Comparison of the SDSM and LARS-WG weather generators in Modeling of Climate Change in Golestan Province of Iran

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Abstract

The impact of climate change on hydrologic design and management of hydro systems could be one of the important challenges faced by future practicing hydrologists and water resources managers. Because of the increasing demand for water, studying the potential climate change and its impacts on water resources is necessary. The purpose of this paper is to predict the climate change based on the General Circulation Models (GCM), by applying two weather generators, namely SDSM and LARS-WG, at the Golestan province of Iran, in the period of 2011-2040 and compare their Result for a variety of different weather characteristics of the observed and synthetic weather data such as, the lengths of wet and dry series, the distribution of precipitation and Temperature. After modeling different Result obtained from SDSM and LARS-WG Models, will be compare to select the best climate change model for the case study.

Keywords: Weather generators, Model comparison, Climatic change, LARS-WG, SDSM

1. INTRODUCTION

A rising trend of the Earth's temperature and changes in the associated weather conditions across the globe are referred to as climate change. In the absence of suitable mitigation and adaptation measures, climate change is likely to affect major sectors of the world, such as agriculture, water resources, and tourism. Global Climate Models (GCMs), which are presently considered to be the most reliable source providing the climate change information, have spatial resolutions too coarse for hydrologic impact models. To provide hydrologists with the desired information in terms of hydro-meteorological variables at a very fine spatial resolution (in the order of a few kilometers) or station scale, downscaling is usually employed. The existing downscaling techniques have two broad classes: statistical and dynamical. Extensive details about the theories behind these classes as well as their advantages and disadvantages can be found in [1 to 4]. Among the statistical downscaling techniques used by hydrologists to obtain station-scale climatic information, multiple regression models and stochastic weather generators have far more applications than the others [5], as they are computationally less demanding, simple to apply, and efficient [6 to 9]. Regression-based downscaling methods involve developing empirical relationships between large-scale GCM data or observed data as ''predictor'' variables and local- or small-scale climate variables as ''predictand'' variables (e.g. temperature, precipitation) using traditional linear and nonlinear regression methods [10,11]. Examples of traditional regressionbased downscaling methods include linear regression, canonical correlation analysis (CCA), and principal component analysis (PCA) [12].

Weather generators are traditionally used to stochastically generate long synthetic series of data, fill in missing data, and produce different realizations of the same data [13]. They employ random numbers and take the observed time series of a station/site as input. Stochastic weather simulation is not new, and has a long history starting from the 1950s, as reported by Racsko [14]. Among the researchers who contributed to its evolution are Bruhn [15], Bruhn et al. [16], Nicks and Harp [17], Richardson [18], Richardson and Wright [19], and Schoof et al. [20]. Wilby presented a comprehensive review of its theory and evolution over time