## Application of Mobile Operators' Data in Modern Geographical Research

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Mobile operators' data are one type of Big Data. These are any data about events related to the use of a mobile phone. These data include subscriber identifiers and associated time and location attributes. Big Data in general usually includes datasets with sizes beyond the ability of commonly used software tools to capture, curate, manage, and process data within a tolerable elapsed time. Big Data can be described by the following key characteristics: volume, variety, velocity, veracity, value, variability etc. Mobile operators' data are supplied by the Mobile Network Operators. The main distinguishing features of the operator are, firstly, the possession of a state license to use the radio frequency spectrum, and, secondly, the possession or control over the elements of the network infrastructure necessary to provide services to subscribers in the authorized radio frequency spectrum. The smallest structural territorial element for cellular communication systems is a cell; its dimensions can be different (250 by 250 m, 500 by 500 m, etc.).

Keywords: mobile operators' data ; statistical data ; population ; settlement system ; migration ; transport modeling ; monitoring of socio-economic processes ; strategic planning ; delimitation of agglomerations ; natural and man-made risks

The flows of people, vehicles, and information are the most important components of the modern society life. At the same time, collection and analysis of data on these flows using traditional methods of social science research becomes more and more difficult every year. The need for a high degree of localization and temporal fragmentation of information makes official statistics unusable for analyzing a significant number of socio-economic processes. It becomes evident that in order to overcome the existing statistical barriers, it is necessary to use alternative information resources. These include data from satellite images, social networks, Internet web pages, bankcard transactions, mobile phones, and other sources, collectively referred to as "Big Data".

In 2008, the American scientist D. Hellerstein described the appearance of "Big Data" as a kind of "industrial data revolution" <sup>[1]</sup>. Indeed, the 21st century marked a real technological revolution in the field of obtaining and analyzing information: the appearance of fundamentally new data sources, improvement of their processing methods, and the widespread introduction into research practice. All this provided scientists with great opportunities to supplement and expand knowledge based on traditional statistics.

A special place in the extensive list of possible Big Data resources is occupied by mobile operators' data, which in recent years have become one of the most promising sources of additional statistical information. According to the figurative expression of Professor A. Pentland from the Massachusetts Institute of Technology, mobile operators' data are "digital breadcrumbs" that clearly mark the ways people move in space <sup>[2]</sup>. In government, academia, and the business communities, mobile operators' data are expected to fill gaps in official statistics.

The International Telecommunication Union (ITU) report for 2014 states that the average mobile penetration rate is 96.4 per 100 inhabitants worldwide, while in Russia, this figure reached 99.7 per 100 inhabitants <sup>[3]</sup>. Almost every person in the world lives within range of a mobile cellular signal. These figures demonstrate the widespread penetration of mobile communications into modern society, and determine the high representativeness of the data, based on almost 100% of the sample. Moreover, the report notes that this source of information is particularly relevant for developing countries, as well as countries that have problems with the collection of statistical information  $^{[3][4]}$ .

## References

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