# Heating of differently colored house facades and their impact on the formation of urban heat islands

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Introduction and explanation of the topic

# Objective of the Study

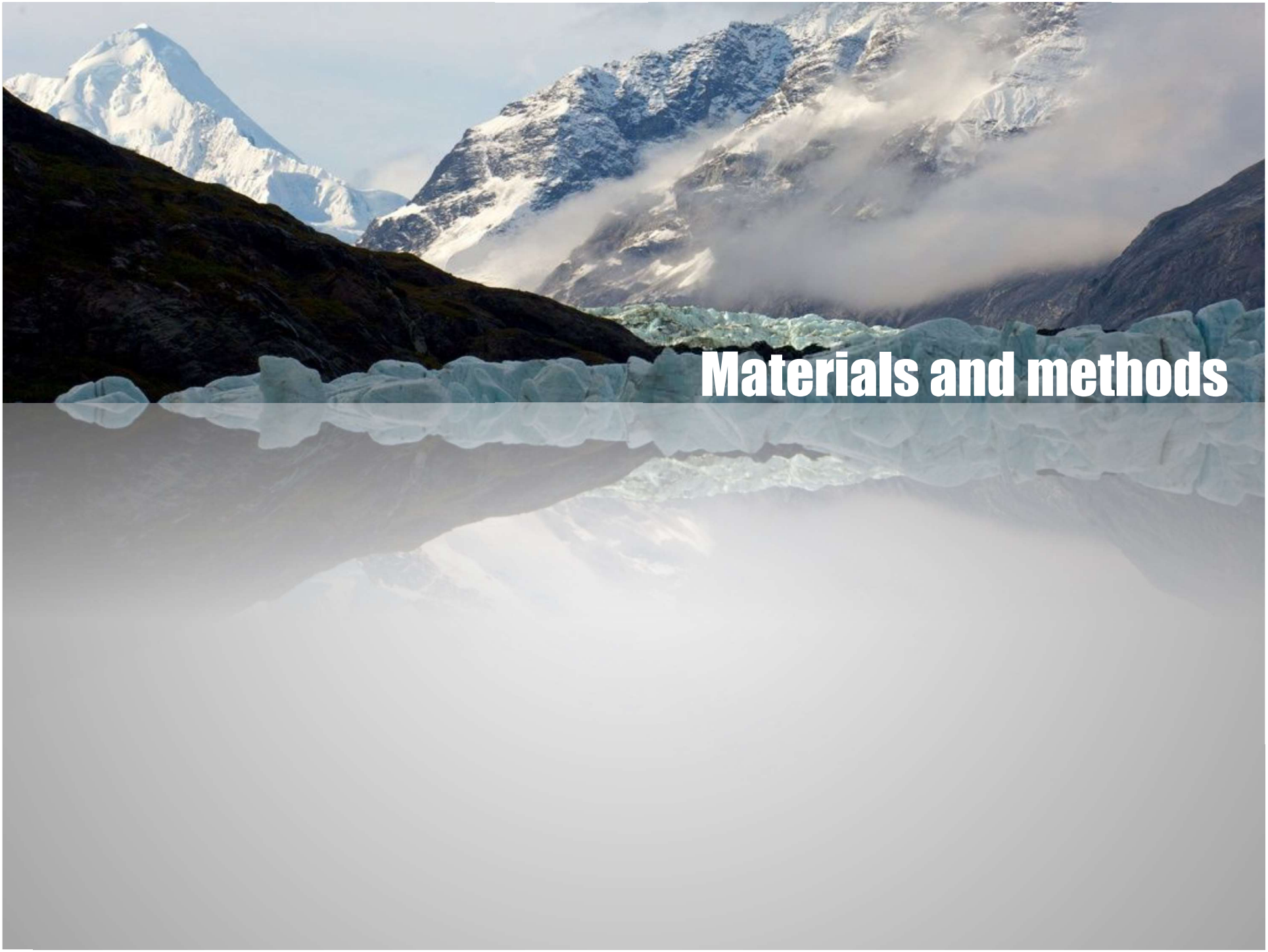
The aim of the study is to examine the heating of differently colored surfaces, with an emphasis on the heating of differently colored surfaces of residential and commercial spaces, and to investigate their impact on the occurrence of urban heat islands.

# Research questions

- Does the color of the surface affect the rate of ice melting?
- Do different surfaces such as water, soil, and snow heat up at the same rate?
- Does the surface temperature differ for differently colored facades exposed to the same amount of solar radiation?
- How does the albedo effect influence the occurrence of urban heat islands?

# Hypotheses

- Ice will melt faster when placed on a dark-colored surface compared to ice placed on a light-colored surface.
- Darker surfaces heat up more than lighter surfaces; therefore, dark-colored house facades will be warmer than light-colored facades.
- Dark house facades will contribute to the occurrence of urban heat islands, an increase in temperature compared to the surrounding area.



# Materials and methods

# *The rate of ice melting*

**Figure 1** Melting ice on a dark and light background

# *Heating of differently colored surfaces*

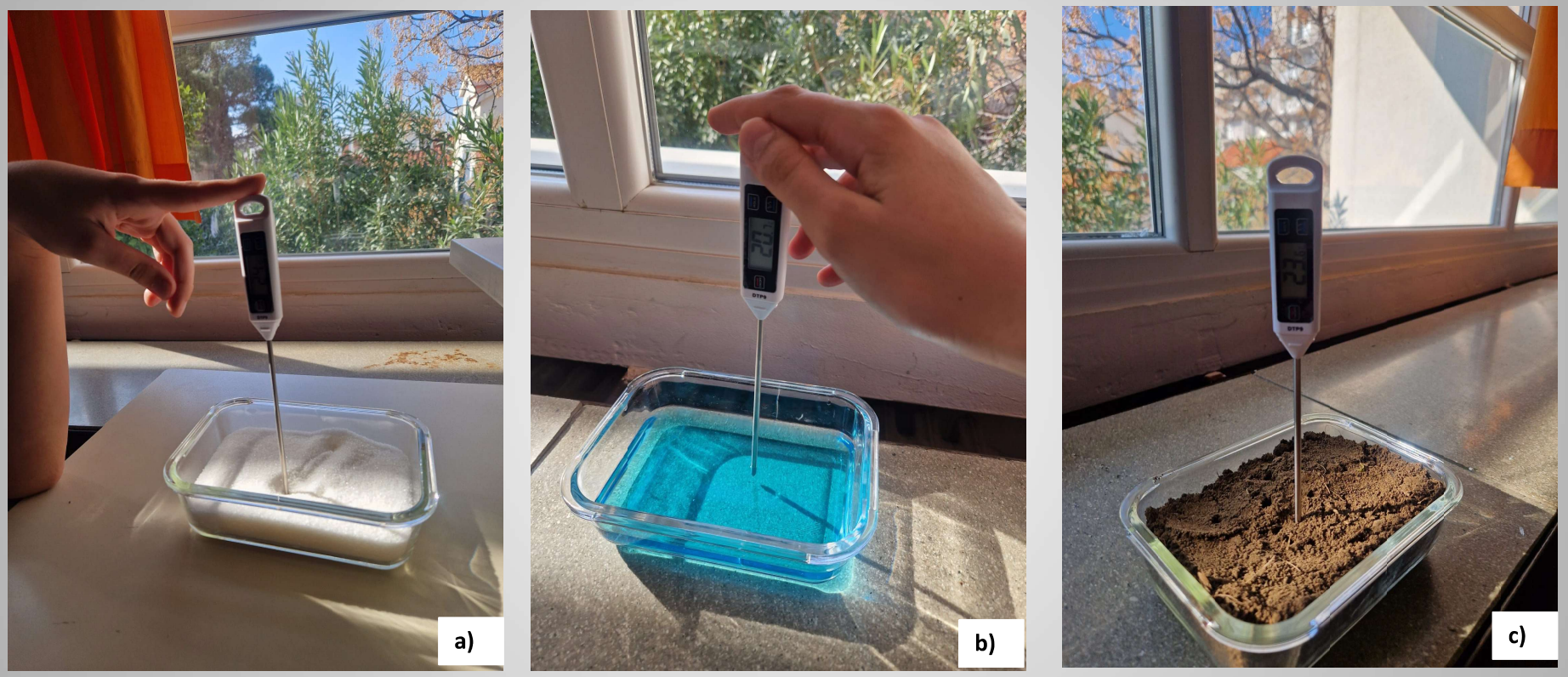



**Figure 2** Heating of differently colored surfaces during 10 minutes of exposure to solar radiation: a) heating of the "glacier,„ b) heating of the "sea, c) heating of the soil

# *Measuring the temperature of differently colored facades*


**Figure 3** Houses with differently colored parts of the facade: a) measuring station 1, b) measuring station 2


**Figure 4** Infrared thermometer

Measurement Period: From June to December

Number of Stations: Five houses where measurements were conducted.

Measurement Intensity: Twice a month.

For one object:

- Intensive measurement once a month.

-Temperature measurements at 9:00, 12:00, 15:00, 18:00, and 21:00


**Figure 5** Measuring the temperature of a house facade with an IR thermometer:
a) Luka, b) Filip

# *Urban heat islands*

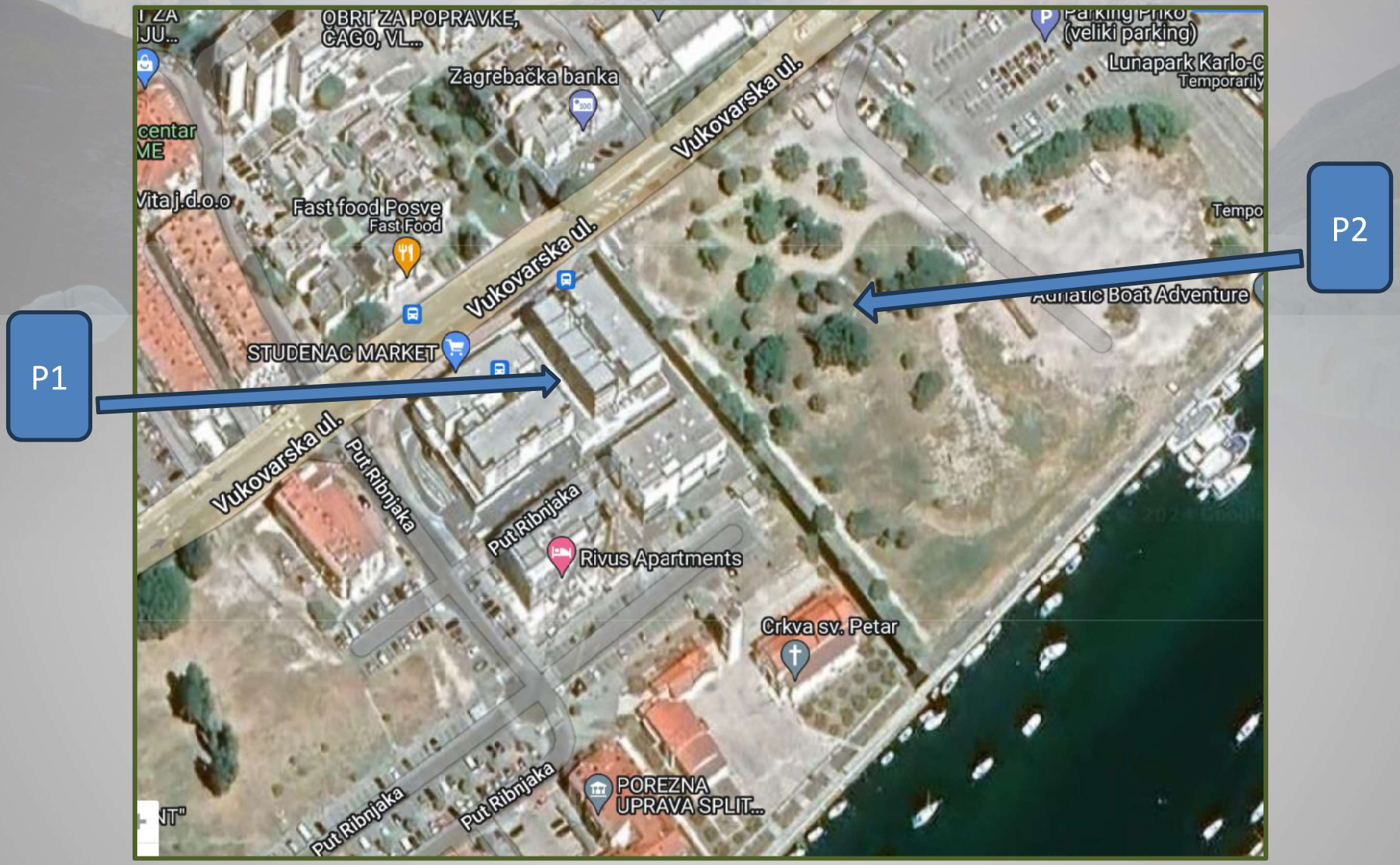



**Figure 6** Stations (P1 and P2) where air temperature was measured and the occurrence of urban heat islands was examined

# Results and discussion

## *Ice melting rate on light and dark surfaces*

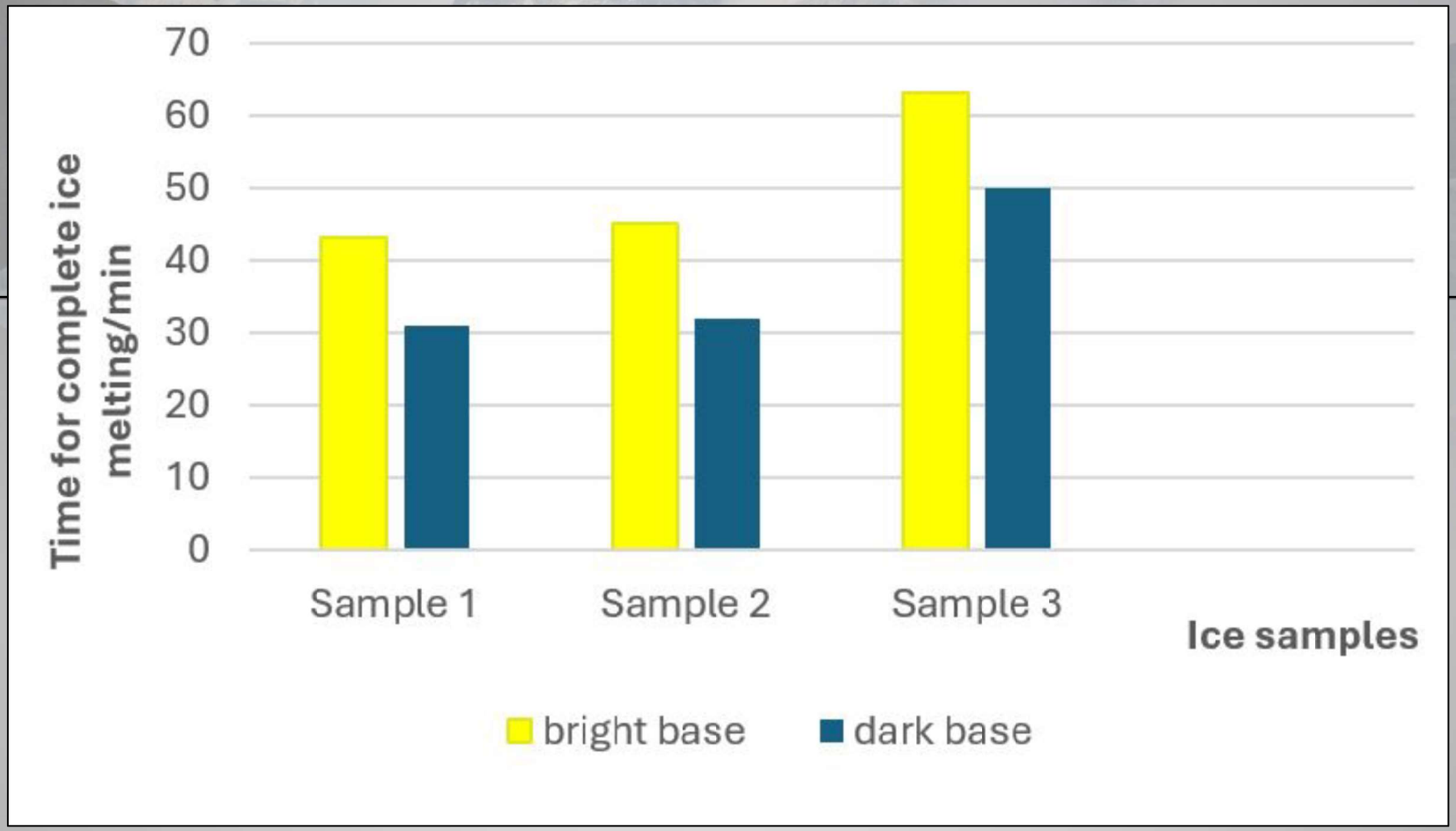



**Figure 7** Graphic representation of the time required for ice cubes to melt depending on the color of the substrate on which they are located

# *Heating of differently colored substrates*

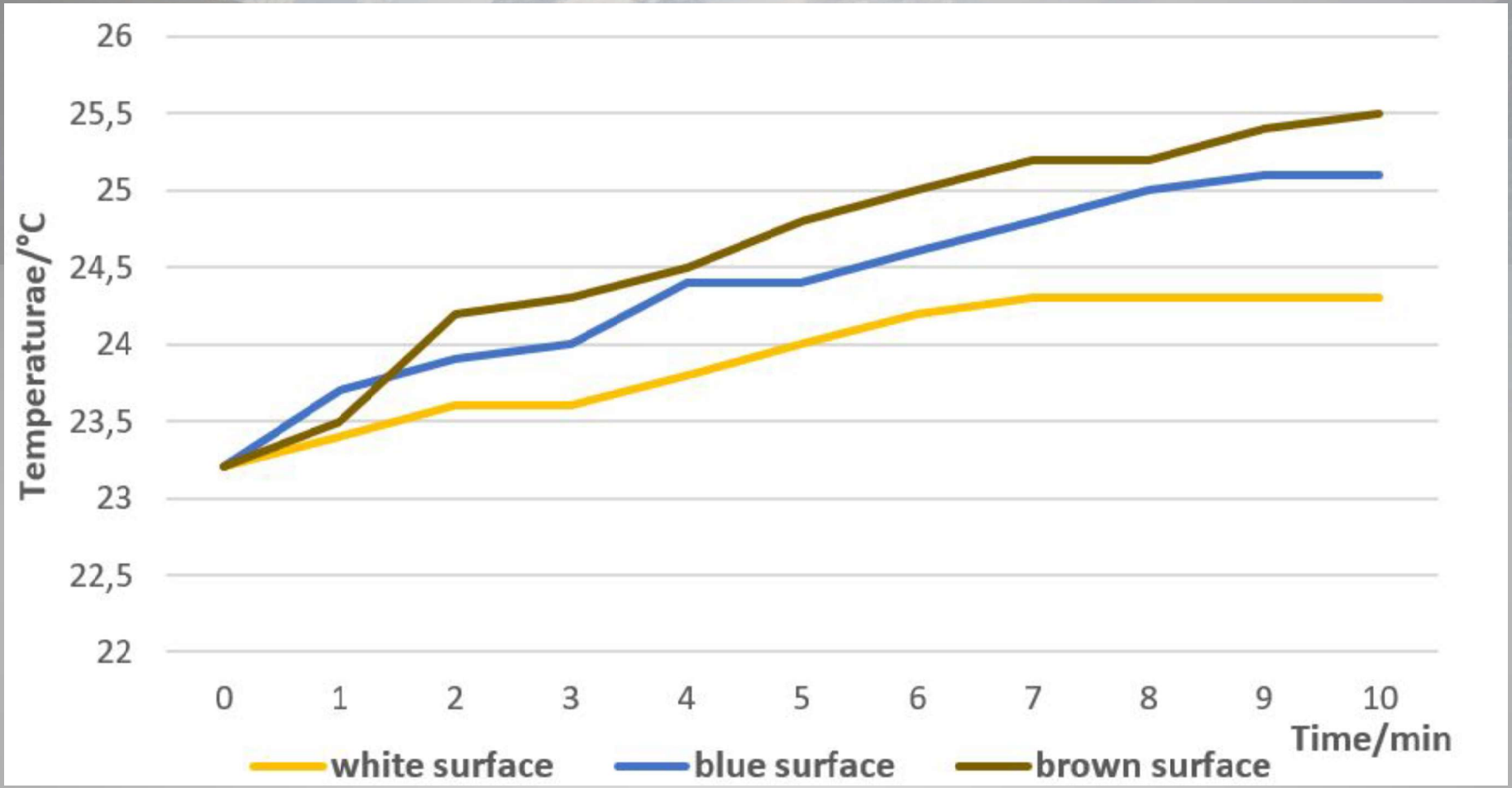



**Figure 8** Graphical representation of the heating of differently colored substrates at a depth of 2 cm during 10 minutes of exposure to solar radiation

# *Heating of differently colored parts of building facades 5*

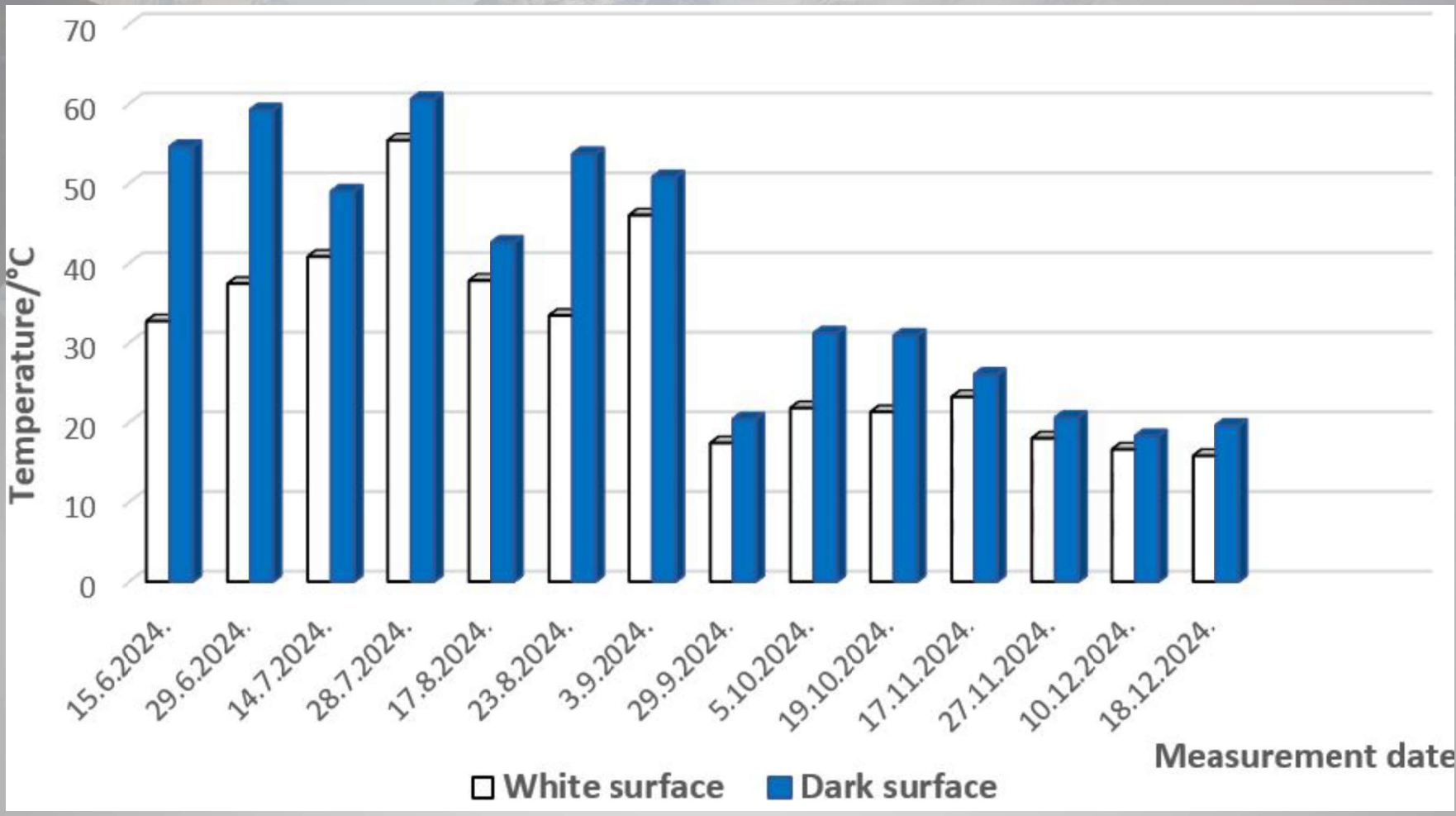
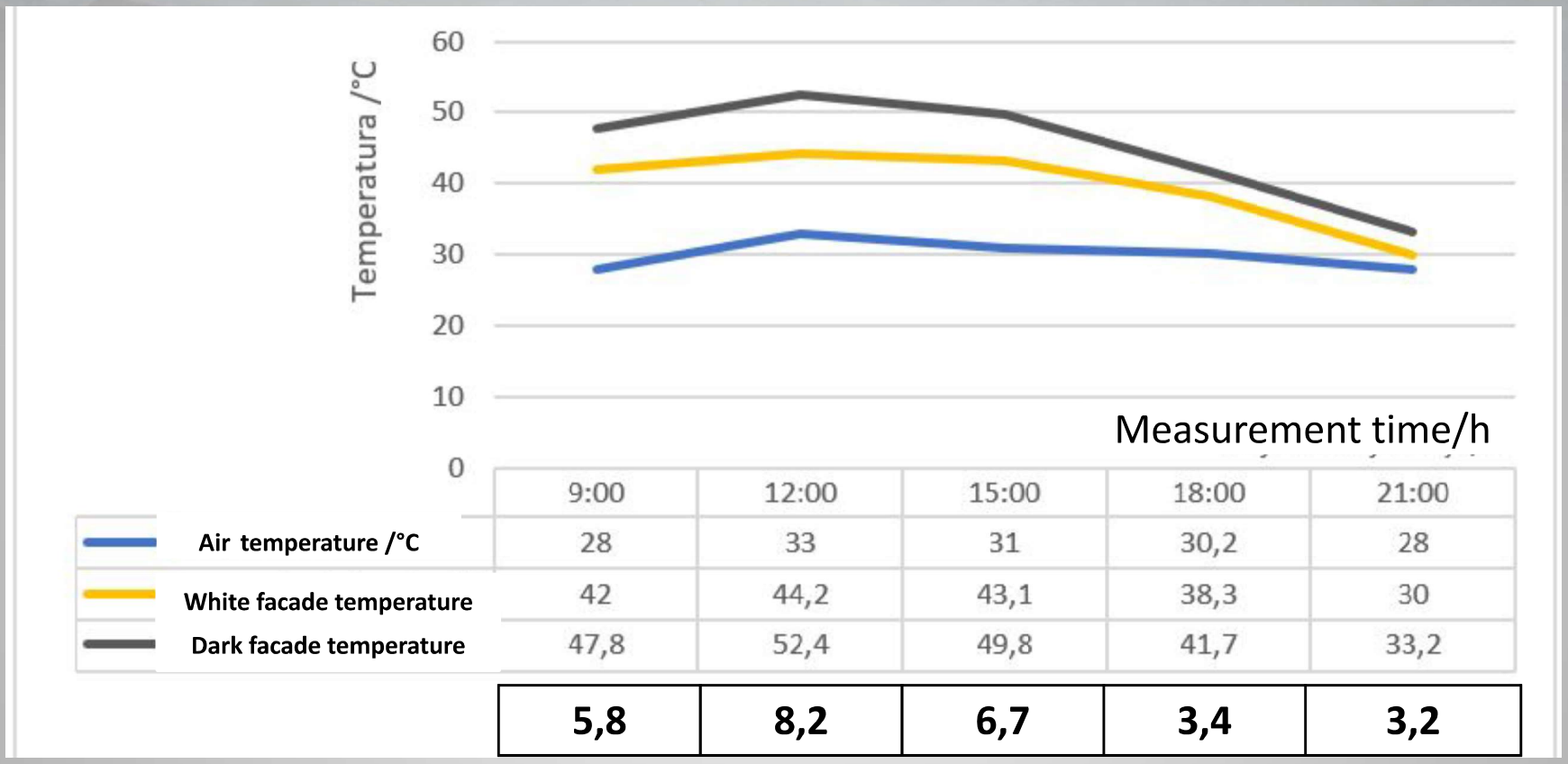



**Figure 9** Graphical representation of the temperature relationship between the light and dark surfaces of object

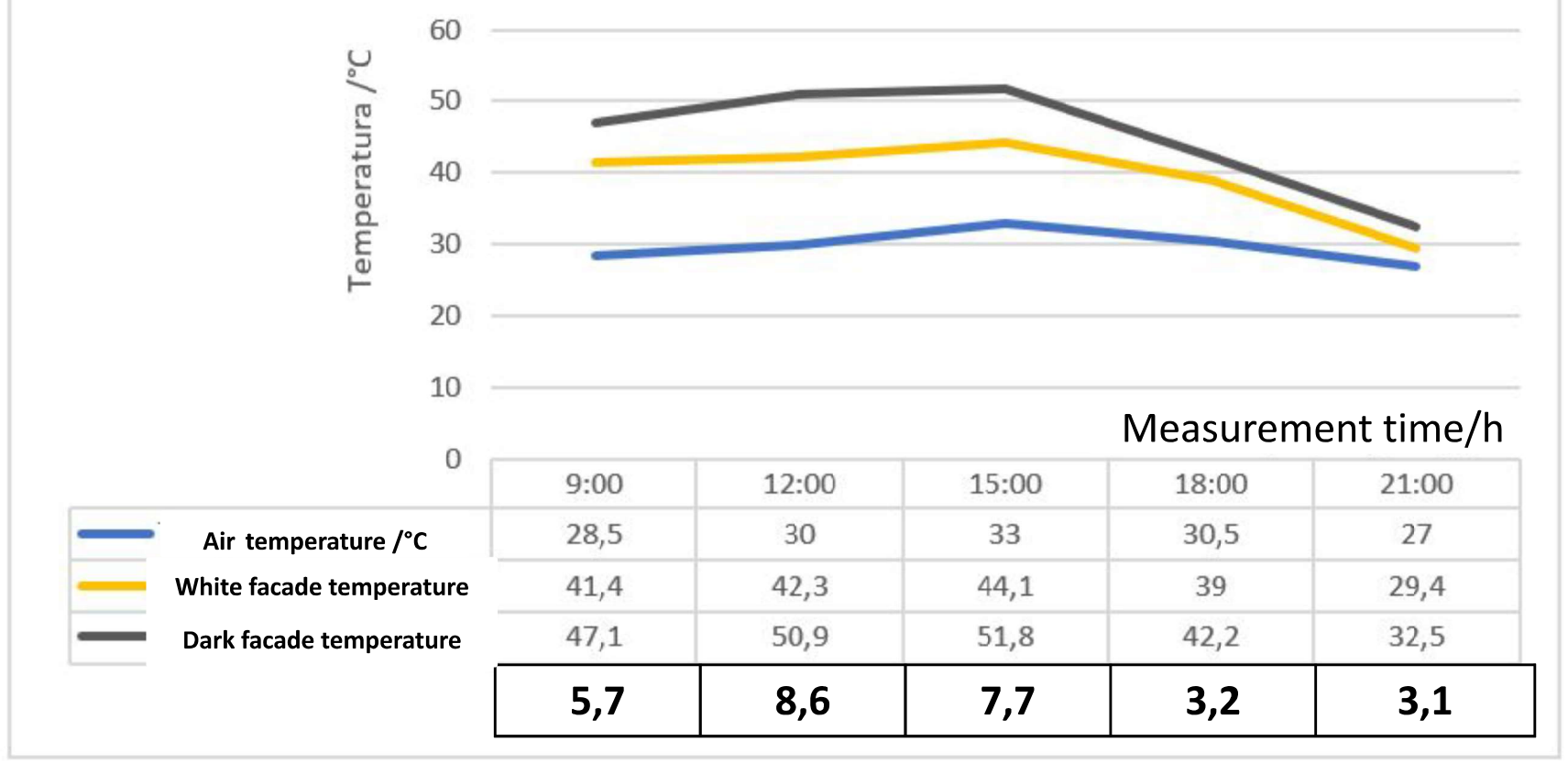
# *Intensive measurements – July 31st*




| | 9:00 | 12:00 | 15:00 | 18:00 | 21:00 |
|---|---|---|---|---|---|
| Air temperature /°C | 28 | 33 | 31 | 30,2 | 28 |
| White facade temperature | 42 | 44,2 | 43,1 | 38,3 | 30 |
| Dark facade temperature | 47,8 | 52,4 | 49,8 | 41,7 | 33,2 |
| | **5,8** | **8,2** | **6,7** | **3,4** | **3,2** |

**Figure 10** Graphical representation of the comparison of air temperature with the temperature of the dark and light facade of building 5 for five measurements during July

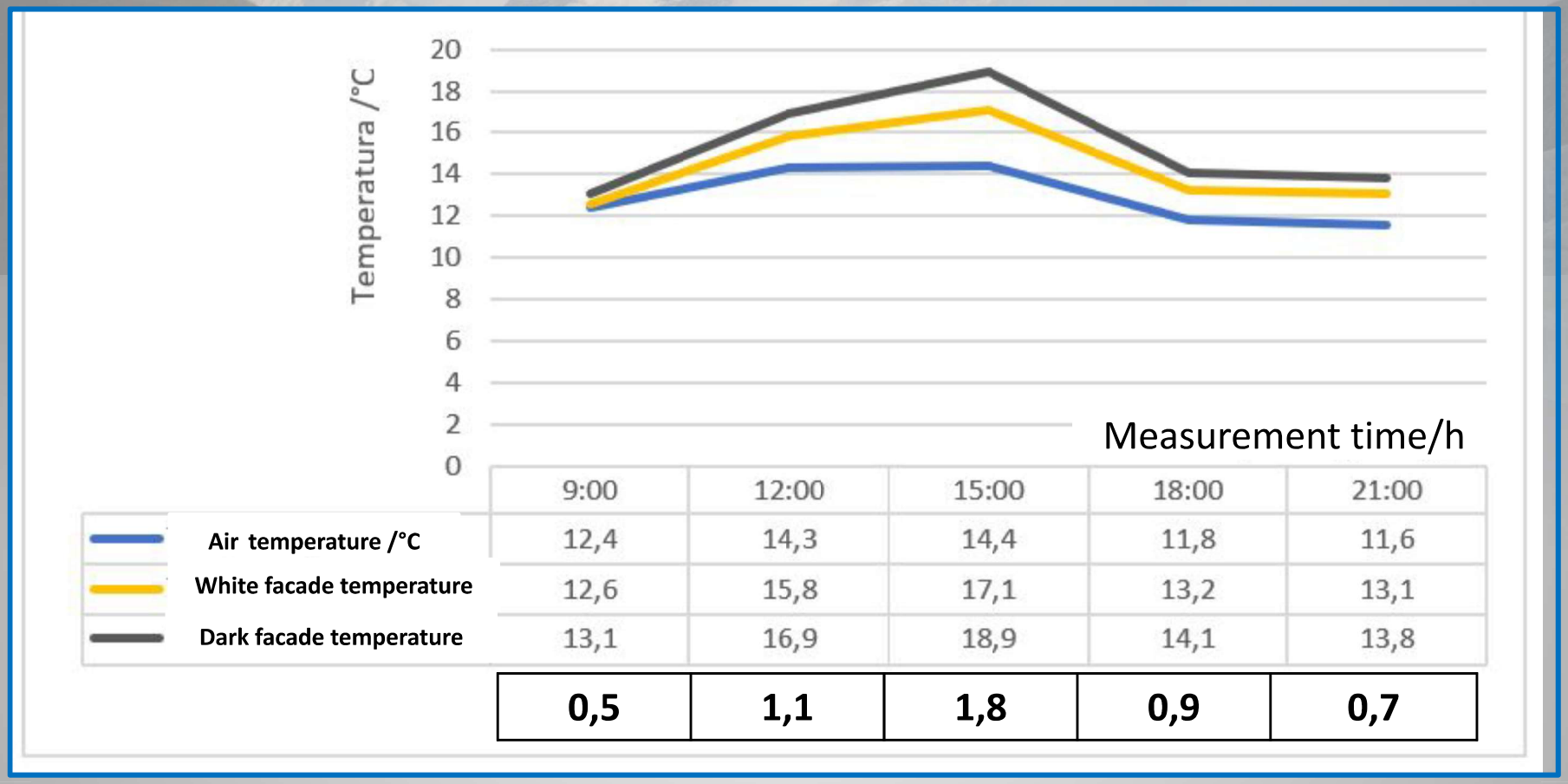
# *Intensive measurements – August 18th*




| | 9:00 | 12:00 | 15:00 | 18:00 | 21:00 |
|---|---|---|---|---|---|
| Air temperature /°C | 28,5 | 30 | 33 | 30,5 | 27 |
| White facade temperature | 41,4 | 42,3 | 44,1 | 39 | 29,4 |
| Dark facade temperature | 47,1 | 50,9 | 51,8 | 42,2 | 32,5 |
| | **5,7** | **8,6** | **7,7** | **3,2** | **3,1** |

**Figure 11** Graphical representation of the comparison of air temperature with the temperature of the dark and light facade of building 5 for five measurements during August

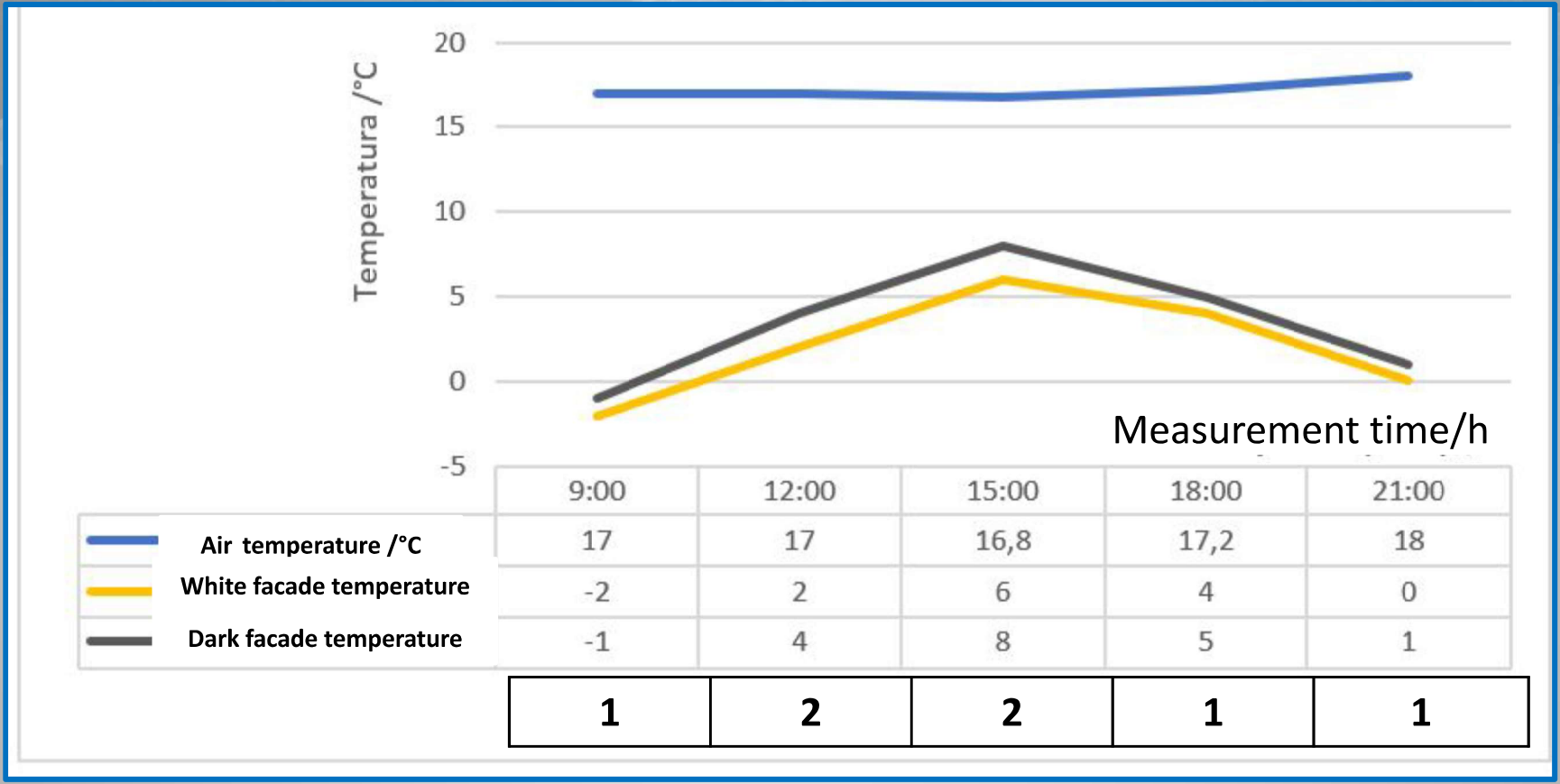
# ***Intenzivna mjerenja*** *– November 18 th*




| | 9:00 | 12:00 | 15:00 | 18:00 | 21:00 |
|---|---|---|---|---|---|
| Air temperature /°C | 12,4 | 14,3 | 14,4 | 11,8 | 11,6 |
| White facade temperature | 12,6 | 15,8 | 17,1 | 13,2 | 13,1 |
| Dark facade temperature | 13,1 | 16,9 | 18,9 | 14,1 | 13,8 |
| | **0,5** | **1,1** | **1,8** | **0,9** | **0,7** |

**Figure 12** Graphical representation of the comparison of air temperature with the temperature of the dark and light facade of building 5 for five measurements during November

# *Intensive measurements – December 13th*




| | 9:00 | 12:00 | 15:00 | 18:00 | 21:00 |
|---|---|---|---|---|---|
| Air temperature /°C | 17 | 17 | 16,8 | 17,2 | 18 |
| White facade temperature | -2 | 2 | 6 | 4 | 0 |
| Dark facade temperature | -1 | 4 | 8 | 5 | 1 |
| | **1** | **2** | **2** | **1** | **1** |

**Figure 13** Graphical representation of the comparison of air temperature with the temperature of the dark and light facade of building 5 for five measurements during December

# *Air temperature in the built-up and unbuilt parts of the city*

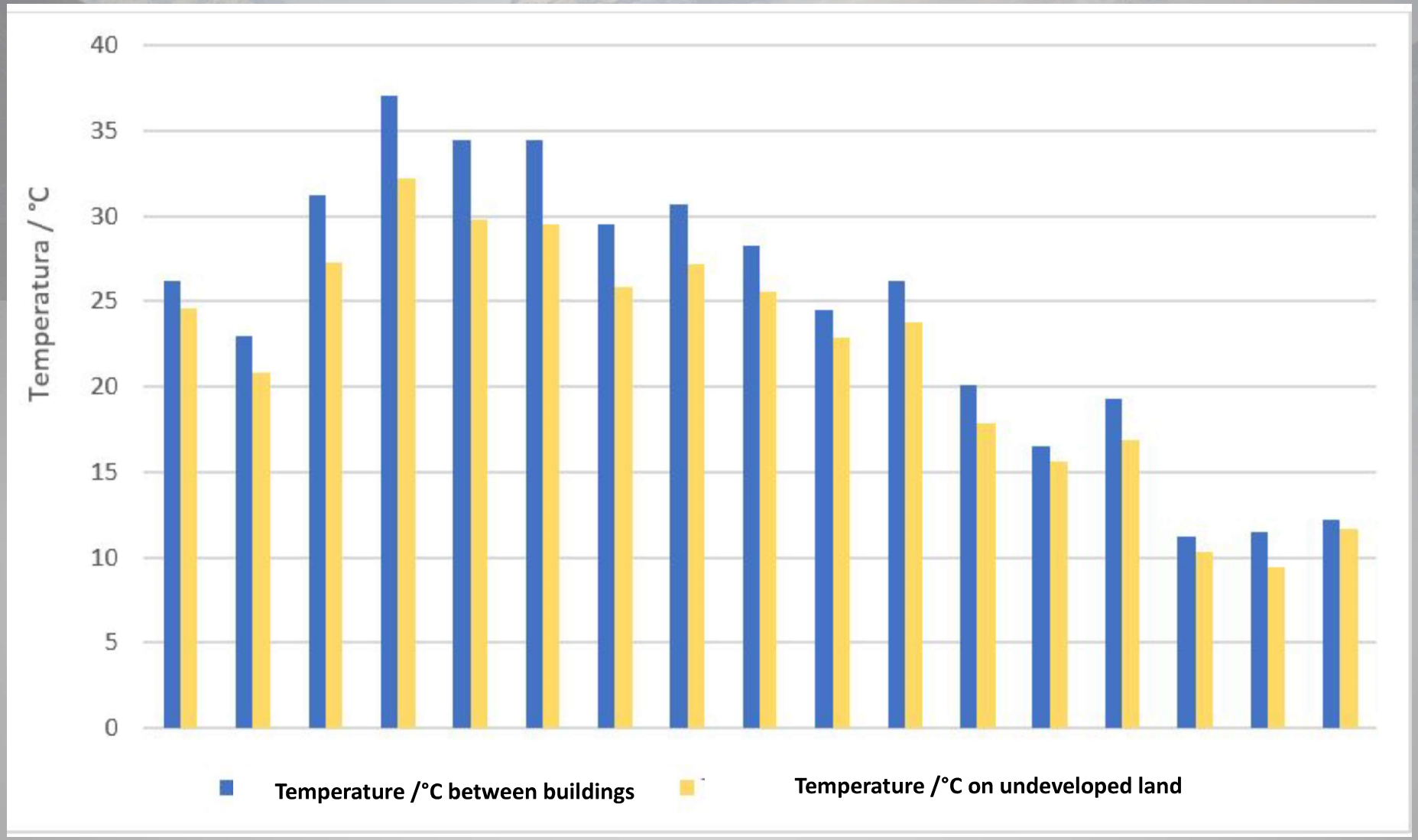



**Figure 14** Graphical representation of the relationship between air temperatures in the built-up and unbuilt parts of the city

# Conclusions

## *Conclusions*

- An ice cube of the same volume will melt faster if placed on a dark-colored surface compared to an ice cube placed on a light-colored surface
- Darker surfaces heat up more than lighter surfaces; therefore, dark-colored house facades will be warmer than light-colored facades.
- Dark-colored house facades will contribute to the occurrence of urban heat islands, for example air temperatures measured in spaces between buildings are higher compared to surrounding areas without residential structures.


THANK
YOU