Assessment of uncertainties in projected temperature and precipitation over the Arabian Peninsula using three categories of CMIP5 multimodel ensembles

ABSTRACT

Background: Projections of temperature and precipitation with low uncertainties are key parameters to climate change related studies. Purpose: The projected temperature and precipitation and their uncertainties over the Arabian Peninsula for the 21st century for three CMIP5 multimodel ensembles under RCP4.5 and RCP8.5 are examined in this paper. Methods: Analyzing the performance of 30 CMIP5 model individually, they are categorized into three groups for the present climate (1976–2005). By applying simple model averaging ensemble method, three multimodel ensemble means, namely: (i) all CMIP5 models ensemble (AME), (ii) selected CMIP5 models ensemble (SME), and (iii) best-performing CMIP5 models ensemble (BME) are developed. Results Over the Arabian Peninsula, a continuous rise in temperature is obtained in all three ensembles (i.e., AME, SME, and BME) in the 21st century. The BME shows enhanced changes in temperature at the end of 21st century as compared to AME and SME. Moreover, the BME shows a remarkable reduction in uncertainties for the projected temperature. The AME, SME, and BME show strong inter-annual variability for the projected precipitation over the peninsula. Compared to AME and SME, the BME revealed enhanced positive change in the annual mean precipitation by the end of 21st century. Conclusions: Regionally, southern/northwestern areas of the peninsula receive enhanced/reduced future precipitation as compared to the present climate. The diferences in the projected precipitation and temperature signals increase largely between the three ensembles towards the end of 21st century. Therefore, it is concluded that selecting the best-performing models may lead a better planning by the policy makers and stakeholder for the region.