Journal of Water and Soil
Vol. 29, No. 5, Nov.-Dec. 2015, p. 1376-1390

نشریه آب و خاک (علوم و صنایع کشاورزی)
جلد ۲۹، شماره ۵، آذر – دی ۱۳۹۴، ص. ۱۳۹۰-۱۳۷۶

Comparative Assessment of SDSM, IDW and LARS-WG Models for Simulation and Downscaling of Temperature and Precipitation

Z. Dehghan[1*] - F. Fathian[2] - S. Eslamian[3]
Received: 22-02-2014
Accepted: 29-11-2014

Introduction: According to the fifth International Panel on Climate Change (IPCC) report, increasing concentrations of CO_2 and other greenhouse gases resulting from anthropogenic activities have led to fundamental changes on global climate over the course of the last century. The future global climate will be characterized by uncertainty and change, and this will affect water resources and agricultural activities worldwide. To estimate future climate change resulting from the continuous increase of greenhouse gas concentration in the atmosphere, general circulation models (GCMs) are used. Resolution of the output of the GCM models is one of the problems of these models. Using downscaling tools to convert global large-scale data to climate data for the study area is essential. These techniques are used to convert the coarse spatial resolution of the GCMs output into a fine resolution, which may involve the generation of station data of a specific area using GCMs climatic output variables. The objectives of this study are, therefore, to investigate and evaluate the statistical downscaling approaches.

Materials and Methods: Different models and methods have been developed which the uncertainty and validation of results in each of them in the study area should be investigated to achieve the more real results in the future. In the present study, the performance of SDSM, IDW and LARS-WG models for downscaling of the temperature and precipitation data of Pars Abad synoptic station were compared and investigated. IDW technique is based on the functions of the inverse distances in which the weights are characterized by the inverse of the distance and normalized, so their aggregate equivalents one. SDSM is categorized as a hybrid model, which utilized a linear regression method and a stochastic weather generator. The GCM's outputs (named as predictors) are used to a linearly condition local-scale weather generator parameters at single stations. LARS-WG is a stochastic weather generator and it is widely used for the climate change assessment. This model uses the observed daily weather data, to compute a set of parameters for probability distributions of weather variables, which are used to generate synthetic weather time series of arbitrary length by randomly selecting values from the appropriate distributions. In this study, data from the Pars Abad meteorological station, which was used as the data for the baseline period, was also used to predict climate variables. The record of data is 30 years (1971-2000), and the mean temperature and precipitation are 13.7 and 283 mm per year, respectively. The driest month is August, which receives less than 5 mm of rain. Most of the rainfall occurs in April, averaging at 47 mm. July is the warmest month of the year, with an average temperature of 28.9 ^{o}C, and January is the coldest, with an average temperature of -2.3 °C. Precipitation differs by 42.8 mm between the driest and wettest months of the year and the average temperature varies by 31.2 °C.

Results and **Discussion**: The calibration and validation results of the SDSM and LARS-WG models in the case of temperature showed that two models have better abilities for temperature simulation in comparison with precipitation data and, in all models, the increasing temperature was observed for most of the warm months. In the case of precipitation, the results of three models have considerable different towards each other and changes intensity of decreasing and increasing precipitation compared to the baseline in IDW model is higher and in LARS-WG model is lower than two other models. But, in case of calculated evapotranspiration, the results of SDSM and IDW models indicate the increasing evapotranspiration in the all months even modest and its maximum value is in last spring and summer. While, calculated evapotranspiration by using LARS-WG model has showed the lower estimation than the baseline period which implies the low ability of model to calculate this model. In general, scenario A2 resulted in more increases in temperature than B2 in each time period. Whereas, in the case of rainfall, the results for each time period were different. For ET_o, in comparison to the baseline,

1,3- Ph.D Student and Professor of Irrigarion and Drainage Engineering, Department of Water Engineeing, Faculty of Agriculture, Isfahan University of Technology
(*- Corresponding Author Email: z.dehghan@ag.iut.ac.ir)
2- Ph.D Student of Water Resources Engineering, Department of Water Engineeing, Faculty of Agriculture, University of Tabriz

both A2 and B2 scenarios showed an increase during both time periods.

Conclusion: In general, the results showed that all three models have similar and good performance for simulating and downscaling of temperature and precipitation data. Therefore, these three models can be adopted to study climate change impacts on natural phenomenon.

Keywords: Pars Abad, Climate change, Climate data, GCMs models