World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:17, No:10, 2023

Climate Change Scenario Phenomenon in Malaysia: A Case Study in MADA Area

Authors : Shaidatul Azdawiyah Abdul Talib, Wan Mohd Razi Idris, Liew Ju Neng, Tukimat Lihan, Muhammad Zamir Abdul Rasid

Abstract : Climate change has received great attention worldwide due to the impact of weather causing extreme events. Rainfall and temperature are crucial weather components associated with climate change. In Malaysia, increasing temperatures and changes in rainfall distribution patterns lead to drought and flood events involving agricultural areas, especially rice fields. Muda Agricultural Development Authority (MADA) is the largest rice growing area among the 10 granary areas in Malaysia and has faced floods and droughts in the past due to changing climate. Changes in rainfall and temperature patter affect rice yield. Therefore, trend analysis is important to identify changes in temperature and rainfall patterns as it gives an initial overview for further analysis. Six locations across the MADA area were selected based on the availability of meteorological station (MetMalaysia) data. Historical data (1991 to 2020) collected from MetMalaysia and future climate projection by multi-model ensemble of climate model from CMIP5 (CNRM-CM5, GFDL-CM3, MRI-CGCM3, NorESM1-M and IPSL-CM5A-LR) have been analyzed using Mann-Kendall test to detect the time series trend, together with standardized precipitation anomaly, rainfall anomaly index, precipitation concentration index and temperature anomaly. Future projection data were analyzed based on 3 different periods; early century (2020 – 2046), middle century (2047 – 2073) and late-century (2074 – 2099). Results indicate that the MADA area does encounter extremely wet and dry conditions, leading to drought and flood events in the past. The Mann-Kendall (MK) trend analysis test discovered a significant increasing trend ($p < 0.05$) in annual rainfall ($z = 0.40$; $s = 15.12$) and temperature ($z = 0.61$; $s = 0.04$) during the historical period. Similarly, for both RCP 4.5 and RCP 8.5 scenarios, a significant increasing trend ($p < 0.05$) was found for rainfall (RCP 4.5: $z = 0.15$; $s = 2.55$; RCP 8.5: $z = 0.41$; $s = 8.05$;) and temperature (RCP 4.5: $z = 0.84$; $s = 0.02$; RCP 8.5: $z = 0.94$; $s = 0.05$). Under the RCP 4.5 scenario, the average temperature is projected to increase up to 1.6 °C in early century, 2.0 °C in the middle century and 2.4 °C in the late century. In contrast, under RCP 8.5 scenario, the average temperature is projected to increase up to 1.8 °C in the early century, 3.1 °C in the middle century and 4.3 °C in late century. Drought is projected to occur in 2038 and 2043 (early century); 2052 and 2069 (middle century); and 2095, 2097 to 2099 (late century) under RCP 4.5 scenario. As for RCP 8.5 scenario, drought is projected to occur in 2021, 2031 and 2034 (early century); and 2069 (middle century). No drought is projected to occur in the late century under the RCP 8.5 scenario. Thus, this information can be used for the analysis of the impact of climate change scenarios on rice growth and yield besides other crops found in MADA area. Additionally, this study, it would be helpful for researchers and decision-makers in developing applicable adaptation and mitigation strategies to reduce the impact of climate change.

Keywords : climate projection, drought, flood, rainfall, RCP 4.5, RCP 8.5, temperature
Conference Title : ICERCC 2023 : International Conference on Environmental Risk and Climate Change
Conference Location : Osaka, Japan
Conference Dates : October 30-31, 2023

Open Science Index, Environmental and Ecological Engineering Vol:17, No:10, 2023 publications.waset.org/abstracts/159296.pdf