Use of Rank Histogram to verify consistency of ensemble precipitation fields simulated by downscaling models

G. Mascaro (1,2), R. Deidda, E. Vivoni (2)

(1) Università degli Studi di Cagliari, Italy, (2) New Mexico Institute of Mining and Technology, New Mexico, USA (gmascaro@unica.it / Fax: +390706755310)

Multifractal models for precipitation downscaling are used in hydrometeorological forecasting chain in order to bridge the spatial and temporal scale gap between meteorological and hydrological models, since they are able to reproduce the statistical behavior of precipitation at high resolution starting from information at coarse scale. Their operative use within such forecasting chain is usually achieved by means of calibration relation between their few parameters and meteorological observable at coarse scale predicted with low uncertainty by meteorological models.

In this study, we propose a method to test the consistency hypothesis (i.e. observed and ensemble members are drawn from the same distribution) for the spatiotemporal precipitation fields outputted by downscaling models. The verification procedure is based on a generalization of the Rank Histogram, a graphical device currently adopted in applied meteorology to test consistency of univariate variable. In particular, the variable used to build the histograms in the method here proposed is the exceedance probability of fixed precipitation thresholds at the fine scale.

The verification method has been applied and tested by means of three numerical experiment using a multifractal downscaling model based on a Log-Poisson generator with two parameters (c and b)p. The strategy adopted to carry out the experiments is to first use the multifractal model to synthetically generate set of events that are considered as “observed events”. Then model parameters are estimated on these “observed events” and interpreted according to different calibration modes. Finally, the “observed events” are hindcasted applying these calibration modes and Rank Histograms are built for different precipitation thresholds.

Results of the three experiments allow us to show that the adoption of calibration relations between model parameter and coarse meteorological observable can be able to reproduce the sampling variability leading to consistent ensemble members.