Spatial Analysis of Peasants' Migrations in Russia/USSR in the First Quarter of the 20th Century

Leonid Borodkin

Abstract The role of migrations in Russian history is immense and cannot be underestimated. This paper is the first one attempting to analyze (using specialized aggregation statistical method and GIS) the macrostructure of the migration flows of Russia's rural population since the end of the 19th century and to the first quarter of the 20th century to create an integral spatial distribution of Russia's rural population inter-regional movement. For such enormous country as Russia it's necessary to use macro-analysis of the migration data. The second section of the paper gives short overview of the peasants' migrations in Russia and reveals the "bottlenecks" in the relevant research literature. The third section shows that these "bottlenecks" can be overcome using the materials of the 1926 All-Union Population Census. The method is applied for the aggregation of the migration flows network according to the data on all the 29 regions of the country (the fourth section); our NetAgg program permits to construct a macrostructure of the inter-regional migration, to reveal the groups of the main regions—the "consumers" and "suppliers" of rural migrants, to determine the intensities of the migration flows between the revealed homogeneous groups of regions. The fifth section gives interpretation of the obtained macro-structure of peasants' migration flows and the last one contains GIS maps to visualize the results of spatial structure of the migration flows.

Keywords Historical GIS · Thematic mapping · Historical texts · Migration flows

1 Introduction

Tendencies of development of modern science are determined, mainly, by profound interdisciplinary processes and informatization of scientific researches. Such processes have affected both technical sciences and humanities.

L. Borodkin (✉)
History Department, Lomonosov Moscow State University, 27-4, Lomonosov Prospect (Shuvalovsky Body), Moscow 119991, Russia
e-mail: lborodkin@mail.ru

Development of branches of research at the junction of informatics and other sciences, including historical, has led to origination of new scientific domain called "digital humanities" [1, 3, 4, 11, 12 and 15]. This domain allows to adapt modern informatics methods and algorithms, automatized data processing methods, for peculiarities of humanities.

Currently, new informatics field for humanities, particularly for historical sciences, is being actively created. It is connected, firstly, with wide access to new digital sources of historical data. Secondly, approaches, methods and technologies of solving historical tasks are changing. New methods of processing complex initial data are arising.

We can observe a trend of convergence of historical and geographical studies, and geographical information system (GIS) is one of the best apparatus for such integration. GIS allows to graphically represent geo-spatial information, retrieve related data, add and manage attribute data, execute analysis of given data and etc. For historical science GIS can become an integrated apparatus for simultaneous processing of heterogeneous types of information: attribute data, spatial data, time series of data and etc. GIS is also able to manage large sets of data, allows executing integrated spatial analysis methods and methods of processing quantitative and qualitative types of data. Application of GIS allows historians to solve problems, associated with analysis of spatial-temporal alterations of territory, based on various historical statistic data. Also it can give spatial representation for given initial information and research results as well. As data sources for GIS historical texts and cartographic materials can be used.

GIS, by no means does not apply to replace classical methods of historical study of history. Nevertheless, GIS can give enough of advantage to scientists by more efficiently managing all sorts of historical data available along with providing data graphic representation.

However, despite the advantages GIS can give to a scientist, its application in historical field of study is currently underdeveloped. This predicament can be solved by several approaches. Firstly, specific algorithms and automatized methods of data processing for historic researches should be developed. Secondly, scientists should respond more actively to emergence of innovative technologies and program products in geoinformation field and should adapt them for application in historical science.

2 Peasants' Migrations in Russia and Their Studies

The active work on the problem dates back to the 19th century. Nowadays an important place in this field belongs to the works dealing with (exclusively, or inclusively) the analysis of directions and values of the particular migration flows, to reveal their general regularities. The most stable of the regularities is the one dealing with the conception of A.A. Kaufmann, according to which the vagrant "instinct", one of the characteristic traits for the Russian peasant's character in all the times, displayed itself "one-sidedly": the main directions of the peasants' migrations went finally from the Russia's center to its outskirts.

The breakup in Russia's peasants' migration started just after the Great reform of 1861 abolishing serfdom. Beginning from the post-reform time a wave of migrations within the country's limits was continuously growing. A special explosion registered in the 1880s–1890s was related to the beginning of the active peasants' colonization of some regions of Siberia and Far East. The other impetus, even more powerful, was given by agrarian reform prepared by P.A. Stolypin at the beginning of the 20th century. During 20 years (1885–1904) 1.491 million peasants left the European part provinces, however in the next 10 years the number of such migrants reached 3.139 million (Sklyarov 1962).

On the whole, a wave-like pattern is peculiar to the spatial migration of Russia's population. The causes of its variation include the startup of the Trans-Siberian railroad, the cyclical pattern of the economic evolution, the explosions of social conflicts, the regional specifics of the agrarian relations, rumors, bad crops, wars, etc. And last, but not least, is the State's position in the migration problem; this position changed many times. The practice of the administrative suppression of peasants' migration to the "free border regions" was substituted by the policy directed at restraint, when possible, of these processes, that didn't, anyway, exclude the good old "well tested" methods in solving of these problems: even in this period the use of the police and even of the army was common in suppressing the migration movement.

The transition from restriction to stimulation of the migration of large strata of population to the far off borders dates back to the 6th of July 1904. That was the day when the new direction of the migration policy was legalized at a declared level. This improved the opportunities of anyone who desired to take part in the stimulated and even publicized by the Government migration process. The special Migration Department has been established under the Agriculture Ministry in that year. This body remained under the Soviet power, too; it became one of the departments of the People's Commissariat of Agriculture.

2.1 "Bottlenecks" in Historiography

Though there is a number of studies on the history of migrations both in the Czarist and the Soviet period there are practically no works dealing with the peasants' migrations within the USSR borders not "cut" (from below or from above) by the 1917 frontier. In other words, a tradition has formed to analyze the domestic migrations in Russia before and after 1917 as two different, completely independent processes. This is the first "bottleneck". As we have revealed, there exists a clearly expressed succession in the essence and the character of the main migration processes between Russia's pre-revolutionary epoch and the first post-revolutionary decade.

The traditionally centrifugal main directions of migrations remained in the early Soviet Russia as well. Legalizing de facto the existing realities the special edict of the USSR All-Union Central Executive Committee and Council of People's Commissars of July 6, 1925 declared the start of the planned migration to the Volga region, Siberia and Far East. The other decree completed this list with the Northern

Caucasus and Urals. The character of the State participation in the migration processes, up to the second half of 1920s stayed in principal unchanged. The Soviets, in accordance with the critics of the autocracy's colonial policy willing to correct the errors of their predecessors, returned in the first years of their rule to the policy of constraining the pressure of the migration wave. But this pressure turned out to be so high (though it never reached the former values) and the problems it raised so acute that the end of 1924—beginning of 1925 gave start to the transition to the "planned migration". The authors of this term were exclusively Soviet theoreticians and organizers of the migration policy, but its sense was quite different in the '20s and the '30s, when migrations within the USSR borders really lost their former sense under the highest level of regulation of the social life.

Analyzing the literature on the evolution of migration processes in Russia one has to state that the picture in a whole seems fragmentary. Characterizing the second "bottleneck" of the analytical historiography, it must be noted that the most widespread is the approach according to which any author chooses as the object of research some particular migration flow ending in a specific region or vice versa the flow originating from a specific region. There's no sense in negating the usefulness of these works. But the value of a particular subject can be fully seen only in the context of a whole background, the integrated structure of all the migration processes in Russia.

Finally, the third "bottleneck" is associated with the fact that very seldom an attempt to match "inputs" and "outputs" of migration flows is being made in works investigating the regions with the most intense out-migration or settlement of migrants from other regions. When "supplier" regions are matched with "consumer" regions, there is still a lack of proper differentiation of the migration flows structure that prevents us from "conjugating" the two corresponding regions [6]. On the other hand, it should be noted that the Soviet/Russian historiography has undertaken to construct migration "supplier-consumer" chains of regions to describe migration movements of Russia's rural population at the turn of the 20th century. However, all these attempts have not gone beyond the limits of specific regions to elucidate only particular fragments of a complicated network of migration routes, and reflected one or another researcher's concern with migration links of a particular region. In this respect of keen interest is the research field working out a concept of landscape similarities between the old and new homeland of settlers [17].

Thus, to sum up what was said above about the bottlenecks of the historiography, the following should be mentioned.

Despite a great number of works that analyze the various aspects of migrations in Russia over the period under consideration there is still no general picture of the migration flows structure giving a systematic presentation of the processes? The main causes are associated, to our mind, with the following historiographic traditions:

- isolated studies of migration processes in the period of the pre-revolutionary development and the first post-revolutionary decade;
- the dominance of local studies limited to the migration processes of a particular region;

- lack of the match between "inputs" and "outputs" of migration flows in the works that surpass the limits of local analysis.

To analyze the migration flows structure as a system and to produce an integral spatial distribution of Russia's rural population migration at the end of the 19th century and the first quarter of the 20th century it is essential to eliminate these bottlenecks and to use the relevant sources and analytic techniques.

What are the requirements that a source should meet to cope with this task?

It appears necessary for a source contain data on the migration flows intensities in every match of the country's regions. The data should be differentiated by principal social categories of migrants (including peasants as a separate category) and reflect the settlement-out-migration dynamics for each region over the period under consideration. The number of regions should be large enough and run into several dozens to represent the regional specificity in detail. The source of that kind is presented in the next section.

3 The All-Union Census of 1926: Potentialities and Limitations

Out of all the sources that describe the country's rural population migration flows from the end of the 19th century to the first quarter of the 20th century, the All-Union 1926 Population Census data satisfy the above-stated requirements to a great extent. The final results of the Census were published in 56 volumes which were divided into seven sections. Section III ("Marital Status. Birth-place and length of residence". Vol. 35–51) is of the most interest for the purpose of our study. The migration flows intensities data were obtained by summing up the answers to the questions 6 and 7 of the census personal questionnaire ("Where were you born: here or not? If not, specify your birth-place and how long you are domiciled in here"). Table VI of the Census Section III ("Natives of other regions by birth-places. The results by social groups") summarizes the data as a matrix that comprises the number of migrants for every match of regions. The number of regions totals 29, they correspond to the USSR regional division for the year 1927. The census recorded 3,605,314 peasant that were natives of regions other than they lived in.

Relevant information about migration flows is also offered by Table IV of the Census ("Population by length of residence, nationality, occupation and employment in branches of economy") and V ("Natives of regions, other that they are domiciled in birth-places and residence").

In fact, the Census data cover the territory of the whole country allowing us to overcome the limits of local research with "inputs" and "outputs" of each migration flow defined clearly by a corresponding match of regions. These data permit us to study particular migration flows for rural migrants without cutting flows at the time cross-section of October, 1917.

Every value a_{ij} in these matrices shows how many natives of a region specified in line i live in another region specified in column j. In the foreword to Section III of the Census the main objectives of the tables' data are described as follows: "(a) to study the directions of migration flows inside the country; (b) to reveal centers that attract population, and (c) to reveal the regions which population is drawn towards in these centers".

To what extent do the final data of the first All-Union Census meet the above-said requirements for a source on a rural population migration structure? This source, to our mind, enables us to eliminate the bottlenecks of historiography. In fact, the data of Table IV of the Census cover the territory of the whole country, allowing to overcome the limits of local research with "inputs" and "outputs" of each migration flow defined clearly by a corresponding match of regions. These data permit us to study peasant migration flows without cutting the flows at the time cross-section of October 1917. The data of Table IV of the Census also make it possible to study dynamics of the migration flows intensities for every "consumer" region. In this table the summary flow of settlers in each region is apportioned by nine time spans, five rather short spans fall in the period of 1917–1926, four lengthier ones cover the pre-revolutionary period.

4 Processing the Census Data

Let us proceed to a preliminary stage of the census data analysis, associated with calculations of most general parameters of inter-regional migration activity.

In this section we will consider indices, characterizing various aspects of the peasants' migration activity for each of 29 regions:

  I—coefficient of migrants increase,
  D—coefficient of migrants decrease,
  B—coefficient of migration balance,

where

$$I = (V_i/V) \times 100\,\% \qquad (1)$$

$$D = (V_d/V) \times 100\,\% \qquad (2)$$

$$B = (V_i - V_d)/(V_i + V_d) \times 100\,\% \qquad (3)$$

where V_i (or V_d) is a number of migrants that settled in a given region (or left it) over the time span under consideration, V is the total number of peasants at the moment of census.

While *I* and *D* describe the population migration mobility of a particular region, the coefficient *B* represents relative predominance of a settlement flow over an out-migration flow. Its value varies from −100 % to +100 %, with plus and minis indicating which of two flows dominates.

Table 1 offers *I*, *D*, and *B* values of rural migrants for all the 29 regions of the country.

Highest values of the increase coefficient (*I*) indicate a substantial share of newcomers among the farmers in Siberia (*I* = 32.7 %), the Far East (23.3), Kazakhstan (15.5), Crimea (10.6) and Northern Caucasus (8.4). Whereas in central regions, as well as most regions of Ukraine and Byelorussia, this index has low values. Instead, it is precisely in Byelorussia and Ukraine where the decrease coefficient (*D*) is highest (11.7 % in Dnepropetrovsk region, 11.2 in the Left-bank Ukraine, 9.5 in Polessie, 8.9 in Byelorussia, 8.7 in Mining Industrial region).

Table 1 The principle parameters of the regional peasants' migration activities

	Regions	*V*	*V_i*	*V_d*	*I* (%)	*D* (%)	*B* (%)
1.	Northern	1,323,877	20,212	26,957	1.5	2.0	−14.3
2.	Leningrad-Karelian	2,617,849	24,598	136,558	0.9	5.2	−69.5
3.	Western	2,242,619	51,806	180,434	2.3	8.0	−55.4
4.	Central Industrial	8,363,813	121,074	255,273	1.4	3.1	−35.7
5.	Central Blaclcsoil	6,287,234	80,967	499,192	1.3	7.9	−72.1
6.	Vyatka	2,048,876	21,137	128,959	1.0	6.3	−71.8
7.	Ural	3,187,729	137,593	111,639	4.3	3.5	10.4
8.	Bashkiria	1,436,148	94,076	43,367	6.6	1.0	36.9
9.	Middle Volga	5,828,751	126,267	321,920	2.2	5.5	−43.6
10.	Lower Volga	2,542,530	76,499	107,570	3.0	4.2	−16.9
11.	Crimea	191,167	20,365	11,389	10.6	5.9	28.3
12.	Northern Caucasus	3,825,108	322,046	98,148	8.4	2.6	53.3
13.	Dagestan	311,609	13,015	4957	4.2	1.6	44.8
14.	Kazakhstan	3,011,978	466,070	46,023	15.5	1.5	82.0
15.	Kirghizia	465,409	36,261	10,114	7.8	2.2	56.4
16.	Siberia	4,258,495	1,359,215	55,784	32.7	1.3	92.1
17.	Buryat-Mongolia	255,855	17,706	6864	6.9	2.7	44.1
18.	Yakutia	166,439	1346	662	0.8	0.4	34.1
19.	Far East	676,302	157,290	12,297	23.3	1.8	85,5
20.	Byelorussia	2,706,481	32,283	242,229	1.2	8.9	−76.5
21.	Polessie	1,642,794	28,821	156,153	1.8	9.5	−68.8
22.	Right-bank Ukraine	4,930,372	50,990	282,547	1.0	5.7	−69.4
23.	Left-bank Ukraine	3,714,564	69,057	415,899	1.9	11.2	−71.5
24.	Steppe	2,860,976	147,650	222,653	5.2	7.8	−20.3
25.	Dnepropetrovsk	1,175,354	65,159	137,621	5.5	11.7	−35.7
26.	Mining Industrial	606,427	40,371	52,666	6.6	8.7	−13.2
27.	Transcaucasus	1,755,038	6767	25,015	0.4	1.4	−57,4
28.	Uzbekistan	1,796,042	12,823	9535	0.7	0.5	14.7
29.	Turkmenia	403,400	3853	2889	0.9	0.7	14.3

Source Tables IV, V All-Union Census of Population (1926) Vol. 35–51

Table 1 contains quantitative assessments of migration activity of the regions known in historiography as "consumers" and "suppliers" of rural migrants. The migration balance coefficient values confirm that maximum prevalence of settlement over out-migration of peasants was typical of the outlying regions of the country: Siberia ($B = 92.1\%$), the Far East (85.5), Kazakhstan (82.0), Kirghizia (56.4) and Northern Caucasus (53.3). On the contrary, maximum predominance of out-migration over settlement of farmers was recorded in Byelorussia ($B = -76.5\%$), Central Blacksoil region (-72.1%), Vyatka region (-71.8%), Left-bank Ukraine (-71.5%), and Leningrad-Karelian region (-69.5%).

Table 1, however, gives no evidence of the migration "mainstreams" structure. To make it possible we calculated the matrix S which contains values of a structural migration coefficient. S_{ij} is the number of peasants—natives of ith region who settled in jth region divided by the total number of peasants emigrated from ith region. This matrix provides data to construct the optimal migration typology of the country's territory.

The network structure grouping method is used here for the aggregation of the migration flows structure according to the data on all the 29 regions of the country. That permits us to construct a macrostructure of the interregional migration network; to reveal the groups of the main regions which are "consumers" and "suppliers" of migrants; to determine the intensities of the migration flows between the homogeneous groups of regions.

The aim of the method is to single out subsystems in the network system under consideration and to disclose the structure of links between the subsystems. Such a classification of migration flows permits us to proceed from hundred (if not thousands) of minor relations to a small number of major relations between the revealed subsystems. It is essential that the concise description of the migration flows structure is provided not by the selection of strongest links, but by its aggregation of the whole multitude of relationships. This approximation method of the weighed graphs aggregation (AMA), taking into account all the migration flows and discovering groups of homogeneous units, is realized both in a fuzzy and "hard" versions [5]. The properties of the quasi-optimal solution of the aggregation problem were proved, and an algorithm to minimize the value of the functional proposed to estimate the quality of approximation was constructed. The program NetAgg [16] created to realize AMA approach contains the procedure of a discrete optimization as a principle block.

5 Macrostructure of the Interregional Peasant Migration Flows

Analysis of the migration network aggregated structure revealed the optimal number of homogeneous groups (macro-regions) to be equal to eight. Aggregation of the S matrix realized on the basis of AMA method resulted in the following composition of the homogeneous macro-regions:

Table 2 Aggregated structure of interregional peasants' migration flows: Matrix *S* of the outmigration structural coefficients (%)

Region number								
	I	II	III	IV	V	VI	VII	VIII
I	–	31.8	5.2	1.5	0.5	0.1	9.5	2.1
II	19.0	–	8.9	1.6	7.3	0.1	0.8	3.6
III	10.6	27.5	–	2.7	1.3	5.1	1.8	2.0
IV	27.5	14.3	12.3	3.5	0.3	0.3	1.7	1.3
V	1.5	42.4	3.0	0.8	14.0	1.3	0.2	1.7
VI	1.2	1.6	62.1	1.1	0.4	11.4	0.1	1.3
VII	40.9	2.4	2.5	0.8	0.1	0.0	16.6	1.5
VIII	45.4	9.0	4.1	0.7	0.2	0.1	0.8	4.0

    I   Siberia;
   II   Kazakhstan;
  III   Northern Caucasus;
  IV   Central Blacksoil, Crimea, Dnepropetrovsk, Mining Industrial, Right-bank Ukraine, Left-bank Ukraine, Byelorussia, Polessie, Steppe;
   V   Kirghizia, Turkmenia, Uzbekistan;
  VI   Dagestan, Transcaucasia;
 VII   Buryat-Mongolia, Far East, Yakutia;
VIII   Central Industrial, Northern, Leningrad-Karelia, Western, Vyatka, Ural, Bashkiria, Middle Volga, Lower Volga.

One can notice that each of these eight groups consists of adjacent territorial units. It is the reason to use the term 'macro-region' in this case. The first three regions have very special position in this aggregated structure, taking into consideration their composition (each of these three groups consists of one territorial unit) and their extremely important role in the peasant migration flow: 59.6 % of all migrants settled just in these three regions. This role is reflected in Table 2, which shows the structure of migration flows between the eight groups.[1]

Each figure in Table 2 is a value of the out-migration structural coefficient S_{ij} calculated for the corresponding pair of aggregated macro-regions. The graphic representation of this aggregated structure is given by Fig. 1, constructed from

---

[1] Each figure in table is a value of the outmigration structural coefficient S_{ij} calculated for the corresponding pair of aggregated macro-regions. For example, Fig. 62.1 in the 6th line and in the 3rd column indicates the average proportion of peasants-natives of Dagestan and Transcaucasia, settled in the North Caucasus, which was equal to 62.1 % from the total number of peasants emigrated from Dagestan and Transcaucasia.
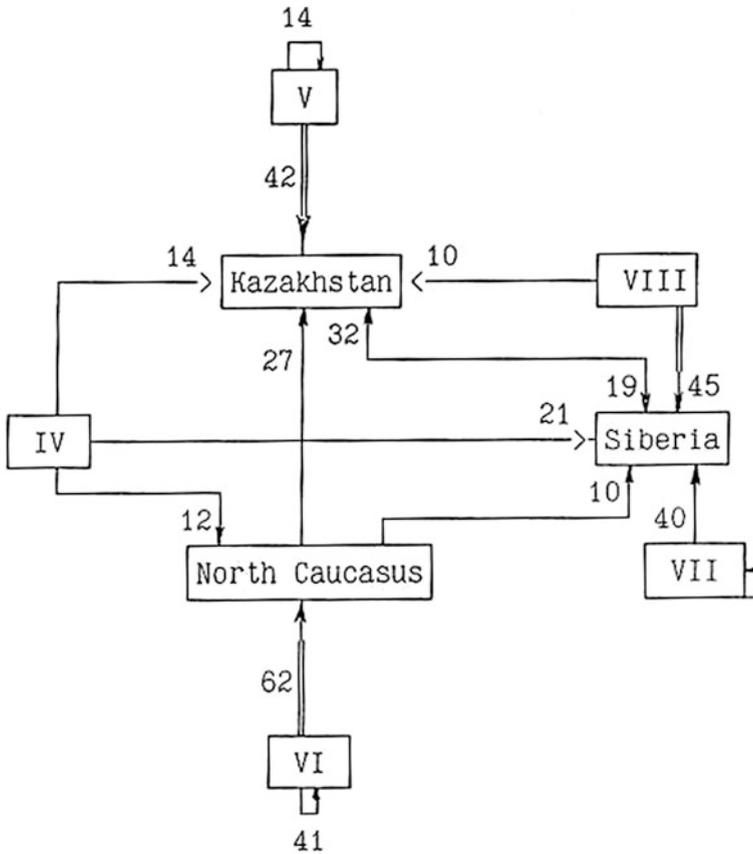
Fig. 1 Macrostructure of peasants' migration flows (the end of 19th—the first quarter of 20th centuries). Numbers have the same meaning as those in Table 2

Table 2. Each edge of the graph coordinates to significant migration flow (the threshold value of the matrix element in Table 2 is 10 %).

Figure 1 gives the evidence of the 'attractors' in the peasant migration structure. These are Siberia, Kazakhstan and Northern Caucasus. It is worth to notice that significant out-migration flows from these three regions were also directed to one (or two) of that regions. Figure 1 shows the migration flows between other five macro-regions, which were basically 'suppliers' of peasant migrants.

NetAgg software made it possible to construct the aggregated spatial picture of the peasant migration in Russia/USSR in the first quarter of the 20th century.

Fig. 2 Spatial distribution of peasants migrations in the end of 19th—beginning of 20th centuries. based on net migration coefficient B (see formula (1)

6 The Spatial Structure of Migrations: Using GIS

Historical cartography is based nowadays mainly on application of GIS technology. Since 1990 a number of works were published in this area (see for instance [7–9, 13 and14]).

In this study, we used GIS MapInfo PRO. The creation of digital cartographic ground was carried out on the basis of the map of Soviet economic regions produced by the USSR Central Statistical Agency on 23/08/1927. We formed GIS layers and linked them with statistical data on interregional migration flows. These layers include the boundaries of 29 economic regions of the country, eight macro-regions (obtained by statistical aggregation of the interregional migrations matrix), cities, migration flows, islands, grid, frame. Creation of this GIS map implies application of both mathematical basis (coordinate system—SC, map projection, scale) and vector conversion according to the various sources.

Our GIS maps show net migration coefficients for each of 29 economic regions of the USSR (Fig. 2), as well as the directions and intensities of the main migration flows between eight macro-regions (Fig. 4). Figures 3 and 5 represent the same spatial distributions for migration flows of hired agricultural workers.
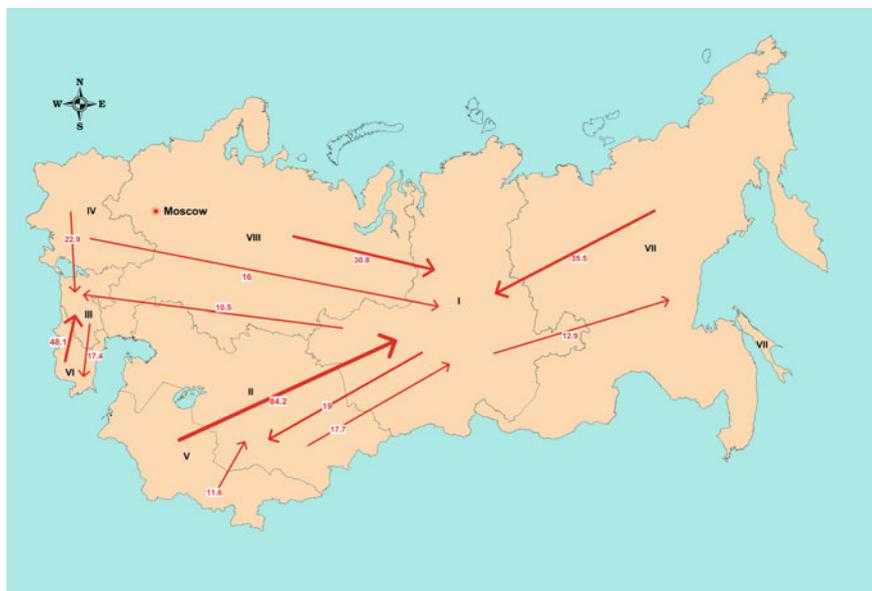
Fig. 3 Spatial distribution of hired agricultural workers' migrations in the end of 19th—beginning of 20th centuries based on the net migration coefficient B (see formula (1))

Fig. 4 Spatial distribution of peasants migration flows in the end of 19th—beginning of 20th centuries based on the structural migration coefficient S_{ij}

Fig. 5 Spatial distribution of hired agricultural workers' migration flows in the end of 19th–beginning of 20th centuries based on the structural migration coefficient S_{ij}

7 Conclusion

Currently, main trend of application of geoinformation in historical researches is application of digital cartography. Involvement of new sources of data in the process of historical research allows to achieve new knowledge about the process under consideration.

Methodology of peasants' migration flows analysis, executed with standard program products as NetAgg and MapInfo, is described in this paper. Application of computing aids allowed to process larger set of original sources, containing information about peasants' migration processes, in the course of research.

However, we should note a certain disbalance between arising of new methods and technologies of processing large sets of data and their application in practice. Thus, there is a need for development of complex method of geo-information integration of geoinformation in historical science. It is evident that to solve this task, close collaboration between scientists of both scientific domais is required.

References

1. Berry DM (2012) Understanding digital humanities. Palgrave Macmillan, Basingstoke
2. Beveridge AA. Immigration, ethnicity, and race in metropolitan New York, 1900–2000. Past time, past place, pp. 65–77.
3. Bod R (2013) A new history of the humanities: the search for principles and patterns from antiquity to the present. Oxford University Press, Oxford
4. Borgmann C (2009) The Digital Future is now: a call to action for the humanities. Digital Humaniti Q 3(4)
5. Borodkin LI (1979) Aggregated structure of graphs with fuzzy blocks. Autom Remote Control 29(8):142–153
6. Bruk SI, Kabuzan VM (1980) Dinamika i etnicheskii sostav naseleniia Rossii v epokhu imperializma (konets XIX veka 1917). Istoriia. SSSR 3:77–79
7. Ell Paul S, Gregory Ian N (2001) Adding a new dimension to historical research with GIS. Hist Comput 13(1):1–6
8. Gregory IN (2003) A place in history: a guide to using GIS in historical research (AHDS guides to good practice). Oxbow Books Ltd, Oxford
9. Gregory IN (2008) Historical GIS: technologies, methodologies, and scholarship (Cambridge studies in historical geography). Cambridge University Press, New york
10. Gregory IN, Kemp KK, Mostern R (2001) Geographical information and historical research: current progress and future directions. Hist Comput 13(1)
11. Hillier A. Redlining in Philadelphia. Past time, past place, pp 79–92
12. Hockney S (2004) The history of humanities computing. In: Schreibman S, Siemens R, Unsworth J (eds) Companion to digital humanities. Blackwell, Oxford
13. Knowles AK, Hillier A (2008) Placing history: how maps, spatial data, and GIS are changing historical scholarship. ESRI, Inc, Redlands
14. Knowles AK (2002) Past time, past place: GIS for history. ESRI Press, Redlands
15. Svensson P (2009) Humanities computing as digital humanities. Digital Humaniti Q 3(3)
16. The NaaS NetAgg system. URL: http://www.harness-project.eu/
17. Yakimenko NA (1980) Sovietskaia istoriografiia pereseleniia krest'yan v Sibir'i na Dal'nii Vostok (1861–1917). Istoriia SSSR 5:91–104