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## THE EFFECT OF EXTREME TEMPERATURES ON HUMAN HEALTH AS A RESULT OF CLIMATE CHANGE

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**Abstract:** Nowadays, assessment of impact health related to climate change is becoming the most important research method at regional and local level, as it explains how adaptation is needed to reduce the current vulnerability to climate change that has already occurred and the need for adaptation to address the health risks anticipated over the coming decades. The purpose of this study is to describe the health impacts of climate change on human health as well as the study of extreme air temperatures and their distribution in the territory. The data of the last years 2017-2018 have been used, based on the Monthly Climate Bulletin published by the Institute of Geosciences, Energy, Water and Environment, Department of Climate and Environment. Extreme values of air temperature are of great interest both theoretically and practically. Their distribution is greater than then averages, therefore for their study a large number of stations are needed. Air temperature is one of the main climatic elements for determining the climate of a country. All physical processes in the earth's atmosphere are related to solar energy. Increasing the air temperature above 30° C provokes an intensification of the activity of thermoregulatory mechanisms. The action of high temperatures usually causes vasomotor reactions in the skin, which are opposite to those caused by low temperatures and consists of dilation of skin vessels. Active dilatation caused by high air temperatures is associated with hyperemia, with high heat radiation from the skin surface and the sensation of heat. High air temperatures cause the effect of sweating and through it the body loses significant amounts of water. The losses are even greater if at increased air temperature and a great deal of physical activity is exercised; e.g. on a working day performed at 1 atm, with air temperature  $\geq 30^{\circ}$  C, a worker can lose up to 10 liters of water. An increase in air temperature causes acceleration of respiration; as a result, the heart rate increases and the systolic blood pressure drops. Other reactions caused by high temperatures are changes in the humoral organs of the body expressed in changes in processes, which occur in the tissues of the human body. The relationship that exists between the temperature of the air (surroundings ambient) and the speed of flow of exchange processes in the body, is such that, if we take as a norm the level of them, which exists in the healthy body for air temperature from + 15° - 20°, then during its decrease from 15° - 0° the exchange increases, for air temperatures from +15, +30 it decreases, while during the increase of temperature above 30° C the exchange increases again.

**Keywords:** climate change, extreme temperatures, human health, consequences

### 1. INTRODUCTION

Cities are the main location of social, economic and technological development, they increasingly contribute and are affected by the impacts of climate change.

The increase in the level of world and urban population is the second reason underlining the importance of climate change in the urban context. Currently half of the world's population lives in urban areas, and by 2030 is expected to go 60% (UN HABITAT, 2009). Wu et al. (2016) defines climate change as the long-term changes in weather conditions and patterns of unusual extreme weather events. The basis for all climate models are assumptions about the future development of emissions, demographics, society, techniques, economics and ecology. These assumptions are described in the scenarios. Most climate models use emission scenarios defined by the International Panel on Climate Change (IPCC, 2007). According to the Intergovernmental Panel on Climate Change (IPCC, 2007), extreme temperatures can lead directly to loss of life, while climate-related disturbances in ecological systems can indirectly impact the incidence of infectious diseases. Shikuku et al. (2017) clearly show that the GHGs are positively correlated with the burning of fossil fuels, oils, forest destruction and agriculture. On the other hand, warm temperatures can increase air and water pollution, which in turn harm human health. Extreme weather can destroy shelter, contaminate water supplies, cripple crop and livestock production, tear apart existing health and other service infrastructures. Many scientific studies show that the potential effects of climate change are based on the following climatic factors (Pálvölgyi T., 2011), such as: Changes in the average annual temperature: with increasing number of summer days and decreasing number of frost days (ESPON, 2017); Relative change in average annual rainfall: may bring rapid flooding, as droughts are becoming more frequent during the summer period; Increasing the frequency of extreme weather events, such as extreme storms and windstorms.

The unfavorable socio-economic position of this area is caused by the unfavorable quality of life, poor health status, lower income, higher rate of elderly, higher level of ethnic groups, etc. (Pálvölgyi T., 2008). Detailed surveys of detailed health hazards caused by heat waves associated with the average temperature rising are abundant. They draw attention to the increased likelihood of deaths and evolving health conditions (e.g., heat stress, cardiovascular disease and related deaths, respiratory complaints, infections, and skin rashes) caused by heat waves. during the summer, with young children, the elderly, the chronically ill, and multiple exposed to particularly high risks (Páldy A., 2014). According to the respective climate scenarios (RegCM - A1B), there will be a 20 to 70% increase in the frequency of heat alarms (reported when the average temperature exceeds 25° C in three consecutive days) across the country between 2021 and 2050,. The relationship between the daily mortality rate and the average temperature will be stronger: if the air temperature will increase by 1 °C, then the daily mortality rate of days with an average daily temperature > 25° C will increase by 4.9 % between 2021 and 2050.

The model of health vulnerability is mainly focused on society's vulnerability to the impacts of climate change and is dedicated to measuring the potential impacts of climate change on social and economic processes (Páldy A., 2015). The major impacts of climate change include severe floods, frequent and prolonged droughts, rising sea levels, crop failure, loss of livestock, lower water availability and quality and an increase in vector and water-borne diseases (Githeko et al., 2000; Patz et al., 2005). Climate change can affect the health of the population through economic problems caused by climate and environmental degradation through developmental obstacles caused by damage to critical public health infrastructure and livelihoods from extreme weather events (WHO, 2013). Other climate change in the coming decades is projected to significantly increase the number of people at risk of various diseases (Confalonieri, 2007). Climate is not the only factor affecting geographical range and health problems. Non-climatic factors can have a strong or even predominant effect, independently or by modifying climatic effects (IPCC, 2007).

## 2. MATERIALS AND METHODS

Methodologically, the study is mainly based on qualitative research tools such as scientific literature review, content analysis and discourse analysis. These qualitative analyzes have focused on international and domestic literature e.g. research reports, IPCC reports, development-oriented planning documents such as health development strategies, special planning documents for environmental protection, etc. From the climate data provided by the Institute of Geosciences, Energy, Water and Environment (IGJEUM) and their comparison with historical data, it results that we have an increasing trend of average temperatures over the last 10 years and a decreasing trend of average rainfall. annual. The focus of the document analysis is on explaining that e.g. health impact assessments of how it can determine the link between climate change and health at the regional and local level through those determinants that affect daily life. The analysis examines adaptation approaches to varying degrees because proactive adaptation strategies, policies and measures need to be implemented by regional and national governments, international organizations and individuals. The study synthesis is based on the ultimate objective of summarizing research results and making proposals for decision makers.

To determine the time intervals unfavorable for humans, caused by air temperatures  $\geq 30$  ° C and  $.10$  ° C we have studied the data provided by the Institute of Geosciences, Energy, Water and Environment.

The meteorological measurements from which these data are provided are equipped with maximum, minimum and pluviometer thermometers. Thermometers serve to measure temperature while pluviometers for the amount of rainfall.

The reporting of these data is done by the observers who take care of the stations, once a day at 7 o'clock in the morning. After processing the data, the scenarios were prepared which are presented through the following tables and graphs, through which we can reach some conclusions.

## 3. RESULTS

The average altitude of our country is 708m above sea level, an altitude approximately twice that of Europe. The higher of country is above sea level the greater its impact on climatic elements. So, for our country, altitude should be considered as an important climatic factor. Among the extreme values of air temperature, the maximums and absolute minimums deserve special attention. The lowest value of air temperature was recorded in the meteorological survey -29.0 ° C, Korça district, on January 9, 2017, breaking the historical record that was observed on January 17, 1963 in the meteorological survey Sheqeras. Albania until now is characterized by an amplitude of 69.7 ° C. This amplitude should be considered as a sensitive but always characteristic value for Mediterranean countries with a rugged relief. For comparison we are mentioning that the marine climate is characterized by a slightly smaller amplitude.

If we make a comparison of the average minimum temperature values of January 2017 with the norm values we will see that we have a decrease of these values on average of 2.9 ° C. We are presenting this in the figure no 1.

Figure 1. Comparison of 2017 and 2018 data with the rate

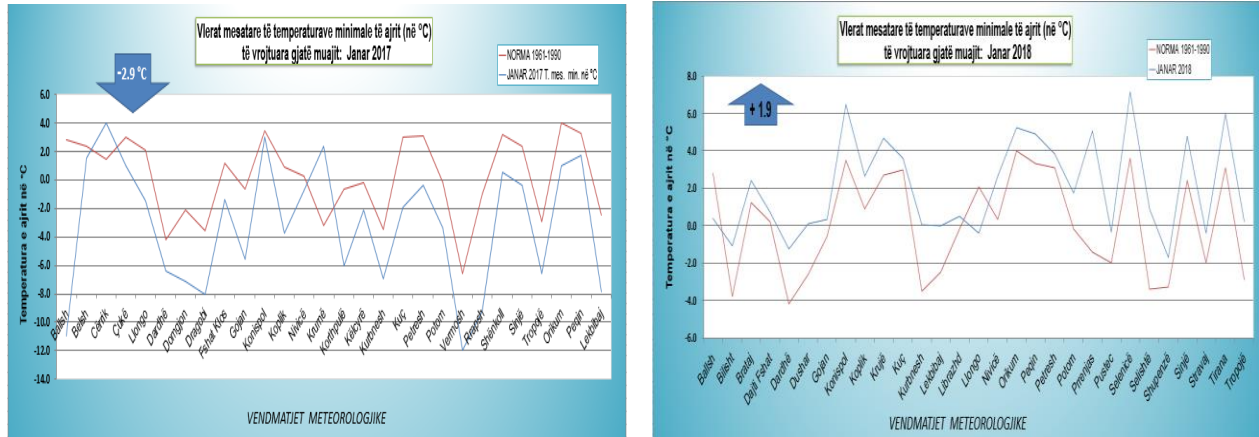
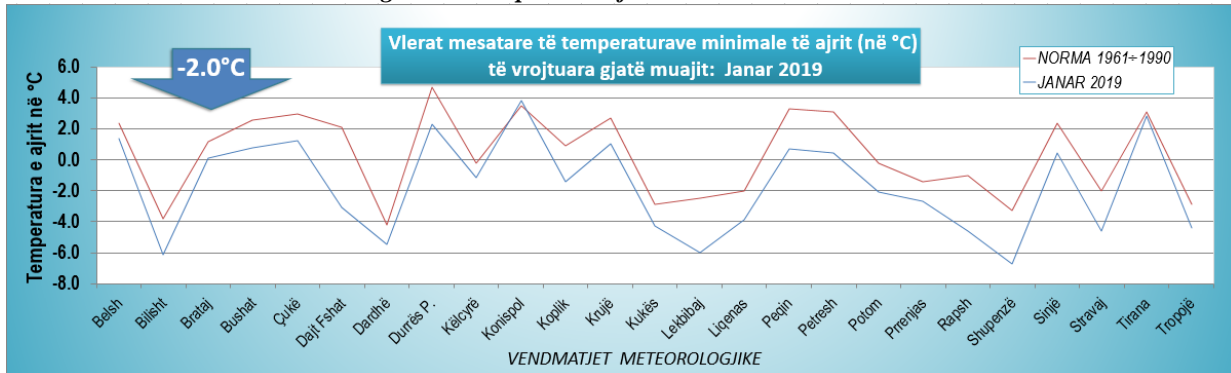


Figure 2. Comparison of 2019 data with the rate



If we make a comparison of the average maximum temperature values of August with the 30-year average maximum temperature values, we will see that we have an increase of these values by an average of 4.7 ° C. We are presenting this in the following figure no

Figure 3. Maximum average temperature of August 2017

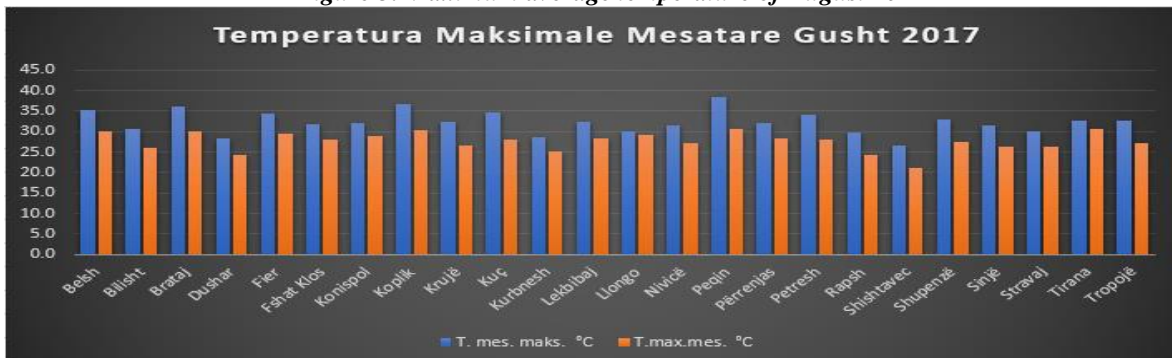
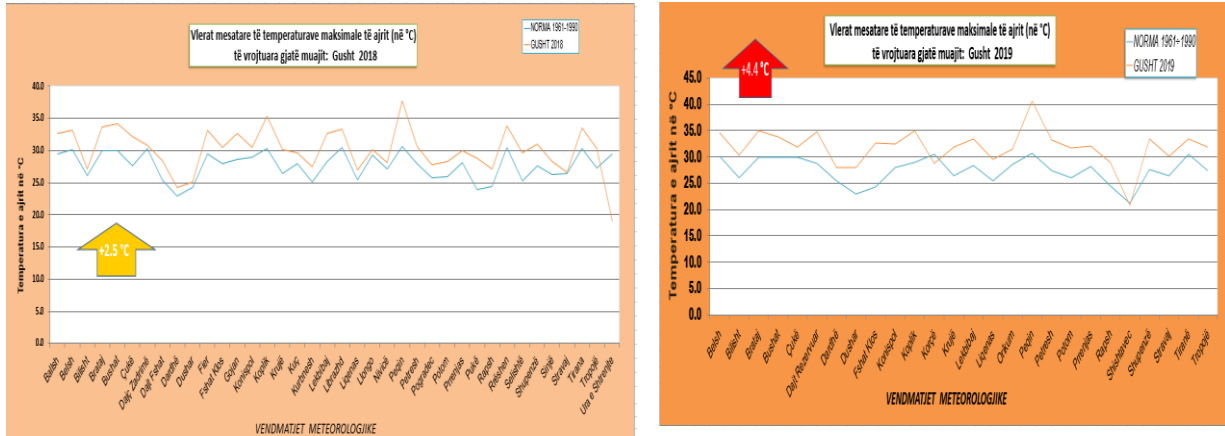


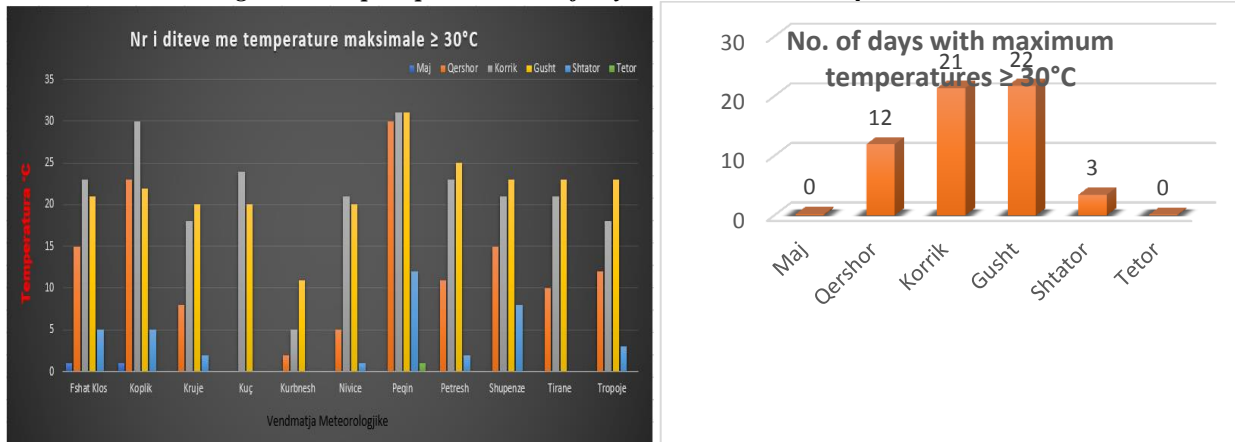
Figure 4. Comparison of 2018 and 2019 data with the rate:



#### 4. EVALUATION OF EXTREME MAXIMUM TEMPERATURES

Based on the data obtained in the study in the above chapter, during which it became possible to monitor the months with extreme maximum temperatures, in different cities of Albania. During this study it was noted that the number of days with temperatures above 30 °C is reached in August. We are presenting this through the following graph:

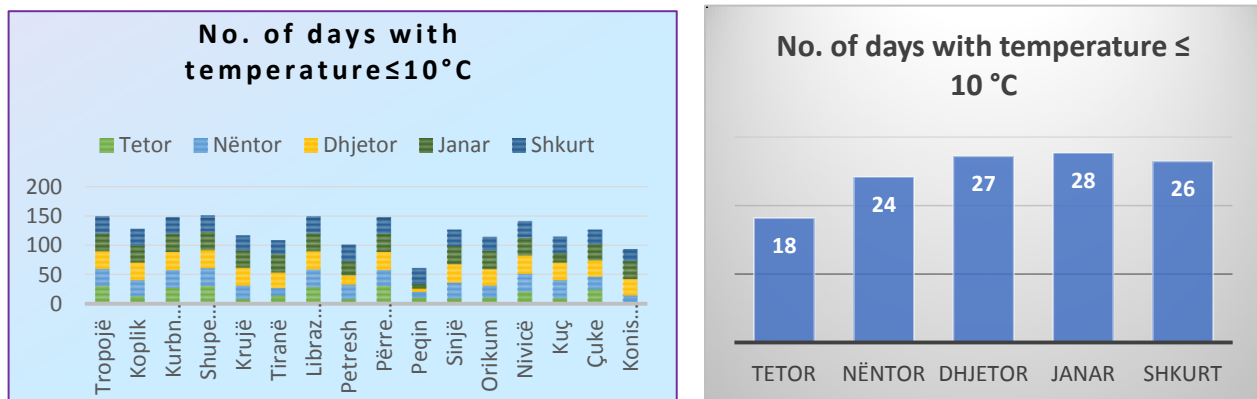
Figure 5. Graphic presentation of days with maximum temperature  $\geq 30^{\circ}\text{C}$



#### 5. EXTREME MINIMUM TEMPERATURE ASSESSMENT

Based on the data obtained in the study in the above chapter, during which it became possible to monitor the months with extreme minimum temperatures, in different cities of Albania. Distribution of no. of days with temperature below 10 °C is given as follows:

Figure 6. Number of days with temperatures below 10 °C in the cities of Albania



Based on the above data, we came to the conclusions that the number of days with temperatures below 10 ° C is reached in January. We are also presenting this through the following table and graph:

## 6. DISCUSSIONS

The average normal human body temperature is 37°C (98.6°F). To maintain this temperature without the aid of heating or cooling equipment, the ambient environment should be around 28°C (82°F). In an environment with extreme temperatures it is important to know what health concerns we may encounter as well as how to avoid any health problems caused by fever. When we talk about extreme hot temperatures we must also take into account the relative humidity that affects us. There are three main ways in which climate change affects human health (WHO., 2018):

- Direct impacts: which are mainly related to changes in the frequency of extreme weather events through weather variables, including heat, drought and storms. These impacts are short-term.
- Indirect impacts: these effects are mediated through natural systems, for example, disease vectors, water-borne diseases, and air pollution. These impacts are medium and long term.
- Third way: these consequences that are severely mediated by human systems, for example, at work, influences, underestimation and mental stress. Environmental conditions such as moderate environmental impacts (eg vegetation, geography, etc.) show how exposure routes to climate change appear in a particular population. There are feedback mechanisms, positive or negative, among society, infrastructure, public health and adaptation measures, and climate change itself (McMichael et al, 2003)“. The current state of the population Social and health inequalities reflect (among many other factors) the degree of success or failure of policies and measures taken to reduce climate-related risks(WHO, 2013). Climate change will make it more difficult to control the wide range of health problems that result in being sensitive to these changes.

## 7. CONCLUSIONS

The period of study for 2017- 2019 had several meteorological phenomena, which result as the most evident in the annual weather performance. The ones that conveyed the most problematic situations, by their nature are:

Significant reductions of air temperature in January with about 7 ÷ 8 days characterized by extremely low values, where was marked the national historical record with -29.0 ° C in the meteorological survey, Korça district on January 8, 2017. Prolonged droughts of meteorological, agricultural and hydrological types, especially during the months of June, July and August, across the country, were felt with negative impacts on the energy and agricultural sectors. Increased occurrence of forest fires, which was associated with major damage to the forest economy and the environment during July and August. Floods recorded in early December as a result of extremely high rainfall, especially in the southern part of the country, which were characterized by intensities in many cases over 120 mm in 24 hours. Emissions from transport have a significant contribution to climate change by deteriorating health and the environment. Proper transportation creates a healthier and safer community. Transport contributes greatly to greenhouse gas emission figures worldwide and 30% in Europe. The situation is estimated to go even worse. From the study conducted we can say that climate change will be the most serious threat to public health in the 21st century. Air pollution, damage, and noise have a major detrimental impact on health, affecting rising temperatures. According to scientific evidence, climate change and its local consequences will negatively affect health status in the coming decades. Identifying local communities sensitive to climate change can help health policymakers prevent negative health-related impacts. The extreme temperature wave plan is based on existing measures taken by local authorities to protect individuals and communities from the effects of hot or cold waves, and to promote community resilience. Provide additional assistance, where possible, to care for those most at risk, including isolated elderly people and those with serious illness or disability.

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