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Comparison of statistical and dynamical downscaling of extreme precipitations over France in present-day and future climate

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We present a comparison of two downscaling methods of extreme precipitations over France at a climatic time scale : a dynamical one performed with the Regional Climate Model ALADIN-Climate used at a resolution of 12 km, and a statistical one based on the weather regime approach and using the analog methodology to reconstruct daily fields of precipitations at a 8 km resolution.
We focus on the most heavy precipitations of the area of interest, which occur in southeastern France in Autumn. Those involve small-scale processes than can be explicitly resolved only with 2-1 km resolution non-hydrostatic models. However, such models can not be used for climate simulations because of their computational cost is still too high. Yet these extreme events cause rather heavy damages, so that their possible evolution in the context of climate change is of great concern. Thus, there is strong need in assessing downscaling methods' ability to represent them.
First, we downscale the low-resolution ERA40 re-analysis over the 1958-2000 time period with ALADIN-Climate, and from the year 1980 to the year 2000 with the statistical method. Then, we apply a quantile-quantile correction to the daily precipitations of the last twenty years of the ALADIN-Climate simulation. The correction rates are computed over the first part of the simulation (1958-1979) using a high-resolution gridded database : the SAFRAN analysis, which provides series of hourly fields for the 1958-2008 period over the french territory at a 8 km resolution.
We assess the performances of each downscaling method in present-day climate by comparing the simulated precipitations to the SAFRAN database. The use of the ERA40 re-analysis allows to reproduce the real chronology in both downscalings, which enables to analyze the results not only from a statistical point of view but also through day-to-day diagnosis such as time correlations or spatial patterns of rain for given extreme events.
Secondly, we apply these downscaling techniques to a climate change scenario performed with the Global Circulation Model ARPEGE-Climate. We analyze the differences in the evolution of extreme precipitations between obtained with each method and discuss their respective advantages and drawbacks.