

Climate projections over France wine growing region and it's potential impact on phenology

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Abstract

Climate change represents a major challenge for the French wine industry. Climatic conditions in French vineyards have already changed and will continue to evolve. One of the notable effects on grapevine is the advancing growing season. The aim of this study is to characterise the evolution of agroclimatic indicators (Huglin index, number of hot days, mean temperature, cumulative rainfall and number of rainy days during the growing season) at French wine-growing regions scale between 1980 and 2019 using gridded data (8 km resolution, SAFRAN) and for the middle of the 21st century (2046-2065) with 21 GCMs statistically debiased and downscaled at 8 km. A set of three phenological models were used to simulate the budburst (BRIN, Smoothed-Utah), flowering, veraison and theoretical maturity (GFV and GSR) stages for two grape varieties (Chardonnay and Cabernet-Sauvignon) over the whole period studied. All the French wine-growing regions show an increase in both temperatures during the growing season and Huglin index. This increase is accompanied by an advance in the simulated flowering (+3 to +9 days), veraison (+6 to +13 days) and theoretical maturity (+6 to +16 days) stages, which are more noticeable in the north-eastern part of France. The climate projections unanimously show, for all the GCMs considered, a clear increase in the Huglin index (+662 to 771 °C.days compared to the 1980-1999 period) and in the number of hot days (+5.6 to 22.6 days) in all the wine regions studied. Regarding rainfall, the expected evolution remains very uncertain due to the heterogeneity of the climates simulated by the 21 models. Only 4 regions out of 21 have a significant decrease in the number of rainy days during the growing season. The two budburst models show a strong divergence in the evolution of this stage with an average difference of 18 days between the two models on all grapevine regions. The theoretical maturity is the most impacted stage with a potential advance between 40 and 23 days according to wine-growing regions.

Keywords: Climate change, phenology, France, grapevine.