Monitoring of Socially Excluded Localities of Ostrava City

Jiří Horák[1], Igor Ivan[2], Tomáš Inspektor[3], Lubor Hruška-Tvrdý[4]

[1,2,3] Institute of geoinformatics, Faculty of Mining and Geology, VSB - TUO, 17. listopadu 15, 70833, Ostrava, Czech Republic
[1] jiri.horak@vsb.cz
[2] Igor.ivan.hgf@vsb.cz
[3] tomas.inspektor.st@vsb.cz
[4] PROCES-Centrum pro rozvoj obcí a regionů, Švabinského 1749/19, 702 00 Moravská Ostrava, Czech Republic
lubor.hruska-tvrdy@rozvoj-obce.cz

Abstract. The monitoring of socially excluded localities requires data sources with a sufficient frequency of data flow to quickly detect the changes and allow taking appropriate measures in time. The register of unemployed persons may provide important indicators of the unemployment status of individual localities and also a movement of social conditions there. A special processing of data from labour offices is necessary to protect the personal privacy. Detection of endangered localities in Ostrava city was based on data records from 2007 and 2009 using both quadrat and kernel methods. A share of registered unemployed to inhabitants in productive age can substitute the rate of unemployment due to high correlation of both indicators. Other evaluated factors include rate of unemployment for young people (between 18 and 25), for older people (between 50 and 65), share of unemployed with basic education, share of health-handicapped unemployed and share of long-term unemployed persons. The comparison of the quadrat and kernel methods indicates more advantages for the kernel type of data processing and aggregation. The method enables to reveal also localities not discovered by experts. The identified localities were compared with a social typology of the city and the evidence of minority ethnic based localities. Monitoring of selected localities utilizes temporal changes of localities expressed in aggregated values, changes of indicators' values and its internal spatial structure. The monitoring of selected localities during several months of 2009 demonstrates similarities and differences in the movement.

Keywords: social segregation, residential separation, kernel map, unemployment

1 Introduction

A specific status of Ostrava city among other large cities in the Czech Republic is determined by its geographical position and namely by its specific history. The Ostrava city has been formed by industrial boom in 19st and 20st centuries. It obtained more features of conurbation and urban agglomeration than characteristics of the classic concentric urban scheme.
A social progress after 1990 deepens differences in the society. The socio-spatial structure of the city, respectively segregation, is the result of the process of socio-economic differentiation. Extensive discussions concerning the socio-spatial structure of the city and its explanations have continued between the sociologists of the city and social geographers to this day (for instance the dual-city concept by Castells [6]).
The characteristics of Ostrava's built-up area (non-continuous built-up areas with many gap sites, free or occupied by brown-fields, contaminated areas, parks or semi-natural forests) facilitate the process of establishing and fixing internal peripheries and excluded areals inside the city.
The concept of marginalisation is usually perceived mainly as a phenomenon creating a periphery of society. Thus it became a part of the concept of social exclusion [13]. "Social exclusion is defined as a situation when an individual or a group of people do not fully participate in the economic, political or social life of the society, or when their access to income and other resources does not enable them to reach the standard of living considered as acceptable in the society" [11]. Social exclusion can manifest itself at the economic, political, social or cultural level, but also at the levels of symbols or spatial arrangement.
Residential segregation is the involuntary "division of differentiated social groups into different residential districts of the city. It is the spatial expression of inequality." [5]. If such division is voluntary, it is then usually called separation. With regard to the size of the territory, residential segregation may exist as the segregation of inner cities and the hinterland within the framework of metropolitan areas and municipal regions, or as the segregation of individual city districts inside cities, or even as the segregation of individual residential blocks [12].
Residential segregation also influences the emergence of the concept of segmented labour market within Economics. The term 'labour market segmentation' implies processes through which there

occurs separation of certain groups of professions or occupations (similarly as in the process of segregation in cities), which leads to the creation of labour market segments, i.e. division of the market into smaller homogeneous parts which, to an extent, are independent of each other due to the existence of barriers. The nature of such barriers may be geographic or professional, they may have to do with the worker's relationship to the employer and in some cases, it may be the socio-demographic characteristics of the worker which become a barrier – for instance his or her race, gender or age [15].
Sociologists usually differentiate between three types of separated territories – ghettos, enclaves and citadels. Ghettos usually develop as the result of the process of segregation. It is possible to differentiate between two types of ghettos: the classic ghetto and the ghetto of the underprivileged. The classic ghetto is defined by spatial separation, inferiority and the involuntary definition of identity. In addition to the previous characteristics, the ghetto of the underprivileged is also defined by the special relation of the residents of the ghetto to the rest of the society, for instance in the form of economic or social exclusion [14].
This development endangers common functions of the city, social interactions and relationships of inhabitants. The monitoring of these processes becomes a necessary part of urban management.
Usually one of the most important factors is an unemployment especially combined with discriminating personal factors like a low education, higher age etc.
The paper describes several possibilities of GIS application and selected data sources suitable for social morphology of the city and monitoring of excluded localities. Spatial differentiation here is perceived in the context of local labour market.
The main objective is to evaluate contributions of two methods of data agregation (quadrat and kernel methods) for assesment and monitoring of socially excluded localities on the example of Ostrava city.

2 Data sources

The continual monitoring of city processes requires data sources producing dense data flow in time and space. Principal data sources for such monitoring are registers created in public sector. The concept of four basic registers for public administration in the Czech Republic will enable to share data among public authorities in a safe and controlled manner via information system of basic registers [7]. The register of territorial identification, addresses and real estate properties (RUIAN), register of rights and duties, register of persons (economical subjects) and register of inhabitants will enable to design indicators suitable to monitor current urban situation and contribute to mapping of social morphology of the current city. Significant information can be also found in the Register of unemployed persons, designed for and managed by labour offices.
These main data sources should be completed from other evidences and information centres, including non-governmental (i.e. charity), health services etc.
Registers contain high volume of data, unfortunately with a low consistency and weak possibility of interlinking databases to make geocoding.
Processing such data strongly requires data harmonisation and elimination of various errors (resulted from semantic and content differences due to a low input integrity constrains, and insufficient locational schemes).
Most of the above mentioned sources contain confidential data. To protect personal privacy it is necessary to applied appropriate data processing.
The collaboration with the Ostrava' Labour Office began at October 2006. Since March 2009 the data exports are provided each month. Similar collaboration was established with the City Authority, providing periodically a population data.
The data from both registers are geocoded using addresses points from GIS of the Ostrava city and RSO (Czech Statistical Office). The success rate for geocoding is usually more than 95 % (99.5% in 2009). Due to the high variability and privacy protection the data is aggregated using quadrat and kernel methods.

3 Methods of data aggregation

Quadrat methods are based on summarisation of data falling into regular (usually square) cells covering the whole study area. The size of quadrats is 100x100 m to enable detail evaluation of local conditions.

The **kernel method** was originally developed to obtain a smooth estimate of a univariate or multivariate probability density from an observed sample of observation. A bivariate kernel estimation can be easily adapted to give an estimate of spatial intensity. If **S** represents a general locations in a study area and $\mathbf{S_1}$, $\mathbf{S_2}$, ..., $\mathbf{S_n}$ are the locations of the n observed events then the intensity, λ**(s)**, at **S** is estimated by [1]

$$\lambda'_{\tau}(s) = \frac{1}{\delta_{\tau}(s)} \sum_{i=1}^{n} \frac{1}{\tau^2} k\left(\frac{(s - s_i)}{\tau}\right) \quad (1)$$

Here **k()** is a suitable chosen bivariate probability density function, known as kernel, which is symmetric about the origin. The parameter $\tau > 0$ is known as the bandwidth and determinates the amount of smoothing. The factor **δ(s)** is an edge correction. For any chosen kernel and bandwidth, values of λ**(s)** can be examined at locations on a suitable chosen fine grid to provide a useful visual indication of variation in the intensity, λ**(s)**, over the study region [1]. The final kernel density estimation is composed from contributions of individual kernel functions centred at each point (fig.2) – in our case at each address point.

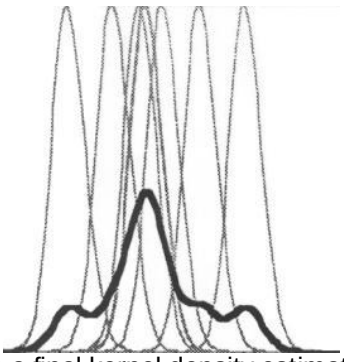

Fig. 1. The principle of composition a final kernel density estimation from individual kernel functions centred at each sample point (Brunsdon 1995)

An example of practical application for employers' distribution can be found in Horák et al. [10]. The relative intensity [3] is useful for an evaluation of the phenomenon which distribution depends on distribution of another parameter.

In our case testing of different bandwidth size found the most appropriate value 150 m. The grid size is 10x10 m. The calculation was made using Kernel Density function in ArcGIS 9.3.

The data from labour office and city authority are geocoded, summarised and aggregated. After that the following indicators are calculated:

- share of registered unemployed to inhabitants in productive age (UP)
- rate of unemployment for young people (between 18 and 25) (U18-25),
- rate of unemployment for older people (between 50 and 65) (U50-65),
- share of unemployed with basic education (UBE),
- share of health-handicapped unemployed (UHH),
- and share of long-term unemployed persons (ULT).

The consistency of results has to be checked. The anomalies are studied and explained (e.g. number of unemployed is higher than local permanent population due to a concentration of temporary staying persons). If necessary, corrections are applied.

The share of registered unemployed to inhabitants in productive age (UP) can substitute the rate of unemployment (UR) due to the high correlation of both indicators [9].

4 Identification of socially excluded localities in the city

Spatial matching of localities carrying high values of selected indicators from the labour market and socio-spatial segregated areas represents a basic premise for our study.
The calculation of kernel maps enables to identify hot spots – places with high density of unemployed population or some specific endangered part of population.
The comparison of kernel and quadrat maps clearly demonstrates advantages of kernel mapping to discover individual hot spots. Quadrat maps are crumbled and it is very difficult to recognise any pattern and identify outstanding localities. Also a high variability in localities with extremely small population usually hides the searched pattern (fig. 2).

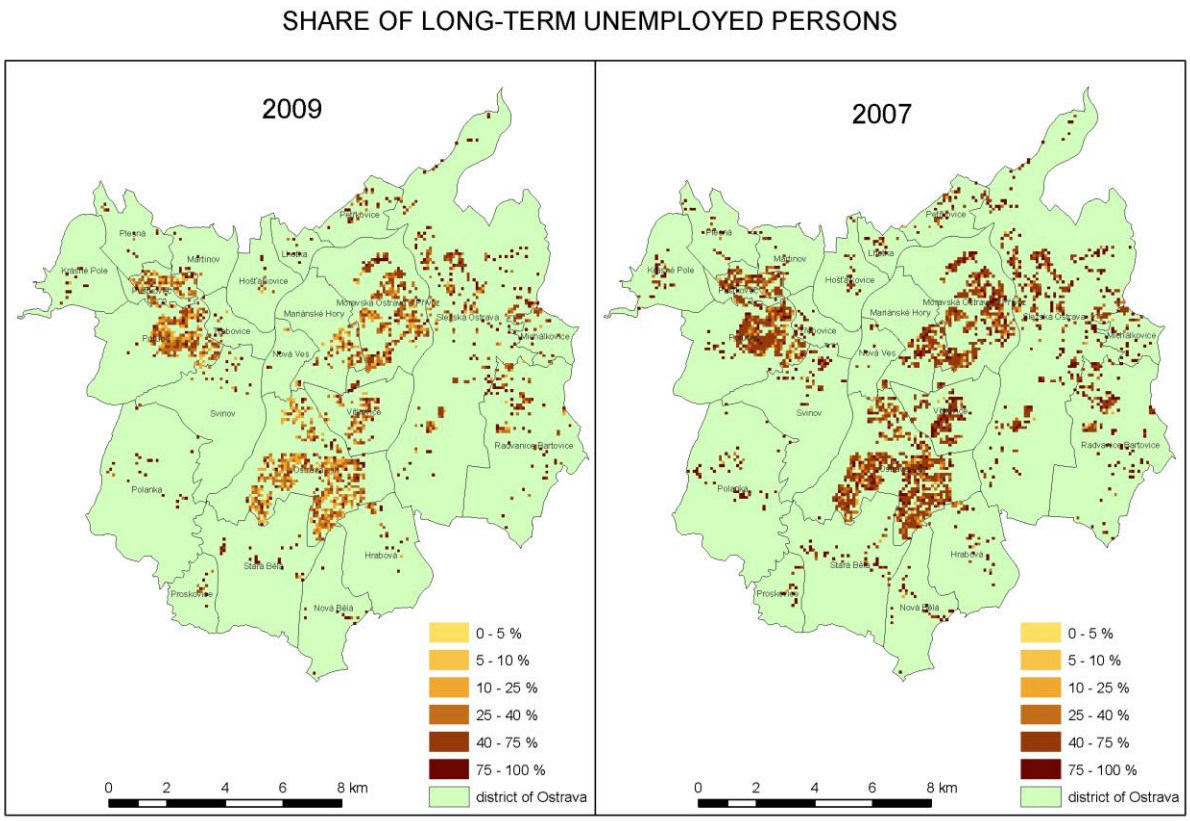

Fig. 2. The quadrat maps of ULT in 2009 and 2007 (the quadrat size is 100x100 m)

The identification of hot spots using kernel map may be based on individual study and comparison of kernel maps for individual factors in different time. Such procedure was applied in Ostrava discovering approx. 35 localities with high concentration of negative, unemployment related phenomena. The most significant localities are indicated in fig. 3.

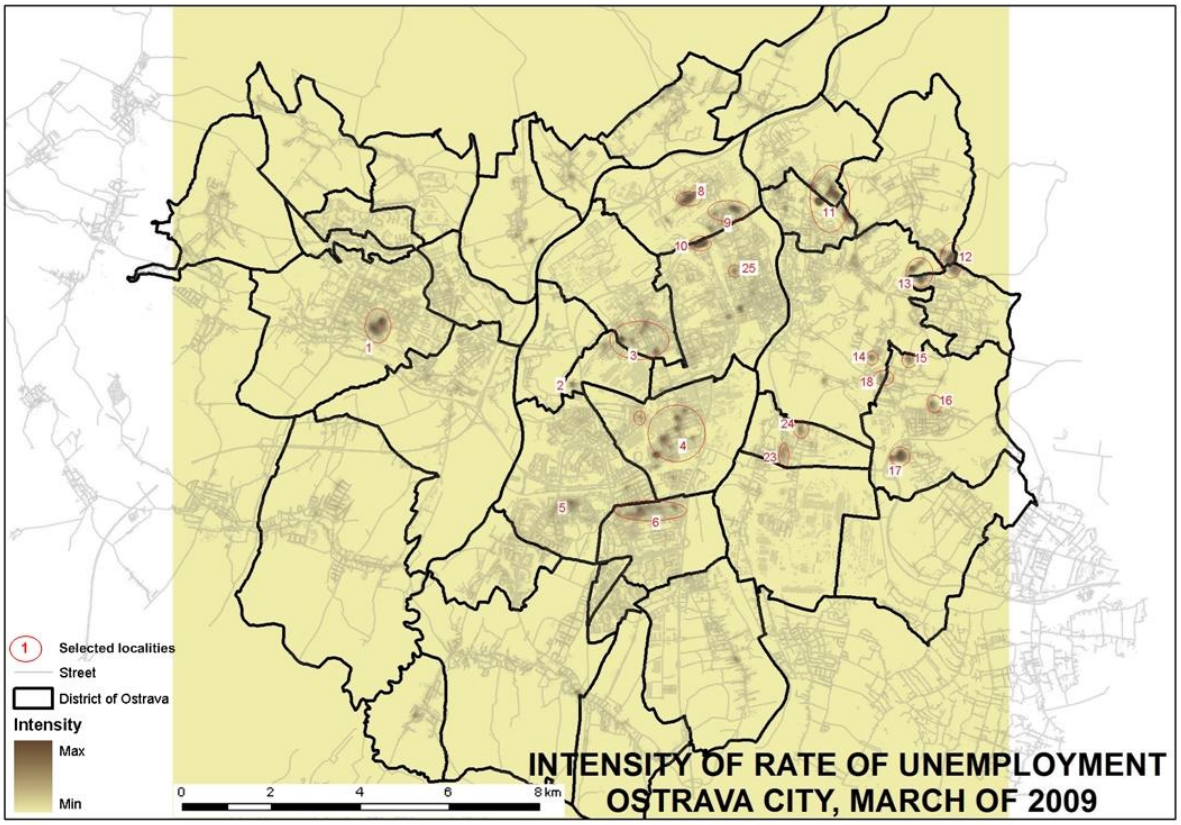

Fig. 3. The kernel density of UP in March 2009. The selected localities are labelled.

The identification of hot spots may also utilise more automated processes of mapping and selection which are more suitable for practical monitoring provided by the City Authority. The automated processes include setting a threshold value of kernel estimation to establish borders of localities (or better to indicate a core of the problem locality). The first step reveals some 70-130 localities (in our case). Then it is recommended to analyse the number and structure of inhabitants and unemployed persons and to skip small localities (with too small number of addresses inside, number of unemployed bellow a threshold etc.). This second step reduces the number of localities to some 20-30 localities. The final localities are more stable in space and time and represent searched significant hot spots.

Mapping of monitored phenomena and discussion of their behaviour in space and time can be found in [9].

The presented hot spots were compared with a social typology of the city and the evidence of minority ethnic based localities.

Discovered localities using kernel method were compared with localities identified by experts in a study of GAC Ltd. for the Ministry of Social Affairs. The analysis of socially excluded gypsy localities mapped the segregated (or endangered) localities also in Ostrava and evaluates also an absorption capacity of social subjects in respective areas. The localities identified by experts in 2006 are depicted in fig. 4.

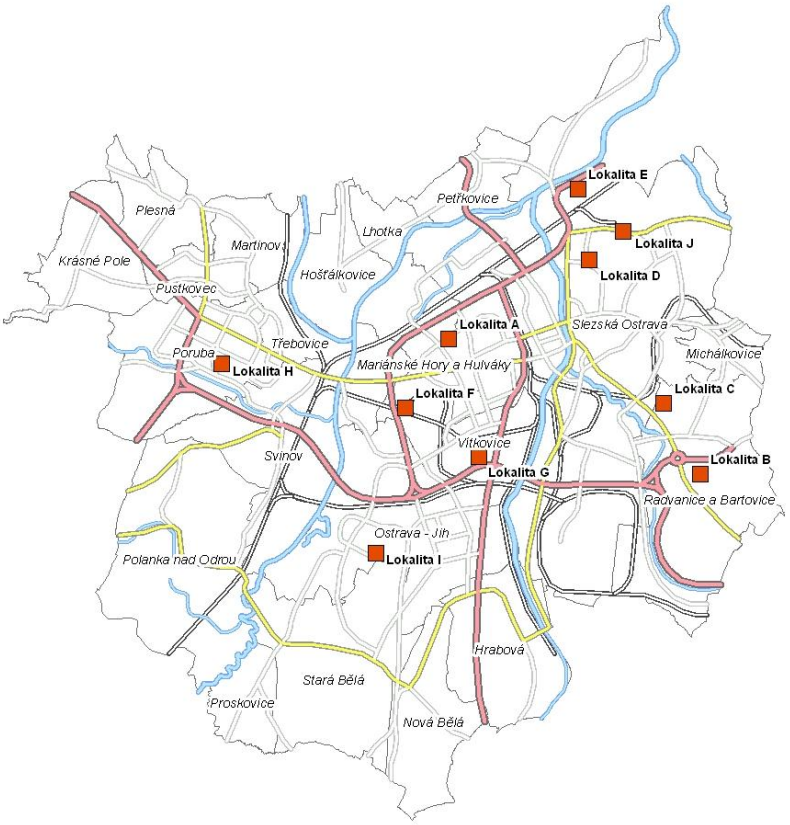

Fig. 4. Social excluded gipsy localities identified by experts in Ostrava [8]

The comparison between this map and kernel maps in 2007 or 2009 shows some differences. Part of the expert localities are not identified by kernel maps. The main reasons are the time mismatch (e.g. locality A is not reproduced later due to the social movement in this area), too small localities not identified by kernel maps and also differences in localities' typology.
To the opposite some important gypsy localities with typical segregation features have not been identified by experts (e.g. Palacky or Jilova streets). The kernel maps are suitable to reveal accumulated dwellings with high level of unemployment (and other indicators) which seems to be a good indicator of potentially segregated localities.

5 Monitoring of selected localities

The localities are attributed according to the concentration of individual factors and its development in space and time. First, a unemployment development in the study period is explored. The unemployment rate (UR) in Ostrava started from 12.5% in 3/2007 and rapidly declines. UR dropped to 8.7% in 3/2008. During autumn 2008 the influence of the financial crises reached Ostrava and the unemployment began to rise again. In 3/2009 UR was 10.8%, in 9/2009 UR reached 11.4%.

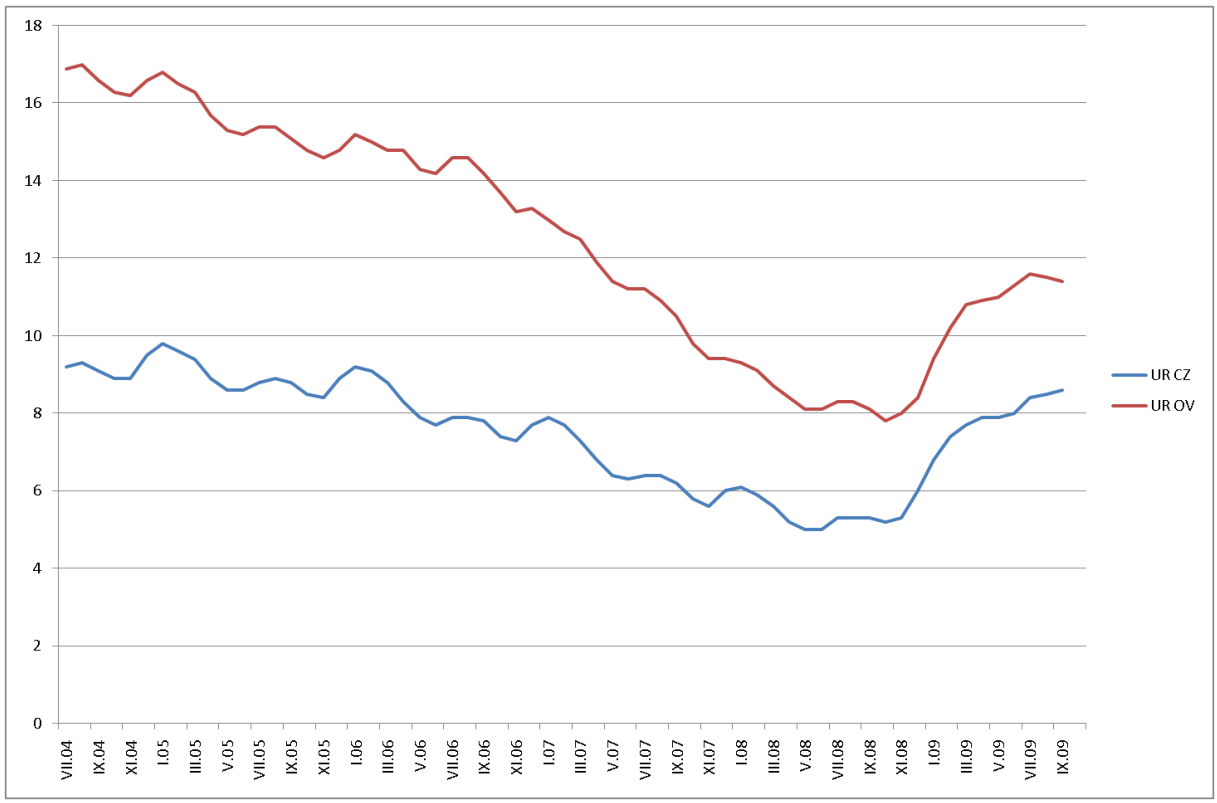

Fig. 5. Unemployment rate (%) of the Ostrava district (OV) and the Czech Republic (CZ)

The logical result of such parabolic development is a substantial decreasing of long-term unemployment (more than 1 year in the evidence) (fig. 2, 11, 13, 14).

The development of selected localities is described using both morphometric and indicators' approaches.
Some of localities are very sharply demarcated and their places are not changed in time (e.g. 2, 8, 17 in fig. 3). These features qualified them to be a good candidate for the ghettoisation process [2].
Other localities cannot be clearly distinguished in space and time. The shape is changed, small centres inside appear, move and disappear. Examples are localities 3 or 4 in fig. 3.
Highly important is to study the behaviour of different indicators in the locality. Appropriate evaluation of the behaviour requires studying also the situation in standard localities, where no special problems of exclusion and unemployment are anticipated. Standard localities may serve as the etalon of a common social development.
Following results depict situation in two endangered localities (Delnicka, Palacky) and two standard localities (Havlickovo and Gavlase).

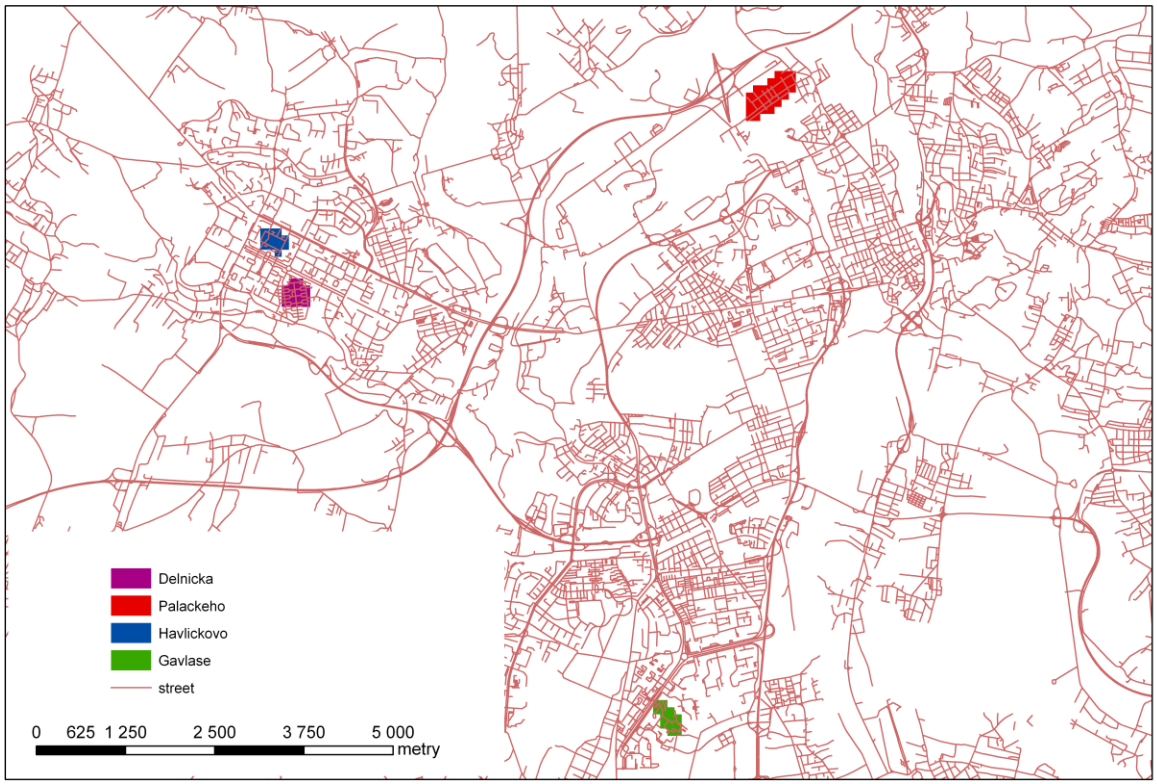

Fig. 6. Situation of presented localities

Nevertheless the monitoring currently covers 12 localities. The endangered localities can be distinguished into two different subtypes. One type can be characterised by more strong residential separation where the locality is bordered by industrial areals, brown-fields, high-speed communications or polluted areas. The poverty of living is coupled with the environmental poverty. Such localities are not suitable for an easy transformation of living conditions due to the neighbourhood's pressure (e.g. locality Palacky). Another situation is recognised in localities where environmental conditions and accessibility are quite good and no barriers (like hundred meters of devastated landscape) surround them. A good example is the Delnicka locality situated in pleasant environment. The conditions of Delnicka locality are depicted in figures 7 and 8.

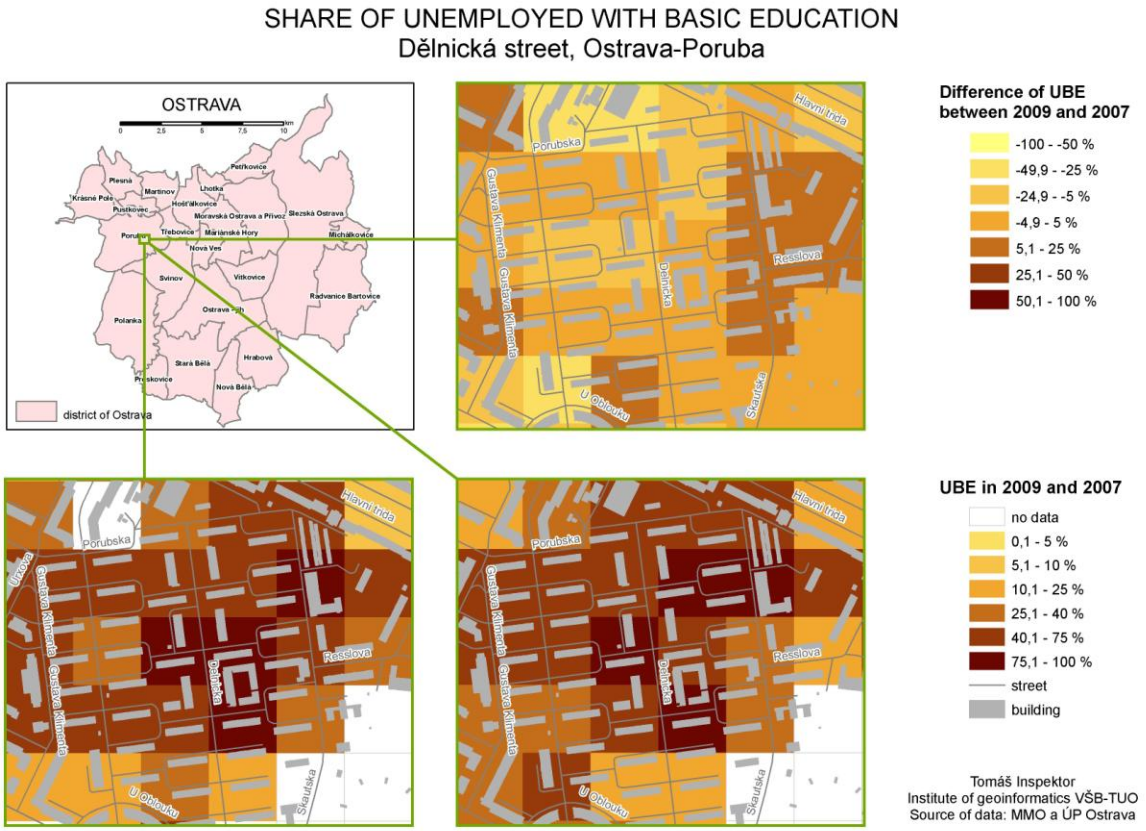

Fig. 7. The share of unemployed with basic education in the Delnicka locality

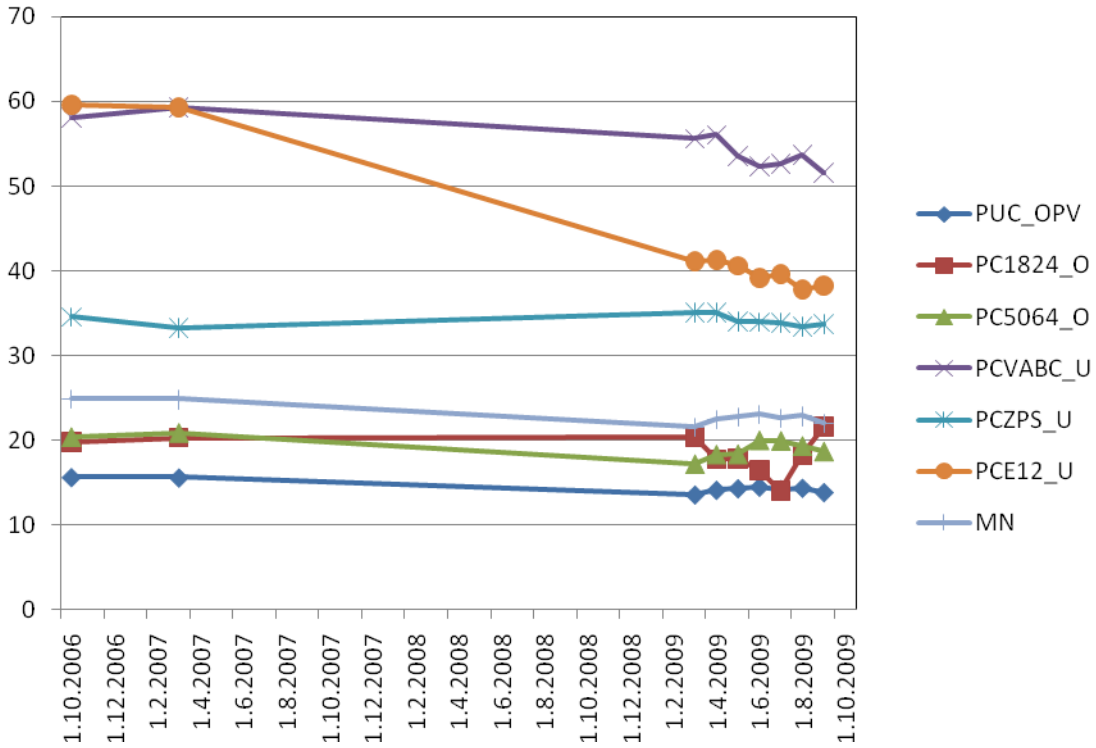

Fig.8. The temporal development of selected indicators in the Delnicka locality (data in %).

The figure 8 shows a higher level of unemployment (MN, around 22%) and a high level of UBE (PCVABC_U, 50-60%). Rapid decreasing of ULT is explained by a parabolic unemployment development in the explored time period (see fig.1). Other indicators exhibit smooth development (except variations in young unemployment).

Fig.9. The temporal development of the kernel hot spot in the Delnicka locality

Fig. 9 presents the development of the Delnicka locality border between 3/2007 and 9/2009. The border was established using a threshold on kernel map of UP (share of registered unemployed to inhabitants in productive age). The border expands and shrinks according the overall intensity of unemployment, but differences are small and the locality seems to be stable in time.

The high level of UBE (basic education) (usually more the 60%) seems to be a typical symptom of gypsy communities. The extreme situation is recognised in the Palacky locality, where the share of unemployed with basic education is constantly around 80% (78-86%) from approx. 300 unemployed (fig. 10). The unemployment rate in this locality is between 49 and 58% (fig. 11). The share of health-handicapped unemployed was significantly increased between 2007 and 2009.

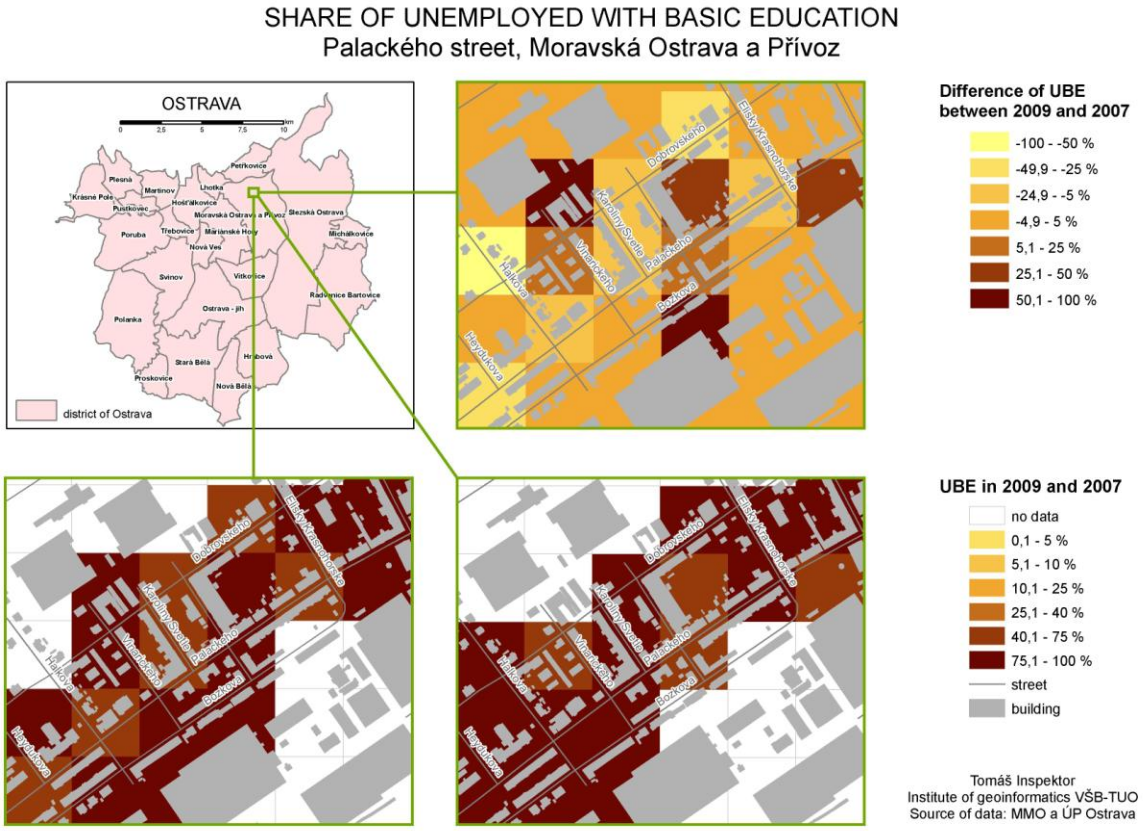

Fig. 10. The share of unemployed with basic education in the Palacky locality

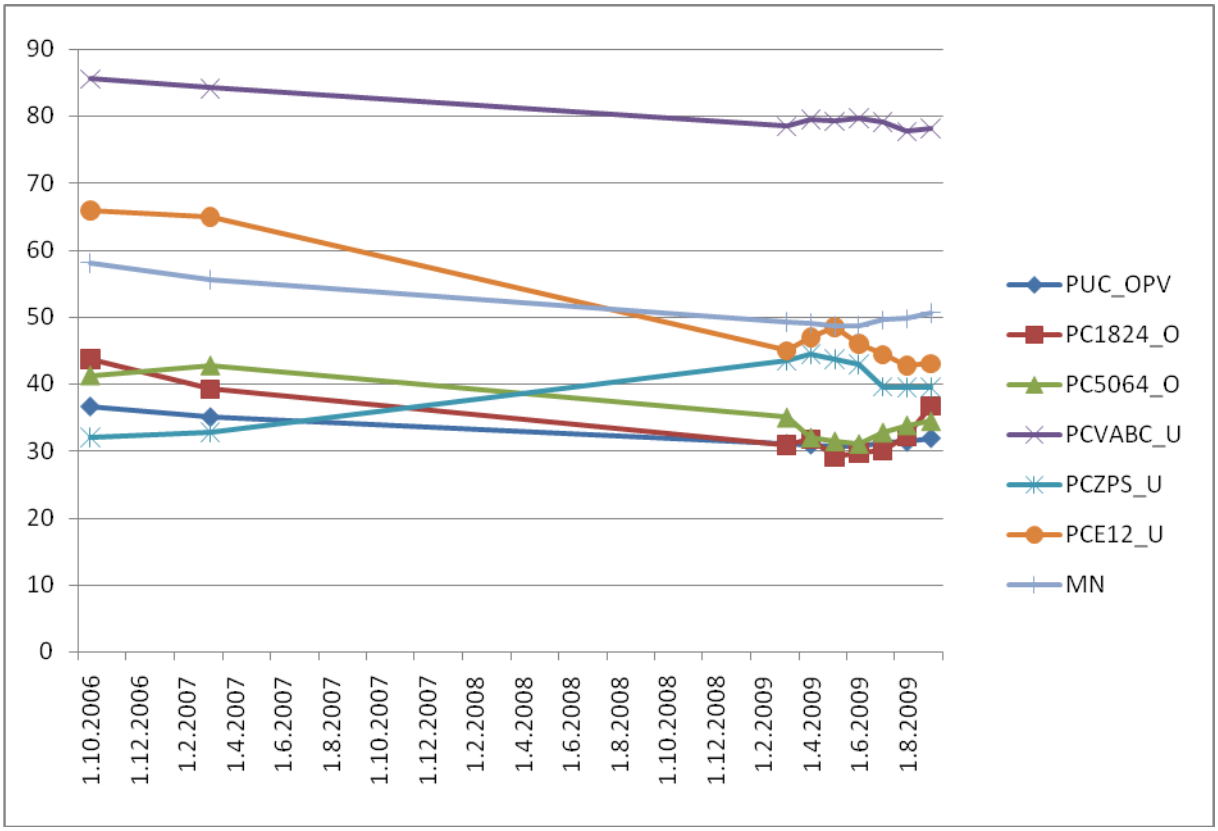

Fig. 11. The temporal development of selected indicators in the Palacky locality (data in %)

Fig. 13. The temporal development of the kernel hot spot in the Palacky locality

The standard localities provide different results in UR as well as in UBE. The development of indicators for the Gavlas and Havlickovo localities are depicted on fig. 13 and 14, respectively. The estimation of UR is between 12 and 16% for the Gavlas locality, while for the Havlickovo locality between 11 and 13%. UBE reaches 25-37% (Gavlas) and 25-29% (Havlickovo).

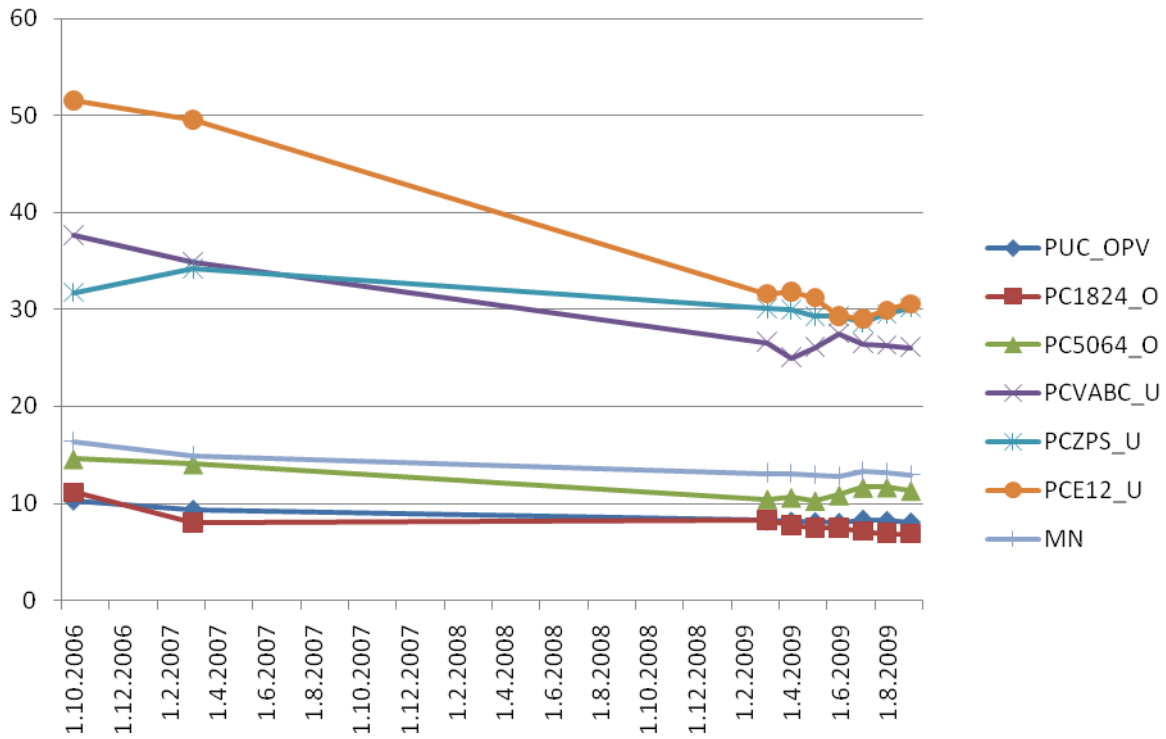

Fig. 13. The temporal development of selected indicators in the Gavlas locality (data in %)

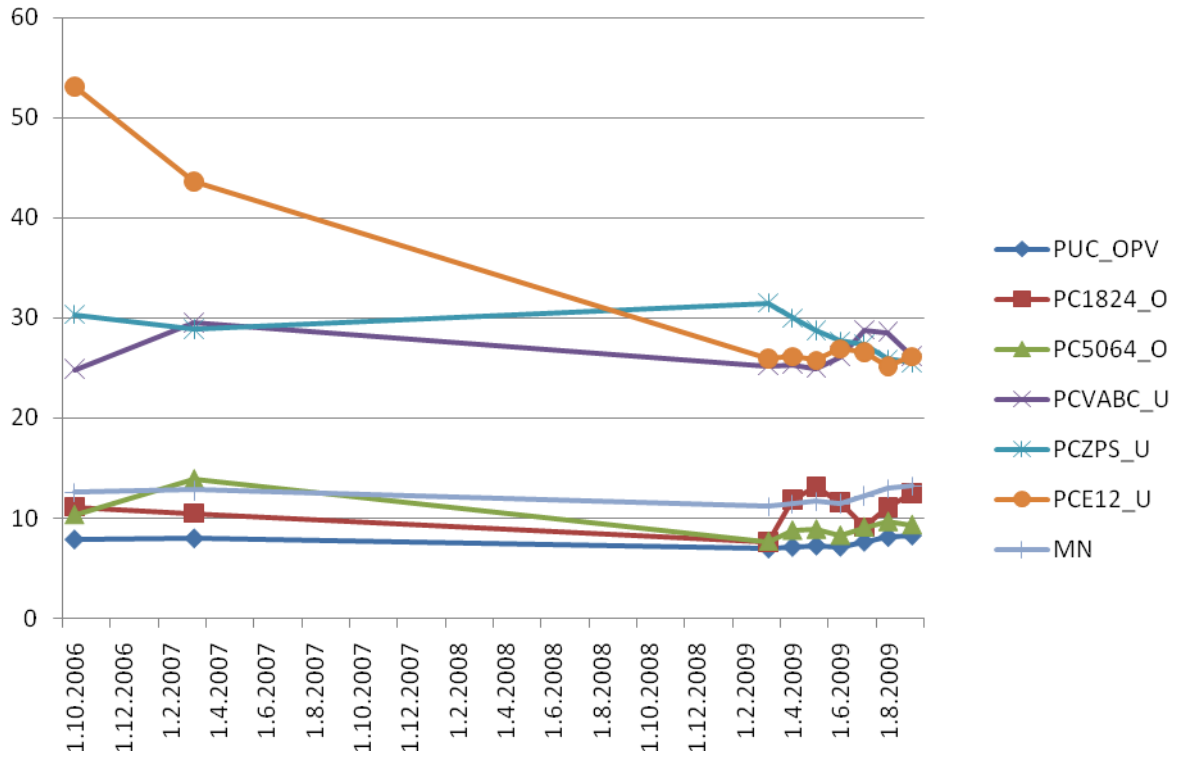

Fig. 14. The temporal development of selected indicators in Havlickovo locality (data in %)

6 Conclusion

The analyses of selected indicators enable to obtain a particular view of unemployment in the city. For social morphology monitoring and mapping in the city, two indicators can be recommended - the unemployment rate (UR) and the share of unemployed with basic education (UBE). The high level of UBE (usually more the 60%) seems to be a typical symptom of gypsy communities. Additionally a high share of young people over the population can contribute to monitoring of endangered localities.

Hot spots for these indicators are usually drawn in same localities documenting the concentration of negative phenomena in the same space.

The study reveals differences among localities and approves the possibility to distinguish localities more demarcated with an environmental load and the other one more suitable for integration process from the residential point of view.

The first type of localities is typically surrounded by poor living environment including industrial areals, brown-fields, transport corridors and polluted areas. Integration of such localities (and any improvement of living status) is practically impossible without large expenses required by transformation of surroundings. The second type of localities can be distinguished by low or missing barriers around a locality. The locality may be surrounded by other type of settlement or some natural areas (forest, pond etc.). The conditions for revitalisation and integration are more suitable.

The comparison of the quadrat and kernel methods indicates more advantages for the kernel type of data processing and aggregation. The method enables to reveal also localities not discovered by experts (the GAC study) yet.

The project continues with the monitoring of the overall situation as well as by the deeper study of selected localities. For these localities also the nature of barriers (geographic and professional) will be studied.

Acknowledgement

The project is supported by the Grant Agency of the Czech Republic ("The Industrial City in a Post-Industrial Society", GA 403/09/1720). Data is provided by the courtesy of Labour Office Ostrava and City Authority Ostrava.

Reference

1. BAILEY, T., GATRELL, A. *Interactive spatial data analysis.* Essex, Longman Scientific & Technical, 1995, 413 pp.
2. BAUM, B. *The Relationship between Spatial Segregation and Social Exclusion in urbanised modern Society.* 2009 (no printed version)
3. BITHEL, J. *Statistical methods for analysing point-source exposures.* In Elliott P., Cuzick J., Engish D., Stern R.(ed.): Geographical & Environmental Epidemiology. New York, Oxford University Press, 1996, p. 221-230, ISBN 0-19-262235-8.
4. BRUNSDON, Ch. *Estimating probability surfaces for geographical point data: an adaptive kernel algorithm.* Computers&Geosciences, Elsevier Science Ltd., 21, 7, 1995, p. 877-894, ISSN 0098-3004.
5. BURJANEK, A. *Segregace.* Czech Sociological Review 33, N. 4, p. 423-434. 1997.
6. CASTELLS, M. *The Informational City.* Oxford: Basil Blackwell, 1989.
7. HORÁČEK, R. (2008) eGovernment. *Public Administration is a Living Organism.* 30.11.2008, Prague. [online] Available at <http://www.mvcr.cz/soubor/cz-horacek-egovernment-public-admin-pps.aspx>
8. GAC (2006) *Analýza sociálně vyloučených romských lokalit a absorpční kapacity subjektů působících v této oblasti.* Projekt Ministerstva práce a sociálních věcí. Available at: http://www.esfcr.cz/mapa/index.html
9. HORÁK, J., IVAN, I., INSPEKTOR, T., TVRDÝ, L.: *Identification and Monitoring of Socially Excluded Localities of Ostrava City using a Register of Unemployment.* Proceedings of ERSA congress, Lodz, Poland, 25-29.8.2009, 18 pp.
10. HORÁK, J. , ŠIMEK, M., HORÁKOVÁ, B. *Distribuce zaměstnavatelů v okrese Bruntál* [CD-ROM] In Proceedings of symposium GIS Ostrava 2004, Ostrava, 2004, 12 p. ISSN 1213-2454
11. MAREŠ, P. *Sociální exkluze a inkluze. In Sirovátka, T. (ed.) Sociální exkluze a sociální inkluze menšin a marginalizovaných skupin.* Brno: Masarykova univerzita, 2004.
12. MUSTARD, S.; PRIEMUS, H. VAN KEMPEN, R. *Towards Undivided Cities: The Potential of Economic Revitalisation and Housing Redifferentiation.* Housing Studies vol. 14, no. 5, p. 573- 584. 1999.
13. SEDLÁKOVÁ, L. *Proměny hranic v moderní společnosti: od marginality k marginalizaci, od inkluzivní k exkluzivní společnosti.* IN: SIROVÁTKA, T. (eds.) Menšiny a marginalizované skupiny. Brno: Masarykova univerzita v Brně, 2001. ISBN 80-210-2791-6.
14. SÝKORA, L.; TEMELOVÁ, J. *Prevence prostorové segregace.* Praha, 2005. http://old.mmr.cz/upload/files/060420_Publikace_segregace.pdf.
15. TVRDÝ, L. *Změny na trhu práce a perspektivy vzdělanosti.* Ostrava: VSB-TU Ostrava. 2008. ISBN 978-80-248-1729-3.