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Assessment of the future climate potential for tourism over Europe using a combination of downscaling approaches and quantitative impact models

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Europe and particularly, the Mediterranean countries, are among the most visited tourist destinations worldwide, while it is also recognized as one of the most sensitive regions to climate change. Climate is a key resource and even a limiting factor for many types of tourism. Owing to climate change, modified patterns of atmospheric variables such as temperature, rainfall, relative humidity, hours of sunshine and wind speed will likely affect the suitability of the European destinations for certain outdoor leisure activities.

Perspectives on the future of second-generation climate indices for tourism (CIT) that depend on thermal, aesthetic and physical facets are derived using model projected daily atmospheric data and present climate "observations". Specifically, daily series of 2-m maximum temperature, accumulated precipitation, 2-m relative humidity, mean cloud cover and 10-m wind speed from ERA-5 reanalysis are used to derive the present climate potential. For projections, the same daily variables have been obtained from a set of regional climate models (RCMs) included in the European CORDEX project, considering the rcp8.5 future emissions scenario. The adoption of a multi-model ensemble strategy allows quantifying the uncertainties arising from the model errors and the GCM-derived boundary conditions. To properly derive CITs at local scale, a quantile-quantile adjustment has been applied to the simulated regional scenarios. The method detects changes in the continuous CIT cumulative distribution functions (CDFs) between the recent past and successive time slices of the simulated climate and applies these changes, once calibrated, to the observed CDFs.

Assessments on the future climate potential for several types of tourist activities in Europe (i.e., sun, sea and sand (3S) tourism, cycling, cultural, football, golf, nautical and hiking) will be presented by applying suitable quantitative indicators of CIT evolutions adapted to regional contexts. It is expected that such kind of information will ultimately benefit the design of mitigation and adaptation strategies of the tourist sector.