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# TRANSPARENT URBAN PLANNING MEASURES FOR CITIZENS' E-PARTICIPATION

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**Abstract**
The article aims to analyse, criticize and recommend urban planning tools for the main actors and stakeholders involved in the planning process using a mixture of techniques such as remote sensing, GIS, Web-GIS, crowdsourcing in order to support availability of data and the transparency of the decision making process. The paper attempts to gather a list of proper urban planning measures for the specified objective based upon the results attained in the "Urban Climate Study of Bucharest" project financed by a Romanian-Swiss Program, which focused on the study of characteristics such as urban development, land use, urban sprawl, urban heat island and green space situation.
**Keywords**: urban planning; citizens' participation

## 1. INTRODUCTION

The climate is defined as a system, which comprises the relevant climatic parts of the planet, and the general statistical “average” state of the climatic elements which characterize the climate over a long period of time. These climatic elements are those psychical quantities which exhibit time and space variations in such a way that are partly steady and partly erratic, like: air temperature, humidity, precipitation, air pressure, wind, clouds (Hantel, 1987). „It is these variations to which the concept of climate is applied” (Hantel, 1987).

The complex combination of the climatic parts of the land’s surface, such as the geographical position, the topography, the altitude, the proximity of large water surfaces, or of high mountains, the presence of vegetation and so on, strongly influences the climatic elements related with solar radiation, wind precipitation, temperature and humidity (Cengiz, 2013). This is why the type of land cover (vegetation, built-up area, street etc) is important on a local scale since it influences the albedo, the surface roughness, the temperatures, the evapotranspiration processes etc (Asimakopoulos, 2001). Increased urbanization generally means more densely built urban areas and a growth in the urban area’s footprint. As a consequence of these changes of the surfaces and of the land cover, the urban climate is subject to microclimatic changes which create a local climate different from that of the surrounding rural landscape (Santamouris, On the built environment-the urban influence, 2001).

The urban climate is modified by the influence of built-up areas and the consequences of their associated socio-economic functions and can be divided into two specific microclimate components: the thermal component which comprises mainly the changes in the temperatures along with moisture and wind ventilation and the air quality component which consists in changes in the natural composition of the air as a consequence of the living activities in an urban environment such as higher pollutant concentrations (gases and aerosols) due to domestic fuels, traffic, and industry (Mayer & Matzarakis, 1998).

According to (Mayer & Matzarakis, 1998) “urban planning should take into account both health and well-being of people living and working in different urban spaces” and in agreement with this idea, the main objective of this article is to propose and provide urban planning tools for the main actors and stakeholders involved in this process and which should take into account the urban climate from the perspective of human comfort.

## 2. METHODOLOGY

The most well documented urban microclimate’s component is the thermal difference of the urban climate from that of the surrounding countryside manifesting itself under the form of the urban heat island effect (Henderson-Sellers & McGuffie, 2012; Alcoforado & Matzarakis, 2010), a phenomenon in which the urban temperature is higher than its rural surroundings during clear and calm nights (Oke T. R., 1987), as a consequence of the changes produced in the heat balance (EPA, 2008).

The urban heat island is considered to be (Landsberg, 1981) the sum of the total microclimatic changes produced due to the development of the urban built-up areas. Since the UHI is influenced and generated by most of the urban climate conditions then the UHI can be regarded as a quite good indicator of the climate state and its influence over the living conditions in an urban area.

The studies on the effects of climate on living organisms attempt to relate different climatic elements and evaluate them mostly based on subjective indices such as thermal sensation (Mayer & Matzarakis, 1998; Steemers & Yannas, 2000). The thermal stress on living organisms produced by the urban heat island effect is therefore considered to be a combination of the following elements: air temperature, humidity, wind and radiation. These elements in turn are affected subsequently by other factors such as the atmospheric pollution and the urban structure. Altogether, these are the main climate elements which are usually measured, monitored and modelled to obtain predictions in order to assess the human comfort in an urban area.

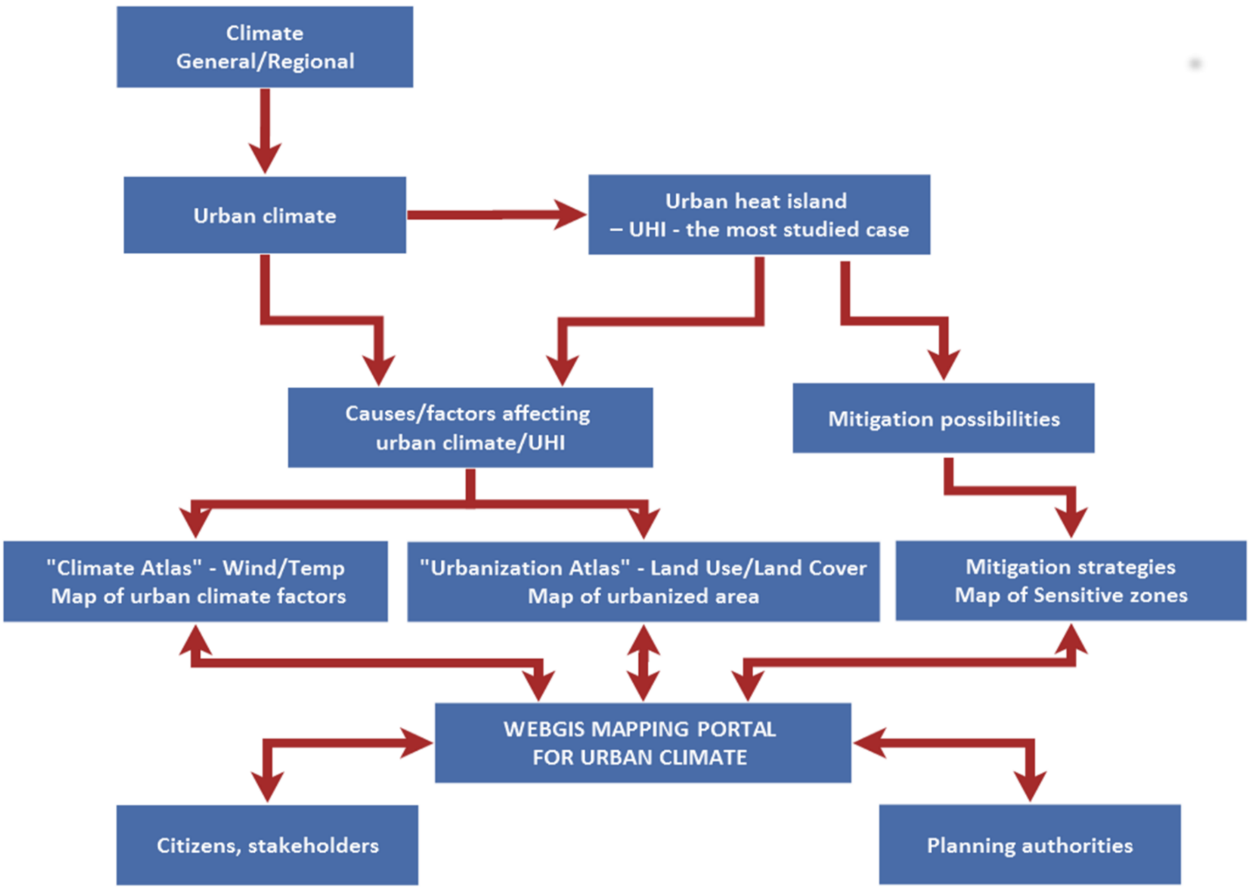


FIGURE 1 - METHODOLOGY FOR SETTING UP AN URBAN CLIMATE WEBGIS PLATFORM FOR THE SUPPORT OF THE DECISION MAKING PROCESS

In order to support the transparency of the decision making process, the planning process should rely upon a series of tools developed from a mixture of techniques such as remote sensing, geographical information systems (GIS), Web-GIS, crowdsourcing and microclimatic modelling. In Figure 1 we present the methodology


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proposed for the implementation of such a decision-making process in order to obtain the desired state of transparency mentioned before. The methodology begins with the measurement, data collection, processing and analysation of the present state of the urban microclimatic components and of the mitigation possibilities. The final stage of the methodology consists in the production of various maps in GIS environment, published online and available for the entire community with the possibility to collect further, more detailed data from the citizens themselves.

### *2.1. The causing factors as the input parameters*

In order for such an decision-making process and such an urban climate WebGIS platform to be developed it is necessary to measure and collect the main input parameters which are related with the climate state and its influence on the living conditions (with emphasis on the main climate indicator - the urban heat island). The main possibilities for the input parameters are the following: the three-dimensional geometry of the urban both for buildings and vegetation, the thermal properties of the urban materials such as the albedo or the storage capacity of heat, the surfaces' degree of sealing, the main sources of anthropogenic heat, the circumstances related to the quality of air, and finally, the parameters related to the meteorological conditions.

The urban street canyon is identified as the basic unit of the urban structure (Nunez, 1974) and is mainly defined as the summation of the street, the buildings lying along both sides of the street and the space/air above the street enclosed between the buildings (Nunez, 1974). Thus, any urban area can be considered as a collection of urban street canyons as the streets alone "usually cover more than a quarter" of the space (Shashua-Bar & Hoffman, 2003). The urban street canyon directly influences the urban climate (air temperature, moisture and wind flow) within the streets as well as the urban structures in the surrounding area (Shashua-Bar & Hoffman, 2003). The three-dimensional geometry of the urban street canyon affects the radiation balance which determines the temperature pattern in the city (Eliasson, 2000). The three-dimensional structure of the urban street canyon is reflected in an index called the sky view factor (SVF) which is considered to be a measure of the street geometry (Eliasson, 2000) and which was developed from previous view-factors and calculated by (Steyn, 1980; Oke T. R., 1981; Johnson & Watson, 1984), etc. The sky view factor as a dimensionless parameter measures the fraction of sky visible when viewed from the ground level upward and varies on a scale to a [0,1] range. The lowest value 0 indicates that the sky is not visible at all and the highest value 1expresses that the sky is completely visible, without any obstacles. Since the sky view factor is the projection of the entire hemispherical radiating environment onto a circular image plane, a reduced sky view factor in urban canyons produces a decrease in the longwave radiation loss in clear weather sunset conditions, creating an excess of heat in that particular urban canyon as opposed to a larger sky view factor in rural areas (Oke T. R., 1981), thus contributing to the development of the UHI effect (Oke T. R., 1987). The canyon directly influences the wind flow within the streets as the wind velocity inside the canyon is reduced by the increased friction created by the urban surface which can be considered as a rough surface (as opposed to a smoother rural surface) which reduces the horizontal airflow in the city and diminishes the natural ventilation of buildings lying along the street (Scherer, 1999).

The reflection of the shortwave solar radiation (urban albedo) is an important parameter of the urban climate which is affected by both the 3D urban geometrical structure and the properties of the urban materials (Frey & Parlow, 2009). The albedo determines how much solar radiation is absorbed by the surface and then made available for other energy fluxes (Frey & Parlow, 2009). During daytime, vertical walls of the urban street canyon reflect or absorb shortwave radiation and decrease the effective albedo by the multiple reflection of this radiation between the canyon surfaces, the urban surfaces' albedo going down by 10% as compared with the rural surfaces (Frey & Parlow, 2009; Oke T. R., 1974). Also, during the night-time the longwave radiation is trapped and cannot escape the canyon because of the decreased sky view factor. As a consequence, the lower urban albedo determines an even greater absorption of the shortwave radiation in the urban areas during the daytime, and coupled with the thermal properties of urban materials (such as the asphalt on the streets and sidewalks) which have a greater capacity to absorb and retain the solar radiation than some of the materials usually found in the rural landscape contribute to an even further increase in the urban canyon temperatures. Hence, one can infer that the net radiation is determined by the albedo and the longwave emission, influenced by the thermal properties of the urban fabric and the three-dimensional structure of the urban canyons (Frey, Rigo, & Parlow, 2005; Eliasson, 2000).

As the main controlling factor of the surface temperature is the evaporation (the latent heat flux) (Frey, Rigo, & Parlow, 2005). The unsealed, natural soils and the vegetation retain water which contributes to the so called "evaporative cooling" and the opposite is valid for the surfaces' imperviousness. If the net radiation provides the available energy for the heat fluxes, when the net radiation is high and the evapotranspiration is significant, the temperatures are lower due to the evaporative cooling as the moist surfaces suppress the sensible heat transfer and enhance latent heat flux. When the net radiation provides less available energy for the heat fluxes, but very low evaporation takes place, the temperatures are higher as the dry urban surface increases the energy put into the sensible heat transfer and suppresses the latent heat flux. The predominance of the impervious surfaces in urban areas due to the presence of buildings, buildings' roofs, streets, sidewalks etc, which collect and discharge precipitations into the sewage system driving the water away from the city, cause an evaporation deficit and consequently higher temperatures (Frey, Rigo, & Parlow, 2005; Oke T. R., 1982). The surface moisture provides a gradual depletion of the water retained which extends the evaporative cooling over a period in the order of days. The impervious urban surfaces evaporate over a period in the order of hours but there is possible that water storage in the surfaces' fabric to be actually underestimated (Oke T. R., 1982; Lacy, 1977). The larger surfaces covered by vegetation in a city (like parks or cemeteries) have greater water storage capacities, comparable with the rural ones, especially if watered or sprinkled (Oke T. R., 1982). The energy balance and the surfaces' moisture contribute to the urban excesses and deficits of humidity in the urban environment, usually all over the year urban humidity being larger than the rural one during the night and being lower than the rural humidity during the summer days (Lee, 1991).

The anthropogenic heat releases in an urban area are usually generated from combustion of fuels, mainly by transportation, from heating (only in the winter), from air-conditioning equipment (only in the summer), from human and animal metabolisms (usually negligible) or from industrial activities (which are gradually moved away from the city). The anthropogenic heat fluxes are generally low (Oke T. R., 1982) but one should take into account that in certain situations they may also become important (Voogt, 2004), especially as their contribution varies with latitude, season and canyon geometry (Shahmohamadi, 2011; Santamouris, 2013). In a temperate city like Bucharest (Romania) for example, also presenting a relatively low number of air-conditioning systems, the anthropogenic heat flux may be more significant in winter.

The main circumstance related to the quality of air refers to the sources of fresh air and their corresponding transport paths for which the lowest level of air pollution should be pursued, maintained and monitored. From this point of view, building structures may act as obstacles for the ventilation paths or for the vertical air mass exchanges, impeding the clearing of the polluted air from top down by mixing with the unpolluted air from above (Scherer, 1999). Another equally important circumstance refers to the already air-polluted urban areas, especially the ones with dense settlements consequently having a large population and high emission rates (Fehrenbach, Scherer, & Parlow, 2001) and which are further affected by the couplings of air pollution and temperature increase. Thus, the emissions generated by traffic and by other urban socio-economic functions are a source of important greenhouse gases and pollutants, including the urban aerosols, especially the Particulate matter (PM) which can penetrate into the lungs, the ultrafine particles even into the blood system (Parlow, 2011). A common situation in many cities is the occurrence of the thermal inversion phenomenon which can be observed on clear nights when the ground surface cools down after the longwave radiation received during daytime is lost, which consequently causes the layers of air above the ground to also cool down creating a situation in which a layer of warmer air remains interposed between two layers of cooler air which is the inverse of the normal situation in which the air is cooler with the altitude increase (Arnold & Edgerley Jr, 1967; McKinney, Schoch, & Yonavjak, 2012). Since the normal physical situation is the warm air raising towards the cooler layers, the inversion traps the cooler layer of air beneath the warmer one, together with the pollutants which cannot be dispersed and diluted at higher elevations (McKinney, Schoch, & Yonavjak, 2012). The thermal inversion is the most important local climatic phenomenon which affects air pollution (McKinney, Schoch, & Yonavjak, 2012). Thus, some of the highest concentrations of local air pollution in urban areas occur during night time (Arnold & Edgerley Jr, 1967).

Meteorological variables like temperature, wind, humidity, shortwave solar radiation, longwave emission, air pollutants and more influence the urban climate and the human comfort (Parlow, 2011). The climatic elements which are affected by the natural environment configuration (Kumar, 1997; Maharani, Lee, & Lee, 2009; Scherer, 1999; Mora, 2010) should also be counted for, since their contribution to the local climate is quite significant as it is shown in Table 1:

TABLE 1 - THE CLIMATIC ELEMENTS WHICH NATURAL ENVIRONMENT CONFIGURATION

| Climatic element | Natural factors of influence |
|---|---|
| Wind (air masses movement) | Influenced by land topography which often forms obstacles (when they are high enough) or routers (when they are in the valley-shaped form) for air flow. |
| Humidity | Influenced by the windward and leeward sides of hills. |
| Temperature | Influenced by the altitude of the landscapes or the natural materials. Also, the south-facing slopes absorb higher levels of solar radiation, giving small micro-variations in the radiative balance and changing the vegetation patterns. Also large bodies of water maintain the temperatures down as the water heats up and cools down very slowly |

### *2.2. The possibilities of mitigation as the input parameters*

The decision makers and planners should be able to take into consideration the climate state and introduce it into the strategic management of their community. The development strategy of the future metropolitan areas should introduce a climate chapter into their stated objectives. The general climatic objectives usually used in these kind of strategy involve actions in order to improve, maintain and monitor the thermal quality and the air quality in the urban areas, and sometimes the hazardous pedestrian-level wind and are shown in Table 2.

TABLE 2 - THE CLIMATE MITIGATION MEASURES FOR PLANNING STRATEGIES

| OBJECTIVE 1: THE WIND CONDITIONS AND VENTILATION PATHS IMPROVED, MAINTAINED AND MONITORED | | |
|---|---|---|
| **Planning measure** | **Action** | **Observations** |
| Open areas – must be much larger and more numerous along the ventilation path | Demolition of buildings and conversion to open space.<br>Maintain existing open space.<br>Avoid forestation if it would block a ventilation path.<br>Monitoring | Open ways result in buildings remaining very exposed to cold winds, especially during winter which is a problem in cold climates. |
| Buildings - should have heights as low as possible | Building at the optimal height.<br>When applicable, reconstruction of lower level buildings.<br>Monitoring | |
| Buildings – should be oriented along the axis of the ventilation path | Building at the optimal orientation, relative to the ventilation paths.<br>When proper time - reconstruction of optimal oriented buildings.<br>Monitoring | |
| Building groups – should not have closed building fronts | Avoid development of closed building fronts.<br>When proper time - open closed building fronts.<br>Monitoring | |
| Building zones – no new building zones which block a ventilation path | Buildings only in the areas in which there are not ventilation paths<br>Monitoring | |


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| OBJECTIVE 2: REDUCED PROBABILITY OF OCCURRENCE OF A WIND HAZARD | | |
|---|---|---|
| **Planning measure** | **Action** | **Observations** |
| Open ways – the gaps causing wind acceleration should be filled | Vegetation use for wind protection.<br>Constructions for wind protection.<br>Monitoring | Open areas which must be much larger and more numerous along the ventilation path comes in conflict with the hazardous open ways which should be filled due to the dangerous wind accelerations they can contribute to. |
| Buildings – should be oriented in connection with the direction of the dominant winds | Avoid the building construction perpendicular to the dominant direction of the strong winds<br>Monitoring | The distances provided for a yard which is protected from wind can come in conflict with the distances required by sun angle. |
| **OBJECTIVE 3: REDUCED NEGATIVE EFFECTS OF FROST OR COLD STRESS** | | |
| **Planning measure** | **Action** | **Observations** |
| Buildings causing insufficient drainage and cold-air accumulation | Constructions causing cold-air accumulation not allowed and dismantled in time<br>Monitoring | |
| **OBJECTIVE 4: AIR POLLUTING EMISSIONS IN SENSITIVE AREAS MONITOR, REDUCE AND MAINTAIN AT THE LOWEST POSSIBLE LEVELS.** | | |
| **Planning measure** | **Action** | **Observations** |
| Maintain transport of fresh air | Preserve and create the sources of fresh air and their corresponding transport paths.<br>Avoid building in locations where the constructions can become obstacles for the ventilation paths.<br>Monitoring | |
| Reduce air pollution in sensible areas | Reduce or eliminate local sources of pollution.<br>Avoid thermal inversion by placement of non-industrial buildings in suitable areas.<br>Monitoring | |
| **OBJECTIVE 5: REDUCED AND MONITORED HEAT LOAD** | | |
| **Planning measure** | **Action** | **Observations** |
| Significantly increase vegetation cover | Urban forestry coverage over paved surfaces to provide shading.<br>Monitoring | Very high temperatures cause lower water-use efficiency and lower evapotranspiration in plants, the more diminished one being the cooling potential of urban vegetation. |
| High albedo materials | Use of high albedo materials to reduce the amount of solar radiation absorbed, thus keeping their surfaces cooler.<br>Monitoring | The interaction of urban materials like reflective pavements and mirrored windows with surrounding buildings must be carefully considered in the context of an urban area. |
| Vegetation - shading | Vegetation decreases local ambient air temperatures through shading and evapotranspiration.<br>Monitoring | |
| Permeable pavements - moisture | Permeable pavements are increasingly being used to store the water which will evaporate at higher temperatures.<br>Monitoring | Different studies measured the infiltration and evaporation fluxes and showed that streets cannot be considered fully impermeable, on the other hand, permeable pavements are increasingly being used to store the water which will evaporate at higher temperatures, |
| Urban canyons | New streets orientation<br>Future adaptation towards large sky vie factors.<br>Monitoring | |

The urban climate strategies can be monitored by local measurements or by the Earth Observations indicators similar with the Earth Observation indicators describing the heat island effects which were exemplified by (Gaman F. L., 2015; Chrysoulakis, 2014). Also, the possibility to analyse Earth Observation time-series and the present state of the green space and infrastructure were described by (Luca, 2014; Gaman, et al., 2016). Open areas within a city and its suburbs which affect the ventilation paths or the wind speed can be estimated as open space also for different time-series by processing satellite remotely sensed images (Aldea, et al., 2015; Shlomo, Parent, Civco, & Blei, 2010). The same possibilities are available in order to estimate the real urban area which is in most cases larger than the official city border (Aldea, et al., 2016).

## 3. RESULTS. “URBAN CLIMATE STUDY OF BUCHAREST”

Half a century before, Arnold (1967) had stated that if the meteorological knowledge possesed at the time would have been available a century before, the layout of our cities would have been different. Fifty years afterwards, this affirmation still stands. The body of knowledge have increased but also our understanding of the urban microclimate complexity. This is why, in order to assess the impact of the various mitigation strategies such as the enforcement of certain patches of vegetation cover, the effects of the use of various permeable materials for paving, the measures to attain the clear air ventilation paths etc, one of the most suitable way is to conduct climatic simulations with numerical models which should predict with an reasonable accuracy the effects at the urban microclimatic scale of such planning measures.

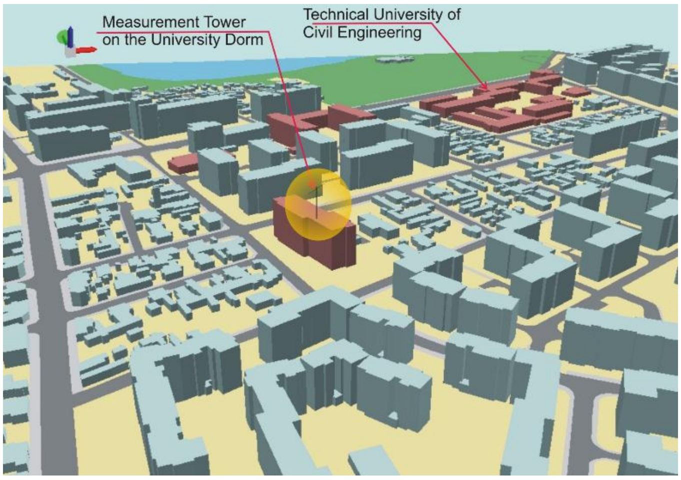


FIGURE 2 - THE LOCATION OF THE FLUX TOWER MEASUREMENTS ON THE 3D MODEL IN THE TECHNICAL UNIVERSITY OF CIVIL ENGINEERING DISTRICT

Such a numerical simulations were conducted in the “Urban Climate Study of Bucharest/Romania", a Swiss National Science Foundation project funded in common with the Romanian Research Agency (UEFISCDI) within the Romanian-Swiss Research Programme. The area under study was selected in the vicinity of the Technical University of Civil Engineering campus. In this area there are several of the University’s buildings of various heights, as marked on Figure 2. On the University's highest building which is a ten story dorm (approximately 32m from street level) was installed a flux tower for micrometeorological measurements. The tower has 12m height and was placed on top of the building in the configuration shown in Figure 2 and covers an area with a radius of several hundred meters.

The sky view factor (SVF) was computed using two different models and a 3D building data base for the Technical University of Civil Engineering District with Sky Helios and with ENVI-met models. The fraction of sky visible when viewed upward from 10 m over the ground, from a point situated on the street canyon situated in front of the flux tower building, is shown in Figure 3 and it was calculated using Sky Helios and it also helps visualise the hemispherical radiating environment and its projection on the circular fish-eye image.

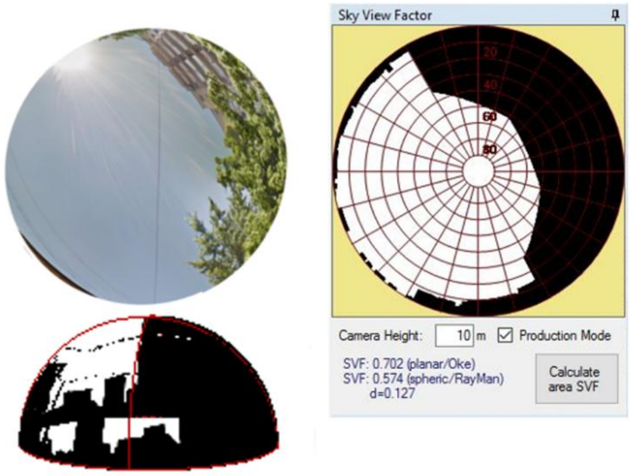


FIGURE 3 - THE SKY VIEW FACTOR CALCULATED IN SKY HELIOS FOR THE STREET CANYON SITUATED IN FRONT OF THE FLUX TOWER BUILDING

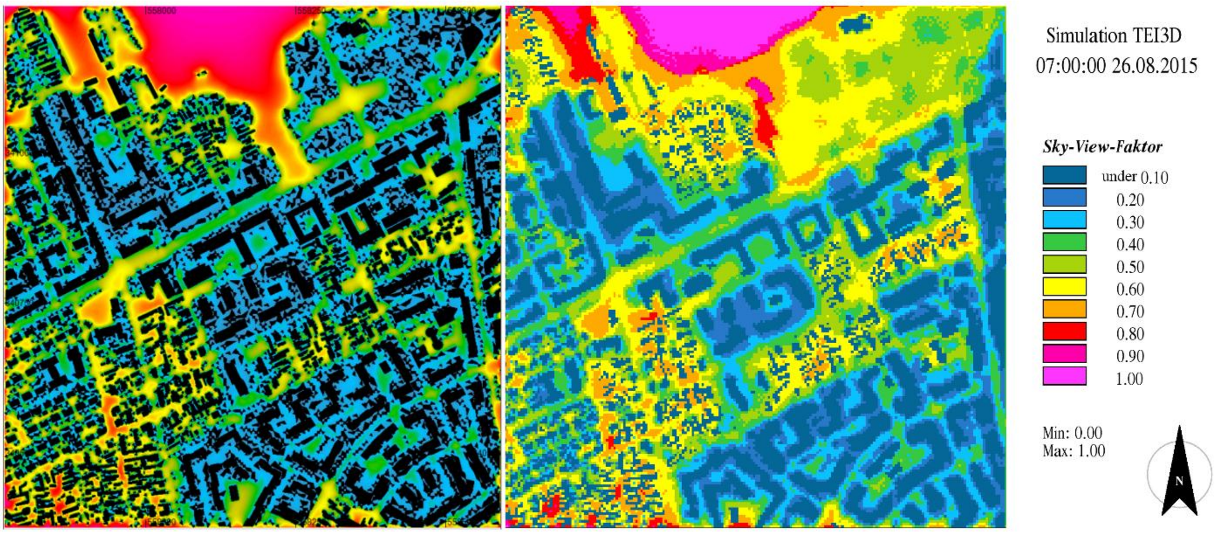


FIGURE 4 - COMPARISON BETWEEN THE TWO CALCULATED SVFS (SKY HELIOS – LEFT AND ENVI-MET – RIGHT)

The in-situ measurements have a high temporal resolution and are considered "indispensable for the validation" (Parlow, Vogt, & Feigenwinter, 2014, p. 109) of both the remote-sensing approaches and the numerical models used for the estimation of the urban climate variables. The use of in-situ measurements coupled with the meteorological information obtained from the processing of the satellite remote sensing images or with the computational fluid dynamics model, make possible the analysis of a larger area by using and extending the records of the flux tower measurements towards the area recorded by the satellite sensor or simulated by the CFD model (Parlow, Vogt, & Feigenwinter, 2014). In our study, we conducted CFD simulations on the 3D model of the District were the Bucharest Technical University of Civil Engineering is situated, with both the 3.1 version and the 4 version of the ENVI-met numerical model. An exemplification is presented for the resulted wind flow in Figure 5 and Figure 6. As it can be noticed, there are street canyons which are longer than 100 metres and where the wind speed increases significantly similar to the , especially the ones parallel with the wind direction similar to the observations made by Alberts (1982). As it can be seen from the Wind Rose in Figure 7, the North-East winds are dominant throughout the year; from this the effects on wind of the three dimensional urban spatial configuration can be better observed.

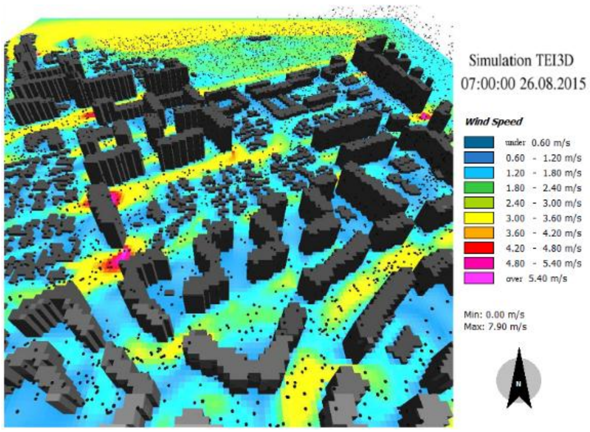


FIGURE 5 - RESULTED WIND FLOW IN 3D AFTER THE SIMULATION IN ENVI-MET

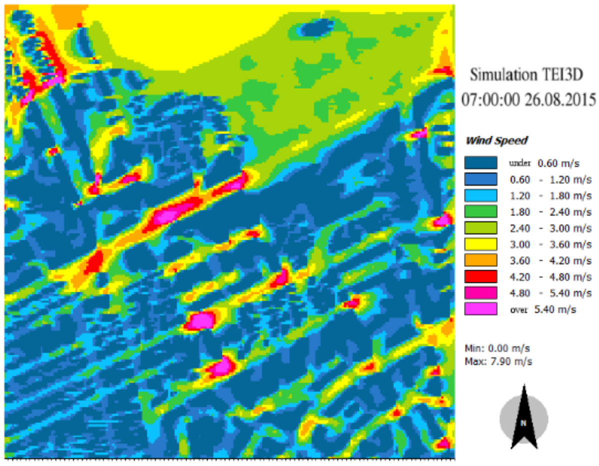


FIGURE 6 - RESULTED WIND SPEEDS IN 2D AFTER THE SIMULATION IN ENVI-MET


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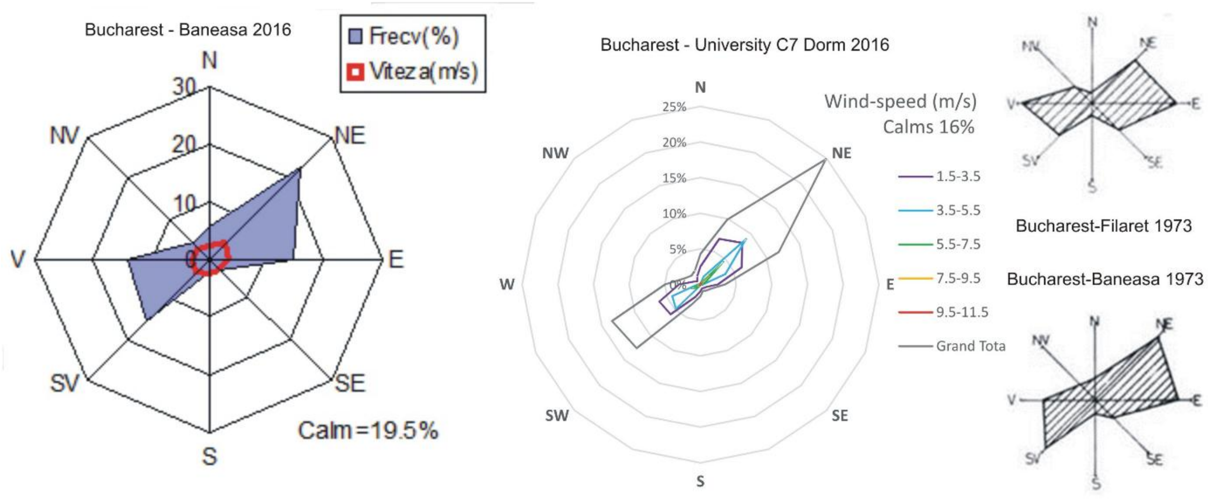


FIGURE 7 - COMPARISON BETWEEN THE HISTORICAL WIND-ROSE FOR BUCHAREST MEASURED AT BANEASA WEATHER STATION AND AT THE UNIVERSITY TOWER

In Figure 7 is presented a comparison between the Normalized Difference Vegetation Index (NDVI) and the Land Surface Temperatures (LST) obtained through processing of the satellite remotely sensed images and the air temperatures estimated with ENVI-met model for a horizontal section at 1.5 m for the same day and hour as the satellite sensor recording date: 26th of August 2015, at around 9:00 o'clock. As it can be easily observed, the differences between the air temperatures and the surface temperatures are more significant in the built-up area, the complex structure of the street canyons introducing a lot of variation.

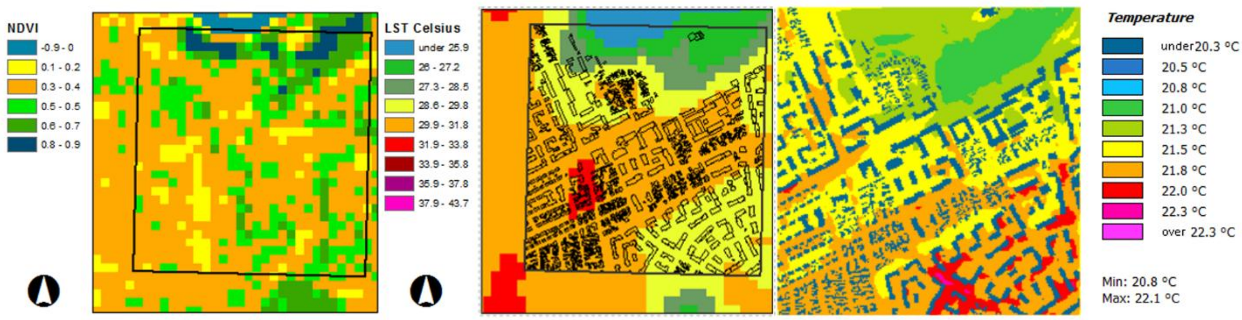


FIGURE 8 - COMPARISON OF THE NDVI AND LST CALCULATED FROM SATELLITE IMAGES AND AIR TEMPERATURES ESTIMATED WITH ENVI-MET MODEL

## 4. CONCLUSIONS AND DISSCUTIONS

The study provides useful information for decision-makers and the public about the preferable options and mitigation strategies in urban planning in order to avoid the deterioration of the urban climate and to avoid the environmental stress produced to human organism. Planning is based on political decisions which sometimes don't factor in scientific studies, much less climate studies (Scherer, 1999) (Fehrenbach, Scherer, & Parlow, 2001).

Part of this problem can only be solved by improving the awareness about the importance of urban climate not only among decision-makers but especially among the public. It is important to provide the public and the local and regional planning authorities with suitable tools and information in order to contribute to a transparent urban planning decision by mapping the possible climate issues.

One effective way to accomplish this idea is to create a WebGIS Mapping Portal concerning urban climate which can offer the detailed information for both the citizens and the public authorities. Usually web map portals contain a basemap, a set of other data layers/maps, navigation tools etc.

In the case of a WebGIS Mapping Portal for Urban Climate we propose, based on the experience of other such cases (Stuttgart) it will contain three types of layers/maps:

- Basemap layers representing the urbanized area obtained by the classification of the satellite imagery
- Environmental maps/layers for the urban climate: air temperatures, wind regime, etc
- Maps/layers for the environmental sensitive zones containing information based on which relevant aspects for planning can be assessed. In order to present the public and the local planning authorities the effects of the various mitigation strategies such as greening, water retentive paving, ventilation path, etc. such maps should include also the results of the numerical simulations of climatic models programs for predicting the effects of district scale countermeasures.

As there is a growing trend in today's communities to use web maps as an interactive display of geographic information which can be used to display or to collect information. E-participation is understood to be (Goodspeed, 2012) the capability offered by the use of Internet technologies to share decision - making, build transparency, obtain support for planning measures and collaboration between the stakeholders and the local governments. Another relatively new concept which can be useful is that of "crowdsourcing" which is based on the principle that the individual citizens are the ones who actually poses the expert knowledge related to their local environment. This expert knowledge is the one which should be used when collecting data and information and which can already come under the form of generated content over the internet. The crowdsourcing mechanism is made available by the development of web applications, such as a Crowdsourcing Mapping Tool, which allow people to upload information easily and allow many others to view and react to this information. This kind of tool allows visitors to put a pin on a map, and provide a short report which is customized to collect a wide range of information, useful for environmental-related observations, such as air temperatures or damage to environmental objects. For example, the potential users of this tool can specify or find a location expressed in lat/lon coordinates, and then has the possibility to fill in a form in which the user can insert a description related to the observation and optionally a picture taken from the mobile phone for example. Next, the user collected data can be visualized as a point of interest on the map and, by clicking on it, information can be retrieved from the internal database.

The method presented in this paper accentuates the main inputs and outputs which should be expected in order to convert the data collected from complex meteorological measurements and satellite remote sensing into actual information required and used by local or regional planning authorities but also by interested citizens. Though widely used in many western countries, especially the German speaking like Switzerland, Germany, or in East Asia (Japan, Hong Kong) this kind of method has never been carried out in Romania.

Our study, among many others, tried to bring forward the importance of the urban climate in humans' lives and their health status, but unlike most of them, it tried to also bring into attention the tools and capabilities available for the urban inhabitant, in the brink of rapid changes in the Information Technology and more and more steps towards an age of Smart Cities. But the main variable here is how the citizens of the future Smart Cities understand and relate to the importance of the urban climate for their own comfort and quality of life and whether they will watch through the transparent window of e-governance and choose to influence the decisions.

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