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Downscaling of monthly precipitation and temperature for drought assessment

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Changes in global climate will have significant impact on local and regional meteorological and hydrological regimes, which will in turn affect ecological, social and economical systems. The climate-change impact studies on hydrologic regime and on droughts usually use the climate estimates of the Global Circulation Models (GCMs). The GCMs simulate the climate at very large grids. The inherent uncertainties of GCMs and their spatial scale result in unreliable climate variables, especially rainfall time-series. Nevertheless, more reliable rainfall time-series corresponding to future climate scenarios can be derived from GCMs outputs by downscaling them to the usable scale. This study investigates and applies several methodologies of downscaling techniques (statistical, dynamical and dynamical-statistical) to generate the possible future monthly values of local meteorological variables such as precipitation and temperature in the region of Thessaly, Greece. The downscaled monthly data are used as input for the calculation of two drought indices, namely the Standardized Precipitation Index (SPI) and the Palmer Drought Severity Index (PDSI). The downscaled precipitation and temperature are compared with the observed precipitation and temperature at a dense network of meteorological stations for the period 1960-2002. Furthermore, the adequacy of the downscaled meteorological data for drought estimation is assessed by comparing the drought indices calculated by using the downscaled data and the drought indices calculated from the observed data. Although the downscaling techniques do not provide identical climate time-series, the subsequent calculated drought indices indicate similar patterns for the present climate.