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Influence of Climatic Conditions on Excess Moisture at Surface and in Soil From Someş Mic Meadow

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Abstract. Soils degraded by excessive moisture are characterized by the content on surface and in the mass of water which prevents normal function of plants and bring soil in poor condition of tillage and cultivation. A special case of excess water are the floods caused by overflowing rivers. The paper addresses a current topic both nationally and internationally, because often the effect of excess moisture in soil is neglected to be studied in detail, although it is mandatory to assess and monitor closely the phenomenon of soil degradation in European countries.The main objective of the paper is to present the influence of climatic conditions on excess moisture at surface and in soil from Someş Mic meadow. Using rainfall values recorded for the period 2011-2012 at the weather stations in Cluj-Napoca, Salatiu and Apahida could create a database necessary to achieve the mean annual precipitation map for Somes Mic floodplain between Cluj-Napoca and Dej, using GIS techniques. Making Geographical Information Systems, in order to elaborate decisions regarding the necessary hydro-ameliorative works in the studied area were based on storaging and editing geographical information and also analysing and studying other parameters measured and determined for the period 2011-2012.

Keywords: excess moisture, climatic conditions, meadow, Someş Mic.

INTRODUCTION

Although the occurrence of excess moisture in some areas cannot be avoided in case of extreme weather events, excess water in the soil can be managed through proper management of the risk of soil degradation by knowing the vulnerability of the soil due to uncontrolled agricultural practices or absence of hydraulic structures to facilitate removal of excess water from the variation of meteorological factors in short intervals (Gokmen *et al.*, 2012).

Decreasing the consequences occur, especially as a result of prior actions of producing the phenomenon of soil degradation. Through the knowledge and assessment of the phenomenon we are being able to find solutions to minimize the damage both economically and socio-culturally (Farelly *et al.*, 2011).

Studies with a hydrological, geotechnical, climatic and demographic character, completed with topographic and geodetic parameters offer concrete data regarding the manifestation of the phenomenon of excess moisture on agricultural land, but also make it possible to design and monitor the behavior of hydrological works (Beilicci and Beilicci, 2010).

MATERIALS AND METHODS

Rainfall values recorded for the period 2011-2012 at the weather stations in Cluj-Napoca, Apahida and Salatiu and also the studies in field, led to obtaining a geographical

information system in which data about the weather or the evolution of the area can be obtained.

Creating this geographic information system allows an easier monitoring of the natural factors variations, so being able to adapt the hydro-ameliorative works to the new conditions, either we refer to the changing of the land use or to the climate change which is characterized by extreme phenomena which occur more often (very long periods of drought or high rainfall intensity).

Based on studies made, we were able to create different thematic maps referring to the climatic conditions in the studied area (rainfall, temperature), maps which present an easier interface for data to be interpreted.

The digital maps involved in the data processing using GIS form a database. The map is decomposed into several layers of data and vice versa, several layers can form a map. The layers can be combined to produce maps that are not in traditional form (Imbroane and Moore, 1999).

In the vector system, a layer carries a set of graphic primitives that share the same topological properties. The raster system uses a layer which represents a thematic image. They can be combined with the vector layers depending on the purpose. To achieve the digitization process using ArcGIS the first step is to determine the control points and only after that can proceed to the next steps: setting the map size, points digitization, arcs digitization, polygon digitization and finally saving the file (Imbroane and Moore, 1999).

In order to achieve the primary database the first step has been introducing the data from the carthographic products into the computer in numerical form by scanning them at a specific scale and after that were imported in ArcMap.

For the present study were scanned and added to ArcMap the topographic maps at scale 1:25.000, the soil map and the geological map containing the study area.

RESULTS AND DISCUSSIONS

Rainfall has a direct influence on the hydrographic evolution by the amount of precipitations in a certain area. In order to facilitate this influence, was made a map which presents the average values of rainfall during a year for the studied area (Fig. 1).

For evaluating the influence of rainfall, especially to characterize the source of the excess water from the soil surface and in the soil, we performed an analysis of rainfall recorded during the two years (2011, 2012).

One of the most important analyses is the one referring to the recorded rainfall in 24 hours, 48 hours or 72 hours.

Rainfall variation in the studied area for the period 2011-2012, and also the rainfall variations for the same month recorded at different weather station has a negative influence on the excess moisture from the soil surface and in the soil (Fig. 2). Also in Figure 2 we can observe that both for 2011 and for 2012 the most significant amount of rainfall is recorded in May, June and July.

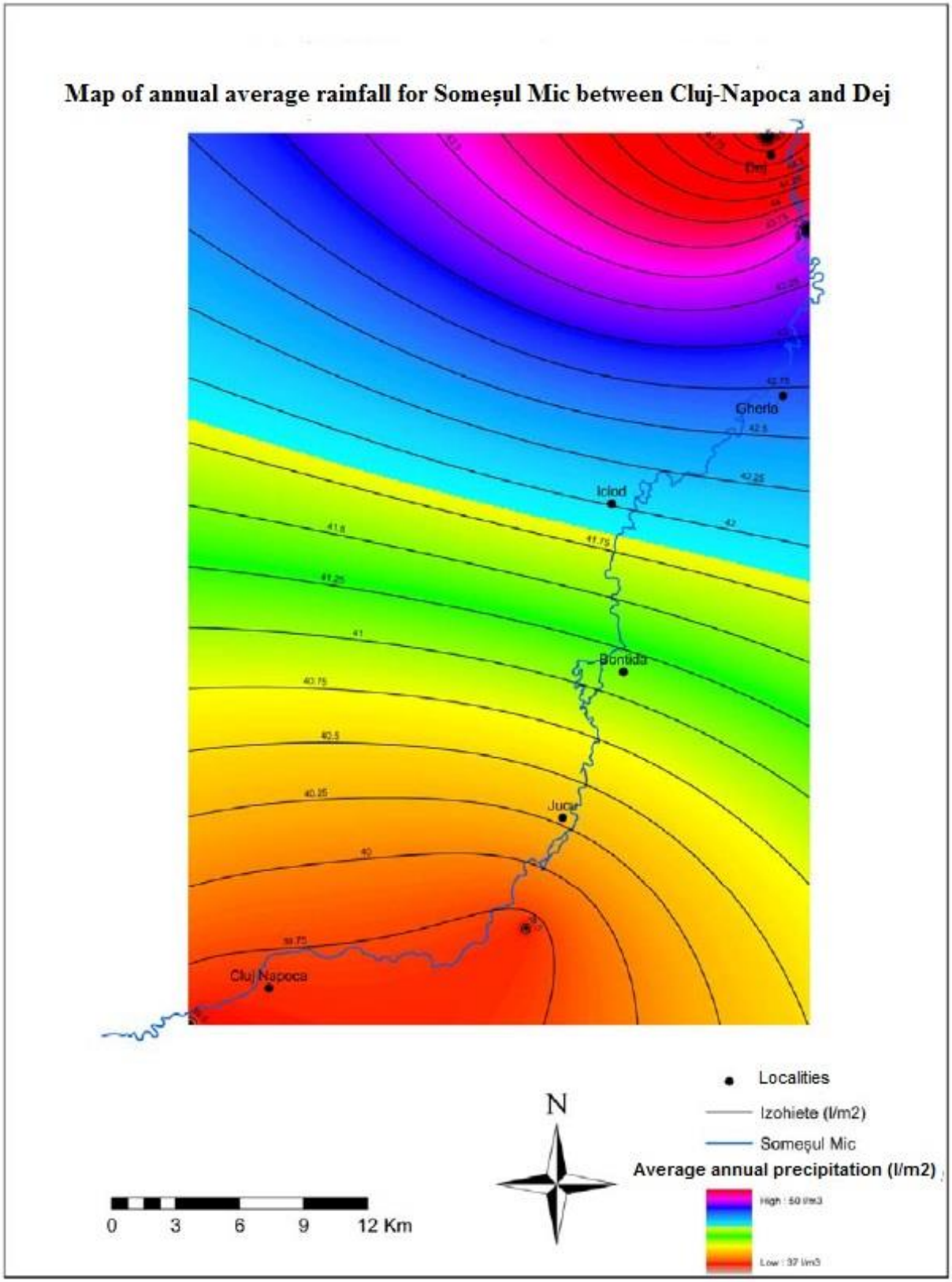

Fig. 1. Map of annual average rainfall for Someşul Mic between Cluj-Napoca and Dej

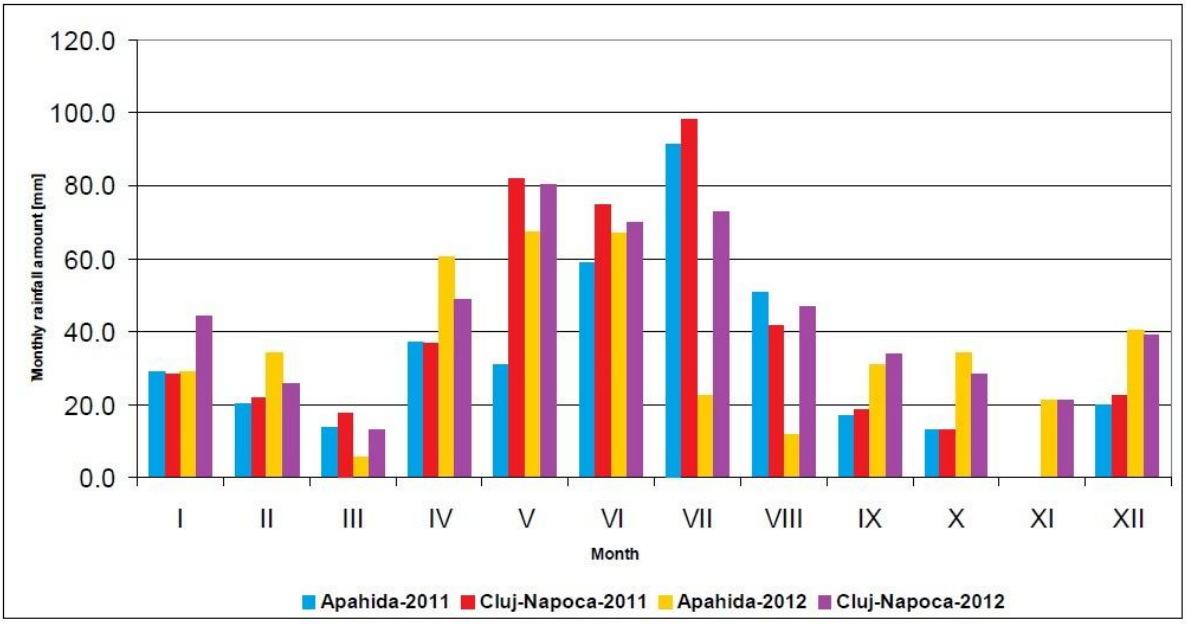

Fig.2. Monthly rainfall distribution in 2011 and 2012 (MS Cluj-Napoca and Apahida)

Based on data collected from the weather stations in the studied area was made a graph that shows the snow thickness in 2011 and 2012 (Fig. 3).

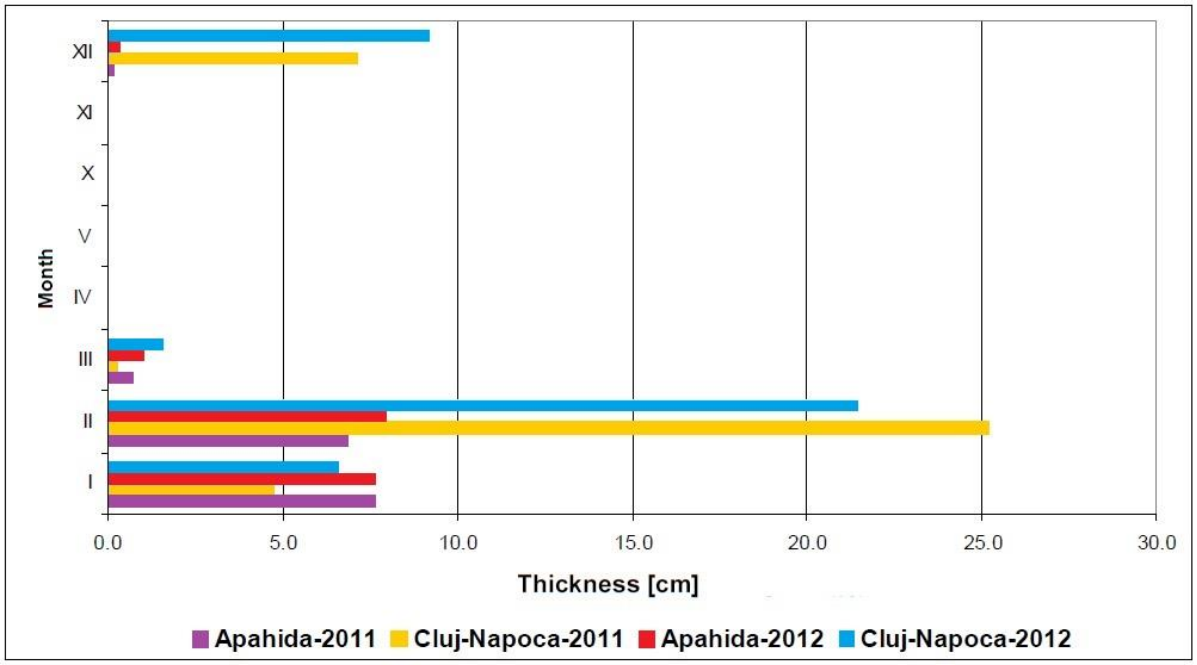

Fig.3. Snow thickness in 2011 and 2012 (MS Cluj-Napoca and Apahida)

The amount of precipitations which falls as snow affects the excess moisture especially in spring when the snow melts and the soil reaches saturation and leads to the puddle phenomena.

Using GIS techniques was made a thematic map for temperature, which is another important factor that influences the excess moisture (Fig. 4). Variation of monthly average

temperature is the factor that contributes to the humidity influencing the water cycle in nature through evapotranspiration.

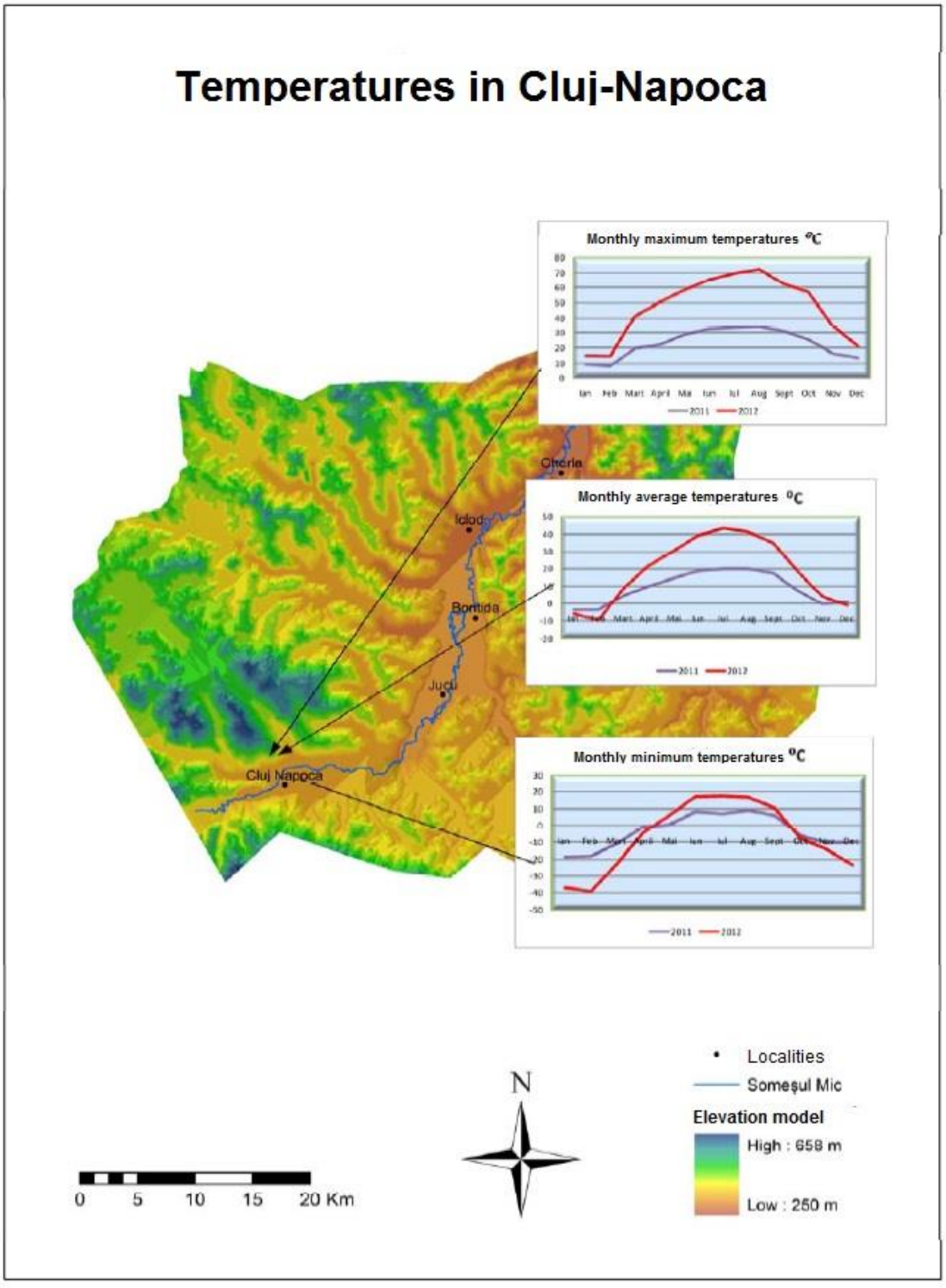

Fig.4. Temperature variation in Cluj-Napoca for years 2011 and 2012

Using the average, minimum and maximum temperatures for each month, was determined the potential evapotranspiration and the reference evapotranspiration for 2011

(Fig. 5) and 2012 (Fig. 6), each was also determined using the specific coefficients for the studied area.

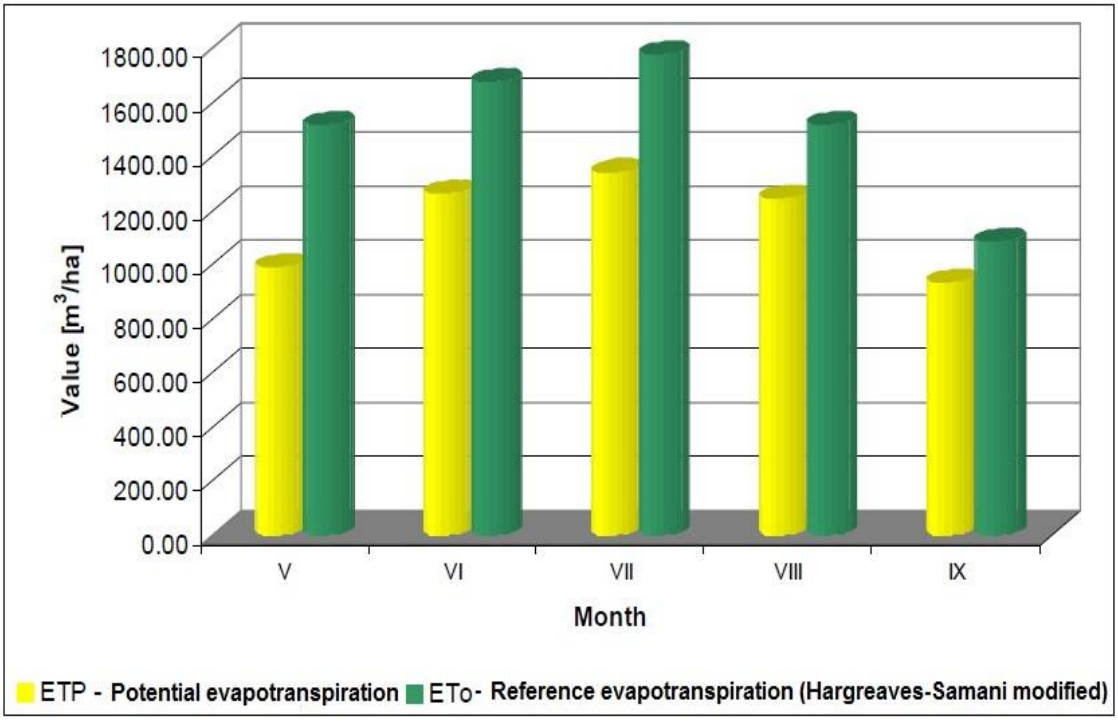

Fig.5. Potential evapotranspiration and reference evapotranspiration, determined by indirect methods (year 2011)

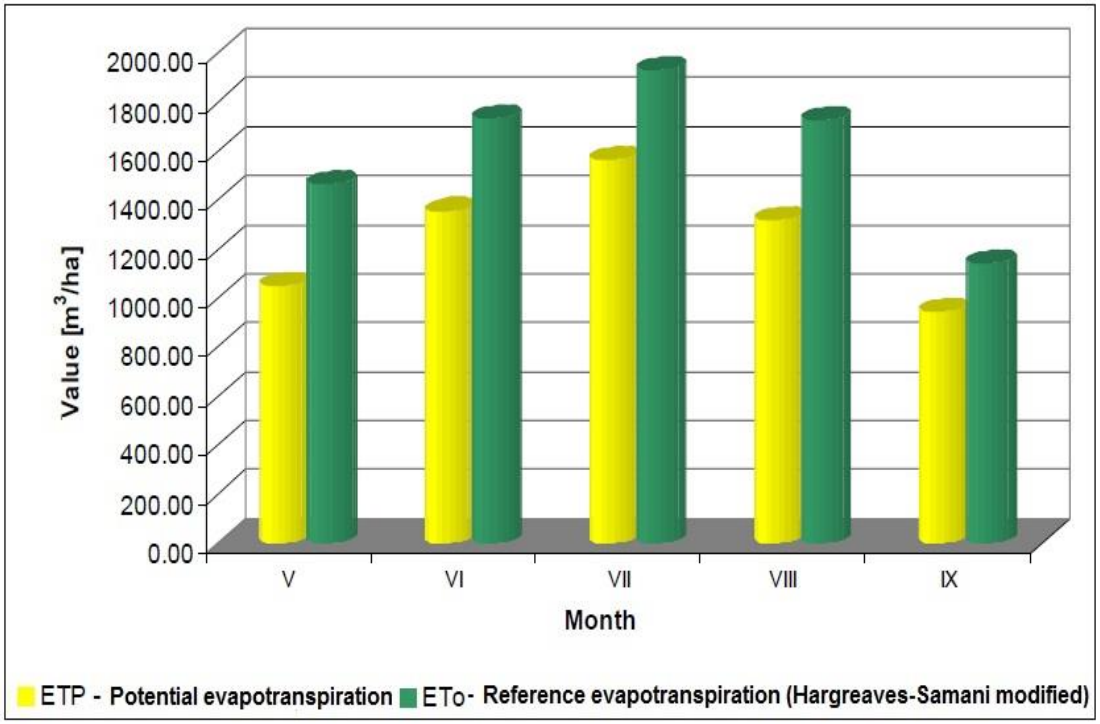

Fig.6. Potential evapotranspiration and reference evapotranspiration, determined by indirect methods (year 2012)

CONCLUSION

The Geographic Information System created using the climatic data collected from the weather stations in the studied area and using the ArcGIS for processing the data was obtained a comprehensive toolkit for spatial analysis and visualization platform of excess water from the soil.

This method allows a better use of resources to make data available for those who need them and can be offered for inspection as online data, maps or standard templates that help in the future to organize information and measure or determine parameters.

Another important aspect of creating a Geographic Information System is the ability to present large volumes of data in an intuitive format based on a map.

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