

Assessing the robustness and uncertainties of projected changes in temperature and precipitation in AR5 Global Climate Models over the Arabian Peninsula

ABSTRACT

The current study presents the future projection of temperature and precipitation based on ensemble from Couple Model Intercomparison Project 5 (CMIP5) at seasonal and annual time scales over the Arabian Peninsula. Various analysis methods and techniques including spatial plots with robustness analysis, line plots with likelihood spread, and bar plots as well as annual cycles with likelihood ranges of both temperature and precipitation have been employed. The Northern Arabian Peninsula (NAP) region shows an increase in projected signal of temperature higher than the Southern Arabian Peninsula (SAP). Moreover, the northwestern part of NAP shows a large decrease in precipitation for both the RCP4.5 and RCP8.5 scenarios. However, the SAP region shows a great increase in precipitation for both the scenarios. Further, the central, southern and eastern parts of Saudi Arabia also show a tendency of increase in precipitation. Moreover at annual time scale, NAP shows a consistent statistically significant (95% level) decreasing trend of precipitation at the rate of 0.66% ($-1.18/ -0.14$ for RCP4.5/RCP8.5) per decade, whereas SAP shows statistically significant (99% level) increasing trend in precipitation at the rate of 1.67% ($0.34/2.99$ for RCP4.5/RCP8.5) per decade, while the precipitation significant (99% level) increasing trend 0.86% ($-0.27/2.00$ for RCP4.5/RCP8.5) per decade over the Arabian Peninsula. The significant (99% level) warming is projected 0.42 °C ($0.23\text{ °C}/0.60\text{ °C}$ for RCP4.5/RCP8.5) and 0.37 °C ($0.20\text{ °C}/0.53\text{ °C}$ for RCP4.5/RCP8.5) per decade over NAP and SAP respectively, which is 0.39 °C ($0.22\text{ °C}/0.57\text{ °C}$ for RCP4.5/RCP8.5) per decade over the whole Peninsula. Our results call for the development of immediate actions and policies in order to combat negative impacts of climate change over the Arabian Peninsula.