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# Application of agroclimatic indices for viticultural zoning at macroscale level

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Viticultural zoning not only gives valuable information about the suitability of a particular region for wine production, but also helps in determining the most adequate varieties for a local site, or even to identify constraints for grapevine production. In addition, regarding the socio-economic relevance of this crop in a context of new challenges enforced by a changing climate, a thorough assessment of its potential future adaptation can only be achieved through scientific analyses. The demarcation of new wine regions is also critically dependent on these studies. Therefore, the present research was focused on developing a computer based model of agroclimatic grapevine zoning at a macroclimate (global) scale. For that purpose, several agroclimatic indices (e.g., thermal and heliothermal indices) were calculated worldwide. In fact, agroclimatic indices are widely used when relating the viticultural climate and the elements of grape and wine quality. Their calculation was carried out by, first, using climatic variables (mostly daily maximum and minimum temperatures and daily precipitation amounts) from the NCEP reanalysis dataset and, second, using data from a general circulation atmospheric model for a specific future emission scenario (A1B). A bioclimatic atlas showing the global fields of the different indices was then produced for two separate recent-past periods (1961-1990 and 1990-2008) and for a future scenario (2030-2050). The comparison between the bioclimatic fields defined for the two different recent-past periods enables the detection of long-term trends, while the comparison of these two periods with the future period allows the isolation of projected changes. Based on the results of these agroclimatic indices and to simplify the analysis, the dimensionality of the problem was reduced by considering a composite index. This provides a macro-characterization of worldwide areas where this crop may preferentially grow, as well as an identification of likely changes under human-induced forcing. As such, it can be a useful tool for viticultural zoning under a climate change scenario, also giving an important contribution for the development of adaptation and mitigation measures in current wine regions, in some cases already struggling due to recent climate variability.