КЛИМА УРБАНЕ СРЕДИНЕ И САОБРАЋАЈ
URBAN CLIMATE AND TRAFFIC

Соња Кетин [1]
Милош Арсић [2]
Сања Јевтић [3]

Стручни рад
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АПСТРАКТ
Рад приказује негативне утицаје на животну средину узроковане транспортом: промену климе и загађење ваздуха. Климатске промене у урбаним срединама су приказане на примеру мапе урбаних топлотних острва тј места где су најчешће тропске ноћи. Пример Београда и топлотних острва која настају као последица климатских промена и интензивног саобраћаја, указује на узроке ових промена, физичке и климатске одлике урбаног простора у летњем периоду, као и на последице по људско здравље које су све израженије у градским срединама.
У истраженим зонама Београда утврђени су најтоплији региони, као и региони најоптерећенији аерозагађењем и интензивним саобраћајем. Индустријске зоне у урбаним срединама такође доприносе стварању топлих зона а ово се мора узети у обзир и када је реч о транспорту сировина и производа.

Кључне речи: *саобраћај, климатске промене, полутанти*

ABSTRACT
The paper shows the negative impacts on the environment caused by transport: climate change and air pollution. Climate change in urban areas is shown on the example of a map of urban heat islands, i.e. places where tropical nights are most common. The example of Belgrade and the heat islands that arise as a result of climate change and intensive traffic indicates the causes of these changes, the behavior of the urban environment, especially in summer periods, and the consequences for human health that are increasingly noticeable in urban areas.

[1]Академија техничко-уметничких струковних студија, Висока железничка школа, Здравка Челара 14, Београд, Србија, sonja.ketin@vzs.edu.rs, ORCID: 0000-0002-2232-0529
[2]Факултет за економију и инжењерски менаџмент, Универзитет привредна Академија, Цвећарска 2, Нови Сад, Србија ORCID 0000-0001-7853-0819
[3]Академија техничко-уметничких струковних студија, Висока Школа информационе и телекомуникационе технологије, Београд, Србија, sanja.jevtic@vzs.edu.rs, ORCID:0000-0002-2456-7883

The observed regions of Belgrade showed the hottest regions as well as the regions most burdened by pollutants and intensive traffic. Industrial regions in urban areas also contribute to warm zones that must be taken into consideration when it comes to the transport of raw materials and products.
Keywords: *traffic, climate change, pollutants*

INTRODUCTION

The climate of the city is significantly different from the climate of the surrounding areas. This is a consequence of two factors that differ in the city's territory from the surroundings (radiation balance and water balance). The different balance of radiation is a consequence of weaker reflection of solar radiation due to the existence of canyon streets. Differences in the water balance are caused by less rainwater sinking into the soil due to soil coverage, which increases runoff and reduces soil moisture. The difference also arises in evaporation due to reduced soil moisture. The consequence of these differences is a stronger warming of the city area. Differences are also very pronounced in some other elements such as wind, fog and smog. Furthermore, differences occur in different parts of the city depending on the topography and structure of the city. Air pollution also has a significant impact on the modification of the city's climate. Today, a large part of humanity lives in large cities, therefore under modified climatic conditions. Many of the climate modifications caused by cities have a negative impact on human health. Such are, for example, high night temperatures during the summer, or reduced ventilation, which contributes to an increase in temperatures and air pollution.

METHODOLOGY

Belgrade is located in the zone of moderate continental climate. The temperate zone extends from 400 to 600 N, and in it the temperatures gradually decrease from south to north. If a location is located deeper in the continent, the differences between summer and winter increase, this is a climatological characteristic of continentality. In our area, the intensity of continentality increases in the direction towards the northeast, i.e. towards the depth of the continent of Asia and Siberia. Within that, already complex situation, we have a specific "Košava" area whose characteristics are dictated by the mountains of Serbia, the Carpathians and a limited part of Pannonia. It is located in such a climatic region.

The local specificities of Belgrade can be divided into three groups of influences (the influence of topography (vertical gradients); the influence of the ground (rivers, land, vegetation); the influence of the city structure (heat island of the city)).

The analysis of Belgrade's climate data determined the basic topoclimatic zones (first level of zoning), which will be structured into smaller microclimate zones with further analysis (taking into account other parameters, e.g. air pollution).

At the first level of zoning, five zones are defined. The names of the zones are conditional, because they are primarily related to the locations of meteorological stations whose observation data were used. The zoning procedure is based on all available data, and the basic characteristics of the zones are presented based on the observation period 1971-1990. (this is the period in which all used meteorological stations had complete series)(Figure 1,2,3).

URBAN CLIMATE

Man's influence on the atmosphere and climate in cities manifests itself through change values of all climatic elements. Since the beginning of the 19th century, it has been considered that the climatic impact of urbanization is most clearly manifested in the air temperature. Most cities have a higher air temperature than their immediate surroundings. In this way, the urban heat island is formed. Intensity and scale of that phenomenon change in time and space.

Urban (urban heat island) as a phenomenon of higher air temperature in cities, in relation to the surrounding area, is the most important consequence of the impact of urbanization on the climate.

- The difference between the urbanized territory and the rural environment in the surrounding area depends on the synoptic conditions, and in this sense the factors of topoclimate education have a great contribution.
- The city climate is most pronounced in anticyclonic situations, when the weather is calm and clear. The differences decrease in cloudy conditions and increased wind

RESULTS

The results obtained by the researchers are presented in graphical form with clearly marked zones and values of characteristic climate parameters.

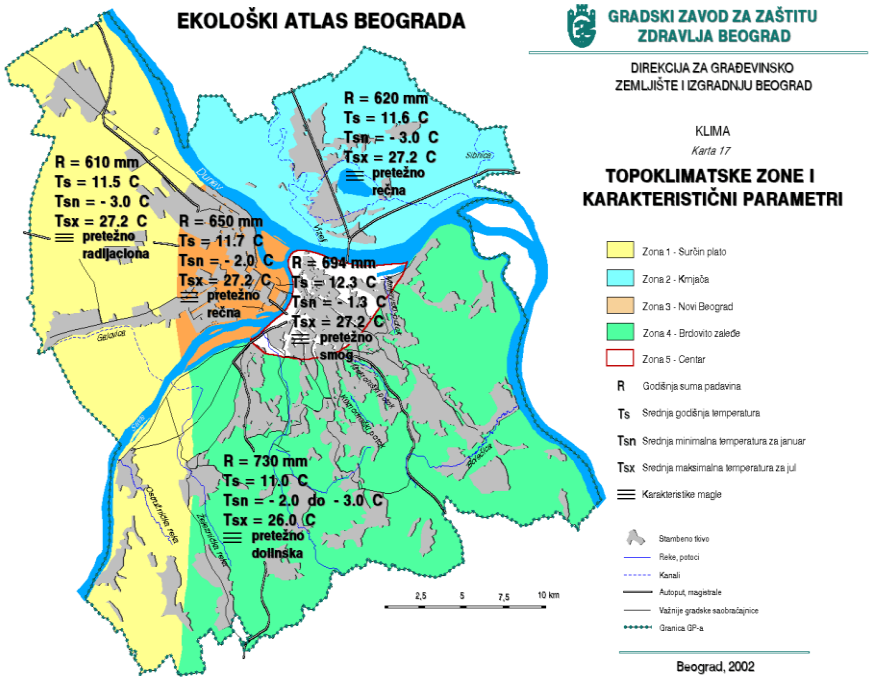


Figure 1. *Topoclimatic zones and characteristic parameters for the city of Belgrade[4] (source: Ecological Atlas of Belgrade)*

In Figure 1 we can see that Belgrade has 6 climate zones (Zone 1-Surčin Plateau; Zone 2-Krnjača; Zone 3-Novi Beograd; Zone 4-Hillside; Zone 5-Center). The zones are shown in the figure in different colors (Zone 1-yellow; Zone 2-blue; Zone 3-orange; Zone 4-green; Zone 5-white). In Figure 1 we can see data on the Annual precipitation R, the average annual temperature Ts; the average minimum temperature for January Tsn; the average maximum temperature for July Tsx. In the image we can see that the highest maximum temperatures for July were measured in zones 1, 23 and 5. The lowest measured maximum temperatures were in Zone 4. The highest precipitation was measured in Zone 4, while the lowest annual precipitation was measured in Zone 1.

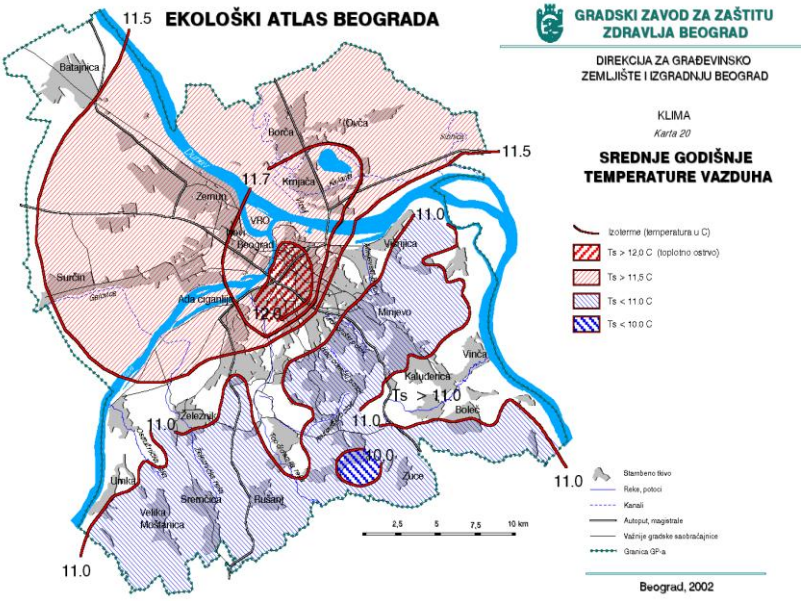


Figure 2. *Average annual air temperatures[4] (source: Ecological Atlas of Belgrade)*

In Figure 2 we can see marked zones with different average annual temperatures (Temperatures over 12 degrees Celsius (heat island); temperatures over 11.2; temperature less than 11 and temperature less than 10 degrees Celsius. We see that heat islands are expected in Zone 5-Center.

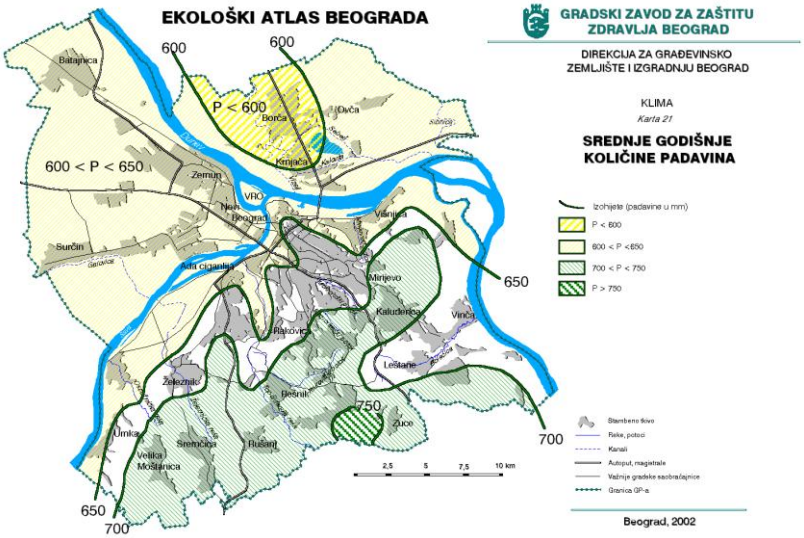


Figure 3. *Average annual precipitation[4] (source: Ecological Atlas of Belgrade*

In Figure 3 we can see a display of the average annual precipitation for the different zones. The figure shows regions for precipitation less than 600 mm; for the precipitation range from 600 to 650; for the region from 700 to 750 mm and a region for precipitation greater than 750 mm. The highest precipitation is observed in Zone 5, and the lowest precipitation was detected in Zone 2.

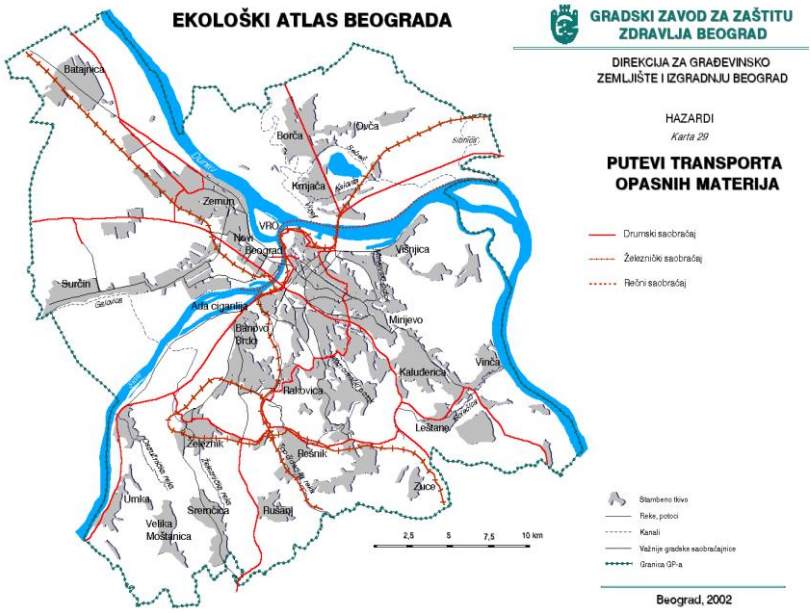


Figure 4. *Hazardous materials transport routes[4] (source: Ecological Atlas of Belgrade)*

The main traffic flows of dangerous goods are shown on the map:

1.In road traffic - highway corridors for freight traffic, and partly through roads
in the urban fabric.
2. In railway traffic, the main flows of dangerous substances
3. In river traffic, transport (Figure 4)

CONCLUSION

Many of the climate modifications caused by the city have a negative impact on human health (high night temperatures in summer). The characteristics of the city that lead to unfavorable local climatic conditions can be corrected by appropriate planning measures in the construction or reconstruction of the city. There are some concrete elements: building density and height, street width, orientation of buildings, adaptability of materials, where adequate use of glass is extremely important for the

climate of the building. From the above, it can be seen that there is a clear annual course of stability characteristics in Belgrade. This annual trend represents an important climatic characteristic, and at the same time it can be practically used to study the spatial and temporal distribution of air pollution. The annual flow of precipitation has predominantly continental characteristics. While the maritime type has its maximum rainfall in November, the continental type has its maximum in June. Although Belgrade is located quite deep in the continent, it also has some maritime characteristics. Thus, Belgrade has two maximums and two minimums in the annual rainfall. Continuity in monitoring these important climate characteristics is important. [1-4,8,9]

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