Measurement of grape vine growth for model evaluation

Mesures de la croissance de la vigne pour l'évaluation des modèles

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Abstract: Within a research project for simulating the nitrogen turnover in vineyard soils and the nitrogen uptake by the grape vine, a previously developed plant growth model (Nendel and Kersebaum 2004) had to be evaluated. A dataset was obtained from a monitoring experiment at three vineyard sites with different soil types, conducted in the years 2003 and 2004. The annual plant growth was measured by collecting non-perennial organs of 10 plants at 5 growth stages (pre-blossoming, setting, bunches closed, veraison, and ready for picking). The dry matter content of leaves, flower/grape clusters, shoots, side shoots, and tipping shoots was determined separately. Leaf area was measured before drying. At one vineyard site the plant fresh weight was additionally recorded. Simultaneously, soil water and N_{min} content were analysed in soil samples taken from 0-30 and 30-60 cm soil depth.
The weather conditions during the investigation were extreme. At all sites the long-term annual mean temperature was exceeded by more than 1°C, during the growth period even by more than 3°C. In the same time precipitation delivered only about 60% of the long-term average. Drought occurred especially during the spring months. *Vitis vinifera* commonly reacts to drought by producing abscisine acid which causes a growth reduction of the vegetative plant organs. The generative parts remain less strongly affected. At two of the monitoring sites these effects could be observed as expected, while at the third site plant growth was not limited because of permanent supply of ground water in the rooting zone. At the sites limited in water supply the shoot dry matter production was reduced to up to 48% of the production observed in the years 1999-2001. Grape dry matter was only reduced to up to 59% of the earlier recorded amount. The data were used to parameterise the model to be able to reproduce plant growth under drought conditions. A clear improvement compared to the previous plant growth model version could be achieved. Now, the biomass development of the vine is a new feature in the output of the extended version of N-VINO 2.0 simulating the nitrogen turnover in vineyard soils and completes the output data of N_{min}, soil water content, and N-leaching. The results can be presented in a time scale, in relation to soil depth, or as a comparison of measured data versus simulated data.

