



## **Subjective and objective wine quality in Central Mediterranean in relation to large scale climate patterns**

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Subjective wine ranking is based on three factors: appearance (eye), smell (nose) and taste (palate); this kind of subjective ranking is often preferred over that based on technical objective means. Wine quality depends on its composition, which is a function of a number of factors: grapevine variety, soil type, cultivation techniques, and climate conditions. Between them, the soil is the main fixed factor; the positive trend is determined by a combination of improved cultural techniques and of warming related to climate change; while the climate variability is the main factor in determining the year-to-year wine quality variations. Therefore, the analysis of the grape composition before harvest is crucial for establishing the quality-climate correlations. In this work, 40 years of objective and subjective wine quality data collected in Italy are analyzed in relation to the climate conditions.

Results show that the year-to-year quality variation of wines produced in North and Central Italy depends on the large scale climate variability, and that the wine quality improvement in the last four decades is partially due to an increase of temperature and to a decrease of the precipitations in West and Central Mediterranean Europe (WME; CME). In addition, wine quality is positively correlated with air temperature throughout the entire active period of the grapevine; weakly negatively correlated with precipitation in spring, and well negatively correlated in summer and fall. The month-to-month composites of the NAO anomaly show that, in years of good quality wine, this anomaly is negative in late spring, oscillates around zero in summer, and is positive in early fall; while, in years of bad quality wine, it is positive in late spring and summer, and negative in early fall; i.e. its polarity has an opposite sign in spring and fall in good versus bad years. The composite seasonal maps show that good wines are produced when the spring jet stream over Atlantic diverts most of the weather perturbations towards North Europe, still providing a sufficient amount of rainwater to CME; when summer warming induced by southerly winds is balanced by the cooling induced by westerly winds; and when a positive geopotential anomaly over WME shelters CME from fall Atlantic storms. Bad quality wines are produced when the jet stream favors the intrusion of the Atlantic weather perturbations into the Mediterranean. Results suggest that the persistence of atmospheric patterns can be used as precursor for wine quality forecast.