

Validation of the Thermal Effect of Roof-Spraying and Green Plants in an Insulated Building

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The Practice Of Rooftop Lawn And Roof Spraying

- The environmental problems have become serious, and consequently various passive methods have been adopted in architectural design.
- Rooftop lawns have many merits such as: reduction in building air conditioning load and mitigation of the heat island phenomenon.
- Roof spraying systems are effective for poorly insulated roofs, reducing heat load in summer.

Introduction

- Roof-spraying and rooftop lawns has proved effective on roofs with poor thermal insulation but have not previously been quantified on roofs of buildings have insulating material to provide thermal insulation during the winter.
- We measured building with a rooftop spraying system and a roof lawn. The studied building is an office building at the Advanced Research Institute of Science and Engineering, Waseda University, which is located in the Kitakyushu Science and Research Park, Japan.

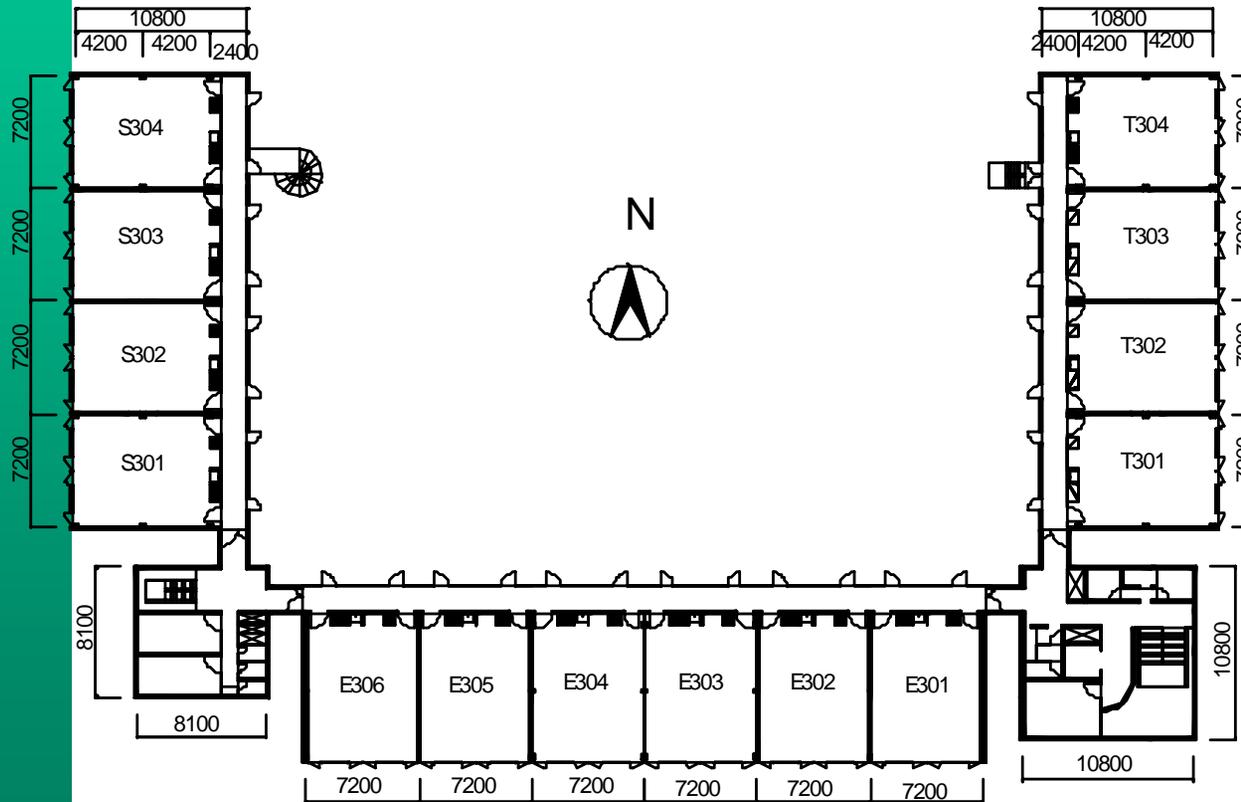
Appearance of Measurement Building



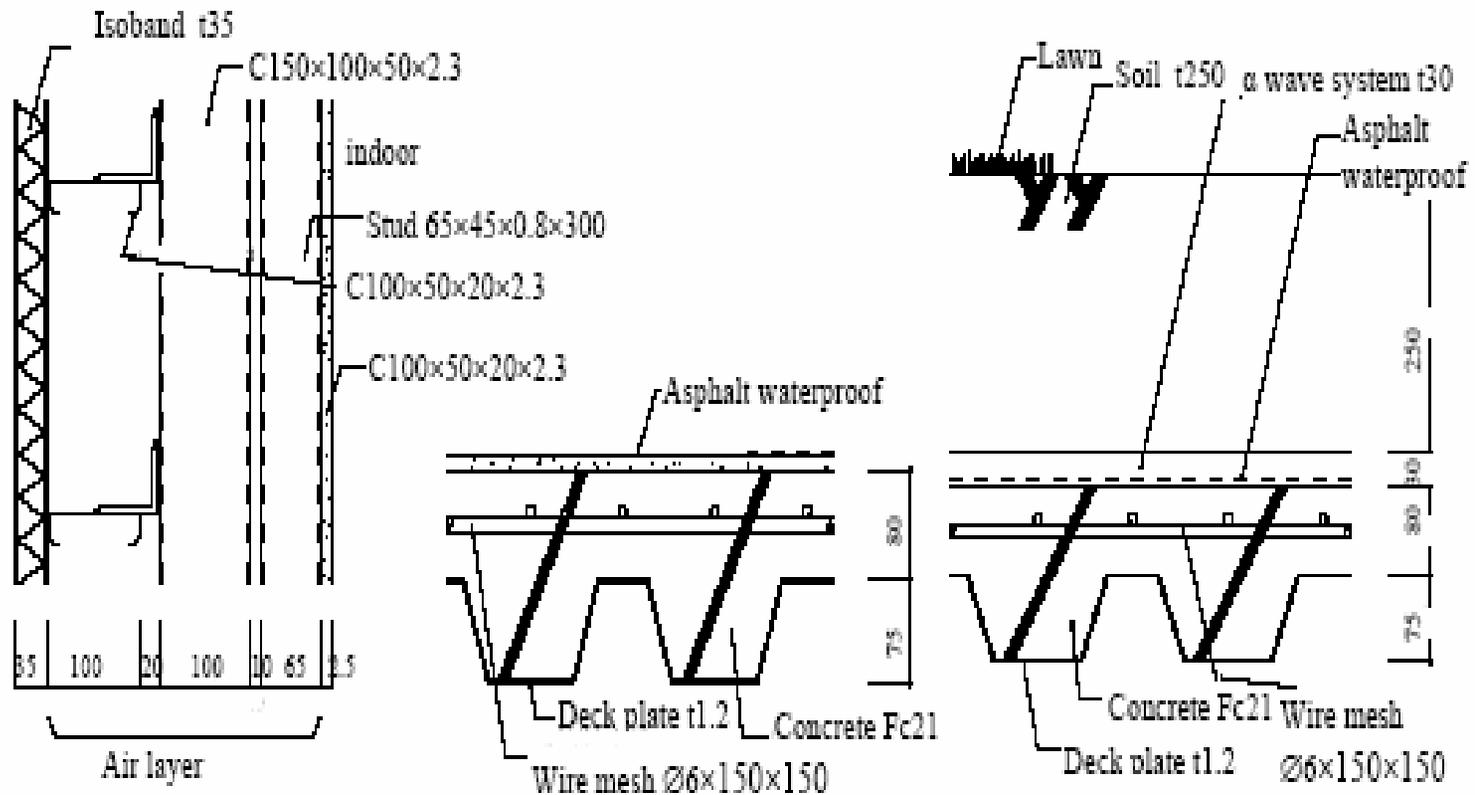
The Roof And The Corridor



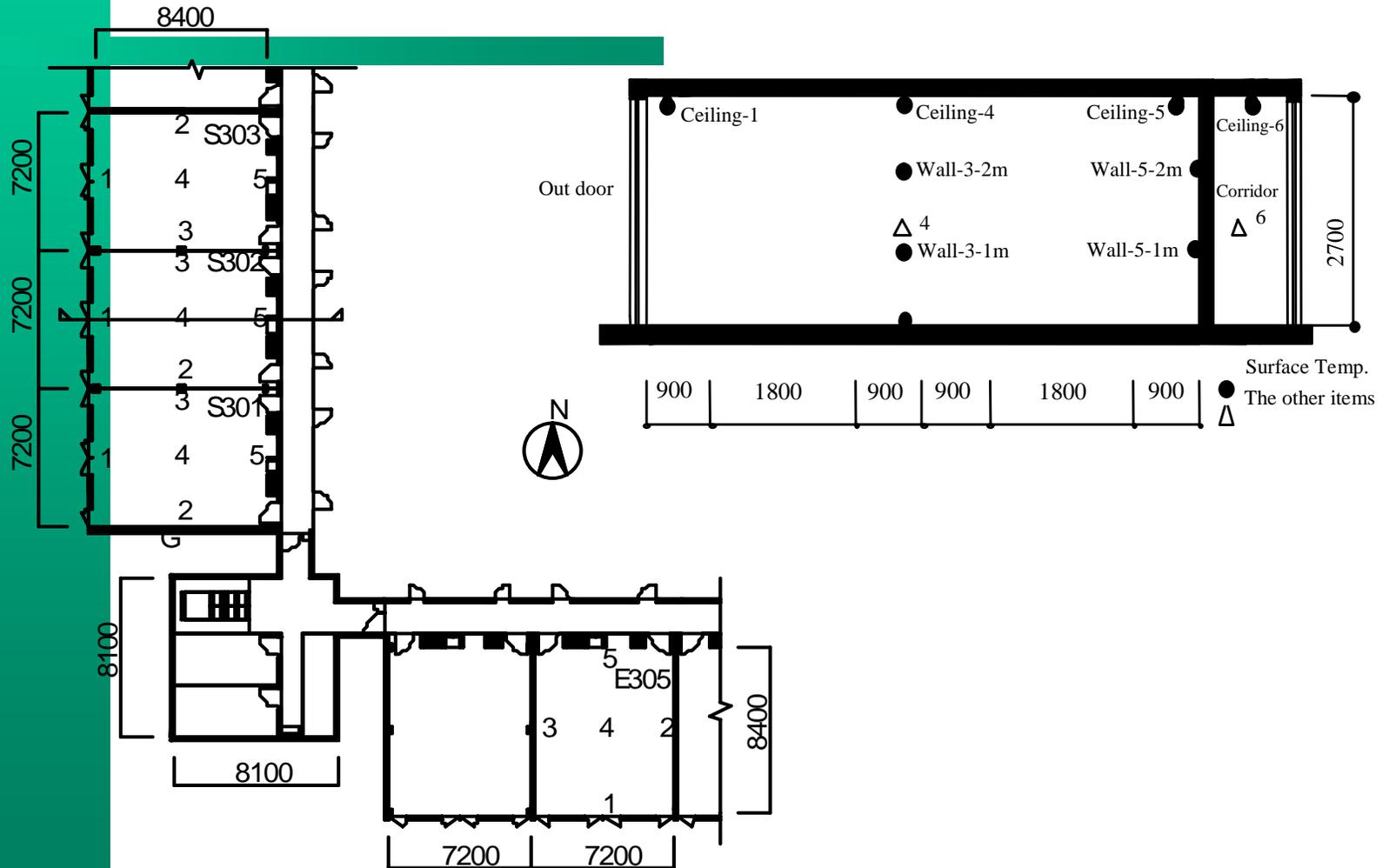
The Plan of Measurement Floor



The Structure of the Wall and Roof



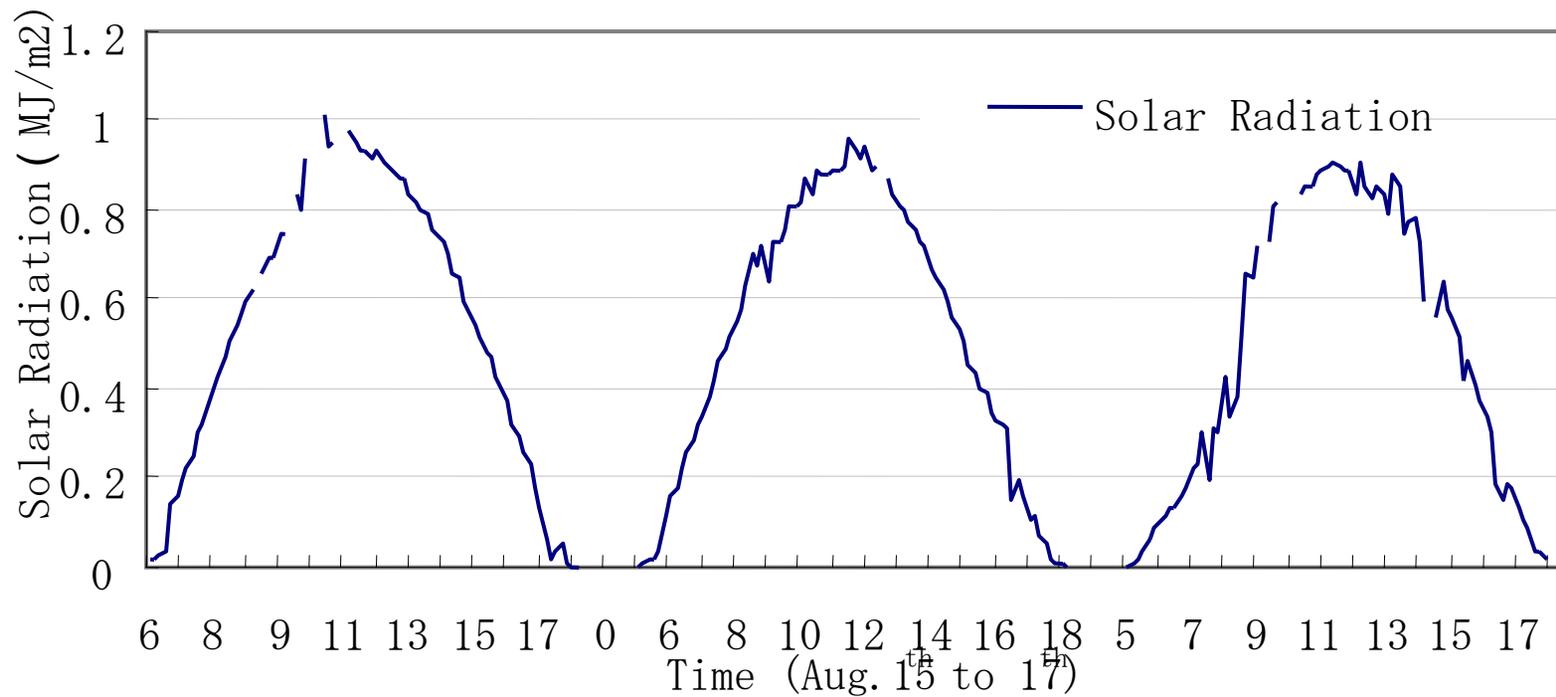
The Measurement Point in Plan



The Measurement Items and Method

Items	Points		Used devices	Detail
Room temperature	center of each room	4,6	Thermo Recorder RH Cooper Constant	① Thermo Recorder RH (T & D . TR-72) ② Cooper Constant (T-type 0.3mm)
	and corridor			
Room humidity	side of each room	5		Cooper Constant 0.3mm
	center of each room	4		Thermo Recorder RH (T & D . TR-72)
Surface temperatur	5 points of ceiling,	1,2,3, 4,5,6	Cooper Constant	T-type 0.1mm
	1 point for corridor			
	floor	4		
Air velocity	wall	2,3,5		T-type 0.3mm
	center of each room and corridor	4,6	Anemo-Thermo meter	Anemo-Thermo Meter (AM - 05)
Glove	center of each room and corridor	4,6	Glove Cooper Constant	
Outdoor temperature and humidity	outdoor		Thermo Recorder RH	① Thermo Recorder RH (T & D . TR-72)
			Cooper Constant	② Cooper Constant (T-type 0.3mm)
Wind velocity	outdoor			RION ANEMOMETER (AM - 09T)
Surface temperature of roof	2 points of each wing		Cooper Constant	T-type 0.1mm
Recorder device	west wing		Dataloga	① Tokyosokki DATALOGA (TDS - 601)
	south wing			② Automatil Swiching Box (ASW-SOC)

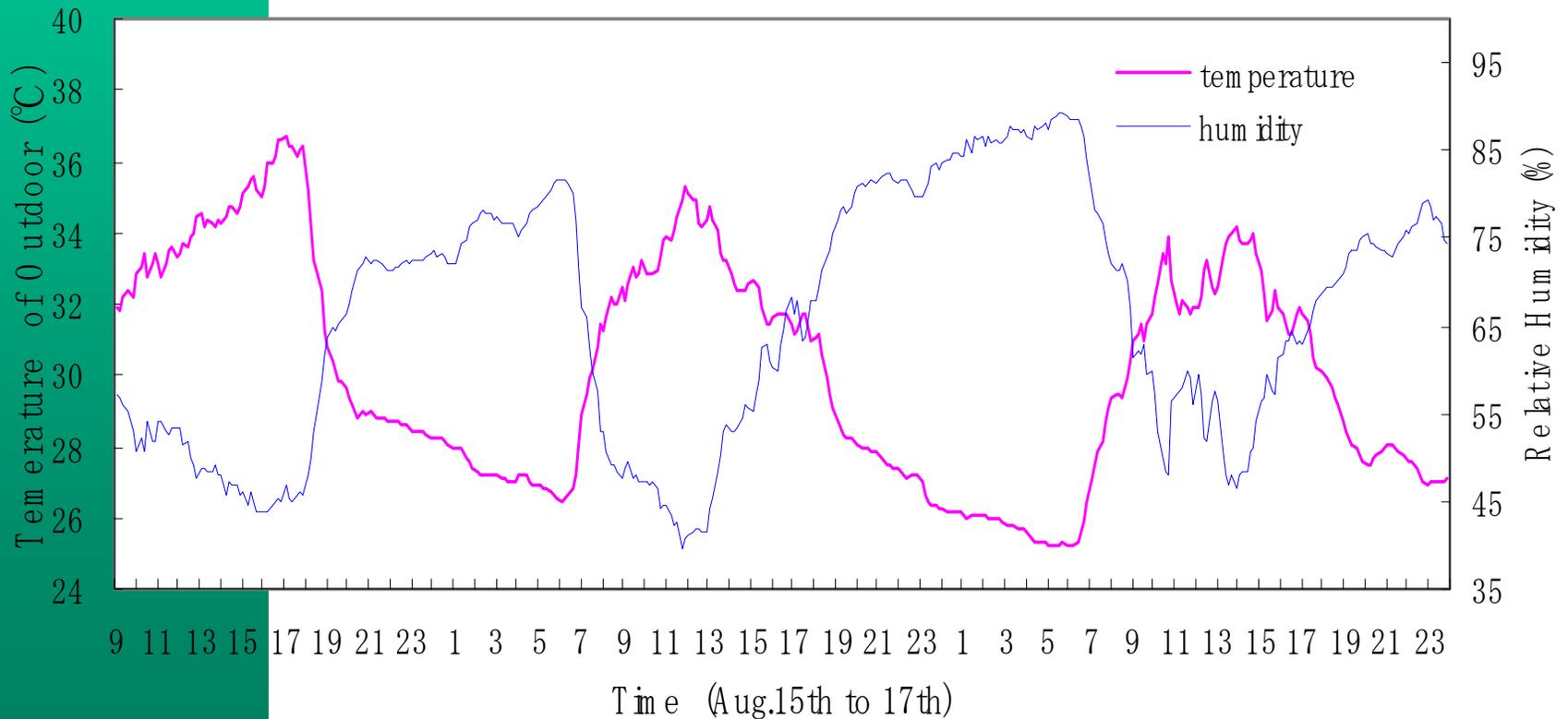
Solar Radiation During The Survey Period



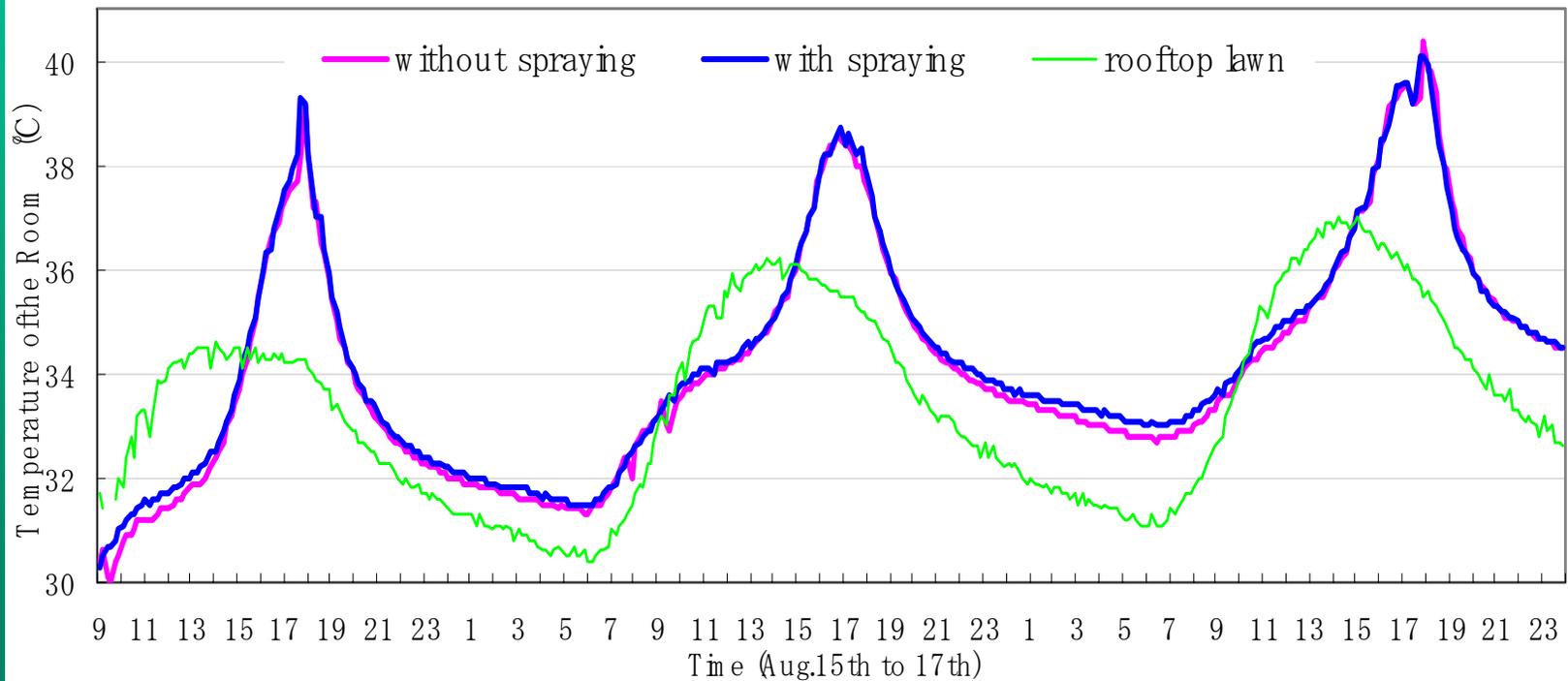
Quantity of spraying

Time	Quantity of spraying	Average spraying amount(ml/sm²)
09:15–10:15	229	1.05
10:15–11:15	182	0.84
11:15–12:15	313	1.44
12:15–13:15	319	1.46
13:15–14:15	158	0.73
14:15–15:15	154	0.71
15:15–16:15	154	0.71

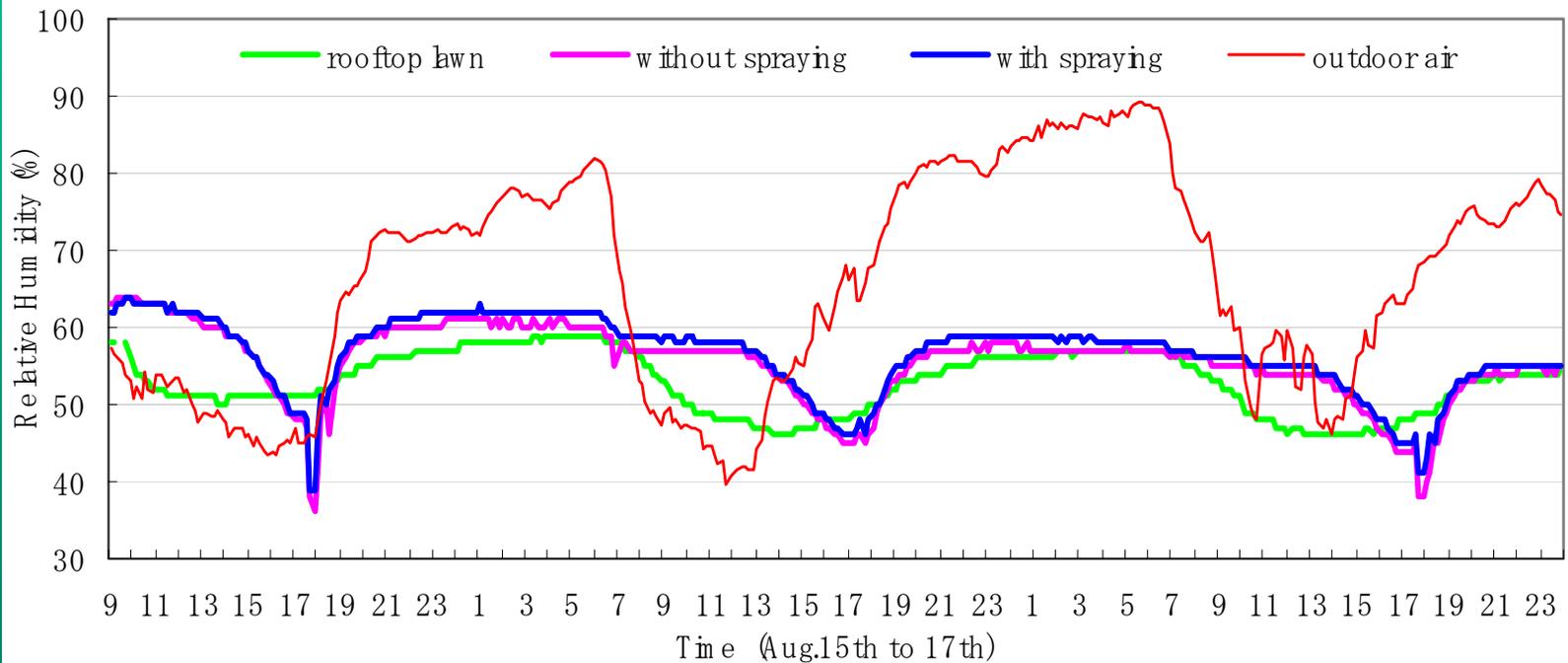
Outdoor Temperature and Relative Humidity



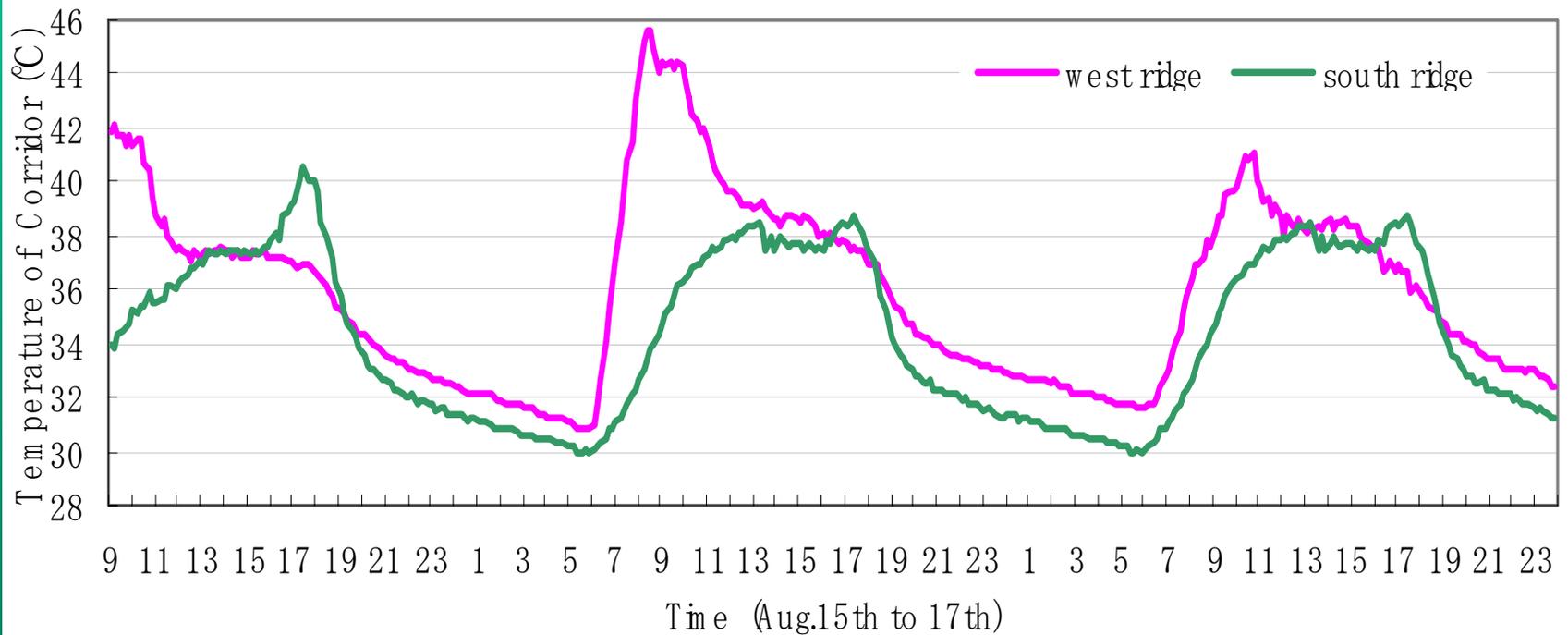
The Indoor Air Temperature



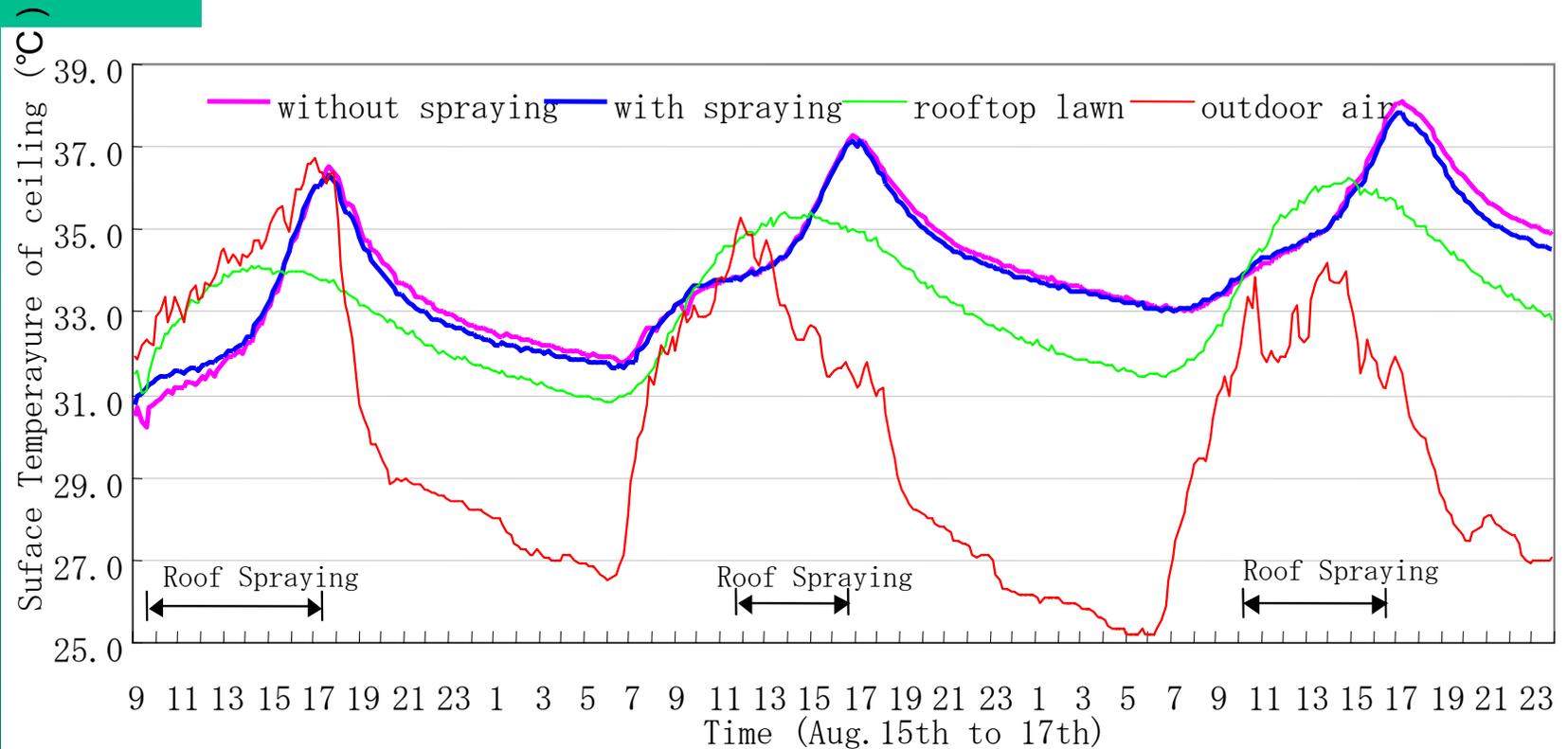
The Indoor Relative Humidity



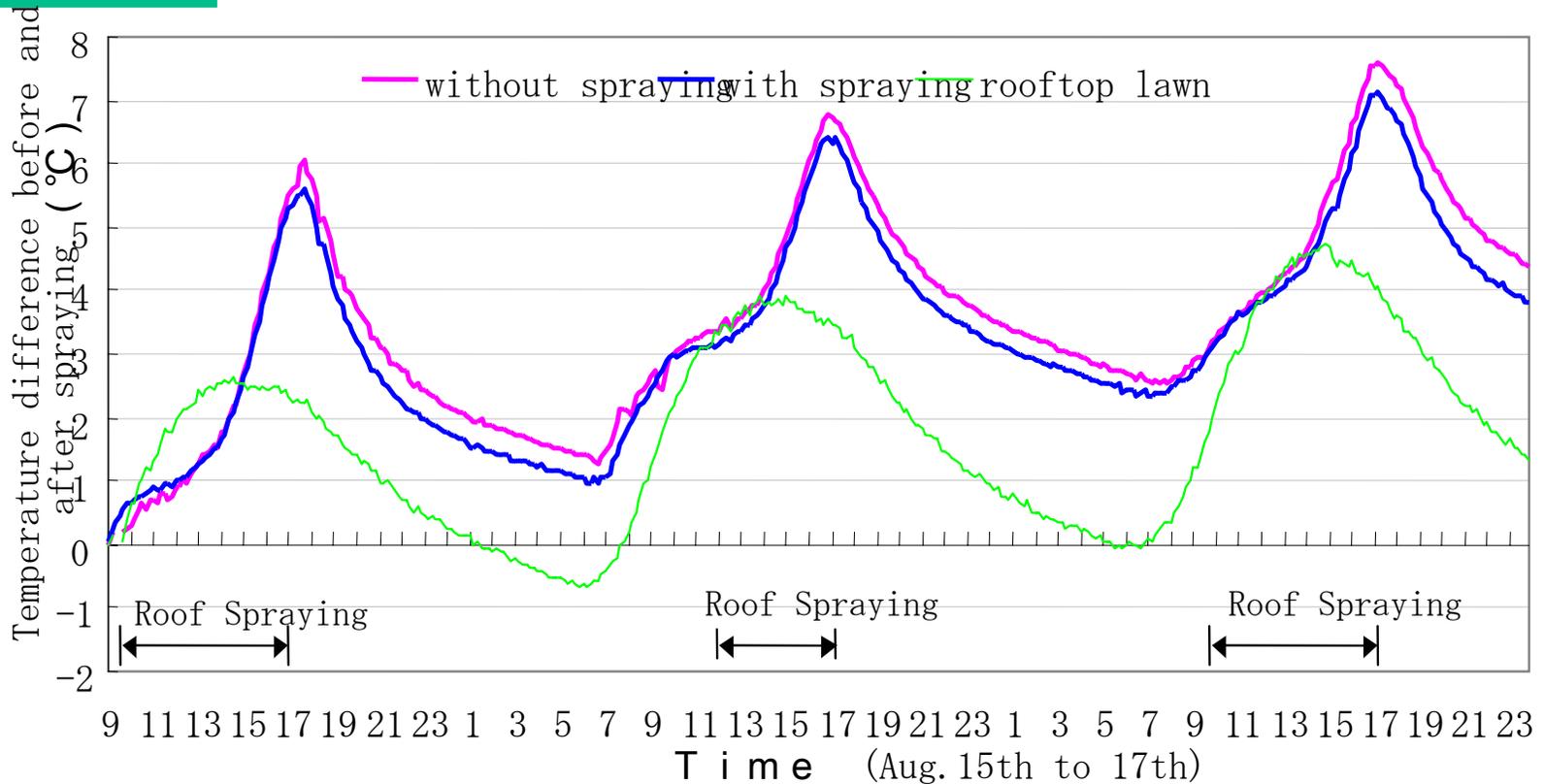
The Temperature of Corridor



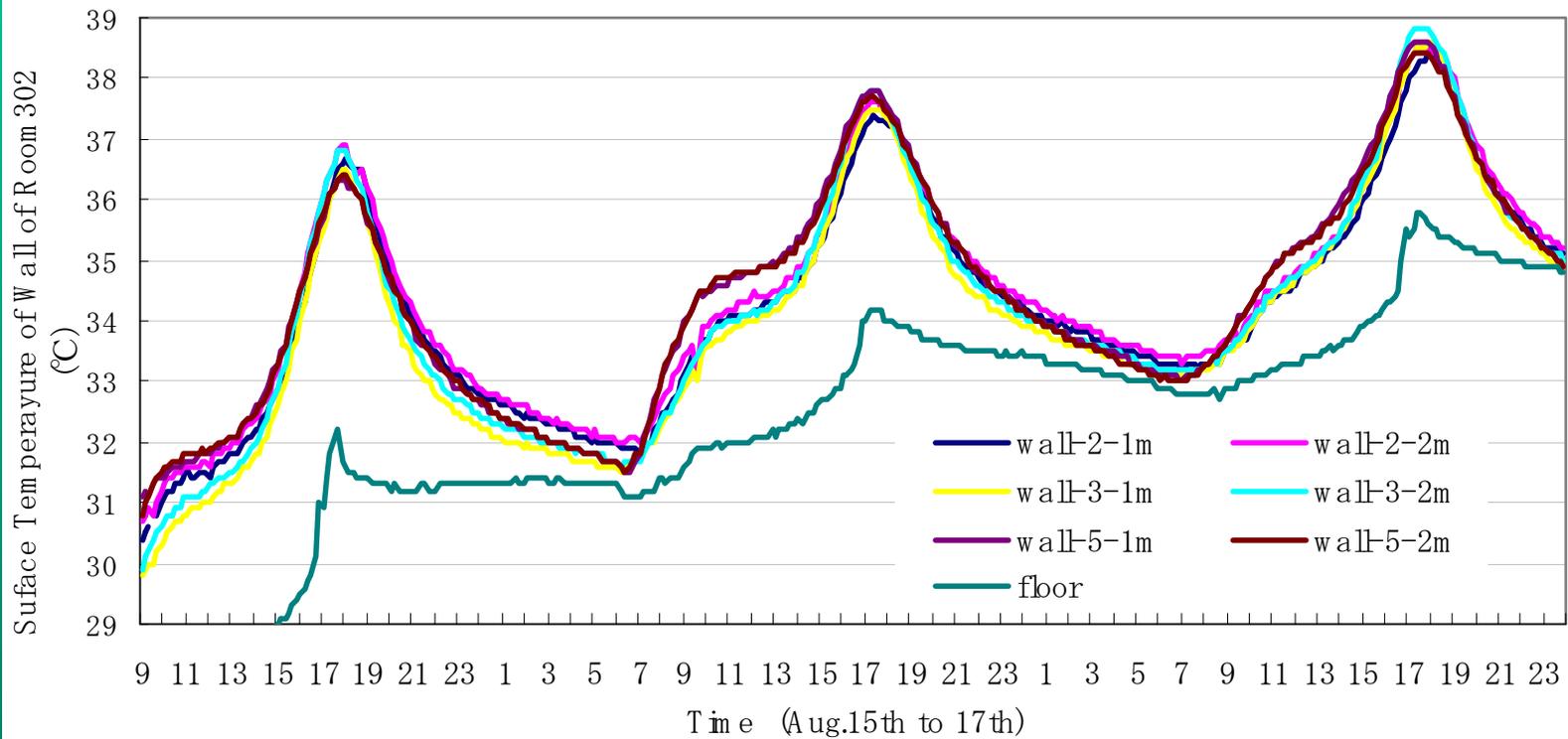
The Ceiling Surface Temperature



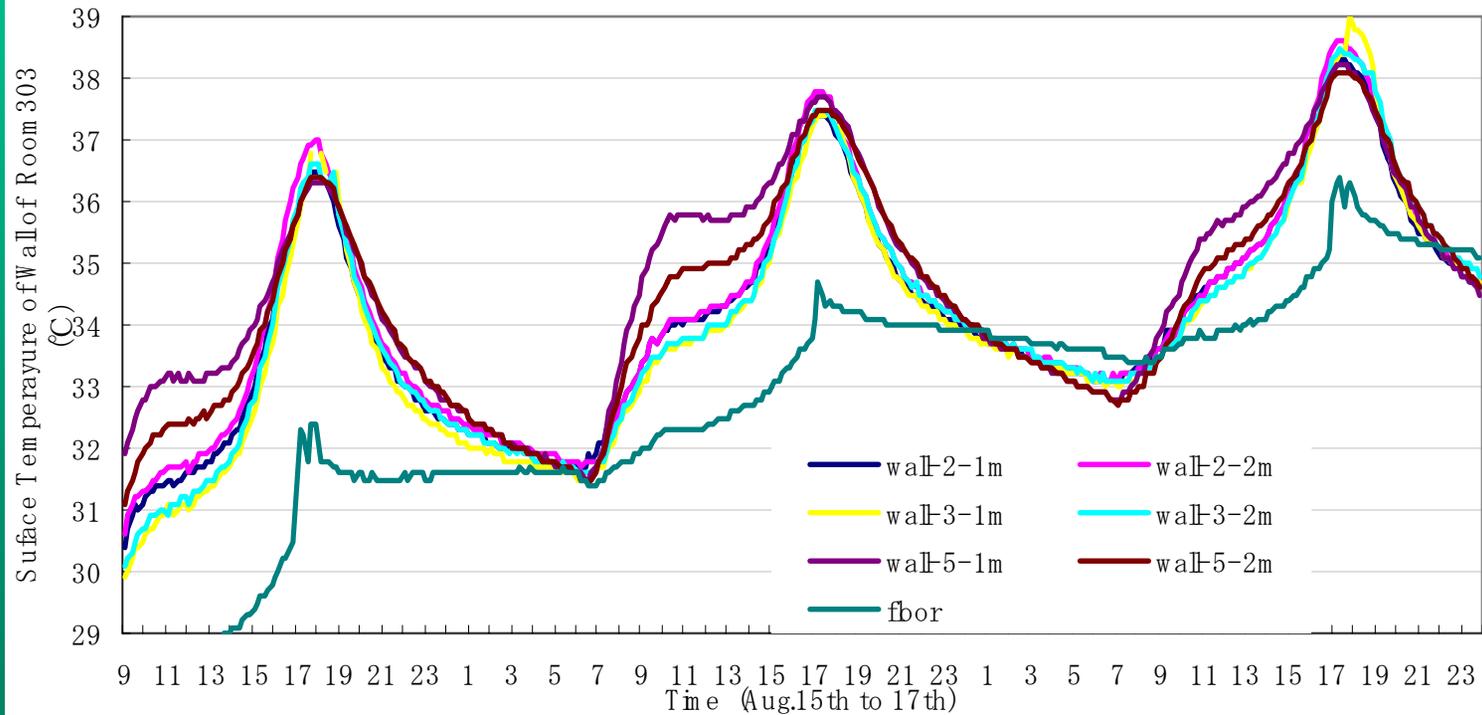
Difference Between Before And After Spraying



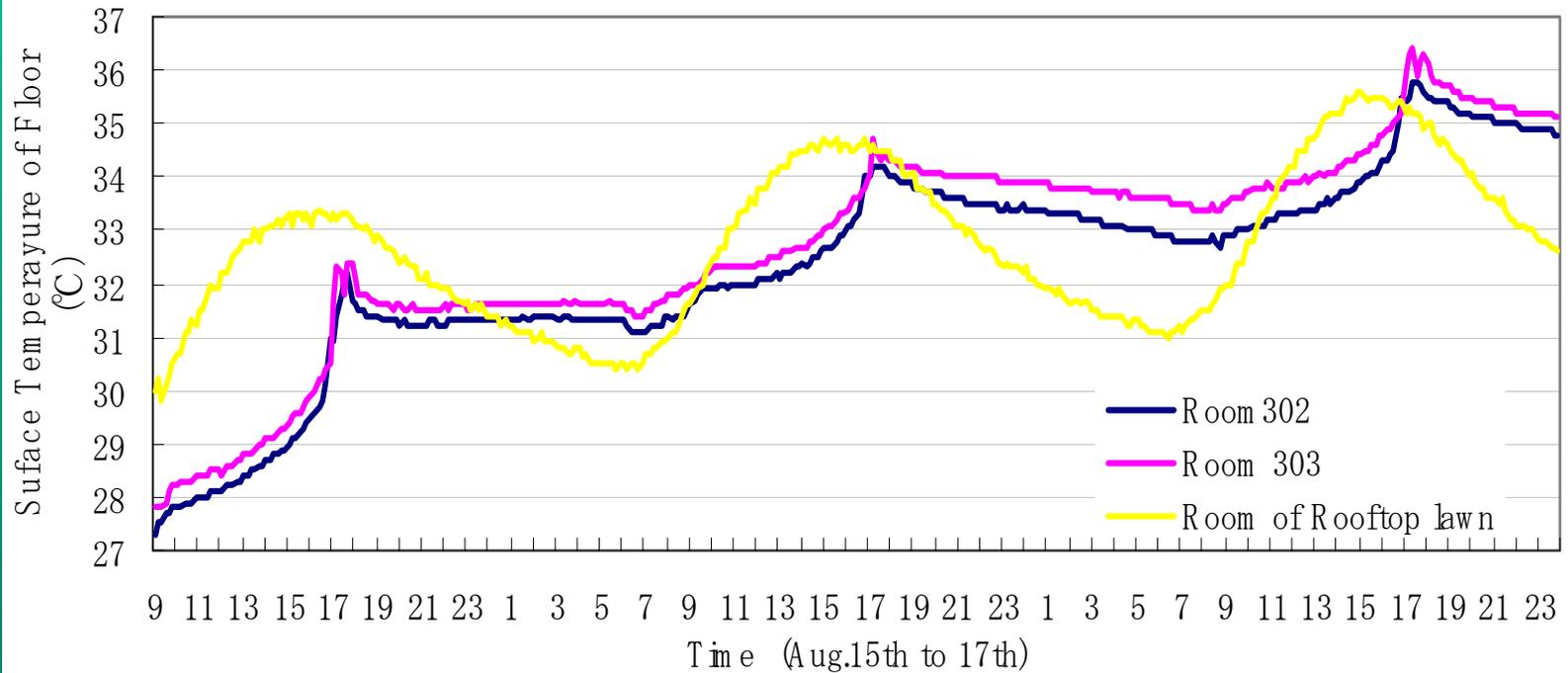
Wall Surface Temperature of Room302



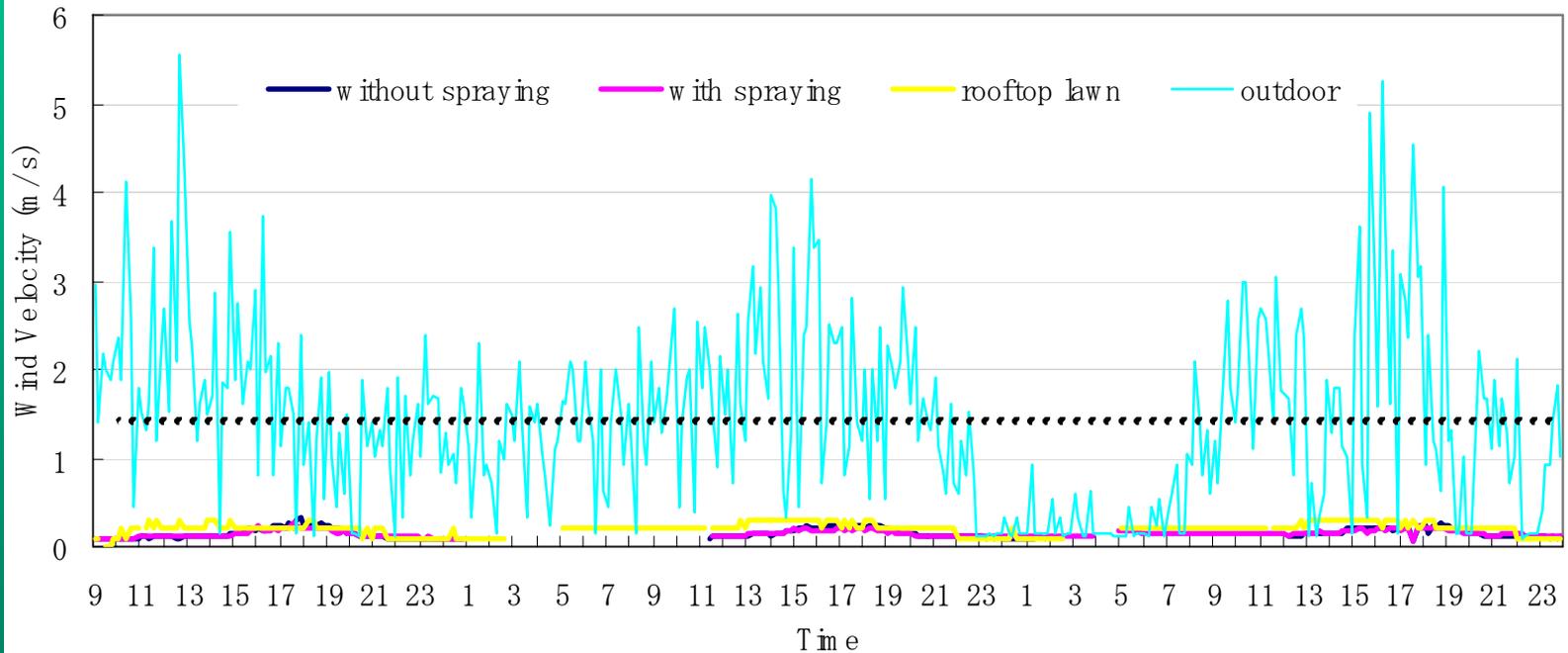
Wall Surface Temperature of Room303



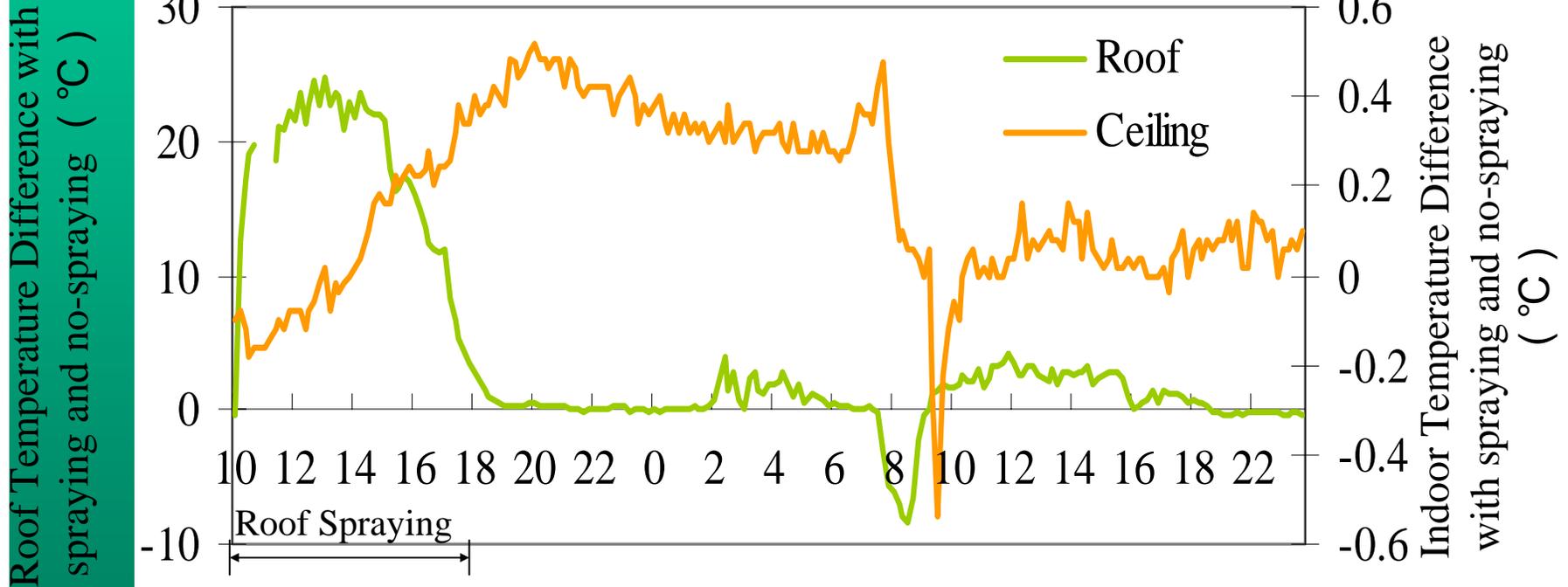
Roof Surface Temperature



The Indoor and Outdoor Wind Velocity

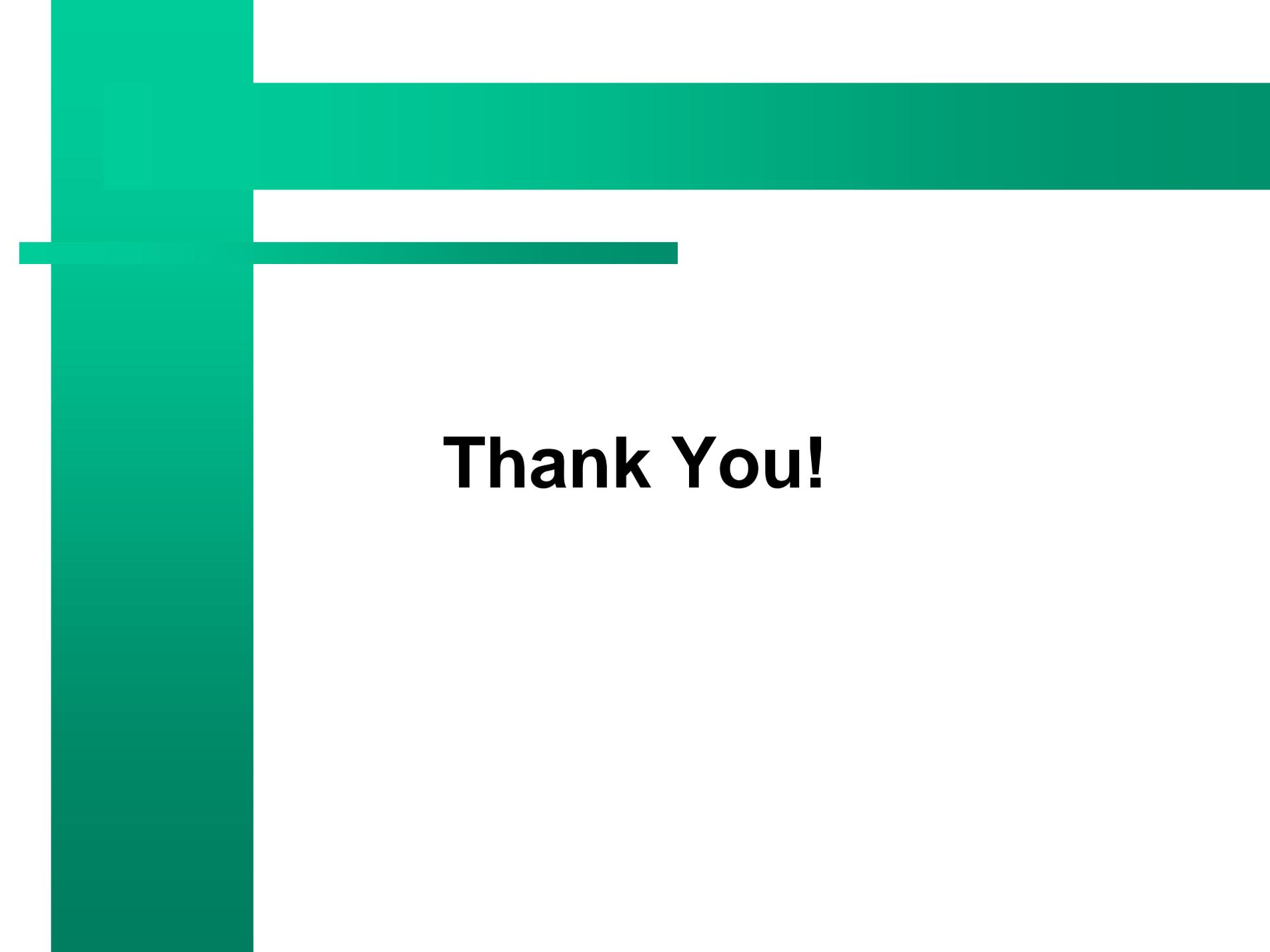


Temperature Differences Of Roof And Ceiling In Aug. 17th



CONCLUSIONS

- **Roof spraying is not suitable for an RC building with a high degree of insulation in the roof.**
- **The rooftop lawn had good characteristics in stabilizing the indoor environment where the lowest temperature obtained at nighttime. It mitigated and restrained the maximum air temperature of the daylight, and also helped in mitigating the heat island phenomenon.**
- **The rooftop lawn is an effective passive method and is also adaptable to many buildings.**

The image features a white background with decorative green elements. A thick vertical bar is on the left side, extending from the top to the bottom. A horizontal bar is positioned near the top, starting from the left edge and extending across the entire width. A shorter horizontal bar is located below the top one, starting from the left edge and extending about halfway across the page.

Thank You!