Mini Review
Volume 12:3, 2023

Irrigation & Drainage Systems Engineering

ISSN: 2168-9768

Open Access

Case Study on the Effect of Climate Change on Irrigation

Jazuri Abdullah *

Department of Civil Engineering, University of Teknologi MARA, Selangor, Malaysia

Abstract

Irrigation plays a crucial role in boosting agricultural output and productivity for the long-term viability of the nation's economy. Due to the rapid change in the climate system, there will be obvious effects on current activities for the design and management of irrigation systems. The future of this paper will focus on assessing how climate change affects the crop yield and irrigation requirements of the Wonji Shoa Sugarcane Plantation Estate. It used projections from the Cordex regional climate model (RCM) with bias correction for the medium concentration representative path way 4.5RCP scenario and the high concentration representative path way 8.5RCP scenario for future climate data. The AQUACROP model was then fed data that had been downscaled. For both the 4.5rcp and 8.5rcp scenarios, the time series show a significant increase in maximum and minimum temperature values and a slight increase in precipitation.

Keywords: Sugarcane plantation • Agricultural output • Evapotranspiration

Introduction

This article provides a description of the anticipated climate outcome during the baseline and future periods. The downscaled RCM of more than 15 models for the scenarios of the rcp4.5 (Medium representative concentration pathway) and rcp8.5 (High representative concentration pathway) from 1990 to 2099 when compared to the base line data from the wonjishoa sugar cane estate research center for the period 1990–2016. The monthly maximum and minimum temperatures for the 4.5 and 8.5 RCP scenarios in the baseline period show a reasonably good agreement with the observed temperature for all months. These results are for the baseline period (1990–2016) of both in rcp4.5 and rcp8.5. The monthly mean maximum and minimum temperatures for the RCM model (CORDEX) and with bias correction give the following results. Given that precipitation downscaling is inherently more challenging than temperature; the bias-corrected RCM model's estimate of the mean monthly precipitation is satisfactory.

Literature Review

The analysis was carried out using four 20-year periods centered on the 2020s (2020–2039), 2040s (2040–2059), 2060s (2060–2079), and 2080s (2080–2099), and the climate scenario result for the future period was developed from downscaled GCM for two representative concentration pathways (4.5 and 8.5 rcp) for 90 years. All of the comparisons in the following analysis were made using data from the wonji shoa research center's baseline period (1990–2016). In both the 4.5 rcp and 8.5 scenarios, the downscaled minimum temperature displays an upward trend for all months across all future time horizons. In the 4.5rcp and 8.5rcp scenarios, the average annual minimum temperature will rise by 1.35°C and 1.59°C, respectively, in the 2020s. In the 4.5rcp and 8.5rcp scenarios, the average annual minimum temperature will rise by 1.79°C and 2.7°C, respectively, for the 2040s. In the 4.5rcp and 8.5rcp scenarios, the average annual minimum temperature will rise by 2.59°C and 3.63°C, respectively, during the 2060s. For the 4.5rcp and 8.5rcp scenarios, the average annual minimum temperature will rise by 2.79°C at the end of the 21st century and the average annual maximum temperature will rise by 1.52°C and 2.98°C at the end of the 20th century, respectively [1,2].

Address for Correspondence: Jazuri Abdullah, Department of Civil Engineering, University of Teknologi MARA, Selangor, Malaysia, E-mail: Jazuriabdullah@unical.it

Received: 01 March 2023, Manuscript No. idse-23-90394; **Editor assigned:** 03 March 2023, PreQC No. P-90394; **Reviewed:** 15 March 2023, QC No. Q-90394; **Revised:** 22 March 2023, Manuscript No. R-90394; **Published**: 28 March 2023, DOI: 10.37421/2168-9768.2023.12.377

Discussion

In the 4.5rcp and 8.5rcp scenarios, the average annual maximum temperature will rise by 1.97°C and 4.17°C for the 2068s periods, respectively. Monthly variations in maximum temperature ranged from 0.8°C to 1.45°C in the 2020s, 1.01°C to 2.6°C in the 2040s, 1.13°C to 3.66°C in the 2060s, and 1.30°C to 4.68°C in the 2080s. In the 2020s, 2040s, 2060s, and 2080s, the precipitation projection showed an increase in the average mean precipitation. As can be seen in the figure below, both scenarios (4.5 rcp and 8.5 rcp) may result in an increase in precipitation in all other months and a decrease in precipitation in May and September. In the 4.5rcp scenario, the overall effect may result in an increase of 6.85mm in average annual precipitation and a 1.57mm increase in average annual precipitation in the 2020s. Overall, the 4.5 and 8.5 scenarios could result in an increase of 9.88 and 18.34 millimeters respectively in average annual precipitation in the 2080s [3-5].

Conclusion

The three primary research questions pertaining to farmers' adoption of the new irrigation tool and WTP are the focus of this paper: 1) Is the new tool in high demand? 2) What factors affect how easily people can access information about the tool 3) How does the tool's information influence farmers' willingness to pay Our study relied on a survey of irrigation farmers in rural Ghana who participated in an on-farm demonstration of the irrigation tool and expressed their WTP to answer these research questions. However, due to a lack of funds to participate in auctions, the farmers' WTP were based on their stated preferences. None of the people who watched the demonstrations had used the irrigation tool before. Despite numerous studies on technology adoption, farmers' WTP for WFD is poorly understood. The majority of studies only provided estimates of farmers' WTP for irrigation without actually examining irrigation scheduling.

Acknowledgement

None.

Conflict of Interest

None.

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How to cite this article: Abdullah, Jazuri. “Case Study on the Effect of Climate Change on Irrigation.” *Irrigat Drainage Sys Eng* 12 (2023): 377.