# Climate-fit.city Online Analytical Platform Needs

*Barbara Vojvodíková, Petra Šobáňová, Iva Tichá, Natálie Szeligová*

(Assoc. Prof, Ing. Ph.D, .Barbara Vojvodikova, IURS - Institute for Sustainable Development of Settlements,Bulharska 1424/25, Ostrava - Poruba, iurs@email.czl)

(Mgr.Ph.D.,Petra Šobáňová :, IURS - Institute for Sustainable Development of Settlements,Bulharska 1424/25, Ostrava - Poruba , petrasobanova@gmail com)

(Ing. Mgr. Ph.D., Iva Tichá, IURS - Institute for Sustainable Development of Settlements,Bulharska 1424/25, Ostrava - Poruba , itichai@seznam.cz)

(Ing., Natálie Szeligová, IURS - Institute for Sustainable Development of Settlements,Bulharska 1424/25, Ostrava - Poruba , natalie.szeligova@vsb.cz)

## 1 ABSTRACT

Urban areas are very vulnerable to the impacts of climate changes, because of the high concentration of people, infrastructure, and economic activity, but also because cities tend to exacerbate climate extremes such as heat waves and flash floods. This article focuses on project Pan-European Urban Climate Service - PUCS Grant Agreement Number: 730004, Service Name: Climate-fit.city. Climate-fit.city translated the best available scientific urban climate data into relevant information for public and private end-users operating in cities across a range of different sectors. The service will quantify the impacts of climate (change) on a range of urban sectors and propose relevant solutions to customers. For Czech republic the main topic is urban planning. The sectoral service on urban planning is focused on the (cor)relation between urban climate (heat) and urban land use structure and development. The first step of the project was to define the needs and expectations for an aplication of online analytical platform (one of the project products). The platform will also allow dedicated tailored scenario analysis based on climate change modelling and varying urban land use datasets. In three pilot areas, Prague, Ostrava and Hodonín, administration responsible for urban planning and strategical planning defined the needs and expectations. In this article will be described in more detail why these three pilot cities were involved and how different expectations and needs representatives have for these three areas.

Keywords: climate-fit.city, urban planning, heat island, urban development, climate platform

## 2 SHORT INTRODUCTION TO CLIMATE-FIT.CITY PROJECT

The current period is bringing more and more debate about responses to climate change. Given the high vulnerability of cities to climate extremes and considering that decisions regarding climate adaptation measures are often made at the city authority level, it is clear that cities deserve tailor-made urban climate information that accounts for their particular urban physical and socio-economic characteristics to assist decision-making.

In this context, Climate-fit.city will demonstrate the added value of integrating urban climate services within user practices and to establish and further upscale an urban climate service, which will translate the best available scientific urban climate data into relevant information for public and private end-users in cities. The service will quantify the impacts of climate (change) on a range of urban sectors and propose relevant solutions to customers.

The added-value of the Climate-fit.city urban climate services for local decision-making is being demonstrated in 6 service cases located across Europe. The demonstration activities are being conducted jointly with service providers and end-users in the domains of active mobility, building energy, tourism, emergency planning, health, and urban planning. Over the course of this project, we will extend this initial portfolio of 6 cases towards new sectoral applications.

Six sectoral service cases are being fully elaborated and demonstrated in the first phase of the project, in a joint effort involving end-users and service providers as project partners. These service demonstration cases are being implemented in Barcelona, Bern, Antwerp, Prague/Ostrava/Hodonín, Vienna, and Rome in the domainof health, building energy, emergency planning, urban (spatial) planning, active mobility, and cultural heritage.

This article focuses on application to the Czech Republic, where testing is being done in the field of spatial planning The urban (spatial) planning sectoral service case will focus on the (cor)relation between urban climate/heat and urban land use structure and development.First, the current status of the climate conditions of pilot cities (Prague, Ostrava, Hodonín,all CZ) will be explored by assessing the dependency of the temperature distribution on theurban structure and identifying the location of the heat hot-spots.

Second, various urban planning scenarios will be introduced by modifying the city's land use plan and will be combined with different climate development scenarios. The urban planning scenarios will represent different city development strategies at different levels of spatial detail and decision making processes, including the entire city level as well as the local neighbourhood level. The effect of these urban planning scenarios on urban temperature conditions will be explored. This will be fulfilled by integrating different versions of the land use/land cover input layers into the UrbClim model (in particular the Copernicus Urban Atlas Layer and 3D models of the cities)  (more about UrbClim model,. De Ridder 2015) and generating corresponding versions of the urban temperature maps.

An online analytical platform will be prepared by GISAT (partner of project), in order to enable the user to visualize and interactively analyse this multi-temporal temperature information, as well as to enable dedicated tailored scenario analysis based on climate change modelling and varying urban land use datasets.

## 3 SPATIAL (URBAN) PLANNING IN CZECH REPUBLIC AND HEATING SPOTS

In the Czech Republic spatial planning can be in a very simplified way divided into the urban planning part itself and the part of the strategic planning and development. The part dedicated to urban planning itself is quite strictly described in the Act No. 183/2006 Coll.,) . On Urban Planning and Building Code, as amended. It describes the process of creating the necessary documents together with defining its content and responsibilities. (Czech Republic. Act no. 183/2006 Coll.). In contrast, the strategic planning part is defined rather generally, even if it is partially addressed by Act No. 248/2000 Coll. on regional development support, as amended (Czech Republic. Act no. 248/2000 Coll).

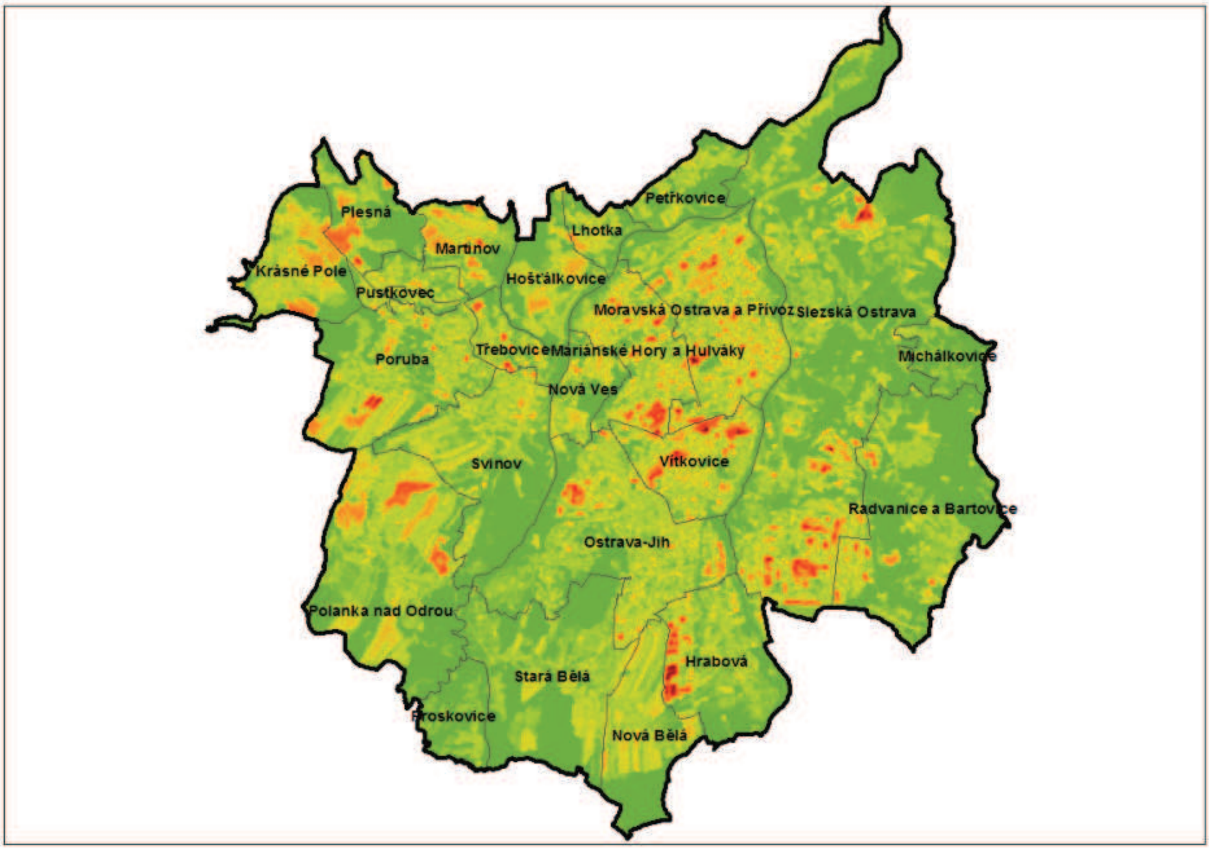


Fig. 1: The thermal islands in the urban structure of the city Ostrava (source Adaptation Strategy of the Statutory City of Ostrava 2017).

The State Environmental Policy of the Czech Republic 2012 – 2020 among the most important and urgent problems indicates Reducing the permanent appropriation of farmland and basement rocks (Ministry of Environment The State Environmental Policy of the Czech Republic 2012 – 2020). The policy noted that in recent years the annual losses of agricultural land totalled approximately 5000 hectares, which means 14 hectares per day. At present, according to (ISSAR, 2014) built-up areas in the Czech Republic occupy about

10.6% of the entire country area. Calculation made by (Prokop, 2011) specified the daily loss of agricultural land in the Czech Republic even to 16 hectares per day. This information is closely related to landscape change and urban planning issues.

Strategy of Adaptation to Climate Change in the Czech Republic has been prepared by the Ministry of Environment in cooperation with other ministries and with use of climatological findings and recommendations of the Czech Hydrometeorological Institute. The strategy is a national adaptation strategy of the Czech Republic. It assesses the likely impacts of climate changes and contains also proposals for specific adaptation measures. This document has direct links to the documents in the urban planning area. It mainly refers to Spatial Development Policy, but also refers to urban plans.

These and other documents mention warmth, thermal comfort and heatind spots as one of the phenomena that need to be reflected in the field of planning.

In one of the pilot areas of this project - Ostrava has been prepared and approved the Adaptation Strategy of the Statutory City of Ostrava for the Impacts and Risks of Climate Change - In its analytical part, the points of view that are the most important of the thermal islands in the urban structure of the city.(fig.1)

## 4 PILOT CITY IN CZECH REPUBLIC

In the Czech Republic, 3 plot areas were selected, Prague, Ostrava and Hodonín.

Prague is the capital city of the Czech republic. It is characterized by a high density of inhabitants and a very compact urban structure. Changes in land use can take place either in the build up area where land use is used, or it is possible to work with the area of brownfields within the structure of the city. Discussions about the use of brownfields are the subject of many public discussions on the territory of Prague, and the public is watching closely how these unique areas are used. Application of the model will help to discuss how to use it so that the future of these areas responds to the sustainable development of the whole city and does not create new problem areas and thermal islands.

Ostrava is the third largest city in the Czech Republic. It is a former industrial city with a polycentric settlement structure. In the territory of Ostrava, the project will be tested, among other things, the effects of burning mines heaps on the UrbClim model. (See Fig. 2) His ability to describe and evaluate these unique phenomena that are located in the urbanized area will be tested. It will be assessed if and how these thermal points affect the climate in the neighborhood and what changes would bring about their extinction.

Fig.2 Burning mines heap Ema in Ostrava


ISBN 978-3-9504173-4-0 (CD), 978-3-9504173-5-7 (print)
Editors: M. SCHRENK, V. V. POPOVICH, P. ZEILE, P. ELISEI, C. BEYER, G. NAVRATIL

Hodonín and the surrounding area has an area of 63.05 square kilometers and a population of over 25,000 inhabitants HOdonín itself is a male town in the south of Moravia situated in the flat terrain of the Pannonian Plain in the framework of the project being studied Reflection of urban planning strategy in urban climate development – small city – very local level (e.g. development of the main square or gardening colony)boundary conditions for UrbClimb model – level of spatial detail, city size. Thus, the capability of the model and its application in a small country will be assessed

## 5 SOLUTION PROCEDURE

The first step in the testing was to obtain a shorn of needs and expectation from the expert to the urban planning in connection with the application of the Ur Clim model.

In order to collect initial user need specifications, as well as information about the current awareness and perception of the urban climate and urban heat problematics, an introductory workshop was organized for the urban planning sectoral case. The workshop took place in the city of Ostrava, in Slezská Ostrava quarter town hall on 31st June 2017.

Main workshop participants: Pilot cities City of Prague, Ostrava city representatives, Slezská Ostrava sub-city district representatives,– Hodonín city representatives (including the major of the city). Regional development agencies (North and South Moravia).VSB - Technical University of Ostrava, Czech Academy of Science – Institute of Geonics, EKOTOXA - Centre for environment and land assessmen

At the end, a questionnaire prepared to explore the specific user requirements was handedaround to be filled in by the participants. The outcomes of this questionnaire are incorporated into the specification of stakeholder needs.The workshop was concluded by an excursion to the top of the near mining heap Ema. The heap Ema is a source of the local temperature maximum and its influence on the surrounding local temperature in the neighbourhood will be examined during the project. During the workshop, all pilot cities as well as other participants made important contributions to the topic. However, the main intention of the workshop was to identify the gaps in urban climate data and services supply, which can be filled by the service provider and, most of all, to gather specific needs and requirements of the present stakeholders.

Urban heat is perceived as a critical issue, especially in big cities. Both, Prague and Ostrava are highly interested in monitoring, predicting and mitigating this negative climate phenomenon. However, urban heat is also considered to be an issue in smaller cities, which,in this case, has been confirmed by representatives of Hodonín.

## 6 CONCLUSION

From workshop the main conclusion can be summary into this short text. For Hodonín, a specific use case has been identified, dealing with different development scenarios at the very local level: the exploration of how the local temperature will be influenced in case that the local gardening colony will be transformed into an industrial/commercial area or other urban land use. Also, Hodonín asked for the exploration of the modifications in the temperature conditions related to the planned construction of the highway bypass around the city.

For Ostrava, the initially required use-case was the exploration of the influence/impact of three heat heaps (related to the local mining activity) on the city’s climate. For both larger cities involved – Ostrava and Prague – the impact of their long-term urban planning strategy on the climate/temperature conditions in the city and the surrounding area would be of major interest. This includes the requirement for different scenarios and predictions until 2030 and 2050.

The next main idea. Users are highly interested in the topic of urban climate/heat. Urban heat is perceived as a big issue. • They are aware of the linkage between urban land use and urbanclimate/temperature. They support sustainable development of the cities – need to address environmental issues, including urban climate in the decision making processes. Biggest climate issues: urban heat, torrential rain events, floods.

### 6.1 Conclusion for project team and the next steps

First, the more detailed input land cover / land use datasets (than the currently used Corine Land Cover layer) will be collected and integrated into the UrbClim model, in order to increase the spatial resolution and accuracy of the results – this will cover, Copernicus Urban Atlas Layer (0,25ha MMU) – for City of Ostrava and Prague,• Local urban planning database for Hodonín City (which is not covered by Urban,Atlas), 3D model from OSM (available for all three cities). Precise 3D model of the City of Prague. Using these datasets, temperature maps for all three cities will be generated, in hourly step and in time series, including the year 2012 (defined by Urban Atlas reference year), as well as predictions until the years 2030 and 2050.The basic set of the maps will be generated for all three cities in 100m spatial resolution.

Second, an interactive online platform will be prepared, for data visualisation, multitemporal interactive analysis and scenario modulation/modification. Time-series of temperature maps will be integrated into this platform, in order to provide the users with a simple visualisation and analytical tool. The tool will also have functionalities for statistical assessments at the level of analytical units, including raster values aggregation, interactive selections of units of interest and their benchmarking.

Third, various urban planning scenarios will be introduced by modifying the input land cover/land use layers. This will be done for various levels of spatial detail, i.e. the entire city level and local neighbourhoods. The impact of urban land use structure modification on temperature distribution will be observed and assessed, at the city level also in the sense of meeting the goals/thresholds of climate change adaptation strategies. In order to enable the users to modify their development scenarios on their own (through modification of the input land cover/land use layers), the interactive tool will allow users tomodify the input land use layer and explore the impact of these modifications on the UrbClim model results, represented by temperature maps.

## 7 ACKNOWLEDGEMENT

This article was prepered in support of project PUCS - The Pan-European Urban Climate Service. This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 730004.

## 8 REFERENCES

Adaptation Strategy of the Statutory City of Ostrava for the Impacts and Risks of Climate Change : [cit. 08-01-2018]. 8 https://www.ekotoxa.cz/wp-content/uploads/2017/09/AS-Ostrava-Analytická-část-plus-pocitová-mapa-a-zranitelnost-1209.pdf , 2018

Koen De Ridder, K., Lauwaet, D., Maiheu, B.: UrbClim – A fast urban boundary layer climate model. Urban Climate 12 (2015) 21–48, 2015

ISSAR: What is current state and chat are trends in land use in the Czech Republic? [online]. Key environmental indicators, Land and Landscape, agriculture [cit. 08-01-2018]. IT system of statistics and reporting. Available at: http://issar.cenia.cz/issar/page.php?id=1598., 2014

Prokop, G., Jobstmann, H., Schonbauer, A., : Overview on best practices for lifting soilsealing and mitigating its effects in EU – 27 (Environment Agency Austria) [online]. Technical Report – 2011-50 [cit. 08-08-2016], 2011.

Strategic Framework for Sustainable Development in the Czech Republic,. Prague: Ministry of the Environment of the Czech Republic. 2010. 97 pp. ISBN 978-80-7212-536-4. (In Czech), 201

Strategy of Adaptation to Climate Change in the Czech Republic, 2016. [online]. Ministry of the Environment of the Czech Republic 2008 - 2015 [cit.04-01-2018]. Available at: http://www.mzp.cz/cz/zmena_klimatu_adaptacni_strategie. 2016