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CLIMATE CHANGE IMPACTS ON THE ACCUMULATION LAKE MODRAC

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ABSTRACT

The catchment area network of the accumulation lake Modrac is made up of three larger streams: Spreča River, Oskova River and Turija River. In the design and construction of the dam and the accumulation of Lake Modrac, it was planned that it serves as a multi-use water management system. The accumulation and Modrac Lake dam is used for the following purposes:

- *to ensure continuous and safe water supply of industrial capacity of Tuzla basin,*
- *to alleviate high water waves and prevent flooding of large areas of agricultural land, especially downstream from the Modrac dam,*
- *supply the population of Tuzla and Lukavac by drinking water,*
- *production of electricity.*

Climate change is having a major impact on the amount of water in the accumulation as well as the appearance of large water waves. One of the key elements for monitoring climate changes is temperature changes. Even slight changes in temperature affect the distribution of precipitation throughout the year, and the amount of precipitation.

This study provides information on the movement of temperature changes in the Lake Modrac accumulation for the period from 1980. It also analyzes the layout and the amount of precipitation in the observed catchment area for the past 30 years.

Keywords: climate changes, temperature, precipitation, Lake Modrac accumulation, water waves.

1. GLOBAL WARMING

Global warming is almost imperceptible rise in temperature on Earth, and we believe that human activity is causing it. Although we do not feel the slight increase in temperature, its consequences would be disastrous. Among the consequences of global warming we include drought and water shortages, hurricanes and wildfires. Also, the changes in the flora and fauna were noted.

Despite the obvious signs of global warming, there is still a ferocious debate about its causes as well as what needs to be done to stop it.

If global warming is not caused by man, then it is the result of natural events. The world has already gone through several major ice ages, in which alternation there were large-scale temperature changes. It is believed that ice ages occur because of inclination changes in the Earth's axis and its orbit around the sun. Global warming may occur due to fluctuations in energy radiated by the sun, and the dust that is created by volcanoes and by human activity.

Scientists already have evidence that the temperature has increased over the past hundred years by about 0.5 °C, while the temperature of the current growth rate is estimated at 0.3 ºC per decade.
If human continues to pollute the atmosphere, the Earth could become warmer by 1 to 5 °C during 21st century. If we want to avoid catastrophic consequences we must descend global warming to below 2 °C over the next 50 to 80 years. The main problem of solving global problems is that they can not be solved on a global level. No protocols and the conferences will provide concrete results if the achieved agreements are not put into practice at the local level.

2. TEMPERATURE CHANGE

One of the key elements for monitoring climate changes is temperature changes. Even slight changes in temperature affect the distribution of precipitation throughout the year, and the amount of precipitation. Therefore, in this study, the diagram (Figure 1) shows the movement of the maximum and minimum temperatures for the period from 1980. to 2010. Temperature values are displayed for the climate station Modrac.

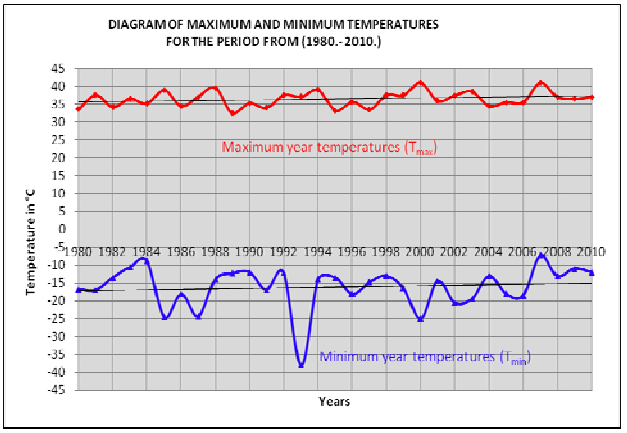

Figure 1. The values of maximum and minimum temperatures for the climate station Modrac for the period from 1980. – 2010. year

Figure 1 clearly shows a visible trend of rising of maximum and minimum temperatures by about 1°C

3. PRECIPITATION CHANGES

To determine how changes in maximum and minimum temperatures affect the amount and distribution of precipitation, we created the diagrams to show the distribution of average monthly precipitation during the year, comparing to the reference period from 1956. to 2007.

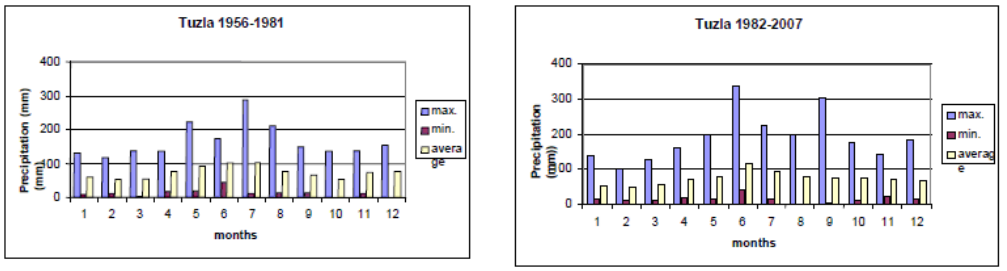

Figure 2. Extreme and average values of monthly precipitation in Tuzla in the period 1956 to 1981. and 1982 to 2007.

In the Figure 2 it is evident a visible increase in the maximum and average values of precipitation compared to the observed time-reference period.
In addition, to determine the trend of changes in precipitation for a sequence of years from 1980. to 2010., the following figure shows the maximum annual precipitation values. From the trend line it is visible an increase in the value of maximum precipitation of about 8 mm.

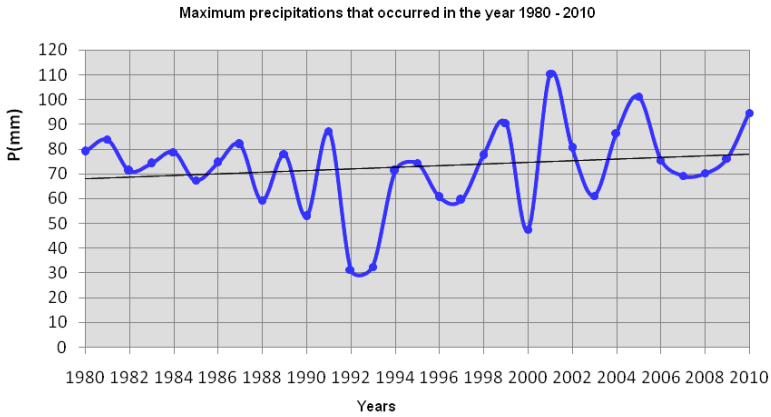

Figure 3. Maximum annual precipitation values for the period from 1980. to 2010.

The amount of precipitation, in addition to other elements of the catchments area, has a direct impact on the formation of water waves and therefore in this study, we created the maximum flow diagram with a change trend line which is shown by the given hydrogram for the analyzed period.

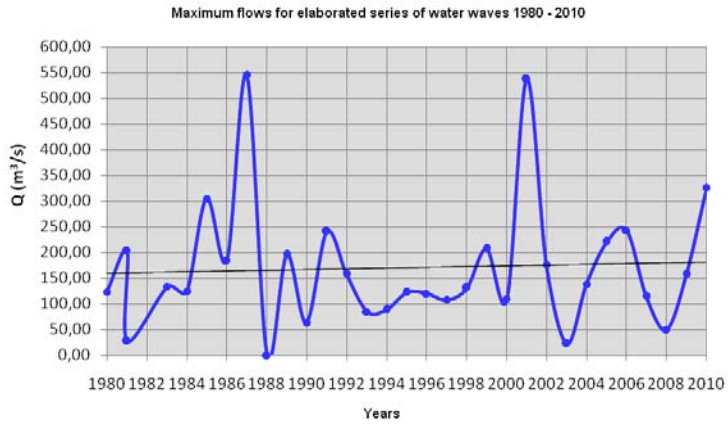

Figure 4. Maximum flows for elaborated series of water waves for the period from 1980. to 2010

In the chain of changes from maximum and minimum temperatures and precipitation, it is logical to expect the value differences in maximum flows too.
Figure 4 shows that the trend of growth in the value of maximum flows is 25m3/s, which is 5% in comparison to the maximum recorded flow rates.

4. CONCLUSIONS

The largest water waves occur in the spring time in the months of April, May, and June. In this period there is a filling of accumulation and in most cases the activation of dam bodies.
In this study, according to the presented analysis of changes in maximum and minimum temperatures and changes in the amount of precipitations, we observe a slight increase in maximum flows at the Lake Modrac dam profile. According to the maximum flow rates analyzed for the period from 1980. to

2010., we see a slight increase in the inflow hydrogram into the accumulation lake of Modrac, which has resulted in some changes in the flow curve of the lake Modrac dam profile, as well as changes in the volume curve.
Analysis of climate changes shows that the global climate changes are also reflected in the catchments area of the accumulation lake Modrac.

5. REFERENCES

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