Avenue system、Planting in rows、Isolated planting
27	Chinese parasol	Sterculiaceae/ Firmiana		16	45	Isolated planting
28	Weeping willow	Salicaceae/Salix		6	10	Isolated planting、Avenue system
29	Lacebark pine	Pinaceae/Pinus		30	300	Isolated planting、Opposite planting、Group planting
30	Pinus thunbergii	Pinaceae/Pinus		25-30	60-80	Isolated planting

31	Viburnum odoratissimum	Caprifoliaceae/ Viburnum		2-10	/	Avenue system
Shrub						
32	Osmanthus fragrans	Oleaceae/ Osmanthus		3-8	/	Isolated planting
33	Moor besom	Rosaceae/ Photinia		1.5-5	/	Isolated planting
34	Pittosporum tobira	Pittosporaceae/ Pittosporum		2-6	/	Isolated planting、 Group planting、 Avenue system
35	Chimonanthus praecox	Chimonanthaceae/ Chimonanthus		2-4	/	Isolated planting
36	Lagerstroemia indica	Lythraceae/ Lagerstroemia		3-7	/	Isolated planting、 Paired Planting、 Group planting
37	Punica granatum	Punicaceae/ Punica		3-6	/	Isolated planting
38	Ligustrum lucidum	Oleaceae/ Ligustrum		2-4	/	Hedge、 Group planting
39	Nerium indicum	Apocynaceae/ Nerium		5	/	Isolated planting
40	Cornus officinalis	Cornaceae/ Cornus		3	/	Group planting

41	<i>Inula magnifolia</i>	Asteraceae/ Rosa		3-8	/	Group planting
42	<i>Cercis chinensis</i>	Fabaceae/ Cercis		2-10	/	Isolated planting、Group planting
43	<i>Euonymus japonicus</i>	Buxaceae/ Buxus		0.6-3	/	Isolated planting
44	<i>Paeonia suffruticosa</i>	Papaveraceae/ Paeonia		1-3	/	Group planting
45	<i>Ligustrum quihoui</i>	Oleaceae/ Ligustrum		1-3	/	Group planting
46	<i>Weigela florida</i>	Oleaceae/ Weigela		1-3	/	Group planting
47	<i>Spiraea japonica</i>	Rosaceae/ Spiraea		1-2	/	Isolated planting
48	<i>Forsythia suspensa</i>	Oleaceae/ Forsythia		1.5-3	/	Isolated planting
49	<i>Cornus alba</i>	Rosaceae/Cornus		1-3	/	Isolated planting
50	<i>Jasminum nudiflorum</i>	Oleaceae/ Jasminum		0.3-5	/	Isolated planting
51	<i>Heptacodium miconioides</i>	Berberidaceae/ Heptacodium		1-3	/	Group planting

52	Berberis thunbergii	Berberidaceae/ Berberis		1-3	/	Group planting
53	Sabina chinensis	Boraginaceae/ Sabina		1-3	/	Isolated planting、Avenue system、Hedge
Herb						
54	Yucca	Liliaceae/Lilium		0.25-0.6	/	Isolated planting
55	Chinese peony	Paeoniaceae/ Paeonia		0.4-0.7	/	Isolated planting
56	Hemerocallis	Liliaceae/ Hemerocallis		0.3-1.5	/	Isolated planting
57	Iris	Lridaceae/Iris		0.6-0.8	/	Isolated planting
58	Fragrant-flowerwd garlic	Amaryllidaceae/ Lilyaceae		0.2-0.3	/	Isolated planting
59	Ivy	Araliaceae/ Hedera		3-30	/	Hedge
60	Euphorbia humifusa	Vitaceae/ Parthenocissus		0.6	/	Isolated planting
61	Ophiopogon/japonicus	Liliaceae/ Ophiopogon		0.15-0.3	/	Isolated planting

Table S4. Summary of ENVI-met model input and output parameters

Category	Input Variables
Meteorological Input	Air temperature, Relative humidity, Wind speed and direction
Landscape Input	Building height, Footprint, Roof material, wall covering Vegetation type, Vegetation height, canopy Pavement and surface materials Water body location and surface properties
Main Outputs	Potential air temperature, Wind Speed, Mean Radiant Temp, Relative Humidity, PET

Table S5. Information about the meteorological station

Site number	HY-3000	Type	Huayun Shengda DZZ5
Site name	New regional station	High degree	1.5m
Longitude	E108°56'33"	Sensor types	HMP-155 Temperature and Humidity Sensor; PTB210 Barometric Sensor; SL3-1 Rain Sensor; Wind Speed Sensor; Wind Direction Sensor;
Latitude	N34°15'40"		
Observation model	Automatic ground observation; wireless network transmission; 5-minute observation frequency	Observational elements	Temperature; Humidity; Barometric Pressure; Wind speed and Direction; rainfall

Table S6 Summary of methodological differences between existing ENVI-MET literature

Ref	Location	Time	Research Focus	Differences from This Study
[100]	Hefei	January	Proposed "height reduction, road expansion, and greening" optimization strategies based on ENVI-met simulation, achieving synergistic reduction of PM2.5 concentration and surface temperature, providing a basis for sustainable optimization of urban streets under the dual-carbon goal.	The study used an 8m×8m coarse grid; this study uses a 4m×4m high-resolution grid to analyze the spatial variation of thermal environment
[62]	Hong Kong	August	Quantified the impact of green space coverage on the thermal environment under different urban densities, and found that ENVI-met had large wind speed simulation deviation in high-density areas but reliable vegetation transpiration simulation.	This study adds innovative morphological indicators such as the green shape index.
[101]	Harbin	July	Explored the summer cooling effect of micro-scale blue-green spaces in cold regions. ENVI-met optimization showed that adding deciduous trees and transforming platforms could further reduce temperature by 1.2-2.5°C and expand the comfortable area by 22%, providing a basis for landscape design in cold regions.	This study uses UTC as the thermal comfort index, while this study uses PET as the core index, focusing on the mechanistic human thermal balance model.
[63]	Netherlands	December	Reviewed urban heat mitigation measures in temperate climates, evaluated the simulation performance of ENVI-met for the combination strategy of cold materials and vegetation, and pointed out that vegetation transpiration simulation might be underestimated by 10%-15%.	This study used wind tunnel measurements for calibration, while this study uses temperature verification from meteorological station data.
[64]	Bilbao	August	Compared the measurement and simulation results of thermal comfort in urban spaces, and found that ENVI-met had an 8% deviation in solar radiation simulation for high-density blocks.	This study mainly evaluates the reliability of the model under different meteorological conditions, while this study serves urban form optimization and quantifies the correlation between landscape indicators and PET.

Table S7 Comparison of ENVI-MET studies of the same kind

Ref	Research Focus	R2	RMSE	MAE	d
[102]	Thermal comfort in Chongqing urban parks	0.9346	0.60°C	0.7°C	0.97
[103]	Urban heat island mitigation in Phoenix, USA	0.736	2.79°C	2.26°C	0.92
[64]	Evaluation of ENVI-met model in Bilbao	/	1.04°C	0.83°C	0.94
[104]	Evaluation of ENVI-Met vegetation models for four common tree species in Guangzhou	/	1.13°C	1.03°C	0.94
[105]	Importance of spatial layout of Melbourne urban parks in mitigating extreme high temperatures	0.96	1.61°C	1.2°C	/

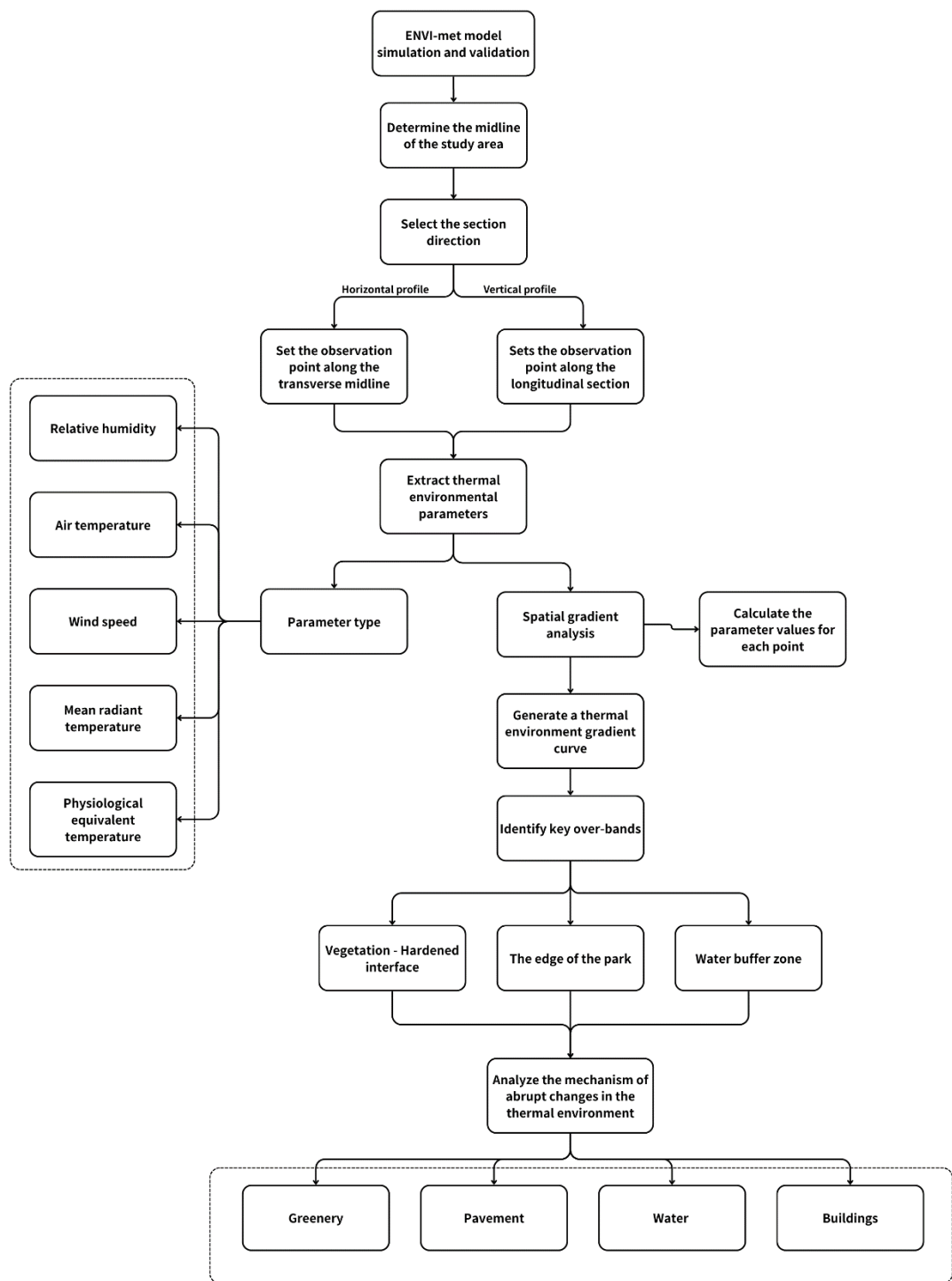


Figure S1 Schematic Illustration of the Midline Cut-off Approach