FINE-SCALE PROJECTIONS OF FUTURE CLIMATE IN THE VINEYARDS OF SOUTHERN URUGUAY

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Abstract:

Context and purpose of the study - In viticulture, climate change significantly impacts the plant's development and the quality and characteristics of wines. These variations are often observed over short distances in a wine-growing region and are linked to local features (slope, soil, seasonal climate, etc.). The high spatial variability of climate caused by local factors is often of the same order or even higher than the temperature increase simulated by the different IPCC scenarios. The spatial variability of climate at the regional scale should therefore be considered when defining a rational climate change adaptation policy. In this context, the central question of this work is: How to generate fine-scale projections of future climate? This approach is presented here in a vineyard in Uruguay's southern wine region (Maldonado department). In the last decades, this region has seen its average temperature increase between 1 and 2°C and spring and summer precipitations increase by 20% (FAO, 2011). These changes affect grapevine phenology (e.g. shortening of the ripening period in the Tannat cultivar) and the final berry composition, with a tendency to reduce grape acidity at harvest (Fourment et al., 2013).

Material and methods - This study proposes a method to downscale future climate scenarios at vineyard scales. Networks of temperature loggers were used to collect air temperature inside the vine canopy in the vineyard (Maldonado department). These measurements allowed the creation of fine-scale geostatistical temperature models (90m resolution) and fine-scale maps of daily temperature for the growing season. This geostatistical model has been combined with regional climate change data for 2031-2050 and 2081-2100 for RCP4.5 and 8.5 climate change scenarios to model climate change at the pilot site scale. Several agroclimatic (e.g. degree-days) and ecoclimatic (e.g. GFV, GSR, ...) indices were calculated to assess the adaptability of different grape varieties to future climate and local characteristics of the pilot site.

Results - First, the results show a significant intra-site spatial variability mainly related to the topography, especially slope and exposure. During the vegetative season, temperatures vary on average from 1°C (Tmin) to 0.5°C (Tmax) on the study site, with situations much more marked on certain days. Integrating this spatial temperature variability into future climate projections allowed the simulation of the potential of the Tannat grape variety. Future projections show a generalised increase in accumulated day degrees (120 to 300, depending on the scenario and time horizon). The consequence of this increase in temperature is a significant advance in all phenological stages for the Tannat grape variety (up to 30 days for maturity).

Keywords: Climate change, local scales, spatial modeling, Tannat, Uruguay.