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Generation of future potential scenarios in an Alpine Catchment by applying bias-correction techniques, delta-change approaches and stochastic Weather Generators at different spatial scale. Analysis of their influence on basic and drought statistics.

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Assessing impacts of potential future climate change scenarios in precipitation and temperature is essential to design adaptive strategies in water resources systems. The objective of this work is to analyze the possibilities of different statistical downscaling methods to generate future potential scenarios in an Alpine Catchment from historical data and the available climate models simulations performed in the frame of the CORDEX EU project. The initial information employed to define these downscaling approaches are the historical climatic data (taken from the Spain02 project for the period 1971-2000 with a spatial resolution of 12.5 Km) and the future series provided by climatic models in the horizon period 2071-2100 . We have used information coming from nine climate model simulations (obtained from five different Regional climate models (RCM) nested to four different Global Climate Models (GCM)) from the European CORDEX project. In our application we have focused on the Representative Concentration Pathways (RCP) 8.5 emissions scenario, which is the most unfavorable scenario considered in the fifth Assessment Report (AR5) by the Intergovernmental Panel on Climate Change (IPCC). For each RCM we have generated future climate series for the period 2071-2100 by applying two different approaches, bias correction and delta change, and five different transformation techniques (first moment correction, first and second moment correction, regression functions, quantile mapping using distribution derived transformation and quantile mapping using empirical quantiles) for both of them. Ensembles of the obtained series were proposed to obtain more representative potential future climate scenarios to be employed to study potential impacts. In this work we propose a non-equifeaseble combination of the future series giving more weight to those coming from models (delta change approaches) or combination of models and techniques that provides better approximation to the basic and drought statistic of the historical data. A multi-objective analysis using basic statistics (mean, standard deviation and asymmetry coefficient) and droughts statistics (duration, magnitude and intensity) has been performed to identify which models are better in terms of goodness of fit to reproduce the historical series. The drought statistics have been obtained from the Standard Precipitation index (SPI) series using the Theory of Runs. This analysis allows discriminate the best RCM and the best combination of model and correction technique in the bias-correction method. We have also analyzed the possibilities of using different Stochastic Weather Generators to approximate the basic and droughts statistics of the historical series. These analyses have been performed in our case study in a lumped and in a distributed way in order to assess its sensibility to the spatial scale. The statistic of the future temperature series obtained with different ensemble options are quite homogeneous, but the precipitation shows a higher sensibility to the adopted method and spatial scale. The global increment in the mean temperature values are 31.79 %, 31.79 %, 31.03 % and 31.74 % for the distributed bias-correction, distributed delta-change, lumped bias-correction and lumped delta-change ensembles respectively and in the precipitation they are -25.48 %, -28.49 %, -26.42 % and -27.35% respectively.

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