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Climate parameter uses as indices for assessment of climate change and water balance in Erbil sub-basin North -Iraq

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Abstract

The main goal of current study was to assessment the climatic parameters in a valuable basin in northern part of Iraq it is Erbil central sub-basin. The climate parameters that used for current assessment are rainfall, relative humidity, temperature (average, max and min), evaporation, sunshine duration, and wind speed. The research area's climatic type and drought state were determined using data During the years from the Erbil meteorological station 1980 to 2021. The results show a noticeable drop in relative humidity and rainfall over the past two decades, as well as a considerable rise in temperature and evaporation. The mean annual rainfall was 416mm, relative humidity 48.74% used as term of water availability, and mean annual temperature was 21.98°C, total annual evaporation was 2257.59mm, sunshine duration was 8.2 hours/day, and wind speed 1.7m/s were used as water loss elements. Kharufa technique was applied to determine the potential evapotranspiration, water deficit and water surplus periods. According to the findings, there is a total of 2257.59 mm of potential evapotranspiration, water excess, and water deficit, 89.22mm, and 1953.95mm, respectively. Annual surface runoff was 37.85mm, and annual recharge from rainfall was 13.07%. Different climatic classifications, including those by Mather, Alkubaisi, Brown, and Cocheme, were utilized to identify the Erbil central sub-climatic basin's type. The results showed that the climate is arid according to the first classification, moist to sub-arid according to the second classification, and dry according to the third classification.

Keywords: Climate parameters, climate change, water balance, Erbil sub-basin, and climate classification

Dedication

I dedicate this project the head of the department and to the research supervisor and finally to all those who would benefit from this project. Presented to all who brought the Kurdistan closer to freedom and happiness with their minds, words and lives.

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1. INTRODUCTION

Humans have been affected by global climate change in recent years as a result of increased use of the world's resources. As a result, between 1850 and 1990, the average yearly air temperature over the world increased by around 0.5°C. Carbon dioxide levels increased by about 25% during the same time period as a result of increased use of fossil fuels. Carbon dioxide (CO2) is emitted by volcanic eruptions and respiration. It dissolves in the oceans and is consumed by plants during photosynthesis. There are currently 359 parts per million by volume (ppmv) of CO2 in the atmosphere, a concentration that is increasing as a result of anthropogenic emissions. The semi-arid climate of Iraq has scorching, dry summers and chilly, wet winters. Rainfall occurs between November and April, with May being the exception. While, May to October months, are the hottest and with no rain**(1).** In Iraq, the highest recorded temperatures vary from above 48°C in July and August to below zero°C in January (2). Hydrologic catchments are influenced via hydrological mechanisms like evaporation and precipitation, and the interaction of rivers and aquifers because they are part of the universal water cycle. If the basin's meteorological circumstances and climatic factors are known, the valuable notion of the water balance may be utilized **(3).**

1.1. Objective of study

The primary objectives of this study are as follows:
(1) Investigate evapotranspiration, water loss, and availability of water using a number of methods, such as the water balancing approach.
(2) Achieve hydrometeorological data to evaluate the rainfall variation analysis (monthly, seasonally, and annually).
3) Determining the basin's water surplus and deficit using multiple techniques.
4)Determine runoff, recharge, and other water balance parameters.
5)Determine the climate catagory and the effect of climate change in the area based on climate factors.

1.2. Description of the study area

The study area is located in Erbil province in northern Iraq, with a total area of approximately 1400 km^2 (3.5% of Iraq). The territory of the city of Erbil is around 70 km2 large inside the 1400 km^2 core basin of the Erbil plain. The region has an average elevation of 412 meters and is bounded on the north by latitude 36º08'30"-36º14'15"N and by longitude 43° 51'20"-44° 12'28"E on the east (Figure 1.1).

Figure 1.1. Erbil Central Sub-Basin Map.

1.3. Climate

Hydro-meteorological measurements aid in the planning, managing, creating, and building of water resources. They generate the data required for developing and validating hydrologic models. The hydro-meteorological strategy for water balancing is frequently utilized when the production of a small basin, within which urbanization occupies a portion, is known. Empirical methods were taken into consideration because such output isn't always available. As a consequence, probable water surplus and deficit periods are identified using the input parameters for this type of water balancing. The factors in the first set of these characteristics have to do with water availability, while the ones in the second group have to do with water loss (4). Every facet of the climate can have a detrimental or beneficial impact on one another, or in certain situations, the positive and bad features of the climate can coexist. Exorbitant position, destination according to continents, seas, and oceans, terrain, air depressions, and air masses are among the main elements regulating the climate of the region of north Iraq, according to Naqshbandi (2008)(5). The main air masses that influence the climate are the marine and continental three types of air masses: Polar air masses, tropical air currents on land, and tropical air masses at sea. The semi-arid climate of the study region is recognized for having annual precipitation totals of less than 500 mm (6). (Figure 1.2). Compared to the northern and northeastern zones of the research area, the air temperatures are greater, and a blizzard is uncommon. According to (7), the climate is continental and is characterized by scorching summers and chilly, wet winters. The steppe climatic region is known for having scorching summers and chilly, wet winters (8;9) (10).