Geophysical Research Abstracts
Vol. 21, EGU2019-7345, 2019
EGU General Assembly 2019

Validation of the Italian Vineyard Integrated Numerical Model for Estimating Physiological Values (IVINE) with observations carried out in Piedmontese Nebbiolo vineyards (Italy).

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The numerical crop growth model IVINE (Italian Vineyard Integrated Numerical model for Estimating physiological values) was developed at our Dept. of Physics in Fortran language as a research model in order to evaluate the environmental forcing effects on vine growth, being vines generally strongly sensitive to meteorological conditions, and with the idea of using it for assessing climate change effects on grape growth. IVINE model simulates physiological and phenological vineyard processes with physically based parameterizations of most important processes taking place into vineyards, allowing to understand plant conditions at the microscale. It requires a set of meteorological data as boundary conditions. The main model outputs are: predawn leaf water potential, main phenological stages, leaf development, yield, and sugar concentration. The model requires to set some experimental parameters depending on the cultivar; at present, IVINE is optimized for Nebbiolo grapevine, a variety cultivated mostly in Piedmont region (northwestern Italy), but currently we are implementing it also for other varieties. As a first step, we tested the IVINE accuracy in actual climatic conditions, by performing simulations in the third millennium. In particular, we validated IVINE using experimental observations gathered in different Piedmontese vineyards in which some in-field measurements were performed. The results show performances similar or slightly better than those of other widely used crop models, thus increasing our confidence in the model reliability. We performed also a sensitivity analysis to highlight the effects of the variations of some input parameters on IVINE outputs. Among all, air temperature and soil moisture potential input variables were considered, as the most important ones. The results showed that most phenological phases decrease with increasing temperatures, while berry sugar content saturates at about 25.5 °Bx. Here, the main results of the sensitivity test and of the validation will be presented and discussed.