

Future changes in precipitation patterns and extremes: a model-based approach

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In recent decades, the Earth has experienced abrupt climate changes, including changes of mean precipitation heights as well as precipitation extremes. It is very likely that the abrupt climate changes which are result of the increase of the greenhouse gases (GHG) concentration (IPCC 2007) will continue with an accelerate magnitude in the coming decades. The modern tool used to project the future climate change is General Circulation Models (GCMs). Due to computational resources limitations, the horizontal resolution of present day GCMs is quite low, usually in the order of hundreds of kilometers. In such a crude resolution many local aspects of the climate are unable to be represented. In addition, the topographical input is equally crude, thus excluding important local features of the topographic forcing. For these reasons downscaling methods have been developed, which input the GCM results producing high resolution localized climate information. Dynamical downscaling is achieved using Regional Climate Models (RCMs) that increase the resolution of the GCMs to even less than 10 km.

In that direction, future changes in the mean precipitation as well as precipitation extremes due to the anthropogenic climate change over the area of Greece are examined for various emission scenarios in the framework of this paper (e.g. RCP 8.5, SRES A1B, etc.). Regarding Greece, future changes are based on daily precipitation data from 18 Region Climate Models simulations (6 for RCP 8.5 and 12 for SRES A1B). The changes in precipitation extremes are defined by calculating the changes of nine extreme precipitation indices which are divided in three categories: percentile (R75p, R95p, R99p), absolute threshold (Rmax, R10, R20, R50, RX5day) and duration (CDD) indices, as defined by the Expert Team on Climate Change Detection and Indices (ETCCDI). Taking into account all the results that are discussed explicitly in the following sections we conclude that the mean precipitation as well as the number of moderate rainy days is projected to decrease over Greece especially in the end of 21th century. Nevertheless the frequency as well as the strength of individual extremely high precipitation events will be increased over the largest part of Greece.