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Assessing prediction quality of several phenological process based models using various types of databases. A case study using Vitis vinifera data.

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Modeling phenology has become a major issue in the context of studies on the impact of climate change. Phenology is the first biological indicator of this change and consequently, accurate simulations are essential to correctly predict the timing of development in the future. In recent years several models have been developed and tested to simulate phenology for various species, with many studies focused on perennial species (forest trees, orchards and grapevine). Furthermore, the development of databases and networks of observations have been used to test models under a wide range of climate conditions.

In this study we examined the impact of databases and their origin on the accuracy of simulation of flowering and veraison for the grapevine (Vitis vinifera L.) We compared the results of calibration and cross- validation of several classic phenological models (Growing Degrees Days, Chuine, Sigmoid, Beta function – Wang and Engel and Richardson) for two different varieties (Cabernet Franc and Merlot), at two different locations (Middle Loire Valley and Bordeaux vineyards) using different datasets : 1) Dataset1: a dataset from a network of temperature sensors at a fine scale where phenology was also observed at each of the locations of the temperature sensors (11 to 60 different points); 2) Dataset2: an historical dataset (at least 20 years) from a plot located in the same area as the network , 3) Dataset3: a dataset obtained from other locations in France (Phenoclim database).

Cross tests of the best model calibrated with each dataset on the other sites were conducted to assess the effect of the choice of database on the model output for each of these stages (flowering and veraison) at different scales. Initial results showed that the database used to calibrate different models could influence model parameters. This methodology will help to improve the quantification of uncertainties of each model and check the stability of the model parameters over different datasets. Finally, this methodology will help to identify which type of database is best suited: to simulate spatial distribution of phenology in a specific area (i.e. vineyard); to predict phenological stages in an operational mode; and to quantify the impact of climate change on phenology.