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Hydrometeorological data analysis: a case of study of Ejido La Providencia, Saltillo, Coahuila

Análisis de datos meteorológicos para sistemas hídricos. Caso de Estudio: Ejido La Providencia, Saltillo, Coahuila

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Abstract

In Saltillo, Coahuila de Zaragoza, there are places such as La Providencia common land county, that are considered arid or semi-arid places, where drought is a solid problem. There are water supply alternatives for domestic use such as rainwater systems and atmospheric-water collectors, however, weather conditions are variable and extreme, therefore, it is necessary to collect and to analyze meteorological data in the area. In this work, the precipitation and humidity of the area have been analyzed, finding potential on specific dates of the year to taken as departure to start with water storage systems develop.

Precipitation, Humidity, Water systems

Resumen

En Coahuila de Zaragoza, Saltillo, existen lugares como Ejido La Providencia que se consideran sitios áridos o semiáridos, donde la sequía es un problema alarmante. Existen alternativas de suministro de agua para uso doméstico como sistemas pluviales y captadores de agua por humedad, sin embargo, las condiciones climatológicas suelen ser variables y extremas, en consecuencia, se necesita recopilar y analizar los datos meteorológicos de la zona. En este trabajo se ha analizado que la precipitación y la humedad de la zona, encontrando un posible potencial en ciertos días del año, y puede ser tomada como punto de partida para aplicar sistemas de almacenamiento de agua.

Precipitación, Humedad, Sistemas Hídricos

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Introduction

Organizations should have a strategic management plan and they must implement technologies trying to have an impact on solving situations and keeping low expenses as well considering environmental initiatives in the community they are currently located at. However, the complexity of the technology will vary depending on the site data's analysis and also with the size of the organization, this will demonstrate and justify the technology application.

Water is scarce in many parts of the world and it is expected to continue decreasing because of global warming and inefficient consumption in industrial and commercial areas (Anchan & Shiva Prasad, 2021; Ariyani et al., 2021). Therefore, it is important to analyze this situation, and verify sites that require the implementation of technological alternatives such as rainwater systems and humidity collectors. These solutions are found in water conservation programs, to support arid areas and regions with wetlands(Teston et al., 2018; Zhou et al., 2020). Despite the fact that cities around the world already have standards and regulations for these programs, there are discrepancies between the methods, for example, when sizing the capacity of the rainwater tank, many times they do not satisfy the demand for not considering weather data (Ali et al., 2020; Alim et al., 2020).

In this context, meteorological data assumes the mantle of paramount importance for effective water management systems. Humidity and precipitation, both critical factors, underpin the efficacy of water collectors. Humidity, a linchpin for water collectors, traditionally relies on steam cooling methods with low dew point as condensation catalyst. However, this approach's heightened energy consumption presents a dichotomy between efficacy and operational cost (Heidy Gabriela & Jose Vladimir, 2022; Kim et al., 2022; Weber et al., 2023). Similarly, the operation of rainwater harvesting systems hinges on the aggregation of rainwater in targeted catchment areas, often encompassing rooftops.

Yet, weather-induced wear-and-tear, such as the degradation of waterproof layers or carpets, introduces particulate contaminants that could compromise stored water quality (Marcos et al., 2021; Mohammed et al., 2022; Saldaña-Escorcia et al., 2022).

This research represents the feasibility of obtaining water resources in the community of Providencia common land county in Saltillo, Coahuila. In addition, it aims to determine the potential to supply water with rain and humidity.

Methodology

This work was carried out with the meteorological database taken from CONAGUA agency and the ACURITE ATLAS Meteorological station (Image 1), located at Universidad Tecnològica de Saltillo, which has been operational since February 1st, 2023. Its registers can be monitored on the following platform: www.wunderground.com/dashboard/pws/ISALTI16. It is located at an approximate height of 9.5 m over the ground, and its geographic coordinates are 25.26 °N, 101.17 °W.

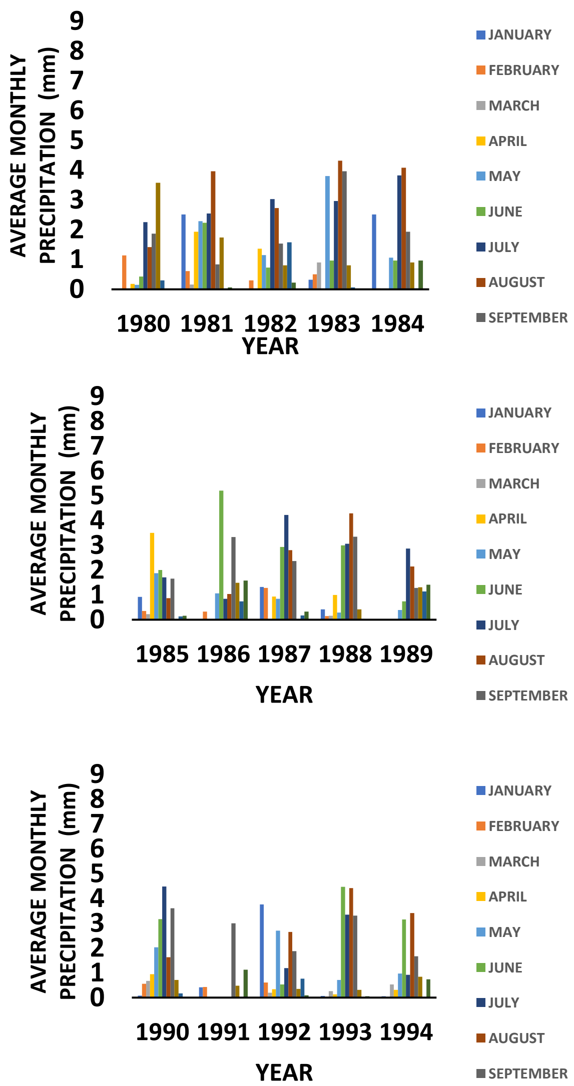
Figure 1 Weather station installation.

Results

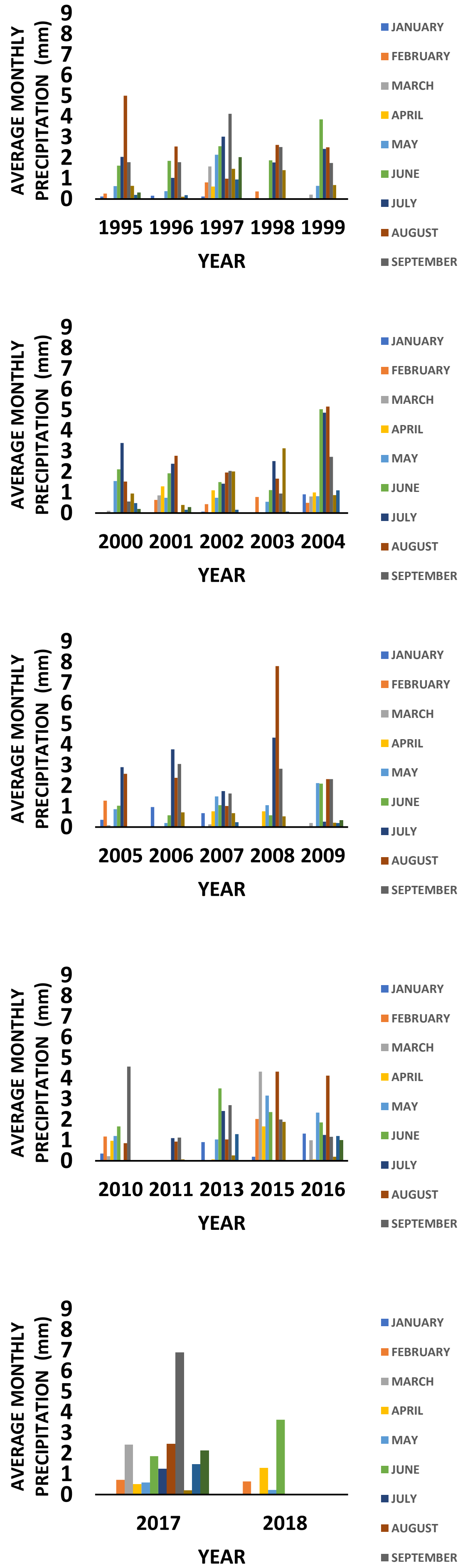
The information shown in graphics 1 and 2 of San Juan de la Vaquería, is from the 1980-2018 period. The graphs show the months with the most rainfall detected, from May to September with a monthly average between of 1.07 to 2.47 mm yearly.

The other months have a low precipitation with less than 0.77 mm. This result indicates that it is likely to have intense and constant rains from May to September. Based on the recorded data, the months with the less of precipitation are from November to January, March and April. Regarding humidity, the data collected from February and March 2023 is shown in graphic 3. In addition, high relative humidity values from 80% to 50% are presented between 10:00 p.m. to 4:00 a.m. Additionally, Table 1 shows monthly meteorological data covering 6 months, including the total accumulation in millimeters and effective time in hours of rainfall, as well as the number of data points acquired. Each data point was recorded to the cloud from the station every 5 minutes. These records indicate a high presence of rainfall in August and June compared to data collected by CONAGUA.

Appendix



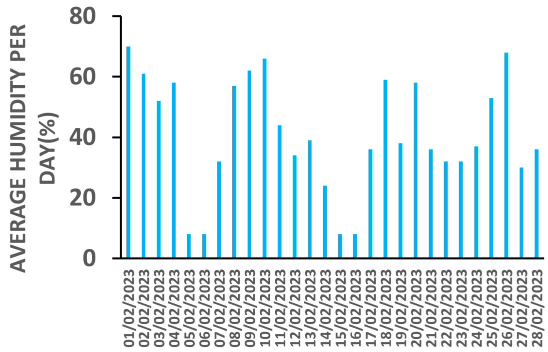
Graphic 1 San Juan de la Vaquería Statistic Information. CONAGUA (1980-1994)

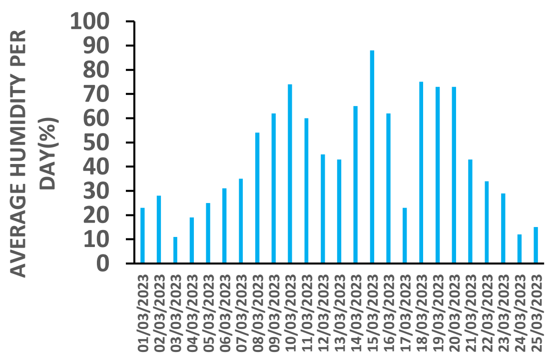


Graphic 2 San Juan de la Vaquería Statistic Information. CONAGUA (1995-2018)

Months	Rainfall accumulated (mm)	#register	Rainfall effective time(h)
February	0	0	0
March	0.1	30	2.5
April	26.5	1013	84.42
May	44.5	1179	98.25
June	16.25	95	7.92
August	59.25	651	54.25

Table 1. Rainfall Data information from San Juan de la Vaquería. ACURITE ATLAS (2023).





Graphic 3 Humidity Statistic Information from *ACURITE ATLAS February-March (2023).*

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Conclusions

Based on the results, the site presents an opportunity to implement a Water System pilot test to increase the residences life quality.

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