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Validation of aerodynamic resistance parameterizations at field scale and their implementation in a distributed hydrological model at basin scale

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A correct evaluation of the aerodynamic resistance to heat transfer, rah, is fundamental in several fields of application, such as sustainable water management at the basin scale and irrigation planning at the field scale. This is due to the fact that this variable has a significant impact on the estimation of surface heat fluxes, sensible and latent heat (H and LE), and, consequently, of evapotranspiration (ET), which plays a key role in the hydrological cycle and in land-atmosphere interaction.
Thus, the analysis focuses on the validation of some parameterizations for rah for different vegetation types and surface roughness, in order to understand the most reliable ones for each case study.
In particular, eight equations chosen from literature (either in accordance with the Monin-Obukhov theory or empirical, with different assumption and levels of simplification) were compared with aerodynamic resistance values estimated from eddy covariance measurements, in a maize canopy, low crops and a forest.
In order to assure data quality, observations have been selected considering only unstable conditions, where eddy covariance measurements techniques theoretical framework is respected.
Moreover, this validation was carried out distinguishing also the different growing phases of the vegetation, from bare soil to the maximum vegetation height, for each case analyzed.
This punctual analysis shows that the error of each model changes with relation to the different vegetation types and heights, thus, highlighting the importance of considering the vegetation height when choosing the parameterization for rah.
In accordance with these results, the most reliable parameterizations were implemented in the distributed hydrological model FEST-EWB, with the purpose of evaluating the effect of rah on the estimation of H and ET over different vegetation coverages also at a distributed scale.
Moreover, the punctual analysis was used to retrieve the correction factors, relative to each equation for rah and for the different ranges of vegetation height considered, so as to implement the corrected relations in the model FEST-EWB, in order to achieve more precise estimates of H and Le.