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Changes in the length of the seasons over the Iberian Peninsula for future conditions from ENSEMBLES regional climate models ensemble

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The estimation of spring season onset and length variation is an important issue because it is related with the variability of growing season and also affects ecosystems and crop production. Many studies show earlier onset and longer length spring trends in the past years compared with the XX^{th} century. Nevertheless, the study of the rest of seasons is also important, because many natural hazards and natural systems are not only are related with spring, like wildfire activity or floods in the Mediterranean areas. The overall increase in temperature shown in all the future climate projections for the XXI^{st} century is expected to be translated into an increase of summer duration and a reduction of winter length compared with present-climate conditions. There is more uncertainty on what is going to happen on the transitional seasons (spring and autumn), how are they going to be displaced, reduced or increased, from a mid-latitude climatic perspective.

The main aim of this study is to define the onset and end for the four seasons and its change in the future over the Iberian Peninsula (IP) as modelled from eleven Regional Climate Models (RCMs) with high spatial resolution (25 km^2) from the European Project ENSEMBLES. The analysis periods are 2021-2050 and 2071-2100 under the A1B emissions scenario. First, an evaluation of their performance during present climate period (1961-1990) is done, comparing the SPAIN02 gridded temperature dataset and ERA-40 reanalysis.

There are many methods that use phenological, climatological criteria or the combination of them to estimate the spring onset. Methods are usually based in fixed temperature and/or precipitation thresholds, or in change of the annual cycle of temperature, in terms of its phase and amplitude. Here, a threshold-based model is used in the onset season definition, not only for spring, but for all the seasons. To avoid the potential arbitrariness or location-dependence of using a fixes threshold, we propose a criteria to define the onset of the seasons from 25^{th} and 75^{th} temperature percentiles at each point, computed for present-climate period. Both maximum and minimum daily temperatures are used to obtain these indexes.

Results show that summer season tends to be longer and winter to be shorter in the future for all the models. Autumn also exhibit an increase in its length, meanwhile spring show a more uncertain behaviour, as some models give a small decrease, and other a small increase, over the IP, for 2021-2050 period. The start of spring is earlier, meanwhile the autumn start is delayed. Winter starts later and ends earlier. For the far future period (2071-2100), these results present a pronounced similar behaviour, with spring showing a more common pattern to a slight increase of its duration.