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# On the use of weather generators for the estimation oflow-frequency floods under climate change scenarios

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The present work presents a novel methodology based on the use of stochastic Weather Generators (WG) for the estimation of high return period floods under climate change scenarios. Starting from the premise that the 30-years climate projections, commonly used for future flood studies, do not provide enough information to obtain accurate extreme quantile estimations (especially in arid and semi-arid climates), we propose to exploit the available information by performing a regional study of maximum precipitation of the bias-corrected climate projections (mid-term and long-term), the outputs of which will improve the WG implementation.

This methodology has been applied in a case study, Rambla de la Viuda (Spain), a typical Mediterranean ephemeral river located in eastern Spain. The river is ca. 36 km in length and 1513 $km^2$ in catchment surface, with a remarked variability: large floods are a significant element of this irregular hydrological regime, producing up to 80% of annual discharge volume. Precipitation and temperatures were obtained from the EUROCORDEX project: twelve combinations of Global Circulation Models and Regional Circulation Models were evaluated for a RCP8.5 emissions scenario.

The results obtained shown a clear increase in maximum and minimum temperatures for both projections (up to 3.6ºC), this increase being greater for the long-term projection, where the heat waves intensify importantly in both magnitude and frequency. In terms of precipitation, the results are similar, with precipitation quantiles increasing for practically all models and for both projections, although slightly reducing the annual amount of precipitation. The long synthetic series of precipitation that fed a fully-distributed hydrological model translated into substantial shifts in the river flows regimes, presenting, in general, lower flows during the year but increasing the frequency and magnitude of extreme flood events, reaching 100 years return period quantile values up to 58% higher at the river outlet and up to 130% at a smaller upper subcatchment.

These results have demonstrated the solidity and effectiveness of the proposed methodology. In the field of meteorological modeling, the results have been consistent and satisfactory, demonstrating the methodology's ability to accurately represent the complexities of extreme climate patterns. Likewise, in the hydrological field, the methodology has exhibited an effective capacity to represent and simulate the processes related to the water cycle, offering coherent and satisfactory results in the estimation of low frequency flood events under climate change scenarios. This consistency in the robustness of the methodology, both in meteorological and hydrological modeling, supports its applicability and reliability in diverse environments and climatic conditions.