SSUGT
SIBERIAN STATE
UNIVERSITY OF GEOSYSTEMS
AND TECHNOLOGIES

Vestnik SSUGT
Scientific journal
Published since 1996
Issued 4 times a year

Volume 23(1), 2018

Before 2015 journal
was published under the name
«Vestnik SSGA»

Starting from 2017 numbering of the volume refers to the number of years the journal has been circulated. The number of the issue refers to how many times the journal was published during the year

CONTENTS

GEODESY AND MINE SURVEY

CARTOGRAPHY AND GEOINFORMATICS

Registration certificate
PI № FS 77-62654 of 10.08.2015

The journal is included in the List of refereed scientific journals, recommended by HAC for publishing the scientific results of dissertations in candidacy for a degree of Candidate or Doctor of Science degree

Journal included in Russian Science Citation Index (RSCI)

Subscription indexes in catalogues:
«Russian press» – 43809
Electronic catalogue «Russian periodicals» (www.ideg.ru) – 43809э

Layout editor of journal
A. V. Koneva

Reduction address:
630108, Novosibirsk,
10 Plakhotnogo St., r. 436
E-mail: vestnik@ssga.ru
Tel. (383)361-06-55
http://vestnik.ssga.ru

English translation
D. V. Romanov

Editor
E. N. Uchenova

Desktop publishing
K. V. Ionko

Signed to print 16.03.2018.
Format 70 × 100 1/16.
Conv. pr. sheets 22,82.
Circulation 1 000 copies.
Order 20.

Printing and publication department SSUGT
630108, Novosibirsk,
10 Plakhotnogo St.

Printed in map printing laboratory SSUGT
630108, Novosibirsk,
8 Plakhotnogo St.

LAND MANAGEMENT, CADASTRE AND LAND MONITORING

OPTICS, OPTICAL AND ELECTRONIC DEVICES AND COMPLEXES

ECOLOGY AND ENVIRONMENTAL MANAGEMENT

METHODOLOGY OF SCIENTIFIC AND EDUCATIONAL ACTIVITY

ANNIVERSARIES

CURRENT STATE AND FUTURE DEVELOPMENT OF ACTIVE SATELLITE GEODETIC NETWORKS IN RUSSIA AND THEIR INTEGRATION INTO ITRF

Vladimir S. Vdovin
JSC «Russian Space Systems», 111250, Russia, Moscow, 53 Aviamotornaya St., Head of Sector, e-mail: vdo-vladimir@yandex.ru

Vyacheslav V. Dvorkin
JSC «Russian Space Systems», 111250, Russia, Moscow, 53 Aviamotornaya St., Dr. Sc., Main Constructor of Direction, e-mail: dvorkin@rambler.ru

Alexander P. Karpik
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Dr. Sc., Professor, Rector, phone: (383)343-39-37, e-mail: rector@ssga.ru

Leonid A. Lipatnikov
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Leading Engineer, Head of Center for GNSS Technologies, phone: (923)227-89-57, e-mail: lipatnikov_l@mail.ru

Sergey D. Sorokin
Industrial Geodetic Systems R&D, 644007, Russia, Omsk, 111 Chapaeva St., Director, phone: (3812) 904-628, e-mail: sorokin@geosystems.aero

Grigory M. Steblov
Schmidt Institute of Physics of the Earth of the Russian Academy of Sciences, 123242, Russia, Moscow, 10 B. Gruzinskaya St., Building 1, Dr. Sc., Professor, Main Researcher, phone: (499)766-26-56,
e-mail: steblov@ifz.ru

Problems and prospects for integration of Russian continuously operating reference stations into single reference frame for improving efficiency of high-precision positioning and timing are discussed. Important tasks for achieving that goal are outlined. They are: harmonization of legislation, updating and concretization of technological normative documents, development of effective online services for precise positioning and coordinate transformation. Immediate steps are proposed. Firstly, operators of satellite geodetic networks are offered to eliminate collisions in reference stations identifications (list of collisions is provided). Secondly, it is proposed to establish and keep up to date a common free-access online register and logs of Russian base stations. Providing information for that register is to be voluntary at the current stage. Thirdly, it is proposed to organize an ftp-archive maintained by a research institute or a university to provide free access to historical satellite measurements data. The content is to be uploaded to the archive by network operators after some period of time since the epoch of measurements. It is presumed that implementation of those urgent steps will pave the way for further significant improvement of positioning, navigation and timing efficiency in Russia.

Key words: GLONASS, reference frame, geodetic network, global navigation satellite systems (GNSS), continuously operating reference stations (CORS).

REFERENCES

1. Surnin, Yu. V. (2015). About correct application of international terminology "Reference System" and "Reference Frame" to "koordinatnaya sistema" and "koordinatnaya osnova" in practice of geodesy in Russia. *Geodezija i kartografija [Geodesy and Cartography]*, 8, 3–9 [in Russian].
2. Surnin, Yu. V. (2011). Development of the active coordinate and gravitaional reference on the limited area of the Earth's surface by GLONASS/GPS measurements. *In Sbornik materialov GEO-Sibir'-2011: T. 1, ch. 2 [Proceedings of GEO-Siberia-2011: International Scientific Conference: Vol. 1, Part 2]* (pp. 198–209). Novosibirsk: SSGA Publ. [in Russian].
3. Blick, G., & Donelly, M. (2012). Should active control networks replace passive control networks. *In FIG Working Week 2012 Proceedings.* Italy: Rome.
4. *HIVE*. (n. d.). Retrieved from https://hive.geosystems.aero/.
5. *International GNSS Service (IGS)*. (n. d.). Retrieved from http://igs.org/.
6. *Russian system of differential correction and monitoring*. (n. d.). Retrieved from http://www.sdcm.ru.
7. *Nonprofit partnership of high precision satellite positioning networks*. (n. d.). Retrieved from http://nposvsp.ru/index.php?id=6 [in Russian].
8. *PRIN network of base stations*. (n. d.). Retrieved from http://www.prin.ru/seti_referencnyh_ stancij/ [in Russian].
9. *SmartNet Russia*. (n. d.). Retrieved from http://smartnet-ru.com/index.htm [in Russian].
10. *EFT. Base stations on the territory of the Russian Federation*. (n. d.). Retrieved from http://eft-cors.ru/ [in Russian].
11. *Network of continuously operating differential stations GSI*. (n. d.). Retrieved from http://topnet.gsi.ru/ [in Russian].
12. *GLONASS/GPS. GPKK Krastechcenter*. (n. d.). Retrieved from http://www.krastehcentr.ru/glonass [in Russian].
13. *State budget establishment Center of Navigation and Geo-information Technologies of the Novosibirsk Region*. (n. d.). Retrieved from http://rtk.nso.ru/ [in Russian].
14. *Reference stations network of Buryatia republic*. (n. d.). Retrieved from http://geo-baikal.ru/spiderweb/frmIndex.aspx [in Russian].
15. Federal law of the Russian Federation No. 431-FZ of December 30, 2015. *About geodesy, cartography, and spatial data and about introducing changes into particular laws of the Russian Federation*. Retrieved from ConsultantPlus online database [in Russian].
16. Altamimi, Z., Rebischung, P., Métivier, L., & Collilieux, X. (2016). ITRF2014: A new release of the International Terrestrial Reference Frame modeling nonlinear station motions: ITRF2014. *Journal of Geophysical Research: Solid Earth*. doi: 10.1002/2016JB013098.
17. Rebischung, P. (2016). Upcoming switch to IGS14/igs14.atx. *IGSMAIL-7399*. Retrieved from https://igscb.jpl.nasa.gov/pipermail/igsmail/2016/008589.html.
18. *Site Guidelines – IGS*. (n. d.). Retrieved from http://kb.igs.org/hc/en-us/sections/200409633-Site-Guidelines.
19. *NGS National Geodetic Survey – CORS Guidelines*. (n. d.). Retrieved from https://www.ngs.noaa.gov/CORS/Establish_Operate_CORS.shtml.
20. *The DOMES Numbering System*. (n. d.). Retrieved from http://itrf.ign.fr/domes_desc.php?page=2.
21. *OPUS: the Online Positioning User Service*. (n. d.). Retrieved from https://www.ngs.noaa.gov/OPUS/.
22. *AUSPOS – Online GPS Processing Service*. (n. d.). Retrieved from http://www.ga.gov.au/scientific-topics/positioning-navigation/geodesy/auspos.
23. *SAPOS*. (n. d.). Retrieved from http://www.sapos.de/index.html [in German].
24. GKINP (GNTA)-01-006-03. (2014). *Fundamentals of state geodetic network of the Russian Federation*. Moscow: CNIIGAiK Publ. [in Russian]
25. GKINP (GNTA)-06-278-04. (2014). *User's manual for accomplishing works in reference system of the year 1995 (SK-95)*. Moscow: CNIIGAiK Publ. [in Russian].

26. Resolution of the Government of the Russian Federation No. 1240 of November 24, 2016. *About adoption of state reference systems, state height system and state gravimetry syste]*. Retrieved from ConsultantPlus online database [in Russian].

27. Reference document. (2014). *Earth's Parameters of year 1990 (PZ–90.11)*. Retrieved from http://structure.mil.ru/files/pz-90.pdf [in Russian].

28. *List of coordinates and velocities of FAGS reference points]*. (n. d.). Retrieved from http://geod.ru/data/fags/ [in Russian].

29. Order of Rosreestr No. P/0134 of March 23, 2016. *About adoption of geometrical and physical numeric geodetic parameters for state geodetic reference system system of the year 1995 (SK-95)*. Retrieved from ConsultantPlus online database [in Russian].

Received 25.11.2017

APPLICATION OF THE REVERSE LINEAR-ANGLE RESECTION FOR ESTIMATION OF STABILITY OF POINTS OF THE PLANE DEFORMATION OF GEODESIC NETWORK

Igor V. Goryainov
State University of Land Use Planning, 105005, Russia, Moscow, 15 Kazakova St., Ph. D. Student, Department of Geodesy and Geoinformatics, phone: (903)184-63-62, e-mail: igorgoryainow@yandex.ru

Nowadays, despite the wide use of electronic total stations, their potential, laid by developers, is realized not fully. To a greater extent, this refers to the performance of geodetic work and monitoring of planned altitude deformations. A significant supply of accuracy and algorithms which are used by the total station allow us to implement ate deformation monitoring on other principles that significantly save both time and material costs. In this paper, we consider the application of the reverse linear-angle resection for estimating the stability of a deformation geodetic base. The method of an estimation of accuracy of an reverse linear-angled resection produced by a total station is described. The corrections to the measured values and the error of the station coordinates allow us to make a reliable estimate of the stability of the deformation geodetic network. The results of experiments confirm the reliability of determining the values of the movements of the geodetic network points in various schemes of the reverse linear-angle resection and different values of the deformations of the support points. Recommendations for the optimal number of network points are given.

Key words: reverse linear angular resection, total station, error, residuals, stability estimation, coordinates, deformation geodetic network.

REFERENCES

1. Code of Practice. (2012). *SP 126.13330.2012. Set of rules. Geodetic work in construction. Updated version of SNiP 3.01.03-84*. Retrieved from ConsultantPlus online database [in Russian].

2. Simonyan, V. V., Shmelin, N. A., & Zaytsy, A. K. (2015). *Geodezicheskiy monitoring zdaniy i sooruzheniy [Geodetic monitoring of buildings and structures]*. V. V. Simonyan (Ed.). Moscow: NRU MGSU Publ. [in Russian].

3. Shults, R. V., Annenkov, A. A., Khaylak, A. M., & Strilets, V. S. (2014). Statistical examination of retaining wall displacement by geodetic measurements results. *Vestnik SGGA [Vestnik SSGA]*, 3(27), 35–53 [in Russian].

4. Sholomitsky, A. A., Lagutina, E. K., & Soboleva, E. L. (2017). High precision geodetic measurements at deformation monitoring of aquapark. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(3), 45–59 [in Russian].

5. Interstate Standard. (2012). *GOST 24846-2012. Soils. Methods for measuring deformations in the foundations of buildings and structures*. Retrieved from ConsultantPlus online database [in Russian].

6. *Instructions for monitoring the movement of the earth's surface and objects located on it while building underground structures in Moscow (RD 07-166-97)*. (1997). Moscow: IPKON RAS Publ. [in Russian].

7. *Survey Control Survey Trimble Survey: Neighborhood*. (July 23, 2009). Retrieved from http://trl.trimble.com/docushare/dsweb/Get/Document409759/TSC_Stationing%20Programs. htm# Setting up neighbors Date of issue.

8. *Trimble Survey Controller software: configuring the backsight configuration*. (January 21, 2008). Retrived from http://trl.trimble.com/docushare/dsweb/Get/Document409759/ TSC_Stationing% 20Programs. htm # Rear Point Configuration Configuration.

9. Hiller, Bernd, & Jambaev, H. K. (2016). Development and natural tests of automated systems of deformation monitoring. *Vestnik SGUGiT [Vestnik SUGGT]*, *1*(33), 48–61 [in Russian].

10. *Trimble Survey Controller software: problems of resection without redundancy*. (January 21, 2008). Retrieved from http://trl.trimble.com/docusare/dsweb/Get/Document409759/ TSC_Stationing%20Programs.HTM#resection.

11. Goryainov, I. V., Kodirov, A. A., Shevchuk, A. A., Averyanov, S. V., & Delphonians, E. V. (2017). Influence of the positions of the sighting target-the reflective mark on the accuracy of the measurements according to the linear-angle intersection scheme. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 3, 29–35 [in Russian].

12. Goryainov, I. V. (2015). Inverse linear angular intersection: a new look at the geometry of the geodesic intersection. *Inzhenernye izyskaniya. Geomarketing [Engineering Survey. Geomarketing]*, 6, 62–66 [in Russian].

13. Goryainov, I. V. (2016). On the best configuration of the linear-angle intersection and the necessary places to achieve the specified accuracy. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 4, 41–47 [in Russian].

14. Lukin, A. S., & Portnov, A. M. (2011). Geodetic resections accuracy at carrying out cadastral works. *Vestnik SGGA [Vestnik SSGA]*, 3(16), 53–59 [in Russian].

15. Nikonov, A. V. (2014). Investigation of the influence of the original initial geodetic base on the accuracy of the linear-angle intersection. In *Sbornik materialov Interekspo GEO-Sibir'-2014: Mezhdunarodnoy nauchnoy konferentsii: T. 1 [Proceedings of Interexpo GEO-Siberia-2014: International Scientific Conference: Vol. 1]*. Retrived from https://cyberleninka.ru/article/v/ issledovanie-vliyaniya-stabilnosti-polozheniya-ishodnoy-geodezicheskoy-bases-on-tochnost-obratnoy-lineyno-uglovoy-zasechki [in Russian].

16. Nikonov, A. V. (2013). About the accuracy of reciprocal linear-angles resections for short distances. In *Sbornik materialov Interekspo GEO-Sibir'-2013: Mezhdunarodnoy nauchnoy konferentsii: T. 1 [Proceedings of Interexpo GEO-Siberia-2013: International Scientific Conference: Vol. 1]*. Retrieved from https://cyberleninka.ru/article/n/k-voprosu-o-tochnosti-obratnoy-lineyno-uglovoy-zasechki-na-malyh-rasstoyaniyah [in Russian].

17. *Information Bulletin System 1200 – No. 29 TPS1200 Setup – Resection*. (n. d.). Retrieved from http://w3.leicageosystems.com/downloads123/zz/general/general/newsletters/System1200_29_ Resection_2_en.pdf.

Received 27.11.2017

ABOUT DECELERATIONS OF THE EARTH'S ROTATION

Vladimir Yu. Timofeev
Trofimuk Institute of Petroleum Geology and Geophysics of Siberian Branch RAS, 630090, Russia, Novosibirsk, 3 Akademika Koptyuga Prsp., Dr. Sc., Chief Researcher, phone: (383)335-64-42, e-mail: timofeevvy@ipgg.sbras.ru

Elena V. Boyko
Trofimuk Institute of Petroleum Geology and Geophysics of Siberian Branch RAS, 630090, Russia, Novosibirsk, 3 Akademika Koptyuga Prsp., Ph. D., Researcher, phone: (383) 335-64-42, e-mail: boykoev@ipgg.sbras.ru

Dmitrii G. Ardyukov
Trofimuk Institute of Petroleum Geology and Geophysics of Siberian Branch RAS, 630090, Russia, Novosibirsk, 3 Akademika Koptyuga Prsp., Ph. D., Senior Researcher, phone: (383)335-64-42, e-mail: ardyukovdg@ipgg.sbras.ru

Anton V. Timofeev
Trofimuk Institute of Petroleum Geology and Geophysics of Siberian Branch RAS, 630090, Russia, Novosibirsk, 3 Akademika Koptyuga Prsp., Ph. D., Researcher, phone: (383)335-64-42, e-mail: timofeevav@ipgg.sbras.ru

Igor S. Sizikov
Institute of Automatic and Electrometry of Siberian Branch RAS, 630090, Russia, Novosibirsk, 1 Akademika Koptyuga Prsp., Engineer, e-mail: sizikov.i.s@gmail.com

Dmitrii A. Nosov
Institute of Automatic and Electrometry of Siberian Branch RAS, 630090, Russia, Novosibirsk, 1 Akademika Koptyuga Prsp., Engineer, e-mail: danossov@ngs.ru

Earth's rotation Rate is a parameter used in geodesy, gravity, geology, oceanography and other Earth's sciences. It's is viewed at different time periods. Estimations can be made by paleontological, astronomical and space geodesy and other methods. Space geodesy methods are most precise and modern. Problem was in the correlation of astronomical parameters and energy dissipation in the oceans and deep layers of the Earth depths. The calculation of various tidal ocean models is presented for energy's dissipation. We discussed different results obtained by connections of ancient Sun eclipses method with Lunar Location Method. Different point is modern short-term rotational speed relations with global ocean level changes, earthquakes and deep Earth dissipation.

Key words: earth's rotation rate, rotation speed, paleontological method, astronomical method, tidal dissipation, ocean dissipation, energy estimations, short-term variations.

REFERENCES

1. Molodenskiy, S. M. (2004).The influence of the electromagnetic coupling of the nucleus with the mantle on the nutation of the Earth. II. Comparison with observational data. *Fizika Zemli [Izvestiya. Phisics of the Solid Earth]*, 9, 3–13 [in Russian].
2. Molodenskiy, S. M. (2006). Comparison of models of inelastic Earth, constructed by astrometric and tidal gravimetric data. *Fizika Zemli [Izvestiya. Phisics of the Solid Earth]*, 7, 12–16 [in Russian].
3. Pariyskiy, N. N., Kuznetsov, M. V., & Kuznetsova, L. V. (1972). On the influence of the ocean tide on the secular deceleration of Earth's rotation. *Izvestiya AN SSSR, seriya Fizika Zemli*

[Proceedings of the USSR Academy of Sciences, series Phisics of the Solid Earth], 2, 50–55 [in Russian].

4. Timofeev, V. Yu., Valitov, M. G., Dyukarm, B., Ardyukov, D. G., Naumov, S. B., Timofeev, A. V., … Nosov. D. A. (2016). Tidal effects on gravimetric and level observations, oceanic tidal models. *Vestnik SGUGiT [Vestnik SSUGT]*, 1(33), 36–47 [in Russian].

5. Melchior, P., & Francis, O. (1996). Comparison of recent ocean models using ground-based tidal gravity measurements. *Mar. Geod.*, *9*, 291–330.

6. Holme, R., & de Viron, O. (2013). Characterization and implications of intradecadal variations in length of day. *Nature, 499*, 202–204. doi: 10.1038/nature 12282.

7. Stephenson, F. R., Morrison, L. V., Hohenkerk, C. Y. (2016). Measurements of the Earth's rotation: 720 BC to AD 2015. *Proc. R. Soc.*, A 472:20160404. Retrieved from http://dx.doi.org/10.1098/rspa.2016.0404.

8. Williams, E. (1990). Tidal Rhythmites: key to the history of the earth's rotations and the lunar orbit. *J. Phys. Earth., 38*, 475–491.

9. Morrison, L. V., & Ward. C. G. (1975). An analysis of the transits of Mercury: 1677-1973. *Mon. Not. R. Astr. Soc.*, *173*, 183–206.

10. Boucher, C., Altamimi, Z., & Sillard, P. (1999). Results and analysis of the ITRF97. *International Earth Rotation, Reference Systems Service (IERS). Long-term Earth Orientation Series Data EOP08 C04:* Note No. 27 (p. 191). Retrieved from https://www.ierg.org/IERS/EN/ DataProducts/EarthOrientationData/eop.html.

11. Cartwright, D. E., & Ray, R. D. (1989). New Estimates of Oceanic Tidal Energy Dissipation from Satellite Altimetry. *Geophys. Res. Letters.*, *16*(1), 73–76.

12. Cazenave, A., & Daillet, S. (1981). Lunar Tidal Acceleration from Earth Satellite Orbit Analyses. *Journal of Geophysical Research., 86*(B3), 1659–1663.

13. Christodoulidis, D. C., Smith, D. E., Williamson, R. G., & Klosko, S. M. (1988). Observed Tidal Braking in the Earth/Moon/Sun System. *J. Geoph. Res*., *93*(B6), 6216–6236.

14. Platzman G. W. (1985). The role of the earth tides in the balance of tidal energy // *Journal of Geophysical Research, 90*(B2), 1789–1793.

15. Schiwiderski, E. W. (1985). On tidal friction and the decelerations of the earth's rotation and moon's revolution. *Marine Geodesy*, *9*(4), 399–450.

16. Lambeck K. (1977). Tidal dissipation in the oceans: astronomical, geophysical and oceanographic consequences. *Philos. Trans. R. Soc. London*, A 287, 545–594.

17. Ponsar, S., Dehant, V., Holme, R., Jault, D., Pais, A., & Van Hoolst, T. (2003). The core and fluctuations in the Earth's rotation. In V. Dehant, K. C. Creager, S-I. Karato, & S. Zatman (Eds.), *Earth's core dynamics, structure, rotation* (pp. 251–261). American Geophysical Union. Geodynamics Series. Washington, DC: American Geophysical Union.

18. Shum, C. K., Andersen, O. B., & Egbert, G. (1997). Comparison of Newly Available Deep Ocean Tide Models by the TOPEX/POSEIDON Science Working Team. *Journal of Geophysical Research*, 102(C11), 25173–25194.

19. Matsumoto, K., Takanezawa, T., & Ooe, M. (2000). Ocean tide models developed by assimilating TOPEX/POSEIDON altimeter data. *J. Oceanography*, 56, 567–581.

20. Dehant, V., Defraigne, P., & Wahr, J. M. (1999). Tides for a convective Earth. *Journal of Geophysical Research, 104*(B1), 1035–1058.

21. Gillet, N., Jault, D., & Finlay, C. C. (2015). Planetary gyre, time-dependent eddies, torsional waves, and equatorial jets at the Earth's core surface. *J. Geophys. R, Solid Earth*, 120, 3991–4013. doi:10.1002/2014JB011786.

22. Hay, C. C., Morrow, E., Kopp, R.E., Mitrovica, J. X. (2015). Probabilistic reanalysis of twentieth-century global sea-level rise. *Nature*, 517, 481–484.

23. Sabadini, R, Riccardo, E. M. R., & Via, G. D. (2007). Coseismic rotation changes from the 2004 Sumatra earthquake: the effects of Earth's compressibility versus earthquake induced topography. *Geophys. J. Int*., 171, 231–243.

24. Xu Changyi, & Sun Wenke. (2012). Co-seismic Earth's rotation change caused by the 2012 Sumatra earthquake. *Geodesy and Geodynamics, 3*(4), 28–31. doi:10.3724/SP.J.1246.2012.00028.

Received 29.11.2017

DEVELOPMENT OF THE TECHNOLOGICAL SCHEME OF SURVEYING WORKS FOR CADASTRAL REGISTRATION OF UNDERGROUND PARKINGS

Georgy A. Ustavich
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Dr. Sc., Professor, Department of Engineering Geodesy and Mine Surveying, phone: (383)343-29-55, e-mail: ystavich@mail.ru

Polina P. Salnikova
Sibtechenergo, 630032, Russia, Novosibirsk, 18/1 Planirovochnaja St., Engineer Surveyor, e-mail: kapitsina_polina@mail.ru

Valeriy G. Salnikov
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Head of Department of Engineering Geodesy and Mine Surveying, phone: (383)343-29-55,e-mail: salnikov@ssga.ru

Ekaterina L. Soboleva
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Associate Professor, Department of Engineering Geodesy and Mine Surveying, phone: (383)343-29-55, e-mail: e.l.soboleva@mail.ru

It is necessary to have parking place coordinates in car parking spaces for parking space registration. Currently the majority of car parking spaces is located on ground floors. Therefore, use of GNSS technology for the determination of boundaries is not possible. In this regard there is a need to explore other methods for determining of parking place boundary coordinates in underground car parking spaces.

In the paper the technological scheme of the surveying works for the measuring individual car parking place coordinates in an underground car parking space is given. High-rise apartment building with inbuilt public rooms and offices located in Novosibirsk is chosen for testing of this scheme. Three techniques of measuring actual parking place coordinates are discussed: from internal horizontal and vertical control reference points, from external ones, from main building axis.

Key words: technological scheme, intersection, resection, surveying network, reference points, measuring coordinates, cadastre, total station.

REFERENCES

1. Karpik, A. P., Vetoshkin, D. N., & Arkhipenko, O. P. (2013). Improving the model of maintaining the state cadastre of real estate in Russia. *Vestnik SGGA [Vestnik SSGA],* 3(23), 53–60 [in Russian].

2. Federal Law No. 218–FZ of July 13, 2015. *On state registration of real estate*. Retrieved from ConsultantPlus online database [in Russian].

3. Federal Law No 221–FZ of July 24, 2007. *On the state real estate cadastre*. Retrieved from ConsultantPlus online database [in Russian].

4. Federal Law No 122–FZ of July 21, 1997. *On state registration of real estate rights and deals*. Retrieved from ConsultantPlus online database [in Russian].

5. *Federal Knowledge Base of Rosreestr*. (n. d.). Retrieved from at http://support. kadastr.ru/.

6. Karpik, A. P. (2013). Geodetic spatial informational system dataware. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 4/C, 70–73 [in Russian].

7. Lagutina, E. K. (2016). Testing methods of integration regional cors network and the russian state geodetic network. *Vestnik SGUGiT [Vestnik SSUGT]*, 3(35), 35−40 [in Russian].

8. Avrunev, E. I., & Meteleva, M. V. (2014). Improvement of coordinates support of state property cadastre. *Vestnik SGGA [Vestnik SSGA]*, 1(25), 60−67 [in Russian].

9. Avrunev, E. I., & Parkhomenko, I. V. (2016). Coordination control of state land surveillance. *Vestnik SGUGiT [Vestnik SUGGT]*, 2(34), 150–157 [in Russian].

10. Lukin A. S., & Portnov, A. M. (2011). Geodetic resections accuracy at carrying out cadastral works. *Vestnik SGGA [Vestnik SSGA]*, 3(16), 53−59 [in Russian].

11. Code of practice. (2011). *Osnovaniya zdaniy i sooruzheniy (SP 22.13330.2011) [Soil bases of buildings and structures]*. Retrieved from http://docs.cntd.ru/ document/1200084710 [in Russian].

12. Code of practice. (1997). *Inzhenerno-geodezicheskie izyskaniya dlya stroitel'stva (SP 11-104-97) [Engineering geodesic survey for construction]*. Retrieved from http://docs.cntd.ru/ document/871001219 [in Russian].

13. Code of practice. (2012). *Inzhenernye izyskaniya dlya stroitel'stva. Osnovnye polozheniya (SP 47.13330.2012) [Engineering survey for construction. Basic principles]*. Retrieved from http://docs.cntd.ru/document/1200096789 [in Russian].

14. Salnikov, V. G. (2014). Modern techniques for staking out of turbounit principal axes. *Vestnik SGGA [Vestnik SSGA]*, 1(25), 27−34 [in Russian].

15. Kitaev, G. G., Salnikov, V. G., Ryabova, N. M., & Soboleva, E. L. (2014). Techniques for horizontal and vertical control establishment using building structures elements. In *Sbornik materialov Interekspo GEO-Sibir'-2014: X Mezhdunarodnoy nauchnoy konferentsii: T. 1. Geodeziya, geoinformatika, kartografiya, markshejderiya [Proceedings of Interexpo GEO-Siberia-2014: International Scientific Conference: Vol. 1. Geodesy, Geoinformatics, Cartography, Mine Surveying]* (pp. 7–13). Novosibirsk: SSGA Publ. [in Russian].

16. Salnikova, P. P., Salnikov, V. G., & Ryabova, N. M. (2017). Determination of deformation parameters of 6-section ventilation cooling tower. In *Sbornik materialov Interekspo GEO-Sibir'-2017: XIII Mezhdunarodnoy nauchnoy konferentsii: T. 1. Geodeziya, geoinformatika, kartografiya, markshejderiya [Proceedings of Interexpo GEO-Siberia-2017: International Scientific Conference: Vol. 1. Geodesy, Geoinformatics, Cartography, Mine Surveying]* (pp. 85–93). Novosibirsk: SSUGT Publ. [in Russian].

17. Ustavitch, G. A., Seredovich, S. V., Salnikov, V. G., & Skripnikov, V. A. (2017). Geodetic monitoring of construction of the residential high-rise building. In *Sbornik materialov Interekspo GEO-Sibir'-2017: XIII Mezhdunarodnoy nauchnoy konferentsii: T. 1. Geodeziya, geoinformatika, kartografiya, markshejderiya [Proceedings of Interexpo GEO-Siberia-2017: International Scientific Conference: Vol. 1. Geodesy, Geoinformatics, Cartography, Mine Surveying]* (pp. 93–100). Novosibirsk: SUGGT Publ. [in Russian].

18. Code of practice. (2012). *Nesushchie i ograzhdayushchie konstruktsii (SP 70.13330.2012) [Load-bearing and separating constructions]*. Retrieved from http://docs.cntd.ru/ document/1200097510 [in Russian].

19. Building codes and regulations. (2001). *Bezopasnost' truda v stroitel'stve: Chast' 1, Obshchie trebovaniya (SNiP 12-03-2001) [Job safety in construction: Part 1, General requirements]*. Retrieved from http://www.tehbez.ru/Docum/ DocumShow_DocumID_306.html [in Russian].

20. Hao Yang, Mohammad Omidalizarandi, XiangyangXu, & Ingo Neumann. (2017). Terrestrial laser scanning technology for deformation monitoring andsurface modeling of arch structures. *Composite Structures*, 169, 173–179.

21. Mill, T., & Ellmann, A. Terrestrial. (April 3-4, 2014). Laser Scanning Technology for DeformationMonitoring of a Large Suspension Roof Structure. *INGEO 2014 – 6th International Conference on Engineering Surveying* (pp. 179–186). Prague, Czech Republic.

Received 25.01.2018

PROSPECTS OF USING FREE SOFTWARE FOR GNSS MEASUREMENTS POST-PROCESSING

Stanislav O. Shevchuk
Siberian Research Institute of Geology, Geophysics and Mineral Raw Materials, 630091, Russia, Novosibirsk, 67 Krasniy Prospekt, Ph. D., Head of the Geodetic and Metrological Support of Geophysical Works Laboratory, phone: (383)222-45-86, e-mail: staspp@211.ru

Karina I. Malyutina
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Student, phone: (913)716-61-30, e-mail: malyutina.karina.ivanovna@yandex.ru

Leonid A. Lipatnikov
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Leading Engineer, Head of Center for GNSS Technologies, phone: (923)227-89-57, e-mail: lipatnikov_l@mail.ru

Opportunities of free software application for GNSS post-processing are discussed in the article. The comparison of the performance of different examples of commercial and free software for GNSS Post Processing in relative and PPP kinematic and static modes are given. Free software is presented by RTKPOST which is a part of RTKLIB. Commercial software used for experiments was Magnet Office Tools, GrafNav and Justin. The experiments have shown that accuracies of static processing results obtained using commercial software, free open source RTKLIB software and free of charge online processing service CSRS-PPP are comparable. The best processing results in PPP kinematic mode have been obtained using online service CSRS-PPP. Processing of trajectory data using RTKLIB in PPP kinematic mode has shown significant deviations from etalon trajectory, which is, apparently, connected with high frequency of GNSS measurements data in observation file. The detected deviation is up to 1.5 m while data logging frequency is 5 Hz. The conclusion has been made that free software and online services can be applied in practice for high accuracy positioning with certain limitations.

Key words: GNSS, GPS, post-processing, GNSS post-processing software, RTKLIB, Precise Point Positioning.

REFERENCES

1. El-Rabbany, Ah. (2002) Introduction to GPS. *British Library Catalouging in Publication Data*.

2. Antonovich, K. M. (2006) *Ispol'zovanie sputnikovyh radionavigacionnyh sistem v geodezii: T. 2 [Using satellite radio-navigation satellite systems in geodesy: Vol. 2]*. Moscow: Cartgeocentr [in Russian].

3. Ocalan, T., Erdogan, B., & Tunalioglu, N. (2013) Analysis of web-based online services for GPS relative and precise point positioning techniques. *Boletim de Ciencias Geodesicas*, *19*(2), 191–207.

4. Rapiński, J., & Cellmer, J. (2011) Tests of Selected Automatic Positioning Systems in Post-Processing Mode. Technical Sciences, 14(1), 45–56.

5. Bisnath, S., & Gao, Y. (2009). Precise Point Positioning – A Powerful Technique with a Promising Future. *GPS World*, 4, 43–50.

6. Chasagne, O. (2012). One-centimeter accuracy with PPP. *Inside GNSS*, 2, 49–54.

7. Jäger, R. (n. d.). *GOCA – GNSS Control*. Retrieved from http://goca.info/docs/flyer/GNSSControl-Flyer_English.pdf.

8. *Exploring ultra-low cost precision GPS with RTKLIB and Ublox receivers*. (n. d.). Retrieved from https://rtklibexplorer.wordpress.com/.

9. *Reach High accuracy L1 RTK GNSS*. (n. d.). Retrieved from http://emlid.com/reach/.

10. Shevchuk, S. O., Kosarev, N. S., & Antonovich, K. M. (2016). Comparison of the commercial software performance of GNSS kinematic measurement postprocessing for aerial geophysics geodetic support. *Vestnik SGUGiT [Vestnik SSUGT]*, 3(35), 79–102 [in Russian].

11. Shevchuk, S. O., & Kosarev, N. S. (2016). Comparing results of GNSS kinematic postprocessing by commercial program products for geodetic support of aerial geophysical works. The first conclusions. In *Sbornik materialov Interekspo GEO-Sibir'-2016: Mezhdunarodnoy nauchnoy konferentsii: T. 1. Geodeziya, geoinformatika, kartografiya, marksheyderiya [Proceedings of Interexpo GEO-Siberia-2016: International Scientific Conference: Vol. 1. Geodesy, Geoinformation, Cartography, Mine Surveying]* (pp. 69–76). Novosibirsk: SSUGT Publ. [in Russian].

12. Precise Point Positioning. (n. d.). *National Resources Canada – Earth Sciences*. Retrieved from: https://webapp.geod.nrcan.gc.ca/geod/tools-outils/ppp.php.

13. *RTKLIB: An Open Source Program Package for GNSS Positioning*. (n. d.). Retrieved from http://www.rtklib.com/.

14. *GrafNav/GrafNet User Guide*. (n. d.). Retrieved from http://www.novatel.com/assets/Document/Downloads/NavNet780_Manual.pdf.

15. *Justin User Guide*. (n. d.). Retrieved from http://www.javadgnss.ru/doc/justin/Justin_Software_Manual_RUS.pdf/

16. *Magnet Tools User Guide*. (n. d.). Retrieved from https://eu.sokkia.com/sitesdefault/files/sc_files/downloads/magnet_field_v300_help_manual_en.pdf/

17. Nehin, S. S. (2015). Main problems of cartographic application conversion to coordinate system GSK 2011. *Vestnik SGUGiT [Vestnik SSUGT]*, 2(30), 38−47 [in Russian].

18. Lipatnikov, L. A. (2016). Implementation of a geocentric terrestrial reference frame for the territory of Russia and bordering countries. *Vestnik SGUGiT [Vestnik SSUGT]*, 3(35), 16−24 [in Russian].

19. Avrunev, E. I., & Parhomenko, I. V. (2016). Improvement of coordination control of state land surveillance. *Vestnik SGUGiT [Vestnik SSUGT]*, 2(34), 150−157 [in Russian].

20. Lagutina, E. K. (2016). Testing methods of integration regional cors network and the russian state geodetic network. *Vestnik SGUGiT [Vestnik SSUGT]*, 3(35), 35−40 [in Russian]

21. Mazurova, E. M., Antonovich, K. M., Lagutina, E. K., & Lipatnikov, L. A. (2014) Analysis of the Russian national reference network condition considering modern and prospective requirements. *Vestnik SGUGiT [Vestnik SSUGT]*, 3(27), 84–89 [in Russian].

22. Shevchuk, S. O. Study of precise point positioning method for geodetic support for geological and geophysical works. In *Sbornik materialov Interekspo GEO-Sibir'-2012: Mezhdunarodnoy nauchnoy konferentsii: T. 2. Geodeziya, geoinformatika, kartografiya, marksheyderiya [Proceedings of Interexpo GEO-Siberia-2012: International Scientific Conference: Vol. 2 Geodesy, Geoinformation, Cartography, Mine Surveying]* (pp. 251–258). Novosibirsk: SSUGT Publ. [in Russian].

23. Prihoda, A. G., Lapko, A. P., Malcev, G. I., & Shevchuk, S. O. (2011). Navigation and geodetic maintenance of geologic and geophysical works with the use of global satellite systems

GLONASS and GPS. In *Sbornik materialov Interekspo GEO-Sibir'-2011: T. 1 [Proceedings of Interexpo GEO-Siberia-2011: Vol. 1]* (pp. 174–180). Novosibirsk: SSUGT Publ. [in Russian].

24. *NGS Geodetic Toolkit*. (n. d.). Retrieved from https://www.ngs.noaa.gov/TOOLS/.

25. *Next Era SAR Toolbox*. (n. d.). Retrieved from https://earth.esa.int/web/nest/home.

26. *Open GIS 2015: Proceedings*. (2015). Retrieved from http://gisconf.ru/materials.

27. Dubinin, M. Yu., & Rykov, D. A. (2009). Open desktop GIS: current situation overview. *Informatsionnyi biulleten GIS-Assotsiatsii [Information Bulletin of GIS Association]*, 5(72), 20–27.

28. *Land Information New Zealand. Download Geodetic Software*. (n. d.). Retrieved from http://www.linz.govt.nz/data/geodetic-services/download-geodetic-software.

29. *Land Information New Zealand on GitHub*. (n. d.). Retrieved from https://github.com/linz

Received 16.10.2017

CARTOGRAPHY AND GEOINFORMATICS

SCIENTIFIC BASIS OF THE INFORMATION CONCEPT CARTOGRAPHIC RESEARCH METHOD

Andrei N. Beshentsev
Baikal Institute of Nature Management SB RAS, 670031, Russia, Ulan-Ude, 6 Sakhyanovoy St., Dr. Sc., Professor of RAS, Head of laboratory, phone: (3012)43-36-76, e-mail: abesh@mail.ru

In the article executed the analysis of existing theoretical concepts in cartography. Presented the results of development of a new concept of cartographic method based on the phenomenon of cartographic information and its transformation. Proposed the structure of the concept, describe the stages of creation and modeling of cartographic information. Presented the essence of information postulates, concepts, procedures and constructs of the proposed concept. Established the essence of the cartographic method of research as a socio-technical process, which manage the technological and socio-historical mechanisms. Presented a practical example of creating a map store vector data, revealed the possibility of automated mapping based on the store of vector data, and an example interactive simulation of cartographic information through queries. Proposed the example of creating an international geoportal, which includes a cartographic service on open platform for the publication and dissemination of cartographic information.

Key words: cartographic method of research, cartographic information, information concept, postulates, concepts, procedures, constructs, mechanisms.

REFERENCES

1. Baranskiy, N. N. (1956). *Ekonomicheskaya geografiya. Ekonomicheskaya kartografiya. [Economical geography. Economic cartography]*. Moscow: Geografgiz Publ. [in Russian].

2. Salischev, K. A. (1982). *Kartovedenie [Cartography]*. Moscow: MGU Publ. [in Russian].

3. Berlyant, A. M. (1978). *Kartograficheskiy metod issledovaniya [The cartographic method of research]*. Moscow: MGU Publ. [in Russian].

4. Aslanikashvili, A. F. (1974). *Metakartografiya: osnovnyie problemyi. [Metartartography: the main problems]*. Tbilisi: Metsniereba Publ. [in Russian].

5. Arnberger, E. (1978). Properties of cartographic representations. *Kartograficheskaya seriya. Izdaetsya Shveytsarskim obschestvom kartografii [Cartographic Series. Published by the Swiss Society of Cartography]*, 3, 7–13 [in German].

6. Kolachnyi, A. (1968). Cartographic information – a fundamental concept and term in modern cartography. *Kartograficheskiy zhurnal [Cartographic Journal]*, 6(1), 47–49.

7. Robinson, A., & Petchenek, B. B. (1983). The map as communication system. *Kartografiya. Zarubezhnyie kontseptsii i napravleniya issledovaniy [Cartography. Foreign Concepts and Research Areas]*, 1, 34–51 [in Russian].

8. Bocharov, M. K. (1966). Osnovyi teorii proektirovaniya sistem kartograficheskih znakov *[Fundamentals of the theory of designing systems of cartographic signs]*. Moscow: Nedra Publ. [in Russian].

9. Berten, Zh. (1983). Visual perception and cartographic transcription. *Kartografiya. Zarubezhnyie kontseptsii i napravleniya issledovaniy [Cartography. Foreign Concepts and Research Areas]*, 1, 76–94 [in Russian].

10. Lyutyiy, A. A. (1981). *Yazyik kartyi [The map language]*. Moscow: Znanie Publ. [in Russian].

11. Berlyant, A. M. (1997). *Geoinformatsionnoe kartografirovanie [The geoinformation mapping]*. Moscow: MGU Publ. [in Russian].

12. Lure, I. K. (2008). *Geoinformatsionnoe kartografirovanie [The geoinformation mapping]*. Moscow: KDU Publ. [in Russian].

13. Beshentsev, A. N. (2013). Informacionnaja koncepcija kartograficheskogo monitoringa geosistem [Information concept of cartographic monitoring of geosystems]. *Doctor's thesis.* Irkutsk [in Russian].

14. Materuk, A. Yu., & Topchilov, M. A. (2001). Specification and qualification of digital cartographic mapping (justification of research priorities). *Vestnik SGGA [Vestnik SSGA]*, 6, 93–97 [in Russian].

15. Vovk, I. G. (2001). Modeling in applied geoinformatics. *Vestnik SGGA [Vestnik SSGA]*, 14, 69–75 [in Russian].

16. Beshentsev, A. N. (2009). The geoinformation approach to the cartographic method of research. *Geodeziya i kartografiya [Geodesy and Cartography]*, 11, 40–43 [in Russian].

17. Lyutyiy, A. A. (1988). *Yazyik kartyi: suschnost, sistema, funktsii [Map language: entity, system, functions]*. Moscow: IG AN SSSR Publ. [in Russian].

18. Beshentsev, A. N. (2011). Geoinformation concept of the cartographic method of research. *Geodeziya i kartografiya [Geodesy and Cartography]*, 9, 31–37 [in Russian].

19. Vasilev, I. V., Korobov, A. V., & Pobedinskiy, G. G. (2015). Strategic directions of development of topographic and geodetic and cartographic support of the Russian Federation. *Vestnik SGUGiT [Vestnik SSUGT]*, 2(30), 5–23 [in Russian].

20. Simonov, A. V. (1996). Geoinformation education in Russia: problems, directions and opportunities for development. *IB GIS-Assotsiatsii [IB GIS-Association]*, 3, 54–55 [in Russian].

21. Beshentsev, A. N. (1996). On the use of properties of the informative nature of color and form in the map language. *Geografiya i prirodnyie resursyi [Geography and Natural Resources]*, 2, 121–122 [in Russian].

22. Lisitskiy, D. V., Komissarova, E. V., & Kolesnikov, A. A. (2017). Theoretical bases and features of multimedia cartography. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(3), 72–87 [in Russian].

23. Plusnin, V. M. (Ed.). (2015). *Ekologicheskiy atlas basseyna ozera Baykal [Ecological Atlas of the Lake Baikal Basin]*. Irkutsk: Institute of Geography SB RAS Publ. [in Russian].

24. Rozov, M. A. (1977). *Problemyi empiricheskogo analiza nauchnyih znaniy [Problems of the empirical analysis of scientific knowledge]*. Novosibirsk: Nauka Publ. [in Russian].

25. Lisitskiy, D. V. (2013). Perspectives of the development of cartography: from the system "Digital Earth" to the system of virtual georeality. *Vestnik SGGA [Vestnik SSGA]*, 2(22), 8–16 [in Russian].

Received 22.12.2017

SINGLE DIMENSIONAL PARAMETRIC VECOTOR OF LAYERED SET AS A GROUND MASS DESCRIPTION

Andrew S. Deimundt
ITMO University, 199034, Russia, Saint Petersburg, 14-16 Birzhevaya Line, Ph. D. Student, phone: (812)457-15-51, e-mail: starburst91@corp.ifmo.ru

Andrew G. Karmanov
ITMO University, 199034, Russia, Saint Petersburg, 14-16 Birzhevaya Line, Ph. D., Senior Teacher, Department of Geoinformatics, phone: (812)457-15-51, e-mail: karmanov.nip@gmail.com

Olga V. Grigorenko
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Assosiate Professor, Department of Higher Mathematics, phone: (983)125-45-90, e-mail: ogrigorenko2311@mail.ru

Elena M. Redikarceva
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Head of the Department of Higher Mathematics, phone: (383)343-25-77, e-mail: redikarceva@ssga.ru

The article considers the possibility of unified data performance of geological survey's results as a layered set's parametric vector. The theoretical and mathematical support is focused on results of statistical interpretation of geological surveys. Conclusions are the result of rational and mathematically adequate ground massive description's search. Ground description is based on a mathematical description of drilled ground massive as a layered set with a priori known order of layers in it. This description is also applicable either to the whole ground massive or to the single ground layer and has predictive power which can be used as a theoretical base either to CAD applications development or as a theoretical base (axiomatic) of specific kinds of GIS analysis.

Key words: mathematical, information support for GIS, array of soil, layered set, parametrical vector, statistic.

REFERENCES

1. Kashperyuk, P. I., & Yulin, A. N. (2014). Quality of engineering surveys as a factor of natural-technogenic systems formation. *Vestnik MGSU [Vestnik MGSU]*, 1, 83–89 [in Russian].

2. Kashperyuk, A. A., Kashperyuk, P. I., & Korshunova, N. N. (2013). Geological engineering surveys before the implementation of construction projects in urban and extensive suburban areas. *Vestnik MGSU [Vestnik MGSU]*, 2, 64–72 [in Russian].

3. Arxangel'skij, I. V. (2003). The current state of integrated engineering and geological surveys. *Zapiski Gornogo institute [Journal of Mining Institute]*, *153*, 120–122 [in Russian].

4. Cheskidov, V. V. (2011). The development of the CAD for geoengineering researches with the implementation of the cluster analysis. *Gornyj Informacionno Analiticheskij Byulleten' [Mining Informational and Analytical Bulletin]*, 5, 341–346 [in Russian].

5. Savinykh, V. P. (2012). System for obtaining coordinate-time information for solving monitoring tasks. *Nauki o Zemle [GeoScience]*, 3, 5–10 [in Russian].

6. Savinykh, V. P., & Cvetkov, V. Ya. (2010). The development of methods of artificial intelligence in geoinformatics. *Transport Rossijskoj Federacii [Transport of the Russian Federation]*, 5, 41–43 [in Russian].

7. Tsvetkov, V. Ya. (2011). Georeferencing as the analysis and knowledge tool. *Nauki o Zemle [GeoScience]*, 2, 63–65 [in Russian].

8. Borodko, A. V., Bugaevskij, L. M., Vereshhaka, T. V., Zapryagaeva, L. A., Ivanova, L. G., Knizhnikov, Yu. F., Savinyx, V. P., Spiridonov, A. I., Filatov, V. N., Cvetkov, V. Ya. (2008). *Geodeziya, kartografiya, geoinformatika, kadastr: T. I, A-M [Geodesy, cartography, geoinformatics, cadastre: Vol. I, A-M]*. A. V. Borodko, & V. P. Savinykh (Eds.). Moscow [in Russian].

9. Lisickij, D. V. (2013). Prospects for cartography development: from digital land to virtual georeality. *Vestnik SGGA [Vestnik SSGA]*, 2(22), 8–16 [in Russian].

10. Katsko, S. Yu. (2011). GIS for non-professional users as one of the modern tools for dealing with geoinformation. In *Sbornik materialov GEO-Sibir'-2011: T. 1, ch. 1 [Proceedings of GEO-Siberia-2011: Vol. 1, Part 1]* (pp. 234–238). Novosibirsk: SSGA Publ. [in Russian].

11. Lisickij, D. V. (2005). Purpose and features of the digital cartographic image in geoinformation mapping. In *Sbornik materialov GEO-Sibir'-2005: T. 4 [Proceedings of GEO-Siberia-2005: Vol. 4]* (pp. 28–31). Novosibirsk: SSGA Publ. [in Russian].

12. Lisickij, D. V. (2008). The substance and functions change of cartographic images at present society development stage. *Geodeziya i kartografiya [Geodesy and Cartography]*, 2, 28–30 [in Russian].

13. Katsko, S. Yu. (2008). Evolution of the concept and role of cartographic images. In *Sbornik materialov GEO-Sibir'-2008: T. 1, ch. 2 [Proceedings of GEO-Siberia-2008: Vol. 1, Part 2]* (pp. 203–207). Novosibirsk: SSGA Publ. [in Russian].

14. Katsko, S. Yu. (2011). Possibilties of information-analytical GIS for non-professional users to work with geospatial information. *Vestnik SGGA [Vestnik SSGA]*, 1(14), 76–80 [in Russian].

15. Majorov, A. A. (2012). The current status of geoinformatics. *Inzhenernye izyskaniya [Engineering Survey]*, 7, 12–15 [in Russian].

16. Savinykh, V. P., & Cvetkov, V. Ya. (2014). *Geodata as a system information resource Vestnik rossijskoj akademii nauk [Bulletin of RAS]*, 84(9), 826–829 [in Russian].

17. Ivannikov, A. D., Kulagin, V. P., Tixonov, A. N. etc. (2005). *Prikladnaya geoinformatika [Applied Geoinformatics]*. Moscow: MaksPress Publ. [in Russian].

18. Tsvetkov, V. Ya. (1999). Fundamentals of Geoinformation Modeling. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 4, 147–157 [in Russian].

19. Tsvetkov, V. Ya. (2000). Digital maps and digital models. *Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 2, 147–155 [in Russian].

20. Tsvetkov, V. Ya. (2014). Information field. *Life Science Journal*, 11(5), 551–554.

21. Komarov, S., Xajme, N. M., & Babenyshev, A. P. (1976). *Mnogomernyy statisticheskiy analiz v inzhenernoy geologii [Multidimensional statistical analysis in engineering geology]*. Moscow: Nedra Publ. [in Russian].

22. Rao, S. R. (1968). *Linejnye statisticheskie metody i ix primeneniya [Linear statistical methods and their applications]*. Moscow: Nauka Publ. [in Russian].

23. Ivchenko, G. I., & Timonina, E. E. (1982). On the estimation of the size of a finite population. *Teoriya veroyatnostej i ee primenenie [Theory of Probability and its Applications]*, *27*(2), 380–384 [in Russian].

24. Ivchenko, G. I., & Medvedev, Yu. I. (1965). Some multidimensional theorems concerning one classical problem on permutation. *Teoriya veroyatnostej i ee primenenie [Theory of Probability and its Applications]*, *10*(1), 156–16. [in Russian].

25. Ivchenko, G. I. (1984). On some problems of statistical inference for stratified populations. *Teoriya veroyatnostej i ee primenenie [Theory of Probability and its Applications]*, *29*(1), 113–118 [in Russian].

Received 13.12.2017

MAPPING OF BUILDING INDUSTRY PROCESSES (THE BAIKAL REGION)

Tat'yana I. Zabortseva
V. B. Sochava Institute of Geography SB RAS, 664033, Russia, Irkutsk, 1 Ulan-Batorskaya St., phone: (3952)42-68-20; Irkutsk State University, 664003, Russia, Irkutsk, 1 K. Marx St., Dr. Sc., Associate Professor, Department of Geography, Cartography and Geosystem Technologies, Head of the Laboratory of Economic and Social Geography, phone: (3952)52-10-71

Petr V. Rogov
V. B. Sochava Institute of Geography SB RAS, 664033, Russia, Irkutsk, 1 Ulan-Batorskaya St., Ph. D. Student, Laboratory of Economic and Social Geography, phone: (3952)42-68-20, e-mail: geografrogov@yandex.ru.

Creation of economic and geographical maps is an effective analytical method of a particular economic activity in space and time. Particularly, the location of one building enterprises is bound to the sources of raw materials due to their low transportation which implies high expenses. The location of the others is bound to the area of the construction material consumers and building industry itself. The article gives the conclusion that the key sector of building complex is the production of construction materials and especially building residential sector. It also represents the review of modern maps showing the content and characteristics of building industry on authors' maps in the "Ecological atlas of the lake Baikal" and fundamental ideas for the development of this mapping topic. The modern building industry maps, created on that basis, characterize the dynamics of regional residential building, reflect its results in specific indicator of new housing supply (square meters per person), and allow to find out sufficient or insufficient housing provision in administrative areas of the Baikal region, and serve as the basis of organizational, legal and executive measures, aimed at life quality improvement of people.

Key words: socio-economic maps, atlas mapping, construction industry, the building complex, Baikal region, input of habitation, territorial differentiation.

REFERENCES

1. *Regiony Rossii. Osnovnye kharakteristiki sub"ektov Rossiyskoy Federatsii [The Regions of Russia. Main characteristics of subjects of the Russian Federation]*. (2015). Moscow [in Russian].

2. Urbanaev, O. L. (2016). The Spatial development of the Baikal region: problems and goals. In *Sbornik materialov X Mezhdunarodnoy nauchno-prakticheskoy konferentsii: Novoe slovo v nauke: perspektivy razvitiya: T. 2, No. 4(10) [Proceedings of the International Scientific and Practical Conference: New Word in Science: Perspectives of Development: Vol. 2, No. 4(10)]* (pp. 221–224). O. N. Shirokov etc. (Ed.). Cheboksary: CNS "Interactive plus" Publ. [in Russian].

3. Kavkaeva, N. V. (2015). *Osnovy jekonomiki i tehnologii vazhnejshih otraslej hozjajstva [Fundamentals of Economics and technology the most important sectors of the economy]*. Moscow–Berlin: Direkt-Media Publ. [in Russian].

4. Pliseckij, E. L. (2013). *Regional'naja jekonomika [Regional economy]*. Moscow: KNORUS Publ. [in Russian].

5. Karavaev, G. A. *(*Ed.). (1964). *Stroitel'stvo: T. 3, Serija "Jenciklopedija sovremennoj tehniki. Jenciklopedii. Slovari. Spravochniki" [Construction: Vol. 3, A series of "Encyclopedia of modern technology. Encyclopedia. Dictionaries. Reference"]*. Moscow: "Sovetskaja Jenciklopedija" Publ. [in Russian].

6. Evteev, O. A. (1999). *Proektirovanie i sostavlenie social'no-jekonomicheskih kart [Design and drafting of socio-economic maps]*. Moscow: MGU Publ. [in Russian].

7. Zhukov, V. T. (n. d.). *Social'no-jekonomicheskaja kartografija [Socio-economic cartography]*. Retrieved from http://www.twirpx.com/file/1638805/ [in Russian].

8. Karetina, I. P. (2013). Place retrospective maps of soil cover of land settlements in the classification of cartographic materials. *Vestnik SGGA [Vestnik SSGA]*, 3(23), 138–146 [in Russian].

9. Veretel'nikov, G. K. (Ed.). (2016). *Atlas istorii zarozhdenija i razvitija stroitel'nogo kompleksa gosudarstva Rossijskogo: T. 2, Rossijskij sojuz stroitelej [Atlas of history of origin and development of the construction complex of the Russian state: Vol. 2.]*. Moscow: Intergrupp Publ. [in Russian].

10. *Jekologicheskij atlas bassejna ozera Bajkal [The ecological Atlas of the Baikal basin]*. (2015). Irkutsk: V. B. Sochava Institute of Geography SB RAS Publ. [in Russian].

11. Pozdnjak, G. V. (Ed.). (2008). *Rossija. Atlas: T. 3, Naselenie. Ekonomika. Rossiya [Atlas: Vol. 3, Population. Economy. Russia]*. Kaliningrad: "Skaz" Publ. [in Russian].

12. Larin, S. I. (Ed.). (2004). *Atlas Jamalo-Neneckogo avtonomnogo okruga: tjumenskij gos. un-t [Atlas of the Yamal-Nenets Autonomous district: Tyumen state University]*. Omsk: Omskaja kartograficheskaja fabrika [in Russian].

13. Atlas mapping: tradition and innovation. (2015). In *Sbornik materialov X nauchnoy konferentsii po tematicheskoy kartografii [Proccedings of X Scientific Conference on Thematic Cartography]*. (228 p.). Irkutsk: V. B. Sochava Institute of Geography SB RAS Publ. [in Russian].

14. Bilich, Ju. S. & Vasmut, A. S. (1984). *Proektirovanie i sostavlenie kart [Design and mapping]*. Moscow: Nedra Publ. [in Russian].

15. Zaborceva, T. I. (2010). Characteristics of the housing sector of the Baikal region. *Izvestija Irkutskogo gosudarstvennogo universiteta. Ser. Nauki o Zemle [Proceedings of Irkutsk state University. Series Earth Science]*, *3*(2), 69–79 [in Russian].

16. Federal law No. 131–FZ of October 06, 2003. *On General principles of organization of local self-government in the Russian Federation*. Retrieved from Consultant Plus online database [in Russian].

17. Korytnyj, L. M. (Ed.). (2016). *Zona Transsiba kak Evrazijskij jekonomicheskij koridor [Area TRANS-Siberian railway as the Eurasian economic corridor]*. Irkutsk: V. B. Sochava Institute of Geography SB RAS Publ. [in Russian].

18. *Stroitel'stvo v Zabaykal'skom krae [Construction in Zabaykalsky Krai]*. (2015). Chita: Zabajkalkrajstat Publ. [in Russian].

19. *Stroitel'stvo v Respublike Buryatiya [Construction in Burjatija Republic statistical compendium]*. (2015). Ulan-Udje: Burjatstat Publ. [in Russian].

20. Gorenskya, M. A. (2015). *Vvod v deystvie zhilykh domov po munitsipal'nym rayonam i gorodskim okrugam Irkutskoy oblasti, tys. kv. m. obshchey ploshchadi [Commissioning of dwelling houses in the municipal districts and urban districts of the Irkutsk region, thousand sq. m. total area]*. Irkutsk: Ministry of construction of the Irkutsk region Publ. [in Russian].

Received 03.11.2017

ON MODERNIZATION OF CURRENT METHODS OF URBAN GREEN SPACES INVENTORY TAKING INTO ACCOUNT THE ACHIEVEMENTS OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

Polina I. Mullayarova
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D. Student, Department of Ecology and Environmental Management, phone: (383)361-06-86, e-mail: lina181991@mail.ru

The article describes the role of green spaces in providing of optimal urban environment quality. Proportion of green space in some Russian and European cities is compared. The main normative documents for urban green management are listed. The current methods of urban green inventory are described. The necessity of modernization of the methods taking into account the achievements of remote sensing and Geographic Information Systems is stated. The basic outline of using of free-of-charge remote sensing data and ground photography data for green spaces inventory is suggested. A case study of using said data for green space inventory in Leninsky district of Novosibirck city, Russia, is described. The part of developed data base is presented. The digital layers for data base visualization are listed. The fragment of digital map of urban green spaces condition in Leninsky district of Novosibirck city is given. The conclusion is made about advantages of developed methods and the necessity of additions of technique for assessment of dense urban forests state.

Key words: remote sensing, Geographic Information System, urban green spaces, green spaces inventory, geoportals, methods.

REFERENCES

1. Mullayarova, P. I. (2016). The influence of plantations on the dust conditions of the urban territories. In *Sbornik materialov Interekspo GEO-Sibir'-2016: Mezhdunarodnoy nauchnoy konferentsii: T. 2. Distancionnye metoda zondirovaniya Zemli i foto-grammetriya, monitoring okruzhayushchej sredy, geoehkologiya [Proceedings of Interexpo GEO-Siberia-2016: International Scientific Conference: Vol. 2. Remote Sensing Methods of the Earth and Photogrammetry, Environmental Monitoring, Geoecology]* (pp. 89–93). Novosibirsk: SSUGT Publ. [in Russian].

2. Kulakova, S. A. (2012). Assessment of the state of green plantations of the city. *Geograficheskij vestnik [Geographical Bulletin]*, *4*(23), 59–66 [in Russian].

3. *Bäume und Pflanzen lassen Städte atmen/ Schwerpunkt – Feinstaub*. (n. d.). Retrieved from http://www.helix-pflanzensysteme.de/media/block_downloads/281/end_bro_feinstaub_2008-05-14.pdf [in German].

4. Johnston, S. A., Nicholas, S. S., & Parzen, J. (2013). *The Guide to Greening Cities*. Island Press/Center for Resource Economics.

5. Volker, D., Pfäfflin, F., & Wursthorn, H. (2013). *Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit Forschungskennzahl*. IVU Umwelt GmbH, Freiburg, Herausgeber: Umweltbundesamt Wörlitzer Platz 1 06844 Dessau-Roßlau [in German].

6. **Palazzo**, D., & **Steiner**, Fr. (2012). *Urban Ecological Design: A Process for Regenerative Places*. Washington: Island Press.

7. Construction norms and regulations. (2011). SNiP 2.07.01-89. The urban development. The planning and construction of urban and rural settlements. Moscow: Gosstandart [in Russian].

8. **Araya**, D. (2015). *Smart Cities as Democratic Ecologies*. Palgrave Macmillan UK.

9. Menke, Peter. (2013). *Stiftung «Die grüne Stadt» [Foundation «The Green City»]*. Berlin: 40 Seiten [in German].

10. Tröger, V. J., Klack, M., & Pätzold, A. (2016). Mitarbeit: Christian Latz Wissenschaftliche Beratung: Simon Nieland und Philipp Gärtner (TU Berlin), Joachim Maack (Uni Freiburg). Retrieved from https://interaktiv.morgenpost.de/gruenste-staedte-deutschlands/ [in German].

11. *The rules of creation, protection and maintenance of green areas in the cities of the Russian Federation of December 12, 1999*. Retrieved from https://zakonbase.ru/content/base/48758 [in Russian].

12. *Methodology inventory of urban green space*. (1997). Moscow: MinStroj RF. Retrieved from http://www.opengost.ru/iso/3087-metodika-inventarizacii-gorodskih-zelenyh-nasazhdeniy.html [in Russian].

13. Decision of the Council of Deputies of the City of Novosibirsk No. 539 of February 22, 2012. *On the Rules for the Creation, Protection and Maintenance of Greenery in the City of Novosibirsk.* Retrieved from http://gorsovetnsk.ru/sessions/view/solution/3752 [in Russian].

14. The decision of Council of deputies of Novosibirsk city No. 824 of December 26, 2007. *On the General plan of Novosibirsk*. Retrieved from http://gorsovetnsk.ru/sessions/ view/solution/3373/ [in Russian].

15. Mullayarova, P. I. (2017). On the need to improve the methodology of inventory of urban green spaces. In *Sbornik materialov Interekspo GEO-Sibir'-2017: Mezhdunarodnoy nauchnoy konferentsii: T. 2. Distancionnye metoda zondirovaniya Zemli i foto-grammetriya, monitoring okruzhayushchej sredy, geoehkologiya [Proceedings of Interexpo GEO-Siberia-2017: International Scientific Conference: Vol. 2. Remote Sensing Methods of the Earth and Photogrammetry, Environmental Monitoring, Geoecology]* (pp. 180–185). Novosibirsk: SSUGT Publ. [in Russian].

Received 01.11.2017

FROM MULTI-PURPOSE CARTOGRAPHIC RESOURCE TO «SMART MAP»

Svetlana S. Yankelevich
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Associate Professor, Department of Cartography and Geoinformatics, phone: (383)361-06-35, e-mail: ss9573@yandex.ru

Lyudmila K. Radchenko
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Associate Professor, Department of Cartography and Geoinformatics, phone: (383)361-06-35, e-mail: kaf.cartography@ssga.ru

Yevgeny S. Antonov
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D. Student, Department of Cartography and Geoinformatics, phone: (383)361-06-35, e-mail: kaf.cartography@ssga.ru

The article considers the peculiarities of the present state development of cartography, fundamental change of its role and functions in the modern economic society that are caused by revolutionary changes in the field of Informatization. Cartography is considered as the science of systematic informational-cartographic modelling and geosystems cognition. The map appears as a graphic - symbolic geoinformation reality model, it is at the same time a tool of knowledge, a method of analog simulation of reality, and a means of transmitting information in digital form. The article gives the definition of a new cartographic product – a multi- functional cartographic resource, which represents a specialized information cartographic system incorporating the cartographic information, tools to work with it in order to create final information products – maps.

The article observes the obvious transition from traditional map to the map interface that is based on a new trend "smart mapping".

Key words: map, map functions, cartographic modeling, GIS, spatial data, multipurpose map resource, smart map, consumer.

REFERENCES

1. Castells, M. (2010). *The Information Age: Economy, Society and Culture: Vol. I, The Rise of The Network Society*. Wiley-Blackwell.

2. Lisitsky, D. V., Khoroshilov, V. S., & Kolesnikov, A. A. (2014). Animation cartography – nature, characteristics and prospects. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 4, 91–97 [in Russian].

3. Ibáñez, R. (2014). *Mechta ob ideal'noy karte. Mir matematiki: T. 26, Kartografiya i matematiki [The Dream of a perfect map. The world of mathematics: Vol. 26: Cartography and mathematics]*. Moscow: De Agostini [in Russian].

4. Dyshlyuk, S. S., Nikolaeva, O. N., & Romashova, L. A. (2015). To the question of formalization of the process of creating thematic maps in GIS environment. *Vestnik SGUGiT [Vestnik SSUGT]*, 2(30), 78–85 [in Russian].

5. Lisitsky, D. V. (2013). Prospects of development of cartography: from the system of "Digital Earth" to the virtual reality system. *Vestnik SGGA [Vestnik SSGA]*, 2(22), 8–16 [in Russian].

6. Berlyant, A. M. (2014). *Kartografiya [Cartography]*. Moscow: KDU Publ. [in Russian].

7. Lisitsky, D. V. (2008). Changing the nature and functions of map images at the present stage of development of society. *Geodeziya i kartografiya [Geodesy and Cartography]*, 2, 28–30 [in Russian].

8. Automated Cartography. (n. d.). Retrieved from http://www.slideserve.com/kenyon/ automated-cartography-python-scripting-project.

9. Lisitsky, D. V. (2016). Cartography in the information age: new challenges and opportunities. *Geografiya i prirodnye resursy [Geography and Natural Resources]*, 4, 22–29 [in Russian].

10. Lisitsky, D. V., Dyshlyuk, S. S. (2015). Multipurpose map resource is a new trend in cartography. *Geodeziya i kartografiya [Geodesy and Cartography]*, 11, 9–13 [in Russian].

11. Lisitsky, D. V. Bugakov, P. Y., & Nguyen Anh Tai. (2016). *Trekhmernaya komp'yuternaya kartografiya [Three-dimensional computer mapping]*. Novosibirsk: SSGA Publ. [in Russian].

12. Process for Keeping Pace with Evolving Web Mapping Technologies. Roth R. E., Donohue R. G., Sack C. M., Wallace T. R., Buckingham T. M., 2015. A Cartographic Perspectives. DOI: 10.14714.CP78.1273.

13. Tatarenko, V. I., & Radchenko, L. K. (2015). Prospects of development of navigation and cartography. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 5/S, 227–229 [in Russian].

14. Lisitsky, D. V., Komissarova, E. V., & Kolesnikov, A. A. (2017). Theoretical basics and features of multimedia mapping. *Vestnik SGUGiT [Vestnik SUGGT]*, *22*(3), 72–88 [in Russian].

15. Khoroshilov, V. S., & Kazko S. Y. (2015). Geo-information space and virtual geograpical environment. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 5/S, 256–260 [in Russian].

16. Narrow, M. V., & Narrowa, T. P. (2016). Big data in mapping, clever mapping :the future or technological change. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, *60*(5), 42–45 [in Russian].

17. Tsorlini, A., Hurni, L., Sieber, R., Gloor, T., & Klauser, H. (August 23–28, 2015). Generation of thematic maps with wizards based on cartographic principles. The case study of

OCAD Thematic Mapper. *Proceedings of 27th International Cartographic Conference 16th General Assembly*. Rio de Janeiro. BrazilMaps.

18. Lisitsky, D. V., Kolesnikov, A. A., Komissarova, E. V., Bugakov, P. Y., & Pisarev V. S. (2014). The direction in multimedia cartography *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 3, 40–44 [in Russian].

19. Beata Medyńska-Gulij. (2014). Cartographic sign as a core of multimedia map prepared by non-cartographers in free map services. *Geodesy and Cartography*, *63*(1), 55–64. doi: 10.2478/geocart–2014–0004.

20. Crampton, J. W., & Krygier, J. (2006). An introduction to critical cartography. *ACME: Intern. E-Journ. Critical Geographies*, 4(1), 11–33.

21. Florian Ledermann, & Georg Gartner. (August 23–28, 2015). Mapmap.js: A Data-Driven Web MappingAPI for Thematic Cartography. *Proccedings of 27t International Cartographic Conference 16th General Assembly*. Rio de Janeiro, BrazilMaps Connecting the World.

22. Taylor Tracey Lauriault. (Ed.). *Cybercartography: Vol. 5, Theory and Practice* (1st Ed.). Elsevier Science.

23. Maiellaro, N., & Varasano, A. (2017). One-Page Multimedia Interactive Map. *ISPRS Int. J. Geo-Inf.*, *6*(2), P. 34.

24. Malinvernia, E. S., & Tassettiaa, A. N. (November 27–29, 2013). GIS-based smart cartography using 3D modeling. *Proceedings of International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, ISPRS 8th 3DGeoInfo Conference & WG II/2 Workshop: Vol. XL-2/W2*. Istanbul, Turkey.

Received 15.01.2018

LAND MANAGEMENT, CADASTRE AND LAND MONITORING

DESING OF INFORMATION MODEL FOR THE PURPOSE OF INCREASING RELIABILLITY OF CADASTRAL INFORMATION

Evgeny I. Avrunev
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Head of the Department of Cadastre and Territorial Planning, phone: (383)344-31-73, e-mail: avrynev_ei@ngs.ru

Mikhail P. Dorosh
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D. Student, Department of Cadastre and Territorial Planning, phone: (383)266-02-73, e-mail: doroshmp@mail.ru

Cadastral information contained in Unified State Register of Immovable Property (USRIP) is the taxation basis for particular taxes calculation and ensures constitutional rights of owners on immovable property belonging to them. Whereas USRIP might contain unreliable cadastral information which means nonfulfillment of its basic functions. That's why increasing reliability of cadastral information is the task of highest importance which faces the Rosregister specialists and relevant organizations. For the purposes of efficient error detection and correction, and also control under these technological procedures the article suggests the method to put incorrect data into a

separate information model that ensures processing and correcting such data. This model represents a set of parts each of which describes a particular type of unreliable information. The suggested information model allows to computerize data processing which provides significant efficiency improvement of technological procedures aimed at increasing reliability of cadastral information in USRIP.

Key words: Unified State Register of Immovable Property, cadastral information reliability increase, information model, right register, cadastral register.

REFERENCES

1. Federal Law No. 149–FZ of July 27, 2006. *On information, information technologies and information protection*. Retrieved from ConsultantPlus online database [in Russian].

2. Lidovskiy, V. V. (2004). *Teoriya informatsii [Theory of Information]*. Moscow: Kompaniya Sputnik plyus [in Russian].

3. Fursov, V. A. (2006). *Lektsii po teorii informatsii [Lectures on Information Theory]*. N. A. Kuznetsova (Ed.). Samara: Samara State Aerospace University Publ. [in Russian].

4. The report on the results of the expert and analytical exercise "Analysis of the completeness and reliability of information on real estate for the purpose of calculating property taxes" (taking into account the control measures of the Accounts Chamber of the Russian Federation and control and accounting bodies of the subjects of the Russian Federation. (2016). *Byulleten' Schetnoy palaty Rossiyskoy Federatsii [Bulletin of the Accounts Chamber of the Russian Federation]*, 6, 235–294. Retrieved from at http://audit.gov.ru/activities/bulleten/879/ [in Russian].

5. Karpik, A. P., Vetoshkin, D. N., & Arkhipenko, O. P. (2012). Analysis of the current condition of the state cadastre of real estate in Russia. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 7, 161–165 [in Russian].

6. Federal Law No. 218–FZ of July 13, 2015. *On the Unified State Register of Real Estate*. Retrieved from ConsultantPlus online database [in Russian].

7. Order of the Ministry of Economic Development of the Russian Federation No. 943 of December 16, 2015. *On the establishment of the procedure for maintaining the Unified State Register of Real Estate.* Retrieved from ConsultantPlus online database [in Russian].

8. Order of Rosreestr No. P/0013 of January 19, 2016. *On the approval of the plan of measures to ensure the creation and functioning from January 1, 2017 of the Unified State Register of Real Estate*. Retrieved from ConsultantPlus online database [in Russian].

9. *Federal Knowledge Base of Rosreestr*. (n. d.). Retrieved from at http://support.kadastr.ru/ [in Russian].

10. *Regulations, instructions, templates of documents. Technological standards and recommendations*. (n. d.). Retrieved from at http://smev3.gosuslugi.ru/portal/ [in Russian].

11. *The minutes of the meeting with the deputy head of Rosreestr on improving the data quality of the EGRN from 08.15.2017*. (2017). Retrieved from at https://rosreestr.ru/site/ [in Russian].

12. Karpik, A. P., Kolmogorov, V. G., & Rychkov, A. V. (2013). Development of criteria for assessing the quality of cadastral data. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 4/S, 133–136 [in Russian].

13. Order of Rosreestr and The Federal Tax Service No. P/302/MMV-7-11/495@ of August 12, 2011. *On approval of the procedure for the exchange of information in electronic form on the registered rights to real estate (including land plots) and transactions with it, the owners of real property and on real estate objects*. Retrieved from ConsultantPlus online database [in Russian].

14. Karpik, A. P., Novoselov, Yu. A., & Rychkov, A. V. (2013). Development of a methodology for qualitative and quantitative assessment of cadastral information. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 4/S, 137–142 [in Russian].

15. The Tax Code of the Russian Federation (Part Two) No. 117–FZ of August 05, 2000. Retrieved from ConsultantPlus online database [in Russian].

16. Zevenbergen, J. (2002). *Systems of Land Registration. Aspects and Effects.* NCG, Delft. Retrieved from registrationacts.in/Pdf/51Zevenbergen%20on%20land%20registration.pdf.

17. Karpik, A. P., Fedorenko, Yu. V., & Parkhomenko, D. V. (2017). On the geoinformation role in civil-legal problems of estate state register data public reliability (on the example of Irkutsk region)]. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(2), 154–170 [in Russian].

18. Karpik, A. P., Osipov, A. G., & Murzintsev, P. P. (2010). *Upravlenie territoriey v geoinformatsionnom diskurse [The territory management in geoinformation discourse]*. Novosibirsk: SSGA Publ. [in Russian].

19. Parkhomenko, D. V., & Lenshina, I. V. (2017). Revisiting the role of the specialist and the expert in integrated state real estate register errors dispute in civil processes. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(1), 190–199 [in Russian].

20. *The Quick Reference SQL*. (n. d.). Retrieved from http://4its.ru/html/sql-commands.html.

21. Kuznetsov, S. D. (1996). SQL Relational Database Language Standards: An Overview. *SUBD [SUBD]*, 2, 6–36. Retrieved from at http://citforum.ru/database/articles/art_2.shtml.

22. Date, C. J. (2005). *Vvedenie v sistemy baz dannykh [An introduction to Database Systems]*. Moscow: Vil'yams Publ. [in Russian]

23. Pushnikov, A. Yu. (1999). *Vvedenie v sistemy upravleniya bazami dannykh: Chast' 1, Relyatsionnaya model' dannykh [Introduction to database management systems: Part 1, Relational Data Model]*. Ufa: Bashkir University Publ. [in Russian].

24. Pushnikov, A. Yu. (1999). *Vvedenie v sistemy upravleniya bazami dannykh: Chast' 2, Normal'nye formy otnosheniy i tranzaktsii [Introduction to database management systems: Part 2, The normal forms of relations and transactions]*. Ufa: Bashkir University Publ. [in Russian].

25. Digo, S. M. (1995). *Proektirovanie i ispol'zovanie baz dannykh [Design and use of databases]*. Moscow: Finansy i statistika Publ. [in Russian].

26. Kogalovskiy, M. R. (2002). *Entsiklopediya tekhnologiy baz dannykh [Encyclopedia of Database Technologies]*. Moscow: Finansy i statistika Publ. [in Russian].

27. Order of the Ministry of Economic Development of the Russian Federation No. 877 of November 24, 2015. *On approving the procedure for cadastral division of the territory of the Russian Federation, the procedure for assigning cadastral numbers, registration numbers, registry number of borders to real estate objects*. Retrieved from ConsultantPlus online database [in Russian].

Received 10.01.2018

MONITORING AND RATIONAL USE OF AGRICULTURAL LAND OF KRASNODAR TERRITORY

Victor B. Nepoklonov
Moscow State University of Geodesy and Cartography, 105064, Russia, Moscow, 4 Gorokhovsky Line, Dr. Sc., Senior Researcher, Acting Pro-Rector for Scientific Work, phone: (499)261-69-53, e-mail: nauka@miigaik.ru

Irina A. Khabarova
Moscow State University of Geodesy and Cartography, 105064, Russia, Moscow, 4 Gorokhovsky Line, Senior Teacher, Department of Cadastre and Bases of Land Law, phone: (499)404-12-20, e-mail: irakhabarova@yandex.ru

Denis A. Khabarov
Moscow State University of Geodesy and Cartography, 105064, Russia, Moscow, 4 Gorokhovsky Line, Assistant, Department of Space Monitoring and Ecology, phone: (499)267-27-72, e-mail: khabarov177@yandex.ru

This article presents monitoring and rational use of agricultural lands in the Krasnodar Territory over the past decade. The analysis of degradation processes of agricultural lands is carried out. The authors made the assessment of the processes occurring on agricultural land in the Krasnodar Territory with their intensive use. The authors suggested a set of measures to improve land productivity; to strengthen control by the public authorities over the use, protection and improvement of land and the efficient use of capital investments. It is noted that when developing a set of measures for preventing and eliminating negative processes of the impact of natural and anthropogenic
factors on land resources, it is necessary to take into account the indicators of increasing the efficiency of land use in southern Russia, as well as the natural, geological and socio-economic characteristics of the region.

Key words: rational use of arable land, the structure of sown areas, productivity, valuation, agricultural land.

REFERENCES

1. State (national report) on the status and use of land in the Russian Federation in 2015. (2016). Moscow [in Russian].
2. Zharnikov, V. B. (2017). Rational land use and basic condition of its realization. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(3), 171–179 [in Russian].
3. Mishina, Z. A. (2011). Economic efficiency of agricultural land use in the Nizhny Novgorod region. *Vestnik NGIEI [Bulletin NGII]*, 5(6), 51–63 [in Russian].
4. Khabarova, I. A., & Vorobei, T. N. (2017). Environmental protection technologies of soil pollution. *Konstruktorskoe biuro [Design Bureau]*, 3(128), 46–51 [in Russian].
5. Khabarov, D. A., & Sizov, A. P. (2017). The use of the dynamics of the balance of the lands of the Russian Federation for analysis of their media forming properties. *Izvestiia vuzov. Geodeziia i aerofotosieemka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 3, 57–61 [in Russian].
6. Khabarova, I. A. (2017). Development of a multifactorial model of land use in the North Caucasus Economic Region, taking into account regional features. *Zemleustroistvo, kadastr i monitoring zemel [Land Management, Cadastre and Land Monitoring]*, 3, 31–36 [in Russian].
7. Rasskazova, A. A. (2014). Determination of the factors influencing the efficiency of agricultural land use in the region. *Zemleustroistvo, kadastr i monitoring zemel [Land Management, Cadastre and Land Monitoring]*, 10, 61–64 [in Russian].
8. Varlamov, A. A., Galichenko, S. A., & Klyushin, P. V. (2015). Modern problems of development of agricultural complex in Russia. *Agrarnaya Rossiya [Agricultural Russia]*, 6, 18–22 [in Russian].
9. Khabarova, I. A., & Nepoklonov, V. B. (2017). Russian and foreign experience in forecasting and planning of land use. *Izvestiia vuzov. Geodeziia i aerofotosieemka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 3, 100–104 [in Russian].
10. Volkov, S. N., Komov, N. V., & Khlystun, V. N. (2015). How to achieve effective land management in Russia? *Mezhdunarodnyi selskokhoziaistvennyi zhurnal [International Agricultural Journal]*, 3, 3–7 [in Russian].
11. Bocharova, A. A., Zharnikov, V. B. (2012). The main conditions for the rational use of forest land. *Vestnik SGGA [Vestnik SSGA]*, 3(19), 69-77 [in Russian].
12. Lipchu, N. V., & Gagay, I. V. (2014). Efficiency of land use in agricultural organizations of the Krasnodar Territory. *Politematicheskii setevoi elektronnyi nauchnyi zhurnal Kubanskogo*

gosudarstvennogo agrarnogo universiteta [Polythematic Online Scientific Journal of Kuban State Agrarian University], 96, 422–431 [in Russian].

13. Vershinin, V. V., Murasheva, A. A., Shirokova, V. A., Khutorova, A. O., Shapovalov, D. A., & Tarbaev, V. A. (2016). The solutions of the agricultural land use monitoring problems. *International Journal of Environmental and Science Education, 11*(12), 5058–5069.

14. Musaev, M. R., Shapovalov, D. A., Klyushin, P. V., Savinova, S. V. (2016). Ecology of land use of agricultural land in the North Caucasus Federal District. *Iug Rossii: ekologiia, razvitie [South of Russia: Ecology, Development]*, *11*(2), 132–142 [in Russian].

Received 24.11.2017

ORGANIZATIONAL AND LEGAL MECHNISM OF RATIONAL USE OF LAND

Valeriy B. Zharnikov
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Professor, Department of Cadastre and Territorial Planning, phone: (383)361-05-66, e-mail: v.b.jarnikov@ssga.ru

Rational use of land (RUL) and mechanisms of its realization define one of the vital and difficult problems of modern Russia – spatial development of the country and its regions. The full-fledged solution of this problem is able to provide and partially provides the whole range of basic national strategic advantages. One of the latter is the cultivation of pure agricultural products on the basis of bioagriculture which is the only way to get it. Russia has almost no competitors in this sphere, but there are still few positive results of “green” economy development. That’s why it’s very important to develop the methods to overcome the current, in most cases, non-rational use of land and administrative-territorial entities, which (the methods) are based on the RUL factors and on the system of their evaluation parameters in the given process. A special group here is formed by organizational-legal factors (OLF) and determined by them organizational-legal mechanism (OLM), which are the objects of research of this article. In the result the OLF system is represented with 3 groups of factors: 1. legal norms of acting law; 2. items in municipal budgets for spatial development purposes; 3. administrative-executive norms providing required quality of OLM realization. The article gives the examples of such factors and evaluation of their influence on OLM and discusses the results from the viewpoint of RUL.

Key words: rational use of land (RUL), RUL factors and parameters, organizational-legal mechanism, results of social and economic activity.

REFERENCES

1. Volkov, S. N. (2013). *Zemleustroystvo [Land use]*. Moscow: GUZ Publ. [in Russian].

2. Varlamov, A. A. (2014). *Sistema gosudarstvennogo i munitsipal'nogo upravleniya [System of state and municipal management]*. Moscow: GUZ Publ. [in Russian].

3. Erofeev, B. V. (1999). *Zemel'noe pravo [Land law]* (3d ed.). Moscow: MSUPL Publ. [in Russian].

4. Stepin, V. S. (2000). *Teoreticheskoe znanie. Struktura, istoricheskaya evolyutsiya [Theoretical knowledge. Structure, historical evolution]*. Moscow: Progress-Traditsiya Publ. [in Russian].

5. Pereslegin, S. (2009). *Novye karty budushchego, ili Anti-Rend [New maps of the future, or Anti-Rand]*. Moscow: AST Publ., Saint Petersburg: Terra Fantastica Publ. [in Russian].

6. Alekseev, S. S. (1999). *Pravo: azbuka–teoriya–filosofiya. Opyt kompleksnogo issledovaniya [Right: the alphabet-theory-philosophy. Experience in complex research]*. Moscow: Statut Publ. [in Russian].

7. Spiridonov, L. I. (2009). *Teoriya gosudarstva i prava [Theory of government and rights]*. Moscow: Prospekt Publ. [in Russian].

8. *Byudzhetnyy Kodeks RF: po sostoyaniyu na 01.02.2017 g. [Budget Code of the Russian Federation: as of 01.02.2017]*. (2017). Novosibirsk: Normatika Publ., [in Russian].

9. Bulletin of local government of the city of Novosibirsk of December 25, 2017 No. 57: Parts 1 and 2 [in Russian].

10. Bulletin of local government of the city of Novosibirsk of February 15, 2018 No. 6 [in Russian].

11. Bogolyubov, S. A., & Zolotova, O. A. (n. d.). *Zemel'noe zakonodatel'stvo [Land legislation]*. Retrived from www.prospekt.org [in Russian].

12. Barkhatov, M. V., & Mazurov, A. V. (2002). *Novoe zemel'noe zakonodatel'stvo Rossiyskoy Federatsii [New land legislation of the Russian Federation]*. Moscow: Yurayt+ Izdat Publ. [in Russian].

13. Bogolyubov, S. A., & Zolotova, A. (n. d.). *Kommentariy k Zemel'nomu kodeksu RF [Commentary on the Land Code of the Russian Federation]*. Retrived from www.prospekt.org [in Russian].

14. Komov, N., Rodin, A., & Alakoz, V. (1995). *Zemel'nye otnosheniya i zemleustroystvo v Rossii [Land relations and land management in Russia]*. Moscow: Russlit Publ. [in Russian].

15. Zharnikov, V. B. (2017). Rational land use and basic condition of its realization. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(3), 171–179 [in Russian].

16. Zharnikov, V. B. (2016). Land relation assessment as instrument of modern municipal management and city buildung activity. *Vestnik SGUGiT [Vestnik SSUGT]*, 2(34), 119–126 [in Russian].

17. Karpik, A. P., Osipov, A. G., & Murzintsev, P. P. (2010). *Upravlenie territoriey v geoinformatsionnom diskurse [Territory management in geoinformation discourse]*. Novosibirsk: SSUGT Publ. [in Russian].

18. Lebedeva, T. A., Gagarin, A. I., & Lebedev, Y. V. (2017). Sustainable land management on the intensively developed territories. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(2), 201–211 [in Russian].

19. Markov, Yu. T., Turchenko, V. N., Chirkin, E. A., & Yurkov, S. A. (1995). *Sotsial'no-pravovye mekhanizmy prirodopol'zovaniya [Social and legal mechanisms of nature use]*. Novosibirsk: SO RAN, GPNTB Publ. [in Russian].

20. Dobrotvorskaja, N. I., & Dubrovskiy, A. V. (2016). General questions of safeguard and protection of soil cover for the purpose of rational land use on the territory of settlements. *Vestnik SGUGiT [Vestnik SSUGT]*, 2(34), 184–191 [in Russian].

21. Mozalov, V. P. (2013). *Geoinformatsionnye tekhnologii v kadastre i upravlenii territorial'nymi obrazovaniyami [Geoinformation technologies in the cadastre and management of territorial entities]*. Moscow: GUZ Publ. [in Russian].

22. Shevchuka, A. V. (Ed.). (2014). *"Zelenaya" ekonomika. Novaya paradigma strany [The "green" economy. The new paradigm of the country]*. Moscow: SOPS [in Russian].

23. *Towards Green Growth: Monitoring Progress*. (2011). OECD Indicators, OECD Publishing.

24. Larionov, Yu. S. (2012). *Biozemledelie i zakon plodorodiya pochv (teoreticheskie osnovy) [Biomedicine and the law of soil fertility (theoretical basis)]*. Omsk: IP Skornyakova E. V. Publ. [in Russian].

25. Yashutin, N. V., Drobyshev, A. P., & Khomenko, A. I. (2008). *Biozemledelie (nauchnye osnovy, innovatsionnye tekhnologii i mashiny) [Biomedical engineering (scientific basis, innovative technologies and machines)]*. Barnaul: AlGAU Publ. [in Russian].

Received 13.03.2018

MICROWAVE IMAGING THE CANCER OF THE MAMMARY GLAND

Oleg V. Minin
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Dr. Sc., Professor, Department of Special Devices, Innovation and Metrology, phone: (383)361-07-45, e-mail: prof.minin@gmail.com

Igor V. Minin
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Dr. Sc., Professor, Department of Special Devices, Innovation and Metrology, phone: (383)361-07-45, e-mail: prof.minin@gmail.com

In clause the question of an opportunity of microwave visualization of a tumour of a cancer of a mammary gland with superdifraction the sanction is considered. The brief review of microwave methods of diagnostics of a cancer of a mammary gland is resulted. Methods microwave ternografii, radar-tracking technics, microwave holography and a tomography, a videopulse radar, methods of pulse compression with frequency modulation, the microwave-image with difraction a tomography, return methods of dispersion and reception of the image of object with use of methods of an electric impedance are considered. The way microwave image a cancer of a mammary gland with use of effect of "photon" jets or "tera jets" is offered.

Key words: a cancer of a mammary gland, маммография, a photon jet, diffraction a limit, microwave imaging, the spatial sanction.

REFERENCES

1. Cancer Facts & Figures 2010. Breast Cancer Facts & Figures 2009-2010, American Cancer Society Retrieved from http://www.cancer.org/research/cancerfactsfigures/cancerfactsfiguresforafricanamericans/cancer-facts-figures-for-african-americans. (Acessed: 01.04.2014.).

2. Bridges, J. E., Taflov, A., Hagness, S. C., Sahakian A. Microwave antenna for cancer detection system. Patent US 6061589.

3. Emine Avşar Aydin, Mustafa Berkan Biçer, & Ali Akdağli. (2015). Assesment of accurate dielectric model and selected patents on microwave breast cancer detection. *Technical journal*, *9*(4), 454–460.

4. Xua, M., Thulasiramana, P., & Noghanianb, S. (2012). Microwave tomography for breast cancer detection on Cell broadband engine processors. *J. Parallel Distrib. Comput. Elsevier*, *72*, 1106–1116.

5. Santorelli & M. Popovic. (2011). SAR distribution in Microwave Breast Screening: Results with TWTLTLA Wideband Antenna. *Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), Seventh International Conference* (pp. 11–16). Montreal, Canada.

6. Lazaro, D. Girbau, & R. Villarino (2010). Simulated and experimental wavelet-based detection of breast tumor using a UWB radar. *Proceedings of the 40th European Microwave Conference* (pp. 373–376). Paris.

7. Dan Zhang, & A. Mase (2011). Ultrashort-Pulse Radar System for Breast Cancer Detection Experiment: Imaging in frequency band. *Microwave Conference Proceedings (CJMW)* (pp. 1–3). Hangzhou.

8. Elise C. Fear, et al. (Aug. 2002). Confocal Imaging for Breast Cancer Detection: Localization of Tumors in Three Dimensions. *IEEE Transaction on Biomedical Engineering*, *49*(8), 812–822.

9. Elise C. Fear, et al. (Mar. 2002). Enhancing Breast Tumor Detection with Near-Field Imaging. *IEEE Microwave Magazine* (pp. 49–56).

10. Elise Fear et al. (2003). Microwaves for Breast Cancer Detection? IEEE Potentials (pp. 12–18).

11. Gary A. Ybarra et al. (2007). Microwave Breast Imaging, Emerging Technology in Breast. *Imaging and Mammography*, Chapter 16, pp. 1–12.

12. Nikolova, N. K. (Dec. 2011). Microwave Imaging for Breast Cancer. *IEEE Microwave Magazine*, pp. 78–94.

13. Xu Li, et al. (Feb. 2005). An Overview of Ultra-Wideband Microwave Imaging via Space-Time Beamforming for Early-Stage Breast-Cancer Detection. *IEEE Antennas and Propagation Magazine*, *47*(1), 19–34

14. Yao Xie, et al. (Aug. 2006). Multistatic Adaptive Microwave Imaging for Early Breast Cancer Detection. *IEEE Transactions on Biomedical Engineering*, *53*(8), 1647–1657.

15. Meaney, et al. (2000). Microwave imaging for breast cancer detection: preliminary experience publication. *Proceedings of SPIE, 3977*, 308–319.

16. Larsen, L. E., & Jacobi, J. H. (Eds.). (1986). *Medical Application of Microwave Imaging*. IEEE Press.

17. Hassan, M., & El-Shenawee, M. (2011). Review of Electromagnetic Techniques for Breast Cancer Detection. *IEEE Reviews in Biomedical Engineering, Vol. 4*.

18. El-Shenawee, M. (2011). Electromagnetic Imaging for Breast Cancer Research. *BioWireleSS 2011 IEEE*, pp. 55–58.

19. Guray Ali CANLI. Breast cancer imaging device through microwave surface impedance. Patent WO 2014126540.

20. Winters, D. W., Van Veen, B. D., & Hagness, S. C. Time domain inverse scattering techniques for use in microwave imaging. Patent US 7809427.

21. Jian Li, & Gang Wang. Multi-frequency microwave-induced thermoacoustic imaging of biological tissue. Patent US 7266407.

22. Gabriel, C., Gabriel, S., & Corthout, E. (1996). The dielectric properties of biological tissues: I. Literature survey. *Physics in Medicine and Biology*, *41*(11), 2231–2249.

23. Gabriel, S., Lau, R. W., & Gabriel, C. (1996). The dielectric properties of biological tissues II. Measurements in the frequency range 10 Hz to 20 GHz. *Physics in Medicine and Biology*, *41*(11), 2251–2269.

24. Gabriel, S., Lau, R. W., & Gabriel, C. (1996). The dielectric properties of biological tissues III. Parametric models for the dielectric spectrum of tissues. *Physics in Medicine and Biology*, *41*(11), 2271–2293.

25. Christian Weber. (Sep. 27, 2010). *Development of Patient-Specific Electromagnetic Model (PSEM) Based on MR Breast Images*, pp. 1–36.

26. Clegg J., et al. (2012). A Genetic Algorithm for Optimizing Multi-Pole Debye Models of Tissue Dielectric Properties. *Phys. Med. Biol.*, 57, 6227–6243.

27. Truong, C. Q., Tuan, H. D., Fitzgerald, A. J., Wallace, V. P., & Nguyen, H. T. (February 2015). A Dielectric Model of Human Breast Tissue in Terahertz Regime. *IEEE Transactions on Biomedical Engineering*, *62*(2).

28. Sill J. M., et al. (2007). Realistic Breast Models For Second Generation Tissue Sensing Adaptive Radar System. *The Second European Conference on Antennas and Propagation*, 4 pages.

29. Lazebnik, M., et al. (2007). A Large-Scale Study of the Ultrawidebanc Microwave Dielectric Properties of Normal Breast Tissue Obtained From Reduction Surgeries. *Phys. Med. Biol.*, *52*, 2637–2656.

30. Lazebnik M., et al. (2007). A Large-Scale Study of the Ultrawideband Microwave Dielectric Properties of Normal, Benign and Malignant Breast Tissues Obtained from Cancer Surgeries, 2007. *Phisics in Medicine and Biology*, *52*, 6093–6115.

31. Lazebnik M., et al. (Dec. 2007). Highly Accurate Debye Models for Normal and Malignant Breast Tissue Dielectric Properties at Microwave Frequencies. *IEEE Microwave and Wireless Components Letters*, *17*(12), 822–824.

32. Zastrow, et al. (2008). Development of Anatomically Realistic Numerical Breast Phantoms with Accurate Dielectric Properties for Modeling Microwave Interactions With the Human Breast. *IEEE Transactions on Biomedical Engineering*, *55*(12), 2792–2800.

33. Chaudhary, S. S., et. al. (February, 1984). Dielectric properties of normal and malignant human breast tissues at radiowave and microwave frequencies. *Indian Journal of Biochemistry and Biophysics*, *21*, 76–79.

34. Klemm, M., Craddock, I. J., Leendertz, J., Preece, A. W., & Benjamin, R. (11–16 Nov. 2007). Breast cancer detection using symmetrical antenna array. *The second European Conf. on Antennas and Prohagation, EuCAP2007, the EICC*. Edindurgh, UK.

35. Minin, I. V., Minin, O. V. (2017). Photon jets in a science and technics. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(1), 212–234.

36. 36. Born, M., & Vol'f, E. (1970).Osnovy optiki [Bases of optics]. Moscow: Nauka Publ [in Russian].

37. Heifetz, A., et al. (2006). Experimental confirmation of backscattering enhancement induced by a photonic jet. *Appl. Phys. Lett.*, *89*, 221118.

38. Minin, I. V., & Minin, O. V. (2016). *Diffractive optics and nanophotonics: Resolution below the diffraction limit*. Springer. Retrived from http://www.springer.com/us/book/9783319242514#aboutBook<http://www.springer.com/us/book/9783319242514>

39. Minin, I. V., & Minin, O. V. A way of formation of the image of objects with subdifraction the sanction in millimetric, teragertz, infra-red and optical ranges of lengths of waves Positive the decision under the patent application № 2016142114 from 22.06.2017.

40. Kong, S.-C., Taflove, A., & Backman, V. (2009). Quasi one-dimensional light beam generated by a graded-index microsphere. *Optics Express*, *17*, P. 3722.

41. Gejnts, Y. E., Zemlyanov, A. A., Panin, E. K., Zemlyanov, A., & Heinz, Y. E. (2004). Intensivnost of an optical field inside poorly absorbing the spherical particle shined femptosecond by a laser impulse. *Optika i spektroskopiya [Optics and Spectroscopy]*, *96*(2), 337–344 [in Russian].

42. Heinz, Yu. E., Zemlyanov, A. A., & Panin, E. K. (2012). Time dynamics a photon jet from a dielectric microparticle at an irradiation a laser impulse. *Optika atmosfery i okeana [Optics of an Atmosphere and Ocean]*, *25*(12), 1028–1033 [in Russian].

Received 09.01.2018

COUNTING *N*-PLEXED RESTRAINABLE COORDINATE TRANSFORMER FOR SIMULATOR-ANALYZER OF MICROWAVE AMPLIFIERS AND AUTO-GENERATORS

Sergei V. Savel'kayev
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Dr. Sc., Professor, phone: (383)361-07-31, e-mail: sergei.savelkaev@yandex.ru

Vladimir A. Litovchenko
Novosibirsk Higher Military Command School, 630117, Russia, Novosibirsk, 49 Ivanova St., Head of the Laboratory of the Department of Educational Intelligence (and Airborne Training), phone: (383)332-50-45; Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D. Student, Department of Metrology and Optical Production Technology, phone: (923)100-89-86, e-mail: litovchienko.vladimir@mail.ru

At present, simulators-analyzers of amplifiers and microwave generators have found wide application in computer-aided design systems. Simulators-analyzers allow to simulate these devices in accordance with the technical design for their design and measure the parameters of its loads in the real operating conditions of this device in the amplifying and autogenerating modes. Such an adequate measurement of the parameters of the transistor and the parameters of its loads for the design of amplifiers and self-excited generators makes it possible to increase the economic efficiency of the computer-aided design systems of these devices, since it eliminates the need for multiple correction of their prototype.

The proposed article is devoted to the solution of the problem of providing an automated specification of complex reflection coefficients of loads of a transistor with the help of tunable matching transformers of the simulator-analyzer in the simulator simulation of amplifiers and self-excited generators. After measurement, complex reflection coefficients are used for direct calculation and design of these devices, without using the parameters of the transistor.

To solve the automation problem, a mathematical model of a tunable matching transformer and a mathematical model of its calibration nave been developed that provide the possibility of automatically specifying the required parameters for reflecting the loads of the transistor in simulation of an amplifier and an autogenerator based on a preliminary approximate calculation of these parameters by the computer aided design system.

Key words: simulator-analyzer of microwave amplifiers and auto-generators, computer-aided design system, mathematical model of tunable matching transformer and mathematical model of its calibration, complex reflection coefficients of loads of the transistor, set by a reconfigurable matching transformer and automation of their assignment.

REFERENCE

1. Savel'kaev, S. V., Romas'ko, S. V., Litovchenko, V. A., & Zarzhetskaya, N. V. (2016). Theoretical basis for the design of simulator-analyzer active microwave circuits. *Vestnik SGUGiT [Vestnik SSUGT]*, 1(33), 175–188 [in Russian].

2. Savel'kaev, S. V., Romas'ko, S. V., Litovchenko, V. A., & Zarzhetskaya, N. V. (2017). Theoretical basis for the design of simulator-analyzer active microwave circuits. *Uspekhi sovremennoy radiotekhniki [Achievements of Modern Radioelectronics]*, 2, 50–61 [in Russian].

3. Savel'kaev, S. V., Romas'ko, S. V., Litovchenko, V. A., & Zarzhetskaya, N. V. (2017). Theoretical basis for the design of simulator-analyzer active microwave circuits. *Radioelektronika. [Radio Engineering]*, 1, 63–74 [in Russian].

4. Savel'kaev, S. V., & Zarzhetskaya, N. V. (2016). Calculation and design of self-excitation microwave devices in the S-parameters space. *Radioelektronika [Radio Engineering]*, 1, 41–53 [in Russian].

5. Etkin, V. S. (Ed.). (1975). *Poluprovodnikovye vkhodnye ustroystva SVCh: T. 1 [Semiconductor Microwave Input Devices: Vol. 1]*. Moscow: Sov. Radio Publ. [in Russian].

6. Savel'kaev, S. V., Romas'ko, S. V., & Litovchenko, V. A. (2017). Mathematical model of the imitator of analyzer of amplifiers and autogenerators microwave. In *Sbornik materialov Interjekspo GEO-Sibir'-2017*: *Nacional'noy konferencii: T. 2. Nauka. Oborona. Bezopasnost'-2017 [Proceedings of Interexpo GEO-Siberia-2017: National Conference: Vol. 2. Science. Defense. Security-2017]* (pp. 131–137). Novosibirsk: SSUGT Publ. [in Russian].

7. Savel'kaev, S. V., Ayrapetyan. V. S, & Litovchenko, V. A. (2014). Calculation autogenerators microwave in space S-parameters. In *Sbornik materialov Interekspo GEO-Sibir'-2014: Mezhdunarodnoy nauchnoy konferentsii: T. 2. SibOptika-2014 [Proceedings of Interexpo GEO-Siberia-2014: International Scientific Conference: Vol. 2. SibOptica-2014]* (pp. 164–171). Novosibirsk: SSGA Publ. [in Russian].

8. Litovchenko, V. A. (2015). Techniques for analysing active shf-circuits stability and their S-parameters measurement. *Vestnik SGUGiT [Vestnik SGUGT]*, 1(29), 90–100 [in Russian]

9. Savel'kaev, S. V., Ayrapetyan, V. S, & Litovchenko, V. A. (2015). Three sectional drift-diffusion mathematical model of the field effect transistor with a Schottky barrier. *Vestnik NGU. Seriya: Fizika [Bulletin of NSU. Series: Solid State Physics, Semiconductor Nanostructures]*, 10, 57–62 [in Russian].

10. Savel'kaev, S. V., & Litovchenko. V. A. (2015). A method for calibrating a stripe contact devices. In *Sbornik materialov Interekspo GEO-Sibir'-2015: Mezhdunarodnoy nauchnoy konferentsii: T. 3. SibOptika [Proceedings of Interexpo GEO-Siberia-2015: International Scientific Conference: Vol. 3. SibOptics]* (pp. 36-41). Novosibirsk: SSUGT Publ. [in Russian].

11. Savel'kaev, S. V., & Litovchenko, V. A. (2016). Method of calculation of the microwave oscillator in the space of S-parameters. *Elektromagnitnye volny i jelektronnye sistemy [Radio engineering. Journal of Electromagnetic Waves and Electronic Systems]*, 8, 36–46 [in Russian].

12. Savel'kaev, S. V., Romas'ko, S. V., Litovchenko, V. A., & Zarzhetskaya, N. V. (2016). Stability analysis method of active microwave circuits. In *Sbornik materialov Interekspo GEO-Sibir'-2016: Mezhdunarodnoy nauchnoy konferentsii: T. 1. SibOptika [Proceedings of Interexpo GEO-Siberia-2016: International Scientific Conference: Vol. 1. SibOptics]* (pp. 224–228). Novosibirsk: SSUGT Publ. [in Russian].

13. Vladimirova, S. V., & Pal'chun, Ju. A. (2012). Analysis of high-precision methods for measuring reflection parameters in coaxial paths. *Vestnik TGTU [Vestnik TGTU]*, 18, 856–862 [in Russian].

14. Vladimirova, S. V., Pal'chun, Ju. A., & Kolpakov, A. V. (2010). Use the interpolations and extrapolations functions for definition calibration interval for coaxial load In *Sbornik materialov Interekspo GEO-Sibir'-2010: Mezhdunarodnoy nauchnoy konferentsii: T. 5. SibOptika [Interexpo GEO-Siberia-2010: International Scientific Conference: Vol. 5. SibOptics]* (pp. 127-129). Novosibirsk: SSGA Publ. [in Russian].

15. Vladimirova, S. V., Pal'chun, Ju. A., & Kolpakov, A. V. (2011). Algorithmic methods of definition of function of the amendment at measurement of parameters of reflection. In *Sbornik materialov Interekspo GEO-Sibir'-2011: Mezhdunarodnoy nauchnoy konferentsii: T. 5. SibOptika [Interexpo GEO-Siberia-2011: International Scientific Conference: Vol. 5. SibOptics]* (pp. 261–263). Novosibirsk: SSGA Publ. [in Russian].

16. Romas'ko, S. V. (2015) Technique of determination of coefficients of interpolation and extrapolation of the microwave oven of measures of easing for reflection coefficient module. In *Sbornik materialov Interekspo GEO-Sibir'-2015: Mezhdunarodnoy nauchnoy konferentsii: T. 3. SibOptika [Interexpo GEO-Siberia-2015: International Scientific Conference: Vol. 3. SibOptics]* (pp. 50–52). Novosibirsk: SSUGT Publ. [in Russian].

Received 12.01.2018

SOILS OF ARCTIC TUNDRA'S LANDSCAPES: BACKGROUND STATE UNDER CURRENT AND PRECEDING ECONOMIC DEVELOPMENT (BY THE EXAMPLE OF WESTERN COAST OF NOVAYA ZEMLYA ARCHIPELAGO'S YUZHNUI ISLAND)

Irina A. Kuznetsova
N. Laverov Federal Center for Integrated Arctic Research, 163000, Russia, Arkhangelsk, 23 Severnoy Dvinu Emb., Ph. D., Senior Researcher, phone: (8182)28-76-96, e-mail: kia.iepn@gmail.com

Vidas V. Kriauchiunas
N. Laverov Federal Center for Integrated Arctic Research, 163000, Russia, Arkhangelsk, 23 Severnoy Dvinu Emb., Ph. D., Leading Researcher, phone: (8182)28-76-96, e-mail: vidas76@mail.ru

Nikolay S. Larionov
N. Laverov Federal Center for Integrated Arctic Research, 163000, Russia, Arkhangelsk, 23 Severnoy Dvinu Emb., Ph. D., Head of the Laboratory, phone: (8182)28-76-96, e-mail: nikolay.larionov@fciarctic.ru

Dariya D. Bedrina
N. Laverov Federal Center for Integrated Arctic Research, 163000, Russia, Arkhangelsk, 23 Severnoy Dvinu Emb., Research Assistant, phone: (8182)28-76-96, e-mail: bambba@mail.ru

Being essential for establishing concentrations of elements in soils and indicating major factors of soils' development within Novaya Zemlya archipelago, special conditions for soil buildup are based on a unique geographical position and landscape, as well as on the start of construction of mining and processing plant at the archipalago. While trying to study those, one should take into account planned, current and preceding anthropogenic activities within the territory. The aim of the present paper is to study the geochemical peculiarities of the microelements' distribution within arctic tundra soils of the western coast of Novaya Zemlya archipelago's Yuzhnui island. The result of the study is the evaluation of background concentration of elements in the soils: Cr – 48,5 mg/kg, Ni – 33,3 mg/kg, Pb – 7,5 mg/kg, Cu – 14,3 mg/kg, Zn – 38,9 mg/kg, Cd – 0,1 mg/kg.

Based on the presented data, territories of high concentrations of elements are indicated. The source of the elements flow is ongoing activities and the ones in the past. Furthermore, it's revealed that anomaly concentrations within topographic lows may happen due to the natural flow of elements to geochemically affluent landscapes. Presented study fills up the data on soil composition of Yuzhnui island and forms the database, needed for a development of specific regional threshold concentrations of elements in the soils.

Key words: Novaya Zemlya archipelago, heavy metals, geochemical landscapes, arctic tundra soils, background concentrations, anthropogenic pollution, migration of elements.

REFERENCES

1. Usacheva, A. A., Semenkov, I. N., Miroshnikov, A. Yu., Krupskaya, V. V., & Zakusin, S. V. (2016). Geochemical features of Arctic tundra landscapes of the Novaya Zemlya eastern coast. *Vestnik Moskovskogo Universiteta: S. 5, Geografiya [Bulletin of Moscow University: S. 5, Geography]*, 6, 87–95 [in Russian].

2. P. V. Boyarskiy (Ed.). (1998). *Novaya Zemlya: Priroda. Istoriya. Arheologiya. Kultura&: Kn. 1, Priroda [Novaya Zemlya: Nature. History. Archeology. Culture: B. 1, Nature]*. Moscow [in Russian].

3. Larionov, N. S., Kriauchunas, V. V., Iglovskiy, S. A., Gorbova, N. S., Kuznetsova, I. A., Lyubas, A. A., Skyutte, N. G., Romanis, T. V., & Bedrina D. D. (2016). *Evolyutsiya ostrovnyih i materikovyih territoriy Evropeyskogo sektora Arktiki pod vliyaniem prirodnyih i antropogennyih faktorov [Evolution of the island and continental territories of the European Arctic sector under the influence of natural and anthropogenic factors]*. Arkhangelsk [in Russian].

4. Evseev, A. V. (1982). Arctic tundra soils of Aion island. Eurasian Soil Science. *Pochvovedenie [Eurasian Soil Science]*, 1, 31–38 [in Russian].

5. Pechurov, L. V. (1983). *Spitsbergen*. Moskow: Myisl Publ. [in Russian].

6. Petriga, A. A., & Goryunova, N. V. (2016). Composition of snow in impact regions of the Arctic using the example of the Isfjord Gulf communities of the Spitsbergen archipelago. *Vestnik nauki i obrazovaniya [Bulletin of Science and Education]*, *2*(14), 106–110 [in Russian].

7. Demeshkin, A. S. (2015). Geoekologicheskaya otsenka sostoyaniya prirodnoy sredyi v rayone raspolozheniya rossiyskogo ugledobyivayuschego rudnika Barentsburg na arhipelage Shpitsbergen [Geoecological assessment of the state of the natural environment in the area of the location of the Russian coal mining Barentsburg mine in the Svalbard archipelago]. *Candidat's thesis*. St. Petersburg [in Russian].

8. S.V. Maslov (Ed.). (2016). *Sostoyanie i ohrana okruzhayushchej sredy Arkhangelskoj oblasti za 2015 god [The state and environmental protection in Arkhangelsk region in 2015]*. Arkhangelsk [in Russian].

9. Zharnikov, V. B., Nikolaeva, O. N., Safonov, V. V. (2013). Technogenic transformation of land and its indicators for monitoring. *Vestnik SGGA [Vestnik SSGA]*, 2(22), 36–43 [in Russian].

10. Stille, P., Pourcelot, L., Granet, M., Pierret, M.-C., Guéguen, F., Perrone, Th., Morvan, G., & Chabaux, F. (2011). Deposition and migration of atmospheric Pb in soils from a forested silicate catchment today and in the past (Strengbach case): Evidence from 210Pb activities and Pb isotope ratios. *Chemical Geology, 289*, 140–153.

11. Wuana, R. A. & Okieimen, F. E. (2011). Heavy metals in contaminated soils: a review of sources, chemistry, risks and best available strategies for remediation. *IISRN Ecology, 2011*, 1–20.

12. Evseev, A. V. & Krasovskaya, T. M. (2017). Toxic metals in soils of the Russian North. *Journal of Geochemical Exploration, 174*, 128–131.

13. Beznosikov, V. A., Lodygin, E. D., & Kondratenok, B. M. (2007). Assessment of background concentrations of heavy metals in soils of the northeastern part of European Russia. *Pochvovedenie [Eurasian Soil Science]*, *9*, 1064–1070 [in Russian].

14. Chernova, O. V. & Beketskaya, O. V. (2011). Permissible and background concentrations of pollutants in environmental regulation (heavy metals and other chemical elements). *Pochvovedenie [Eurasian Soil Science]*, 9, 1102–1113 [in Russian].

15. Song, L., Jian, J., Tan, D.-J., Xie, H.-B. , Luo, Z.-F., & Gao, B. (2015) Estimate of heavy metals in soil and streams using combined geochemistry and field spectroscopy in Wan-sheng mining area, Chongqing, China. *International Journal of Applied Earth Observation and Geoinformation, 34*, 1–9.

16. M-02-902-157-10. (2010). *Method for measuring the mass fraction of the elements Al, As, B, Ba, Be, Bi, Cd, Co, Cr, Ca, Cu, Fe, Hg, Li, K, Mg, Mn, Mo, Na, Ni. P, Pb, S, Sb, Sn, Sr, Ti, V, Zn, Zr in prepared samples of soils using atomic-emission spectrometry with inductively coupled plasma using an ICPE-9000 spectrometer*. Moskow: GICI SI FGUP "VNIIM" Publ. [in Russian].

17. Krupskaya, V. V., Miroshnikov, A. Yu., Dorzhieva, O. V., Zakusin, S. V., Semenkov, I. N., & Usacheva, A. A. (2017). Mineral composition of soils and bottom sediments of the bays of the Novaya Zemlya Archipelago. *Okeanologiya [Oceanology]*, *57*(1), 238–245 [in Russian].

18. Laverov, N. P., Velichkin, V. I., Miroshnikov, A. Yu., Krupskaya, V. V., Asadulin, N. E., Semenkov, I. N., Usacheva, A. A., Zakusin, S. V. & Terskaya, E. V. (2016). Geochemical structure

and radiation state of coastal landscapes of the Kara Sea Gulfs of Novaya Zemlya. *Doklady Akademii nauk [Reports of the Academy of Sciences]*, *467*(3), 342–346 [in Russian].

19. Greenwood, N. N., & Ernsho, A. (2008). *Himiya elementov: T. 2 [Chemistry of elements: Vol. 2]*. Moscow: Binom Publ. [in Russian].

20. Kryauchyunas, V. V., Iglovsky, S. A., Shakhova, E. V., & Malkov, A. V. (2014). Heavy metals in the arctic soils of the western coast of Svalbard archipelago. *Ekologiya cheloveka [Human Ecology]*, 9, 11–12 [in Russian].

21. *Kosmofotograficheskoe kartirovanie masshtaba 1 : 500 000 ostrovov Vaygach i Novaya Zemlya: otchet partii №4 o rabotah, provedennyih v 1984–1987 gg.: Kniga 1 [Cosmphotographic mapping of the scale of 1 : 500 000 islands of Vaigach and Novaya Zemlya: a report of the party number 4 on the work carried out in 1984–1987: Book 1]*. (1988). Moscow: MOMKAGE. Aerogeology [in Russian].

22. Kuznetsov, A. E., & Gradova, N. B. (2006). *Nauchnyie osnovyi ekobiotehnologii [Scientific basis of ecobiotechnology]*. Moscow: Mir Publ. [in Russian].

23. Rodinkov, O. V., Bokach, N. A., & Bulatov, A. V. (2010). *Osnovyi metrologii fiziko-himicheskih izmereniy i himicheskogo analiza [Basics of metrology of physical and chemical measurements and chemical analysis]*. St. Petersburg: VVM Publ. [in Russian].

24. Ilyin, V. B. (1974). *Biogeohimiya i agrohimiya mikroelementov v yuzhnoy chaste Zapadnoy Sibiri [Biogeochemistry and agrochemistry of microelements in the southern part of Western Siberia]*. Novosibirsk: Nauka Publ. [in Russian].

25. Motuzova, G. V. (2001). *Pochvenno-himicheskiy ekologicheskiy monitoring [Soil-chemical ecological monitoring]*. Moscow: Moscow University Publ. [in Russian].

26. Kuznetsova, I. A., Bogolytsyn, K. G., Larionov, N. S., Boytsova, T. A., Palamarchuk, I. A., & Aksenov, A. S. (2012). Investigation of the sorption properties of humic acids with respect to Cd (II) and Pb (II). *Izvestiya vysshih uchebnyh zavedenij. Lesnoj zhurnal [News of Higher Educational Institutions. Forest Journal]*, 1, 146–150 [in Russian].

27. Kuznetsova, I., Bogolitsyn, K., Larionov, N., Boytsova, T., Palamarchuk, I., & Aksenov, A. (2014). Structure and physical-chemical properties of humic asids of oligotrophic peat bog of Arkhangelsk region. *Ekologia Bratislava*, *33*(1), 1–8.

28. Bondaletova, L. I., Novikov, V. T., & Alekseev, N. A. (2000). *Raschet vyibrosov zagryaznyayuschih veschestv pri szhiganii topliva v kotloagregatah kotelnyih [Calculation of emissions of pollutants during fuel combustion in boilers of boiler houses]*. Tomsk: TPU Publ. [in Russian].

Received 08.11.2017

SEARCH CRITERIA AND PROSPECTS OF USING UNDERGROUND WATER OF THE MIDDLE-VERNHEDEVON WATERFILL COMPLEX FOR MAINTENANCE OF THE ECONOMIC-DRINKING WATER SUPPLY OF THE CITY OF LIPETSK

Alena V. Yermienko
Moscow Hydrometeorological Technical School, 143980, Russia, Moscow Region, Balashikha, Kucino Microdistrict, 3 Gidrogorodok St., Ph. D., Teacher, Department of Ecology, phone: (904)289-61-22, e-mail: Alena18er@bk.ru

Aida A. Kalieva
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Associate Professor, Department of Ecology and Environmental Management, phone: (913)453-07-80, e-mail: Kalieva_aida@mail.ru

Arslanbek T. Baishuakov
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Student, phone: (923)241-06-23, e-mail: arslan.bayschuaov@mail.ru

The economic and drinking water supply of the population of Lipetsk is based on the use of fresh underground waters in the southern part of the Moscow Artesian Basin. Underground waters of the region are a hydrodynamic structure, with prevailing multiply realized infiltration water exchange to a depth of 200–250 m from the surface. In the hydrogeological structure of the territory of the Lipetsk region, the Neogene-Quaternary and Upper Devonian aquifer complexes are taking part, consisting of the Upper-Famensk (Lebedyansko-Danukovsky), Zadonsko-Yelets and Evlanovsko-Livenskii aquifers. It is shown that the existing ideas about the high "self-cleaning" ability of groundwater during filtration from chemical contamination are not sufficiently substantiated, many chemical compounds of mineral and organic substances are stable, not decomposing, not oxidizing and not precipitating; At the same time, they are not sorbed or sorbed to a small extent by particles of filtering rocks, and the intensive exploitation of groundwater also contributes to pollution, since zones of increased filtration rates are formed near the water intakes and pollutants enter them in the first place. In the conditions of constantly increasing technogenic load, the task is to find new sources of water supply, protected from surface pollution. Two main search criteria are proposed: valleys of large rivers in the presence of tectonic disturbances stretched along the rear seams of the left-bank part of the first and second above-floodplain terraces in the areas of levitation of alluvial terraces to the fluvioglacial ridge, and over-depleted parts of Neogene paleolines under conditions of their development in zones of linear tectonic disturbances. It is recommended to organize prospecting works to identify new groundwater deposits for water supply and other regions in similar geological and hydrogeological conditions.

Key words: groundwater, domestic and drinking water supply, hydrodynamic structure, groundwater infiltration, water exchange, aquifer complex, man-caused load, chemical pollution, water content, mining and hydrogeological conditions.

REFERENCES

1. Nadtochii, V. S. (2017). Evaluation of Dynamics of Water Use of Subjects of Western Siberia. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(3), 215−227 [in Russian].
2. Boyko, S. M., Konstantinov, V. M. et al. (2007). *O sostoyanii i ispol'zovanii vodnykh resursov na territorii Lipetskoy oblasti v 2006 godu [On the state and use of water resources in the territory of the Lipetsk region in 2006]*. Lipetsk: Don Basin Water Authority, Department of Water Resources in the Lipetsk Region [in Russian].
3. Bocharov, V. L. (2010). Problems of study and use of underground drinking water resources in the Voronezh Region. *Vestnik VKGU. Seriya: Geologiya [Proceedings of Voronezh State University. Series: Geology]*, 1, 243−251 [in Russian].
4. Dyunin, V. I. (2001). *Otchet o rezul'tatakh izucheniya zagryazneniya nitratami podzemnykh vod na vodozaborakh g. Lipetska, raschet zon sanitarnoy okhrany i razrabotka rekomendatsiy po likvidatsii nitratnogo zagryazneniya [Report on the results of the study of groundwater contamination with nitrates in water intakes of Lipetsk, calculation of sanitary protection zones area and development of recommendations for nitrates impact elimination]*. Lipetsk: Lipetsk Branch of the Federal State Unitary Enterprise "Geinfoteka" [in Russian].
5. Prudovsky, E. L. (2006). Vyyavlenie prichin i istochnikov zagryazneniya podzemnykh vod v Lipetskoy oblasti [Identification of reasons and sources of groundwater pollution in the Lipetsk region]. Lipetsk: Lipetsk Branch of the Federal State University TFI [in Russian].
6. Kremneva, I. P, & Kossinova, I. I (2009). Ecological and hydrogeochemical characteristics of groundwater in the Lipetsk region. *Vestnik Moskovskogo gosudarstvennogo oblastnogo universiteta. Seriya: Estestvennye nauki [Bulletin MRSU. Series: Natural Sciences]*, 3, 113−119 [in Russian].

7. Kossinova, I. I., Sigora, G. A., Nikchkova, L. A., Dobrovolskaya, E. V., & Simonova, E. S. (2016). Monitoring of nitrate ions contamination of groundwater of Sevastopol and Bakhchisarai cities. *Vestnik VKGU. Seriya: Geologiya [Proceedings of Voronezh State University. Series: Geology]*, 3, 123−127 [in Russian].

8. Ermienko, A. V. (2007). *Ekologicheskaya ekspertiza i otsenka vozdeystviya na okruzhayushchuyu sredu (Na primere stroitel'stva Pavlodarskogo elektroliznogo zavoda) [Environmental expertise and environmental impact assessment (Case study of Pavlodar Electrolysis Plant construction)]*. Pavlodar [in Russian].

9. Bazarsky, O. V, & Kossinova, I. I. (2005). Uniform metric of a complex environmetal-geological range. *Vestnik VKGU. Seriya: Geologiya [Proceedings of Voronezh State University. Series: Geology]*, 2, 168−172 [in Russian].

10. Bocharov, V. L., Vershinina, Yu. E., & Strogonova, L. N. (2014). Characteristics of underground waters anthropogenic metamorphisation of the Mikhailovsky mining region (Kursk region). *Vestnik VKGU. Seriya: Geologiya [Proceedings of Voronezh State University. Series: Geology]*, 4, 85−92 [in Russian].

11. Abdrakhmanov, R. F., & Popov, V. G. (2017) Ground waters of the Neogene valleys of the Paleo-Belaya system in the Southern Cis-Urals. *Geoekologiya [Geoecology]*, 6, 30–40 [in Russian].

12. Bocharov, V. L, Babkina, O. A, Deshevikh, G. Yu., Stroganova, L. N, Ustimenko, Yu. A. (2017). Hydrogeological conditions of the Novokhopersky nickel-bearing region. Article 2. Mesozoic and Cenozoic. *Vestnik VKGU. Seriya: Geologiya [Proceedings of Voronezh State University. Series: Geology]*, 1, 135−145 [in Russian].

13. Lekhov, V. A, & Sokolov, V. N. (2017). Experimental calculation of filtration and diffusion coefficients in poorly permeable deposits. *Geoekologiya [Geoecology]*, 3, 67−84 [in Russian].

14. Ermienko, A. V., & Kaliyeva, A. A. (2016). Environmental impact and assessment of groundwater potential of the Middle-Upper Devonian aquifer complex for sustainable water supply in Lipetsk. *Mezhdunarodnyy zhurnal gumanitarnykh i estestvennykh nauk [International Journal of Humanitarian and Natural Sciences]*, 3(1) 174−178 [in Russian].

15. Mazurov, B. T. (2016). Geodynamic system (kinematic and deformation model of block movements). *Vestnik SGUGiT [Vestnik SSUGT]*, 3(35), 5−15 [in Russian].

16. Viktorov, A. S, & Sadkov, S. A. (2014). The use of probability models in the study of exogenous geological processes. *Geoekologiya [Geoecology]*, 3, 58–65 [in Russian].

Received 16.01.2018

METHODOLOGY OF SCIENTIFIC AND EDUCATIONAL ACTIVITY

APPLICATION OF PROGRAM PRODUCTS «AUTODESK» IN TEACHING STUDENTS WITH THE «LAND MANAGEMENT AND CADASTRE» PROGRAM

Lyubov A. Maximenko
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Associate Professor, Department of Geomatics and Real Estate Infrastructures, phone: (383)361-07-09, e-mail: maksimenko_la@mail.ru

Elena A. Tanygina
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Senior Lecturer, Department of Geomatics and Real Estate Infrastructures, phone: (383)361-07-09, e-mail: yel_tan@mail.ru

Victor A. Kalugin
Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Head of the Department of Geomatics and Real Estate Infrastructures, phone: (383)361-07-09, e-mail: kaluzhin@mail.ru

The effectiveness of the cadastral engineer is largely determined by his abilities and skills in various software environments. As a study of the characteristics of the selected software company Autodesk, as the most acceptable for many applications in the land management and inventories.

Based on Autodesk products proposed integration of the disciplines «Computer graphics» and «Applied Informatics» discipline «Information modeling» that are related to training students in the field of «Land management and cadastres». Software Autodesk allows to consider the dimension and representation of the information model intelligent 2D schematics, master plans, geographic information systems; engineering 3D models; digital terrain models; spherical panorama; 4D – the integration of engineering models with the schedule of manufacture of works, 5D – data integration about the procurement and supply; 6D – integration with data on the cost of resources, etc.

It is shown that the understanding of the capabilities of the software environments and modern technologies will allow future professionals to effectively engage in common information environment of digital simulation and support of the life cycle of the property.

Key words: cadastral activity, educational process, Autodesk, AutoCAD, AutoCAD Civil 3D, abilities, skills, tasks, integration, Geomatics, information modeling.

REFERENCES

1. Order of the Ministry of education and science of the Russian Federation No. 1084 of October 01, 2015. *About approval of Federal state educational standard of higher education in the direction of training 21.03.02 Land management and cadastre (bachelor level)* (Registered in Ministry of justice of the RF No. 39407 of October 21, 2015). Retrieved from ConsultantPlus online database [in Russian].

2. Avrunev, E. I. & Trukhanov, E. A. (2015). Improvement of the educational space of University for solving of topical tasks of the cadastral activity, the GKN management and registration of rights to real estate. In *Sbornik materialov Mezhdunarodnoy nauchno-metodicheskoy konferentsii: Ch. 2. Aktual'nye voprosy obrazovaniia. Vedushchaya rol' sovremennogo universiteta v tekhnologicheskoy i kadastrovoy modernizatsii rossiyskoy ekonomiki [Proceedings of International Scientific and Practical Conference: Part 2. Topical Issues of Education. The Leading Role of the Modern University in the Technology and Cadastre Modernization of the Russian Economy]* (pp. 3–8). Novosibirsk: SSUGT Publ. [in Russian].

3. *Official site of company AUTODESK*. (n. d.). Retrived from http://www.autodesk.ru.

4. Gavrilyuk, L. E. (2011). A model of formation of professional readiness of students of technical universities in the process of learning geometric-graphic disciplines (on the example of specialty "Land management and cadastres"). *Izvestiya PGPU imeni V. G. Belinskogo [News of PSPU named after V. G. Belinsky]*, 26, 439–445 [in Russian].

5. Maksimenko, L. A. (2014). On the preparation of technical plans of real estate objects. In *Sbornik materialov Interekspo GEO-Sibir'-2014: Mezhdunarodnoy nauchnoy konferentsii: T. 1. Ekonomicheskoe razvitie Sibiri i Dal'nego Vostoka. Ekonomika prirodopol'zovaniia, zemleustroistvo, lesoustroistvo, upravlenii e nedvizhimost'iu [Proceedings of Interexpo GEO-Siberia-2014: International Scientific Conference: Vol. 1. Economic Development of Siberia and*

the Far East. Enviromental Economics, Land Management, Forestry Management and Property Management] (pp. 192–198). Novosibirsk: SSGA Publ. [in Russian].

6. Ilinykh, A. L. (2016). Analysis of the use of the software product Autodesk InfraWorks for the formation of three-dimensional objects of real estate. In *Sbornik trudov Mezhdunarodnogo simpoziuma imeni akademika M. A. Usova studentov i molodykh uchenykh, posvyashchennyy 120-letiyu so dnya osnovaniya Tomskogo politekhnicheskogo universiteta: T. I. Problemy geologii i osvoeniya nedr [Proceedings of the XX International Symposium Academician M. A. Usova Students and Young Scientists, Dedicated to the 120th Anniversary of the Founding of Tomsk Polytechnic University: Vol. I. Problems of Geology and Mineral Exploration]* (pp. 746–748). Tomsk: Tomsk Polytechnic University Publ. [in Russian].

7. Yusupova, A., & Erzin, E. (2014). Rapid prototyping of infrastructure models with Autodesk InfraWorks. *SAPR i grafika [CAD and Graphics]*, 3, 13–17 [in Russian].

8. Maksimenko, L. A. (2017). *Tipologiya ob"ektov nedvizhimosti. Podgotovka planov zdaniy v graficheskom redaktore AutoCAD [Typology of real estate objects. Preparation of building plans in the graphic editor AutoCAD]*. Novosibirsk: SSUGT Publ. [in Russian].

9. Order of Ministry of economic development No. 953 of 18 December 2015. *On approval of the form of the technical plan and requirements to its preparation, the composition of contained information and Declaration form about the property and requirements for its preparation, composition of the contained information*. Retrieved from ConsultantPlus online database [in Russian].

10. Maksimenko, L. A., & Kalugin, V. A. (2001). Analysis of the conditions of creation of an engineering cadastre and monitoring of buildings and structures. *Vestnik SGGA [Vestnik SSGA]*, 6, 76–80 [in Russian].

11. Gavrilenko, E. A. (2015). The Essence of the concept "real estate" and their classification in teaching the disciplines of cadastral profile. In *Sbornik materialov Mezhdunarodnoy nauchno-metodicheskoy konferentsii: Aktual'nye voprosy obrazovaniia. Vedushchaya rol' sovremennogo universiteta v tekhnologicheskoy i kadastrovoy modernizatsii rossiyskoy ekonomiki [Proceedings of International Scientific and Practical Conference: Topical Issues of Education. The Leading Role of the Modern University in the Technology and Cadastre Modernization of the Russian Economy]* (pp. 11–17). Novosibirsk: SSUGT Publ. [in Russian].

12. Eastman, C., Teicholz, P., Sacks, R., & Liston, K. (2011). *BIM Handbook* (2 ed.). N. Y.: Wiley.

13. Krisel, E., & Niec, B. (2008). *Green BIM: Successful sustainable design with building information modeling*. N. Y.: Wiley.

14. Talapov, V. V. (2015). *Tekhnologiya BIM: sut' i osnovy vnedreniya informatsionnogo modelirovaniya zdaniy [BIM: the essence and the basics of implementing building information modeling]*. Moscow: DMK-press [in Russian].

15. Resolution II interdisciplinary information technology forum "RUSSIA MULTIDIMENSIONAL" Information modeling of industrial facilities. Information modeling of industrial facilities. (2016). *SAPR i grafika [CAD and Graphics]*, 6, 15–17 [in Russian].

Received 18.01.2018

SLAVIC «TRACE» IN THE LIFE OF THE GREAT GERMAN COMPOSER OR ABOUT THE «MORAL BELIEF» OF V. F. ODOEVSKY

Natalia A. Zhdanova

Siberian State University of Geosystems and Technologies, 630108, Russia, Novosibirsk, 10 Plakhotnogo St., Ph. D., Associate Professor, Department of Language Training and Intercultural Communications, phone: (383)343-29-33, e-mail: kluft@mail.ru

Basing on historical-literary and philosophical materials the author tries to explain the assurance of the Russian writer and musicologist V. F. Odoyevsky in the Slavic origins of the great German composer Sebastian Bach. Thus, this idea of the writer can be considered from the imagological viewpoint and it gets one of the essential elements of his short novel "Sebastian Bach". The main character in this context should be interpreted as an image of "Alien" that becomes "Own̓ influenced by the society. This viewpoint of V. F. Odoyevsky, connected with his philosophical conception of the "instinctual power̓, explains the tragic final of the story in a new light and also adds specific connotations to the philosophical intention of the novel "Russian Nights" which includes the above-mentioned story.

Key words: imagology, Russian literature of the XIX century, national character, image of a compser, German, Slavic, West, national idea.

REFERENCES

1. Papilova, E. V. (2011). Imagology as a humanitarian subject. *Vestnik Moskovskogo gosudarstvennogo gumanitarnogo universiteta im. M. A. Sholohova. Filologicheskie nauki [Vestnik of Sholokhov Moscow State University for the Humanities: PHILOLOGY Series]*, 4, 31–40 [in Russian].

2. Lebedeva, O. B., & Januškevič, A. S. (2014). *Obrazy Neapolya v russkoy slovesnosti XVIII – pervoy poloviny XIX vekov [Images of Naples in the Russian literature of the XVIII – early XIX centuries]*. M. Capaldo, & A. D'amelia (Ed.). Salerno [in Russian].

3. Mednis, N. E. (1999). *Veneciya v russkoy literature [Venice in the Russian literature]*. Novosibirsk: NSU Publ. [in Russian].

4. Zhdanov, S. S. (2015). Germanness as an implementation of order in the Russian literature: from N. V. Gogol to S. Chorny. *Vestnik SGUGiT [Vestnik SSUGT]*, 2(30), 151–163 [in Russian].

5. Satyukova, E. G. (2012). Fenomen "angliyskost" v tvorchestve G. Svifta [Phenomenon of the "Englishness" in J. Swift's works]. *Extended abstract of candidate's thesis*.Yekaterinburg [in Russian].

6. Turyanб M. A. (1991). "*Strannaya moya sud'ba…" O zhizni V. F. Odoevskogo [My strange fate: About V. F. Odoevsky's life]*. Moscow: Kniga Publ. [in Russian].

7. Odoyevsky, V. F. (1981). *Sochineniya: T. 1, Russkie nochi. Stat'i [Works: Vol. 1, Russian nights. Articles]*. Moscow: Hudozhestvennaja literatura Publ. [in Russian].

8. Granovskiy, B. (1952). Notes on Vl. Odoyevsky. *Sovetskaja muzyka [Soviet Music]*, 9, 44–50 [in Russian].

9. Paul, A. (2014). Slavs in the Central Germany. *Rusin [Rusin]*, 1(35), 6–16 [in Russian].

10. *Istoriya Luneburga [History of Lüneburg]*. (n. d.). Retrieved from http://www.cult-turist.ru/country/germany/niedersachsen/lueneburg/history/?q=1169&dp=hstr [in Russian].

11. Zhdanov, S. S. (2015). Russian chaos versus German order as a continuation of the Russian literature traditions in Sasha Chorny's stories. *Vestnik SGUGiT [Vestnik SSUGT]*, 1(29), 149–157 [in Russian].

12. Papilova, E. V. (2013). Hudozhestvennaya imagologiya: nemcy glazami russkih (na materiale literatury 19 v.) [Literary imagology: Germans rom the Russians' viewpoint (based on the literary materials of the 19 century). *Extended abstract of candidate's thesis*. Moscow [in Russian].

13. Zenkovsky, V. V. (1991). *Istorija russkoj filosofii: T. 1, ch.1. "Archival young men": D. V. Venevitinov, V. F. Odoyevsky, P. Ya. Chaadaev [History of the Russian philosophy: Vol. 1. Part 1, "Archival Youths": D. V. Venevitinov, V. F. Odoevsky, P. Ya. Chaadaev]* (pp. 143–184). Leningrad: EGO Publ. [in Russian].

14. Lishaev, S. A. (2004). Lecture 4. Philosophical awakening. In *Istoriya russkoy filosofii: Ch. 1, S drevnejshih vremen do serediny XIX veka [History of the Russian philosophy: Part 1. From the ancient time to the middle of the XIX century]* (pp. 116–150). Samara: Samara Humanitarian Academy Publ. Retrieved from: http://www.phil63.ru/lektsiya-4-filosofskoe-probuzhdenie [in Russian].

15. Belov, M. V. (2012). "Slavic character": Russian essay writers, literary critics and travelers of the first half of the XIX century in search of "national spirit". *Dialog so vremenem [Dialog with the Time]*, 39, 124–147 [in Russian].

16. Belinsky, V. G. (1978). *Izbrannye stat'i [Collected works]*. Moscow: Detskaya literature Publ. [in Russian].

17. Milyugina, E. G. (1995). V. F. Odoevsky and Wackenroder. In *W.-H. Wackenroder i russkaya literatura pervoj treti XIX veka [W.-H. Wackenroder and the Russian literature of the early XIX century]* (pp. 37–58). Tver: TSU Publ. [in Russian].

18. Zhdanov, S. S. (2017). Russian-German "music" dialog of cultures in the works of V. F. Odoyevsky. *Filologicheskie nauki. Voprosy teorii i praktiki [Philological Sciences. Matters of Theory and Practice]*, 12-2 (78), 25–29 [in Russian].

19. Odoyevsky, V. F. (1956). *Muzykal'no-literaturnoe nasledie [Musical-literary legacy]*. Moscow: State Musical Publ. [in Russian].

20. Stupel', A. M. (1985). *V. F. Odoyevsky. 1804–1869 [V. F. Odoyevsky. 1804–1869]*. Leningrad: Muzyka Publ. [in Russian].

21. Kyuno, Ya. (2001). In Search of the Mystery of human psyche: V. F. Odoyevsky's Novel "Kosmorama". *Acta slavica iaponica*, *18*, 79–98 [in Russian].

22. Mann, Th. (1961). *Sobraniye sochuneniy: T. 10, Germaniya i nemtsy [Collected works: Vol. 10, Germany and Germans]* (pp. 303–326). Moscow: Goslitizdat [in Russian].

Received 22.12.2017