GEOGRAPHICAL ASPECTS IN RESEARCH OF THE CLIMATIC, OROGRAPHIC AND HYDROGRAPHIC INFLUENCE IN DROUGHTS MITIGATION IN THE GEOSPACE OF THE REPUBLIC OF NORTH MACEDONIA

Vesna Stojanova
Elementary School "Bratstvo" – Karposh, Skopje, North Macedonia, vesna.stojanova@hotmail.com
Vasko Lazarevski
Skopje, North Macedonia, lazarevskivasko@gmail.com
Maja Pop Arsova
Elementary School "Braka Miladinovci"-Kumanovo, North Macedonia, m.poparsova@yahoo.com

Abstract: This work deals with the general climatic influences, the relief characteristics, as well as with the significant climatic modifications, the cyclonic and anticyclonic activity because they`re substantive for the wielding, transmitting, or creation of centers and frontal systems. The natural-geographic complex in the Republic of North Macedonia is distinguished with particular variety and complex, because of that the complex researches of this area which is under the influence of natural geographic and socioeconomic factors, is necessary and indispensable, and because of the fact that the geospacer is conditioned by different processes and phenomena which caused some problems and consequences concerned to the evolution and its economical exploitation. The Tikvesh area is one of the driest not only in RNM but in the Balkan Peninsula. The average rains in the year in this area measured in the last 50 years are lower than 500 mm.
Keywords: weather, climate, cyclone, climatic factors, meteorological elements

1. INTRODUCTION

Weather and climate have always been significant elements of the human environment and depending on their particularity, to a greater or lesser extent, they have influenced the overall activity of humans in their daily lives. Interest in weather, and weather conditions, dates back to the very beginning of humanity. Thunderstorms, rains, floods, droughts, and other unusual phenomena caused interest in humans. One of the oldest human experiences is the knowledge of the constant variability of the weather: cold, hot, dry, rainy, windy, etc. Those changes can be so fast that in one day the weather can change several times.Weather is the current state of the atmosphere in a certain place or it represents the real state of meteorological elements and phenomena at a given moment in a certain place. Therefore, time is a variable concept, and climate or subclimate represents the averaging of all atmospheric conditions that occurred in some regions over a long series of years.

The following factors influence the formation of climate and weather in a certain area: astronomical, meteorological, geographical and anthological.

2. CLIMATE CONDITIONS

The Republic of North Macedonia, although its area is small (25713 km2), is characterized by diverse climatic conditions. It is located in moderate latitudes, between 40º51'08" and 42º22'20", north latitude, at a short distance from the Mediterranean Sea, that is, it is 66 km from the Aegean Sea, and 88 km from the Adriatic Sea. The climate in the country is influenced by the Atlantic Ocean through the western winds, as well as the western circulation, which appears as a strong source of moisture and which significantly affects the climate in N. Macedonia. Therefore, more climatologists - P. Vujević (1952, 1954), A. Lazarevski, M.Zikov, P. Ristevski, and others include N. Macedonia in the continental-Mediterranean climate area. Accordingly, these two climatic types of the climate of N. Macedonia are combined in the most unfavorable way. Cold and wet continental winters, with frequent penetration of polar air masses, and hot and dry Mediterranean summers alternate here. With that, the annual temperature fluctuations as well as the degree of congeniality have increased, while only a small part of the river valleys and valleys are under a stronger influence of the Mediterranean climate. Those influences are best felt in the Gevgelisk-Valandovo and Dojran Basin, to the north of the Demirkapi Gorge, in certain years, along the entire Povardarie region, then in the Strumica-Radoviška Basin, along the valley of the river Crn Drim and the Debar Valley.

3. CYCLONE AND ANTI-CYCLONE CENTERS AS FACTORS FOR THE CLIMATE REGIME IN NORTH MACEDONIA

Changes in weather conditions and disasters depend on the movement of air masses, which, in turn, move due to temperature differences. Since it all takes place in free space, without restraints, the air that is under high

atmospheric pressure literally rushes in or like an imaginary river flows into the space with lower pressure, i.e. lower atmospheric pressure, causing wind. The greater the pressure differences, the more the airflow increases, that is, the wind becomes stronger and stronger. This movement and displacement of air masses happen due to temperature differences, but also due to the movement, that is, the rotation of Earth, which dictates the direction of air movement inside the cyclone and anticyclone. In terms of cyclonic activity, our territory represents a space over which different air masses are brought and transferred by the air circulation from permanent and secondary centers, but frontal systems of different scales are created and disappear. At the center of the cyclone, the atmospheric pressure is the lowest, so the air (circular due to the rotation of the Earth) flows towards the center in a counter-clockwise direction. When the cyclonic air reaches the center of the cyclone, it rises up, in the heights, carrying with it the water vapor that it collected in the lower layers of the earth's surface. That moisture, when it comes to the upper colder layers in the atmosphere, becomes visible as a cloud or condenses, it condenses into water, which in the form of raindrops, snowflakes, and sometimes as pieces of ice, falls again on the earth's surface. Therefore, when a cyclone occurs, we have bad weather, but sometimes this kind of weather is needed by farmers after a long dry period. Anticyclone, as a rule, brings good weather. At the center of the anticyclone, the atmospheric pressure is the highest, so the air in the anticyclone flows in a circle around the periphery, that is, the ends of the anticyclone, while in its center, from above, from the high layers of the atmosphere, unsaturated dry, vapor-free air flows. Descending air is the cause of stable weather conditions in the center of the anticyclone. According to A. Lazarevski (1993), permanent centers of high air pressure are the Azores anticyclone and the Icelandic cyclone or depression, which have a significant influence on the weather, and thus on the climate in N. Macedonia. In the warm part of the year, cyclones move further north from our territory, and in winter we are also affected by them. For these reasons, in the summer months the precipitation is weaker and mainly comes from the Aegean and Adriatic Seas so that when they find themselves in the central part of our country, they are depleted of moisture. The reason for this is the high mountains that appear as the main obstacles on which most of the moisture falls. According to the spatial distribution of the annual amounts of precipitation, there are several smaller areas in N. Macedonia with an exceptionally dry climate. Those dry areas also include Ovchepolie and the middle course of the river Vardar with the wider area of Gradsko. The dry periods are the result of the formation of the Azores anticyclone, which conditions a long period of dry weather. Without going into detailed studies of the pluviometric regime, from the aspect of the need for moisture of agricultural crops, it can be assessed that the annual amount of precipitation in N. Macedonia is insufficient, and the pluviometric regime is unfavorable. In fact, the maximum rainfall occurs in the late autumn and winter months when the moisture needs of the vegetation are the least, while the summer dry spell makes the development of many agricultural crops significantly more difficult.

4. THE RELIEF AS A FACTOR OF THE CLIMATE REGIME IN THE REPUBLIC OF NORTH MACEDONIA

In our country, the relief has a great influence on the climatic characteristics because it, as a climatic modifier, has a significant role in the unfolding of atmospheric processes. More specifically, the radiation is conditioned by the relief, but also the atmospheric air circulation. The Republic of North Macedonia is distinguished by a very interesting relief structure filled with mountains, valleys, valleys, gorges and other orographic forms. According to the data, it can be concluded that the Republic of North Macedonia is a hilly-mountainous country with a large vertical division. According to M. Zikov (1995), in relation to the total surface, about 19% belongs to the macro relief forms - valleys and fields, about 12% to the medium-high mountains, and 18% to the high mountains. The mountains, which are divided into high, medium and low by their direction of extension, have a visible influence on the atmospheric condition in N. Macedonia, on the regime of meteorological elements and their spatial distribution, and therefore on the climate regime.

5. HYDROGRAPHIC CONDITIONS

Water is the only natural liquid that conditions life and is the basis for the survival of all living things on planet Earth. Earth without water would be a desert similar to any other planet, therefore the development path of the living world is closely related to this natural liquid. Water is the basis of everything, everything arises from it and everything returns to it. Water in the atmosphere is one of the important components of the water balance in nature. It is a significant factor for life on Earth and the atmosphere. It is found in three aggregate states: gaseous (water vapor), liquid (rain, water, dew) and solid (ice, snow, hail). The entire world reserve of water on Earth is closely correlated with hydrometeorological processes in nature. Those processes include the circulation of water at the earth-atmosphere-earth relation, evaporation, precipitation and runoff. The General Assembly of the UN, starting on March 22, 1993, made a decision to declare this day and month as World Water Day. By marking this day, the UN reminds the world public and its member states that water resources are of vital importance for human survival and

economic development. According to the knowledge so far, it is obvious that the majority of the population in the world still does not know the true value of water for people's life and work, and even today they treat it irresponsibly. At the World Water Forum held in March 2003 in Kyoto, Japan, 2003 was declared the Year of Freshwater. The reason for this was the fact that about 4 billion people in the world (out of a total of 8 billion in 2015) do not have enough quality water for drinking and irrigating agricultural lands.

6. DROUGHT AS A METEOROLOGICAL PHENOMENON

Drought is a natural phenomenon that is conditioned by various climatic factors and results in insufficient amounts of water. Drought, as a meteorological phenomenon, is an additional feature of the wind regime. As a consequence of the drought is the loss of the melioration potential of the reservoirs in the Republic of N. Macedonia, and with it the losses in the yield of certain agricultural crops. Therefore, there are several definitions in the literature, but we decide that drought means a longer period of time without precipitation, when the soil is without the necessary moisture, and the air is with insufficient humidity. It culminates when this is followed by high air temperatures, blowing of dry and hot winds and strong evaporation. According to A. Lazarevski (1993), under a dry period are considered ten or more continuous days in which the daily amount of precipitation is flat or above 0.1 mm, that is, a series of days in which there was no precipitation. Therefore, the number of dry periods does not correspond to the amount of annual precipitation. Thus, for example, in the annual number of dry periods in the territory of N. Macedonia, the middle flow of the river Vardar, from Veles to the lower reaches of the river Vardar - Gevgelija, has the highest frequency of dry periods. According to M. Zmejkovski (2002), regarding the impact of drought on vegetation, we distinguish between atmospheric drought and soil drought. Atmospheric drought is characterized by high temperatures and low relative air humidity of up to 12%. This means that the vegetation lags behind in its normal growth, during which it withers, and then, with the extension of the dry period, it dries up. With a longer duration and extension of the influence of the atmospheric drought, there is also a drought of the soil, with the consequences on the agricultural crops and on the vegetation, in general, being catastrophic. As a consequence of the large dry periods, surface watercourses dry up, subsurface water levels drop, agricultural crops dry up, grass dries up on pastures and meadows, frequent fires occur, animal diseases, etc. Droughts do not have any specific mode of occurrence so they can be predicted in a specific time and space. In the Republic of North Macedonia, dry periods lasting over 30 days are observed almost every year, and in some years and in some areas the duration of the maximum dry periods is over 80 days. The territory of North Macedonia belongs to the group of countries characterized as the driest area of the Balkan Peninsula, and the surroundings of Gradsko and Tikvesh with about 250 mm, is the driest area of the Balkan Peninsula. As a consequence of the low rainfall, our country has been repeatedly affected by catastrophic droughts. Thus, according to A. Lazarevski (1993), extreme autumn drought was registered from July 14 to October 9, 1956. (88 days) in Gevgelija-Valandovska, The Dojran, Strumica, Tikveshka, Pelagonia, Kumanovska and Kochanska Valleys, then in the Ovche Pole, Veleshka, Kichevska, Pološka and Debarska Valleys, with a duration of 75 to 88 days, in the Ohrid, Prespa and Skopje Valleys with a duration of 60 to 65 days, and in the Berovska, Delchevska and Krivopalanečka Valleys with a duration of 40 to 50 days. The extreme winter-spring drought of 1953 which lasted 56 days is also noteworthy, as well as the 1983 occurrence of the winter-spring drought, the drought in 1985, 1993 etc. From the above, we can conclude that R. N. Macedonia is an area in which the iridescence of droughts is a frequent occurrence (high temperatures and minimum precipitation), which necessitates the application of agrotechnical measures - irrigation, which is the most effective method in the fight against drought, that is, aridity.

7. HYDROMELIORATIVE IRRIGATION SYSTEMS IN DRY CONDITIONS

Before the Second World War, there were no irrigation systems built in N. Macedonia, that is, there were only primitive ditches and furrows through which small and fragmented plots of land were irrigated, mostly gardens for horticultural production. The active fight against drought in our country began in the post-war period with the construction of the first irrigation systems. They contributed to the change of the agrarian landscape in the geographical area of N. Macedonia and the introduction of new intensive, economically profitable, agricultural crops in agricultural production. The Republic of North Macedonia is a continental country with 1,249,124 ha of agricultural land, of which 663,526 ha or 51% is arable land and 634,209 ha or 49% are meadows and pastures. According to the vertical distribution, 44% of the arable land is in the flat-slope area and 56% in the hilly-mountainous area. Annual plants cover 553,050 ha or 83%, while 110,476 ha or 17% are perennial plantations. Under the HMS for irrigation, of the total arable area, close to 123,000 ha are planned for irrigation, but only 66,000 ha of them are irrigated. Accordingly, with HMS for irrigation, 21% are planned to be irrigated, and 10.6% are irrigated. So far, more than 90 HMS for irrigation have been built in the Republic of North Macedonia, and in the structure of the irrigated areas, the majority is cereal crops, equally industrial and horticultural crops, and least of all

fodder crops and other crops. Water for irrigation is provided from reservoirs, watercourses, underground water, etc. Irrigation systems are mainly relatively complex objects with a great influence in the development of the agrarian space, i.e. they change their immediate and more distant surroundings. The costs of management, operation and maintenance of HMS (capture, storage, transport and distribution) to the end user are covered, mainly, from the water fee, from the water users. However, the problems highlighted by the water users of the systems are that the quantities of water are delivered untimely and insufficiently, then, the lack of suitable equipment for more efficient irrigation of the arable land, the high price of the water fee, the lack of a market for agricultural products, the low purchase price is highlighted as a problem. price etc. The untimely settlement of the water fee is also a consequence of the crop and its placement.

8. CONCLUSION

The climatic conditions prevailing at the locations of the irrigation systems are related to the water needs of the crops. The required amounts of water for agricultural crops are determined on the basis of climatic indicators, and are shown with the help of the hydrological balance of a certain area. From the point of view of water supply to crops, of all climatic factors, the height and distribution of precipitation and temperatures are the most important. Global changes in recent decades have been characterized by increasingly pronounced changes in weather and climate. Meteorological-climatic changes on the Earth, according to the size and intensity, have different manifestations such as the drought in the 70s and 90s in Europe, the monsoon influences in the climate change in Asia, the penetration of the polar winds in the more southern parts of America, etc. Such changes have a significant impact on water management, agriculture, forestry, traffic, tourism, etc. The Republic of North Macedonia is an area in which the presence of droughts is a frequent occurrence (high temperatures and minimum precipitation), which necessitates the application of agrotechnical measures - irrigation, which is the most effective method in the fight against drought. Irrigation is defined as one of the hydro-technical measures by which water is artificially introduced into the land during the dry periods of the year when it is lacking during the vegetation period of agricultural crops.

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