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A downscaling method for the assessment of local climate change

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The use of complimentary models is necessary to study the impact of climate change scenarios on the hydrological response at different space-time scales. However, the structure of GCMs is such that their space resolution (hundreds of kilometres) is too coarse and not adequate to describe the variability of extreme events at basin scale (Burlando and Rosso, 2002). To bridge the space-time gap between the climate scenarios and the usual scale of the inputs for hydrological prediction models is a fundamental requisite for the evaluation of climate change impacts on water resources.
Since models operate a simplification of a complex reality, their results cannot be expected to fit with climate observations. Identifying local climate scenarios for impact analysis implies the definition of more detailed local scenario by downscaling GCMs or RCMs results.
Among the output correction methods we consider the statistical approach by Déqué (2007) reported as a 'Variable correction method' in which the correction of model outputs is obtained by a function build with the observation dataset and operating a quantile-quantile transformation (Q-Q transform). However, in the case of daily precipitation fields the Q-Q transform is not able to correct the temporal property of the model output concerning the dry-wet lacunarity process.
An alternative correction method is proposed based on a stochastic description of the arrival-duration-intensity processes in coherence with the Poissonian Rectangular Pulse scheme (PRP) (Eagleson, 1972). In this proposed approach, the Q-Q transform is applied to the PRP variables derived from the daily rainfall datasets. Consequently the corrected PRP parameters are used for the synthetic generation of statistically homogeneous rainfall time series that mimic the persistency of daily observations for the reference period. Then the PRP parameters are forced through the GCM scenarios to generate local scale rainfall records for the 21st century.
The statistical parameters characterizing daily storm occurrence, storm intensity and duration needed to apply the PRP scheme are considered among STARDEX collection of extreme indices.