ANALYSIS AND ASSESSMENT OF REGULARITIES OF TEMPORARY CHANGES OF GROUND LAYER AIR TEMPERATURE (ON THE EXAMPLE OF GYUMRI CITY)
Margaryan Varduhi
Yerevan State University, Yerevan, Armenia
vmargaryan@ysu.am

Air temperature is characteristics of situation on of links of climatic system, atmosphere. It is being determined by features of solar energy distribution on the earth surface, by the processes of interactions between links of climatic system. It is very important the role of air temperature in runoff formation, evaporation, ice events generation and disappearance, thermal and moisture circulation, in frosts, droughts and desertification processes also. The role of thermal regime is also very important in water requirement of agricultural crops and yield formation. So, clarifying and estimation of regularities of temporal distribution of air temperature has importance, especially for more accurate definition of thermal balance, for productive using of thermal resources.

So, the goal of this work was to clarify, analyze and estimate regularities of change dynamics of air temperature in Gyumri city.

For solving this task are collected clarified and analyzed results of actual observations of air temperature of Gyumri meteorological station which are being kept in Armhydromet. The theoretical basis for solving the tasks of research, in particular, are the research works about climate change and its effects’ mitigation [1-4]. As a methodological basis used by our scientific work are characterization, analysis, statistical analysis, mathematical and correlation methods.

In the work are collected and worked out the results of actual observations of air temperature of Gyumri meteorological station, which are in table. 1.

The meteorological station of Gyumri (the height is 1523 m) locates in Gyumri city, which is the centre of Shirak marz of the Republic of Armenia. By the population (119,9 thousand inhabitants, 01.01.2014) and by his significance Gyumri is second city of the Republic of Armenia, after the capital Yerevan. The meteorological station of Gyumri founded in 1843, where meteorological continuous observations made since 1893. But in 1961 have been changed the place of meteorological square,
and in the result of it is broken the homogeneity of observations. So, in the work are discussed and analyzed actual data of observation for 1961-2015.

Table 1

<table>
<thead>
<tr>
<th>Meteorological elements</th>
<th>Months</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Average</td>
<td>-8,68</td>
<td>-7,17</td>
</tr>
<tr>
<td>Average maximum</td>
<td>-1,92</td>
<td>0,30</td>
</tr>
<tr>
<td>Average minimum</td>
<td>-15,7</td>
<td>-14,5</td>
</tr>
</tbody>
</table>

In the studying territory the warmest months are July and August with monthly average temperature 19,7 °C, the coldest month is January - with monthly average temperature - 8,68 °C (table 1). According to annual average values of air temperature in Gyumri the coldest year was 1973, and the warmest year - 2010. 2010 was the warmest year in Armenia during all period of observations.

![Temperature graph](image)

Fig. 1. Annual course of air temperature at the time of observation of meteorological station of Gyumri

The climate of Gyumri is continental, compared with warm summers and cold winters. Average annual amplitude of vibration of air temperature is 23,2-35,8°C, absolute amplitude - 50,8-68,9°C. In winter sometimes are strong frosts, minimum air temperature can decrease up to -36,0 °C. The winter is with a lot of snow and cold and occurs from December to March inclusively. The spring is short and cool. It occurs just one and half month. The summer is compared warm and on occurs from the beginning of June to the end of September. Autumn is warm too (fig. 1). Gyumri is one of the first in Armenia with the number of sunny days. Annual number of precipitation is 500 mm.
In the work have got the multifunctional correlation links \((r=0.68)\) between annual average \((T)\) and absolute maximum \((T_{\text{max}})\) and absolute minimum \((T_{\text{min}})\) values of air temperature of Gyumri. This link can be shown with the following equation: \(T = 0.17T_{\text{max}} + 0.15T_{\text{min}} + 4.71\). It gives possibility to calculate average annual air temperature in advance, if we have absolute minimum and maximum values.

There is close correlation relation \((r=0.89)\) also between annual average values of air temperature of surface layer and soil surface temperature of Gyumri (fig. 2). It give possibility to calculate any value characteristics of temperature having the value of another.

![Correlation link between average annual values of air and soil surface temperature](image)

**Fig. 2.** Correlation link between average annual values of air and soil surface temperature

After researches became clear, that observes a tendency of increase of average annual and extreme values of air temperature of Gyumri city (fig. 3, 4). Such regularity characterize to other regions republic also [2-3, 5-7]. In the work have been studied the dynamics change of air temperature Gyumri city by months, which has the following view. Dynamics change of annual average monthly values of air temperature characterized by increased tendency, exception are only the values of December. So, in Gyumri during warm period is being waited increasing of dryness of climate, during cold period - softening and in December- increasing of cold weather.
Fig. 3. Dynamics change of average annual values of air temperature of Gyumri

This change will have its inevitable consequence of a change in the balance of components of hydrothermal study area, of a violation of the ecological balance of natural ecosystems, as well as the social, environmental and economic development of the city. Consequently, to adapt to changing temperature needs an ecosystem approach, for mitigation – implementation of complex measures for adaptation.

Fig. 4. Dynamics change of average minimum (1) and average maximum (2) air temperature of Gyumri

In the work tried define also the monthly average values of air temperature Gyumri in 2030, 2070, 2100, using the method of extrapolation. And the result is, if change process will be continue, the annual average values of air temperature will increase with comparison to now a day normal: in 2030 - 0,09 °C (1,37 %), in 2050 - 0,27 °C (4,12 %), in 2070 - 0,48 °C (7,32 %), in 2100 - 0,85 °C (13 %).

By the forecasts of ECHAMS, GFDL, GISSER, HadCM3 models in Armenia predicts annual increase of air temperature for 1,1-1,5 °C in 2011-2040, 2,0-3,0 °C in 2041-2070, and 3,5-5,5 °C – in 2071-2100 [3]. Changes of temperature in different regions of the territory of the Republic of Armenia and in different seasons have dif-
ferent tendency. In table 2 shown changes of seasonal and annual temperature in Shirak in 1961-1990 relatively average by PRECIS model [6].

So, estimation and management of air temperature dynamics change, also working out the ways of softening of impacts is necessary to make by local scale spatially in mountainous countries.

In the result of study became clear, that features and regularities of spatiotemporal distribution of air temperature depend on complex influence of physical-geographical and anthropogenic factors; in perennial observations notes a tendency of increase of annual average values of air temperature; providing of meteorological stations with modern equipment (especially automatic); inform to population about climate change; realization legal-organization, institutional, technical arrangements for adaptation of economy to new natural conditions and soften of climate change consequences.

References


