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Evaluating the evapotranspiration of a row cropped vineyard using 1D modelling approaches: comparison of energy and water balance based models.

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Estimation of vineyard evapotranspiration (ET_a) is not straightforward, since they exhibit explicit bi-dimensional features resulting from their wide row planting structure. Methods developed to define ET_a are either based on the water balance or on the energy balance equations, each having its advantages and drawbacks. The objective of this study was to compare the performance of models based on either water balance or combined water and surface energy balance in vineyard flux estimation, taking into account the water transfer in the soil layers based on the Richard's one dimensional equation, the preferential root water extraction, and the proper available energy partitioning between vine canopy and bare soil. Surface fluxes were estimated based on the two-component energy combination model of Shuttleworth and Wallace (1985), which accounts for the separated but coupled fluxes of soil evaporation and plant transpiration. Both approaches gave very acceptable results on daily and hourly time basis. The good performance of both approaches was mainly due to accurate soil hydrodynamic properties and to the adoption of proper root water extraction models. Results showed that adopting an energy partitioning model specific to hedged rows (Riou, 1989) has added precision to the models performance. Moreover, although the energy based model was slightly more accurate than the water balance based one, its high sensitivity to plant and atmospheric resistances, which are rather difficult to assess, made its performance mainly dependent on the accuracy of these parameters. The major value of this study resides in the considerable simplification brought by the one dimensional approach adaptability on vineyards exhibiting two dimensional features, which significantly reduces the number of parameters and the complexity of the equa-

tions. Furthermore, when estimating ET_a with limited input data, the water balance based approach showed advantages that are mainly related to its simplicity and time of calculation compared to the energy balance based approach. Furthermore, the water balance approach provided very accurate estimates of ET_a, even at an hourly time step. However, if the aim is to develop techniques for a quantitative use of remotely sensed information in ET_a estimation, the energy balance approach is more adaptable since the water balance approach method does not allow the assimilation of remotely sensed data, such as the brightness temperature in the thermal infrared domain.