

Kurdistan Region - Iraq  
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# **Estimation of Potential Evapotranspiration in Kurdistan Region Using Different Empirical Models**

**A Thesis**

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## Abstract

In this research work, the value of monthly potential evapotranspiration were calculated for (24) stations in Kurdistan Region of Iraq for the period (2000-2012), using five different models (Hargreaves, Hamon, Hargreaves -Samani ,Penman - Monteith, FAO Penman - Monteith) these models are considered the best and the most widely used globally to calculate the estimated value of the potential evapotranspiration .

The Meteorological parameters recorded at (24) meteorological/ Agrometeorological stations in Kurdistan region such as the data were analysed, and arranged in the form of tables includes (24) station in the three governorates (Dohuk, Hawler, Sulaymaniyah) was developed tables for each governorate a special table of climatic parameters are (Maximum air temperatures, Minimum air temperatures, Average air temperatures, wind speed, relative humidity, rainfall) for the period (2000-2012) as shown tables attached.

The original data and calculated potential evapotranspiration are shown as maps and tables by using software application (surfer8) in the text and as tables in the appendix.

The isothermal maps show that the highest annual mean minimum air temperature recorded in Makhmur station was 16.7°C and the lowest was recorded in Penjwen station was 7.6°C. The highest annual mean maximum air temperature was 30.0 °C in Bateel station and the lowest was 19 °C in Penjwen station.

The highest annual Rainfall was recorded in both Mergasour and Penjwen stations were 1260.6mm and 1085.9mm, respectively. While the lowest was recorded in Makhmur station was 236.2 mm.

The estimated monthly potential evapotranspiration shows that the lowest value was in January at both Amadia and Penjwen stations due to the low air temperature at these locations this is because at these two locations, the lowest air temperatures at these locations.

The highest value of monthly mean potential evapotranspiration was at Bateel station in July due to the high air temperature recorded at this location. The annual mean calculated potential evapotranspiration in general varied between 1100-1600 mm/year.

A fitting equation for each of the five models (Hargreaves, Hamon, Hargreaves-Samani, Penman- Montheith, FAO Penman- Montheith) between potential evapotranspiration and mean monthly air temperature recorded at (24) stations was conducted.

The statistical test showed that a highest correlation coefficient obtained was by using the FAO Penman Monteith model. For Sulaimaniya Governorate stations are in the rate 0.97-0.99 and the second was in Hawler Governorate stations 0.96-0.9, and lowest rate is in Dohuk Governorate stations 0.95-0.99. And (120) fitting equations were determined. It is concluded that the FAO Penman-Monteith model for measuring potential evapotranspiration is the most accurate and widely used among all other models for Kurdistan Region and the results gave a perfect estimate of the potential evapotranspiration. These empirical formulas can be used to estimate monthly total potential evapotranspiration from knowledge of mean monthly air temperature only for any location in Kurdistan region where no climate information is available.