Creating daily high resolution meteorological datasets for climate change adaption

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High-resolution gridded daily datasets are essential for natural resource management and the analysis of climate changes and their effects. This study aimed to create gridded datasets of daily precipitation and daily minimum and maximum temperature, both for the past (1980-2010) and the future (2020-2050). The horizontal resolution of the developed datasets is 1 x 1 km^2, covering the area of the Republic of Cyprus (5,760 km2).

To create the gridded dataset for the past, observational data recorded at 145 stations for rainfall and 34 stations for temperature were used. Fifteen different interpolation techniques were evaluated with a set of scores based on cross-validation. The interpolation techniques tested include regression models (multiple linear regression and geographically weighted regression), neighbouring interpolators (inverse distance weighting - IDW, 3D thin plate splines - TPS, and kriging) and combinations of these two. For precipitation, IDW performs best for local events, while a combination of step-wise geographically weighted regression and IDW proves to be the best method for large scale events. For minimum and maximum temperature, a combination of step-wise linear multiple regression and TPS is recognized as the best method.

Six different Regional Climate Models (RCMs) for the A1B SRES emission scenario from the EU ENSEMBLE project database were selected as sources for future climate projections. The RCMs were evaluated to explore their capacity to simulate Cyprus climatology for the period 1980-2010. Data for the period 2020-2050 from the three best performing RCMs were downscaled at the location of observational stations with a stochastic rainfall and temperature generator. Finally three gridded datasets depicting projected future climate conditions were created with the identified best interpolation methods.

The resulting datasets indicate a decrease of the mean annual rainfall over the study area between 5 and 70 mm for 2020-2050, relative to 1980-2010 (its spatial pattern is presented in Figure 1). Average annual minimum and maximum temperature over the Republic of Cyprus are projected to increase between 1.2 and 1.5 ºC. The dataset is currently used to compute agricultural production and water use indicators.

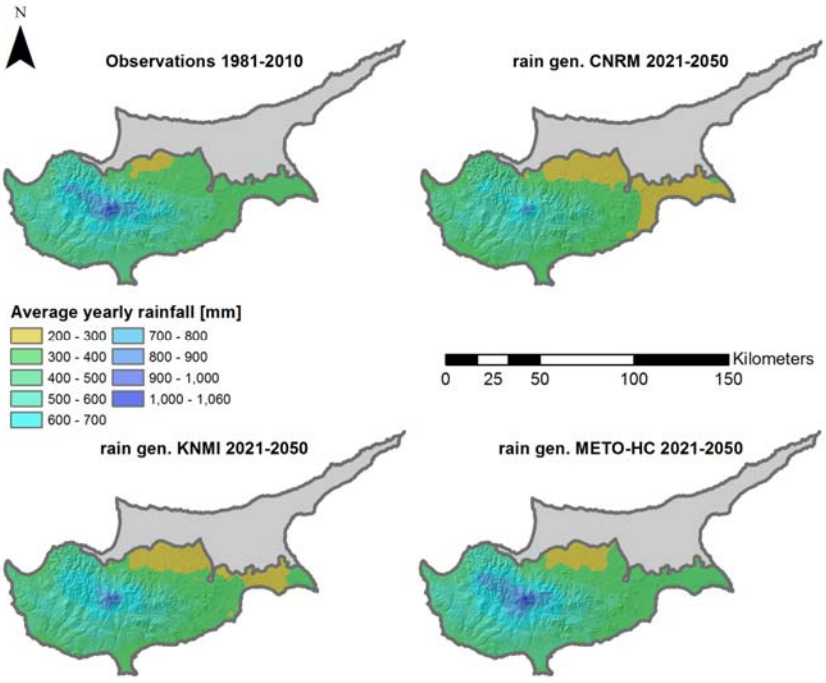

Figure 1. Average annual rainfall (hydrological years) as calculated from observations (1981-2010) and the statistical downscaling of three RCMs (2020-2050).

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