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Validation of a crop growth model in Piedmontese vineyards

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Agricultural production is substantially affected by variability in weather conditions and recently by climate change. For this reason, it is essential to understand how much meteorology and climate can influence crop productivity and quality.

In the frame of a multiannual project, a numerical crop growth model has been specifically developed in order to evaluate the effects of micrometeorological conditions on vine growth and grape quality. The numerical model simulates physiological and phenological vineyard conditions allowing the knowledge of plant processes at the microscale and their responses to environmental forcing. The target of the project is the development of an advanced tool able to monitoring in real time the physiological and phenological vine processes, and to support the activity of decision-making, allowing a sustainable vineyard management.

The boundary meteorological conditions required by the model during the simulation are the following physical quantities: temperature and relative humidity of the air above the vegetation, solar global radiation, photosynthetically active radiation, soil temperature and water content in the root zone, wind speed and direction above the vegetation, rainfall, and leaf wetness. The numerical model, in addition to the geographical information, also requires some initial and boundary conditions related to vineyard and soil characteristics: soil texture, plant density, varietal characteristics, and vineyards management procedures. The main model outputs are the predawn leaf water potential, the principal phenological phases, the leaf development, the plant yield, and the grape sugar concentration.

A specific advanced experimental campaign has been performed within a vineyard of Nebbiolo cultivar located in Langhe area (Piedmont, Italy), during the 2016 and 2017 vegetative seasons, by directly measuring phenological phases and some physiological variables, with the specific aim to calibrate and validate the numerical model. Here, the model will be described and the main results of the validation will be presented.

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