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Impact of a SPG convection collapse on the European viticulture

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The temperature evolution over the North Atlantic throughout the 21st century is connected with the fate of the subpolar gyre (SPG) oceanic convection, an important process regulating the heat exchange between deep ocean and atmosphere. State-of-the-art climate models qualitatively agree in projecting a decrease in SPG convective activity under RCP scenarios, yet large uncertainty subsists in assessing the extent of such a reduction in the future. A subset of seven CMIP5 models indeed simulate a complete collapse of the SPG convection within the end of the 21st century. As a consequence, two main different temperature evolutions have been identified over the North Atlantic, i.e. (i) a continuous warming trend associated with a reduced but still active SPG convective activity and (ii) a warming trend, which is suddenly interrupted by an abrupt temperature drop associated with a collapse of the SPG convection.

Here we analyze the impact of these different scenarios over Europe and their potential implications for viticultural practices. The grapevine growth is mainly influenced by temperature and the onsets and durations of each developmental stages can significantly affect both the yield and the quality. The aim of this study is therefore to discern the different phenological responses associated with the different SPG convection behaviors and to identify their specific features. Our methodology consists in coupling dynamical downscaled CORDEX temperature projections with phenological models simulating the main developmental stages of the grapevine, i.e. budburst, flowering and veraison. The comparison between the different phenological responses discloses specific risks associated with the two different scenarios of SPG convection evolution. This implies the consideration of a large range of adaptation measures to tackle the climate change.