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Evaluation of downscaled ERA-40 reanalysis temperature and precipitation over the Balkan Peninsula against observational data.

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Researchers in the field of climate science are often confronted with the deficiency of data so spatial interpolation schemes are commonly used to estimate meteorological variables at 'unsampled' locations. Meteorological estimates of high spatial resolution are becoming essential inputs to regional models particularly in climate change impact studies. The choice of an appropriate interpolation technique is a critical point especially when applied to mountainous regions where meteorological records are sparse and variables may vary at small spatial-scales. In this study, Thin Plate Spline (TPS) interpolation has been used to downscale temperature and precipitation from the ERA-40 reanalysis initially from 1-degree resolution (approx. 100-km in the domain of study) down to a high spatial resolution of 1-km grid. The performance of the scheme has been assessed against observational data obtained from a number of stations distributed almost evenly over the Balkan Peninsula. The stations were selected at various altitudes to represent the complex terrain of the study region. The primary goal of this work was to develop a tool for deriving high spatial resolution temperature and precipitation data, based on a three-dimensional interpolation scheme. Topography is a factor that strongly influences climatic variables and hence, altitudinal data are incorporated into the downscaling procedure as a third spatial covariate along with the more customary longitude and latitude geographical coordinates. Several downscaling runs were undertaken (with/without elevation, using model/real altitudes) for various rasters covering the studied sites. The downscaled reanalysis and the observational data were compared using correlation analysis and detailed examination of their time

series and spatial patterns. The results indicate that including the elevation factor improves the downscaling, with the biggest improvements being in the high altitude sites and particularly during winter. The Digital Elevation Model used, was proved equally sufficient with the real altitude, as the latter did not yield major improvements. The method performance was generally better for temperature than precipitation, better for mean temperature than max/min temperatures and better in winter than in summer.