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Estimating grapevine hydric status within heterogeneous Mediterranean vineyards from high spatial resolution optical remote sensing.

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Water balance is an important component of crop functioning within Mediterranean vineyards, given it directly influences grape quality and yield. Due to the landscape structures, mostly including small fields, the use of remote sensing has not been extensively investigated, apart from airborne observations. Space borne ASTER data, collected with high spatial resolutions over the optical domain, is of strong interest for the mapping of vineyard crop hydric status in relation with surface and soil properties, provided vegetation thermal and hydric status are strongly linked. The objective of this study is to assess the performances of different approaches that estimate instantaneous energy fluxes from solar remote sensing. These methods differ by the way they describe the composite surface in terms of soil and vegetation, as well as by the way they use the spatial information captured over the solar and thermal domains. First, land surface can be described as a composite one-layer structure through the excess resistance approach, or as a two-layer structure through the discrimination of soil evaporation and vegetation transpiration. Second, the spatial information can be characterized through the temperature - albedo diagram that is controlled by radiative and evaporative processes, or through the temperature - vegetation index triangle that is controlled by soil moisture. Such approaches have been widely used over various landscapes, but their relevance over vineyard remains questionable. The current study is conducted within the La Peyne basin, a 100-km^2 watershed located in southern France which includes vineyards by more than 70%. For each ASTER data acquisition, maps of evapotranspiration and hydric status indicators are computed and intercompared.

Additionally, validations are performed against 1/ eddy covariance measurements over two contrasted sites and 2/ water balance estimates deduced from neutron probe data within nine fields. Hydric status indicators are next compared against 1/ pedological based water availability, land use and agricultural practices in terms of spatial patterns, and 2/ ground based measurements of grape delta C13 content in terms of temporal accumulation. The study emphasizes large spatial contrasts of radiometric temperature, from 25° to 45°C. Although results from the different approaches may differ, we observe well-pronounced spatial correlations between remotely sensed hydric indicators and pedological based water availability.