

Future simulation of solar radiation and cloud fraction over the Malaysia region under RCP 4.5 and RCP 8.5 scenarios

ABSTRACT

Climate change may be defined as a significant change of weather patterns over a long period of time. It has adverse impacts on developing countries such as Malaysia that strongly rely on agriculture and natural resources development and extraction. This present study projected the future average solar radiation and total cloud fraction from 2010-2100 over the Malaysian region based on IPCC Fifth Assessment Report. A global climate model, the Bias-corrected Community Earth System Model (CESM) was used for initial and boundary conditions for Weather Research Forecast (WRF) modelling system. Generally, the model underestimated the reanalysis data for solar radiation and overestimated for cloud fraction over the Malaysia region. The future simulation showed that the averaged solar radiation increased by 12.4 W/m² in Winter and 26.2 W/m² in Summer season under RCP8.5 scenario, relative to the baseline period. In RCP4.5 scenario, the increment of solar radiation was lower in Winter (7.4 W/m²) but higher in Summer (45.7 W/m²) as compared to high emission scenario during Winter and Summer seasons, respectively. At the end of this century, the total cloud fraction decreased over Malaysia domain around 12.9 and 15.9% during Winter and Summer seasons, respectively in RCP 8.5 scenario. Meanwhile, the changes of cloud fraction decreased by -0.9% in January but increased about 27.1% in July under a low emission scenario. Our simulation suggests that climate variability in future scenarios could lead to climate-related risks such as air quality impacts and vulnerability in the region.