CLIMATE CHANGES AND THE EXPECTED IMPACT TO THE TRANSBOUNDARY WATER RESOURCES IN ALBANIA

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The climate impact in water resources and in turn for the Albania's power sector, which is more than 90% dependent on hydropower for the energy and electricity supply, is significant. Albania has currently experienced less rain than ever, therefore dryness of the reservoirs. Country can meet only 50% of its electricity needs. Albania is currently undergoing the deepest energy crisis reflected with shortage of energy supply.

Given the importance for the country and high likelihood of significant climate impacts the Vjosa River Catchment's has been selected as a pilot area.

The climate changes scenarios for Albania project an average increase in annual temperature up to 2.0°C (2050) and 4.0°C (2100). A high warming during summer, up to 2.8°C (2050) and 5.6°C (2100) might be expected. As far precipitation, the annual scenario leads to a decrease of annual value (average) up to 6.1% (2050), and 12.4% (2100). A drastic decrease in precipitation total is likely to occur in summer.

The present study aims to analyze the river flow of Vjosa River, situated in southern Albania, using the data from this watershed.

To evaluate the effects of Climate Change on the Vjosa Basin, a hydrological rainfall – runoff model was applied. The precipitation and temperature input into the model was spatially averaged over the basin using Thisean method for precipitation and arithmetic mean for temperature. The model was calibrated with data for standard period 1961-2000.

> The climate variation does impact the water flow, but human influence cannot be ignored.
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> In this study the data used are of some hydrometric station having a long time record and free of human influence.

Different studies show cycles with different continuity from 2-3 year to 100 year. The water flow differs from year to year under the influence of climatic factors and mainly atmospheric precipitation and air temperature. Other factors, except human influence, have a slow influence, coming after the climatic changes. So from all factors, the climatic one is the most changeable. Climatic changes influence directly in water resources regime and step by step, the changes in flora, relief etc. in natural conditions the hydrologic regime needs century, and the soil and relief much more than this. But, under the human influence these rhythms change a lot in increasing direction.

To characterize the water flow fluctuation, during the years, you must have a very long data series. In our case the conclusions are not definitive.

By the analysis results that the most important climate changes effect in the Vjosa basin is a change in the timing of stream flow through the year.

Analyzing the fluctuation of the river flow during the years, we can detach a slight orderliness.
In this study the water distribution even during the year is analyzed and the influence of factors as climacteric and morphologic factors are taking in consideration.

Trend analyses of river floods and low flow

The issue of detecting climate change signature in river flow data is very complex because the process of river flow is the integrated result of several factors, such as precipitation inputs, catchement storage and evaporation losses but also the river training measures taken over time and the morphological processes changing the river conveyance (Pinter et al., 2003).

Change in a series can occur in numerous ways: gradually (a trend), abruptly (a step change) or in a more complex form and may affect the mean, median, variance autocorrelation or almost any other aspect of the data.

A number of floods in Europe, as well as in our country too, during the past decade have provoked the question of whether they are an effect of a changing climate or not. Different studies found out that flood risk in some basins can be expected to rise in winter, whereas at the same time summer drought may become more severe.

But in some areas at risk from flooding, the threat of inundation had sometimes also been aggravated by man. Whether floods are increasing ore not has therefore become an even more acute issue to study.

The objective of the study is to investigate whether there is any support for increases in river floods in observational data. Trend analyzes requires long records to distinguish trend from climate variability preferably in excess of about 50 years (Kundzewicz and Robson, 2000).

From the world experience there are some global, continental, regional scale studies of trends in river flow using monthly, seasonal or annual flow data. Studies using daily mean data are fewer. Some other authors use annual maximum daily mean river flows (e.g. Douglas et al., 2000). Flood trend studies tend to focus in the annual maximum flood series, which means that in years with many high flows only one flood event per year will be selected, and in years with no large flows at all, a relatively low flow will be selected.

In the present study we decided to adapt (Robson and Reed, 1999) a more representative way of describing the occurrence of floods using a Peak-Over- Threshold approach (POT). This selects all floods above a certain threshold that occur in an entire flow record, provided that the floods extracted can be regarded as independent. This means that in one particular year several floods may be recorded, whereas in another year no floods may be recorded. Thus the use of POT series also allows an estimate of the trend in the frequency of floods, rather just their magnitude, by calculating the number of POTs that occur each year and investigating the trend in this series. The data to be use are these of maximum monthly river flow in Vjosa river basin and are selected to be free of human influence (as much as it is possible).

Five different indices were used to describe the characteristics of floods. The first of this is the annual maximum daily river flow (Ann.Max). In flood-rich year the annual maximum series will only include one of the large floods; whereas in flood-poor years a small river flow will be selected that may not necessarily be a flood at all. Peak over threshold (POT) series consist of a series of independent monthly maximum river flow that exceed a certain threshold. Two POT indices describing flood magnitude were use: the POT 1 Magnitude (POT 1 Mag.) and POT 2 magnitude (POT 2 Mag.) As the threshold for the POT1 Mag. the smallest annual flood for the whole period was selected and after that the values of the series were selected from the maximum monthly discharges. For the POT 2 Mag the mean of the maximum annual series was selected.

The frequency of flood events can be described by counting the number of POTs occurring in each year. Two such flood frequency indices were used: POT 1 Frequency (POT 1 Freq) and POT 3 frequency (POT 2 Freq.). This annual frequency series were derived from the corresponding POT magnitude series as was explained above.

The first series (Ann.Max) describe the magnitude and frequency of the most extreme floods, whereas POT 1 and POT 2 series characterize the behavior also of the more moderately sized floods.

Because the drought tend to be longer lasting than floods, data of lower temporal resolution than daily are more likely to be sufficient for low flow studies than they are for flood events. The monthly minimum discharges for detecting trends in the Vjosa catchemnt area are used. One low flow indice was used to describe the lower flow spectrum, the series of 30 day (Min. 30-day) minimal river flow.

Result and discussion

Detection of trends in long time series is an important scientific issue. It is necessary if we are to establish the true effect of climate change in our hydrological systems, and it is fundamental for planning of future water resources and flood protection. Studies of trend detection are also of importance because of our need to understand the changes of the "natural" word. In view of the many dramatic recent floods, detection of trends in long time series of flood data is of paramount scientific and practical importance.

The hypothesis that climate change will cause increases in frequency and severity of extreme hydrological events has resulted in growing recent interest in change detection in flow data.

Yet, to date, there is little concrete evidence of climate – induced change for river flood-records. There are problems with strong natural variability and with data availability and quality. The search for weak changes in time series of hydrological data, which are subject to strong natural variability, is a difficult task, and use of adequate data and of good quality methodology is essential.

Finding a significant change in time series of river flow data by statistical testing is not difficult if a change results from a major human intervention in the river regime, such as, for instance, dam construction. It is far more difficult to find a gradual change, related to climatic impact, in the behavior of the extremes of flow amidst natural variability.

Flood risk may have grown due to a range of land-use changes (deforestation, urbanization, reduction of wetlands etc.) which induce land-cover changes, hence of hydrological systems.

Flood risk may have grown due to considerable changes in socio-economics systems, such as economic development of flood-prone areas, with a general increase in population and wealth, which lead to increasing exposure and exacerbated flood losses.

The method used to estimate whether is a significant positive or negative trend in flood magnitude and frequency is the linear regression. By this method a regression line fits to the series and the slope describes whether the trend is strong or not. The null hypothesis is that the slope of the line is zero.

However, the linear regression method requires the assumption of normal distribution and is very sensitive to outliers in the data; by ranking the observation and applying the non-parametric Mann – Kendall test, a more robust measure of trend is obtained.

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