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On the added value of regional climate and convective permitting simulations performed in the framework of EURO-CORDEX

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In the framework of EURO-CORDEX, the largest regional climate model (RCM) set of simulations for climate change assessment was produced. This set included simulations at 0.44 and 0.11° spatial resolutions covering the full European domain. Very recently, the Flagship Pilot Study - Convective phenomena at high resolution over Europe and the Mediterranean – promoted a new set of simulations exploiting finer grid spacing at the convective-permitting resolution (∼0.03°), covering a smaller central European domain. These climate runs are computationally very demanding and do not always show improvements. The latter depend on the region, variable and object of study. The gains or losses associated with the use of higher resolution in relation to the forcing model (global climate model or reanalysis), or to different resolution RCM simulations, is known as added value. Its characterization is a long-standing issue, and many different added-value measures have been proposed.
In the current work, a recently proposed method is applied to assess the added value of finer resolution simulations, in comparison to its forcing data or coarser resolution counterparts. This approach builds on a probability density function (PDF) matching score, giving a normalised measure of the difference between diverse resolution PDFs, mediated by the observational ones. The distribution added value (DAV) is an objective added value measure that can be applied to any variable, region or temporal scale, from hindcast or historical (non-synchronous) simulations. The DAVs metric and an application to the EURO-CORDEX simulations, at 0.44°, 0.11° and 0.03° resolutions, for precipitation, are here presented.
The EURO-CORDEX first set of simulations at resolutions, 0.44o and 0.11o, display a clear added value in relation to ERA-Interim, with values around 30% in summer and 20% in the intermediate seasons. When both RCM resolutions are directly compared the added value is smaller. The regions with the larger precipitation DAVs are areas where convection is relevant, e.g. Alps and Iberia. When looking at the extreme precipitation PDF tail, the higher resolution improvement is generally greater than the low resolution for seasons and regions. The convective permitting runs also reveal added value when compared with the coarser resolution grid, especially for extreme precipitation. However, the DAVs spatial analysis shows large added value heterogeneity.

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