Climate Prediction of Rainfall over Saudi Arabia

marwan sakkal

Presidency of Meteorology and Environment, Jeddah, Kingdom of Saudi Arabia(dr_msakkal@hotmail.com)

Abstract

Being located within the dry belt of the northern hemisphere subtropics, Saudi Arabia has a very poor water resources. Excluding the mountainous of the south west and a limited area of the central regions of the country, the average annual rainfall is less than 100 mm every where. Accordingly, the country is very vulnerable to any natural or human-induced climate change which will impact its fragile environmental and social systems.

The government of Saudi Arabia is currently conducting an ambitious long term national program on rain enhancement by seeding and the associated cloud physics research. An important component of the program is the provision of climate predictions of rainfall to help identifying its future trend and distribution. The program hence, could reorient its activities towards regions having a significant future rainfall reduction.

GCMs were first used to project the rainfall over the kingdom. Out of seventeen, three GCM models were found to simulate very closely the climatic trend characteristics of Saudi Arabia.. Results obtained from running the combination of these three models, for the reference (P50)and the policy (WRE-350) emission scenarios, indicated that the spatial distribution of rainfall in the year 2041 is generally resemble that of the year 1991.

The highest increase in precipitation occurs in summer in all regions. Obviously, this is trivial for areas having no summer rain., but in southern and southwestern regions, where precipitation regime is characterized by two peaks(one in summer and another in spring), such an increase has an important implication.

However, scenarios of climate change derived directly from GCM output are of insufficient spatial resolution., with a consequent loss of some of the regional climate characteristics which may have important impacts on the socio-economy of the local community. One of particular importance to the kingdom of Saudi Arabia is the lack of representation of the Assir mountains in GCMs, and the inherent indiscrimination between seas, shore stripes, mountain ridges and desert land within a single grid square. From the many "downscaling" techniques to overcome this deficiency, Regional Climate Model (RCM) rather than (GCM) is applied, next, to obtain high resolution information of climate fields.

PRECIS (Providing Regional Climates for Impact Studies) of Hadley centre has been selected as an appropriate RCM for that purpose. Boundary conditions are required at the limits of the model's domain, which were obtained from three, most frequently used, sources.

Preliminary results for the period 1972-2001 show that , PRÉCIS has simulated well the broad features of the actual regional climate and been able to capture the observed extreme events in the climate record over the recent past. Hence, the model can be used with some confidence to produce the main characteristics and trends of the future rainfall over the kingdom.

The aim of the present work is to study the performance of the model for future period and to correlate the predicted rainfall pattern and trend to the objectives of the national program on rain enhancement by seeding .