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THERMAL SPRINGS AND HEALTH TOURISM – THE ANALYSIS OF THE METEOROLOGICAL PARAMETERS

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Abstract: In the modern conditions of tourism development, thermal springs are widely presented as they perform recreational functions. Thermal springs are becoming popular tourist attractions in Russia, while their concentration on Russian territory is rather uneven. In comparison with other countries, where thermal springs play a leading role and represent a dynamically growing recreational and tourist segment, in Russia this segment is still an insignificant part of national tourism. In our research, we studied natural conditions of the territories where thermal springs are located, as well as their quality and convenience for people. We also analyzed the regime of meteorological parameters of the territories of thermal springs located in the Ural Federal District for the period 2015-2017. The analysis of the territory showed that the most comfortable climatic conditions are the characteristic of the southwestern part of the district, which comprises the thermal springs located in the Chelyabinsk region and Sverdlovsk region.

Keywords: thermal springs, meteorological parameters, recreation, the Urals, Russia

Introduction

Thermal springs in Russia are becoming the objects of intensive development of tourist and recreational spheres in domestic tourism. Their role in Russian national tourism is quite significant and is gradually growing because of the opening of new tourist objects, whose main activity is concentrated around the outdoor and indoor pools with the thermal water of different mineralization grade and content. In the conditions of internal tourism development, thermal springs are becoming the center of tourist attraction, especially in those regions where tourism development is connected with clustering technologies.

The Ural Federal District is located on the geographical border between Europe and Asia, mostly on the east side of the Ural Mountains. The Urals consist of several chains of low mountains (Mount Narodnaya is the highest peak: 1,895

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m), stretching in a meridian direction. The biggest part of district's territory is occupied by the vast West Siberian Plane, with a branching river network and rich deposits of groundwater. The rivers mostly belong to the Ob River, i.e. the basin of the Kara Sea, which is the part of the Arctic Ocean. The territory covers an area of 1,818,497 km^2 with more than 12.3 million inhabitants, territorially organized in four regions: Kurgan, Sverdlovsk, Tyumen and Chelyabinsk and two autonomous territories: Khanti-Mansi and Yamalo-Nenets (both located within the Tyumen Region/Oblast) (http://uralfo.gov.ru/). The administrative center of this area is the City of Yekaterinburg, the fourth-largest city in Russia.

In order to define the influence of thermal springs on internal tourism development, it is necessary to identify the potential of these objects and to estimate all factors influencing their recreational and tourist potential. One of the leading roles in assessment of natural conditions of thermal springs will belong to the meteorological parameters from 14 different stations in the region. Thermal springs in Russia are independent localities, which acquire the status of thermal resorts or belong to the system of SPA-centers. The analysis of the meteorological parameters of thermal springs is the base for the monitoring and assessment of thermal springs' potential in order to create national and regional touristic clusters and to define the development strategy for regional tourism based on thermal springs. In our research, we studied natural conditions of the territories where thermal springs are located, as well as their quality and convenience for people. We also analyzed the regime of meteorological parameters of the thermal springs' locations situated in Ural and Siberia. Those are the following regions: Tyumen (Tyumen, Tobolsk and Zavodoukovsk), Kurgan, Sverdlovsk (Turinsk, Rezh, Talitsa and Tavda) and Chelyabinsk (Etkul).

With the aim to assess the medical and biological characteristic of the regions with thermal springs located in Ural Federal District, the system assessment method is used implemented in complex geography. The base of this method is the assessment of each factor separately and integrated assessment of the degree of medical and biological influence of climate on the human body. The integral assessment of the environmental comfort of the climate for the territories with thermal springs does not allow taking into account all meteorological parameters because they are numerous. Therefore, it is necessary to select the most important of them and to identify main, determining, and secondary factors. For the analysis, the following parameters/regimes have been estimated in this study: thermal, ultraviolet, insolation (light), humidity, wind regime and the precipitation regime in the summertime and wintertime. The monitoring comprises the period from 2015 to 2017. As a result of the monitoring, we

defined the average monthly values of the analyzed parameters of the regions with thermal springs, located on the territory of the Ural Federal District. We also defined the values of parameters having recreational influence on the human body.

Theoretical background

Short overview

Tourism's health-related components for therapeutic purposes are not new, because people have used thermal and mineral waters for bathing and health reasons since the ancient times (Wigtman, 1985). The Ancient Greeks and Egyptians travelled for the therapeutic benefits of springs and baths (Snyder, Crooks, Johnston & Kingsbury, 2011) and during the Roman period, water was used for treatment, fitness and leisure (Goodrich, 1993; Didaskalou, Nastos & Matzarakis, 2004). Across Europe, the health benefits of spas were well-established in the 19th century and famous health resorts (e.g. Bath in the UK, Baden Baden in Germany, Vichy in France, etc.) were very popular destinations for wealthy travelers (Bender, Balint & Balint, 2002). Many cities or resorts in these countries, as well as the health facilities, have grown up around thermal springs. Tourists visit such resorts for rest and relaxation as well as for treatment of various ailments (Goodrich & Goodrich, 1987). Cockerell (1996) stated that there are two different market segments of health tourism sector: those visiting health resorts for primarily medical reasons and for purposes more closely aligned to traditional tourism motivations. This was conditioned by several current trends that are challenging the traditional concept of health resorts, based on medical cures and thermal springs. The new trends include the growing number of fitness enthusiasts, non-medical services and an increased interest in relaxation and beauty treatments (Lee, 2010).

In modern science, there are different approaches to the study of thermal springs. Recent studies have been conducted in order to assess microbiological and physical-chemical characteristics of thermal springs (Fazlzadeh, Sadeghi, Bagheri, Poureshg, & Rostami, 2016; Amin et al., 2017). Due to their health benefits, thermal springs are most often studied within the broad concept of health tourism (Wigtman, 1985; Goodrich, 1993, Borović & Marković, 2015; Jónás-Berki, Csapó, Pálfi, & Aubert, 2015; Yessengabylovaa, Bekbulatovaa, Suraganovaa, Bissekova, & Zhumanova, 2016; Clark-Kennedy & Cohen, 2017; Han, Lee & Ryu, 2018), or wellness tourism (Mueller & Kaufmann, 2001; Chen, Liu & Chang, 2013; Heung & Kucukusta, 2013) as non-medical subcategory of health tourism. Tourism service models for health travel involving thermal

springs have been developed in Europe and contain various attempts to integrate health care and tourism (Han et al., 2018). Analyzing this topic, certain authors use the expression "hot springs tourism sector" (Hsieh, Lin & Lin, 2008; Lee & King, 2008). Different authors put special emphasis on the study of climatic and bioclimatic conditions of the area of thermal springs (Didaskalou & Panagiotis, 2003; Didaskalou et al., 2004), in order to assess the impact on the development of health tourism and satisfaction of the visitors' needs. Although the earlier health tourism development was mainly stimulated by the demand of European consumers, over the last decades the influence of the Asian countries increased. Due to the quality and diversity of thermal springs, different Asian destinations have joined this increasingly lucrative market, and certain countries (e.g. Japan, Malaysia, Thailand, Singapore, etc.) have become major healthcare destinations (Lee & King, 2008; Jónás-Berki et al., 2015).

Water resources and thermal springs of the Ural Federal District

Water resources of the observed area comprise the river network of approximately 514,780 km (density of the river network is 0.28 km/km^2), natural and artificial lakes of approximately 377,970 km^2, swamps and wetlands of more than 400,000 km^2. Among Russian federal districts, the Ural Federal District is on the first place for the swampiness of its territories and on the third place for the quantity of lakes, after the Siberian and Northwest Federal Districts (http://water-rf.ru/Регионы_России/2200/Уральский_федеральный_округ).

Forecast groundwater resources in the observed area are 142,575,000 m^3 per day, which is equal to 16.38% of the total forecast groundwater resources of Russia. Most of the forecast resources is stored in the Khanti-Mansi Autonomous Okrug (94,657,000 m^3 per day or 66.39%), and the smallest amount is located in the Kurgan region (1,041,000 m^3 per day or less than 1%). The District is on the third place for forecast groundwater resources after the Siberian and Far East Federal Districts. The studied territory is characterized by very specific physical and geographical characteristics, which is presented in detail in Table 1.

The Sverdlovsk region is located in the middle and northern parts of the Ural Mountains and in the west part of the West Siberian plane. Subdued and lowland reliefs and forest landscapes dominate on the territory of the region. The river network of the region comprises 18,414 rivers (density of the river network is 0.07 km/km2). According to the Limnologic institute of the Russian Academy of Science, on the territory of the region there are more than 5,850 natural and artificial lakes, with the total area of approximately 1,350 km2. The forecast

groundwater resources of this region are 7,781,000 m3 per day (http://water-rf.ru/Регионы_России/2564/Свердловская_область).

Table 1. Physical-geographical conditions of Ural Federal District

Federal subject	Geograph. position	P (km^2)	Coordinates	Climate	Hydrology
Sverdlovsk Oblast	North, Middle Ural. Zauralsky Peneplain, Ufa Plateau	194,307	56°08'54.1"–61°56'14.8" N 56°51'58.1"-66°10'00.4" E	Continent.	18,414 rivers
Chelyabinsk Oblast	Middle and Southern Urals, Zauralsky Peneplain, West Siberian Lowland	88,529	51°59'43.6"–56°21'24.2" N 57°08'14.0"–63°20'27.7"E	Continent.	3,602 rivers
Kurgan Oblast	South Ural. West Siberian Plain	77,488	54°12'46.6"–56°50'19.8" N 62°02'57.8"–68°43'07.6" E	Continent.	449 rivers and streams,
Tyumen Oblast	North, Subpolar, Polar Ural. The southwestern part of the West Siberian lowland	160,122	55°10'27.8"–59°58'53.7" N 64°51'58.5"–75°10'33.8" E	Continent.	4,971 rivers and streams, 36000 lakes
Khanty-Mansi Autonomous Okrug (Yugra)	The Central part of the West Siberian lowland	534,801	58°36'13.3"–65°42'21.4" N 59°11'59.1"–85°58'23.4" E	Continent.	19,600 rivers, more than 600000 lakes
Yamalo-Nenets Autonomous Okrug	The Northern part of the West Siberian plain, the Eastern slopes of the Polar and Subpolar Ural	769,250	62°11'31.9"–73°30'55.8"N 62°00'58.6"–85°57'58.0"E	Arctic, Subarctic	1 million lakes, 50,000 rivers

Source: The Federal Water Resources Agency, 2017

Among the explored deposits of the mineral water of the region there are hydrocarbonate chloride, hydrocarbonate natrium and chloride natrium cold and thermal types of mineral water, as well as chloride sodium weak hydrosulfuric,

radon and ferruginous types of water. The most famous are "Nizhneserginskaya", "Obukhovskaya", and "Talitskaya" types of mineral water. Thermal springs near towns Rezh, Talitsa, Turinsk and Tavda are considered as important thermal recreational areas.

The Chelyabinsk region is situated in the Middle and South Ural. An improvised border between Europe and Asia passes mostly through the dividing range of the Ural Mountains. The river network of the region comprises 3,602 rivers (density of the river network is 0.2 km/km^2). In the region, there are more than 3,200 lakes, with the total area of approximately 2,600 km^2. Forecast groundwater resources of the Chelyabinsk region are 4,110,000 m^3 per day. The resort fund of the Chelyabinsk region includes 14 health resorts, such as Kisegach, Yelovoye, Sosnovaya gorka, Uvildy, Ural, Solnechniy, Dalnaya Dacha, Sungul', Yubileyniy and recreation centers Utes, Karagayskiy Bor and Turgoyak. In the Chelyabinsk region, there is highly active radon water of the Uvildy Lake. Weak mineralized radon water from Uvildy deposits is only for external use. The balance reserves of peloid from the Sabanai Lake are 1,416,000 m^3. The territory of Khomutinino five lakes comprises peloid and mineral drinking water, which is certified under the name Uralochka. There are deposits of ferruginous water in the Uvelskiy district of the region, near the lake Podbornoye. The depth of location is 45 m. Water mineralization varies from 3.60 to 3.96 g/l.

The Kurgan region is located on the borderline of Ural and Siberia in the southwestern part of the West Siberian plane in the basin of the river Tobol and Iset. Water objects of the region belong to the basin of the Kara Sea. The river network of the Kurgan region includes 449 rivers (density of the river network is 0.07 km/km^2). On the territory of the region there are more than 7,000 lakes with the total area of approximately 2,770 km^2. The forecast ground water resources of the Kurgan region are 1,041,000 m^3 per day (http://water-rf.ru/Регионы_России/2563/Курганская_область). The Kurgan region possesses significant deposits of natural medicinal resources, such as brine and mud of salt lakes and underground mineral water. There are some famous health resorts like Ozero Medvezhye, Sosnovaya Roscha, Lesniki and Zhemchuzhina Zauralya. In the state register four deposits of peloid are mentioned – the lake Gorkoye-Zverinogolovskoye, Gorkoye-Victoria, Medvezhye, and Ptichye with the total registered deposits of 17.3 million m^2. The deposits are being developed and annual production is no more than 1,100 m^3. On the territory of the region there are 15 deposits and water extraction areas of mineral underground water. The largest of them is the Shadrinskoye deposit of carbonated mineral water, which is unique in its kind. Its water is close to Essentuki–4 and Essentuki–17 in terms of its chemical content, water mineralization varies from 7.0 to 10–12 g/l.

On the territory of this region the mineral water of Mirgorodskiy, Talitskiy and Dzhavskiy type is extracted with the mineralization from 2–3 g/l to 5 g/l.

The Tyumen region is situated in the heart of Eurasia, within the West Siberian plane and stretches from the borders of the Republic of Kazakhstan to the coasts of the Arctic Ocean. Flat part of the region is heavily swamped and covered by many lakes. The river network of the Tyumen region consists of 4,971 rivers and with more than 36,000 natural and artificial lakes on the total area of approximately 3,100 km^2. The Tyumen region possesses underground mineral water resources: chloride, sodium bromide, and iodine-bromine water with a different grade of mineralization. In the purposes of treatment, the mineral water of mineralization up to 15 g/dm^2 is used, and more highly mineralized water (20-40 g/dm^2) is a valuable treatment resource for balneotherapy. In all major cities of the region there are hydropathic establishments and swimming pools with mineral water. Table mineral water such as Tyumenskaya, Taraskulskaya and Isetskaya is produced in the region. There are 15 lakes on the territory of the region (Bolshoy and Maliy Taraskul, Akhmanka, Tulubayevo, etc.), containing sapropel mud, non-sulphide freshwater sapropels. In 267 lakes of the region there are deposits of sapropel, 174 of them are estimated and developed (Sundukul, Ayginskoye, Mergen etc.). The deposits of this area, especially Maly Taraskul, possess sapropel deposits that outperform current needs in this resource.

The Khanti-Mansi Autounomous Okrug-Yugra is situated in the center of the Tyumen region in the central part of the West Siberian plane. The significant part of the territory is occupied with swamps. The river network of the Khanti-Mansi Autonomous Okrug comprises more than 19,600 rivers and with more than 600,000 lakes of the total area of approximately 22,700 km^2. Forecast groundwater resources of the Khanti-Mansi Autonomous Okrug are 94,657,000 m^3 per day (66.39% of the total forecast groundwater resources of the Ural Federal District). Among regions of the federal district this territory is on the first place for its total forecast groundwater resources.

The Yamalo-Nenets Autonomous Okrug is situated in the region of the north on the West Siberian plane, on the seaside of the Kara Sea. It pushes out to the north with Gydan and Yamal peninsulas. From west a narrow strip of eastern slopes of the Polar Ural enters the territory of the region. Local landscapes are characterized by ancient drainage valleys, multiple moraines and lakes, most of which are of glacial origin. The river network of this area comprises more than 50 thousand rivers with the total length of approximately 291 thousand km (density of the river network is 0.38 km/km2). Among regions of the federal

district the Yamalo-Nenets autonomous okrug is on the first place for the length and density of the river network. Among the regions of the federal district the Yamalo-Nenets autonomous okrug is on the first place for the total area of lakes (more than one million lakes). It is also on the third place in Russian frame, after Yakutia and Krasnodar Krai. Forecast groundwater resources of the Yamalo-Nenets autonomous okrug is 29,808 thousand m^3 per day (20.91% of the total forecast groundwater resources of the Ural Federal District and 3.24% of Russian resources in total).

The regime of meteorological parameters

The integral part of the characteristic of the natural and climatic conditions of the territories with thermal springs is the bioclimatic characteristic, which allows identifying the factors of the negative and positive influence of different climatic indices and their combination on the human body. The medical and biological characteristic of the climatic conditions allows determining the degree of environmental comfort for tourists' staying on the territory of thermal springs with recreational purposes. In order to determine the comfort of thermal regime we have analyzed average temperature indices during one calendar year. The temperature statistics shows that during a year average daily temperature varies from -16.9 ºC to -3.9 ºC in winter recreation period and from +12.6 ºC to +25.8 ºC in summer recreation period in the Tyumen region (Figures 1a and 1b); from -13.2 ºC to -2.7 ºC in winter recreation period and from +15.1 ºC to +23.8 ºC in summer recreation period in the Chelyabinsk region; from -15.2 ºC to -3.5 ºC in winter recreation period and from +13 ºC to +23.3 ºC in summer recreation period in the Sverdlovsk region; from -15.2 ºC to -4 ºC in winter recreation period and from +15.1 ºC to +24.3 ºC in summer recreation period in the Kurgan region; from -18.9 ºC to -6 ºC in winter recreation period and from +10.9 ºC to +23.2 ºC in the Khanti-Mansi Autonomous Okrug.

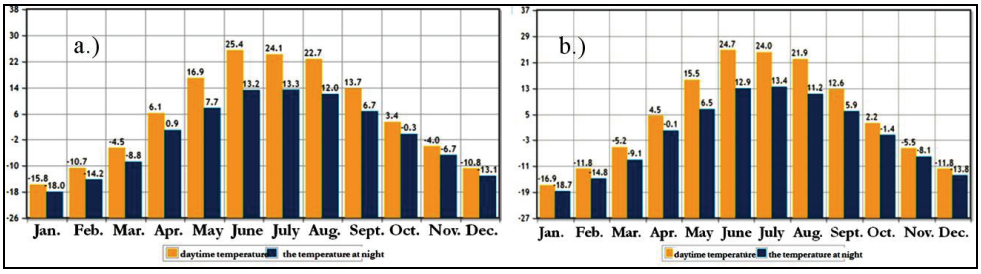

Figure 1. Average monthly temperature in: a) Tyumen; b) Tobolsk

Despite the fact that temperature perception is an individual index, the most comfortable conditions for the human body are registered at a temperature of 18–25 ºC, which corresponds with the temperature in the studied areas. One of the main meteorological parameters is solar radiation. For tourism, the most significant parameters are the light and ultraviolet regimes of solar radiation. Value of light radiation (insolation) when it is possible to organize different tourist activities, is determined by sunshine duration. In north latitudes sunshine duration in the summertime is insufficient, at the same time in the period of the polar night in the absence of sunshine tourist activities are impossible (Table 2).

Table 2. Characteristics of the UV regime

Sites	Area's latitude
Etkul	54°49′31″
Rezh	57°22′00″
Kurgan	55°26′27″
Zavodoukovsk	56°30′00″
Tyumen	57°09′00″
Turinsk	58°02′00″
Tobolsk	58°11′43″
Khanty-Mansiysk	61°00'08.0"

In the optimal zone of UV comfort there are Etkul, Rezh, Kurgan, Zavodoukovsk and Tyumen, therefore, they are favorable for recreation in any period of the year. Etkul is on the first place for its annual quantity of sunshine, while Rezh and Turinsk have the minimal quantity of sunny days (Figure 2). The analysis of wind regime was performed on the base of the indices from the international exchange data server NOAA, USA in the format of SUNOP&METAR by counting annual values during the studied period (Table 3).

The highest average annual index of south wind direction is registered in Zavodoukovsk, it is the maximum index in the statistics of wind directions for the Ural Federal District. Wind directions: N, NNE, NE, ENE, E, ESE, SE are stable for all objects studied, except for Tobolsk, where the ESE direction has the maximum index of 9.4%. The maximum index of the calm wind is in Turinsk, and it equals 21.6. Wind directions: WSW, W, WNW, NW, NNW have almost no differences, except for Etkul, where west winds prevail, and Rezh, where the parameter of north-west winds has the maximum index (Figure 3).

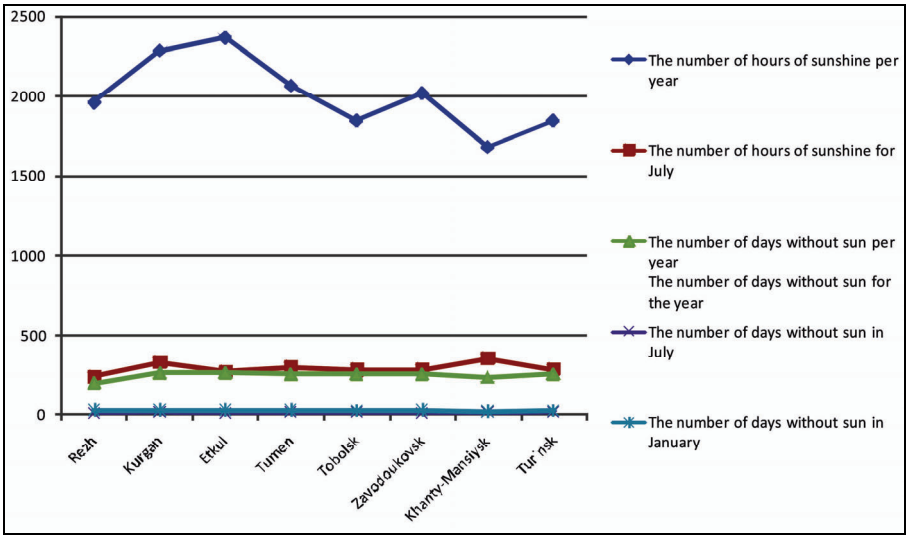

Figure 2. Characteristics of the light regime

Alvarez Cobelas, Rojo, and Angeler (2005) claimed that wind regime has controversial influence on the human body. Dominated west wind improves the nervous system. It helps to cope with stress, nervous excitement, psychic problems and insomnia, but the wind from the west is contraindicated in case of compromised immunity, after heart diseases and during migraines.

Table 3. The wind regime of the cities in the Ural Federal District (in per cent)

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C	VWD
1.	5.3	3.3	1.5	0.4	0.5	0.1	2.9	7.8	16.3	9,1	4.9	3.6	9.3	6.1	8.8	4.7	14.3	0.0
2.	5.2	2.2	1.5	1.2	0.9	1.0	1.6	3.4	21.8	7,1	5.1	5.0	11.6	6.6	14.5	3.1	7.5	0.8
3.	2.9	1.7	1.6	2.1	1.5	1.1	2.4	6.3	3.1	3.4	5.0	11.5	17.8	5.2	8.5	4.4	21.6	0.0
4.	6.9	3.0	1.3	1.0	2.0	1.5	2.9	4.7	24.4	16.4	3.6	5.0	5.4	3.9	3.5	3.8	10.8	0.0
5.	6.9	3.0	2.2	1.3	0.9	1.7	2.8	4.3	33.0	9.4	3.5	7.0	8.4	4.5	3.8	4.8	2.5	0.0
6.	3.2	1.6	1.1	1.2	3.7	3.9	3.9	6.1	13.9	12.6	10.6	9.6	6.6	5.0	5.5	4.5	7.0	0.0
7.	4.0	0.9	1.4	1.6	5.6	9.4	6.0	4.8	7.6	9.3	10.5	7.6	9.1	3.8	6.3	6.4	5.6	0.0
8.	7.3	3.2	2.7	1.5	2.9	3.1	4.9	8.3	14.9	6.8	6.9	4.2	10.5	5.4	5.2	3.8	8.4	0.0

Note: Sites 1: Etkul; Sites 2: Rezh; Sites 3: Turinsk; Sites 4: Kurgan Sites 5: Zavodoukovsk; Sites 6: Tyumen; Sites 7: Tobolsk; Sites 8: Khanty-Mansiysk; C – Calm; VWD – Variable wind direction.

East wind is considered as the most healing for the whole body. It improves heart performance, and vascular tonus, it also possesses sedative effect and helps to cure skin diseases. Nevertheless, in the period of north-west winds scientists register the increase of heart attacks.

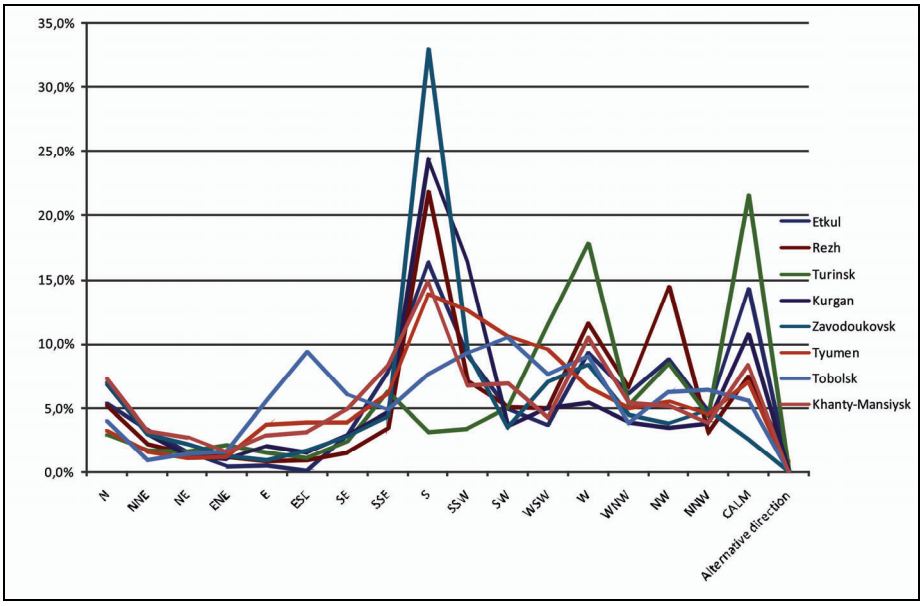

Figure 3. Characteristic of the wind regime

Among the important meteorological parameters there are air humidity and precipitations. Humans' ability to sense humidity and wetness is connected with the relative humidity. For tourist purposes the index of relative humidity during the daytime is very important. In the wintertime, relative humidity is high (up to 80%) almost everywhere. In the summertime, there are some daily variations of humidity (from 80% at night up to 50–60% at day). Sometimes humidity falls to 30% and less. For healthy people the most comfortable relative humidity is 40–60%.

All territories of thermal springs are characterized by increased humidity; however, the lowest index of humidity is in Kurgan, which is the most favorable region according to this criterion (Figure 4).

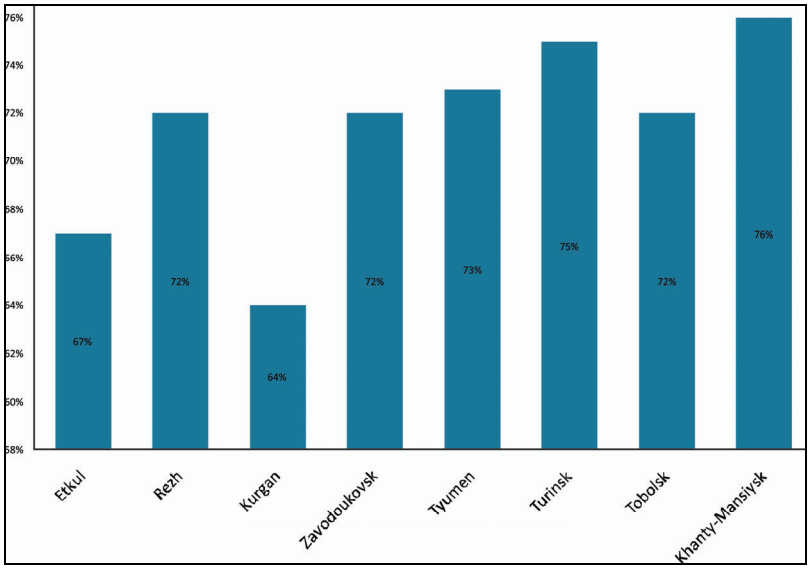

Figure 4. Characteristics of the humidity regime

The peculiarity of the Ural Federal District is snow cover in the wintertime, which increases the level of insolation regime and contributes to air humidity. The most stable snow cover is in Khanti-Mansiysk, Turinsk, Tobolsk and Etkul (Figure 5), which brings more satisfaction from the emotional perspective while visiting thermal springs in the wintertime. In the summertime, humidity level is characterized by the percent of daily precipitation frequency of more than 3 mm.

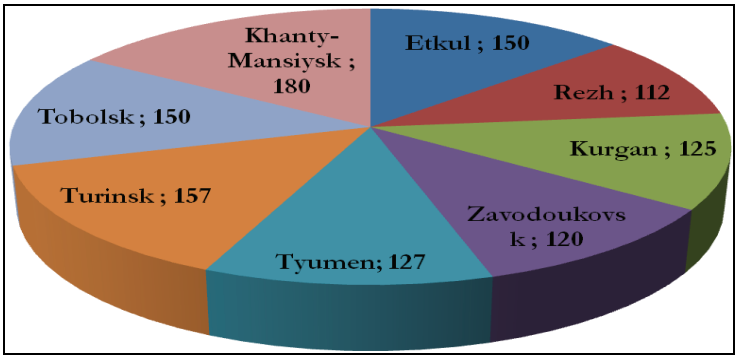

Figure 5. Duration of occurrence of stable snow cover (in days)

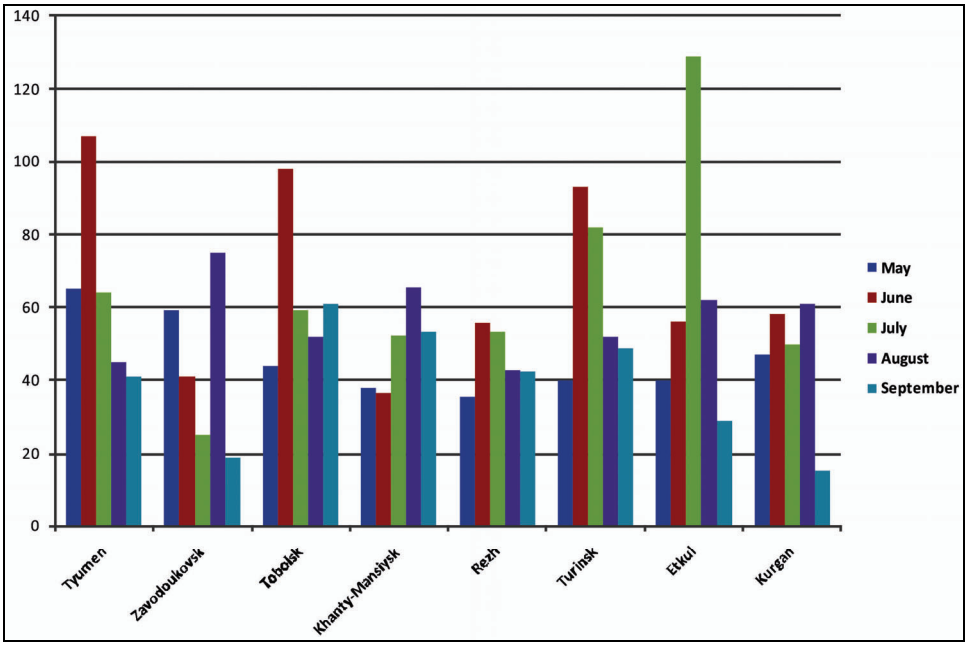

Figure 6. Characteristic of the precipitation regime in the summertime

From the emotional perspective, heavy precipitation in summer recreation does not allow to feel satisfaction from holidays and decrease the quantity of tourists. Therefore, the most favorable towns for visiting outdoor thermal pools are Zavodoukovsk, Rezh and Etku (Figure 6).

Conclusion

On the territory of the Ural Federal District, there are 24 thermal springs with the temperature regime from 35 ºC to 70 ºC and different mineralization grade. The assessment of the medical and biological potential of the thermal springs located in the District was performed using six climatic and meteorological parameters for different thermal springs for the period of 2015–2017. Such a period allows determining the modern tendencies of the spatial dynamics of climate comfort indices. The analysis of the territory showed that more comfortable climatic conditions are mostly the characteristic of the southwestern part of the district, which comprises the thermal springs located in the Chelyabinsk and Sverdlovsk region. The territory of the thermal springs located in the Kurgan region is characterized by moderately comfortable climatic conditions. Less comfortable climatic conditions are in the southwestern part of the district, which comprises

the thermal springs located in the Tyumen region. The conditions of small comfort are the characteristic of the thermal springs located in the Khanti-Mansi Autonomous Okrug situated in the central part of the region. This region is an improvised pole of cold for the thermal springs as it combines low temperatures, strong winds, and the longest snow period. At the same time, geographical differentiation of climate within the district is of little significance and does not influence the geography of tourist and recreation activity in the region, giving place to more significant factors such as geographical position in relation to the consumers of tourist and recreational services, tourist infrastructure and transport accessibility of thermal springs.

In general, the assessment of the tendencies of meteorological parameters for 2015–2017 shows their improvement, especially in the wintertime, as well as climate softening in the region with thermal springs. In relation to the climatic conditions, the thermal springs located in the Ural Federal District belong to the category of favorable territories suitable for health tourism, the establishment of recreational zones, and creation of tourist clusters in the region of thermal springs. Identification of main approaches to the analysis and assessment of medical and biological potential of thermal springs could contribute to the establishment of Russian thermal springs' database, enlarging information field concerning thermal springs. The results can also be useful for the development of the indices and criteria for the assessment of the tourist potential of Russian thermal springs and certain regions of the country and from abroad.

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References

Alvarez Cobelas, M., Rojo, C., & Angeler, D. (2005). Mediterranean limnology: current status, gaps and the future. *Journal of Limnology, 64*(1), 13–29. doi: https://doi.org/10.4081/jlimnol.2005.13

Amin, A., Ahmed, I., Salam, N., Kim, B., Singh, D., Zhi, X., Xiao, M., & Li, W. (2017). Diversity and Distribution of Thermophilic Bacteria in Hot Springs of Pakistan. *Microbial Ecology*, *74*(1), 116–127. doi: https://doi.org/10.1007/s00248-017-0930-1

Bender, T., Balint, P. V., & Balint, G. P. (2002). A brief history of spa therapy. *Annals of the Rheumatic Diseases*, *61*(10), 949–950. doi: http://dx.doi.org/10.1136/ard.61.10.949

Borović, S., & Marković, I. (2015). Utilization and tourism valorisation of geothermal waters in Croatia. *Renewable and Sustainable Energy Reviews, 44*, 52–63. doi: https://doi.org/10.1016/j.rser.2014.12.022

Chen, K., Liu, H., & Chang, F. (2013). Essential customer service factors and the segmentation of older visitors within wellness tourism based on hot springs hotels. *International Journal of Hospitality Management, 35,* 122–132. doi: http://dx.doi.org/10.1016/j.ijhm.2013.05.013

Clark-Kennedy, J., & Cohen, M. (2017). Indulgence or therapy? Exploring the characteristics, motivations and experiences of hot springs bathers in Victoria, Australia. *Asia Pacific Journal of Tourism Research, 22*(5), 501–511. doi: https://doi.org/10.1080/10941665.2016.1276946

Cockerell, N. (1996). Spas and Health Resorts in Europe. *Travel and Tourist Analyst*, *1*, 53–77. Retrieved from https://www.cabdirect.org/cabdirect/abstract/19961808511

Didaskalou, E. A., & Panagiotis, N. (2003). The Role of Climatic and Bioclimatic Conditions in the Development of Health Tourism Product. *Anatolia*, *14*(2), 107–126. doi: https://doi.org/10.1080/13032917.2003.9687020

Didaskalou, E. A., Nastos, P., & Matzarakis, A. (2004). The Development Prospects for Greek Health Tourism and the Role of the Bioclimate Regime in Greece. In: Matzarakis, A., de Freitas, C. & Scott, D. (Eds.), *Advances in tourism climatology. Berichte des Meteorologischen Institutes der Universität Freiburg, 12*, 149–157. Freiburg: Meteorologischen Institutes der Universität Freiburg.

Fazlzadeh, M., Sadeghi, H., Bagheri, P., Poureshg, Y., & Rostami, R. (2016). Microbial quality and physical–chemical characteristics of thermal springs. *Environmental Geochemistry and Health*, *38(2)*, 413–422. doi: https://doi.org/10.1007/s10653-015-9727-7

Goodrich, J. N., & Goodrich, G. E. (1987). Health-care tourism — an exploratory study. *Tourism Management, 8*(3), 217–222. doi: https://doi.org/10.1016/0261-5177(87)90053-7

Goodrich, J. N. (1993). Socialist Cuba: A Study of Health Tourism. *Journal of Travel Research, 32*(1), 36-41. doi: https://doi.org/10.1177/004728759303200106

Han, J., Lee, T., & Ryu, K. (2018). The promotion of health tourism products for domestic tourists. International Journal of Tourism Research, *20*(2), 137–146. doi: https://doi.org/10.1002/jtr.2161

Heung, V. C. S., & Kucukusta, D. (2013). Wellness Tourism in China: Resources, Development and Marketing. *International Journal of Tourism Research*, *15*(4), 346–359. doi: https://doi.org/10.1002/jtr.1880

Hsieh, L., Lin, L., & Lin, Y. (2008). A service quality measurement architecture for hot spring hotels in Taiwan. *Tourism Management, 29*(3), 429–438. doi: https://doi.org/10.1016/j.tourman.2007.05.009

Jónás-Berki, M., Csapó, J., Pálfi, A., & Aubert, A. (2015). A Market and Spatial Perspective of Health Tourism Destinations: The Hungarian Experience. *International Journal of Tourism Research, 17*(6), 602–612. doi: https://doi.org/10.1002/jtr.2027

Lee, T-H. (2010). Assessing visitors' experiences at hot spring recreation areas in Taiwan. *International Journal of Tourism Research, 12*(2), 193–203. doi: https://doi.org/10.1002/jtr.748

Lee, C. F., & King, B. E. (2008). Using the Delphi method to assess the potential of Taiwan's hot springs tourism sector. *International Journal of Tourism Research*, *10*(4), 341–352. doi: https://doi.org/10.1002/jtr.661

Mueller, H., & Kaufmann, E. L. (2001). Wellness tourism: Market analysis of a special health tourism segment and implications for the hotel industry. *Journal of Vacation Marketing, 7*(1), 7–15. doi: https://doi.org/10.1177/135676670100700101

Russian Waters (2017). Retrieved from http://water-rf.ru/Регионы_России/2200/Уральский_федеральный_округ (Accessed on June 2017, in Russian)

Russian Waters (2017). Retrieved from http://water-rf.ru/Регионы_России/2564/Свердловская_область (Accessed on June 2017, in Russian)

Russian Waters (2017). Retrieved from http://water-rf.ru/Регионы_России/2563/Курганская_область (Accessed on June 2017, in Russian)

Snyder, J., Crooks, V. A., Johnston, R., & Kingsbury, P. (2011). What do we know about Canadian involvement in medical tourism? A scoping review. *Open Medicine*, *5*(3), 139–148. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3205829/pdf/OpenMed-05-e139.pdf

The Federal Water Resources Agency (2017). Retrieved from http://voda.mnr.gov.ru/ (Accessed on June 2017, in Russian)

The Ural Federal District (2017). Retrieved from http://uralfo.gov.ru/ (Accessed on June 2017, in Russian)

Wigtman, D. (1985). The Spa Experience at Radium Hot Springs. *Annals of Tourism Research, 12*(3), 393–416. doi: https://doi.org/10.1016/0160-7383(85)90006-4

Yessengabylovaa, A., Bekbulatovaa, A., Suraganovaa, S., Bissekova, A., & Zhumanova, B. (2016). Recreational Potential of Kazakhstan and Prospects of Medical Health Tourism in This Country. *International Journal of Environmental and Science Education, 11*(15), 8447–8469. Retrieved from https://eric.ed.gov/?id=EJ1117740