The uncertainties in CMIP3/CMIP5 temperature scenarios over Saudi Arabia

Mansour Almazroui

Affiliation: Center of Excellence for Climate Change Research, King Abdulaziz University, Jeddah, Saudi Arabia

The Coupled Model Inter-comparison Project phase 3 (CMIP3) and phase 5 (CMIP5) data are analyzed for understanding the uncertainties in temperature scenarios over Saudi Arabia. Some statistical methods such as mean, standard deviation, range, root mean square difference, skewness, correlation as well as pattern recognition are carried out to obtain the models performance in the simulation of temperature. The projection for temperature is conducted for the CMIP3 data using different climate change scenarios (SRES B1, A1B and A2) while for the CMIP5 datasets the RCP4.5 and RCP8.5 scenarios are considered. For the present climate (1970–1999), the 22/30 CMIP3/CMIP5 models are grouped into two main categories: i) all models ensemble (MME) and ii) best performing models ensemble (BME). These two categories are used to assess the uncertainties in the future temperature over Saudi Arabia. For the period 2070–2099, the MME (BME) models ensemble revealed an increase in temperature by 2.32±2.45 (3.85±1.54), 3.49±2.49 (4.91±1.61) and 3.82±1.47 (5.36±1.47) ℃, relative to the present climate, under the B1, A1B, and A2 scenario, respectively, while the inter-model ranges are projected to be from -3.36 to 6.08 (0.84 to 5.96), -2.26 to 7.68 (1.94 to 7.29) and -1.79 to 7.40 (2.75 to 7.10) ˚C respectively. For the same period, the temperature is supposed to be increased by 2.51˚C±0.72˚C (2.79˚C±0.30˚C) and 4.87℃±0.86℃ (5.26℃±0.32℃), compared to the present climate for the AME (BME) under RCP4.5 and RCP8.5 scenario, respectively. The inter-model ranges from 1.10℃ to 3.69℃ (2.11℃ to 3.22℃) and 3.49℃ to 6.34℃ (4.36 ℃ to 5.95 ℃) for the AME (BME) under RCP4.5 and RCP8.5, respectively. A better choice of models from the CMIP3/CMIP5 database could reduce the uncertainty range associated with future projections of temperature over Saudi Arabia, which may help policymakers to address better the climate-related threats in the country.