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A procedure for assessing future trends of subdaily precipitation values on point scale

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In many areas of Italy, urban flooding or floods in small mountain basins, induced by heavy precipitations on subdaily scale, represent remarkable hazards able to cause huge damages and casualties often increased by very high population density.
A proper assessment about how frequency and magnitude of such events could change under the effect of Climate Changes (CC) is crucial for the development of future territorial planning (such as early warning systems).
The current constraints of climate modeling, also using high resolution RCM, prevent an adequate representation of subdaily precipitation patterns (mainly concerning extreme values) while available observed datasets are often unsuitable for the application of the bias-correction (BC) techniques requiring long time series.
In this work, a new procedure is proposed: at point scale, precipitation outputs on 24 and 48 hours are provided by high resolution (about 8km) climate simulation performed through the RCM COSMO_CLM driven by GCM CMCC_CM and bias-corrected by quantile mapping approach. These ones are adopted for a monthly stochastic disaggregation approach combining Random Parameter Bartlett-Lewis (RPBL) gamma model with appropriate rainfall disaggregation technique. The last one implements empirical correction procedures, called adjusting procedures, to modify the model rainfall output, so that it is consistent with the observed rainfall values on daily time scale.
In order to take into account the great difficulties related to minimization of objective function required by retrieving the 7 RPBL parameters, for each dataset the computations are repeated twenty times.
Moreover, adopting statistical properties on 24 and 48 hours to retrieve RPBL parameters allows, according Bo et al. (1994), to infer statistical properties until hourly scale maintaining the information content about the possible changes in precipitation patterns due to CC.
The entire simulation chain is tested on Baiso weather station, in Northern Italy; the station is representative of a basin of Secchia river, tributary of the Po River; for this station, are available hourly data on 2003-2012 time span while, since 1981, are available daily data and maximum yearly values until hourly scale.
In order to evaluate the uncertainties related to stand-alone approach for retrieving hourly data, it is first tested adopting, as input, observed data on 1981-2010 period; after, for the same time interval, RPBL parameters are estimated using BC RCM precipitation data. However, as control, the available hourly data cover only a part of this span. The results show how the approach, in term of mean and maximum values, return satisfying results until 6 hours while for higher resolutions the errors became significant.
Finally, in order to assess the possible effects of CC on subdaily precipitation patterns, the same simulation chain is adopted to provide hourly precipitation datasets also for thirty years 2071-2100 under concentration scenarios RCPs 4.5 and RCP 8.5; the comparison between these ones and control period, permits to understand how, in wet season, the expected warming could produce a reduction in mean duration of precipitation events but with higher rainfall intensity; however, during the summer, the strong reduction in precipitation values could deeply affect also hourly values.