



## **Assessment of future extreme climate events over the Porto wine Region**

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The Douro Demarcated Region (DDR) is a wine region, in the northern Portugal, recognized for the Porto wine, which is responsible for more than 60% of the total value of national wine exportations. Since the viticulture is highly dependent on weather/climate patterns, the global warming is expected to affect the areas suitable to the growth of a certain variety of grape, its production and quality. This highlights the need of regional studies that assess the future climate changes effects in the vineyard, which might allow an early adjustment.

We explore future climate change in the DDR region using a high-resolution regional climate model for Weather Research and Forecasting (WRF) forced by the Max Planck Institute Earth System Model - low resolution (MPI-ESM-LR). Two future periods have been simulated using the emission scenario RCP8.5 - for the mid- (2046-2065) and late 21st century (2081-2100) - and compared to a reference period (1986-2005). The RCP8.5 is a "baseline" scenario without any climate mitigation and corresponds to the pathway with the highest greenhouse gas emissions compared to other scenarios developed by the Intergovernmental Panel for Climate Change.

Our regional WRF implementation uses three online-nested domains with increasing resolution at a down-scaling ratio of three. The coarser domain of 81-km resolution covers part of the North Atlantic Ocean and most of the Europe. The innermost 9-km horizontal resolution domain includes the Iberian Peninsula, a portion of Northern Africa and the adjacent part of the Atlantic Ocean and Mediterranean Sea. Our study uses this 9-km resolution domain and focuses on a confined area, which comprises the DDR. Such dynamical downscaling approach gives an advantage to assess climate effects on the DDR region, where the high horizontal resolution allows including effects of the oceanic coastline, local riverbeds and complex topography.

The climatology of the DDR region determines the more suitable wine variety to be produced (Porto and Douro wine), while climate variability affects the annual productivity and quality of the grape harvest. Our study investigates changes in the extreme climate events in the future model runs, through a set of climate change indicators defined by the WRCF's Expert Team in Climate Change Detection and Indices, which uses variables such as daily maximum and minimum temperatures and precipitation amounts. Furthermore, we explore heat waves and their properties (duration, intensity and recovery factor). The analysis shows an increase of the mean temperature in the DDR higher than 2°C by the mid-21st century and 4.5°C by the end of the century, relatively to the reference period. Moreover, we found a major predisposition towards higher values of minimum and maximum daily temperatures and a decrease in the total precipitation during both future periods. These preliminary results indicate increased climatic stress on the DDR wine production and increased vulnerability of the wine varieties in this region.