Downscaling extremes with EDS, TreeGen, and BCSD

§1 Introduction

Empirical downscaling is based on statistical analysis of present climate records for a zone, usually modeled by a statistical downscaling model that relates large-scale indices to local climate variables. The process involves two steps: first, identifying the dominant climate patterns, second, projecting future climate for the region under study. The main purpose is to obtain the same parameters as for the present climate, which are considered proxies of the past climate. A sufficient and robust comparison between the present and past climates is the main goal.

Given the widespread nature of techniques and results, downscaling experiments provide guidance for choosing the methodology for specific regions. These methods are particularly useful to synthesize the main features of past climate variability and change (Menzel and Bürger, 1996). Using the downscaling framework in the context of the local station variables, a series of indices can be analyzed to understand the local climate variability.

§2 Reproducing present statistics

The climate software produces annual time series of the indices, which are then used to drive the BCSD model. The BCSD model consists of three major steps: (1) bias correction of large-scale monthly GCM fields against aggregated gridded observations, using quantile mapping; (2) reproducing present statistics at spatial scales suitable for application; and (3) stochastic downscaling of the spatial fields, using a spatially-aware approach.

Note that a significant number of indices are not directly related to the present climatic conditions, but rather to the historical records. By using the observed VIC grid instead as a reference, the BCSD model can reproduce the actual annual index fluctuations when driven by the analyses.

It should be noted that using BCSD in 1990 has no significant effect on the WRF model. This is likely due to the fact that the first few months of the simulations are not fully developed and that the indices do not reach a steady state.

In summary, the statistical distribution of about half of the indices is reproducible for present climatic conditions. However, the reproducibility is still an issue, especially for the extreme events which are not well captured by the models.

§3 References


