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# Investigation of Base Flow Reserve in Konya Closed Basin

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**Keywords**
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**Abstract**

Management and protection of water resources, planning and implementation of water budget are of great importance for the development of countries. Calculate on of the water levels and flow values in the rivers is of great importance in the management and planning of water resources. The aim of this study is to investigate the base flow reserve of the Konya Closed Basin by using the stream flow values and to increase the use of water resources to a satisfactory level. Base flow values were obtained based on the stream flow data of the stations in the Konya Closed Basin in 1987 and 2015. Interpolation maps were produced using base flow values and IDW method. According to the created interpolation maps, the base flows of the Konya Closed Basin changed between 0.087-46.54 $m^3/s$ for 1987 and between 0.180-70.14 $m^3/s$ for 2015. Despite some stations shutting down in a period of about 30 years, the base flow values are variable levels in this region.

## Introduction

Base flows play an important role in the protection and appropriate management of water resources. In this study, it is aimed to increase the water resources of Konya Closed Basin (KCB) to a more prosperous level thanks to the knowledge of the base flow.

When the studies in the literature are examined, the base flow estimations are obtained with the help of ARMA models in rivers [1]. Base flows were also estimated by variable slope methods [2]. Graphical methods and withdrawal analyze are among the estimation methods [3-4].

In this study, the base flow values of the KCB were obtained for 1987 and 2015 by using the flow continuity curve (existing 95% of the time) and IDW (Inverse Distance Weight) methods.

## Material and Method

In the study, stream flow data of 1987 and 2015 of KCB were used. The flow data were obtained from the official website of the General Directorate of State Hydraulic Works [5]. The KCB is the largest closed basin of Turkey, covering an average of 62.000 $km^2$ in the inner part of the Anatolian peninsula and including the provinces of Konya, Karaman, Niğde and Aksaray [6]. KCB is located 36°51' and 39°29' north latitude, and 31°36' and 34°52' east longitude [7]. The studied study area is shown in Figure 1.

## Method

Flow continuity curve (flow-rate -confidence interval relationship) and IDW methods were used in the study.


**Figure 1.** Study area [8]

**Flow Continuity Curve**

Flow-continuity curves were used to calculate the base flow in this investigation. A flow rate values curve is a graph that depicts the amount of flow in a given time unit changing over time [9]. The flow-confidence relationship is used to create the flow-continuity curve of monthly average flows [10-11].

**IDW (Reverse Distance Weight)**

The Inverse Distance Weighting (IDW) is an interpolation method used to create data from the data that cannot be sampled by the exemplary points, wherein the creation of these data depends on the interposition distance and formula applied by considering relations with various points [12].

$$f(x,y) = \sum_{i=1}^{n} w_i f_i \tag{1}$$

$$w_i = \frac{h_i^{-p}}{\sum_{j=1}^{n} h_i^{-p}} \tag{2}$$

In Equations 1 and 2;
p; is taken as a power parameter and denoted by exponent,
$h_i$; represents the spatial distance between the sample points and the interpolation points,
$w_i$; represents the weights and the sum of their values must Equation 1,
$f_i$; represents the known height value [13-14].

**Application**

Knowing the base flow values has an important place in controlling water resources. From the base flow data obtained, the base flow reserves of the KCB can be investigated. In this study, the stream flow values of the KCB in 1987 and 2015 were examined and the base flow values approximately 30-year period were found. Flow data of 51 stations in the KCB in 1987 and 2015 were taken into account. Interpolation maps were created with the IDW method in accordance with the base flow values of these stations.

The interpolation map for 1987 is shown in Figure 2 and the interpolation map for 2015 is shown in Figure 3.

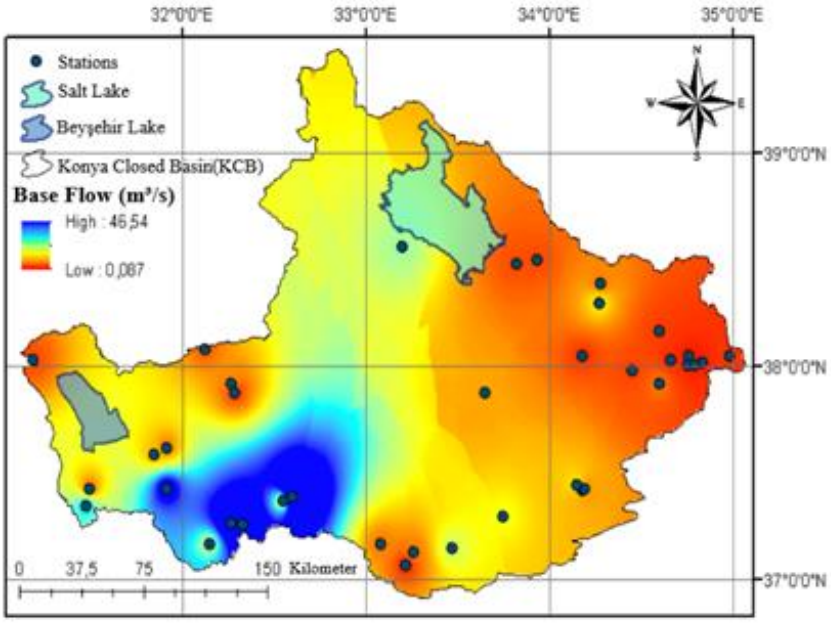


**Figure 2.** Interpolation map for 1987

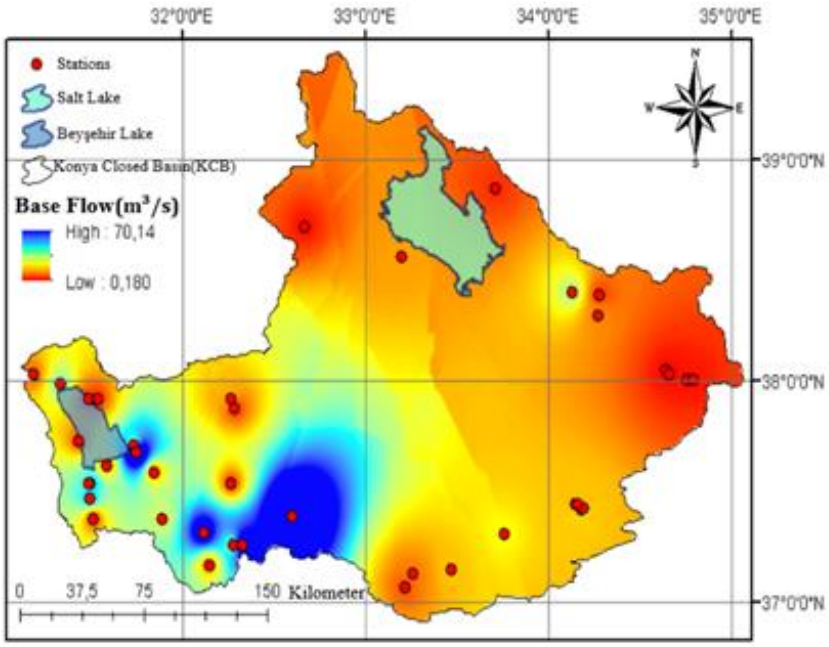


**Figure 3.** Interpolation map for 2015

In Figure 2 and Figure 3, the base flows of the KCB vary between 0.087-46.54 $m^3/s$ for 1987 and between 0.180-70.14 $m^3/s$ for 2015.

## Results

In this study, base flow values were obtained by using the average stream flow rates values ($m^3/s$) of 51 stations in the KCB for the years 1987 and 2015 and by using the flow continuity curve method. The variation of the base flows obtained for these two years was examined. Using the IDW method, interpolation maps of the years 1987 and 2015 were created from these values. When the maps are examined, while the base flow values in the South-West section of the study area were the highest, the base flow values in the East region were the lowest, according to the station base flow values in 1987. In 2015, high base flow is observed in the South-West region of the study area, as in 1987. It is seen that the base flow values are low in the North and North-West regions of the study area.

While some of the stations used in this study were available in both 1987 and 2015, some of the other stations were only available in 1987 and some were only available in 2015. For this reason, all existing and accessible stations were used to represent the basin in the study. In the next study, the base flows for all stations will be obtained and compared using different interpolation methods.

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