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Areti Tseliou

Ioannis Tsiros

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Thermal sensation, perception and microclimatic data at a city with Mediterranean climate

Areti Tseliou,
Ioannis Tsiros

Title: Thermal sensation, perception and microclimatic data at a city with Mediterranean climate
(Data Article)

Authors: Areti Tseliou¹, Ioannis Tsiros²

Affiliations: ¹Zayed University, Dubai, UAE, ²Agricultural University of Athens, Greece

Contact email: areti.tseliou@zu.ac.ae

Abstract

This data article presents the data collected through an extensive research work that was conducted in urban areas across Athens in the period from 2010 to 2012. The study deals with the estimation of human thermal sensation conditions in a Mediterranean climate (Athens). The data concern 2313 interview questionnaire and microclimatic data that were collected through interviews with the visitors of the examined areas using parallel monitoring of the urban microclimatic characteristics. The field surveys carried out occasionally throughout the year covering, as much as, possible the different seasons of a city with Mediterranean climate.

1. Specifications Table

Subject area	<i>Bioclimatology</i>
More specific subject area	<i>Thermal comfort in the urban environment</i>
Type of data	<i>Excel files</i>
How data was acquired	<i>field surveys were carried out including both microclimatic monitoring with the use of a portable mini weather station (Campbell CR10 data logger) and structured questionnaires related to thermal sensation</i>
Data format	<i>Raw, analyzed</i>
Experimental factors	<i>2313 interview questionnaires, both genders, all age groups</i>
Experimental features	<i>Use of a portable mini weather station monitoring the urban microclimatic characteristics during the surveys</i>
Data source location	<i>Athens (37°58'46" N 23°42'58" E), Greece</i>

Data accessibility	<i>Data accompany this data article</i>
Related research article	<i>Tseliou, A., Tsiros, I. X., & Nikolopoulou, M. (2017) Seasonal differences in thermal sensation in the outdoor urban environment of Mediterranean climates—the example of Athens, Greece. International Journal of Biometeorology, 1-18.</i>

2. Value of Data

These data are valuable because they:

- consist of the results of an extensive field survey that lasted two years, made the use of an expensive equipment (portable mini weather station) involving many individuals; the interviewees and the students / researchers who carried out the interviews and operated the mini weather station);
- present the microclimatic characteristics of typical urban areas of a Mediterranean city;
- represent the actual thermal sensation and thermal preferences of many population;
- consist of a valuable source of data that can be used for comparisons with similar data retrieved from field surveys conducted in cities with different microclimatic characteristics. Thus, can be used for the investigation of human thermal sensation variation among cities with different climatic characteristics; and
- can be a valuable addition to research studies in cities with similar climatic characteristics increasing the total data volume and contributing to a more valuable research investigation.

3. Data

The data presented in this data article include interview questionnaire data that give information regarding the thermal sensation and the thermal preferences of 2313 individuals throughout the year [1], and microclimatic variable data that were collected during the surveys from the use of the mini weather station.

4. Experimental Design, Materials, and Methods

The described research work consists of two main frameworks as shown in the following:

4.1 Field surveys

The field survey took place intermittently between 2010 and 2012 and was conducted in three typical urban outdoor areas to examine the thermal sensation conditions that people experience in their neighbouring open areas [2]. The examined areas are located in three neighborhoods of Athens consisting of typical resting places where people visit for recreation, including relaxing, meeting friends and walking with kids or pets (**Figure 1**)

Figure 1. The monitoring areas and the portable mini weather station



The actual questions that were included in the structured questionnaire used for the investigation of human thermal sensation is presented in the following:

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DATE/ TIME:

SEASON: warm / cool period

- **Age:** child, teenager, 18-25, 25-35, 35-45, 45-55, 55-64, >65
- **Gender:** Male Female
- **Clothing:** T-shirt, (sleeveless/short/long) shirt, (cotton/woolen) jumper, sweatshirt, shorts, trousers, jeans, skirt (long, short), dress (short/long, no/short/long sleeves) vest, cardigan, jacket (denim/cotton, wool), raincoat, overcoat, tie, umbrella
- **Food/drink consumption:** 1) cold drink 2) hot drink 3) food
- **Interviewee is smoking?** Yes / no
- **For how long have you been in this place:** <10 minutes, 10-1 hour, > 1 hour
- **Position:** standing, sitting
- **Interviewee presently stays in sunlight;** yes / no

How do you find air temperature at the moment: very cold, cold, slightly cool, neither cool nor warm, slightly warm, hot, very hot

Do you prefer cooler or warmer conditions at the moment? I prefer: Warmer conditions – cooler conditions - I am satisfied

How do you find sun/ or solar radiation at the moment: gloomy, pleasant, strong, too much sun

How do you find wind at the moment: stale, little wind, pleasant, windy, too much wind

How do you feel at the moment? Comfortable, uncomfortable

What is the more unpleasant weather parameter at the moment? Wind, sun, air temperature, humidity, none, all

What do you think of the luminous appearance of this space? Very dark, dark, neither dark nor bright, bright, very bright

Noticeably glaring surfaces: NO, pavement, water surface, surrounding buildings, vegetation, urban furniture, canopy or sky

Does the view from your position affect your appreciation of this site? Negatively, nice, positively

Sound level: very quiet, quiet, neither quiet nor noisy, noisy, very noisy

Why do you visit this place? Rest, walking by, sports, meeting friends, work (break time), passage to another place, taking care of children / pet, shopping, other

Where have you been before visiting this place?

Car, at home, at work, public transport, on the street, other indoor place

Is there something you don't like in the area; I am satisfied, limited vegetation, a lot of pavement, noisy, view, other **Do**

you like green areas, in general; yes, no, I don't care

What do you like in an open area? Vegetation, view, water, other

Are you local inhabitant; yes , no

How long have you been here?

The maximum duration of each interview was five minutes and the time of the interviews was marked. The data collected from the answers of the 2313 questionnaires along with the microclimatic data when then elaborated statistically in order to investigate the human thermal sensation and perception microclimatic conditions for the citizens of a Mediterranean city.

4.2 Microclimatic monitoring

Micrometeorological instruments were positioned on a wheeled tripod to easily transport the weather station to different positions (**Figure 1**). The height of the station was about 1.1 m, corresponding to the average height of the centre of gravity of adults. Air temperature and RH were measured with RHT2-type sensors (Delta-T Devices; accuracy $\pm 0.5^{\circ}\text{C}$ and $\pm 2\%$, respectively). Solar radiation was measured using a CM7 albedometer that measures the albedo using two pyranometers combined into one instrument ($4\text{--}6 \mu\text{V}/(\text{W m}^{-2})$ sensitivity and $\pm 1\%$ error). Wind speed was measured using a cup anemometer (Vector Instruments Model A100L2; accuracy $\pm 1\%$, threshold 0.15 m s^{-1}). Finally, globe temperature was measured using a Pt100 sensor inserted into a 38-mm diameter hollow acrylic sphere, painted with flat grey matte black paint.

5. Overview of Research Findings

The analysis for Athens, a city with Mediterranean climate, highlighted that the vast majority of individuals are in ‘thermal comfort’ for both the warm (86.6%) and cool (82.4%) season, despite the average difference in air temperature of more than 10.0°C , suggesting that individuals are well adapted in their thermal environment. Comparing thermal neutrality between the two seasons, as a proxy for thermal comfort, the highest percentage of votes in the ‘neither cool nor warm’ category (ATSV=0) is observed during the cool months (42.0%) which also constitutes the category of ATSV that gathers the majority of votes among the other ATSV categories during the cool months. This also influences people’s attendance in the outdoor urban areas, which is bigger during the cool months when the majority of the thermal sensation responses are for the ‘neither cool nor warm’ category of ATSV. This suggests that despite the wide adaptive capacity, the most

pleasant environmental conditions occur during the cool months where the average air temperature, solar radiation and wind speed vary at around 15 °C, 400Wm⁻² and 0.7 m.s⁻¹, respectively. As far as the warm months in concerned, the category of ATSV that gathers the majority of votes is ‘slightly warm’ (ATSV = 1: 32.0%) while the ‘neither warm nor cool category’ accounts for 27.0% of the votes. Warm months. The combination of ‘hot’ (ATSV =2: 50.0%) and very hot conditions (ATSV = 3: 27.0%), strong sun (sun sensation =1: 53.0%) and little wind (wind sensation = -1: 47.0%) are strongly related with the ‘thermal discomfort’ votes.

(For more details about the project or the findings, please contact the corresponding author at: areti.tseliou@zu.ac.ae)

6. Acknowledgments

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7. References

- [1] Tseliou, A., Tsiros, I. X., & Nikolopoulou, M. (2017) *Seasonal differences in thermal sensation in the outdoor urban environment of Mediterranean climates—the example of Athens, Greece. International Journal of Biometeorology, 1-18.*
- [2] Tseliou, A., Tsiros, I. X., Nikolopoulou, M., & Papadopoulos, G. (2016). *Outdoor thermal sensation in a Mediterranean climate (Athens): The effect of selected microclimatic parameters. Architectural Science Review, 59(3), 190-202.*