

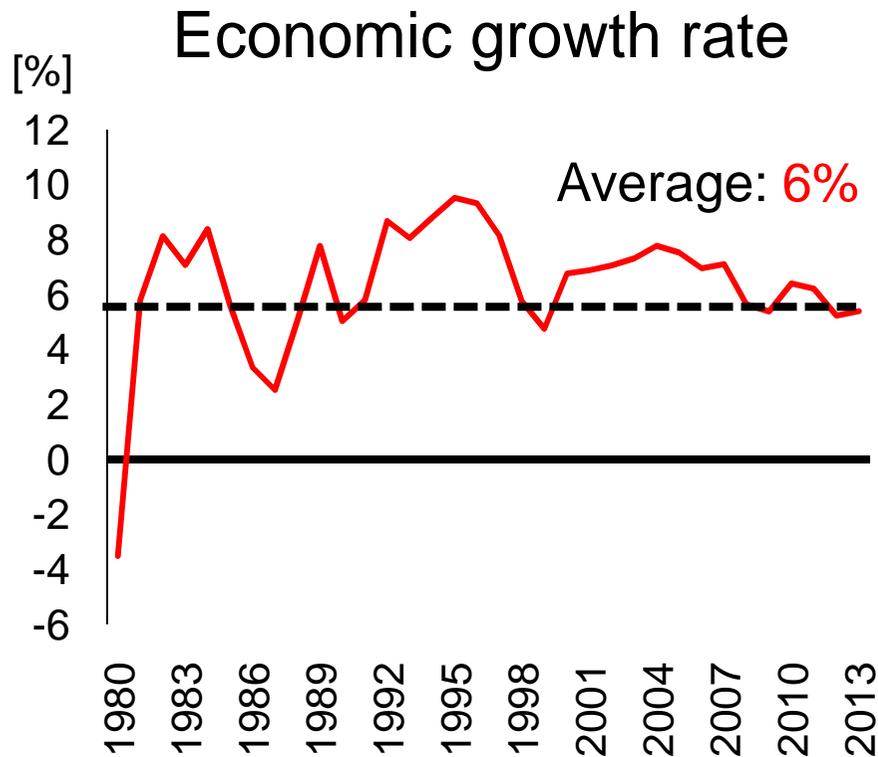
Impacts of a future city master plan on on thermal and wind environments in Vinh city, Vietnam

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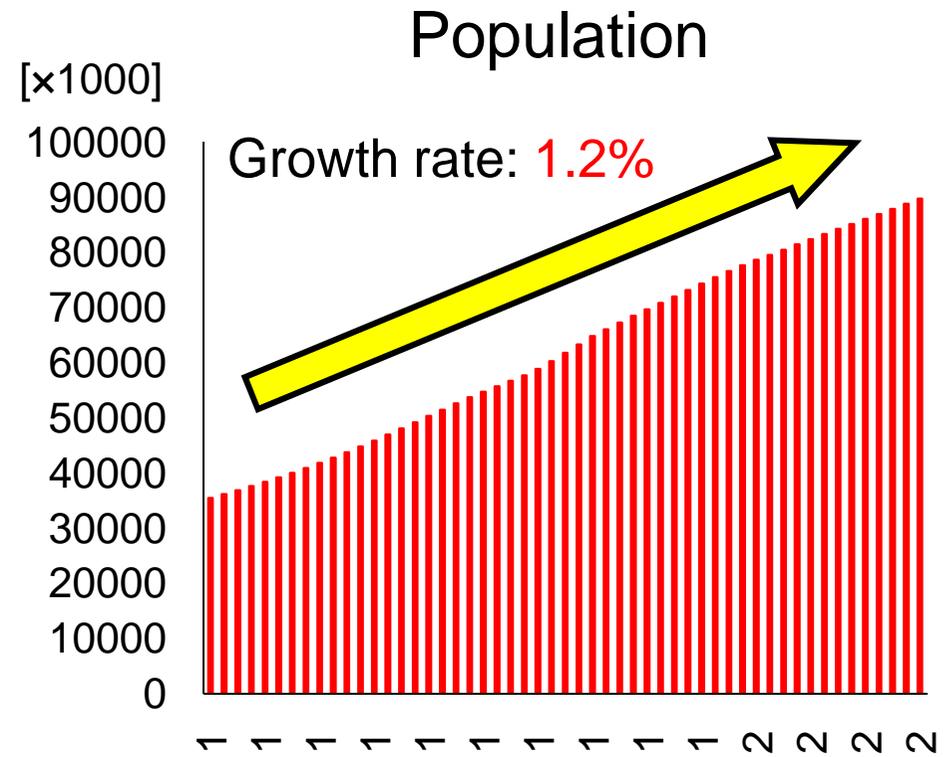
Tatsunori Ito, Nagoya University, Japan

Masato Miyata, Mitsubishi UFJ R&C, Japan

Background: Vietnam's recent growth



Source: IMF-World Economic Outlook Databases



Source: The World Bank

Under the situation of Vietnam's recent growth, many city master plans have been proposed.

City master plan for Vinh city, Vietnam

By Nikken Sekkei Civil Engineering Ltd., Japan

Target period : 2030
Planned population : 900,000



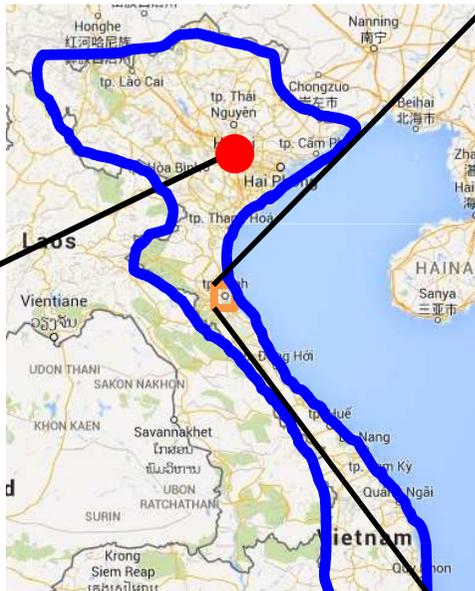
Vinh city, Vietnam (1)

Population 450,000

Land Area 105 km²



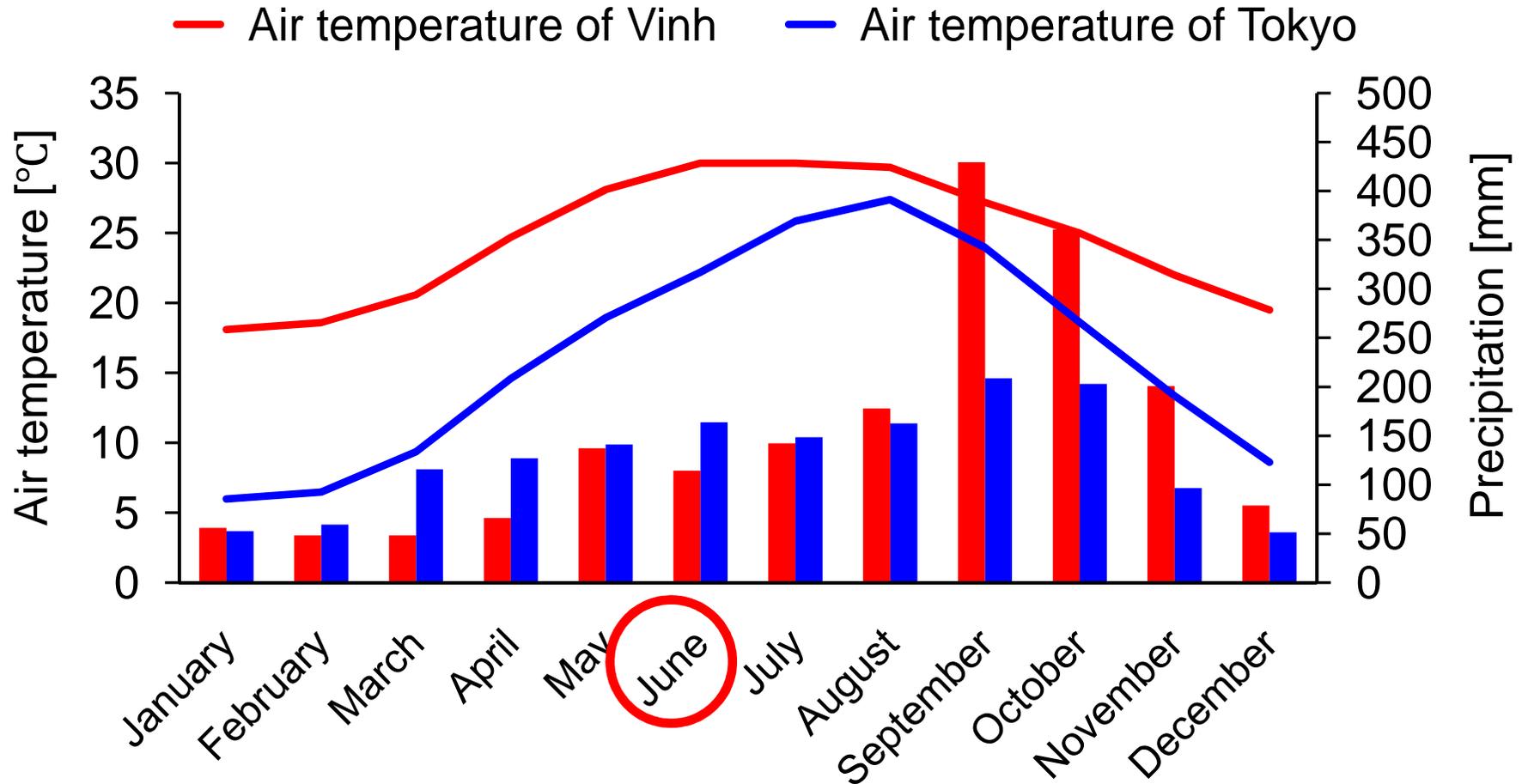
Hanoi



Ho Chi Minh

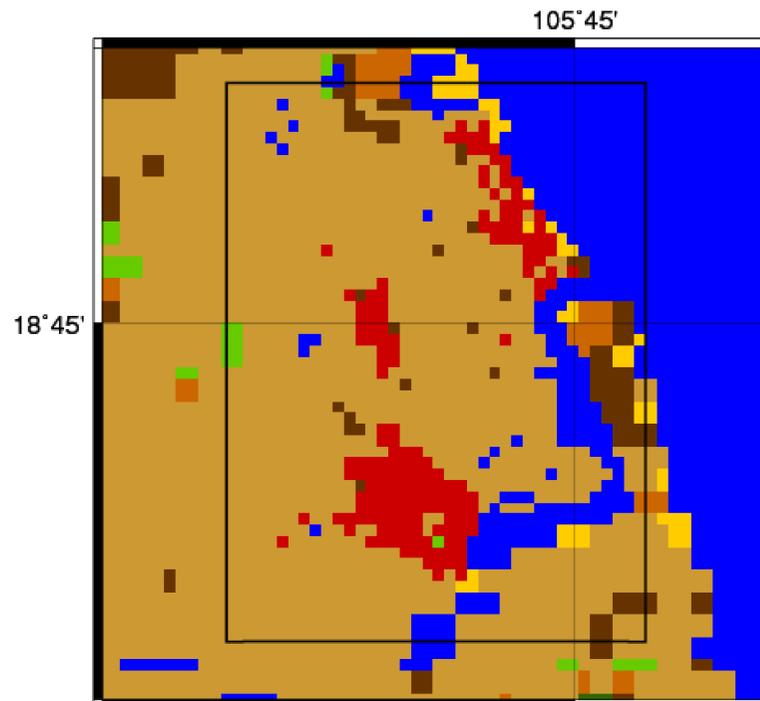


Vinh city, Vietnam (2)

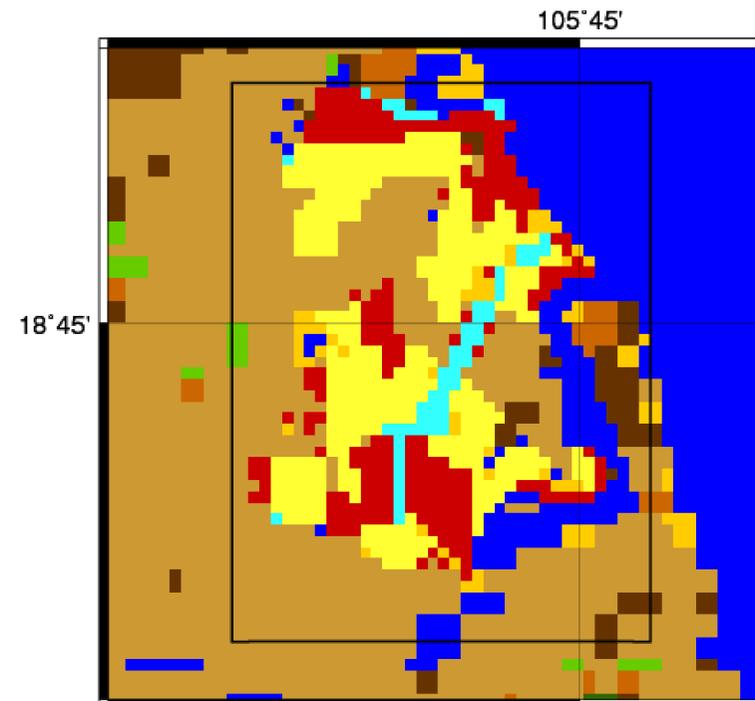


In Vinh city,
June is the hottest month. Sep. and Oct. are rainy months.

Introduction of city master plan

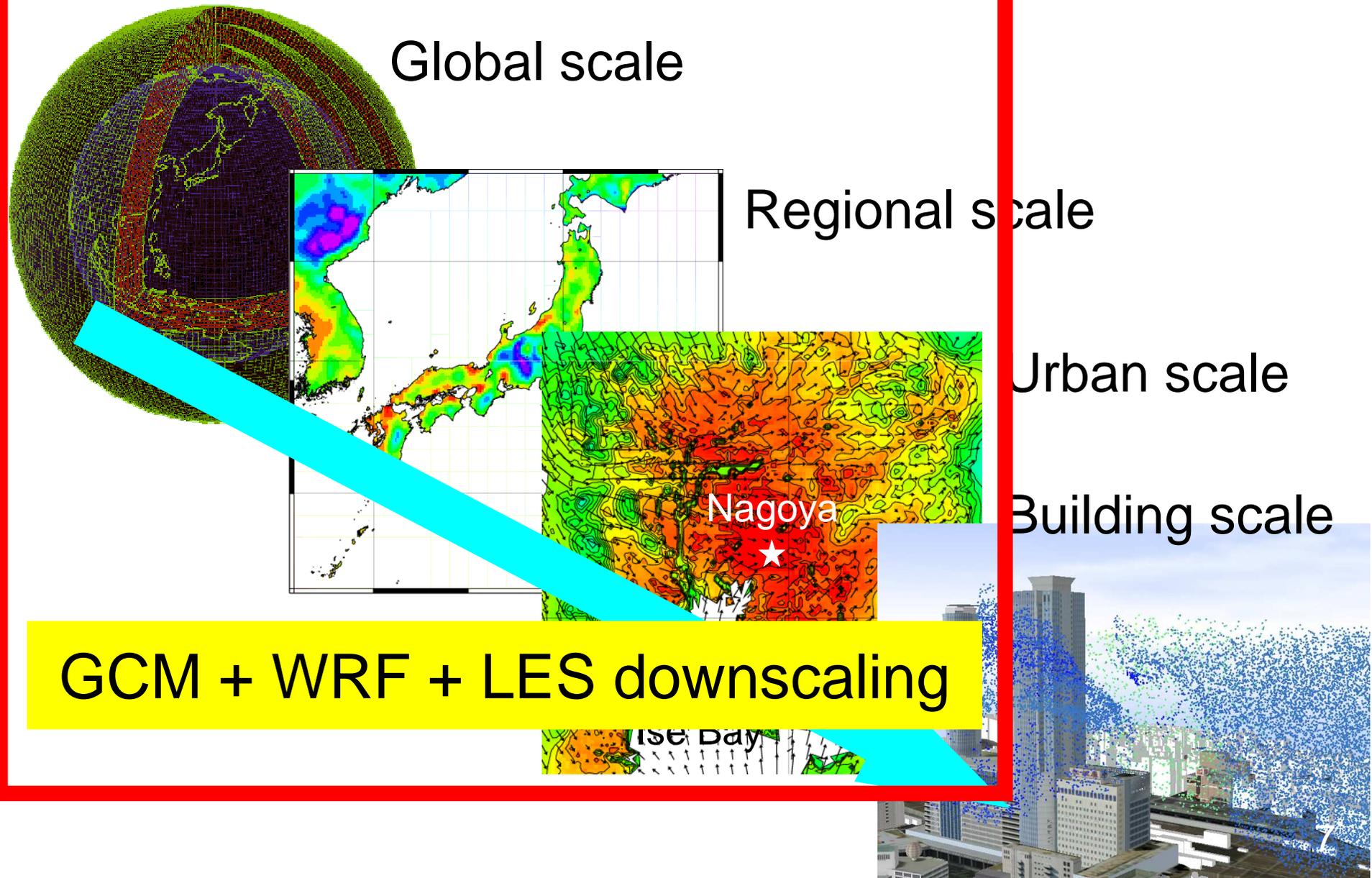


Present land use

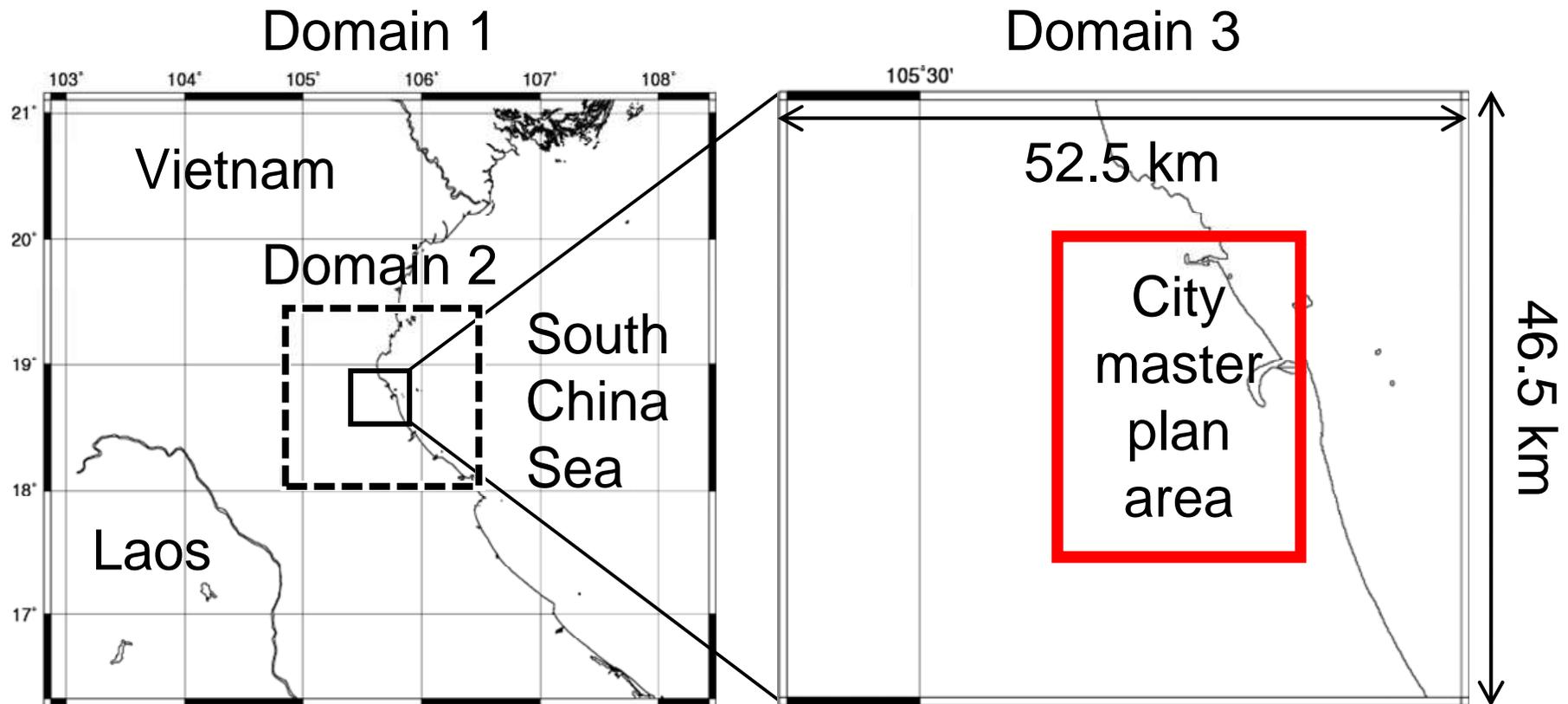


City master plan
(2030; 900,000 people)

Development of downscaling model



Computational domains and grid design



	Size	Grid points	Horizontal grid
Domain 1	585 km×540 km×21 km	130×120×34	4.5 km
Domain 2	177 km×159 km×21 km	118×106×34	1.5 km
Domain 3	52.5 km×46.5 km×21 km	106×94×34	0.5 km

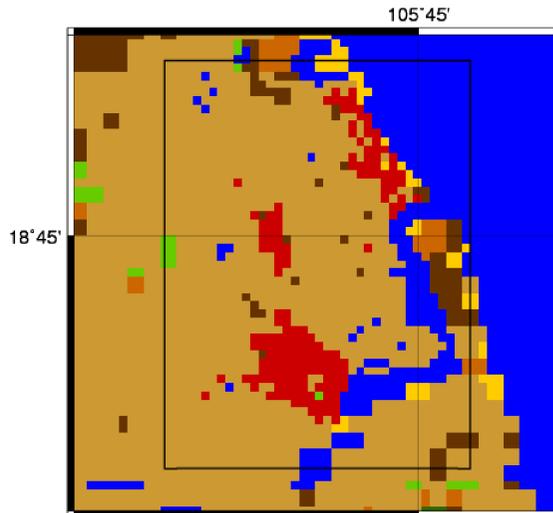
Simulated cases (1)

	Period	Land use
Case 0	June in 2011 (Present)	Present land use
Case 1	June in the 2030s (Future)	Present land use
Case 2		City master plan
Case 3		Northern concentration of the new urban districts
Case 4		Southern concentration of the new urban districts

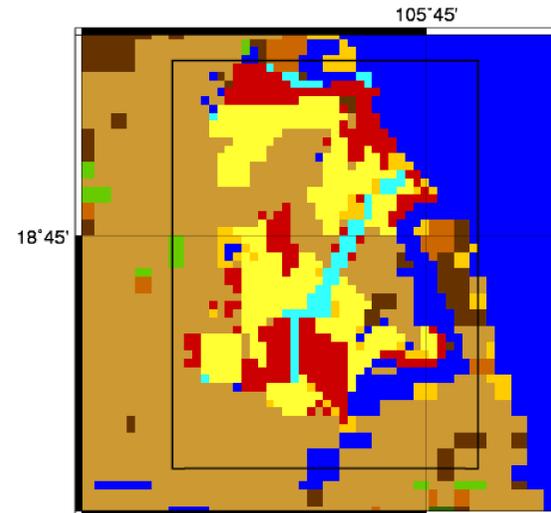
Three categories in the urban area:

1. Central business district (**CBD**)
Average height of buildings: 26 m, Building (green) coverage ratio: 50% (50%)
2. **Existing** urban district
Average height of buildings: 12 m, Building (green) coverage ratio: 70% (30%)
3. **New** urban district
Average height of buildings: 12 m, Building (green) coverage ratio: 70% (30%)

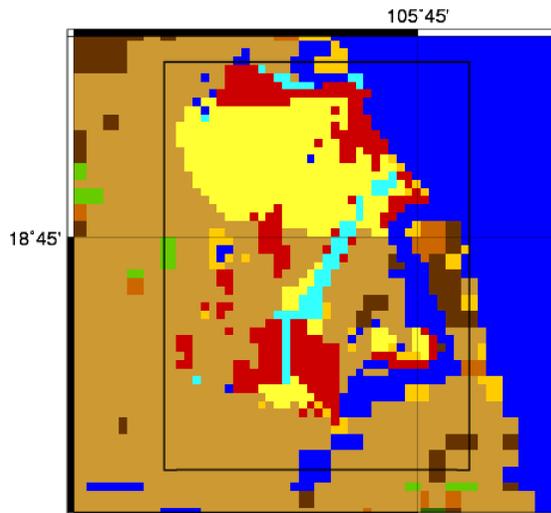
Simulated cases (2)



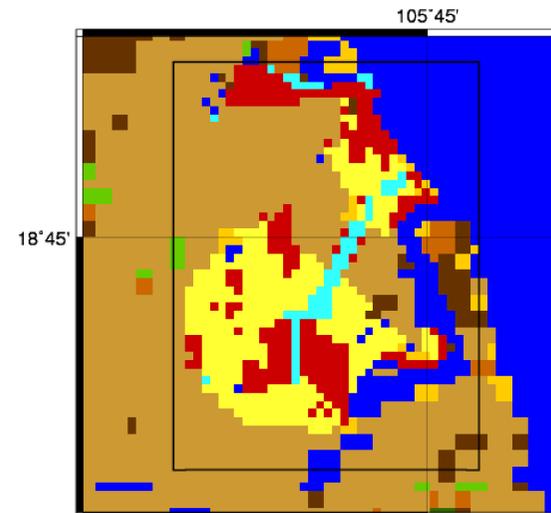
Present land use (Cases 0 and 1)



Master plan (Case 2)

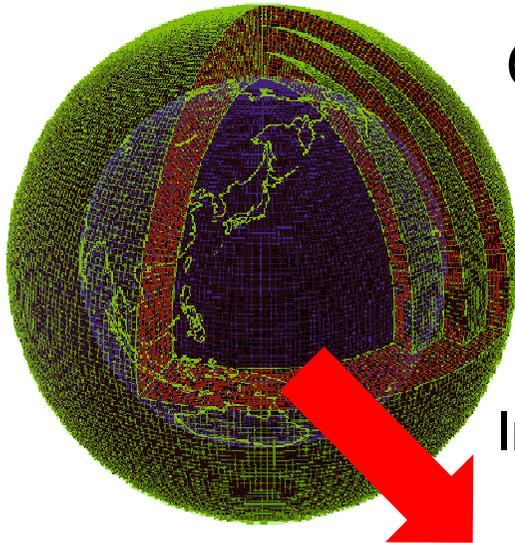


Northern concentration (Case 3)



Southern concentration (Case 4) 10

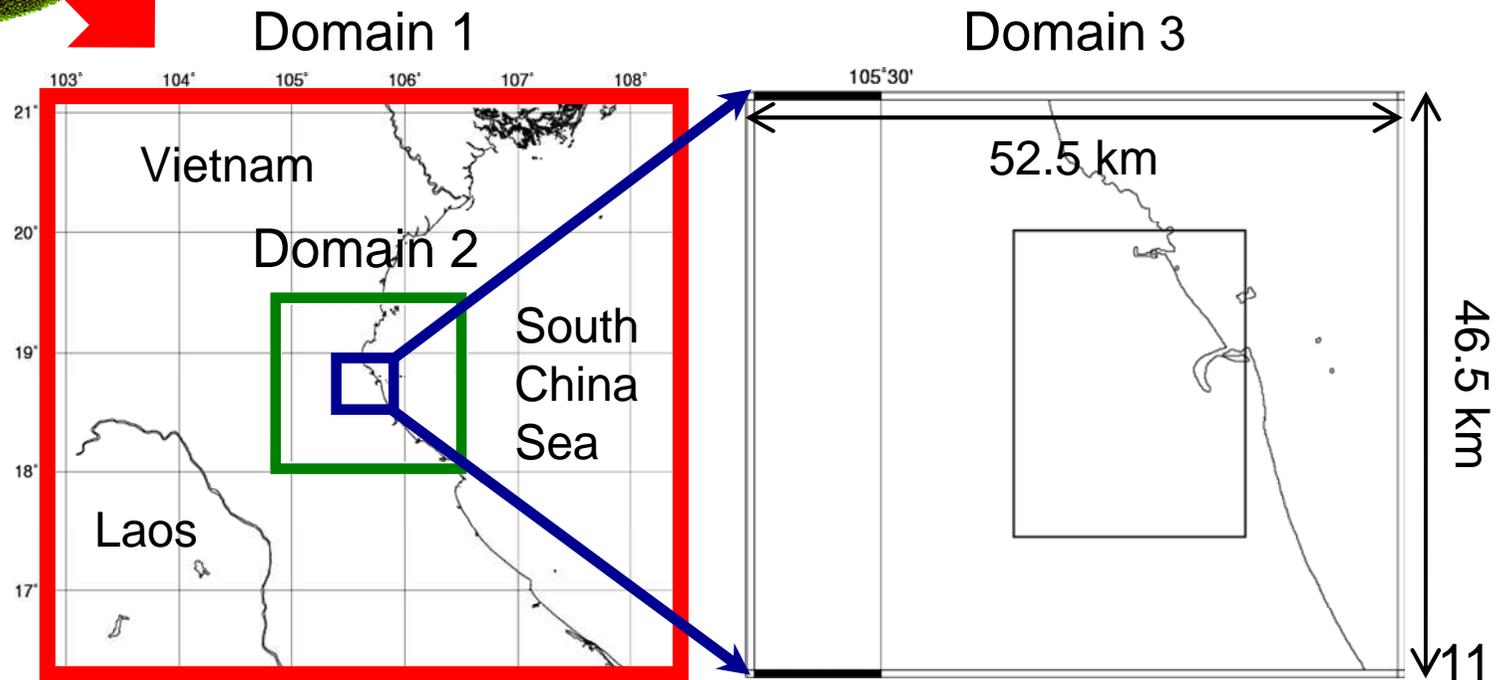
Future projection by pseudo global warming method



General circulation model: GFDL-CM3

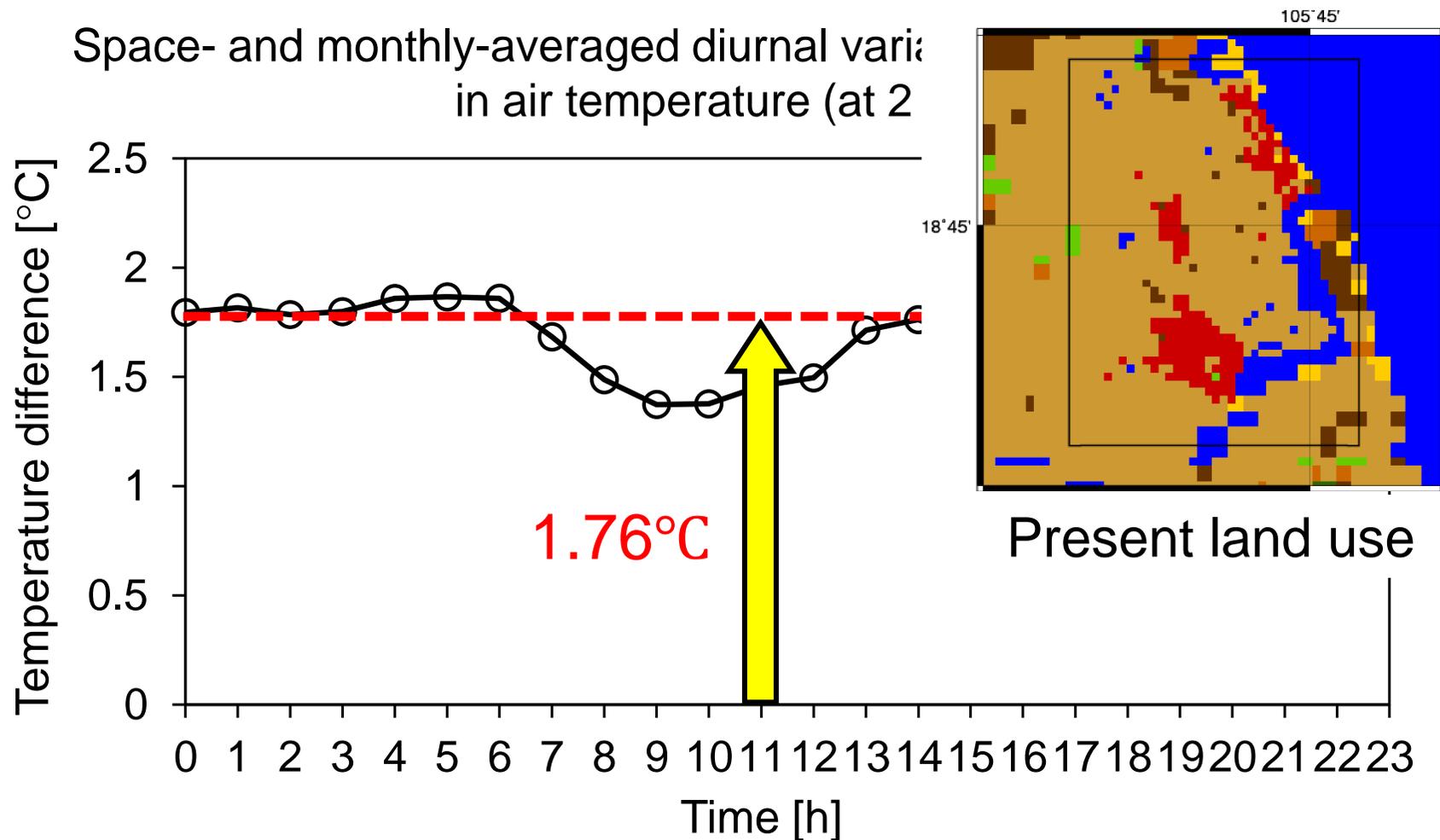
Pseudo global warming data based on RCP 8.5 scenario

Initial and boundary conditions for WRF simulations



Effect of global warming in the 2030s

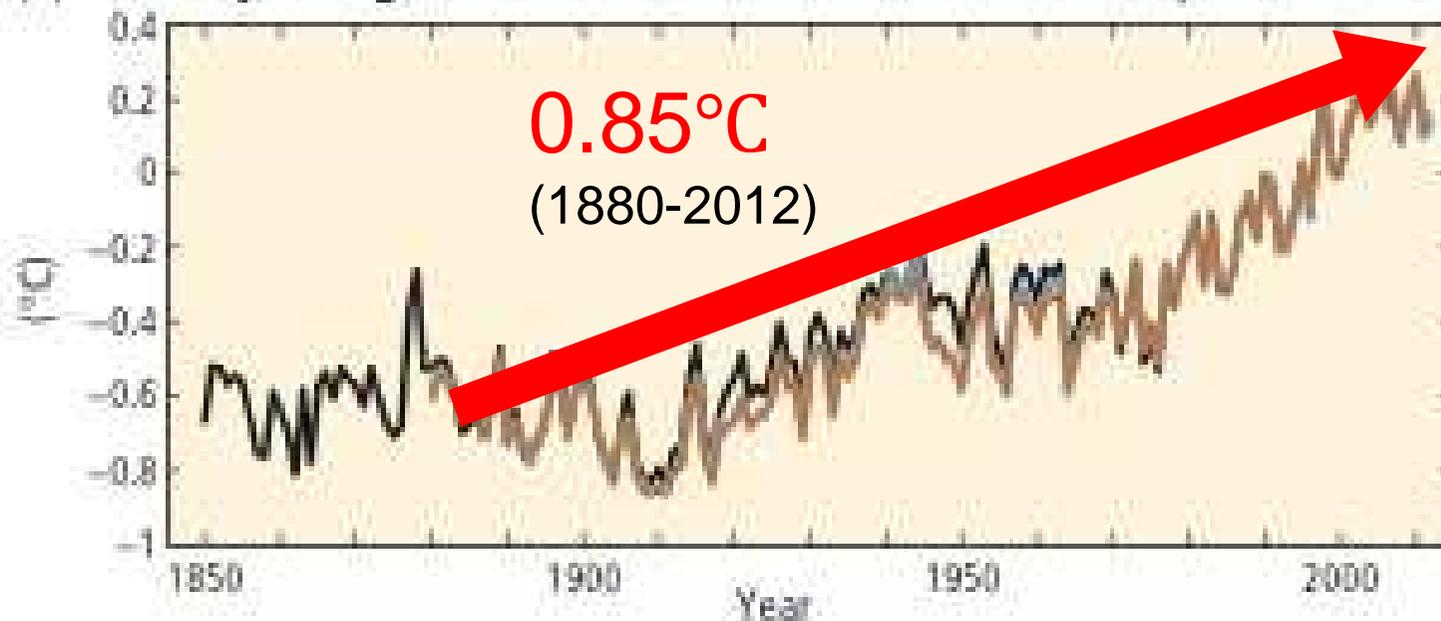
- Future (the 2030s) climate with present land use (Case 1)
- Present (2011) climate with present land use (Case 0)



Effect of introducing city master plan

- Future (the 2030s) climate with city master plan (Case 2)
- Future (the 2030s) climate with present land use (Case 1)

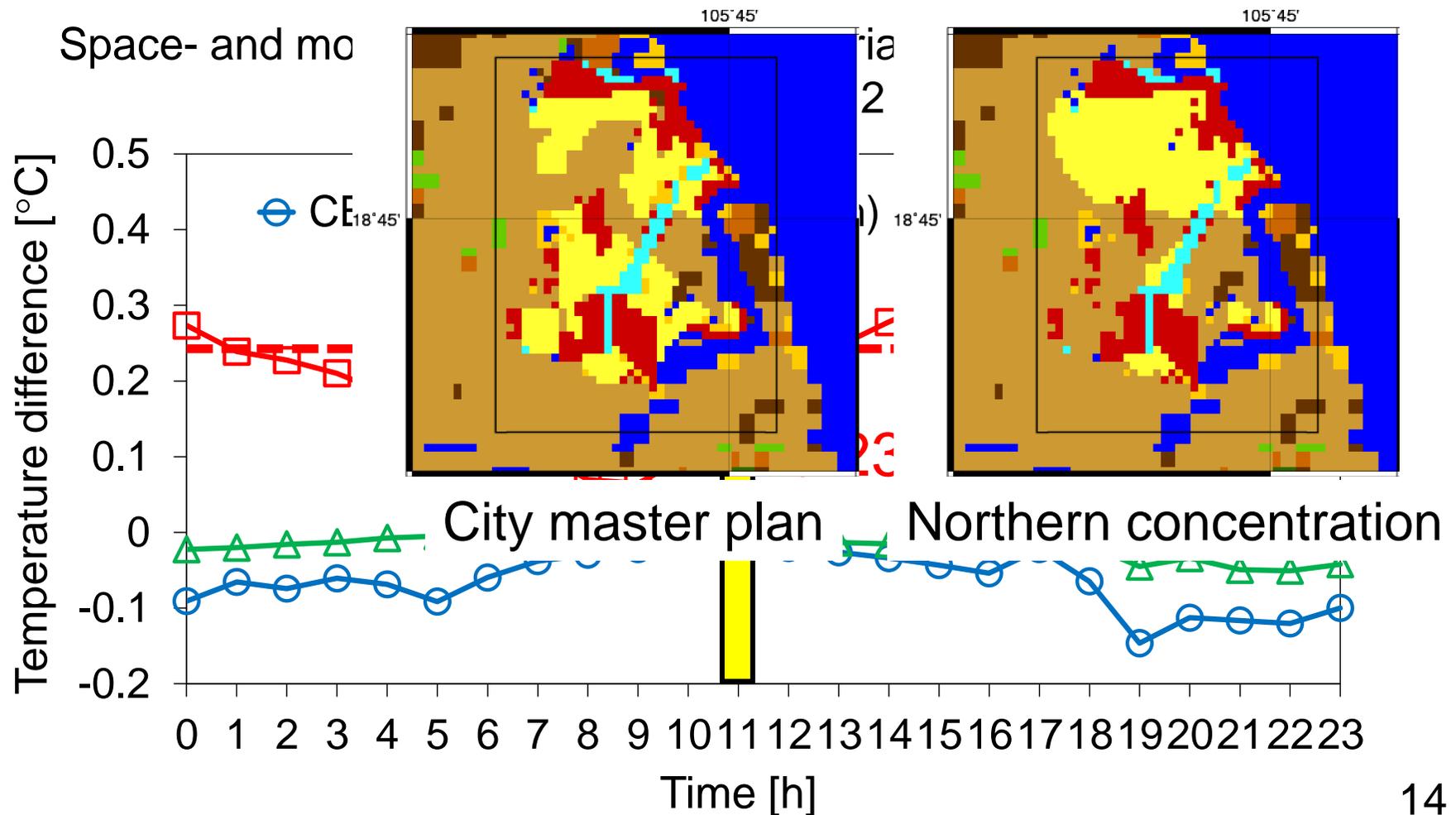
(a) Globally averaged combined land and ocean surface temperature anomaly



Source: IPCC Fifth Assessment Report, Synthesis Report (SPM)

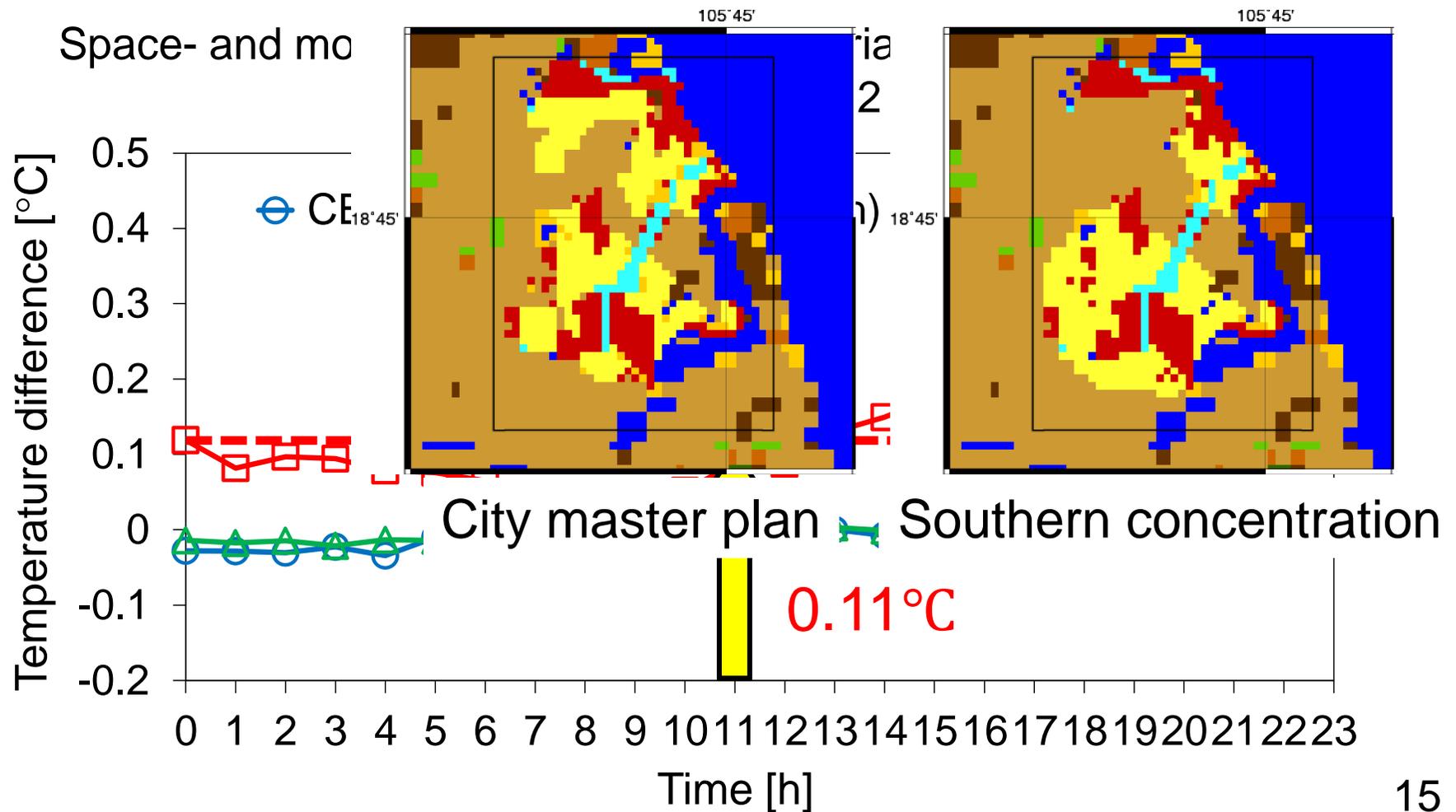
Effect of new urban district structure (1)

- Future (the 2030s) climate with **modified master plan** (Case 3)
- Future (the 2030s) climate with **city master plan** (Case 2)



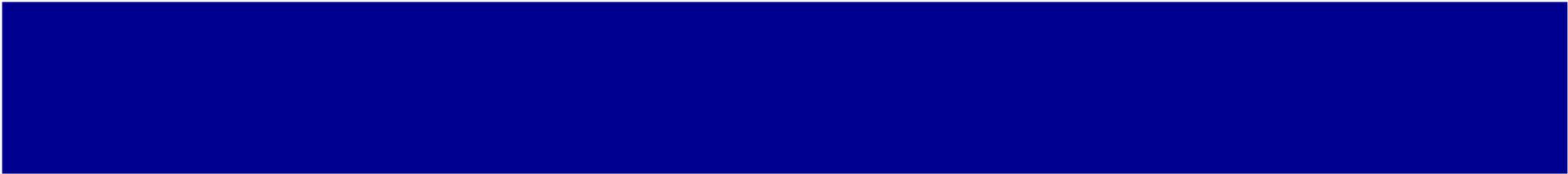
Effect of new urban district structure (2)

- Future (the 2030s) climate with **modified master plan** (Case 4)
- Future (the 2030s) climate with **city master plan** (Case 2)



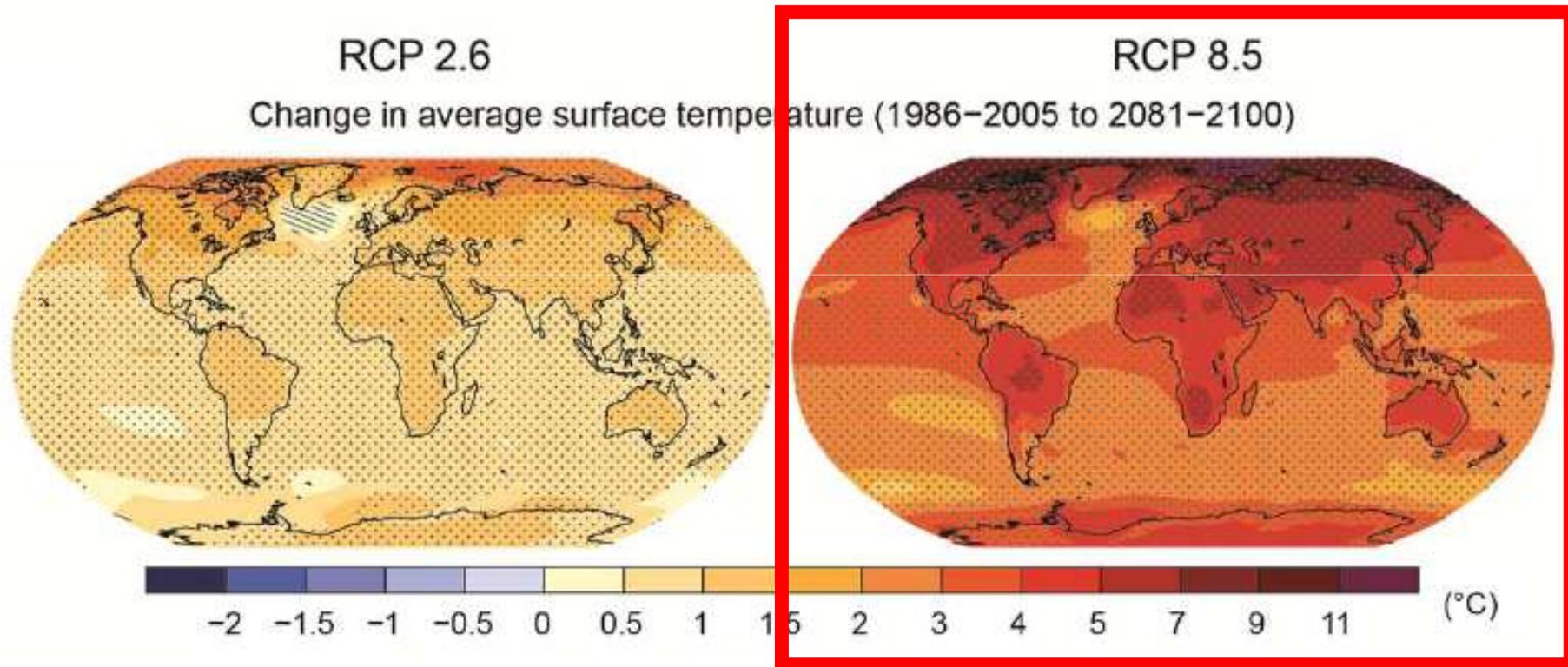
Summary

1. With the continuous progress of global warming, the future (the 2030s) thermal environment in Vinh city was about **1.8°C hotter** than that in the present status.
2. By introducing the proposed city master plan, the averaged air temperature in the urban areas was **0.17°C higher** than that in the case with the present land use.
3. The future (the 2030s) thermal environment in the case with the original city master plan was **better** than that with the northern or southern concentration of the new urban districts.



RCP scenarios IPCC 5th assessment report

RCP: Representative Concentration Pathway



Source: IPCC AR5 Working Group I Summary for Policymakers

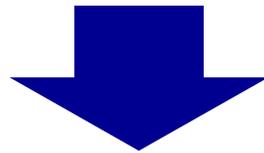
Pseudo global warming data (1)

Components of global warming

1. Horizontal wind components
2. Potential temperature
3. Geopotential height
4. Sea surface temperature
5. Ground surface temperature

Pseudo global warming data (2)

- 1) Monthly variations of 10-year averaged data from 2030 to 2039 based on the RCP 8.5 scenario
- 2) Monthly variations of 10-year averaged data from 2000 to 2009



1) – 2) was added to the present (June 2011) NCEP Final Operational Global Analysis data.