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ASSESSMENT OF BIOCLIMATIC CONDITIONS IN CITIES FOR TOURISM AND RECREATIONAL PURPOSES (A WARSAW CASE STUDY)

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Abstract

The assessment of biometeorological conditions for tourism and recreational purposes is usually based around fundamental meteorological data, climate-tourism indices or biometeorological indices. Specific methods for investigating the sensible climate in the context of urban tourism had not been devised hitherto, but the present paper offers results of an assessment of the bioclimate of the Polish capital city, Warsaw, from the point of view of tourism and recreation, using the *UTCI* and *PET* indices. Values for these indices are then compared with thermal sensation votes cast by tourists in the course of leisure activities in Warsaw's Old Town area. This validation revealed that, while weather perception does not only depend on meteorological factors, usage of *UTCI* is an appropriate approach to the study of the bioclimate of urban areas for tourism and recreation purposes.

Key words

UTCI • *PET* • weather perception • tourism and recreation • Warsaw

Introduction

Information on climate is an important aspect taken into account as the destination and most favourable time for a holiday are chosen. It is also crucial for the tourism industry and local authorities, because it allows regional tourism offers to be optimised. However, if the information in question is to be made useful, collection and analysis must be followed by presentation in a form capable of meeting consumer expectations.

As tourists are affected by many atmospheric factors simultaneously, their perceptions and reactions may be similar where configurations and values in regard to meteorological elements are different (Lin et al. 2011). Moreover, it is usual for people to lack the ability to assess the effects of particular weather components on their thermal sensations separately, because their perception is determined by a whole group of meteorological factors very often acting synergistically (Oliveira & Andrade 2007). For that reason, conventional climatological data (usually comprising long-term mean temperature, air humidity, wind speed or precipitation totals) are not adequate indicators of sensible conditions for human beings (de Freitas 2003). Hence it is necessary to employ a comprehensive approach that accounts for the combined effect of all meteorological elements.

Furthermore, there is a strong demand for a cohesive set of research methods that may be applied in evaluating climatic conditions for all forms of tourism and recreation (de Freitas 2003; Błażejczyk 2004). In this respect, one of the most comprehensive and popular climatic indices applicable to tourism is *TCI* (the Tourism Climatic Index) (Mieczkowski 1985) which considers, not only thermal aspects of climate, but also other atmospheric elements influencing tourism and recreation.

TCI is based on a rating system that brings together the 5 elements of daytime comfort (comprising maximum daily air temperature and minimum daily humidity), daily comfort (mean daily air temperature and humidity), precipitation totals, sunshine duration and wind speed. The daytime comfort index is considered of paramount importance, since most tourist activities take place around midday, and the daytime temperature is an important indicator of the suitability of weather for tourism and recreation (Amelung & Moreno 2009).

Although devised on the basis of physiological and biometeorological research findings, the *TCI* criteria for assessing particular climate elements are as chosen by its author in a manner arbitrary enough to leave its objectivity and universality in question. Likewise, the rating schemes and weightings attached to climate variables reflect the author's subjective ideas, and have never been verified in empirical tests on tourists. Beyond these issues is the fact that the climate evaluation scheme for tourism and recreation proposed by *TCI* is in principle intended to assess such typical tourism-related activities a sightseeing and shopping (Scott & McBoyle 2001). In practice, it rates given climate suitability for tourism depending mainly on air temperature. Using this index, the most positive rates are usually obtained for the warmest months, even when it comes to regions of hot climate in which heat stress burdensome to the human organism is observed. This leads to a conclusion that the evaluation scheme proposed by Mieczkowski (1985) is mostly suitable for 3S (sun-sea-sand) tourism, in respect of which a major role is played by sunshine duration and air temperature (Lindner-Cendrowska 2011).

Recently de Freitas, Scott & McBoyle (2004) have developed the Climate Index for Tourism (*CIT*), as a new scientific tool by which climate conditions for weather-dependent tourist activities may be assessed. This Index rates weather and climate conditions across a range from favourable to unfavourable, basing itself around groups of variables concerning so-called thermal (*T*), aesthetic (*A*) and physical (*P*) facets of the atmospheric environment. To determine *CIT* values, it is necessary to:

1) evaluate the level of human thermal perception using any biometeorological index based on the nine-point ASHRAE thermal sensation scale,

2) define aesthetic characteristics expressed in relation to cloudiness and

3) assess weather limitations caused by precipitation or strong wind.

In practice, precipitation exceeding 3 mm (or of 1-hour duration) or wind speed exceeding 6 $m \cdot s^{-1}$ have the effect of reducing the final *CIT* value substantially (de Freitas et al. 2008). The main advantage of *CIT* compared to *TCI* is that its rating system has been validated against measures of tourist satisfaction with meteorological conditions (de Freitas 1990). However, as that validation was confined to tourists spending time on a beach, this index can only gain valid application where assessment of weather and climate for 3S-type tourism is concerned, not being suitable in any way for evaluating the potential the atmospheric environment offers potential for other forms of tourism and recreation.

In the face of the lack of a universal climate-tourism index, biometeorological indices based on the human heat budget are applied. For this purpose, many previous studies have made use of the *PET* (Physiological Equivalent Temperature) thermal sensation index (Höppe 1999); the value here corresponding with the temperature at which the human heat budget in reference (standard indoor) conditions is balanced by the same skin and body temperature as would be observed in the actual outdoor environment. Thus *PET* has not particularly been designed as a tool assessing weather conditions for tourism and recreation purposes, though use of the Rayman application (Matzarakis et al. 2007) facilitates calculation.

PET has in fact been applied in several studies analysing climatic tourism potential in different climate zones (e.g. Nemeth et al. 2007; Lin & Matzarakis 2008; Farajzadeh & Matzarakis 2009).

Another biometeorological index expected to apply to the assessment of outdoor thermal conditions in various fields of human biometeorology is *UTCI* (the Universal Thermal Climate Index) (Błażejczyk et al. 2010; Bröde et al. 2011). *UTCI* has already been made subject to a range of applications (Błażejczyk et al. 2009; Bąkowska 2010; Idzikowska 2011), although technically it remains at the validation and implementation stage. *UTCI* is defined as an equivalent ambient temperature (°C) of a reference environment providing the same physiological response of a reference person as the actual environment (see article in the current issue Błażejczyk et al. 2013), in contrast to *PET* and many other biometeorological indices. *UTCI* is not a measure of thermal sensations, but it is able to assess heat stress in human beings.

The main objective of this study is to present an application of *UTCI* in climate valorization for the purposes of urban tourism and recreation, as well as to compare the results with a validation obtained using the *PET* thermal sensation index. Another subject of interest of this study arises out of the fact that weather perception and thermal comfort are influenced, not only by microclimatic conditions (the combined impact of air temperature and humidity, wind and solar fluxes), but also by personal parameters like physical activity, clothing, age or psychological factors (motivation, individual preferences or cultural background) (Nikolopoulou & Steemers 2003; Knez & Thorsson 2006). The secondary objective of this study is to determine whether biometeorological indices (i.e. *UTCI*) may accurately reflect the actual thermal state, thermal sensations and weather preferences of people engaged in tourism and recreational activities.

Study area, materials and methods

Study area

Warsaw (52°13’56”N, 21°00’30”E) is the largest city in Poland, with nearly 1.7 million inhabitants. Its average elevation is around 100 m above sea level. It is a popular tourist destination, especially for business tourism. Every year more than 12 million tourists visit Warsaw, among whom 29.8% are foreign in origin (Ipsos 2011).

Field data collection

Field studies were carried out in the district of Warsaw most popular with tourists, i.e. the Old Town. Microclimatic measurements and questionnaire surveys were conducted in the Market Square there, a rectangular (90×73 m) space, lined on all four sides by three or four-storey historic houses (Fig. 1).

The field studies entailed the simultaneous measurement of microclimate and running of thermal perception questionnaire surveys. The measurements were made over several days in each season of the year: in July 2010, as well as in February, April and October 2011. Prevailing weather conditions during the sampling periods were often typical for the seasons and for the central districts of Warsaw, though this was not true of July 2010, during which a heatwave occurred (Tab. 1). Irrespective of season, only low wind speeds (<1 $m \cdot s^{-1}$) were registered, this reflecting limitations on air

Figure 1. Weather station used to measure weather parameters (left), and surroundings of the study area (right).

Table 1. Meteorological conditions in the seasons during performing questionnaire surveys (n=596).

Season	t (°C)				$Kglob$ ($W{\cdot}m^{-2}$)				v ($m{\cdot}s^{-1}$)
	lowest	average	highest	SD	lowest	average	highest	SD	average
Spring	11.2	14.4	17.7	1.6	56.9	448.0	893.1	251.6	0.8
Summer	25.1	27.2	30.0	1.1	90.6	668.8	901.9	219.1	0.6
Autumn	9.0	10.1	11.8	0.8	14.4	152.1	628.1	130.7	0.7
Winter	-6.8	-3.0	-1.3	1.5	20.6	176.5	453.1	135.5	0.7

flow as a result of high building density downtown. Measurements and surveys were usually pursued between 11 a.m. and 4 p.m. (local time), when the majority of tourists visited this area and the whole place was well insolated.

Basic meteorological parameters were measured using a HOBO® weather micro station (Fig. 2). Air temperature (t), relative humidity (f) and global solar radiation ($Kglob$) sensors were placed at 1.5 m above the ground. Wind speed (v) was measured about 2 m above the ground. Meteorological data from all sensors were recorded every 30 seconds, before being averaged over 5 minutes.

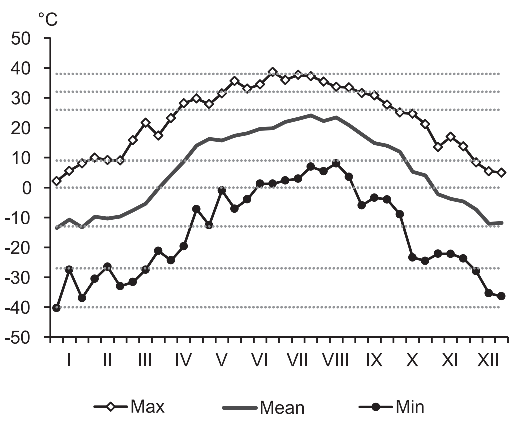

Figure 2. Annual course of mean, absolute maximum and absolute minimum *UTCI* ten-day values for Warsaw-Okęcie (2000-2009).

Mean radiant temperature ($Tmrt$) values were calculated using BIOKLIMA software MENEX (Błażejczyk 2005). The formula applied is:

$$Tmrt = R + 0,5{\cdot}Lg + 0,5{\cdot}Lash{\cdot}\sigma 0,25 - 273 \quad (1)$$

where:

R – absorbed solar radiation,
Lg – surface thermal radiation,
La – sky radiation,
sh – the emissivity coefficient for humans,
σ – the Stefan-Boltzmann constant.

Absorbed solar radiation (R) was calculated from global solar radiation ($Kglob$) using the *SolGlob* model offered by BIOKLIMA. Its value depends on elevation of the Sun (hSl), as well as on the coefficient reducing convective and radiative heat transfer due to clothing (Irc) and the albedo of clothing (ac). Surface thermal radiation (Lg) was estimated from ground surface temperature (Tg), while sky radiation was calculated using values for air temperature (t) and vapor pressure (vp). Detailed formulae are to be found in Błażejczyk (2004).

In order to calculate *UTCI* wind speed was recalculated to the level of 10 m above ground by BIOKLIMA software, using the simplified equation:

$$v10m = v2m0,667 \quad (2)$$

Insight into subjective assessments of the weather were obtained using a weather perception questionnaire, adapted from Spagnolo & de Dear (2003) (Annex 1). The survey was carried out in Polish or in English, and completion of a questionnaire took 2 minutes on average. The first part of the survey concerned the thermal perception of the interviewee, as well as preferences in relation to weather parameters. People assessed their thermal sensation using a 7-point scale, from -3 – 'cold' to +3 – 'hot'. Preferences regarding particular weather elements where described as -1, where a lower intensity was preferred, *via* 0 – donating no change desired, through to +1 – where a higher intensity of the given element was preferred. A second part of the survey then addressed such personal characteristics of interviewees as gender, age, state of health, place of residence, time of stay in Warsaw, time spent outdoors, purpose of visit to the specific place, clothing[1] worn at the time and recent physical activity. The questionnaires used in different seasons were almost identical, the only differences concerning the list of clothing items.

In total, 818 questionnaires were collected, though only 553 of these were suitable for use in further analysis. Exclusions concerned interviewees:

1) who had not come to the Old Town Market Square for tourist or recreational purposes,

2) suffering from chronic diseases like hypertension, coronary or rheumatic disease, respiratory system disease and asthma, etc. or

3) aged 15 or below or 65 and above (the aim here being to avoid any possible skewing impact on thermal perceptions due to age).

Results and discussion

Under the Köppen classification, Warsaw represents the zone of humid continental climates with an annual average temperature of about 9°C[2]. Seasonally, average temperatures range from -0.8°C in winter to 18.6°C in summer. Annual amplitude of temperature is of 21.5°C. Average vapour pressure is about 9.6 hPa, with 14.9 hPa in summer and 5.4 hPa in winter. Annual precipitation is of 555.6 mm on average.

Mean *UTCI* values in Warsaw change during the year from -15°C in January to nearly 19°C in July (Fig. 2). In the cold half of the year moderate cold stress prevails, while in warm months slight cold stress and thermoneutral conditions are most common. Beyond that, there is the possibility throughout the entire year of significant fluctuations in the maximum and minimum *UTCI* values. Thus extreme cold stress may appear in winter, while in summer very intense heat stress is possible. Taking this into consideration, *UTCI* values indicate that the best sensible conditions for tourism in Warsaw are present in late spring and September.

Just over half (52.6%) of interviewees were women. The most represented age group (accounting for 59.1% of the total) comprised 15-29 year-olds, while 26.2% of those questioned were foreign tourists, and 36.4% domestic tourists. That left 37.4% of interviewees who were residents of Warsaw and its surroundings. The predominant physical activity participated in by respondents was walking (77.5%), while more than 75% had been outdoors for at least half an hour at the time of interview.

Figure 3 presents the relationship between respondents' clothing and actual air temperature in particular seasons. In winter, with air temperature below zero, clothing offering an insulation of 1.3-1.4 clo was used most frequently. As temperatures increase through the year, the numbers of garments become more and more limited, and insulation decreases in summer to 0.4 clo (shorts, t-shirt, sandals and underwear). Further reduction of clothing below this value was rendered impossible by social and cultural norms. Nevertheless, within a given season, tourists usually adjust to a single set of clothing, this potentially explaining occasional problems with adjusting their garments to temporary changes in thermal conditions. This transient maladjustment may sometimes affect people's sensations of warm or cold conditions markedly.

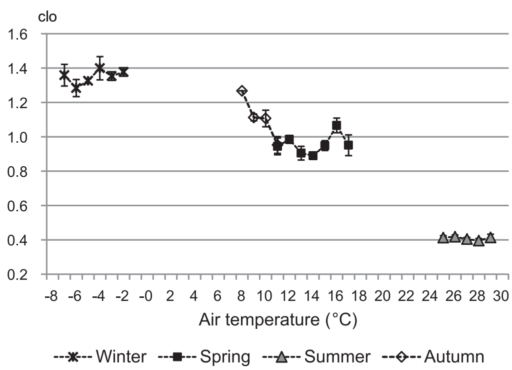

Figure 3. Mean clothing insulation (*clo*) used by respondents during tourist and recreational activities in 1°C air temperature ranges. Data points represent the means +/- SEM.

Biothermal conditions and their perception

In the course of the project, *UTCI* was fully consistent in indicating thermoneutral conditions, i.e. situations that are theoretically ideal for tourism and recreation in a city. At the same time, the *PET* index indicated thermal sensations ranging from 'cool' (in 39% of cases) and 'slightly cool' (31%)

[1] Basing on information obtained in regard to clothing, total thermoinsulation (in clo units) was calculated in ce toline with the tables included in ISO 9920 (2007).

[2] Climatic data is from the Warsaw-Okęcie synoptic station from the period 2000-2009.

to 'comfortable' (25%). In turn, in summertime, according to *UTCI*, the commonest state (in 88% of cases) was 'moderate heat stress', whereas *PET* most frequently indicated a 'warm' sensation (70%). In autumn, notwithstanding mean air temperature slightly lower than in spring, thermoneutral conditions indicated by *UTCI* still dominated (59%), though 'slight cold stress' was declared in 34% of cases. At the same time, according to *PET* it was common for this season to produced thermal sensations equivalent to 'cold' (51% of the time) or 'cool' (37%). Finally, in winter, *UTCI* indicated 'moderate cold stress' (65% of the time) or sometimes 'slight cold stress' (33%), even though the prevailing thermal sensation in *PET* terms was 'very cold' (97%) (Fig. 4).

The thermal sensation votes of respondents were less diverse than the thermal sensations predicted using biometeorological indices (Fig. 5). Regardless of the season, it was most frequent for interviewees to perceive thermal comfort or subcomfort (defined by 'slightly cool' or 'slightly warm' sensations). The exception was winter, during which more than 20% of respondents declared that they felt cold. Answers oscillating around thermal comfort were given across almost all observed ranges of *UTCI*. This can be partially explained by the fact that it is the norm for people to feel comfortable, on account of their having adjusted their clothing to different types of weather. A further possible explanation is that meteorological conditions at the time of the field studies were close to the average conditions expected in particular seasons. Hence respondents treated them as reference level while expressing their sensations. and regarded them as natural and acceptable, even when indices indicated thermal discomfort. Strong conformity between respondents' perceptions and *UTCI* was observed for thermal sensations related to heat stress. The 'hot' sensation only appeared within a small range of *UTCI* values, above 28°C.

Analysis of mean values for *UTCI* set against particular thermal sensation votes revealed a near-linear dependence (Fig. 6). It is further

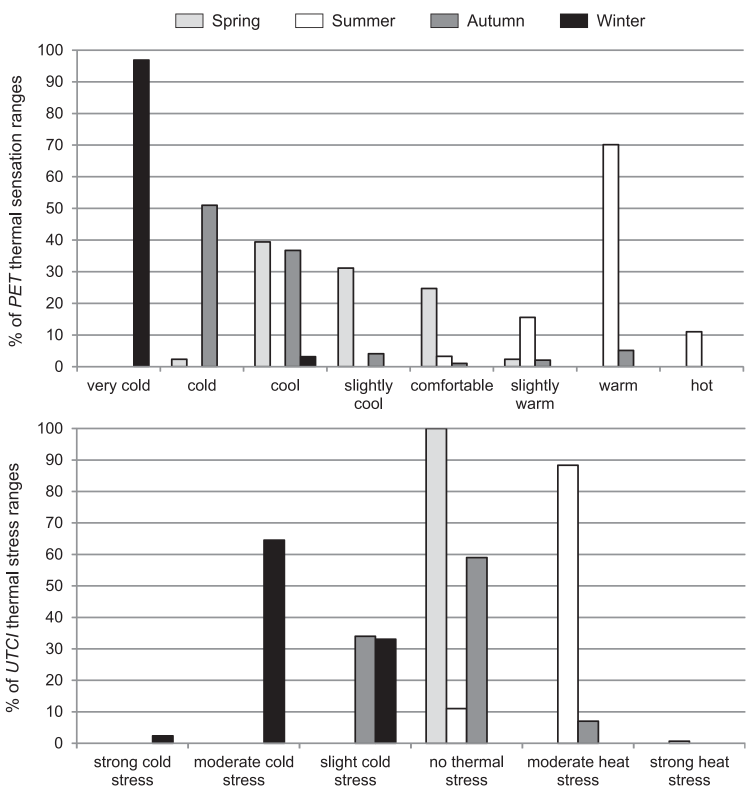

Figure 4. Frequency (%) of thermal stress according to *UTCI* and thermal sensations according to *PET* during field research in particular seasons.

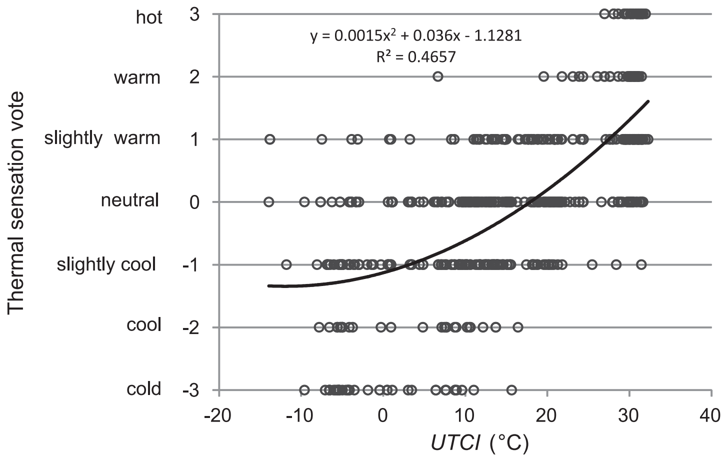

Figure 5. Thermal sensation votes versus *UTCI* values with a second-order polynomial trend line.

typical that a thermal sensation one unit higher or lower is associated with a 5.5°C change of *UTCI* value. Over the year as a whole the average *UTCI* for the thermal sensation perceived by subjects as 'cold' is at around 0°C, while 30.3°C coincides with the thermal sensation 'hot'. According to respondents' votes, neutral thermal sensations were determined by *UTCI* values of about 15.3°C. Beyond that, it is worth mentioning that interviewees declared they were feeling subcomfort in extremely diverse biometeorological conditions ranging all the way from -14°C to less than 35°C. The smallest range of *UTCI* values was observed under circumstances in which respondents described what they were feeling as 'hot'. However this may be related to very small differentiation of sensible conditions during summertime observations.

The results confirm findings (Lin et al. 2011) to the effect that the most likely explanation of season-to-season differences in the way thermal comfort is perceived is a psychological adaptation such as a differentiation of expectations where seasonal comfort is concerned. Thus the mean value of *UTCI* corresponding with subjective sensations of thermal comfort among interviewees changed during the year from -0.7°C *UTCI* in winter, through 13.2°C and 16.3° in autumn and spring respectively, to 28.8°C *UTCI* in summer.

Thermal comfort preferences

The feature characteristic of tourists' preferences is evident expectation of air temperature being higher (Fig. 7). It is obvious that respondents prefer warmer conditions when air temperature is low and

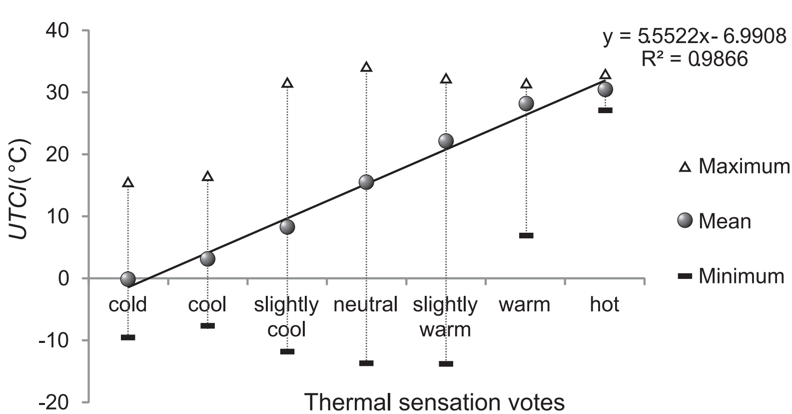

Figure 6. Average, maximum and minimum values of *UTCI* for each thermal sensation vote.

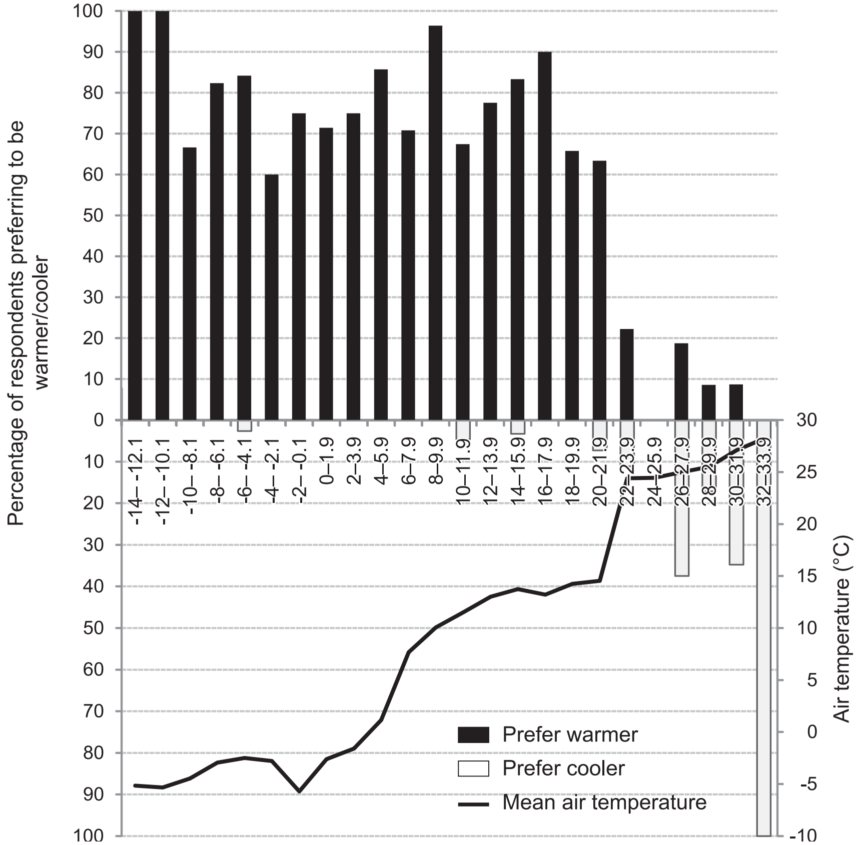

Figure 7. Subjects' preferences regarding temperature versus mean air temperature for each 2°C *UTCI* range.

UTCI values are below 9°C, although it is notable that a state of slight cold stress (0-9°C *UTCI*) corresponded with declarations of feeling comfortable among up to 45% of interviewees. Also interesting is the fact that – across a very wide range of thermoneutral conditions (from 9-26°C *UTCI*), as many as around 70% of tourists would have preferred the weather at the given moment to be warmer. Only above 26°C of *UTCI* does this trend reverse, with a preponderance of people expressing a preference for cooler conditions. Nevertheless, while moderate heat stress is being experienced, there are still more than 60% of respondents who claimed to be satisfied with the thermal conditions and not seeking any change.

This project also revealed specific preferences of tourists as regards other weather elements. In the case of solar radiation, it was usually more intensive sunshine that would have been preferred. This is probably related, not only to the perception of heat, but also to aesthetic aspects and desires, e.g. in relation to sunbathing. At *UTCI* below 22°C, people assessed solar radiation as satisfying, and this was never outweighed by opinions that solar radiation should be less intensive. The preferences of interviewees as regards wind were diverse, even though wind velocities were very weak and undifferentiated in all seasons due to the high density of housing in the studied area. Below *UTCI* of -8°C tourists wanted weaker wind (mean wind speed was at that time 1.2 $m \cdot s^{-1}$). At higher *UTCI* values, responses divided between 'blow less strongly' and 'stay unchanged'. Even if *UTCI* indicated moderate heat stress, it was still very rare for interviewees to say they wanted the wind to blow harder. Regarding air humidity, tourists most often preferred an unchanged level, irrespective of *UTCI* values.

Biometeorological indices vs human thermal sensation votes

It is very difficult to assess whether *UTCI* properly reflects human thermal sensations, since it defines levels of thermal stress and does not provide for a thermal sensation scale. However, an attempt was made to assign particular thermal sensation votes to *UTCI* heat-load categories. For this study the thermal stress scale for *UTCI* was adapted, under the presumption that thermoneutral conditions (9-26°C *UTCI*) could be classified as comfortable and slightly warm (considering that tourists prefer a slightly higher temperature and recalling the asymmetry of the *UTCI* scale), while extreme ranges of the scale (extreme, very strong and strong heat stress as well as extreme, very strong and strong cold stress) would be classified as utmost sensations on the 7-point scale of thermal sensation votes. In the case of *PET*, the overall conformity of respondents' opinions with index values in the subcomfort range is limited (Tab. 2). Interviewees were less extreme in their assessments than the index, frequently perceiving predicted cool conditions as subcomfortable and comfortable (a divergence in responses of -1 or -2). On the other hand great coherence is observed between thermal sensation votes and *PET* values in extreme conditions, especially when the index defines sensible conditions as 'cold' (95%). Total conformity of *UTCI* with respondents' thermal sensation votes were on average still rather small in the thermoneutral range (36.1%), however, discrepancies in responses are smaller and sparser, so the assessment is better when using *UTCI* than *PET*. For *UTCI*, low conformity was observed in extreme ranges of the assessment scale ('cold' and 'hot'). On the other hand, considering tourists' responses

Table 2. Frequency (%) of total conformity (difference – 0) and partial conformity (difference 0 or +/-1) between thermal sensation votes and corresponding thermal sensations/stress defined by reference to the *PET* and *UTCI* indices (°C).

Thermal sensation votes	Total conformity of responses with index		Partial conformity of responses with index	
	PET (%)	*UTCI* (%)	*PET* (%)	*UTCI* (%)
cold (-3)	95	0	97	59
cool (-2)	22	44	100	74
slightly cool (-1)	7	20	44	100
neutral (0)	14	60	32	74
slightly warm (1)	10	45	55	91
warm (2)	66	84	91	100
hot (3)	12	0	88	100

that are matching or nearly matching conditions defined by biometeorological indices (i.e. where the difference between thermal sensation votes and thermal sensation is of between +1 and -1), the conformity of responses was much better (72% for *PET* and 85% for *UTCI*).

Conclusions

The paper presents possible applications of *UTCI* to biometeorological studies carried out in relation to tourism and recreation. Weather perception is known to be a complex phenomenon that depends, not only on meteorological factors, but also on cultural factors, personal features, recent experiences, etc. It seems that weather perception is also influenced by peoples' expectations concerning thermal comfort, these having roots in their knowledge about average climate conditions in particular places and seasons. This may ensure that, even where weather conditions produce thermal stress, respondents may assume that they feel exactly as they should in the given season, and are thus not prone to come up with extreme thermal sensation votes. Great differentiations in thermal votes may also result from the fact that people cannot evaluate their actual feelings precisely, and so rather base their assessment of current weather on their recent experiences (i.e. those from the last couple of hours). Additionally, tourists are less inclined to evaluate the weather as extreme, perhaps in a reflection of a mostly positive attitude being maintained in the course of leisure activities that after all entail 'voluntary' exposure to certain weather conditions.

Considering the difficulties in quantifying complex human sensations and preferences, the preferred method of studying bioclimate in regard to tourism and recreation is to use biometeorological indices. Our results indicate that their ranges do not fit perfectly with individual thermal sensations, but do allow quantitative analyses to be performed. It seems that *UTCI* is appropriate for this purpose, because it generally agrees well with subjective thermal sensation votes. However, this does not mean abandoning the search for an adequate climate-tourism index. and especially for one that would be applicable to various types of tourist activity. Such a new-generation climate-tourism index would potentially allow for the inclusion of specific features of tourists' weather perception that are not considered by the biometeorological indices in use currently (such as increased tolerance towards annoying conditions or a preference for higher temperature, etc.).

Editors' note:
Unless otherwise stated, the sources of tables and figures are the author(s), on the basis of their own research.

Annex 1. The weather perception questionnaire designed for interviews carried out in the springtime.

1. Air temperature:

– Being dressed as you are at the moment, how do you assess your current thermal sensation:

old	cool	slightly cool	neutral	slightly warm	warm	hot
(-3)	(-2)	(-1)	(0)	(+1)	(+2)	(+3)

- Would you prefer it to be:

cooler	unchanged	warmer
(-1)	(0)	(+1)

2. Wind:

- Would you like the wind to blow:

less hard	as it is	harder
(-1)	(0)	(+1)

3. Sun:

- Would you like the sun to shine:

less intensively	as it is	more intensively
(-1)	(0)	(+1)

4. Cloudiness:

- Would you prefer the sky now to be:

cloudless	somewhat cloudy	completely cloudy
(0)	(1)	(2)

5. Humidity:

- Would you like the humidity to be:

lower	unchanged	higher
(-1)	(0)	(+1)

6. Clothing:

- Choose the clothes you are wearing now:

T-shirt / top / shirt with short	shorts / short skirt	socks / leg wormers	scarf / gloves
shirt /blouse with long sleeves	trousers / long skirt	tights / leggings	
sweatshirt / jumper / cardigan /	¾ trousers	shoes / trainers /	headdress: yes / no
1-layer jacket / 1-layer trench coat / quilted jacket / woollen	ankle boots	hat / cap / head shawl	
coat / down vest / leather jacket / fleece jacket / other overcoat (what?)	Sandals	hood / headband	

– The colour of the top layer of your clothes is rather: light / dark
– Do any of you clothing elements have special thermal properties (gore-tex, hydrotex,etc.)? ....

7. Recent physical activity:

- Where were you before coming here (last half-hour):

outdoors	indoors (with / without air conditioning)	in a vehicle (with / without air conditioning)	in a vehicle (with / without air conditioning)	other..............

- During the last half-hour your main activity has been:

sitting	standing	walking	other..................

8. Reason for being in this placeplace:		
- Are you in this place for tourist / recreational reasons: Yes / No		
9. Personal features:		
- Age: below 15 / 15-29 / 30-44 / 45-65 / over 65	Sex	male/female
- Skin tone: pale / dark	Body type:	small build / average build / large build
- Where do you live (country and city):………………………………………………		
- For how long have you been in Warsaw or its surroundings (number of days):….		
- Do you suffer from any of the diseases mentioned below:		
hypertension / coronary (heart) disease / rheumatic disease / respiratory system disease (including asthma and allergy) / chronic gastric ulcer disease		

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